International Conference on Applied Science and Engineering in a Changing World (ICASECW-24)

Hotel Grande, Pokhara, Nepal

June 11-13, 2024

Book of Abstracts (Draft)

Organized By:

Faculty of Science and Technology, Pokhara University

Nepal

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Anthracite as Filter Media in Filtration Process

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Abstract

This research was carried out to see the performance of anthracite as filter media in filtration process. The study also aimed to compare two filter media in terms of turbidity it removed, head loss development with time and filter run with increase in influent turbidity. Two rapid gravity filter (RGF) columns were prepared having internal dimensions of 11 x 11 x 290 cm^3, one with anthracite and another with sand as filter media. The uniformity coefficient of sand and anthracite of 1.54 and 1.4 were maintained from sieve analysis. Nephelometric, Piezometer and Volumetric methods were used for measurement of turbidity, head loss and discharge respectively. Constant Filtration rate of 3m/h was set and other ancillary activities were made same for both filter models. The experiments were repeated seven times with different influent turbidity ranges of 0-25, 25-50, 50-100, 100-150, 150-200, 200-250, 250-300 NTU. Both the Filters were backwashed with backwashing velocity of 24 m/h, when the terminal head loss of 165.4 cm was obtained. The effluent quality of anthracite obtained was better for all the filter run. The head loss development with time was more for sand filter in all filter runs. The filter run time for sand vary from 150 to 8 hours and for anthracite, it varies from 172 to 13 hours from first to seventh filter run. The average turbidity removal efficiency for sand was 94.76 % and for anthracite was 95.76%. Anthracite should not be treated as coal only but also should be used to treat turbid water with efficiency.

Keywords: *Efficiency, head loss, rapid gravity filter, sand, anthracite, turbidity.*

Use of Artificial Neural Networks for Predicting the Compressive Strength of Concrete

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Abstract

Concrete is a fundamental material in construction, and predicting its compressive strength accurately is crucial for ensuring structural integrity and cost-effectiveness. Researchers have been actively working on developing models to predict concrete compressive strength, as it can help adjust mix proportions to avoid under or over-strength concrete, leading to fewer construction failures and cost savings. Predicting the compressive strength of concrete is a complicated process due to the heterogeneous mixture of concrete and high variable materials. This paper presents a study on the use of artificial neural network (ANN) for predicting the compressive strength of concrete. A database consisting of 1,559 concrete mix designs obtained from past studies is used for the ANN model development. From the dataset 70% of the data used is used in training the model and 30% for testing and validation of the model. The input parameters for the ANN model are quantities (kg/m^3) of cement, blast furnace slag, fly ash, water, coarse aggregate, and fine aggregate used in the concrete mixture, and the age of the concrete (days). The output target variable is the compressive strength (MPa). For the network of the ANN model, Multilayer Perceptron (MLP) employed, and the network architecture (size of Various layers and Functions) was optimized through a trial-and-error process by varying the number of hidden layers, the size of hidden layers, the transfer function, and the training function.

It was found that the hyperbolic tangent sigmoid function as the transfer function and the Levenberg-Marquardt backpropagation algorithm for training yielded the best results. The performance of the developed ANN model was evaluated using the mean squared error (R^2 value) . The developed ANN model had a R^2 value of 0.96. An experimental case study is also performed to check the accuracy of the ANN model to predict the compressive strength of concrete mix and it was found that the ANN was able to correctly estimate the compressive strength with less than 5% variation.

Keywords: *Compressive strength, Artificial neural networks (ANNs), Multilayer Perceptron (MLP), Hyperbolic tangent sigmoid function, Levenberg-Marquardt backpropagation algorithm.*

ELABX - An Extended Online Laboratory Management System

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Abstract

ELABX revolutionizes online lab management through its pioneering use of WebAssembly (WASM) technology, establishing a secure sandboxed environment tailored for programming tasks. This innovative approach ensures robustness and security while enhancing accessibility and usability in programming education.The system's core architecture includes a clang compiler compiled to WASM, facilitating the execution of C++ codes directly within web browsers. Test cases retrieved from a centralized database are dynamically inserted into user-submitted code, allowing comprehensive testing by comparing expected output with program output. Crucially, all code compilation processes occur on client-side, mitigating security risks associated with executing untrusted code on the server. JavaScript plays a pivotal role in generating object code, WASM code, and executing wasm code within the browser. To optimize performance, essential libraries, compilers, and linkers are preloaded. Teachers utilize the system to review solutions and monitor student progress, ensuring a seamless educational experience. ELABX represents a significant advancement in programming education, offering a scalable and adaptable solution for managing and conducting programming labs. Its methodology, rooted in WASM technology and client-side code execution, underpins its security and efficiency, revolutionizing the assessment and collaboration processes in educational settings. Importantly, findings affirm the system's capability to securely execute code within its sandboxed environment along with progressive learning mechanism in a managed environment.

Keywords: *WASM, course management, sandbox, automated code testing*

Strain Limit for Numerical Simulation Based on Experiments with Notches Under Tension

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Abstract

In structural design, it is essential to modify the shape of components by adding holes, notches or grooves to reduce weight or provide access to other components. However, such modifications can create areas of high stress at the location of the holes or notches, which can be significantly higher than the average stress levels across the entire component. Therefore, it is crucial to predict the potential for ductile fracture when evaluating the performance of structural components that require large local deformations before reaching design resistance. This study focused on determining the design resistance of plates with semicircular notches using plastic strain limits as a key indicator. The study examined the design resistance criteria specified in established standards and performed numerical simulations to define the corresponding threshold for semicircular notches. Experimental and numerical analyses were performed on plates with semicircular notches while subjected to uniaxial loading. The strain during the experiment was measured using the Digital Image Correlation (DIC) technique. Reliability analysis is employed to derive plastic strain values, advocating for a 5% plastic strain limit of material as a suitable criterion for semicircular notch design.

Keywords: *Numerical simulation, stress concentration, plastic strain limit, notch, finite element method*

Bloodlink: Revolutionizing Emergency Blood Donation Through Mobile Application

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Abstract

Blood donation can save many lives, making it a crucial act during medical situations such as trauma cases, surgeries, organ transplants, and treatments for diseases like cancer and sickle cell disease. In today's fast-paced world, finding new blood donors has become more difficult. The challenge lies in delivering accurate information to the appropriate audience precisely when needed. This poses a significant challenge in meeting the demand for blood transfusions. The lack of a centralized platform and real-time notifications hinders the connection between individuals in urgent need of blood and willing donors, resulting in delays, increased risks, and added burden on hospitals, blood banks, and patients' families. Furthermore, blood banks struggle to keep optimal blood stock levels, exacerbating the situation. The Bloodlink application, a flutter-based mobile application is proposed to connect blood donors with people in need during an emergency. The proposed app uses the incremental model, to accommodate changing requirements and to facilitate modular development. The proposed application uses mobile technology to connect blood donors within a specific radius to ensure swift response times during emergencies, revolutionizing the process of finding them. The application includes features like real-time notifications, donor verification, inventory restocking for blood banks, and making blood transfusions more accessible and efficient. The app consists of a mobile application for blood donors where patients can search donor-based geo-

location and a web-based application for administration processes like user verification, blood donation campaigns, and inventory restocking. The proposed Bloodlink application reduces the gap between donors and recipients and optimizes the utilization of available blood resources; the app has the potential to reduce emergency response time while strengthening the overall emergency response infrastructure. Bloodlink application continues to evolve and expand its user base, it can save countless lives by ensuring timely access to blood donations during critical moments. Bloodlink has the potential to have a significant and long-term impact on global public health thanks to active participation from donors, healthcare institutions, and blood donation campaigns.

Keywords: *Flutter app, efficient blood donor connection, real-time notifications, stream lined blood transfusions*

Comparative Analysis of Support Vector Machine and Multilayer Perceptron for Classifying Imbalanced Data Using Sampling Techniques

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Abstract

With the evolution of the technology, data have been very important than it has ever been. Today, many decisions are made based on data. More the data, more possibility to get accurate result. But in many cases, available datasets are imbalanced i.e. one class have more data called majority class and other class have few data called minority class. In that case when we use machine learning algorithms for data classification with these imbalanced datasets, the classifier will be more biased towards majority class and will result in wrong data classification. So, this paper focuses to minimize this problem. In this paper, first the imbalanced data are collected from the University of California Irvine (UCI) repository which is "Online Shoppers Purchasing Intention Datasets". The datasets consist of total number of 12,330 data and 18 attributes (14 numerical and 4 categorical data). Then this imbalanced data is sampled using three different sampling techniques stratified random over sampling, stratified SMOTE sampling and stratified SMOTE-TOMEK Links sampling which balances the imbalance dataset. Then, Support Vector Machine and Multilayer Perceptron (MLP) are used for data classification. Two hidden layers with 128 neurons and 64 neurons respectively are used in MLP and sigmoid function is used for activation function in output layer. For model

validation and hyperparameter tuning, Nested Cross Validation is used. After that, the models are tested using test data and result is evaluated using different evaluation metrics like Precision, Recall, F1 Score and ROC Curve. After all the evaluations, we find that SMOTE-TOMEK Links sampling technique perform better for Support Vector Machine and SMOTE sampling technique perform better for Multilayer Perceptron. Among two models used in this paper, Multilayer Perceptron model gives better result with average F1 Score of 0.91.

Keywords: *Imbalanced data, Over Sampling, SMOTE, TOMEK Links, Stratified Sampling, Support Vector Machine, Multilayer Perceptron, Nested Cross Validation*

An Effective Sentiment Analysis Pipeline for Romanized Nepali Text

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Abstract

This paper addresses the growing need for sentiment analysis in Romanized Nepali text, prevalent in social media, online forums and various digital platforms. The lack of robust sentiment analysis tools specifically tailored for Romanized Nepali hinders organizations and individuals from effectively understanding public opinion, customer feedback, and market trends within Nepali-speaking communities. In this work, we propose a novel sentiment analysis pipeline specifically designed for Romanized Nepali. The Romanized Nepali text undergoes rigorous preprocessing steps like tokenization, stopword removal, and special character handling. This ensures the data is clean and suitable for further analysis. We then extract informative features from the preprocessed text. This includes traditional bag-of-words representations that capture word frequency, along with advanced word embeddings, which are real-valued word representations that capture lexical semantics. This combination provides a richer and more nuanced understanding of the text. Finally, we explore a range of machine learning and deep learning models for sentiment classification. This includes classical methods like Naive Bayes and Support Vector Machines alongside transformer-based models like language-specific BERT. Our evaluation shows that BERT achieves superior performance compared to other models, exceeding 90% accuracy on sentiment classification tasks.

Keywords: *Natural language processing, Romanized Nepali, Sentiment Analysis, Transformer-based Models, BERT*

Optimizing the Use of Parking Spaces at Supermarkets with Dynamic Pricing and Time-based Pricing

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Abstract

Consumers dread shopping during peak hours at supermarkets. This has given rise to the "congestion aversion" behaviour among shoppers. The effects of overcrowding and long waiting times, primarily on safety but also on effective use of its parking spaces, were highlighted during the recent COVID-19 pandemic. Supermarkets and grocery stores have begun to trial time-based pricing where they charge higher prices during congested peak hours. To improve urban parking reservations are also being trailed, specifically for on-street parking. It is safe to say that it remains a challenge to optimally manage limited parking resources in busy urban areas, including within busy businesses such as supermarkets and grocery stores. Static pricing is operationally much easier to plan. Similar is the case for free-of-charge parking for a short duration. Most of the grocery stores and supermarkets in Nepal prefer the latter. However, the immediate effect of the free-of-charge model is a much longer waiting time for the next customer. This has a direct impact on store revenue and shopping experience. This study investigates the impact of time-based pricing and dynamic pricing strategies on parking space utilization. Specifically, the focus is on pricing adjustments during off and on-peak hours and real-time adjustments based on demand and traffic flows. We utilize a combination of quantitative methods and data analytics

to examine the effectiveness of dynamic pricing models on parking space utilization and revenue generation. Key findings highlight the significance of dynamic pricing mechanisms in managing parking space demand efficiently. By adjusting prices based on peak hours and real-time demand, supermarkets can optimize the use of limited parking resources. It alleviates congestion and enhances customer experience. The study contributes to the existing knowledge by offering practical insights useful not only for supermarkets but also for urban parking spaces. Furthermore, it underscores the importance of leveraging technology and data-driven approaches to understand parking demand and congestion control.

Keywords: *Demand based pricing strategy, Parking space utilization, Revenue generation, Time based pricing, Traffic flow*

Assessing Municipal Solid Waste Composition and Generation with Emphasis on Recyclable Waste in Pokhara Metropolitan City

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Abstract

Pokhara Metropolitan City located in Nepal's Gandaki Province, is a well-known city for its natural beauty. Rapid urbanization and population increase has become a key issue in solid waste management of the city. The population of Pokhara as of CBS 2021 data is 513504. This is 2.1% Annual Population Change from 2011 to 2021 A.D. The urbanization results in production of solid-waste such as organic, in-organic and hazardous solid waste generation rapidly. This study examines existing waste management methods, recycling and composting projects and challenges faced by the Pokhara Metropolitan City for sustainable waste management. As urbanization accelerates understanding the composition and volume of garbage has become crucial for sustainable waste management techniques. The study adopts a comprehensive mixed methodology of both qualitative and quantitative data. The study investigates composition of MSW using trash characterization. Furthermore, the study studies and analyzes the MSW generation rates in various residential, commercial and industrial sectors providing insights into waste production patterns over time and space. By focusing on recyclable waste streams, the study intends to uncover prospects for resource recovery and trash diversion techniques leading the development of effective waste. This study covers the core subject of how solid waste is managed in PMC, the efficiency of present recycling and composting activities and barriers to sustainable

waste management. Random sampling of households covering high-income medium income and low-income, institutions, commercials and informal waste management sectors were chosen for data collection and analysis. A list of questionnaires and discussions were conducted with the related stakeholders and organizations. The overall collection and disposal of waste is currently handled by the private waste collecting operators while the management of the landfill site is done by the PMC. The sanitation value chain of solid waste management in PMC is Generation, Storage, Collection- door to door, Road side collection, Transport /Handling, Final Disposal. The 7 private operators responsible collect waste from the designated location provided by PMC. The per capita waste generation rate is 0.354 kg. As of 2024 the total population of the PMC is 552000. Total waste generation rate is 195 tons. Among which 64.4% is biodegradable waste, 14.57% reusable and recyclable waste and 20.69% is landfill waste. The city is in need of proper policy and feasible landfill technology for the management of solid waste generated.

Keywords: *Solid Waste, Landfill, Segregate, Urbanization*

Sustainability Assessment of Community-Based Water Supply Systems: A Case Study of the Deurali-Hupsekot Urban Water Supply and Sanitation (Sector) Project

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Abstract

Sustainable water supply entails finding reliable and resilient methods to meet human water needs without depleting sources, harming the local economy, or causing environmental damage. Sustainable water supply and sanitation promote public health, better living conditions, and community development. Community-based water supply systems play a vital role in decision-making, operation, and maintenance, promoting ownership and sustainability. This research assesses the sustainability of a community-based water supply and sanitation project, focusing on technical performance, institutional arrangements, and socio-economic conditions. The goal is to evaluate and provide recommendations for improvement. This study includes qualitative and quantitative research and household sampling of 230 respondents. To determine the weight

of factors and subfactors influencing sustainability, the report employs the Analytical Hierarchy Process (AHP), a widely recognized decision-making tool. The AHP allows for a systematic and structured approach to prioritizing factors based on their relative importance, considering the perspectives of experts and stakeholders involved in the project. The project demonstrates a high level of sustainability (91.46%) in terms of quality, quantity, reliability, and water pressure. The assessment also reveals moderate sustainability (61.19%) in the institutional and socio-economic aspects, highlighting the importance of coordination, behavioral changes, and addressing household concerns. The project achieves a sustainability rating of 69.48% in operation and maintenance. This assessment examines income generation, expense management, and the availability of an appropriate skilled workforce. The income trends indicate potential for loan repayment and financial sustainability, while sufficient human resource ensure the smooth functioning and maintenance of the infrastructure. Overall, the project achieves a commendable sustainability rate of 79.89%. The findings from the study provide valuable insights for project implementers, policymakers, and stakeholders involved in similar community-based water supply and sanitation initiatives, promoting sustainable development and improved water access for the community.

Keywords: *Analytical Hierarchy Process (AHP), Community-based water supply system, Institutional arrangement, Socio-economic conditions, Sustainability assessment*

Performance Evaluation of Recycled Coarse Aggregate on Compressive Strength of Concrete

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Abstract

The recycling of construction and demolition waste (CDW) is of paramount importance due to its sustainability and economic benefits, encompassing the reduction of landfill waste, conservation of natural resources, and mitigation of pollution. This practice has become integral to the construction industry, particularly in addressing the substantial construction waste generated from the demolition of reinforced concrete (RC) structures. The experimental examination of the performance of recycled coarse aggregate (RCA) on concrete behavior is fundamental in this context. Recycled Coarse Aggregate (RCA) is produced by crushing, screening, and salvaging concrete waste from demolished structures. A study was conducted to examine the properties of recycled coarse aggregate intended for use as coarse aggregate. The percentage of recycled coarse aggregate replacing natural coarse aggregate varied at 0%, 25%, 50%, 75%, and 100%. Concrete cubes were cast and tested in a laboratory. To assess performance across various curing periods, 90 standard concrete cubes are formed as NCA alternatives, and their compressive strength is evaluated at 7, 14, and 28 days. After analyzing the physical and mechanical properties of these proportions, it was observed that, except

for 75% and 100% replacements, all met the specified limits. The results of the compressive strength tests indicated that both M20 and M25 design mix concretes, without admixture and with 100% NCA, showed higher values at 27.05 MPa and 32.09 MPa, respectively. Conversely, 100% RCA recorded the lowest values at 18.93 MPa and 22.07 MPa for M20 and M25, respectively. The tests were conducted in accordance with the procedures outlined in the Standard IS Codes. The results show that up to 50% of replacements of natural crushed aggregate have a nominal strength of concrete. The analysis of coarse aggregate and concrete mix test results for the mentioned proportions suggests that up to 50% of natural crushed aggregate can be replaced by recycled coarse aggregate without compromising the characteristics and strength of concrete.

Keywords: *Construction and Demolition waste (CDW), Reinforced concrete (RC), Recycled coarse aggregate (RCA), Natural Crushed Aggregate (NCA).*

The Influence of Artificial Intelligence on Human Behavior and Well-Being: An Empirical Study

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Abstract

Artificial Intelligence (AI) is continuously transforming the way human cognitive processes are carried out, encompassing decision-making, visual perception, language translation, and speech recognition. Artificial Intelligence (AI) is widely incorporated into various industries, including healthcare, education, and social interactions. It greatly enhances the process of making decisions, enhances the results of healthcare, and boosts productivity while effectively tackling intricate societal problems. This empirical study investigates the many impacts of artificial intelligence (AI) on human behaviour and welfare using a comprehensive mixed-methods approach, including structured surveys and a thorough investigation of scholarly literature. This study employed a mixed-method technique, which combined a structured questionnaire with a Likert scale questionnaire. A sample of 150 individuals was surveyed, and this data was supplemented by undertaking an extensive examination of scholarly literature and online databases. This method enabled a comprehensive analysis of the societal and behavioural effects of AI. The data was analysed using SPSS version 25. Educational Support exhibited the highest significant impact, attaining an average rating of 4.89 on a 5-point Likert scale. This demonstrates a significant impact on improving learning settings and

tailoring education to accommodate individual needs. The mean score for Social Isolation was 3.05, indicating a somewhat significant influence, especially in relation to the role of AI-driven technology in influencing users' feelings of isolation. The One-Sample T-Tests yielded statistically significant findings ($p < 0.000$) for all variables. The variable with the biggest mean difference of 4.9 was Emotional and Mental Well-being. These findings emphasise the significant impact of AI on altering human cognition and behaviour. It is imperative for policymakers and engineers to give top priority to creating strong legal frameworks that guarantee transparency, equity, and data security in AI systems. It is advisable to continuously assess and adjust to handle the changing consequences of AI and to maximise the benefits for all parties involved. The incorporation of artificial intelligence (AI) into society offers several prospects as well as difficulties. Stakeholders may responsibly negotiate the intricacies of AI deployment by comprehending its many implications on human behaviour and well-being. They can harness its potential to fulfil societal needs while reducing the risks involved. This study provides vital insights into the ongoing discussion on AI governance, highlighting the significance of proactive steps to encourage the ethical and fair utilisation of AI in a world that is increasingly reliant on AI.

Keywords: *Artificial Intelligence, Human Behavior, Well-Being, Educational Impact, Social Isolation*

Comparative Study on Seismic Behavior of Regularand Irregular Buildings in Sloping Ground

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Abstract

Nepal occupies a region prone to frequent seismic activity, characterized by its predominantly hilly and mountainous terrain. The scarcity of flat land has led to a rapid surge in urbanization, with buildings constructed on sloping ground. These structures are particularly vulnerable to earthquake damage. This study aims to investigate the seismic behavior of various building configurations on hill slopes, including step back (SB), step back set back (SBSB), split foundation (SF), and split foundation set back (SFSB) buildings, both regular and irregular in shape. The analysis incorporates soil-structure interaction (SSI) effects and compares them with fixed-base structures and those on flat ground (PG). Soil stiffness is represented as a point spring at the base of the structure to simulate soil behavior. The seismic performance of each building configuration is assessed using Finite Element Method (FEM) software ETABS, considering parameters such as fundamental time period, base shear, top story displacement, inter-story drift, and torsional irregularity ratio. A comparative analysis shows how different configurations vary in their vulnerability to earthquakes. The findings indicate that, on sloping terrain, buildings with split foundations (SF) exhibit higher vulnerability, while those with step back set back (SBSB) configurations perform relatively better. Incorporating soil effects significantly influences building performance, resulting in increased flexibility and higher top displacements and time periods for structures with flexible bases, along with reduced base shear.

Keywords: *Seismic, Regularand Irregular Building, Sloping ground, SSI.*

Economics of Sludge and Water Effluent Management of Wastewater Treatment Plant

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Abstract:

The Guheshwori Wastewater Treatment Plant (GWTP) was used for the study work. The main objective of the research work was to analyze the economic benefits of sludge and water effluent management of the Wastewater Treatment Plant (WWTP). The Cost Benefit Analysis methodology was used and analyzed to meet the research objectives. The Wastewater treatment plant has significant environmental benefits as well as monetary values that can be generated from water effluent, sludge effluent, and plant visit fares, which indicates the revenue generation from the wastewater treatment plant. This study takes a ground-breaking strategy to economically value wastewater treatment in Nepal. A helpful indication of the viability of wastewater treatment will be the comparison of the benefits of WWTP with the operating costs of the treatment process. On a dry mass basis, the finished sludge had a total nitrogen content of 3.58 percent, a total phosphorus content of 1.54 percent, and a potassium content of 0.15 percent. After pathogen reduction sludge can be used in agricultural fields as fertilizer leading to high monetary values for GWTP. Plant visit fares from the visitors also can generate monetary value. Similarly, water effluent can be used in watering the parks, irrigation, and cleaning, and after turbidity reduction can be used in concreting and curing.

The Guheshwori Waste Water Treatment Plant requires a yearly total of around NRs. 4,49,94,639 to operate. If we merely reuse 5% of the NRs. 94,03,130, 10% of the NRs. 1,88,08,085, 50% of the NRs. 9,40,28,380, and 100% of the NRs. 18,80,61,870, we can produce money. From the wastewater treatment plant's sludge, 57,34,202 may be produced yearly. There is a potential income generation of about NRs. 12,02,500 from the plant visit fares. To close these disparities, GoN must enact legislation on the optimal use of WWTP effluent, the protection of water sources, public health, and environmental economics. The welfare concept of economics concept states the maximum utilization of the reuse of the resources of the effluents from the Guheshwori Wastewater Treatment Plant, NBV>1 can be achieved from an environmental economics viewpoint alongside achieving Sustainable Development Goals SDGs Goals 6, 8, and 11.

Keywords: *Cost-benefit analysis, Sludge, Revenue, Environmental economics, SDGs*

Study of Thermal Performance of Ventilation System with Flow Dynamics

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Abstract:

The thermal comfort is an abstract term. Mathematical representation of thermal comfort is very complex as different individual have different preference and stimulation to thermal conditions. The basic factors that define thermal comfort are air temperature, radiant temperature, air velocity, humidity, clothing insulation level and metabolic rate. These factors can be controlled accordingly to achieve the best thermal condition for maximum occupant. The previous studies have been focused on the finding the analytical solution to the thermal comfort problem. Some simulation studies have been performed on the space ventilation, but this research takes an integrated approach to studying ventilation performance with computational fluid dynamics tools along with the study from analytical/empirical method. The main objective of this research is to properly understand thermal behavior and flow dynamics of ventilation system.The Specific objectives of this research is to successfully perform the parametric study and design optimization and analyzing how the flow dynamics and the thermal comfort are related.Moreover the research intends to identify the type of ventilation system that will be most efficient in term of providing thermal comfort to maximum number of occupants. This study describes an application that uses simulation and CFD to prepare the ventilation system for the movie hall at Pokhara's Mid-town retail mall. Using the CLTD approach, the cooling load was calculated. CFD simulations were used to predict detailed air flow

velocity and space temperatures as well as to evaluate the accuracy of the different size and configuration of inlets and outlets (diffuser and exhaust) to achieve best temperature and velocity condition in the occupant region. Selection criteria for the arrangements and parameter for the inlets are local temperature and air speed at the occupant region. These value can be compared with the ASHRAE standard and it there parameter fall in the acceptable range, the requirements regarding ventilation system design can be achieved.The result of the simulation indicates that parametric control to both designs can improve the thermal comfort to the occupant space for cooling application. During ventilation design for a space, best configuration and parameter for inlets can be optimized based on CFD results without the need for expensive and time consuming experiments. Interior flow fields and internal temperatures were simulated using CFD to explain how to pick a desirable design configuration. Temperature and velocity distribution was obtained for the simple simulation could help identify the diffuser size and AHU sizing and load.Comparison of the predicted effects of temperature in the habitat showed a good agreement between mathematical calculation and CFD results.

Keywords: *Thermal performance, Ventilation System, Thermal Comfort, Computational Fluid Dynamics*

ASSESSMENT OF THE CAPACITY OF ROADSIDE DRAINAGE ON LAMACHAUR ROAD

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Abstract

Lamachaur Road (Pokhara, Nepal), situated in a region prone to heavy rainfall and flash floods during the monsoon season, faces recurrent issues of waterlogging and roadway obstruction. In response to these challenges, this study investigates the efficiency of existing roadside drainage systems in managing runoff and proposes strategies for mitigation. The primary objectives encompassed the determination of peak runoff during rainfall events, assessment of the current drainage capacity, and exploration of feasible measures for enhancing drainage efficiency. According to the frequency analysis of observed precipitation data and hydrological analysis employing the rational method, peak runoff for the 50-year return period was 25.943 cumecs. Subsequently, a hydraulic model was developed to simulate runoff dynamics along the Lamachaur Road for the design discharge requirement using the Hydrologic Engineering Center's River Analysis System (HEC-RAS) software. Through analysis, it was revealed that the existing drainage infrastructure has capacity significantly below the required capacity, with an observed deficiency of 82.7%. Quantitatively, the drainage system exhibited a capacity of approximately 4.5 cumecs, insufficient to adequately manage peak runoff volumes during intense precipitation events. Furthermore, attempts to augment drainage capacity through size enlargement yielded inconclusive results, as the anticipated reduction in flood was insignificant. Moreover, the prospect

of constructing larger drainage systems faced practical limitations due to the constrained availability of roadway space. In conclusion, this study underscores the pressing need for proactive measures to address the inadequacies of roadside drainage infrastructure along Lamachaur Road. By embracing innovative strategies and integrating sustainable approaches to water management, sustainable solutions can be realized, ensuring enhanced resilience against the challenges posed by monsoon-induced flash floods.

Keywords: *Runoff, Catchment, Discharge, Drainage, Hec-RAS*

Evaluation of Flexible Pavement Friction Coefficients: A Case Study of East-West Highway near Mahendranagar City, Nepal

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Abstract

Friction in highway engineering serves as the vital traction force between a vehicle's wheels and the road surface influencing the movement, speed, and efficiency on highways. This crucial factor depends upon various elements, including the materials utilized for pavement surface, traffic volume, age of the road, temperature, and prevailing climatic conditions. Multiple methodologies exist for determining the coefficient of friction, yielding slightly varying values. Among these, the Skid Resistance Test, employing a Portable Skid Resistance Tester (measured in British Pendulum Number), calculates the coefficient of friction by dividing the BPN by 100. An assessment conducted on a 5 km stretch of the East-West highway near Mahendranagar Bazaar revealed longitudinal and lateral coefficients of friction as 0.354 and 0.184, respectively under both dry and wet conditions. This evaluation, pertinent for design speeds ranging from 60 to 80 km/h, factored in an Annual Average Daily Traffic (AADT) of 10,321 Passenger Car Units (PCU) during the year 2023/2024. Notably, these findings exhibited a variance of 0.19%, alongside a poor International Roughness Index (IRI) value of 2.05. This section of the highway, post three years of construction completion, featured a Single Bituminous Surface Dressing course laid with uncrushed natural riverbed Quartzite

and Semi-Quartzite aggregates sourced from the Mahakali River. These aggregates consisted of a specific gravity ranging from 2.6 to 2.67 and were sized at 13.2 mm, applied at rates averaging between 12 to 15 kg per square meter. It's imperative to note that a higher coefficient of friction corresponds to diminished vehicle efficiency. Thus, meticulous scrutiny of coefficient of friction values, coupled with detailed specifications, remains paramount for ensuring traffic safety and road integrity.

Keywords: *AADT, Friction, IRI, Skid Resistance Test, Surface dressing*

Design and Fabrication of Pedal-Powered Rope Pump

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Abstract

Access to clean water remains a critical challenge in many rural communities worldwide. This study presents the design and fabrication of a pedal-powered rope pump as an innovative solution to address water pumping challenges in remote areas. The overarching objective of this research endeavor is to develop a sustainable, low-cost, and efficient water pumping system capable of enhancing agricultural productivity and improving access to clean water for rural populations. The research methodology adopted in this study can be classified as applied experimental research which contains systematic approach, beginning with a comprehensive literature review to understand existing water pumping technologies, design principles, and operational considerations. Based on the insights gained, a conceptual design of the pedal-powered rope pump was developed, integrating principles of fluid dynamics, mechanical engineering, and sustainable design practices. Critical theoretical calculations were conducted to optimize key design parameters, including seal velocity, volume flow rate, and power requirements. Theoretical models were validated through rigorous experimental testing, which involved fabricating prototype components and conducting performance evaluations under simulated operating conditions. Materials for the rope pump components were carefully selected based on their durability, cost-effectiveness, and suitability for local manufacturing. Local artisans and

technicians were engaged in the fabrication process, ensuring precision and quality in component production and assembly. The experimental results demonstrated the effectiveness of the pedal-powered rope pump in lifting water from wells or boreholes with a flow rate of 38.54 liters per minute and mechanical efficiency of 64.23%. These findings underscore the pump's potential to improve agricultural irrigation, mitigate water scarcity, and empower rural communities to achieve water security and economic resilience. In conclusion, the design and fabrication of the pedal-powered rope pump represent a significant advancement in sustainable water pumping technology, offering a practical and scalable solution for addressing water access challenges in resource-constrained environments. Future research directions may include further optimization of the pump design, integration with renewable energy sources, and community-based implementation strategies.

Keywords: *Pedal-powered rope pump, Fabrication, Experimental testing, Community empowerment*

Thakal Fruit Peel Extract Incorporated Biodegradable Films for Active Food Packaging: Preparation, Characterization and Antioxidant Activity

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Abstract

This study explores the emerging field of bio-based active food packaging with incorporation of natural extracts. The objective of this research is to develop an antioxidant food packaging films using biodegradable polymers infused with thakal (Phoenix acaulis Roxb.) extract (TPE). A series of composite films with different formulations were prepared from starch, polyvinyl alcohol and chitosan via solution casting method. The thakal extract used in this study was derived from peel of thakal fruit. The

films' properties were comprehensively characterized through techniques such as IR, XRD, SEM, TGA, and UV-visible spectrophotometry. These composite films showed better compatibility and enhanced barrier properties. Various factors including pH responsiveness, thickness, water vapor permeability, moisture content, and water solubility were also examined. Notably, the fabricated film based on polyvinyl alcohol, starch and TPE demonstrated satisfactory antioxidant properties. These findings suggest the potential utility of these films in bio-active based food packaging applications.

Keywords: *Thakal extract; food packaging; biopolymer; biodegradation*

Advancing Augmentative and Alternative Communication: Insights from a Pilot Study and Iterative Refinement Process

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Abstract

AAC applications play a critical role in facilitating communication in Nepal. But when it comes to being user-friendly and blending in with Nepali culture, they frequently fall short. To suit local needs, they truly must be adapted. Objective: The project aims to develop an accessible AAC tool that is tailored to Nepal, taking into account the Nepali language, regional differences, and technological accessibility, all while addressing issues like prices, technical knowledge requirements, and access barriers. Overall Approach: This study employs a comprehensive approach to address the communication challenges faced by individuals with disabilities in Nepal. Beginning with an in-depth needs assessment and cultural exploration, the project embraces a participatory framework, engaging people from diverse backgrounds. Cultural sensitivity was woven into every aspect, focusing on incorporating familiar symbols and language options relevant to the Nepali community. Methods: Utilizing knowledge in software development and cross-platform technologies, created an AAC application using Flutter, a versatile framework known for its adaptability. Flutter is used, to build a user-friendly interface with customizable features, including text-to-speech synthesis and dynamic

symbol libraries. It took a hands-on approach, starting with brainstorming ideas and sketching out initial designs. Once the concept took shape, dived into coding, iteratively building and refining the application's features. Each phase involved practical testing and adjustments based on user feedback, ensuring the application's usability and effectiveness. Procedures: Following the initial development, a pilot study was conducted among people to assess the effectiveness and usability of the AAC application in real-world settings. The pilot study involved ten participants each, preschool children, parents, educators, and speech-language pathologists, and through it gathered qualitative and quantitative feedback on their experience with the application. Based on the findings from the pilot study, iterative refinement processes were implemented to address identified issues and enhance the application's functionality, and accessibility. Results: The development of the AAC application resulted in significant advancements in accessibility and usability. Through testing and user feedback, the application demonstrated marked improvements in facilitating communication for individuals with disabilities. Overall, the AAC application emerges as a transformative tool, empowering individuals with disabilities in Nepal. Recommendation and Conclusion: A notable instance of a significant advance is the personalized application of AAC in Nepal, which promotes independence and confidence in daily interactions while improving communicative autonomy for individuals with impairments. These initiatives are urged to be enhanced and expanded to further empower people with disabilities worldwide.

Keywords: *Augmentative and Alternative Communication, speech and language impairment, AAC application, usability and accessibility*

Examination of Two-factor Authentication in a Student Enrollment Setting

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Abstract

Setting up two-factor authentication is an important step in new student enrollment in many universities around the globe. During this process, students create an account and register their email, mobile phones and other computing devices. The two-factor authentication is used for everything: installing software, paying fees, accessing emails, registering for a course and voting on campus. The utility of two-factor authentication is that it helps prevent data breaches, automated attacks, targeted phishing and hacking. This paper is chiefly an empirical study of the pseudorandom generator (PRNG). PRNG is an important component of the OTP-generating algorithm. The focus of the paper is on generating unique and strong random numbers. We put the standard PRNG of the OTP generation pipeline against the Wichmann-Hill algorithm to assess their utility in student enrollment applications. We evaluate the performance of the approaches by looking at the repetition rates and validate their differences through permutation tests. Based on the conclusions drawn from these tests, we suggest suitable OTP lengths for institutions with different student numbers. This approach aims to boost the security of the enrollment system and protect student data from unauthorized access. In conclusion, the implementation of Two-Factor Authentication (2FA) and the use of strong, unique random numbers play a crucial role in securing the student enrollment system. By automating the enrollment process and enhancing security measures, this project aims to streamline administrative tasks and ensure the confidentiality of student's personal information.

Keywords: *Student enrollment, OTP, 2FA, random number generation, LCG, Wichmann-Hill, otp algorithms*

Assessment of behaviour of reinforced concrete beam-column joints: A comparison of NBC 105:2020 and international standards

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Abstract

Nepal is situated in a seismically active region, and there is a growing requirement for the continuous development of the seismic code, and the reliance on precise techniques, such as numerical analysis, becomes pivotal for the thorough evaluation of code provisions. The study aims to compare the shear strength obtained from numerical analysis with NBC 105:2020 predictions, assessing how it differs from predictions made by EN 1998-1 (2004), IS 13920:2016, ACI 318-19, and NZS 3101-1:2006. Also comparison of beam-column joint designed with older MRT recommendations is made with current NBC 105:2020 recommendations. Utilizing a mesh-insensitive CDP model integrated into the ABAQUS standard, a numerical database was formed through nonlinear static analyses involving monotonic load increments on thirty-three study joints. The force-displacement behaviour of beam column joints, as well as the maximum shear force withstood by these joints are presented. Reliability of the numerical database is determined by developing a shear strength equation derived from the numerical database, incorporating the shear strength model found in existing literature, and implemented on a database of experimental tests. Finally, statistical evaluation comparing the shear strength predicted by the codes with that obtained from the numerical study is provided. The conclusion indicates that a code-compliant numerical database of beam-column joints effectively assesses shear

strength provision of NBC 105:2020, and this code provides a satisfactory prediction when compared to other codes. However, equations calibrated based on various parameters gives accurate shear strength predictions for beam-column joints that comply with code requirements, providing minimal standard deviation in comparison. In short, this research provides valuable insights for policymakers, facilitating the development of safer and more resilient beam-column joint designs in the seismic context of Nepal.

Keywords: *NBC 105:2020, Shear strength, Exterior beam-column joint, Numerical Database, Monotonic loading*

Projection of Climate Variables Based on the CMIP6 Model in the Seti River Basin of Nepal

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Abstract

The Seti River, originating from the Annapurna Massif, flows as a vital tributary into the Himalayan River system, which is reliant on meltwater. Climate change is projected to cause changes in precipitation patterns within the basin. The purpose of this study is to evaluate projected changes in temperature and precipitation in the Seti River basin under two emission scenarios: SSP245 and SSP585, using ensembled bias corrected multiple CMIP6 model outputs. By utilizing linear Quantile mapping, bias is adjusted. The time series of maximum and minimum temperature as well as precipitation up to 2100 A.D., were projected at six meteorological stations for each climate variable using five different Global Circulation Models (GCMs) under the future emission scenarios SSP245 and SSP585 for three future periods, namely, near future (2015-2050), mid future (2051-2075), and far future (2076-2100). The results of the Mann-Kendall test indicated a significant warming trend in both Tasmax and Tasmin as well as significant rising trends in precipitation, at 5% level of significance. With a rate of 0.064°C/yr (p-value = 2.36E-37) for SSP585 and 0.031°C/yr (p-value = 1.25E-31) for SSP245, Khairini Tar shows the highest trend for the Tasmin variable in the SSP scenario. Likewise, Damauli has the highest trend for the Tasmax variable, with rates of 0.053°C/yr (p-value = 1.21E-

33) for SSP585 and 0.029°C/yr (p-value = 1.02E-26) for SSP245. With 26.55 mm of precipitation per year (p-value= 3.45E-16) for SSP585 and 8.4 mm/yr. (p-value = 0.000132) for SSP245 at Lamachaur, the station has the highest trend in terms of precipitation. The findings of this research will contribute to a better understanding of climate change and shall be useful for further investigations in future climate and hydrology of the basin to provide valuable insights for policymakers, local communities, and relevant stakeholders to understand, prepare, and develop better strategies to adapt and mitigate these changes.

Keywords: *CMIP6; GCMs; Mann-Kendall test; Seti River Basin; Quantile Mapping*

Study of Impact of Mixed infections of Phytoplasmas on Environment

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Abstract

Phytoplasmas are a group of cell wall-less, obligate phytopathogenic bacteria belonging to the class Mollicutes. They are related with wide range of plant diseases throughout the world causing significant damage. These bacteria are enormously transmitted by phloem sap-feeding hemipterans as well as by grafting, dodder, and in certain cases by seeds. Mixed infections in plants possesses catastrophic effects posing severe threats to agricultural crops and natural ecosystems. Molecular techniques were utilized to detect the possible causal agents of chilli crop samples showing mixed symptoms of yellow leaf curl and little leaf type diseases in Uttar Pradesh, India. Total genomic DNA was extracted from twenty-five samples and amplified by uniplex and duplex PCR using a universal primer pair for begomovirus and phytoplasma. Mixed infection samples show positive amplified products for begomovirus (DNA-A and betasatellite) and phytoplasma (16S rRNA and Sec A). Sequence analysis of the begomovirus under study showed the highest identity (94.2%) with ChiLCV isolates identified in Oman (MK757213), whereas *Candidatus* Phytoplasma trifolii associated with chilli has a 99.04% nucleotide sequence identity infecting *Helichrysum* flowering plants in India. Subsequently, in-silico based on phylogenetic interweaves, and putative recombination reveals divergent evolutionary patterns with significant variation and recombination events. In-silico analysis of phylogenetic

interweaves and probable recombination reveals distinct evolutionary processes with with important variation and recombination events. Such findings could be the first in silico combined infection analysis of ChiLCV and Ca.P.trifolii in a chilli crop in India, revealing the potential adaptation and evolution of begomovirus and phytoplasma to a new geographic range and crop. The environmental conditions and combined effects of different pathogens lead to rapid diseaseprogression and substantial yield losses.

Keywords: *Chilli, phytoplasma, diseases, mixed infection, symptoms, virus, molecular approch*

Unveiling Trichoderma's Arsenal: A Multifaceted Approach to Environmental Biotechnology

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Abstract

Trichoderma, a genus of ubiquitous fungi, has emerged as a powerful tool in environmental biotechnology due to its diverse and beneficial properties.*Trichoderma* has shown great potential in various applications, such as biocontrol of plant pathogens, degradation of environmental pollutants, and enhancing plant growth and nutrient uptake. Further research and development are expected to uncover new strains of *Trichoderma* with enhanced traits, such as improved tolerance to harsh environmental conditions and increased efficiency in pollutant degradation.These advancements will contribute to the development of more efficient and sustainable bio-remediation strategies, leading to a cleaner and healthier environment. The future prospects of *Trichoderma* in environmental biotechnology are bright, with its potential in biocontrol, pollutant degradation, and plant growth promotion. This paper explores the multifaceted role of *Trichoderma* in various areas of environmental concern, highlighting its potential for sustainable solutions.

Keywords: *Trichoderma, Bioremediation, Biocontrol agent, environmental biotechnology, Plant Growth Promotion*

Identification of Safety Risks in Drilling Equipment Maintenance Operation in the Oil and Gas Industries: A Sequential Explanatory Research

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Abstract

This study aims to identify the most hazardous drilling activities and their associated potential hazards during maintenance operations in both onshore and offshore drilling operations through cross sectional research investigation. Qualitative and quantitative data was collected from three national level oil and gas industries located in Malaysia, Pakistan and Saudi Arabia. Moreover, a total of three health and safety experts and eighty crew members of oil and gas drilling have been carefully selected from specific petrochemical industries, taking into consideration their relevant work experience and specialized knowledge. In quantitative data analysis, descriptive statistical methods have been used by using SPSS 27. Further, thematic analysis approach was carried out for qualitative data analysis to identify potential risky conditions associated with drilling maintenance operations. As per the results and findings in accordance with the feedback from selected oil and gas industries, it has been identified that

the drilling equipment maintenance operation, in general is moderately hazardous and is linked with chemical, safety and ergonomic hazards during onshore and offshore drilling operations. Whereas, the Malaysian onshore and offshore drilling crew view equipment maintenance as more hazardous as compared to the respondents from Saudi Arabia and Pakistan. The mean range for this perception is 3.44 for offshore and 3.32 for onshore activities. Conclusively, this study was aimed at assisting safety and health professionals in the oil and gas drilling industry in effectively managing and mitigating the risks associated with equipment maintenance at onshore and offshore drilling sites. Further, it emphasizes the importance of following the hierarchy of hazards controls, which includes engineering, administrative, and personal protective equipment controls.

Keywords: *Drilling, Occupational Safety and Heath Environment, Equipment, Maintenance, Risk Management, Hazard Identification.*

Fixed Point Theorems in Dislocated Quasi b-Metric Space

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Abstract

The concept of fixed point theories is one of the most important results in Functional Analysis. Several generalizations are made to the well-known fixed point result known as the Banach contraction principle. Replacing the metric space with generalized metric spaces is a common method of studying the Banach contraction principle. There has been a number of generalizations of the usual notion of a metric space. One such generalization is a dislocated quasi b-metric space introduced and studied by Rahman and Sarwar in 2015. This paper aims to offer the fixed point results in the context of dislocated quasi b-metric space.

Keywords: Dislocated quasi b-metric space, fixed point, self-mapping, Cauchy sequence.

Strengthening Disaster Preparedness Program in Nepal: Assessing Community Preparedness Using the Disaster Ready Community Checklist

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Abstract

The Paschim Disaster Preparedness Project (PDPP), implemented from 2020 to 2022, aimed to strengthen the capacity of vulnerable communities within Nepal's high-risk districts of Baitadi (ranked 9th) and Doti (ranked 10th) according to the Nepal Hazard Risk Assessment. The project supported Nepal Red Cross Society and local governments to better manage, prepare for, and respond to disaster risks inclusively. The project used Disaster Ready Community Checklist (DRC) a robust tool informed by similar initiatives from organizations like the IFRC, Red Cross-National Societies, and governments to measure the disaster preparedness level at the community level. The DRC tool was employed to measure the various aspects of community preparedness in 24 project communities across Baitadi and Doti Districts of Sudurpaschim Province. The tool has been revised based on learnings captured from assessments undertaken in Bangladesh, Nepal, Indonesia, and the Philippines by external consultants during the last quarter of 2019 2020, and 2021. The tool was primarily guided by Margaret Ann Cargill Philanthropies' (MACP) Disaster Ready Community Model which uses four determinants to define a 'Disaster Ready Community' which are a) Self-organization; b) Ability to take action; c) Knowledge and Awareness; and d) Connectivity. The data were collected through focused group discussions and group interviews with

Community Disaster Management Committees (CDMC) members and local leaders respectively. Additionally, secondary data sources such as project documentation, activity reports, surveys, observation reports, evaluation reports, and monitoring reports were used to triangulate information and ensure a well-rounded assessment. In addition to obtaining qualitative information on the overall level of community disaster preparedness, every 28 indicators within the tool were assigned a score from 0 to 3, with 0 indicating 'no work done', 1 indicating 'low', 2 indicating 'medium', and 3 indicating 'high' preparedness/readiness. These scores were then used to calculate percentages for each of the four determinants. Finally, an overall "Disaster Ready Community Index" (DRCI) was derived by averaging the determinant percentages. The aggregated DRCI of the project communities stands at 71% reflecting a remarkable increase of 63 percentage points from the baseline in 2021. The DRC serves as a crucial guide for project implementation at the community level, identifying gaps and areas to strengthen community preparedness. This tool is a step forward to ensure stakeholders prepare and strengthen communities for natural hazards and disasters and measure their level of preparedness within their based community-based. By employing this clear and well-instructed tool with a transparent scoring system, the project identifies communities to reach a desired level of preparedness, ultimately strengthening community resilience.

Keywords: *Disaster, Community, Determinant, Tool*

Review on Hypergeometric Functions, Properties, and its Applications

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Abstract:
Hypergeometric functions are transcendental functions that are applicable in various branches of mathematics, physics, and engineering. They are solutions to a class of differential equations called hypergeometric differential equations. In this presentation, we shall give an overview of the hypergeometric series, covering its properties, and applications across various fields. Beside these, we give the contiguous function relations for Gauss's hypergeometric function in single variable and their connections with analysis. This presentation aims to offer a comprehensive understanding of hypergeometric series and their significance in modern mathematics. By synthesizing recent research developments and providing insights into future directions.

Keywords: *Hypergeometric series, Applications, Gamma function, Contiguous relations, Differential Equation.*

Seismic Responses of Reinforced Concrete School Buildings considering Soil Structure Interaction (SSI)

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Abstract

Nepal has long historical evidence for the construction varieties of buildings with their unique architectural, structural, and functional characteristics. Talking about the present context construction of pre-engineered or professionally engineered buildings or other structures has recently begun. The country felt the importance of investigating seismic responses of such pre-engineered or professionally engineered structures after the massive Gorkha Earthquake. To analyze the behavior of these buildings, how they perform during shaking in different soil conditions, professionally engineered building models prepared by the National Reconstruction Authority were studied. Soil deformable properties, changes in wave propagation travelling through soil up to foundation and interaction between soil foundation (substructure) and finally considering substructure to superstructure interaction are not considered in fixed base analysis. To incorporate the properties of soil, point springs stiffness are defined based on George Gazeta's formulas. And soil properties were taken from Bowle's Foundation Analysis and Design. Static analysis for both fixed and flexible base models were conducted. For a flexible system, point springs with six degrees of freedom (three translation and three rotational) where assigned at the base. This point springs system

incorporates the mechanical properties as well as deformability of the soil in the RC building models. The result shows an increment in the natural time period of the buildings, a decrease in base shear force and an increase in the value of maximum storey drift for the lower storey and the increment in the drift decreases for higher stories. An increase in the time period and a decrease in the base shear may have beneficial effects on the structures but an increase in maximum storey drift may have detrimental effects.

Keywords: *Fixed Base Model (FBM), Maximum storey drift, Natural time period, SoilStructure Interaction (SSI)*

An Experimental Investigation on use of Post-Consumer Waste Plastics in Structural and Non-Structural Concrete

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Abstract

Plastic is manufactured in large quantities around the world. It takes more than a thousand years for plastic to completely break down. Solid waste management has become a major environmental issue in the country. This research examines the use of post-consumer waste plastics as a substitute for fine aggregate in concrete to produce lightweight concrete. The purpose of the study is to assess the impact of adding shredded waste plastics on compressive strength, splitting tensile strength, flexural strength and density of concrete. Ordinary Portland Cement was mixed with the aggregates to produce the concrete composites. 1:2 cement sand mortar proportion and 0.5 w/c ratio was used for the experiment. Six-weight fractions 0%, 2%, 2.5%, 5%, 7.5%, and 10% shredded waste plastic were employed in the batching process. The mortar mixture was tested for slump; the moulds were cast into sizes 70.6 mm by 70.6 mm by 70.6 mm; cured for 7 days and 28 days respectively. Concrete samples were subjected to different fresh and hardened testing. Workability, density, water absorption, compressive, splitting tensile and flexural strength were determined. The results showed that the workability and water absorption increased with the increasing percentage of replacement of plastic whereas compressive, splitting tensile and flexural strength

decreased with the increasing percentage of replacement of plastic. The results also showed a decrease of the unit weight (density) of concrete with the increment in percentage of plastic waste replacement. The conclusion of this research is that plastic waste is not a good material to improve the strength development of the concrete mix. However, it can be used for the production of light-weight concrete in the construction industry like precast brick, partition wall, panel wall, canal lining etc.

Keywords: *Waste plastic, Ordinary Portland cement, Compressive strength, Lightweight concrete.*

Leveraging Blockchain and Big Data Analytics to Safeguard Lending Practices in Nepal's Financial Sector

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Abstract

Existing financial lending practices in Nepal encompass a diverse range of approaches employed by banks, financial institutions, cooperatives, insurance companies, employee provident fund, citizens investment fund and other informal lenders to extend credit to individuals and businesses. These institutions must navigate a diverse array of lending practices, from traditional loan products to innovative digital lending platforms, to meet the evolving needs of borrowers. Regulatory frameworks, risk management strategies, and technological advancements significantly shape this lending environment. The lending landscape is plagued by a myriad of challenges that impede the effective functioning of credit markets. Limited access to formal credit sources, coupled with high interest rates and stringent collateral requirements, constrain the ability of individuals and businesses to obtain loans. Moreover, inadequate credit assessment mechanisms and weak enforcement of loan contracts contribute to elevated credit risks and non-performing loans within the financial system. Addressing these issues necessitates comprehensive reforms aimed at enhancing credit infrastructure, improving risk management practices, and fostering greater transparency and accountability in lending operations. By addressing these underlying challenges, Nepal can unlock the full potential of its financial sector and drive sustainable economic growth and development. Nepal's unique socio-economic context presents both

opportunities and challenges for lenders, influencing their approaches to credit evaluation, loan disbursement, and debt recovery. Understanding these intricacies is paramount for policymakers, regulators, and industry stakeholders to promote financial inclusion, mitigate risks, and foster sustainable economic development. Despite the strides made, the lending landscape in Nepal's financial sector remains susceptible to disaster, fraud and data breaches. However, the integration of Blockchain technology and Big Data Analytics presents a promising solution to fortify lending practices and mitigate associated risks. Blockchain offers an immutable and transparent ledger, facilitating secure and tamper-proof record-keeping of loan transactions. Additionally, Big Data Analytics empowers financial institutions to analyze vast amounts of data, identifying patterns and potential risks in real-time. Leveraging these technologies, Nepal's financial sector can enhance resilience against threats, build trust among stakeholders, and foster a more inclusive and secure lending environment. By adopting these innovative solutions, financial institutions can fortify their lending practices, thereby contributing to the overall stability and sustainability of Nepal's financial ecosystem.

Keywords: *Digital Payment; Credit Risk Management, innovative technologies; Big Data Analytics; Blockchain; Credit Infrastructure;*

Immediate Impact of Jajarkot Earthquake in Load Bearing Structures in Affected Areas

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Abstract

The Jajarkot Earthquake, which occurred on November 3rd, 2023 at around 11:47 pm local time, registering a moment magnitude(M_w) 5.7 and Local Magnitude (M_L) of 6.4 on the Richter scale, was the reminder of Nepal's vulnerability to seismic activity. This study focuses into the aftermath of the earthquake, specifically focusing on the damage suffered by load-bearing masonry structures in Jajarkot and Rukum East. In these regions, where 95% of buildings are constructed using load-bearing masonry, approximately half of the structures experienced either complete or partial collapse due to the earthquake's impact. To assess the extent and nature of the damage, this research utilized a comprehensive methodology combining on-site field observations with analysis of secondary data sources. This paper's goal is to systematically categorize and understand the types, mechanisms, and root causes of the structural damage witnessed post-earthquake. The observed damage included extensive cracking along load-bearing walls and corners, diagonal fractures originating from door and window openings, and significant displacement and collapse of both internal and external walls. Additionally, we noted fractures in lintels supporting doors and windows, along with ruptures in outer wall surfaces and partial roof collapses, which represented unique forms of damage not commonly seen in prior seismic events. The underlying causes of this widespread damage were due to various factors such as irregular bonding systems, weak mortar usage, inadequate stone block formation, absence of

crucial structural elements like tie beams, weakly connected corners, and insufficient wall-roof and wall-floor connections collectively contributed to the vulnerability of these structures. By identifying these underlying issues and understanding their impact, this research underscores the critical importance of improving construction practices in seismic-prone regions like Jajarkot and Rukum East. Addressing these vulnerabilities is essential for enhancing the seismic resilience of buildings and mitigating risks associated with future earthquakes.

Keywords: *Jajarkot Earthquake, load-bearing wall, failure mechanisms, seismic vulnerability*

Rainfall-runoff Simulation in Fusre River Basin Using HEC-HMS

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Abstract

Understanding and managing water resources in ungauged river basins is challenging but crucial for its sustainable development. The Fusre river basin, a significant tributary of the Seti river, remains largely unexplored. This study focuses on predicting rainfall-runoff processes in the ungauged Fusre River basin, a tributary of the Seti River basin in Nepal, utilizing the Hydrologic Engineering Center-Hydrological Modeling System (HEC-HMS). HEC-GeoHMS in ArcGIS, enabled to establish several model parameters necessary for running the HEC-HMS model. Calibration and validation of the HEC-HMS model parameters were performed using daily streamflow data from the Damauli hydrological station and precipitation data from three meteorological stations across the Seti basin for different periods. Both continuous and event-based rainfall-runoff modeling enabled estimation of mean monthly flow and peak discharge values. Model performance was assessed using statistical parameters such as Nash-Sutcliffe Efficiency (NSE), Root Mean Square Error (RMSE), Percent Bias (PBIAS), and coefficient of determination (R^2). Upon achieving satisfactory model accuracy, the HEC-HMS model was applied to project streamflow in the ungauged Fusre River basin. Flood-frequency analysis based on simulated streamflow data indicated peak discharge values of 457.3 m^3/s and 534.6 m^3/s for the 10-years and 20-years return periods, respectively. Due to smaller number of annual stream flow values, the flood-frequency analysis was constrained to 10 and 20-year return periods. Finally, the HEC-HMS model is concluded as a very useful tool for estimating flow in ungauged river basins.

Keywords: *HEC-HMS, Fusre River Basin, Ungauged, Rainfall-runoff*

Generalized Cesàro Sequence Space of Non-Absolute and Absolute type as Complete Paranormed Space

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Abstract

This work aims to introduce and study a new class of generalized Cesàro sequence space of non-absolute and absolute type. Besides the investigation of the linear structures of the classes Ces (P) and Ces_P, our primary interest is to explore the paranormed structures and completeness of the classes Ces (P) and Ces_P when topologized with suitable natural paranorms.

Let ω denote the vector space of all complex valued sequences $x = (x_k)$. For a fixed positive number n and $0 < p < 1$, Ahmad & Mursaleen constructed the following Cesàro sequence space of bounded type

$$S(p) = \left\{ x = (x_k) \in \omega : \sup_{\substack{k \geq 1 \\ n \geq 0}} \left| \frac{1}{k} \sum_{i=1}^{k} x_{n+i} \right|^p < \infty \right\}$$

Nanda & Mohanty [10] studied the p-norm on S(p) defined as follow:

$$\|x\| = \sup_{\substack{k \geq 1 \\ n \geq 0}} \left| \frac{1}{k} \sum_{i=1}^{k} x_{n+i} \right|^p, \; x \in S(p)$$

Let $P = (P_k)$ is a bounded sequence of strictly positive real numbers and $0 < P_k \leq M$ and let X be the vector space over the field $\mathbb{C}$ of complex numbers. In this work, we have investigated the paranormed structures

and completeness of the space *Ces (P)* with paranorm G defined by

$$G(x) = \sup_{k \geq 1} \left(\frac{1}{k} \sum_{i=1}^{k} \left| X_i \right|^{Pk} \right)^{1/M}$$

and Ces_p with paranorm H defined by

$$H(x) = \sup_{k \geq 1} \left(\left| \frac{1}{k} \sum_{i=1}^{k} x_i \right|^{P_k} \right)^{1/M}, \text{ where } M = \max\{1, \sup P_k\}$$

Keywords: *Paranormed space, Sequence space, Cesàro sequence space.*

Assessment of Groundwater Potential Zones by Integrating Geographic Information Systems (GIS), and Analytical Hierarchical Process Techniques in Parsa District

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Abstract

Groundwater is a critical resource for meeting the domestic, agricultural, and industrial water demands in Nepal's Parsa district inner terai. This study aims to delineate the groundwater potential zones in the Parsa district using a multi-criteria decision analysis approach integrated with Geographic Information System (GIS) and remote sensing techniques. The study evaluates various hydrogeological and environmental factors influencing groundwater potential, such as geology, geomorphology, land use/land cover, slope, drainage density, and rainfall. These factors were weighted and integrated using the Analytical Hierarchy Process (AHP) to create a groundwater potential index map. Department of Hydrology and Meteorology (DHM) has been used for Precipitation data, LANDSAT-8 OLI data has been processed for lineament density and LU/LC analysis, SRTM Digital Elevation Model (DEM, 30×30) was used to obtain the slope, and density analyses, and the Department of Agriculture, Ministry of Agriculture and Livestock Development for soil study. The results of the analysis identify areas with Poor, moderate, Good, and Excellent groundwater potential with respective normalized groundwater potential indexes of 0 -0.08, 0.08 -0.28, 0.28 -0.6, and 0.6-1. The map covers

"Poor" (0.34% area), "Moderate" (51.41% area), "Good" (40.79% area), and "Excellent" (0.46% area) in Parsa district. The excellent potential zones are primarily located in the flood plains and alluvial fans, where the aquifer characteristics are favorable for groundwater exploitation. The moderate and poor potential zones are associated with areas with shallow water tables, poor aquifer properties, and high drainage density. The groundwater potential zoning map developed in this study can serve as a valuable decision-support tool for urban water resource planning, management, and sustainable development in the Terai region of Nepal. The findings can guide the prioritization of groundwater exploration and extraction activities, as well as the implementation of appropriate groundwater recharge and conservation measures to ensure the long-term sustainability of this vital resource.

Keywords: *Groundwater potential zoning, Geographic Information System (GIS), Remote Sensing, Analytical Hierarchical Process (AHP), Water resource management, Sustainable utilization, Parsa District.*

A multidimensional analysis of water poverty at local scale: application of improved water poverty index for Budhiganga Rural Municipality

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Abstract

Water scarcity has become a pressing issue in Nepal, attributed to various factors such as population growth, climate change, poorly planned road construction, and land-use transitions. This study was conducted in Budhiganga Rural Municipality, Morang, in the Koshi Watershed, to investigate water scarcity. The study employed the water poverty index (WPI) to analyze five components: access, resource, use, capacity, and environment. The results revealed that the WPI score was 75.93, indicating a low level of water scarcity. The study further revealed that the WPI score of Budhiganga Rural Municipality was found to be low to very low, and its components were ranked in the following order: Use > Resources > Access > Capacity > Environment. Across different wards, which are the smallest administrative units, the WPI scores ranged from 62 to 78. The use component garnered the highest score, while the environmental component had the lowest score. It was discovered that water use for household and agricultural purposes was minimal compared to other uses. To increase household water, use and consumption in the watershed, effective water management plans are essential. The WPI serves as an integrated tool for water resource management. It works at various scales, from local to national. It links all environmental factors. This helps identify and prioritize areas needing immediate management interventions. It also promotes integrated, multi-disciplinary, and sustainable water resource management.

Keywords: *Water Poverty Index, Changing Climates, Groundwater, Sustainable Development*

An assessment of Energy efficiency for the Vernacular Building Construction Practices: A case of different community houses typologies of Chitwan District

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Abstract

With the introduction of modern construction technologies in the country, the building sector has adopted uniform design and building techniques that neglects local climate conditions and local vernacular technology and rely on energy-intensive mechanical means to provide thermal indoor comfort. Especially for heating and cooling, a lot of energy is used and the overall operational energy requirement in buildings has therefore increased with Nepal's growing urbanization. In the rapidly changing scenario of the building construction sector, planners, architects, engineers and builders are looking for new materials and technologies to adopt in future constructions that benefit energy efficiency, improved indoor air quality and life cycle cost reduction and durability. The objective of this research was to compare the houses of Darai, Tharu and Modern community groups in terms of the construction practices that had been adopted for maintaining energy efficient and thermal comfort buildings. Questionnaires were prepared using criteria discovered through literature review, pilot study, and expert input. To investigate the difference in various parameters of energy efficient houses quantitative analysis

(QA) was used to discover the most significant factors affecting energy efficient parameters. 20 years climatic data (2002-2022) of Chitwan were purchased from Department of Hydrology and Metrology, Government of Nepal. The comfort temperature of Chitwan was assessed using the Nicol formula. The thermal performance of investigated vernacular with thatch roof houses of Darai community were seen better since it was found to be 3.44°C cooler in summer and 2.64°C warmer in winter. Comparing within the Vernacular houses, houses with thatch roof were found more thermally comfortable than houses with khapata. This study showed Vernacular houses saves minimum 3.44°C temperature in summer season and 2.64°C in winter seasons compared to other investigated houses. Vernacular houses were found more thermally comfortable to live in both summer and winter and more energy efficient which has been verified through calculation of regression analysis and relative importance index (RII). In the context of Chitwan district, Tharu community people are still continuing their houses construction technology for the energy efficient construction practices. Vernacular construction practices were found better in energy saving approach compared to conventional modern construction.

Keywords: *Climatic conditions, vernacular architecture, climate-responsive, energy efficient, thermal comfort*

Overall Performance Evaluation of An Urban Water Supply System: A Case Study of Dharan Sub-Metropolitan

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Abstract

The Nepalese government has set a goal to implement a Water, Sanitation, and Hygiene (WASH) plan for all 753 local levels (Palikas, Local Government body) by 2023 to use as a tool to accelerate the Sustainable Development Goals (SDGs). According to the Ministry of Water Supply, the national water coverage is 88% and sanitation coverage is 98%. However, only 25.4% of water supply projects are fully operational because of the various challenges in their functioning. The Dharan Water Supply Management Board is an example of a water supply project facing several challenges in managing urban water utilities. These include Infrastructure Maintenance, Supply and Demand Imbalance, Climate Change, Regulatory Compliance, Community Engagement, intermittent water supply, sub-standard water quality, and inadequate service delivery. The implementation of effective strategies for addressing these challenges is crucial to ensure a reliable and sustainable supply of safe drinking water. The main focus of this study was to evaluate the actual performance level of water supply system based on hydraulic efficiency, quality, cost recovery, customer satisfaction, Water Resources management, financial management and human resource management. The water distribution system status was measured using reliability, resilience, and vulnerability as performance indicators. Weightage Arithmetic Water Quality Index

(WAWQI) and household-based questionnaires were used to evaluate the water quality and customer satisfaction, respectively. The study showed that the hydraulic efficiency of the system was moderate, with a pressure index of 0.630 and velocity-based sustainability index of 0.120. The quality of water was also examined, and it was discovered that the slow sand filter was able to remove over 97% of bacteria and maintain a turbidity level below 0.1 NTU at the filter outlet. According to the WAWQI results, over 70% of the tap water samples met the drinking water standards. The study also revealed that customers cover approximately 90% of the production costs, but 65% of consumers expressed dissatisfaction with the quantity of water supplied which indicates addition of new source of water. Furthermore, staff productivity was poor, with a productivity index value of 3.67 from to 2018-2023. Thus, the study concluded that the performance of Dharan Water Supply Management Board is up to satisfactory level in water Quality and hydraulic efficiency but unsatisfactory level in other performance till this study year 2023.

Keywords: *Water Quantity, Turbidity, Slow Sand filter, Staff productivity, Water Quality, Bacterial removal efficiency, Staff Ratio*

Unraveling Global Protest Behavior: Insights from ICEWS Dataset Analysis

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Abstract

This research project delves into the analysis of global protest behavior utilizing the Integrated Conflict Early Warning System (ICEWS) dataset. Leveraging data science methodologies, we meticulously filter and process the ICEWS dataset to extract pertinent information regarding protests across various countries. Our focus lies in understanding the dynamics of protest occurrence, including their frequency, geographic distribution, and associated magnitudes. The initial phase of our study involves parsing through the ICEWS dataset to isolate countries and their corresponding protest events, along with their respective magnitudes. Through rigorous data preprocessing techniques, we prepare a refined dataset conducive to deeper analysis. Utilizing dynamic time warping (DTW) and k-means clustering algorithms, we embark on uncovering latent behavioral patterns among countries with regards to protest occurrences. The application of DTW allows for the detection of similarities in protest time series data, enabling the identification of countries exhibiting comparable protest trends. Subsequently, employing k-means clustering facilitates the categorization of countries into distinct groups based on their protest behavior. Our findings reveal insightful clusters of countries with similar protest behavioral patterns, shedding light on underlying socio-political dynamics and shared grievances. By elucidating these clusters, our research contributes to a better understanding of global protest movements and offers valuable insights for policymakers, researchers, and stakeholders concerned with conflict prevention and resolution.

Keywords: *Data Science, ICEWS Dataset, Protest Behavior, Dynamic Time Warping, K-means Clustering, Socio-political Dynamics.*

Mode Choice Modelling: A Case Study of Manipal Teaching Hospital

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Abstract

Mode choice models play a pivotal role in managing transport facilities by providing planners and policymakers with valuable insights into the preferences and behaviors of travelers. Different modes of transportation are used by individuals to commute to Manipal Teaching Hospital. The objective of this research is to identify the different factors influencing the mode choice behavior of individuals and develop an MNL model. Based on the review of the literature on transportation surveys, the RP survey is conducted with a designed questionnaire to collect data on various socio-economic factors, travel patterns, and individual preferences and distributed to the individuals visiting MTH. The collected data is converted to a spreadsheet. The final data after removing the missing data is then divided into model fitting and testing data set. The multinomial logistic regression was run in SPSS to develop the model. The final model developed is checked with different statistical tools like -2loglikelihood, and pseudo R^2 to determine its performance. The factors affecting the mode choice were travel time (in vehicle), travel cost, travel time (walking + waiting), gender, vehicle ownership, trip distance, occupation, and education. Factors like marital status, income, safety, and comfort which seem to affect mode choice behavior are not included in this model. Although the models developed in this study can not necessarily be generalized to all hospital or institutions yet they provide insights for other hospitals or institutions when investigating their travel patterns and mode choice determinants.

Key Words: *Mode choice modeling, RP, log likelihood, SPSS, MNL model.*

Evaluation of a New Class of Integrals Involving Generalized Hypergeometric Function

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Abstract

In the theory of hypergeometric and generalized hypergeometric series, classical summation theorems such as those of Gauss, Gauss second, Bailey and Kummer for the series ${}_2F_1$; Watson, Dixon, Whipple and Saalshutz for the series ${}_3F_2$ play a key role. Applications of the above mentioned summation theorems are well known. In our present investigation, we aim to evaluate twenty five new class of integrals involving generalized hypergeometric function in the form of a single integral of the form:

$$\int_0^1 x^{c-1}(1-x)^{c-1}[1+px+q(1-x)]^{-2c}\,{}_3F_2\left[\begin{matrix} a, & b, & c+\frac{1}{2} \\ \frac{1}{2}(a+b+i+1), & 2c+j & \end{matrix}\;;\;\frac{4(1+p)(1+q)x(1-x)}{[1+px+q(1-x)]^2}\right]dx$$

for *i, j = 0, ± 1, ± 2.* The results are established with the help of the generalizations of the classical Watson's summation theorem obtained earlier by Lavoie et al. together with an interesting integral due to MacRobert. Fifty interesting integrals in the form of two general integrals (twenty five each) have also been given as special cases of our main findings.

Keywords: *Generalized hypergeometric function; Watsons theorem; definite integral; MacRobert integral*

An Assessment of Soil Organic Carbon (SOC) and Soil Properties Variation in Banpale Forest of Tribhuvan University, Pokhara Campus

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Abstract

The analysis and the distribution and dynamics of soil carbon is an essential requirement for sustainable land management in forests. As forest is the greatest sink of soil organic carbon, assessment of its distribution is important. Similarly, the amount of clay present in soils determines many soil response properties such as soil water content, soil fertility, porosity, etc. The study area shows that the average clay percentage of the soils in *Banpale Danda* forest is 16.62 % with maximum of 25.20 and minimum value of 7.62 %. The higher percentage of clay is concentrated in the middle region of the forest. As the study area is mostly occupied by slopy landscape and the mean annual rainfall of this region is higher, clay percentage is higher where the soil loss from surface runoff is lower. Similarly, the mean soil pH in the first soil layer (0-10), second layer (10-20) and third layer (20-30) cm are 4.88, 4.90 and 4.96. The soil in the forest is dominated by acidic reaction. There is not much variation in soil pH, however, the south facing slope in the mid region of *Banpale Danda*

has higher soil pH values in comparison to west and eastern locations of the forest. The mean SOC content on the top horizon is highest with the value of 2.7 % whereas the mean SOC at second and third soil layer are 1.77 % and 1.69 % respectively. With some exceptions, SOC content variation towards depth shows inverse relation with soil depth having high SOC content at the topsoil layer. Our research findings could be helpful to characterize different aspects of the forest and land restoration management of the *Banpale* forest.

Key Words: *Soil organic carbon, forest, soil properties*

Highway Alignment Planning Using Analytical Hierarchy Process (AHP), Geographic Information System Modelling: A Case Study for Road Network in Kaski

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Abstract

Highway Alignment Planning is an important albeit most looked down aspect of highway development in developing countries. More often than not, highway alignments are influenced by various issues which further complicate the planning process. In this study, a road network is planned that connects the administrative centers of all local-level governments in the Kaski district, Nepal. To plan the road network, various criteria such as Elevation (Altitude), Slope, Aspect, Soil type, Rock type, Land Use Land Cover, Drainage Orders, Existing Roads, Agricultural area, Built-up area, water bodies in the locality, noise and air pollution, are considered which govern the highway alignments selection of the highway alignment. These criteria are grouped into three respective themes i.e. Engineering, Economical, and Environment. An Analytical Hierarchy Process based on an Expert survey is conducted to identify the weightage of each criterion in each theme. The questionnaire was prepared for AHP and distributed to Experts recognized in the field of Transportation both professionally and academically. The response from

the experts were evaluated based on the AHP guidelines to ascertain the weightage of each criterion. The criteria maps are then processed in GIS and criteria theme maps were generated using GIS and results from AHP. The spatial analysis (Least Cost Path Analysis), an integrated function in GIS was employed to generate alignments for respective themes of the road network are generated. In this study, the Analytical Hierarchy Process (AHP) and GIS with LCPA were successfully integrated to obtain multiple alignments connecting the administrative centers of Local Level Governments in the Kaski District which eliminates the laborious and tedious conventional method of alignment planning.

Keywords: *Highway Alignments, Analytical Hierarchy Process (AHP), Least Cost Path Analysis (LCPA), Geographic Information System (GIS)*

Evaluation of Perception and Satisfaction on Quality of SMART Two-wheeler Ride Sharing Services: A Case Study of Kathmandu Valley OF NEPAL

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Abstract

Ride sharing service (RSS) is a time and facility oriented updated service using secure and convenient smartphone technology in real-time ride pooling where two groups of people as driver and passenger exist. Smart RSS have revolutionized modern transportation, promoting economic, environmental, and social sustainability. In Kathmandu Valley, RSS has induced a transformative shift in urban mobility, offering a digital, on-demand alternative. Understanding the impacts of app-based RSS on Nepal's transportation ecosystem remains a trial, creating knowledge gaps for policymakers. This study aims to address these gaps by assessing service quality, satisfaction, and commuter perceptions in a concise exploration of the RSS landscape. A cross-sectional study was conducted in the districts of Kathmandu, Bhaktapur, and Lalitpur in the Bagmati Province to research active commuters utilizing RSS. This study encompassed various demographics, including students, service personnel, entrepreneurs, and other professionals. The data collection method involved administering questionnaires using a snowball sampling technique, was done with a sample size of (n=385). Descriptive indexes were employed to present data for each variable. Additionally,

regression analysis was utilized to systematically assess hypotheses pertaining to the SERVQAL domain and user satisfaction, employing inferential statistics for a robust evaluation. Regression analysis findings indicate significant associations between various dimensions of service quality and user satisfaction. Specifically, reliability (p=.04), empathy (p=.00), and assurance (p=.00) were found to positively influence user satisfaction, whereas responsiveness (p=.14) and tangibles (p=.23) did not demonstrate significant effects. Respondents expressed favorable sentiments towards 2W-RSS, highlighting its time-saving, cost-effective, and convenient attributes. However, persistent challenges such as privacy concerns, affordability issues, and navigation difficulties underscore the ongoing need for service providers to prioritize user privacy, enhance safety measures, and address cost barriers. These efforts are imperative for sustaining user satisfaction and ensuring the enduring viability of 2W-RSS in the Kathmandu Valley.

Keywords: *Ride-Sharing Services, Service Quality, User Satisfaction, 2W-RSS, SERVQUAL dimension*

Enhancing Real Estate Search Through the Application of Lexical and Phrase-Based Query Expansions

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Abstract

This paper explores the application of language processing techniques for improved query expansion within the domain of real estate websites. A query and the set of relevant documents likely use different vocabulary and writing styles while referring to the same physical entity or concept. For example, 'flat' and 'apartment' could have the same meaning from the perspective of the buyer. However, only one of these can be present in the property's description while the query contains the other. Our approach aims to address the limitations of keyword-based search by incorporating richer information such as Part-of-Speech (POS) tags and word senses. At the lexical analysis level, query expansion adds similar terms to the initial query thereby increasing the number of results retrieved from the search. We use WordNet as the source for query expansion of individual terms. WordNet is one of the most popular hand-built lexical databases that is popularly used for Query expansion and word-sense disambiguation. We further investigate the effectiveness of phrase-based expansion by extracting patterns from constituency and dependency parse trees for deeper syntactic analysis to refine user intent. These phrases are expanded using Wikipedia database. Wikipedia titles, in-links and out-links provide an alternative phrasing for the original phrases. Wikipedia contains redirect pages which are used to overcome the challenge of searching

based on abbreviated tokens. The proposed approach and rich features provide a more robust search experience characterized by increased precision and recall, user satisfaction, and contextually relevant results. We demonstrate the efficacy of the proposed language processing pipeline by integrating it into a real estate portal.

Keywords: *Query Expansion, Natural Language Processing (NLP), Part of Speech (POS), Syntactic Parsing, Real Estate Portal, Semantic Search, Subscription system, WordNet*

Interface Design of Geo-Location-Based Real Estate Search

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Abstract

This paper presents and evaluates a design of a geo-location-based search interface for real estate. We use the design principles of HCI to display Point of Interests(PoIs) on the map in an intuitive and clear way. Maps are based on cartographic principles that pay attention to legibility, visual contrast, figure-ground organization, hierarchical organization, and balance. Additionally, the maps are capable of displaying PoIs, landmarks and search results. We conduct experiments to verify the performance of the search interface for intuition and usability. In the first experiment, users are given a map and asked to pinpoint locations where they want to search for the desired property. The search functionality finds relevant property instances that are in the vicinity of the selected locations. They are then instructed to select the desirable property instances. In the second experiment, the user is taken to random locations on the map. The user is then asked to select properties of a particular type. Users are presented with different scenarios such as budget, distance from the city center, land dimension, family-size etc. The results provide evidence to comprehend users' preferences and along with objective evaluation of the interface, this study uses post-experiment questionnaires that evaluate variations on a five-point Likert scale for subjective data for analysis.

Keywords: *Human Computer Interaction (HCI), Geo-location Integration, Open Street Maps, Real Estate Web app*

Bloodlink: Revolutionizing Emergency Blood Donation Through Mobile Application

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Abstract

Blood donation can save many lives, making it a crucial act during medical situations such as trauma cases, surgeries, organ transplants, and treatments for diseases like cancer and sickle cell disease. In today's fast-paced world, finding new blood donors has become more difficult. The challenge lies in delivering accurate information to the appropriate audience precisely when needed. This poses a significant challenge in meeting the demand for blood transfusions. The lack of a centralized platform and real-time notifications hinders the connection between individuals in urgent need of blood and willing donors, resulting in delays, increased risks, and added burden on hospitals, blood banks, and patients' families. Furthermore, blood banks struggle to keep optimal blood stock levels, exacerbating the situation. The Bloodlink application, a flutter-based mobile application is proposed to connect blood donors with people in need during an emergency. The proposed app uses the incremental model, to accommodate changing requirements and to facilitate modular development. The proposed application uses mobile technology to connect blood donors within a specific radius to ensure swift response times during emergencies, revolutionizing the process of finding them. The application includes features like real-time notifications, donor verification, inventory restocking for blood banks, and making blood transfusions more accessible and efficient. The app consists of a mobile application for blood donors where patients can search donor-based geo-

location and a web-based application for administration processes like user verification, blood donation campaigns, and inventory restocking. The proposed Bloodlink application reduces the gap between donors and recipients and optimizes the utilization of available blood resources; the app has the potential to reduce emergency response time while strengthening the overall emergency response infrastructure. Bloodlink application continues to evolve and expand its user base, it can save countless lives by ensuring timely access to blood donations during critical moments. Bloodlink has the potential to have a significant and long-term impact on global public health thanks to active participation from donors, healthcare institutions, and blood donation campaigns.

Keywords: *Flutter app, efficient blood donor connection, real-time notifications, stream lined blood transfusions*

Rethinking Engineering Education in Nepal; Adapting to Industry Needs and Technological Advancement

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Abstract

There has been a significant gap between Academia and Industry Needs which has consequently resulted in Engineering graduates finding it difficult to find appropriate job in current job market causing a decline in number of students opting for Engineering studies in Nepal. To counteract this growing problem, this presentation highlights integration of modern teaching technique into existing classroom teaching learning practice showing experimental results of various modern teaching technique like Active Learning, flipped classroom, Project based learning, Collaborative learning implemented on Pokhara University Engineering students for enhanced learning experience to increase interest of student in Engineering studies. Furthermore, this presentation also discusses experimental results of incorporation of spirituality and liberal art to engineering students for their enhanced learning experience. Additionally, this presentation proposes implementation of design thinking in Engineering students to foster innovation, sustainable idea generation to encourage entrepreneurial mindset contributing to self-sustaining Nepalese economy based on Triple Helix Model – Industry, Academia and Government. Orientation towards national need-based research is also highlighted in this presentation. Furthermore, this presentation discusses an interactive model between Industry Expert, Faculty and Students providing skill based learning platform to its student as per job market needs; a probable model for examination pattern of Engineering Academic institutions in context of

situation where mother institution have several affiliated colleges spread all across the nation, with centralized examination system opening doors for oral examination, open book examination with supreme decisive authority handed over to subject committee regarding examination pattern to be held in addition to current closed book examination; rethinking curriculum design pattern with dynamic market based syllabus; mandating one or two interdisciplinary engineering courses to be chosen by student as per their personal interest in addition to basic fundamental interdisciplinary engineering courses currently being offered to equip engineering student to tackle growing inter disciplinary nature of modern engineering problems. Furthermore, this presentation encourages use of Learning Management System (LMS), eLearning platforms by Nepalese Engineering academic institutions, and in contrast, provide counteractive solutions to increased use of Artificial Intelligence, and information bombardment through Internet technology to preserve creativity and innovation in Engineering student. To conclude, this presentation proposes models that can be implemented in Nepalese Engineering Education, remaining in financial constraint Nepalese Academic Institution holds, in a quest to solve problems faced by Engineering Education in Nepal increasing turnout in student choosing Engineering, enhancing their creativity, adapting them to new technological advancements and increasing their chances of employability which ultimately contributes towards national economy and development more than ever.

Keyword: *Industry Needs, Modern Teaching Technique, Skill based Learning, Examination System, Learning Management System, Design Thinking*

Evaluation of the Influence of Angle Variations on Irregular RC Building Performance

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Abstract

Nepal, situated in a seismically vulnerable region, has experienced the devastating effects of past earthquakes, notably the Gorkha earthquake of 2015. The majority of building structures in Nepal exhibit regular rectangular or square shapes, as well as irregular L-shaped configurations, which have been shown to suffer significant damage in previous studies. However, the transition from regular to L-shaped structures with angle variations in specific bays remains unexplored, highlighting a critical gap in current research. The structures are considered to have angle variation of beam longitudinal axis from primary grid axis which resulted in varying column position on plan view for a specific bay. This creates the condition of 3D angle variation of building about global Z axis with inducing eccentricity along both global X and Y direction. The study aims to address this gap by quantifying the performance of structures undergoing such transitions, focusing on displacements, drifts, torsion, base shear, inter-story shear, torsional rotation about Z axis, torsional irregularity ratio and the critical angle of seismic incidence, analyzed through the Response Spectrum Method. Architectural, functional, and operational needs often dictate non-parallel arrangements of structural elements, leading to increased

abnormal behaviour in RC building structures. The primary factor contributing to this behaviour is the variation of center of mass and center of rigidity. For the considered models, this critical angle of seismic incidence is determined through a trial-and-error method, and the angle creating the largest reaction along one of the loading directions is identified as the critical angle. The results highlight the adversity faced by structures with higher angle variations, emphasizing the need for special consideration in their design.

Keywords: *Irregular buildings, Response spectrum analysis, Seismic incident angle, FEM, Inter-storey drift ratio*

Quantifying Soil-Structure Interaction Effects on the Response of Irregular RC Buildings and Soil Behaviour

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Abstract

The Gorkha seismic sequence of 2015 inflicted substantial damage on Kathmandu, underscoring the vulnerability of densely populated areas to seismic events. Traditional structural design practices in Nepal have predominantly relied on fixed base conditions, neglecting the intricate interplay between soil dynamics and structural integrity during earthquakes. This study aims to bridge this gap by employing dynamic nonlinear analysis using Opensees and STKO platforms to evaluate structural and soil performance under seismic loading conditions. Three distinct soil types and plan irregular building structures which were selected from aerial surveys imageries extracted using Google Earth Engine, were modeled, totaling 126 simulations. Through Python automation on STKO, structural responses such as relative displacement, drift ratio, torsional irregularity ratio, and diaphragm torsional rotations were rigorously analyzed against seismic records scaled from IS 1893-2016. Additionally, the study examines the shear stress-strain hysteretic behaviour of the soil beneath superstructures at various Gauss points during original seismic events, highlighting energy dissipation mechanisms. The findings underscore amplified responses in flexible base conditions, particularly on soft soils, necessitating a reconsideration of structural dimensions and design paradigms. This emphasizes the imperative of incorporating nonlinear soil-structure interaction (SSI) dynamics, particularly in regions prone to seismic activity and soft soil conditions, to enhance structural resilience and mitigate vulnerability to natural disasters.

Keywords: *Irregular buildings, Soil structure interaction, Nonlinear dynamic analysis, FEM, Opensees*

Comparison of Transient Response for an Underground Structure Subjected to Blast Load, with and without Shockwave Barrier

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Abstract

An underground free-standing cantilever wall is normally designed to protect humans and important equipment housed in any subsurface infrastructure facility during critical attacks, say, nuclear and other explosion-related attacks. The recent increase in sabotage attacks worldwide has shown that blast loads' impact on structures is of serious concern; hence, related transient loads are to be considered at the design stage. In the present study results from numerical analyses of an underground concrete wall subjected to blast loads at different standoff distances, within the soil medium are studied in detail. Response parameters, viz., the time history of deformation, velocity, acceleration, and stresses are assessed and compared for both cases, i.e., with and without barrier. Based on the results, an appropriate radial distance is recommended for the given quantity of explosive (TNT equivalent) to ensure the safety of the wall for these loads. Blastwave barriers made of different materials are inserted between the source of the blast and the wall, to protect the wall. The effectiveness of these barriers is studied by comparing deformations of the wall, with and without a barrier. In conclusion, shock wave barriers of suitable material are quite effective in reducing structural response due to blast loads. The results of this study will help in designing single or multiple barriers capable of mitigating the effects of explosions, The selection of suitable barrier material is an important aspect and cannot be ignored. Protecting human lives and critical components housed within the underground infrastructure should be the primary focus for detailed design.

Keywords: *Blast load, concrete, radial distance, shock wave barrier, underground structure*

Uncertainties in Estimation of Rocking Springs Based on Codal Provisions: Comprehensive Review

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Abstract

National and international codes provide limited guidelines for modeling founding medium as equivalent springs under seismic, dynamic and transient loading conditions. One of the common methods of approximation is based on impedance method, where semi-infinite medium is represented by three translation and three rotation springs. Underlying assumption for this method is, that, the foundation is sufficiently stiff and hence, local or differential displacements are negligible. Foundation is assumed to have translations and rotation as a rigid body. When foundation is flexible, say, raft or strip footing, this assumption will lead to unrealistic results. Further, industry practice is to distribute total stiffness and apportion it based on contributory area of finite element mesh. As per this practice, translation stiffness induces fictitious rotational stiffness. However this value may be far away from realistic stiffness mobilized under the foundations, in either way, say too low or too high. A few cases are analyzed with different foundation and founding medium stiffness, to assess the effect of these lumped soil stiffness parameters on dynamic response. Flexibility of foundation (or raft) is taken into consideration for estimating global response, say, differential settlements, rotations and stress in founding medium and foundation. Stiffness of founding media is varied within the

possible range for soils to medium stiff rock. Shear wave velocities for normal, medium compacted and highly compacted soils with shear wave velocity of 200, 400 and 600 m/sec are considered. Machine foundation of 4m square and 2m thick is modelled in two cases, viz., a) lumped block with springs attached at center, b) distributed springs at the bottom. Outcome of the study is presented for differences in foundation response to machine vibration. Analysis and design guidelines are recommended for practising engineers.

Keywords: *Raft flexibility, soil structure interaction, founding medium, differential displacements, rotational stiffness*

Integrating BIM into the B. Architecture Curriculum of Pokhara University

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Abstract

Building Information Modeling (BIM) is a crucial tool in architectural education to create designs, increase design precision, streamline project collaboration, simulate real-world scenarios, and encourage sustainable and efficient building practices. The primary challenges to the deployment of BIM in Nepal are the high cost of software licensing, the necessity for specialist training, and the integration of these technologies into the architectural curriculum. The shortage of trained BIM professors, computer infrastructure, and poor networks are some of the difficulties in incorporating BIM into architecture programs. The objective of this study is to analyze the Bachelor of Architecture curriculum to allow the integration of BIM tools. To achieve the research goal, the content analysis to review and find gaps in the existing curriculum and the SOAR analysis for the introduction of a standalone BIM course, as well as the incorporation of architectural design and visualization courses to address multiple dimensions of BIM, are integrated and adapted. Pokhara University is implementing BIM for a few standalone courses, electives, and advanced graphic courses. Still, for greater integration, it can be combined with design studios, construction technologies, cost estimation, research, and design thesis-related subjects. For starters, CAD and BIM cannot be introduced at the basic level since they rely heavily on manual skills, which architects require. The fundamental concepts of CAD and presentation tools such as Photoshop can be integrated into classes like Architectural Graphics and Design Studio-I, which focus on improving

presentation abilities and small-scale design. In the third semester, BIM 3D, which contains the actual representation of building elements in three dimensions, can be added as an independent course in addition to Sketchup, Rhino-Grasshopper, and 3Ds Max. In the fourth semester, students should be introduced to 3D rendering tools such as Lumion, Enscape, and Twin-Motion BIM for exploring digital information and collaborating on design and construction projects. BIM as 4D (time) can be offered as an individual course in the fifth semester as an elective alongside interior design. Similarly, workshops, interdisciplinary collaborations, and training can be separated or combined with internship-related courses. BIM 5D (cost) and 6D (facility management) can be included in elective II, together with theoretical subjects to supplement in the eighth semester. BIM 7D (lifecycle) can be taught as an elective III course in the ninth semester. Finally, because the project scale is complex, multifunctional, and multiuser, the sixth to tenth semesters may be appropriate times to incorporate BIM into design projects. In conclusion, this study recommends cooperative learning, narrative videos, guided self-study, and case studies as pedagogical approaches in BIM education, as well as partnerships between universities and construction industry enterprises to eliminate barriers.

Keywords: *Integration, BIM, B. Architecture curriculum, Pokhara University*

Microstructural Evaluation of TMT and MS Bars under Various Heat Treatment Conditions

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Abstract

From ancient times to now, human society has been greatly impacted by metal discovery. Characteristics like conductivity, melting temperature, strength, and flexibility formed tech and shaped businesses. Notably, steel was essential to the Industrial Revolution, technological advancement, and infrastructure. The study of material grain requires an understanding of heat treatment. The microstructure is altered by heating and cooling, including grain composition and size. The samples of TMT rebar and MS rod are prepared for examination ensuring proper gripping and handling. To facilitate the examination process, Marbles reagent and Nital are prepared in a chemistry laboratory. Various heat treatment processes, including normalizing, annealing, and quenching, are then applied to the samples before observing grain structure and boundaries as it not only enhances the material's properties but also facilitates clearer and more insightful microscopy analysis. The analysis concentrated on mild steel and TMT FE 500 D rebar, which were identified by their distinct production processes. Samples were examined under a 500x magnification microscope after being polished and etched to expose microstructural features. In the examination of both MS rods and TMT rebars, distinct phases such as ferrite, pearlite, and martensite were observed. By analyzing the distribution of these phases, valuable insights into the microstructural characteristics and mechanical properties of the MS rods and TMT rebars were obtained. In annealed TMT rebars and MS

steel rods, the individual size of ferrite increases, signifying increased ductility. Finer grains observed at lower temperatures lead to improved hardness, whereas coarse grains observed at higher temperatures lead to improved machinability in both TMT rebars and mild steel. As the annealing temperature rises, the gap between ferrite and pearlite widens, leading to an increase in interlamellar spacing. Similar to annealing, in the normalization process of TMT rebars and MS rods, as the temperature rises, grains maintain their structure from fine to coarse. Additionally, the spacing between ferrite and pearlite also widens, although to a lesser extent than in annealing. Quenched steel is characterized by the formation of martensite, which signifies high hardness, strength, and brittleness. The formation of martensite structure intensifies as the sample piece is cooled from elevated temperature levels. These results highlight how important heat treatment is in determining a material's characteristics. As steel is widely used in the military, aerospace, industrial, medical, manufacturing sectors and many other applications, it is important to understand its grain and phase structures and the effect of heat treatment in materials properties. Numerous factors, such as cooling rate, heat treatment method, and material composition, impact our understanding of steel's properties and increase the number of sectors in which it is used.

Keywords: *Heat Treatment, Microstructure, Microscopic, Etching*

DISASTER PREPAREDNESS USING MODERN TECHNOLOGIES

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Abstract

Disaster Response Protocol plays a vital role in deciding the impact of the disaster. An efficient Disaster Response Protocol will reduce the impact only when its practice is effective. A unified system with remote communication, geo-tracking, and high-end technology can enhance the Disaster Response Protocols to the next level to guide a person in the time of disaster when he needs mental, emotional, and physical support the most. So that, his experience of the disaster is less disastrous. Sakha is one such effort for disaster preparedness and rescue. Sakha is an AI-integrated app with an alert system designed to notify everyone about disasters, ranging from the smallest to the most severe. Additionally, it is developed to train Sakha users through activities to be mentally, emotionally, and physically prepared to face a disaster.

Keywords: *Disaster Management; Technology; Disaster Response Protocol, App development, API*

Strengthening Smallholder Mixed-Farming System for Sustainable Food Self-sufficiency in Nepal

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Abstract

Nepalese agriculture provides livelihoods for nearly two third of the nation's population and contributes about 25% to national GDP. Despite over six decades of relentless governmental efforts on agricultural development, Nepal's dependence on food import is increasing at an alarming rate in recent years not only compromising food security but also potentially national sovereignty. It is hypothesized that the current dismal state of agricultural sector is due to the weakening of critical links between the major components of smallholder mixed-farming system coupled with climate change impacts and the lack of appropriate policy interventions. To Identify factors associated with farm-level variation in smallholder mixed-farming system, to assess farmer's perceptions and adaptation to climate change impacts, and for policy recommendations a full-fledged household survey was launched in May 2012 in Thulokhola watershed of Nuwakot district in Nepal. Land holding size and land types (irrigated, non-irrigated), labor availability, number of goats and cattle owned, fodder and forages, availability of forests products, and income diversification were the key factors associated with farm-level variability. Drought conditions, erratic rain events, livestock diseases and parasites, fodder and water shortages, and forest degradation were major climate change impacts in the watershed. These result suggest that sufficient attention should be given for the better integration of farm size and land types, livestock and crop production, farm labor, agroforestry, forest

resources, farm income diversification, and climate change adaptation to increase overall farm productivity of smallholder mixed-farming system in Nepal. They also suggest that Nepal's agricultural development revolves around five drivers: 1) sustainable commercialization of smallholder mixed-farming system, 2) incentivized farmers, buyers, sellers, traders, and agro-entrepreneurs, 3) pro-poor market, 4) strategic public investment on infrastructure, and 5) policies, plans, strategies, rules and regulations, and trade agreements. Agricultural policies and programs such as purchase and price guarantee, soil and water conservation, agroforestry intervention, livestock community health services, and irrigation water management are necessary for commercialization and development of the smallholder mixed-farming system and sustainable food self-sufficiency in Nepal.

Keywords: *Asta-Ja, agriculture, sustainable development, small holder mixed farming system*

Analytical Study of Spider Web Inspired Cable Net Structures Under Dynamic Loads

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Abstract

Nature provides us insight into the numerous forms of materials and structures. The spider web is among them; proved to be one of the unique and reliable structural frameworks-found within nature. Spider web network epitomizes the perfect blend of geometry and mechanics, forming an effective structure -owing to the optimum disposition of structural mass. Similarly, natural pre-stressing of the web imparts rigidity to the structure which is an economical and efficient mechanism to balance the stress induced. Moreover, localized failure is mostly seen on the spider web but it does not compromise the overall integrity of the structure. In our proposed project, we will develop a wire model using finite element software to simulate a spider web with steel reinforcements. The model will be subjected to various dynamic loads, including impact, wind, and earthquakes on nodal points of radial reinforcements, allowing us to study the behavior of the radial and spiral reinforcements under different dynamic loading conditions.

Keywords: *Biomimetic, spider web, pre-stress, localized failure, dynamic loads.*

Dynamic Modelling of 4kW Induction Motor Using MATLAB / Simulink

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Abstract:

Induction motors stand as pivotal components in the global electrical landscape, serving industrial, commercial, and domestic domains due to their innate simplicity, robust architecture, heightened efficiency, and economic viability. Understanding the nuanced dynamics of these motors through dynamic modelling is imperative, as it offers insights into their behaviour amidst fluctuating loads and enables the implementation of sophisticated speed control mechanisms such as vector control. Moreover, dynamic modelling facilitates the evaluation of motor-driven systems with minor modifications, thereby enhancing overall performance and efficiency. This paper delves into the intricate realm of dynamic modelling by focusing on the induction motor within the DQ axis framework, where it operates at synchronous speed. Mathematical equations serve as the cornerstone of this endeavour, providing a comprehensive framework for understanding motor behaviour under varying conditions. By encapsulating the motor's dynamics within mathematical formulations, researchers gain a deeper understanding of its response to external stimuli, paving the way for enhanced performance optimization and control strategies. The validation of these mathematical models is a critical aspect of the research process, ensuring their fidelity and reliability in real-world applications. MATLAB/Simulink emerges as a powerful tool in this regard, offering a versatile platform for conducting simulations and validating theoretical constructs. In this study, a 4kW rated power

induction motor serves as the focal point for validation exercises, wherein the electromechanical torque generated by the Simulink model serves as a benchmark for comparison against theoretical predictions. In conclusion, dynamic modelling of induction motors using MATLAB/Simulink represents a crucial step towards unravelling the intricacies of these ubiquitous electrical machines. By combining theoretical frameworks with practical validation exercises, researchers can unlock new avenues for enhancing motor performance, efficiency, and reliability in a myriad of industrial, commercial, and residential applications.

Keywords: *dynamic modelling, induction motor, frame transformation*

Soil C:N:S in Krummholz forest at Treeline Ecotones of Central Nepal Himalaya

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Abstract

On a global scale, thermal limitation controls the elevation of the treeline; yet it is still not clear to what extent treeline form is an indicator of treeline responses to warming climate. The major deficit in Himalayan treeline research is that the role of Rhododendron Campanulatum krummholz in treeline dynamics has not been properly addressed. In the central Himalayan alpine treeline ecotones in Rolwalling, Nepal (3800-4300 m amsl), we are assessing soil properties effects to elucidate role of Krummholz zones, underlying mechanisms and feedback that maintain the competitiveness of R campanulatum but unsupportive to other forest species. The specific objective is to assess the limited nutrient availability resulting from low CNS content. The soil and vegetation samples were taken from well-designed two slope sectors Northeast (NE) and Northwest (NW) Slope, four elevational zones in each slope sectors as Upper dwarf

shrub heath: UD, Lower dwarf shrub heath: LD, Upper krummholz: UC and Lower Krummholz: LC. Each elevational zone consists of four sampling plots (20*20 m2) from where compositive samples of three soil profiles were collected. Meanwhile, nutrient limitation as the deviation of the observed nutrient stocks in the krummholz zone and expected nutrient stocks will be calculated from measurements of treelines without krummholz zones planned for the next research site in Langtang national park treeline ecotones. As a preliminary results of Krummholz zones for the soil Carbon, Nitrogen and Sulphur (CNS) content we observed that CNS concentration vary along the elevational gradient. The total carbon present in the soil profile increases from 2013 to 2024 in mineral soil horizon. NW slope has higher mean C percentage than NE (in all soil horizons), However the differences don't show specific trend. For the soil nitrogen, comparison is varied: mean nitrogen for NW O-Horizon higher whereas for other horizons, NE slope contains higher amount of nitrogen percentage. Sulphur present in Ah horizon is significantly higher in NE. Total SOC in O-horizon of the NE slope is significantly vary among the different zones. Whereas in the NW slope the SOC is interestingly higher in UD zone than Lower C zone. In case of sulphur, the E horizon of the UD zone shows higher percentage total sulphur than Loder D zone. NW lower D zone shows higher soil nutrients in general. Our preliminary finding shows that the soil nutrient status plays key role to control the growth of the krummholz forest in Treeline ecotones. The ongoing research findings will enhance the understanding of peculiar characteristics of Rhododendron campanulatum Krummholz forest and the treeline shift phenomenon in the study region.

Key words: *Soil properties, Krummholz, Treeline ecotone, Nepal Himalaya*

Deep Learning Methods for Text Summarization

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Abstract

The exponential growth of textual data in recent years has paved the way for a profound transformation in information extraction and analysis. To effectively harness this wealth of data within practical time constraints, the need for concise summarization techniques becomes paramount. This paper undertakes a comprehensive review of contemporary methodologies in abstractive text summarization, particularly focusing on deep learning models. Additionally, it delves into the examination of prevalent datasets utilized for training and validating these techniques, shedding light on their respective attributes and limitations. Notably, the Gigaword dataset emerges as a staple for single-sentence summary models, whereas the CNN/Daily Mail dataset is favored for multisentence summaries. To conduct this study, a systematic review methodology was adopted, encompassing a meticulous survey of recent literature encompassing abstractive text summarization and deep learning techniques. The data set was classified into training, test and validation data sets. To prevent the overfitting dropout and regeneration techniques was adopted. The model was periodically retrained to improve its performance. This approach facilitated the identification of a diverse array of methodologies, enabling a comprehensive analysis of their strengths, weaknesses, and applicability. The chosen research methodology design, characterized by its systematic review approach, was deemed appropriate owing to its ability to provide a broad spectrum of deep learning strategies tailored specifically to the task of text summarization. This methodological choice ensures

a thorough exploration of the existing landscape, enabling a nuanced understanding of the methodologies' intricacies and their implications for practical implementation. In dissecting the challenges inherent in the summarization process and the corresponding solutions proposed within each approach, this analysis underscores the recurrent neural networks' dominance, particularly those augmented with attention mechanisms and long short-term memory (LSTM). Experimental results highlight the efficacy of employing pretrained encoder models, showcasing superior performance with respect to ROUGE1, ROUGE2, and ROUGE-L scores (43.85, 20.34, and 39.9, respectively). Furthermore, it becomes evident that prevalent summarization models encounter hurdles such as the absence of a golden token during testing, out-of-vocabulary (OOV) words, sentence redundancy, inaccuracies, and the propagation of false information. Within the broader context of text processing, this abstract serves as a testament to the transformative power of deep learning in reshaping the landscape of information extraction and analysis. By elucidating a diverse range of methodologies and their respective performances, this work contributes to advancing the frontier of text summarization, paving the way for more efficient and accurate information retrieval systems.

Keywords: *Text Summarization, Deep Learning Models, Systematic Review, Recurrent Neural Networks, ROUGE Metrics, Pretrained Encoder Models*

Flood Inundation Mapping Of Mahakali River Using Hydraulic Modelling in HEC-RAS

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Abstract

In the current era, floods have emerged as one of the most prominent natural disasters, escalated by the ongoing effects of global warming and climate change. With this increasing risk, the topic regarding flood risk and it's mitigation and management requires even more thorough study. The Mahakali River bordering Nepal and India has large floodplain with huge human settlements, fertile croplands, forests, and physical infrastructures. Recent years have witnessed devastating floods along the Mahakali River, inundating large portion of the floodplain and causing havoc. This study aims to identify the inundation areas due to flooding events in the Mahakali River with 2D hydraulic modeling using HEC-RAS. The research focuses on the reach of the river from the Sharada Barrage to its confluence with the Jogbudha River. Using HEC-RAS and ArcGIS inundation maps were prepared, inundated depths and area of various locations and landcovers were calculated. For the hydraulic analysis, DEM (Digital Elevation Models) with spatial resolution of 12.5m x 12.5m was utilized. Flood discharges for return periods of 10, 50, and 100 years were calculated using both empirical (WECS/DHM 1990, Modified WECS-DHM, Modified Dicken's, and Creager's) and statistical (Gumbel's and Log-Pearson Type III) methods. The maximum discharge for each return period was selected for simulation purpose.

The study showed that wards 11 (Bhujela Village), 12 (Airee Village), and 13 (Badaipur & Pipraiya Village) under the study area were most severely affected by floods. More than 73% of the total area of the wards was found to be inundated for 100 year return period flood. Nearly 12% of the inundated area of the wards 11, 12, and 13 has inundation depth less than 1m and 54% has inundation depth between 1m and 5m. About 35% of the inundated area of wards 11, 12, and 13 are subjected to a flood velocity between 1 m/s to 3 m/s. Also, of the total inundated area, 36.7% of the area was crops, pointing the significant impact of floods in agricultural production. Similarly, 11.68% of the inundated area is built-up area which poses significant threats to human settlements and physical infrastructures. This study will supplement the planners and policymakers of government and non-government organizations in landuse planning, and implementing efficient flood protection measures for the management of floodplains of Mahakali River in the study area and develop resilience against an inevitable future disaster.

Keywords: *Flood impact, inundation mapping, hydrological analysis, Mahakali, HEC-RAS*

Evaluation of Response Reduction Factor of RC Building Considering Soil Structure Interaction

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Abstract

Reinforced concrete framed structures are the most common construction for the modern buildings in Nepal where buildings are designed with fixed base. Although behavior and response of the structure changes significantly due to base conditions, in general fixed base model is incorporated and flexible base is ignored during analysis. The majority of seismic analyses of structures ignore the effect of soil condition during seismic analysis. One crucial seismic parameter that is used to evaluate the nonlinear response through linear elastic approach is the response reduction factor (R) which allows the designer to scale down the elastic response of the structure. The seismic codes in cooperate the response reduction factor without considering the soil effect. Elastic soil structure interaction is in cooperated in the analysis to explain how flexible base conditions affect response reduction values. Eight building frames with different in plan and elevation are selected and analyzed through nonlinear pushover analysis. Gazeta's formula is incorporated to assign point spring on the base for soil structure interaction. Pauley and Priestley method is used to calculate the response reduction considering ductility and overstrength factor. Furthermore, Time period, Base shear, Story displacement, Inter story drift were all used to analyze the structural response and results are presented. The result specifies the substantial effect on the seismic response of the structure with soil structure interaction (SSI) as compared to the fixed base. The study shows that values of response reduction factor is maximum for fixed base and decreases non linearly with considering soil structure interaction.

Keywords: *Response Reduction Factor, Soil Structure Interactions, Pushover Analysis, RC Buildings, Ductility Factor, Overstrength Factor*

Seismic Behaviour of Reinforced Concrete and Steel Concrete Composite Buildings with Irregular Plans

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Abstract

The practice of composite structures in the construction sector is less in Nepal in comparison with many developing countries, Reinforced Concrete framed Structures are preferred to other steel and composite structures due to their conventionality and popularity in construction. However, these structures are suitable for low and medium-rise buildings only and not for high-rise buildings due to their higher dead weight, restriction to maximum span, the requirement of risky formwork, and other reasons. The use of composite structural elements has significantly improved overall performance with slight changes made in the construction method. In the construction of Steel-concrete composite structures composite slab is joined to the composite beam using shear connectors to perform as a single unit. In this present work, seismic analysis of structural parameters of RC and composite structures having irregular plans (L, T, and U shapes) for multistoried (G+4, G+8, G+12, G+16, G+20 and G+24) which are located in earthquake for Bharatpur City for lateral loading as per Nepal National Building Code (NBC) 105:2020 was assigned. Linear static and response spectrum analysis methods were used to compare the structural parameters like natural time period, seismic weight, story drift, story displacement, base shear, axial forces, bending moment, twisting moment, and torsional irregularity of RC and composite structures. The results were compared and concluded that Composite structure performs better than RC structures for multistoried buildings with irregular plans under lateral loading conditions.

Keywords: *Composite structures; Plan Irregular structures; Seismic Analysis; Structural parameters; NBC 105:2020*

On Certain Summability Techniques in Divergent Series

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Abstract

Summability techniques play a crucial role in various branches of mathematics, particularly in analysis and number theory. In this presentation, we shall deal with the fundamental concepts and applications of summability techniques such as Cesàro summation, Abel summation, Holder summation, and Voronoi/Norlund summation methods focusing on their convergence properties of divergent series by assigning the value to the divergent series.

Keywords: *Grandi's series, divergent series, summability, regular.*

Assessing Traffic Volume and Structural Integrity of the Mahakali Bridge in Nepal

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Abstract

The Mahakali Bridge, commonly known as the Dodhara Chandani Bridge, spans the Mahakali (Sharada) River with a length of about 1,496.5 meters and is located in the Kanchanpur District of the Mahakali Zone (Beautiful Far West Nepal, 2012). This study presents a comprehensive assessment of traffic volume and structural integrity of the bridge. Traffic volume data was collected through manual counting of pedestrians, cyclists, and motorcycles at specific intervals, providing insights into traffic patterns. The findings reveal significant traffic volume, with an average of 63 bikes, 9 cycles, and 14 pedestrians traversing the bridge per hour in both directions. During traffic counting, visual inspection of the bridge identified various structural faults and problems, including missing fasteners (bolts and rivets), broken and corroded steel components (particularly in cable connections and anchor points), and minor concrete cracking on the bridge deck. Surface corrosion on exposed metal elements highlights the need for consistent maintenance and protective measures. These findings emphasize the urgent need for addressing traffic management and bridge maintenance to ensure safety. The absence of proper maintenance raises concerns about the bridge's structural integrity, especially under increasing traffic loads and potential environmental impact. This study underscores the importance of sustainable infrastructure development and proactive maintenance practices to safeguard the bridge and the well-being of the community.

Keywords: *Mahakali Bridge, traffic volume, structural integrity, bridge maintenance, sustainable infrastructure*

Comparative Analysis of Control Techniques to Enhance Performance of Antilock Braking System in Vehicles

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Abstract

The Antilock Braking System (ABS) is a crucial safety feature in passenger vehicles which prevents wheel lock-up during braking and maintains steerability. The non-linear behaviour of different road conditions makes it difficult to predict the optimal brake forces to be applied to minimize the stopping distance and maintain steerability. Control techniques play a crucial role in the optimization of the performance of ABS. This study explores control strategies, including Bang-Bang, Proportional – Integral – Derivative (PID), and Fuzzy Logic controllers, to enhance the effectiveness of ABS by developing a mathematical and MATLAB/ Simulink model of the components. The parameters to be controlled are optimal slip and brake pedal force based on the input parameters which are slip, road condition, coefficient of friction and wheel acceleration. Results indicate that while Bang-Bang control offers simplicity, it lacks precision and efficiency compared to PID and Fuzzy Logic approaches. However, the PID and Fuzzy Logic controller demonstrates superior performance over Bang-Bang Controller by reducing stopping time by 8.5 % and stopping distance by 15 %. Moreover, the integration of Fuzzy control further refines braking control, significantly improving vehicle stability and maneuverability, indicated by slip of the vehicle which remains around 0.2 optimal slip value throughout the braking period.

Keywords: *ABS, PID, Fuzzy, MATLAB/Simulink, Steerability, Slip*

Devanagari License Plate Recognition System

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Abstract

This study aims to investigate the topic of Devanagari licence plate detection and recognition using computer vision and machine learning techniques. The primary goal of this project is to create a robust and tailored system for detecting and recognising licence plates, simply ALPR, that is specifically tailored to the linguistic and contextual nuances prevalent in Nepal, where vehicular licence plates are distinguished by the incorporation of numbers and alphabets inscribed in the Devanagari script. This system's applications span a wide range of vital domains, including smart traffic monitoring, parking lot management, law enforcement protocols such as speed detection and penalization of traffic violators, and the monitoring of traffic entrance and outflow within restricted zones. Methodologically, the study takes a multifaceted approach. Initially, the system performs licence plate detection using a Faster-RCNN model that has been rigorously trained on a custom dataset containing vehicle photos native to the location. Following the successful detection of the licence plate boundary box, the next phase involves identifying individual characters contained within the licence plate using a second Faster-RCNN model. These recognised characters are then classified using a Convolutional Neural Network (CNN) model trained on a large dataset of Devanagari characters, which produces a licence plate value. Preprocessing methods like as image normalisation, resizing, grayscale conversion, and binary thresholding are used throughout the process to optimise efficiency and reduce inference time.

Despite obtaining an efficiency rate of 85%, the study found many obstacles that prevent optimal licence plate identification and recognition. These issues are mostly caused by anomalies in licence plate design, typeface changes, and instances of obscured lettering. These parameters have a substantial role in the reported recognition errors, highlighting the need for further refinement and improvement of the detection and recognition system. While the research yields promising results, achieving a higher efficiency rate over 95% remains a critical goal for future efforts. Addressing the aforementioned issues connected with irregular licence plate design and typeface variations, as well as fine-tuning system settings, is the primary focus for improving the overall efficacy and performance of the licence plate detection and recognition system. Through concerted efforts to overcome these problems, the system's capacity to reliably detect and recognise Devanagari licence plates will be greatly improved, increasing its usability and application across a wide range of operational situations.

Keywords: *Devanagari number plate recognition, ALPR, smart traffic management, Faster-RCNN, Convolutional Neural Network (CNN)*

Performance of Concrete Containing Plastic Waste as a Partial Replacement for Sand

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Abstract

Concrete is the most widely used construction material in the construction industry and its production is a major consumer of natural resources. The concrete construction industry's high demand for sand necessitates the development of a sustainable and eco-friendly alternative. At the same time, Nepal faces a significant challenge: a low plastic recycling rate, most of it ending up in landfills, and the long-term environmental consequences of these slowly degrading materials. The study aims to investigate the use of shredded plastic waste which were then converted into pallets of size of average of 5mm as a replacement for sand, partially replacing it in a mix for concrete. In this paper, four different sand replacement ratios (0%, 4%, 6%, and 8%) were used to determine the effect of plastic on compressive strength of concrete. The specimens were tested at the ages of 7, 21 and 28 days of curing. The results show that a 4% replacement ratio achieves the highest compressive strength (22.16 N/mm²) after 21 days of curing. Higher replacement ratios, 6% and 8%, resulted in decreased compressive strength which were 18.29 and 18 N/mm² respectively. These findings support the possibility of using the resulting concrete in applications requiring non-bearing lightweight concrete, such as panels used in facades like building facades.

Keywords: *Sand replacement, Shredded plastic, Eco-friendly concrete, Compressive strength*

Rehabilitation, Upgradation and Modernization of Panauti Hydropower Station: Addressing Operational Limitations for Sustainable Energy Production

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Abstract

Panauti Hydropower Station, also referred to as the Khopasi Hydropower Station, was originally designed to generate 2.4 MW of electricity through three units, each with a capacity of 0.8 MW. Presently, the station is facing operational limitations, with only two units functioning at 600 kW output, while the other one unit requires repair or replacement. Rehabilitation, Upgradation, and Modernization (RUM) is the need of the hour. This comprehensive approach involves assessing and upgrading various components, modernizing intake facilities, and optimizing discharge capabilities. Since increasing the head or adding extra turbines is not feasible, the focus is on enhancing discharge. This could involve expanding storage capacity near the forebay or implementing pondage near the intake, as indicated by field studies and Hydrological Analysis and Catchment area methods. Additionally, a thorough evaluation of all components is proposed to facilitate necessary enhancements. After capacity augmentation, worn-out equipment must undergo either rehabilitation or replacement to improve overall efficiency, reliability, and modernization. These recommendations are expected to significantly boost the plant's capacity and operational quality, addressing current challenges and contributing to meeting the reliable electricity demands. It is expected that Panauti Hydropower Station will become a significant contributor to sustainable energy production in the region.

Keywords: *Hydropower Rehabilitation, Capacity Optimization, Sustainable Energy Production, Upgradation and Modernization*

Predicting Wins in the Premier League Using Logistic Regression

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Abstract

The paper proposes a data-driven model for predicting the outcomes of Premier League football matches by leveraging historical match data and player ratings. The dynamic nature of team strengths is directly incorporated into the model by utilizing comprehensive datasets encompassing team statistics, performances, match conditions, and historical results. The data taken for this model is derived from two websites, i.e. whoscored.com and football-data.co.uk. We gathered details on match outcomes, statistics, betting parameters and other relevant information of four different seasons to provide a comprehensive dataset for football analysis and research. We gathered data on various match attributes, including full-time goals by the home and away teams, the final match result, shots taken by each team, shots on target, fouls committed, corners awarded, yellow cards received, red cards received, and ratings for the home team. These attributes are the important attributes which were identified on the basis of attack and defense by both home and away teams respectively. Now, we calculated composite attributes from the above attributes which are Home (Attack / Defense) Rating, Away (Attack / Defense) Rating. Now, We used Min-Max Scaling, which is a method utilized to standardize numerical features, ensuring they all fall within a specific predetermined range. In this context, the MinMaxScaler from the sklearn.preprocessing module is employed to normalize the columns HomeAttackRating, HomeDefenseRating, AwayAttackRating,

and AwayDefenseRating thus creating four new columns that stores normalized value for each. We used logistic regression, a popular algorithm for binary classification task to predict the outcome of football matches (Home Team Win or Not). Logistic Regression calculates the probability that a given input belongs to a particular class. In our case, it predicts the probability of a home team winning the match based on various features derived from match statistics. The Logistic Regression model estimates the probability P(y=1|X), where y is the binary outcome (1 for Home Team Win, 0 for Not Home Team Win), and X represents the input features. We calculated the F1 score, precision and recall to assess the model's performance. Our model gave an accuracy of 79%, F1 score of 82%, precision of 86% and recall of 79%. Integrating real-time football data such as possession percentage, pass completion rates, shots on target, and even more granular metrics like distance covered by players, successful tackles, and heatmaps illustrating player movement on the pitch enhances our model by providing up-to-date insights. Adding real-time data to the existing model would likely enhance its accuracy and timeliness. The model would become more responsive to evolving match dynamics, improving its ability to capture momentum shifts. We leave the integration of real-time data as a future exploration, recognizing its potential to enhance our model's predictive capabilities.

Keywords: *Premier League, predictive modelling, logistic regression, player ratings, match attributes*

Beyond Conventional Slabs: Enhancing Structural Efficiency in Asymmetric Buildings through the Integration of Grid Slabs

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Abstract

Grid slab floors are integral components of architectural designs in structures necessitating vast, unobstructed floor spaces such as auditoriums, assembly halls, and theaters. Their prevalence in long-span symmetric and asymmetric constructions underscores the importance of understanding their seismic behavior. This study employs analytical models to investigate the seismic response of symmetric and asymmetric building structures incorporating grid slab floors compared to conventional slab systems. The analysis encompasses various structural models, including the symmetric H-building from both axes, the asymmetric T-building from one axis, and the asymmetric L-building. Utilizing the ETABS software, the overall seismic response of these structures is thoroughly examined. The results reveal significant differences between conventional slab systems and grid floor systems in terms of deflection, drift ratios, and torsional irregularity ratios. Notably, conventional slab systems exhibit higher deflection and drift ratios, indicating reduced structural performance under seismic loading. Moreover, asymmetrical buildings demonstrate greater vulnerability to earthquake ground motion compared to symmetric counterparts. However, upon integration of grid slabs, formerly torsional irregular structures with conventional

slabs are found to achieve torsional regularity, enhancing their seismic resilience. In conclusion, this study underscores the seismic advantages of grid slab floors, particularly in mitigating the vulnerabilities associated with asymmetrical building configurations. The findings highlight the importance of adopting innovative structural systems to enhance seismic performance and ensure the safety and resilience of built environments in seismic-prone regions.

Keywords: *Grid slab floors, Seismic behavior, Symmetric structures, Asymmetric structures, Torsional irregularity*

Flood Hazard Mapping Under Climate Change Scenarios in Hanumante Khola, Bhaktapur

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Abstract

Floods are a prominent type of water-related disaster that impacts various regions worldwide. Climate change is expected to increase both the magnitude and frequency of extreme precipitation events, which may lead to more intense and frequent river flooding. This research aims to map flood-inundated areas under the changing climate in the Hanumante basin, Bhaktapur. It further defined the flood risks by classifying the flood hazard into four categories (low, medium, high, and extreme) based on flow depth. A semi-distributed physically based Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS) is used to simulate rainfall-runoff model for hydrological analysis and Hydrologic Engineering Center-River Analysis System (HEC-RAS) 1D steady simulation for hydraulic analysis of results and for preparation of hazard maps for present and future flood scenarios. The bias-corrected results of CMIP6's five General Circulation Models (GCMs) for NF, MF, and FF were used to create future climate scenarios under SSP245 and SSP585. It is found that the magnitude of future floods will be increased by 1.024 times for NF,1.065 times for MF, and 1.065 times for FF for SSP245 and by 1.562,1.166 and 1.624 times for NF, MF, and FF respectively for

SSP585 that of a flood occurring now. Similarly, the inundation areas will be increased by 1.004 times for NF, 1.012 times for MF, and 1.012 times for FF for SSP245 and by 1.184 times for NF, 1.071 times for MF, and 1.196 times for FF for SSP585 than that of an inundation area for a present scenario for the 100-year return period. The result shows that the amount of flood inundation has increased relative to the current condition, pointing to a future with more elevated flood risk and danger. This study emphasizes how crucial it is to anticipate flood danger in the future and use projected climate data to gather crucial data for creating long-term management plans for floodplains.

Keywords: *Climate Change, Coupled Model Inter Comparison Project Phase 6 (CMIP6), HEC-HMS, HEC-RAS, General Circulation Models (GCMs).*

Potential of Municipal Waste on Circular Economy: A Case Study Of Shuklagandaki Municipality

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Abstract

Circular economy principles play a crucial role in transforming solid waste management practices towards sustainability. It aims to minimize waste generation, maximize resource efficiency, and promote the reuse, recycling, and recovery of materials throughout their lifecycle. The study was carried out in Shuklagandaki municipality to examine the potential of residential waste to contribute to circular economy practices and investigates the effectiveness of such practices in residential waste management. Twenty-five houses (which is one forth of total sample to be taken as per Glenn Table on the basis of population) were selected to participate in a study, where they were encouraged to segregate their waste into eight predefined categories over a period of 15 days. The waste collected was measured by using digital weighing machine to analyze the percentage of composition of various types of waste. It also incorporates the analysis of secondary data, like utilization of waste on different practices helps to assess diverse potential of waste in supporting various initiative of circular economy. The study concludes that a significant portion of the waste generated, particularly organic waste (43%), plastics (22%), paper (18%), and textiles (5%), holds considerable potential for integration into circular economy practices rather than mere disposal. The findings highlight the significance of promoting reuse, reduce, recycle, and recovery strategies to minimize waste sent to landfills, increase resource efficiency, and foster sustainable development. Similarly, researching innovative ideas for the waste management like vermicomposting, using organic waste for mushroom substrate can promote sustainable management of waste.

Keywords: *Circular Economy, Municipal Solid Waste, Waste Composition, Resource Efficiency*

Slope stability analysis of landslide in the Nepalese Himalaya: A case study of Kuiyadaha Landslide, Gokuleshor, Baitadi

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Abstract

Landslides are a common geologic feature in the Nepalese topography. Primary concern of this paper was the numerical modelling along with the case study. This research describes a study on the stability analysis of Kuiyadaha Landslide. The objective of the thesis paper is to find out the factor of safety by performing the numerical modelling in different conditions like full saturation and full dry condition without vegetation and earthquake loading. This paper is based on the case study of creeping landslide of Baitadi District. Back Analysis technique was performed to evaluate the soil parameter where strength parameter friction angle (φ) varied determined by keeping the cohesion value zero to obtained SRF value unity. The soil parameter obtained from Back Analysis was used to evaluate factor of safety (FOS) and hence stabilizing measures like ground water table (GWT) reduction along with the toe loading is recommended. Computer software like Cubit, Cygwin, ParaView, Easymesh, Autocad, land-development and Tecplot are used to analyze to the slope stability along with the modified version of SPECFEM3D_GEOTECH which is based on Spectral Element Method (SEM). In this research, it has been found that Kuiyadaha landslide is susceptible to undergo slope slide in rainy season. Stability Analysis can be done precisely for the design of

mitigative measures. This research used Back Analysis as an effective technique for evaluating the slope stability of the Kuiyadaha Landslide. Through study and analysis it was found that reduced GWT along with the toe loading is utilized to stabilized the slope effectively. Validation of the work is made using commercial software Phase2 and comparing the result from phase2 and SPECFEM3D_GEOTECH, 0.965 correlation value is obtained.

Keyword: *Landslides, numerical modelling, stability analysis, back analysis*

ANAEROBIC DIGESTION OF BREWERY SPENT GRAIN AND WASTEWATER TO ASSESS THE BIOENERGY GENERATION

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Abstract

Brewing industries generate large amounts of Brewery spent grain (BSG) which is currently used mostly as animal feed. Anaerobic digestion (AD) of BSG helps to recover energy in the form of methane, potentially increasing the value of this by-product. The study aimed to assess the biomethane production performance using BSG and wastewater generated from the brewery. A laboratory scale batch anaerobic co-digestion of BSG and brewery wastewater as the substrate and anaerobic co-digestate effluent as an inoculum at the different mixing ratios of food to microorganism (F/M) 0.45, 0.40, 0.35 and 0.25 (on volatile solids or VS basis) were carried out maintaining a mesophilic condition (34±1^{o}C) in a water bath. From the study results, it is evidenced that at the F/M ratio of 4:5, produced the maximum quantity of biogas from BSG i.e., 0.196 m^3/kg VS added. The study thus indicates the potential for recycling this waste stream as an energy stream back into the beer production process.

Keywords*: Brewery Spent Grains (BSG), Anaerobic digestion (AD), Biogas, Mixing ratio, wastewater*

Phishing Website Classification: A Feature Engineering Approach Based on URLs

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Abstract

In today's digital era, phishing attacks pose a prevalent threat to social security. Attackers cunningly impersonates reputed and trusted entities such as banks, credit card companies, e-commerce websites and such, manipulating the unsuspecting internet users into disclosing their sensitive credentials on fallacious websites. Phishing attacks take multiple forms, from deceptive emails to fraudulent websites making them a formidable challenge to tackle. Emails, social networking websites, quick response codes, lottery and instant messages, are popular. To combat this menace, this paper presents Safelink, an innovative phishing detection system that leverages machine learning techniques for robust website classification. The traditional list (whitelist and blacklist) based detection is limited because slight alterations to URLs can circumvent their effectiveness. Unlike this method, Safelink takes a deeper dive into the intricate structures of website Uniform Resource Locator (URL), extracting wide range of features to uncover certain patterns that betray phishing attempts. The approach considers the multitude of factors, including the age of domain, presence of HTTPS encryption, and unconventional URL elements, to paint the comprehensive picture of website legitimacy. Moreover, the content-based features such as suspicious keywords and abnormal URL structures along with metadata like URL length and redirects, page ranks from external APIs are also analysed to further refine the model's accuracy. By assaying these features and website characteristics, the model effectively learns to detect the hallmarks of phishing websites,

ultimately predicting their legitimacy. We evaluate the performance metrics of three machine learning algorithms: Gradient Boosting, Logistic Regression, and Decision Tree to identify the best suiting one to predict phishing websites. The outcomes highlight the remarkable effectiveness of Gradient Boosting, which yielded impressive accuracy of 96.8%, a precision of 94.9% and recall of 95.9%. Comparatively, Logistic Regression yielded an accuracy of 89.7 % with a precision of 89.4% and recall of 92.6%, while Decision Tree attained an accuracy of 93.9% with a precision of 94.1%, and a recall of 95.1%. These findings emphasize the critical role of advanced machine learning techniques in safeguarding against phishing threats, with Gradient Boosting as a standout solution in our pursuit of detecting legitimacy of the websites.

Keywords: *Phishing, phishing attacks, phishing detection, internet security, uniform resource locators, machine learning, gradient boosting*

Experimental Investigation of Sand/Silt Particles Size by Rainfall Runoff Simulation Model Applicable in Irrigation on Cultivable Land

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Abstract

Study focus on irrigation on cultivable land. As cultivable land consist of different sizes of particles which play important role in irrigation. Irrigation includes irrigation cannel as sediment deposition reduce the design discharge so for the design of irrigation cannel sediment deposit and sediment transport is important for study. Rainfall runoff simulation model was used for study of different factor affection irrigation on cultivable land. To predict rainfall and runoff rainfall simulator was used based on experimental setup. For the soil sample different types of cultural land soil was chosen for study. Soil sample was placed in rainfall runoff simulator with different cases. Runoff depends on rainfall intensity as depend on geotechnical property of soil sample. Series of experiments were carried in rainfall runoff simulator out with varying rainfall intensity, slope, and soil type. Field capacity, infiltration, surface runoff, slopes of land, particle size of soil. Size of particle and field capacity plays important roles in infiltration which varies on surface runoff. As particle size is small infiltration is low depend on compaction and slope of land. Rainfall intensity was found 443.45mm/hr with runoff volume 0.0213m^3 with average depth of 0.175m with slope 4.89degree. During experiment average sediment was found 0.35gm in area of 2m^2 catchment area. For the design of irrigation cannel and for irrigation by knowing catchment area and slope we can calculate sediment transport and sediment settlement which will helpful of deign of size of irrigation cannel and design discharge for irrigation.

Keyword: *Field capacity, Infiltration, Rainfall runoff simulator, Sediment*

Comparative Study on Efficiency Analysis of Dual-Axis Solar Tracking System Due to Temperature Variation and PV Cell Material

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Abstract

Solar energy is a crucial renewable energy source, offering sustainable solutions to address energy demands and combat climate change. Maximizing the efficiency of solar energy harvesting is essential for widespread adoption and integration into the energy landscape. Solar tracking systems play an important role in increasing the efficiency of solar panels by optimizing their orientation towards the sun throughout the day. This research presents a comparative analysis of the efficiency of dual-axis solar tracking systems, focusing on their performance under temperature variations with different photovoltaic (PV) cell materials using Light-Dependent Resistors (LDRs) and Ultraviolet (UV) sensors as input devices. A closed-loop tracking technique is implemented to adjust the position of the solar panels based on real-time sensor feedback. Comparative study between both sensors demonstrates that UV sensor is more accurate for detecting the sun position because LDRs have significant limitations such as its susceptibility to ambient light conditions and saturation to light intensity that can negatively

impact the solar tracking performance. The efficiency of solar tracking system increases significantly when monocrystalline solar panel is used in comparison to polycrystalline panel. Also, the effect of temperature variation was found to be more in case of monocrystalline panel which makes the efficiency to change significantly as temperature changes. Through experimental evaluation and data analysis, this study provides valuable insights into the tracking efficiency, tracking error, power output and assessment of efficiency variation of dual-axis solar tracking systems in varying temperature environment and with different PV cell materials, offering application for optimizing solar energy harvesting in practical applications.

Keywords: *Closed-loop tracking, dual-axis solar tracking system, efficiency analysis, PV cell material, temperature variation.*

Assessing Climate Change Impacts on Seti Gandaki River Basin Hydrology: Seti Khola Hydropower Project Case

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Abstract

Understanding climate change is crucial for hydropower development. There are still many unexplored rivers from hydropower development perspective. Analyzing past, present, and projected future temperature and rainfall changes/variations helps develop appropriate strategies to adapt to climate change. Using the representative concentration pathways (RCP) 4.5 and 8.5 scenarios for two future periods (2022-2040, 2046-2064), this study investigates how rainfall, maximum temperature, and minimum temperature are projected to change in future in the Seti Gandaki River, Nepal. The Soil and Water Assessment Tool (SWAT) was set up, calibrated (2009 to 2015) and validated (2015 to 2018). Temperature and precipitation projections for the study area were made by statistical downscaling of the outputs of the Canadian Earth System Model Version 2 (CanESM2). For the RCP4.5 and RCP8.5 scenarios from 2022 to 2040, precipitation is projected to decrease annually by 3% and 1.07%, respectively. The maximum temperature is projected to decrease from 29.29^{o} C to 29.28^{0} C and increase to 29.32^{o} C, while the minimum temperature is expected to rise from 17.36^{0} C to 17.42^{0} C and also increase to 17.44^{0} C . Flow may decrease by 4.4% and 11.1%. In

the years 2046–2064, under RCP4.5 and RCP8.5 scenarios, precipitation is projected to decrease by 5.07% and 0.57% respectively. Maximum temperatures may increase from 29.29^0 C to 29.31^0 C and to 29.35^0 C, while minimum temperatures could rise from 17.36^0 C to 17.61^0 C and increase to 17.64^0 C respectively. Flow is expected to decrease by 7.7% and 3.3% annually. This study could be the base for design of hydraulic structure in seti gandaki river basin.

Keywords: *Climate change, SWAT, Seti Gandaki River basin, Hydropower*

Evaluation and Selection of the CMIP6 Climate Model: A Case of Budhigandaki River Basin (BRB), Nepal

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Abstract

This study examines the performance of precipitation and temperature derived from historical runs of the Climate Model Intercomparison Project Phase 6 (CMIP6) across the climatic regions of Budhigandaki River Basin (BRB). Selecting General Circulation Models (GCMs) that accurately represent a region's climate is crucial for climate change. However, uncertainties in GCMs due to computational restrictions like coarse resolution, physical parameterizations, initializations, and model structures necessitate the identification of a representative GCMs for climate change impact assessments. To determine a subset of the most suitable future GCMs in the BRB, an advanced envelope-based multi-criteria selection approach was employed. Four extreme future corners Warm-Wet, Warm-Dry, Cold-Wet, and Cold-Dry were utilized for different model selections. Using CMIP6 GCMs, the research predicts changes in temperature and precipitation under two Shared Socioeconomic Pathways (SSPs), specifically SSP2-4.5 and SSP5-8.5. Four models were selected for each SSP scenario, corresponding to the four corners of the projection spectrum. On average over the basin, the mean air temperature projection for the chosen GCMs indicate an increase range from 2.13°C to 4.43°C for SSP 2-4.5 and from 3.56°C to 7.12°C for SSP 5-8,5 between

the periods 1970-1999 and 2070-2099 respectively. Additionally, there is a considerable uncertainty surrounding future precipitation estimates, with ranges from -1.13% to 27.66% for SSP 2-4.5 and from 4.55% to 40.68% for SSP 5-8.5. Models performing well for different extreme scenarios include EC-earth-CC (Europe), CNRM-CM6-1, MIROC-ES2L, and MRI-ESM2-0 for Warm-Wet, Warm-Dry, Cold-Dry, and Cold-Wet scenarios, respectively SSP 2-4.5. Similarly, IPSL-CM6A-LR, MRI-ESM2-0, GFDL-ESM4, and INM-CM5-0 perform well for the corresponding scenarios under SSP 5-8.5.

Keywords: *Climate change, CMIP6, GCMs, Precipitation, Temperature, BRB*

Detection of Change in Built-up Area of Pokhara Valley using Multiple Indices From 2013 to 2020

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Abstract

Nepal has been urbanizing rapidly for the last 20 years. Immigration in cities for quality life and employment opportunities caused rapid and haphazard urbanization. Haphazard development of built-up areas without a proper plan has caused environmental consequences. This project aims to analyze built-up area change in Pokhara Valley from 2013 to 2020. The indices used for extracting built-up areas are Normalized Difference Built-up Index (NDBI), Normalized Difference Vegetation Index (NDVI), and Modified Normalized difference Water Index (MNDWI). None of the indices were found sufficient for mapping built-up areas alone. NDBI could not separate large water bodies, NDVI failed to extract open soil areas and MNDWI did not separate dense vegetation areas from built-up pixels. All indices complemented each other for built-up extraction. The primary objectives of the study have been summarized as (a) Identify change of built-up area in Pokhara valley from 2013 to 2020 (b) Analyze the roles of NDBI, NDVI, and MNDWI for built-up area study (c) Compare the built-up area extraction from the original method- Built-up Index (BUI) and the modified method- Modified Built-up Index (MBUI). This project integrates Remote Sensing (RS) and Geographical Information System (GIS) technology to extract the built-up area and analyze built-up area change.

Satellite image analysis was used for extracting built-up areas in Pokhara Valley. From 2013 to 2020 built-up areas in the valley have changed by 20%. MBUI was found more suitable for built-up area change study than BUI. MNDWI when integrated with BUI could separate water areas, wetland, open soil, and sparse and dry vegetation classified as built-up areas by BUI. The built-up patterns in the study area was found to be haphazard. Significant chunks of cultivation land and barren land or bare soil areas were converted into built-up lands during the study period. Urban growth expanded along and outside the major roads as well as peripheral areas. Built-up areas have increased in all directions from the core built-up areas. The existing plans and laws seem to be unable in addressing the underlying core issues in the planning of urbanization for sustainable development. This research can contribute to understanding built-up area change, and the use of MBUI for built-up area change analysis. Further, this research can be an essential asset for planners and policymakers to formulate appropriate plans and policies for sustainable city development. There is an urgent need in planning land use patterns and urban development to maintain balanced urban growth.

Keywords: *Remote Sensing, Geographical Information System, Built-up area, Urbanization, Index-based method*

Experimental Study of Steel and Polypropylene Fiber Reinforced Concrete

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Abstract

Fiber-reinforced concrete (FRC) is a composite material made of cement, fine and coarse aggregates, and discrete fibers that are uniformly distributed throughout the mixture. The addition of steel and polypropylene fibers in concrete improves its mechanical properties, such as compressive strength, split-tensile strength, flexural strength, toughness, and impact resistance. Although significant research has been done in this area but there is a lack of comprehensive study that compares the results of experimental tests of concrete samples reinforced with two different types of fibers. This research suggests that fiber added to an ordinary concrete mix increases the compressive strength, split-tensile strength, and flexural strength. Different samples with 1.5 % fiber ratio for polypropylene and 2 % fiber ratio for steel fiber were made. The compressive strength test reveals that concrete reinforced by steel fibers and polypropylene fibers prevents the crack's growth, increases compressive strength compared to conventional concrete's strength, and increases bond strength. Similarly, split-tensile test indicated an increase in split-tensile strength compared to conventional concrete, making concrete less brittle and fragile. The flexural test showed that the effect of fibers in concrete increases its flexural strength; in addition to fibers, the adhesiveness between the materials of concrete was enhanced, making it less susceptible to brittle failure. While comparing two fiber samples, it was found that the compressive strength of polypropylene fiber reinforced blocks is 27.2 % higher than

traditional concrete blocks and that of steel fiber reinforced block is 23.4 % higher than traditional concrete block. Also, the split tensile strength of polypropylene fiber reinforced blocks is 32.2 % higher than traditional concrete blocks and that of steel fiber reinforced block is 42.7 % higher than traditional concrete block. The flexural strength of polypropylene fiber reinforced beams is 20 % higher than traditional concrete beams and that of steel fiber reinforced beams is 35.8 % higher than traditional concrete block.

Keywords: *Compressive strength, Fiber Reinforced Concrete (FRC), Flexural strength, Split-tensile strength*

Revolutionizing Agricultural Trade: A Comprehensive Analysis of an Innovative Agriculture Marketing Application

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Abstract

Nepal, renowned for its agricultural heritage, faces a critical challenge: its farmers, who form the backbone of the nation's economy, often find themselves entangled in the complexities of middlemen and political interference, struggling to secure fair prices according to their invested time and resources. Conversely, buyers contend with uncertainty regarding the freshness and quality of agricultural goods, posing health risks. This research paper investigates the transformative potential of an innovative solution in the form of an agriculture marketing app aimed at addressing the challenges farmers face in Nepal's agricultural sector and creating an efficient marketplace benefiting both farmers and consumers. The objective is to empower farmers by providing them a platform to connect directly with potential buyers, eliminating intermediaries, and ensuring fair and transparent transactions. The overall approach combines technology with the unique needs of farmers to create a comprehensive solution. The research procedure involves the collection of data directly from farmers to understand their needs and preferences regarding the app. Surveys and interviews are conducted to collect farmer interest and willingness to engage with the technology. Additionally, feedback is collected from potential buyers to ensure alignment with market demands. One of the key challenges addressed by this solution is the logistical aspect, including transportation, storage, and distribution, which significantly

impact the accessibility and affordability of agricultural products. Despite initial challenges associated with technology adoption, farmers express enthusiasm about the app's potential to secure fair prices and improve market access. Furthermore, the app is equipped with advanced features such as location-based recommendations and comprehensive market insights, aimed at further enhancing its appeal to users. By leveraging data analytics and market intelligence, the app enables users to make informed decisions and reduce reliance on imported agricultural products. By ensuring fair prices for local produce, the app contributes to decreasing imports and fostering economic sustainability within the agricultural sector. Moreover, the incorporation of artificial intelligence (AI)--based quality assurance mechanisms ensures the consistent delivery of high-quality agricultural products. Through AI algorithms, the app can analyze product attributes and provide real-time feedback on quality. In conclusion, the research highlights the importance of addressing the technological barriers faced by farmers in adopting mobile applications. By providing tailored solutions and comprehensive training, the agriculture marketing app offers a promising avenue for empowering farmers and transforming the agricultural landscape in Nepal.

Keywords: *Agriculture Marketing App, Farmer Empowerment, Fair Pricing, Technological Solution, Market Efficiency*

Interactive Architecture: Designing Spaces that Respond to Human Behavior

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Abstract

When we think of architecture, our perceptions gravitate towards towering skyscrapers, sleek modern housings and perhaps a classical building with greek pillars if we're feeling obscure. This limited perspective neglects the potential of architecture to reflect and impact human emotions, resulting in the concept of emotional architecture. As of now, there are various researches and articles that show how a piece of architecture resembles the creator's personality. The branch of architecture, known as 'emotional architecture' deals with representing emotions in form of sculptors, buildings and various other monuments. An article by Arushi Malhotra perfectly describes the concept by mentioning the factors that might help in resembling one's feelings with the help of architecture (i.e. volume, light, colour, texture, ventilation, etc.) Taking the above concept one step further, I bring up adaptive emotional architecure. What if your flat didn't always have to look the same every day? Lets think of architecture as a whole another species of organisms instead of just monuments that we, as humans build. In envisioning homes as living entities, we bypass the conventional architectural boundaries. No longer trapped within the bounds of imagination, there are endless possibilities. Think of a house as a chameleon which adapts to the sense of human emotions instead of colours. We could have apartments that change colour, temperature and brightness as in regard to it's owners emotions and feelings. Taking into account the relationship between emotions and various physical aspects. This interlinks architecture, psychology,

technology and many other sectors into one project. Human emotions are intricately linked to biochemical processes, and release hormones such as serotonin, dopamine, and endorphins. With the use of biosensors (aptamer biosensors), interactive architectural spaces can intelligently adjust these elements based on occupants' emotional states. For instance, positive emotions might amplify a brighter and warmer environment , while negative emotions are met with a darker and cooler space. Taking the concept of responsive architecture to a nuanced level, the ceiling becomes a canvas mirroring occupants' moods through a simulated false sky. Advanced lighting and projection technologies mimic various weather conditions – from clear skies to stormy clouds. In conclusion, adaptive emotional architecture marks a shift in the field of architectural design. This transformative approach not only enhances well-being but also enriches the very fabric of human experience.

Keywords: *Emotional architecture, interactive architecture, adaptive architecture, Projection technology*

Effects on Contractor's Performance due to yearly budget allocation in Multi-Year Construction Projects of Kaski District

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Abstract

The growth of multi-year project has been particularly notable in developing countries. Due to the budget distribution system in Multi-Year Contract (MYC), construction projects development and economic activity affected significantly. The unpredictability of budget allocation disrupts project timelines leading to delays that extend far beyond the initially planned project completion dates. Fluctuation in yearly budget disbursal influences the performance of contractors during the execution of the project. In the context of Nepal, understanding the management of these projects, especially under fluctuating financial conditions, is critical for national development. The study is mainly focused in contractor's performance due to yearly budget disbursal in multi-year construction projects of Kaski district after Nepal Government adopted federalism. It was found that most of the road projects have faced time overrun and cost overrun compared to building, motorable and trail bridge projects. The fluctuated yearly budget allocation impacted to the performance of contractors in terms of time, cost and quality. Cash flow management has been seen a major challenge to the Contractors. In addition, the quality of the work also get impacted as the Contractors do not follow standard construction methods and conduct required numbers of tests at the site.

Keywords: *Contractor's performance, Multi-year projects, Time overrun, Cost overrun, Quality management*

Leveraging Mobile Technology for Rural Development in Nepal: A Systematic Review

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Abstract

Mobile technology has emerged as a powerful tool for addressing development challenges, particularly in rural areas. This systematic review explores the use of mobile technology in rural Nepal, shedding light on its impact, challenges, and opportunities. Through an analysis of existing literature, this study synthesizes key findings to provide insights into the diverse applications of mobile technology in various sectors including healthcare, agriculture, education, and governance. In rural Nepal, mobile technology has facilitated access to vital services such as healthcare through telemedicine initiatives, enabling remote consultations and health information dissemination. Additionally, mobile platforms have been instrumental in improving agricultural productivity by providing farmers with timely weather forecasts, market prices, and agricultural tips. In the education sector, mobile technology has supported distance learning initiatives, reaching remote communities with educational resources and interactive learning tools. Despite its numerous benefits, the adoption of mobile technology in rural Nepal faces several challenges including limited network coverage, low digital literacy, and affordability constraints. Moreover, issues related to privacy, security, and cultural barriers also pose significant obstacles to the effective utilization of mobile technology in rural settings. However, amidst these challenges, there exist promising opportunities for leveraging mobile technology to foster rural development in Nepal. Collaborative efforts between government, non-governmental organizations, and private sector

stakeholders are crucial for expanding mobile infrastructure, enhancing digital literacy, and designing context-specific interventions tailored to the needs of rural communities. Furthermore, innovative financing mechanisms and public-private partnerships can play a pivotal role in overcoming financial barriers and ensuring sustainable adoption of mobile technology in rural Nepal. Survey and Interviews, Quantitative Data Analysis, Case Studies, Infrastructure Assessment, Community Engagement, Policy Analysis etc. by employing a multidisciplinary methodology encompassing quantitative and qualitative techniques, this study seeks to provide comprehensive insights into the use of mobile technology in rural Nepal and offer evidence-based recommendations for fostering digital inclusion and socio-economic development. mobile technology holds immense potential as a catalyst for rural development in Nepal, offering transformative opportunities to enhance access to essential services, empower communities, and bridge the digital divide. By addressing existing challenges and capitalizing on emerging opportunities, stakeholders can harness the full potential of mobile technology to drive inclusive and sustainable development in rural Nepal.

Keywords: *Information Technology, Mobile Technology, Rural Development*

Effect of Nepal's Politics on Development of Civil Constructions

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Abstract

The goal of this study is to determine how Nepali politics affect the advancement of civil construction. According to various surveys, interviews, articles, and websites, the mayor of the municipality and the construction manager share the budget in many of the nation's impenetrable regions. The residents of these areas are unaware of various development-related facts, such as the budget, investment, limited area, duration of construction, etc. Due to wrong development system and wrong decision of our leader all other citizens are harming. Loss of money, loss of time, and loss of development all we citizens are harming. Despite having the second-largest amount of drinking water resources, Nepal's population lacks access to clean drinking water. This is the town's drinking water crisis. Although there is water in the village, it has not been cleansed by distillation. Why should we fall prey to it ? Every day, numerous accidents occurred as a result of the underdeveloped roads and highways. We have to think technically about all those problems to find the solution. Political instability can lead to delays in infrastructure, projects and change in policies affecting construction regulations and uncertainty for investors hindering the growth civil construction sectors. The long-awaited goal of the people of Kathmandu is to obtain drinking water from the Melamchi River through the Melamchi Water Supply Project (MWSP). However, there is still no MWSP infrastructure for such drinking water supplies. Because of corruption, there can be no sustainable progress. If we examine it with honesty, we will discover millions of issues that are damaging to our country.

Keywords: *Civil Constructions, Numerous Accident, MSWP, Loss of development*

AI and IoT Driven Wildlife Attack Prevention: Safeguarding Human Lives around Bardiya National Park

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Abstract

Bardiya National Park is considered to be the most diversely and densely populated National Park in the country; with the seemingly well-implemented conservation plan in the area, the population of the wildlife has also exceedingly increased. The consequence of this has resulted in the rise in the human-wildlife encounter which has resulted in several human killings. Thus, there is a necessity to incorporate a fast, reliable, robust and scalable monitoring and alert system to safeguard the lives of both people and the wildlife. The manual surveillance system is an ongoing practice in Bardiya National Park which is time consuming and laborious therefore, a fully automated system that can monitor wildlife activities and behaviors, and alert the wildlife experts and locals as the threat escalates, is a must. This paper focuses on real-time monitoring and analysis of animal behavior patterns captured by cameras incorporated with computer vision model, particularly Convolutional Neural Network and sensors, which communicates with the server of National Park through Long Range Communication (LoRa) and triggers a series of immediate alerts via sirens and SMS for locals to anticipate potential wildlife threats through early warning systems before it escalates into dangerous encounters with humans. The challenges that could occur in the process and the future research directions are also discussed in this paper, highlighting the coexistence of both wildlife and humans together, without harming each other.

Keywords: *Computer Vision, Long Range Communication (LoRa), Early Warning System, Convolutional Neural Network (CNN).*

Analysis of Climate Change Impacts on Streamflow using WEAP Model: A Case Study of Modi River Basin

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Abstract

Climate change has become a pressing global issue with far-reaching consequences, including the alteration of hydrological patterns. The Modi River Basin, located in a region highly vulnerable to climate change, serves as a pertinent case study to understand the potential implications of changing climatic conditions on streamflow. In this research, the Water Evaluation and Planning (WEAP) system was used to study the impacts of future climate change on streamflow in the Modi River Basin. Climate projections are used to develop scenarios, that are integrated into the WEAP model, which incorporates hydrological and meteorological parameters to simulate streamflow under different climate scenarios. Climate data, spatial data and observed runoff were the inputs to the WEAP model and calibration and validation was done. Precipitation output of two GCMs of Coupled Model Intercomparison Project Phase Six (CMIP6) were used to characterize the future precipitation. Daily precipitation under the SSP2–4.5 scenario from the Beijing Climate Center (BCC) and China Meteorological Administration, China; and Meteorological Research Institute (MRI), Japan was used to characterize precipitation events. Considering large uncertainties with GCM outputs, direct use of GCM outputs were made to find change in precipitation pattern for future climate. The result showed an increase in precipitation in the near future (2031–2050) and far future (2081–2100), with respect to the base-year (1996–2015). The results of the study indicate that the Modi

River Basin will experience an increase in rainfall while using BCC-GCM and decrease while using MRI-GCM. The climate change impact analysis indicates an increase in the river streamflow due to increase in rainfall using BCC-GCM and decrease in the far future using MRI-GCM. The expected increase in precipitation may pose a severe threat to the long-term viability of social infrastructure, as well as environmental health. The findings of these studies will provide an opportunity to better understand the impacts of precipitation in streamflow and to assess CMIP6 model outputs to estimate anticipated changes.

Keywords: *WEAP, Climate Change, Modi River Basin, GCM.*

State Machine for Efficient Hyphenation in Devanagari Words

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Abstract

The task of identifying hyphenation points in Devanagari words is a complex one due to the intricate structure of the language, as observed in languages like Nepali. This paper introduces a state machine designed to find the breaking point in Devanagari words efficiently. The proposed state machine follows a systematic approach to analyze the phonetic and orthographic rules that govern the formation of Devanagari words. It breaks down words into their constituent graphemes and identifies optimal hyphenation points that maintain readability and linguistic integrity. Our method begins by constructing a comprehensive set of states that represent different possible stages in the decomposition of Devanagari words. Through a series of transitions between these states, the machine evaluates potential breakpoints within the words. This includes accounting for consonant clusters, vowel signs, and other special cases inherent to the script. We evaluated our state machine on a diverse dataset of Nepali texts, assessing its accuracy in determining natural breakpoints. The results demonstrate that our approach provides a significant improvement over existing hyphenation techniques, resulting in better readability and textual aesthetics. In conclusion, the state machine we developed offers a novel solution to the challenge of hyphenation in Devanagari words. Its potential applications extend to typesetting, text-to-speech systems, and natural language processing tasks involving Nepali and other Devanagari-based languages.

Keywords: *Devanagari, Nepali, hyphenation, state machine, natural language processing, typesetting.*

Graphene defect estimation using PSOGSA

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Abstract

Recently, graphene has gained significant attention within the electronics industry owing to its distinctive characteristics, which help overcome the challenges of miniaturization and pave the way for innovative electronic devices. Chemical vapor deposition stands out as a promising and widely used technique among various methods for growing extensive graphene films. However, it is challenging to eliminate defects such as cracks, holes, or wrinkles during this process. These defects significantly impact the electrical properties of graphene, thereby influencing its local conductivity distribution across the surface, which in turn characterizes its electrical behavior. When the graphene defect conductivity and the number of defects are known in advance, the unknowns become the defect geometry and the background conductivity of graphene. The defect geometries are described by truncated Fourier series coefficient which can represent the complex shapes These coefficients are estimated using the PSO-GSA method. Numerical studies have been conducted to characterize graphene with both single and multiple defects. The outcomes of the proposed algorithm are compared against those of the conventional modified Newton-Raphson method and the gravitational search algorithm.

Keywords: *Graphene, Parameter estimation, EIT, PSOGSA, defect detection*

Analysis of Construction Waste and its Management Practices from Buildings in Pokhara Metropolitan City

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Abstract

It has been a challenging issue of construction waste management for Pokhara Metropolitan City administration as well as contractor/relevant stakeholders in Pokhara. The aim of this research study was to assist construction stakeholders in making a decision on construction and demolition waste management. In this study field observation, interview and questionnaire survey were conducted. A questionnaire survey was carried out among the technical staffs and interview was carried out among site workers in order to evaluate the reasons and challenges in managing waste, and the effectiveness of 20 best practice measures regarding construction and demolition waste management. Field observation was carried out to investigate the status of the construction sites and waste situation at the construction sites. Construction waste generated at site were mainly biodegradable waste which is decomposable i.e. cartoon box, wooden scraps etc. and non-biodegradable waste whose decomposition is rare i.e. metal scraps, plastic cement bags, unusable pieces of steel bar etc. Major composition of waste during construction phase were pieces of brick, concrete, steel bar pieces, wooden scraps and empty plastic cement bags. Construction material in which bricks contributes the maximum amount of waste at site. Major challenges in managing waste were unclear understanding about the types of waste, lack of information for separating

common construction and hazardous material etc. Design changes, design error etc. followed by demolition and the variation in design and standard size of the construction material were the reasons for waste generation at the site. Best measures for the effective management of construction waste was developed which will be helpful for the effective management of construction waste in further in Pokhara Metropolitan City.

Keywords: *Construction waste, Waste management practices, Best practice measure, Waste composition*

Catalyzing Clean Energy Integration: Three-Phase DC-AC Model with Synchronous Converter and LCL Filter

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Abstract

In response to escalating demands for clean energy, this study presents a comprehensive model for integrating Direct Current (DC) sources into the established Alternating Current (AC) grid infrastructure within a three-phase system framework. The model employs a meticulously designed converter utilizing the synchronous reference frame methodology, tailored to address the intricate challenges of DC-AC integration. Through precise control over both active and reactive power using a dq reference frame, facilitated by a Proportional-Resonant (PR) controller, the converter ensures optimal performance characteristics. Critical to achieving synchronization and stability is the incorporation of a Phase-Locked Loop (PLL) mechanism, which generates essential operational references necessary for seamless integration. Additionally, an advanced LCL filter configuration is employed to mitigate harmonics and ensure smooth power transmission, enhancing grid reliability. Rigorous evaluation via extensive MATLAB simulations validates the model's efficacy in managing active and reactive power flows during DC-AC integration. This research represents a significant advancement in addressing the challenges of clean energy integration, providing practical solutions for fostering a sustainable energy landscape. By bridging the gap between DC and AC systems, the model lays a foundation for a resilient grid infrastructure capable of meeting future energy demands.

Keywords: *PLL-Phase-Locked Loop; Proportional Resonant controller, LCL filter, d-q references*

AI-Powered Personal Finance Assistant: Budgeting, Expense Tracking and Recommendations

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Abstract

This research introduces an innovative AI-powered personal finance assistant designed to revolutionize the management of individuals' expenses and budgets. Traditional financial tools often lack the adaptability and personalization needed to meet users' diverse financial goals and preferences. Using advanced machine learning algorithms, this personalized assistant provides tailored solutions to optimize financial decisions. By analyzing historical spending patterns and income sources, as well as considering individual financial targets, the assistant offers real-time insights into spending habits. It identifies potential areas for savings and delivers personalized budgeting recommendations to help users effectively manage their finances. This approach ensures that users receive relevant and actionable advice that aligns with their unique financial situations and objectives. The integration of predictive analytics further enhances the capabilities of this AI-powered assistant. By the use of predictive models, the assistant can anticipate future financial trends and provide proactive recommendations to help users stay on track towards their financial goals. This proactive approach enables users to make informed decisions and take proactive steps to improve their financial well-being. This research represents a significant advancement in the field of personal finance management, offering a practical and effective solution to the challenges faced by individuals in managing their expenses and budgets.

Keywords: *Personal finance assistant, Machine learning, Budgeting, Expense tracking, Savings opportunities*

Social Media And Loneliness: An Empirical Study of the Relationship Among Nepali Undergraduate Students

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Abstract

The World Happiness Report 2024 finds that the average happiness of young people is on the decline, far significantly in the West. This has led to the US dropping out of the top 20 ranking for the first time. A connected question whose answer could explain the trend in the West is "When does social media satisfy the need to belong?". The link between social media use and loneliness is inconclusive. Some studies show that social media use harms well-being. A similarly large number of studies show that there is no causal relationship, particularly going from social media use to loneliness. This paper is an empirical exploration of whether social media is capable of satisfying the need to belong, and therefore contribute to happiness. To empirically examine earlier studies on the relationships between social media use and loneliness using a more varied demographic sample, this study studies the association between the degree of loneliness and the amount of social media use. More precisely, we look to determine whether heavy use of particular platforms is associated with a higher risk of loneliness in undergraduate students. Our survey shows that Instagram is the most popular platform. To find out how much time college students spend on social media, a survey of undergraduate students is done. To see if there is a relationship between Instagram use and loneliness, we tally the Instagram use data with the data obtained from the updated UCLA loneliness scale. Research on how social media

use affects loneliness is crucial for understanding its impact on mental health. By studying this relationship, we can gain valuable insights into how our online habits influence feelings of loneliness. Our findings help in developing strategies to promote healthier online interactions, benefiting individuals, particularly undergraduate students who often spend a lot of time on social media. Ultimately, this understanding can lead to improved well-being and eventually contribute to happiness.

Keywords: *Social Media Use, Loneliness, Mental Health, Undergraduate Students*

Study of Compressive Strength of Concrete of Grade M-20 and M-25 by Different Percentages of Fly Ash Contents and Silica Fume

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Abstract

Concrete plays a crucial role in global construction projects, serving as a composite material formed by cement, sand, aggregate, and water. The worldwide demand for concrete has seen a significant upswing due to expanding infrastructure projects. Consequently, finding alternatives to traditional cement poses a formidable challenge. Utilizing industrial waste materials, such as fly ash and silica fume in concrete emerges as a promising solution .The use of fly ash and silica fume, by-products from industrial processes, as substitutes for cement, aligns with this trend, contributing to reduced carbon emissions and more eco-friendly concrete production. Understanding the impact of fly ash and silica fume on the compressive strength of these grades is essential for practical application in real-world construction scenarios. The primary objective of this study is to analyze the variations in the percentages of fly ash and silica fume to assess their individual effects on the mechanical properties of concrete and its general objective is to determine the compressive strength of concrete cubes with a variation of fly ash and silica fume as a partial cement replacement of grade M20 and M25. The study involves adjusting the proportions of fly ash and silica fume to identify the optimal mix design, achieving the desired compressive strength while meeting Grade M20 and M25 specifications. This Paper presents the results of an experimental investigation carried out to evaluate the mechanical properties (workability and compressive strength) of concrete mixtures

and cement was partially replaced with Fly Ash and Silica Fume. Cement was replaced with three percentages (30%, 40%, and 50%) of fly ash and three percentages (5%, 10%, and 15%) of silica fume. Tests were conducted for properties of fresh concrete (workability), and compressive strength was determined at 7, 14 and 28days. This paper acquaints the comparison of result of both the grade of concrete M20 and M25 with a variation of fly ash and silica fume and find its effectiveness in construction material. The use of fly ash and silica fume in replacement of cement is economically and environmentally beneficial.

Keywords: *Concrete, Fly Ash, Silica fume, Cement, Workability and Compressive Strength.*

Effect of Smaller Aircraft Crash on Tall Residential Towers

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Abstract

An attempt has been made to assess response of tall towers for accidental aircraft impact at roof level. Tall / multi-storey towers are slender in nature, due to smaller foot print / plan dimensions, compared to their height. Hence; they are prone to cantilever response predominantly, with longer time periods. Further due to less damping in the framed structure, transient loads of shorter duration may induce critical oscillatory vibrations also. A typical residential tower with 16 floors is taken for analysis. In the plan the structure has 4 and 8 bays in both the horizontal directions, i.e., transverse and longitudinal directions. Structure is considered as symmetric in plan along both the directions. It is modeled for two cases, viz., central core with shear walls for lift shaft, b) shear walls at all the four corners, to increase later stability. Standard commercial structural analysis and design software, STAAD/Pro / SAP-2000 is used for analysis and design check. For global model, reinforcement in structural members is not considered. For local analysis, typical reinforcement is assumed, to assess the capacity of beams and columns.IAEA guide give force time history for smaller general aviation aircrafts, say, Cessna and Learjet. This transient force is applied at the roof level, Eigen value analysis is carried out to review the dynamic characteristics, followed by

linear transient analysis, to see the global structural response. Time step for the analysis is chosen as one tenth (or less) of first natural period of the structure, to ensure convergence during the transient analysis. Structural members with larger shear forces and bending moments are identified, and examined for any non-linear behavior. In conclusion, it is observed that, though there are some local damages, structure is generally stable for accidental crash due to smaller aircraft, like, Cessna.

Keywords: *Crash Analysis; Local Damage; IAEA Guidelines; STAAD-Pro;*

The Perception of Perceptive Civil Engineering Students on the Application of Mathematics for Engineering in Pokhara Valley

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Abstract

The civil engineering student's perception on the application of mathematics for effective engineering is one of the important parts in learning them successfully. The purpose of this study is to identify the uses of engineering mathematics in surveying, construction, chemistry of materials, cost estimation and even in planning. This finding wishes to investigate the opinion of Civil engineering learners' on the independent variable and dependent variables. This study consists of 228 civil engineering and civil & rural engineering students of higher semesters depend on the survey research outline at Pokhara valley. A six –point Likert –scale survey questionnaire, 8 demography variables, and 29 structured questions based on response variables and input variables were prepared and administered by the researcher to the respondents. This fact finding study assesses that most learners strongly agreed that math is the foundation of engineering course and they were good in mathematics in primary level. It explored that the uses of mathematics in civil engineering are influenced by the attitude of learners and teachers, learning environment, and realization of mathematics for engineers. The attitude of learners and tutors, realized of mathematics for civil engineering and learning situation are extremely

affected by the application of mathematics in civil engineers. These three independents variables should be improved to increase the application of mathematics in the given field. The further study about the perception of students of target group of different places and different semester of different colleges should be done separately to validate and generalize the result of this study.

Keyword: *Application, Attitude, Civil Engineering, Mathematics, Perception*

MALWARE DETECTION USING MACHINE LEARNING ALGORITHM

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Abstract

Malware has emerged as a cyber security threat that continuously changes to target computer systems, smart devices, and extensive networks with the development of information technologies. As a result, malware detection has always been a major worry and a difficult issue, owing to shortcomings in performance accuracy, analysis type, and malware detection approaches that fail to identify unexpected malware attacks. Malware is the one which is frequently growing day by day and becomes major threats to the internet security. The struggle between security analysts and malware developers is a never-ending battle with the complexity of malware changing as quickly as innovation grows. There are several methods of classifying of new malware from the existing signatures or code. The traditional approach is not much effective and they failed to compete the new malware. In this paper, there is comprehensive information about the versatile framework about machine learning algorithms. The reason is that by using these algorithms, it is easy to distinguish between clean and malware files. This aims at providing a systematic and detailed overview of machine learning techniques for malware detection and in particular, deep learning techniques. In this paper, we define malware and types of malwares as an overview, as well as the new mechanism of using machine learning algorithms how effective and efficient in classification of malware detection and we presented the existing works related to malware detection classification using various

machine learning algorithms to see the accuracy and prediction on malware datasets and discussed about main important challenges that are faced in malware detection classification. Compare to these Algorithms GD BOOST, NB, Decision Tree and Random Forest that has been used in this project, The more accuracy in Random Forest Algorithm. So, according to our finding, Random Forest is the best algorithm among these four for malware detection. We have proposed a malware detection module based on advanced data mining and machine learning approach and different algorithms which are needed to achieve zero attacks.

Keywords: *Malware, Malware Analysis, Malware Detection, Deep Learning, Malicious Code, Gd Boost.*

Plasticity Variation of High Plastic Silt Mixed with Sand, Stone Dust, and Combination of Both

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Abstract

Weak soil poses significant challenges to construction because of its low shear strength, especially in areas like the Kathmandu Valley. Due to concerns with building structures' carrying capacities and settling, several solutions for stabilizing the soil at shallow depths are needed to avoid deep foundations for small-scale projects. This study investigates the effectiveness of adding sand and stone dust to high plastic silt in the Kathmandu Valley to characterize the plasticity characteristics of weak soil. This study's main goals are to determine the soil's Atterberg's limit after stabilization and evaluate changes in the high plasticity soil's attributes. A range of liquid limit and plastic limit experiments will be used in this study to assess the plastic behavior of weak soil, stone dust, and other materials. For this, disturbed soil from the Kupandole area of Lalitpur was collected and allowed to air dry in a laboratory. After the soil had completely dried, soil dust was collected by hammering the soil into a fine powder so that it could be mixed with powder form of stone dust and sand. The collected soil had a high liquid limit of 93.17%, a relatively low plastic limit of 36.11%, and a high plasticity index of 57.05%, indicating it to be high plastic silt (MH) based on Unified Soil Classification System (USCS). On the other hand, sand and stone-dust utilized in the study were non-plastic. As the proportion of stone dust (SD) rose from 0% to 40% in 5% intervals (i.e. 0%, 5%, 10%, 15%, 20%, 25%, 30%, and 40%),

there were gradual decreases in both the liquid limit and the plasticity index of the soil. In particular, the plasticity index dropped significantly from 57.05% to 14.25% within the same range, while the liquid limit reduced from 93.17% to 57.55%. Similarly, there were significant reductions in the liquid limit—from 93.17% to 52.84%—when the amount of sand (SA) was changed from 0% to 40% in 5% intervals (i.e. 0% 5%, 10%, 15%, 20%, 25%, 30%, and 40%) in the same soil. Over the same interval, the plasticity index showed a steady decline, going from 57.06% to 10.72%. Moreover, a comparable pattern was noted with an increase in the combined percentage of sand and stone dust in soil from 0% to 40% (i.e. 0%, 2.5%SD+2.5%SA, 5%SD+5%SA, 10%SD+10%SA, 12.5%SD+12.5%SA, 15%SD+15%SA and 20%SD+20%SA), the liquid limit dropped from 93.17% to 55.89%. The plasticity index dropped in parallel with the plastic limit's decline, which saw it drop from 36.11% to 27.98%. Together, these results point to a decrease in plasticity as the proportions of sand and stone dust rise. This study resulted in a decrease in plasticity due to the addition of stone dust or sand or both in a high plastic silt of Kathmandu Valley. The reduced plasticity is defined by a lower volume change potential and higher strength characteristics, potentially enhancing a foundation base in construction projects.

Keywords: *Atterberg limits, Soil stabilization, High plastic silt, Sand, Stone dust*

Bearing Capacity Influenced by Footing Dimensions in Diverse Soil Types

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Abstract:

The study explores the role of cohesion and friction angle in determining soil bearing capacity, crucial in geo-technical engineering and foundation design. It aims to evaluate bearing capacity variation with depth and width, analyzing minimum soil bearing capacity and its implications. Study aims to analyze and categorize minimum bearing capacity of soils, and to create a dataset for designing shallow footings across diverse soil conditions. This study explores the influence of cohesion and friction angle on soil bearing capacity calculations, pivotal in geo-technical engineering for stable foundation design. Cohesion and friction angle, integral to bearing capacity equations, determine the structural stability of buildings and bridges. Understanding their variations is crucial for safe construction amidst diverse soil conditions. Through analysis, this research aims to enhance geo-technical engineering practices, ensuring the efficiency, safety, and sustainability of civil infrastructure projects. Methodology design involved data collection, where the data related to soil characteristics such as cohesion, friction, and unit weight were gathered using literatures and GEO5 software. The data was organized and recorded in an Excel sheet and was its analysis included determining minimum bearing capacity and interpreting findings. The report includes data on cohesion, friction angle, and bearing capacity across various soil types, depths, and widths, categorizing soils with critical bearing

capacities. Analysis involved studying graphs of bearing capacity, width, and depth. The research identified various soil types with a bearing capacity below 100 kPa, highlighting critical conditions for foundation design. A bar graph illustrated the bearing capacity of these soil types and clay soils with high or very high plasticity showed the lowest bearing capacity, with the investigation focusing on how this capacity changes with different foundation depths. Depths of 4, 5, 6, and 7 feet were analyzed while maintaining a constant width. The analysis indicates a direct relationship between foundation depth and soil bearing capacity, with deeper foundations exhibiting higher capacities due to increased soil volume. Conversely, shallower depths show lower capacities. Additionally, varying foundation widths demonstrate a consistent increase in bearing capacity, attributed to load distribution over a larger area. While wider foundations generally exhibit higher capacities, the effect is more pronounced at greater depths. Notably, in clay soils with high plasticity, wider foundations significantly enhance bearing capacities. Overall, this underscores the importance of considering both depth and width in foundation design, with depth exerting a more substantial influence on bearing capacity than width. Through comprehensive analysis, it uncovers the varying bearing capacities of different soil types, highlighting a maximum of 1197 kPa and a minimum of 55 kPa. The research underscores the significance of identifying weak soil types, such as high plastic clay, which pose potential foundation failure risks.

Keywords: *Bearing Capacity, Cohesion, Friction angle, Foundation, Shallow Footing*

Classification of Soil at Shallow Footing Depths at Sanepa Area Construction Sites

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Abstract:

The recent incident in 2023 in Bakhundole (neighborhood of Sanepa Area) where nearby houses collapsed while building an apartment, emphasizes how crucial it is to characterize the soil before beginning any construction. Located among lacustrine and river deposits, Sanepa is a well-known residential and commercial complex in the Kathmandu Valley. This study uses laboratory testing to assess the shallow (five feet to eight feet) foundation-level soil conditions of eight active construction sites in Sanepa at various elevations (from 1282 meters to 1304 meters). The research used a methodical manner to understand the most common soil types at footing level of Sanepa by combining field and laboratory findings. First, homeowner consent was obtained, which made it possible to gather disturbed soil from building sites. For the tests that followed, these samples were broken into small pieces using a wooden pallet after being air dried at room temperature for 7 days. By differentiating between coarse- and fine-grained soils, the particle size analysis offered light on the composition of the soil. An assessment of plasticity was then conducted, providing insight into the behavior of the soil at different moisture levels. In addition, tests to determine the optimum moisture content (OMC) and dry density were used to assess the compaction qualities of the soil. The findings revealed a wide range of differences in the distribution of particle sizes, with coefficients of curvature (Cc) ranging from 1.289 to 9.96 and

coefficients of uniformity (Cu) ranging from 3.75 to 44.28. Based on Cu and Cc values and the percentage of soil retained in the sieve, the soil samples were classified according to Unified Soil Classification System. Most of the soil samples (Site no. 1, 2, 3, 5, 7, and 8) from the different sites were found to be Well Graded Sand (SW) and other soil samples (Site no. 4 and 6) were even gap graded and was considered as poorly graded sand (SP). Despite all soils being coarse in nature, they were again put through 75-micron sieves for plasticity testing. The results showed Plasticity Index values ranging from 0.227% to 1.627%. Additionally, studies on the maximum dry densities and optimum moisture contents revealed a variety of values. The maximum dry densities of the soil samples varied, ranging from 1.489 to 1.721 gm/cc, suggesting different compaction potentials. The range of optimum moisture contents, which corresponds to the moisture content at which the maximum dry density is attained, was 18% to 29.7%. This study emphasizes on importance of in-depth studies in order to understand soil qualities at the footing level for building projects. Gaining an understanding of these characteristics is essential to reducing the risks related to construction projects and guaranteeing the stability and structural integrity of structures. The study also highlights the further need for additional investigation aimed at comprehending the engineering behavior of diverse soil types under varied loading circumstances.

Keywords: *Footing-level soil characterization, Atterberg limits, Compaction characters, Grain size distribution, Sanepa soil characterization.*

Streaming Towards the Future: Nepal's Remarkable Journey in Hydropower Development

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Abstract:

Hydropower is the foundation of a country's social and economic development. Sustainable human development is not possible without electricity. Nepal, blessed with abundant water resources, boasts an immense hydroelectric potential underscoring its significance in the country's energy landscape, but we've barely scratched the surface. Even though we've been using hydropower since way back in 1911, we're only using a tiny bit of what we could be. Creating a sea requires aggregating every drop of water, similar to electricity, the unification of all micro and mini hydroelectric power sources plays crucial roles. Overall, 98 % of the populations have access of electricity through NEA grid and isolated solar/ micro hydropower plant, of which 95.03% are connected to the NEA grid. The power sector is one of the most vital sectors that guarantees the sustainable growth and competitiveness of the economy and not only the region, but the entire world. Therefore, we need to pay more attention to the attractiveness and the problem because everyone deserves to have the clean and affordable energy. Accordingly, the paper argues that the development of the hydropower industry will result in positive economic growth in Nepal. The hydroelectric power generation

growth in the long run can increase household income, lower energy prices, significantly reduce poverty, and also protect the economy against oil price shocks. Furthermore, this research represents a remarkable opportunity for Nepal to deliver not only clean, renewable energy while helping to mitigate climate change, driving economic prosperity and environmental sustainability for generations to come. It is essential to use AI based Cyber security system for distribution and manage the electricity and to secure the hydro power of Nepal.

Keywords: *Hydropower, Cyber security, Artificial Intelligence, Sustainable Development, economic growth.*

Exploring Smart Grid Applications in Nepal: An Overview of Status, Challenges, and Opportunities for Sustainable Energy Transformation

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Abstract

Energy transformation and sustainability present pressing challenges, particularly for developing nations like Nepal, characterized by a wide demand-supply gap, heavy reliance on fossil fuels, and limited access to clean energy. Smart grid technology emerges as a crucial solution to address these challenges and facilitate the transition towards more efficient and sustainable energy systems. This research paper investigates the pivotal role of smart grids in bolstering power systems, integrating renewable energy sources, electrifying transportation, and leveraging bioenergy. The research methodology employs a mixed-method approach, combining qualitative analysis of existing literature, policy documents, and reports on Nepal's energy landscape with quantitative assessment through data collection and analysis. Primary data is gathered through interviews and surveys with stakeholders including government officials, energy experts, utility companies, and community representatives. The study also utilizes simulation tools to model the potential impacts of smart grid implementation on energy efficiency, reliability, and environmental sustainability. This paper contributes novelty by providing a comprehensive analysis of the current energy scenario in Nepal and the potential of smart grid technology to address existing and future energy challenges. The

study evaluates the feasibility and implementation barriers of smart grid deployment in Nepal, offering insights for policymakers and stakeholders to initiate programs promoting its adoption. Furthermore, the research serves as a foundation for future investigations into the transformative potential of smart grids in other developing countries with abundant renewable energy resources and similar energy-related obstacles. The findings of this research underscore the urgent need for concerted efforts to embrace smart grid technology as a catalyst for sustainable energy transformation, not only in Nepal but also in other developing nations striving to achieve energy security and environmental sustainability.

Keywords: *Smart grid technology in Nepal, Microgrid Modeling, Energy transition Challenges and opportunity, Nepalese power grid*

Garbage Tracking System–Revolutionizing the Waste Management System

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Abstract:

In numerous cities, the lack of openness and predictability in garbage pickup creates considerable issues for people. Individuals are frequently unaware of when the garbage collection will arrive, resulting in inefficiencies and significant environmental hazards. The Garbage Tracking System is an intriguing waste management system that possesses the potential to counter this omnipresent communal issue. This ingenious approach efficiently addresses the traditional issue of not knowing when the garbage collector will arrive. With an optimised user-centric platform it brings a plethora of possibilities for enhancing self-awareness for garbage management. This work leverages the use of various technologies ranging from MERN for the web, and Flutter for Mobile App to ESP32 (microprocessor within built wifi module) as an IOT aide. Alongside this, it uses HC-SR04 ultrasonic sensors that are easily attachable to the public dustbins and continually monitor the dustbin's occupancy level. These sensors make use of the reflection phenomenon such that if signals transmitted encounter any obstacle a delay is introduced at the receiving end of the sensor. This time delay is used to calculate the distance between the obstacles. Currently, the proposed work delivers a range of 2-400 cm. Following this, the obtained data is sent to the real-time database that internally stores and forwards the data into the web system for valuable insights and further processing. On the other hand, for real-time tracking

of garbage trucks, mobile GPS is used. This work provides a platform for centralised management of garbage. Individuals can create user accounts to access pertinent information on collection schedules, and get real-time notifications of garbage trucks as they approach the user's preset location. This platform also addresses the need for continuous status updates of public dustbins thereby facilitating a unique feature to deliver just that. The Garbage Tracking System utilises Information technologies to revolutionise waste management by offering users optimized scheduling, real-time monitoring for efficient garbage disposal.

Keywords: *Smart Dustbin, IoT, Real-Time Monitoring, Flutter, Optimisation*

Identification of Natural Products in Actinomycetes

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Abstract

Actinomycetes are Gram-positive bacteria with a fungus-like filamentous mycelium. They are good sources of natural products including antibiotics. Nowadays, multidrug-resistant pathogens have seriously threatened human and veterinary diseases. To address this issue, there is an urgent need for new therapeutics. In the search for potent natural products, we have isolated seven actinomycetes BT1, BT2, BT3, BT5, BT36, PT7, and AB1 from soils collected from various parts of Nepal, which were then identified based on morphology and molecular sequencing. Antimicrobial potency of bacterial isolates was carried out against *Staphylococcus aureus* ATCC 43300, *Shigella sonnei* ATCC 25931, *Salmonella typhi* ATCC 14028, *Klebsiella pneumoniae* ATCC 700603, and *Escherichia coli* ATCC 25922. Similarly, actinomycetes' minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were examined. As a result, actinomycetes PC1 and BT36 showed significant zone of inhibition against tested microorganisms. Most significantly, MICs of actinomycetes PC1 against *S. aureus* and *E. coli* were 0.65 mg/mL and 1.5 mg/mL, respectively—its MBCs against *S. aureus* and *E. coli* were 2.63 mg/mL, and 3.0 mg/mL, respectively.

Furthermore, ethyl acetate extracts of shake flask fermentation of some actinomycetes were subjected to liquid chromatography-tandem mass spectrometric (LC-MS/MS) analysis. Interestingly, 45 metabolites including valinomycin, epopromycin A, myxopyronin B, gilvocarcin HE, and okilactomycin A were identified. This study will be useful in isolating natural products from soil microbes in Nepal.

Keywords: *Microorganism; Secondary metabolites; Antimicrobial; Mass Spectrometry*

Evaluation of Rural Road Consistency based on Performance Index Modelling in Kaski

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Abstract

Rural road which occupies most of the road network system in Kaski plays a vital role in the socio-economic development of the locality and country as a whole. These roads are built at local level by Province Government and through participatory approach too. Most of these roads do not confirm to the design standard NRRS 2071 too which were developed from foot trail and possess a question mark regarding to consistency in roadway geometry. So, it seems to develop a methodology for evaluating and improving roadway geometry of rural road in Kaski to achieve consistency in performance and minimize casualties. In this context, this study focus on developing a simplified model to predict performance index of rural road based on pavement width, shoulder width, right of way and average speed of the vehicle respectively. Methlang-Gyarjati road with elevation ranging from 925m to 935.93m and chainage 90.81m is taken as the selected site for the study. Engineer's weightage are assigned as 0, 50 and 100 where 0 indicate upgrading of the road, 50 indicate improvement in road section curve, shoulders and 100 indicate no upgrading in roadway geometry and alignment respectively. The performance index is then calculated. The relation shows a significant relationship with R^2 value 0.9834.The weightage assigned are also acceptable with perfect decision as shown by the consistency index with value ranging from 0 to 0.1 respectively.

The obtained model $PI=20.5_{WP}+19.3_{WS}+40.8_{ROW}+10.1V_{av}$. gives the value of performance index as 59.54,59.0,60.48 for three curve section respectively. Thus, From the preliminary study, it was observed that first right of way must be well define in rural road followed by maintenance of pavement width and shoulder width such that average speed can be maintained to avoid accident. It thus, assisted to prioritize for upgrading of roadway geometry along the curve section of the rural road with similar topography and alignment which helps to maintain consistency in roadway geometry enhancing socio-economic aspect and safety in long run. Overall, there require a minor maintenance in roadway geometry to maintain consistency in rural road of Kaski.

Keywords: *Performance Index, Roadway geometry, Average speed, pavement structure, rural road, accident, Methlang-Gyarjati road, Consistency index*