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NETWORKS AND SCIENCE**

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***Editor(s): Dr. Ciro Rodriguez, Dr. Ashish Bagwari, Dr. Jyotshana Bagwari***

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## Preface

On behalf of the **research group ITDATA from National University Mayor de San Marcos, Peru, and Advanced And Innovative Research Laboratory (AAIR Lab) Dehradun, India**, we are pleased to welcome all the participants of the **Third International Conference on Wireless Technologies, Networks and Science-2025 "(ICWTNS-2025)"** held on 10-11 May 2025. The ICWTNS-2025 provided a prominent international forum for researchers and practitioners to exchange information regarding novel aspects of technology, application, and service development within the multidisciplinary framework of Communication Engineering, Wireless Sensor Networks, Wireless Mesh Networks and Multimedia Networks, Science such as mathematics, computer, environment, and many more.

The Keynote Speakers, Distinguished Lecturers, Invited Talks, and paper presenters at the ICWTNS-2025 conference concentrated on the current running technologies in the areas of wireless, networks, and science, and their issues & challenges.

This year, the response to the conference's call for papers has been outstanding. Many individuals and organizations contributed to the success of this conference. Together with the Technical Program Committee, they worked diligently to select papers and speakers that met the criteria of high quality and relevance to our various fields of interest. We are grateful for all their hard work and efforts. It takes time and effort to review a paper carefully, and every member of the Technical Program Committee is to be commended for his or her contribution to the success of this conference.

The TPC Chairs, Co-Chairs, and members had the unenviable task of coordinating the peer review process and putting together an outstanding technical program. They deserve a lot of thanks. The success of this conference would not have been possible without the dedication and efforts of the members of the Advisory Committee, Publicity Committee, Steering Committees, and other committees.

We would like to extend our gratitude to Hon'ble Chief-Guest, Guest of Honor(s), and Technical Session Chairs for their all-out support and encouragement.

It was an honor and a pleasure for us to accept the responsibilities and challenges of serving as Conference General Chairs. We sincerely hope that everyone who attended the conference enjoyed themselves and learned something new. We thank faculty members and staff of National University Mayor de San Marcos, and AAIR Lab for their valuable contributions and support for the conference. Also, we appreciate and thank to all for the support received from various corners of researchers. See you again in 2026 at the next version of this conference.

For details on upcoming conferences, journals, webinars, and grant-writing services, kindly visit our website ([www.icwtns.aairlab.com](http://www.icwtns.aairlab.com) or [www.aairlab.com](http://www.aairlab.com)).

**Thanks**

**With Regards**

**Dr. Ciro Rodriguez, National University Mayor de San Marcos (UNMSM), Peru**

**Dr. Ashish Bagwari, India**

**Dr. Jyotshana Bagwari, AAIR Lab, India**

Editor, ICWTNS-2025 proceeding

[icwtns2025@gmail.com](mailto:icwtns2025@gmail.com); [2025icwtns@gmail.com](mailto:2025icwtns@gmail.com); [info@aairlab.com](mailto:info@aairlab.com); [info.aairlab@gmail.com](mailto:info.aairlab@gmail.com);

Contact Number: **+91-9870954839 (What's App only)**

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119	Managing Power System Variability through Advanced Energy Forecasting Techniques	Umesh Daivagna, Sudha P, S.Radhika, Suraj Bhan, Niranjana Nayak, Abhinav Mishra	ICWTNS-2025_313
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123	Enhancing Energy Conversion Efficiency in Distributed Generation Systems through Smart Load Management	Gayatri Mohapatra, Megha.D.Bengaluru, Balamurugan V, Mohamed Jaffar A, Suraj Bhan, Amanveer Singh, Jagmeet Sohal	ICWTNS-2025_317
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**Paper Title-Detecting Evolving Deception Patterns in Online Reviews**

Tripti Verma<sup>1</sup>, Saloni Choudhary<sup>2</sup>, Janvi<sup>3</sup>, Greeshma Arya<sup>4</sup>

<sup>1</sup>ECE Dept, Indira Gandhi Delhi Technical University for Women, tripti033bteceai21@igdtuw.ac.in

<sup>2</sup>ECE Dept, Indira Gandhi Delhi Technical University for Women, saloni007bteceai21@igdtuw.ac.in

<sup>3</sup>ECE Dept, Indira Gandhi Delhi Technical University for Women, Janvi005bteceai21@igdtuw.ac.in

<sup>4</sup> Professor, Indira Gandhi Delhi Technical University for Women, greeshmaarya@igdtuw.ac.in

**Abstract-** Introduction: Business and marketing strategies are shaped drastically today due to consumer feedback, and online reviews are particularly influential when making purchasing choices. Unfortunately, the more prevalent problem of fake reviews jeopardizes the credibility of these sites. Identifying such deceptive material requires sophisticated processes in language technology. This paper offers a solution of fake review detection through DeBERTaV2, a transformer model which uses disentangled attention and enhanced position embeddings, allowing for better understanding of text. A feedforward neural network trained on features extracted by DeBERTaV2 is shown to effectively classify and identify reviews as either fake or authentic. This model, tested on a benchmark dataset, outperforms competing models improving the trustworthiness of online reviews.

**Objectives:** This study aims to create an effective and precise fake online review detector using elaborate transformer architectures. The objective is to improve the model's capability in distinguishing reviews by using DeBERTaV2 for deep contextual and linguistic feature extraction and classifying with a Feedforward Neural Network. This research attempts to broaden the scope of traditional and machine learning approaches, overcoming their contextual understanding shortcomings, unbalanced classification, and inadequate accuracy. The intention, however, is to improve trust and transparency in e-commerce, hospitality, digital marketing platforms, and other real-world applications by providing an effective solution that operates under these environments.

**Methods:** Identifying fraudulent reviews has progressed from manual frameworks to AI deep learning techniques. Initial approaches relied on self-defined features, sentiment analysis, and posting behaviors and were outpaced by evolving strategies built around deceit. The advent of machine learning brought supervised frameworks like SVMs, Decision Trees, and Naive Bayes with TF-IDF and word embeddings for feature extraction, which enhanced detection accuracy. Detection without labeled data using clustering techniques and Autoencoders fell short of contextual understanding, requiring a shift to deep learning where RNNs, LSTMs, and GRUs enabled sequential dependency capture of text. The latest transformer models like BERT, RoBERTa, and DeBERTaV3, leverage self-attention, allowing unparalleled consideration of context. In parallel, Explainable AI aims to increase confidence and trust in models through SHAP, LIME, and attention visualizations. Although these technologies have advanced, maintaining class imbalance, generalization across domains, and sophisticated spoofing of review poses challenges requiring ongoing integration of cross-disciplinary innovation.

**Results:** Our newly developed fake review detection model using DeBERTaV2 embeddings and a Feedforward Neural Network (FNN) architecture performed exceptionally well on a dataset containing fake and real reviews. The model achieved 97.30% test accuracy, surpassing all other traditional and deep learning models that tended toward one class. It successfully predicted both classes, accumulating a considerable number of true positives (1933) and true negatives (2002), with relatively low false positives (20) and false negatives (89). Precision scores also validated this with 96% and 99% for real and fake reviews respectively, recall scores of 99% and 96%, and a balanced F1 score of 97% for both. Compared to other models such as HACNN, BMTBA, and BSTC, these results demonstrate that the proposed model achieved greater accuracy because of the contextual embeddings provided by DeBERTaV2 and the FNN's ability to non-linearly manage relationships. The enhanced understanding of context together with a balanced dataset ensured robust performance across the board in identifying deceitful reviews across various domains.

**Conclusions:** In this study, we sought to investigate how impactful DeBERTaV2's contextual feature extraction coupled with a Feedforward Neural Network was for detecting review fraud. The imbalance did not affect the model, as accuracy on the test set was 97.30%, performing well on both classes. These outcomes underscore the efficacy of transformer models with neural networks in performing complex text classification tasks, particularly in deception detection. The current

approach is effective, although future research can help by focusing on efficiency and adaptability across datasets by lowering the computational cost or testing other transformer architectures. In terms of applicability, the approach is highly valuable to e-commerce, online content verification, and digital marketing.

*Keywords:* Deep Learning, Feedforward Neural Network, Machine Learning, DeBERTaV2, Natural Language Processing.

Paper ID- ICWTNS-2025\_542

## Paper Title-Financial Fraud Detection with Enhanced GNN: A Comparative Study on Graph-Based vs. Traditional Fraud Detection Methods

Riya Gupta<sup>1</sup>, Shelly Bhalla<sup>2</sup>, Nandini Parashar<sup>3</sup>, Greeshma Arya<sup>4</sup>

<sup>1</sup>Indira Gandhi Delhi Technical University for Women, Delhi, India  
1riya088btece21@igdtuw.ac.in

<sup>2</sup>Indira Gandhi Delhi Technical University for Women, Delhi, India  
2shelly086btece21@igdtuw.ac.in

<sup>3</sup>Indira Gandhi Delhi Technical University for Women, Delhi, India  
3nandini087btece21@igdtuw.ac.in

<sup>4</sup>Indira Gandhi Delhi Technical University for Women, Delhi, India  
4greeshma.arya@igdtuw.ac.in

**Abstract-Introduction:** Fraud detection in finances is a high priority in today's fast-speed digital economy and the pace and sophistication of fraud transactions on the rise. Classical machine learning techniques are disadvantaged by their inability to identify the subtle relationships and emerging trends characteristic of next-generation finance and cryptocurrency transactions. Emerging Graph Neural Network (GNN) innovations offer the solution in the form of ability to achieve complex network patterns in transaction information, which would enable the development of smart and prescriptive fraud detection.

**Objectives:** This study will try to gain a real evaluation of four new fraud detection models with special focus on a consideration of some simple algorithms such as XGBoost and complex GNN models. In general, the study will try to decide on the advantages and disadvantages of each approach by utilizing some different financial and crypto data sets and construct a deep, efficient platform which may be utilized in real security systems effectively.

**Methods:** The setup used in the work involved a robust experiment, which benchmarked all the models against baselines for tabular and graph-based form of financial transactions. Model performance is compared in terms of accuracy, AUC-ROC, as well as the computational time required. Detection also investigates in the present work according to multimodal model fusion and its influence over incorporating multimodal sources like behavior analytics and metadata on transactions within detection.

**Results:** The experiments confirm XGBoost to be extremely effective on tabular financial data with excellent baseline performance. The GNN-based models overwhelm the traditional models dramatically for graph-structured data, yet the sophisticated fraud patterns and network anomalies unperceivable by other channels are unveiled. The hybrid solution constructed makes use of the best of both strategies to ensure scalable real-time fraud detection deployable across a broad range of financial applications.

**Conclusions:** This piece describes the revolutionary potential of GNNs as a marriage with traditional machine learning methods in deciding fraud detection's destiny. By adopting phenomenon such as transformer patterns, multimodal fusion data, and explainable AI, financial institutions and banks will achieve greater transparency, stability, and resilience to shifting threats. The proposed solution is the new gold standard for effective, stable, and dynamic fraud detection in the new digital banking era.

**Keywords:** Fraud detection, Graph Neural Networks, XGBoost, Financial security, Cryptocurrency, Real-time processing, Explainable AI, Multimodal integration.

## Paper ID- ICWTNS-2025\_124

### Paper Title- English-Punjabi Code-mixed Text Generation

Mukhtiar Singh<sup>1</sup>, Parul Sood<sup>2</sup> and Munish Kumar<sup>3</sup>

<sup>1</sup> Chandigarh University, CSE Department- [mukhtiarrai73@gmail.com](mailto:mukhtiarrai73@gmail.com)

<sup>2</sup> Chandigarh University, CSE Department- [parulsood563@gmail.com](mailto:parulsood563@gmail.com)

<sup>3</sup> Chandigarh University, CSE Department- [ggsceemunish@gmail.com](mailto:ggsceemunish@gmail.com)

*Abstract*-Code-mixing is special type of communicative linguistic process where speakers integrate elements from different languages to construct coherent sentences. This hybrid technique is a very common for giving rise to the hybrid languages such as Hindi-English (Hinglish), Punjabi-English (Punglish). This paper focuses on the pioneering study by introducing a transformative method for generating and analysing the mixed text in Punjabi and English, addressing a critical gap in linguistic research and natural language processing (NLP) for multilingual environments. This research introduces a novel approach for generating code-mixed text in Punjabi and English (Punglish). The framework's performance is robustly measured with the help of sophisticated metrics like code-mixing index (CMI) and degree of code mixing (DCM). The author examined 3,575 code-mixed questions and determined that the mean CMI is 0.3 and the mean degree of code-mixing (DCM) is 7.6 in the research. These findings showcase the framework's capability to generate highly intelligible and naturalistic code-mixed probable phrases, closely mimicking real life multilingual patterns of communication. In this research, the results indicate the potential of developing enhanced natural language processing (NLP) tool's ability to address linguistic barriers within multilingual communities effectively.

**Keywords**— Natural language processing (NLP), Code mixed data, Code mixed text generation, Code-mixed text, English-Punjabi code-mixed text.

## Paper ID- ICWTNS-2025\_136

### Paper Title- Mapping of Urban Expansion in Dehradun City: A SAR-Based Analysis Using Sentinel-1 Data

Pooja Joshi<sup>1</sup>, Devanshu Ghildiyal<sup>2</sup>, Ashutosh Bhatt<sup>3</sup>, Neelam Sharma<sup>4</sup>

<sup>1,3</sup> Department of Computer Science, Swami Rama Himalayan University, Jolly-grant, Dehradun Uttarakhand, India.

<sup>2</sup> Wadia Institute of Himalayan Geology, Dehradun, Uttarakhand, India.

<sup>4</sup> Department of Computer Science, Banasthali Vidyapith Jaipur, India.

*Abstract*- Urban expansion has significant implications for sustainable urban planning and resource management. Dehradun, the capital of Uttarakhand, India, has witnessed substantial urban growth in recent years due to population increases and economic development. This study leverages Synthetic Aperture Radar (SAR) data from Sentinel-1 satellites to analyze and map urban expansion in Dehradun city. SAR data, due to its ability to penetrate clouds and operate under all-weather conditions, offers a robust methodology for continuous and reliable urban monitoring. The analysis employs a multi-temporal approach, using Sentinel-1 imagery acquired over different time periods, combined with advanced processing techniques such as change detection, threshold segmentation, and classification algorithms. Results reveal patterns of urban sprawl, densification, and land cover transitions over the selected study period. The findings underscore the role of SAR technology in providing actionable insights for urban planners, policymakers, and stakeholders to make informed decisions regarding land use and sustainable urban growth. This study contributes to the broader discourse on urban monitoring using remote sensing and highlights the importance of SAR in addressing urbanization challenges in complex and dynamic environments like Dehradun.

**Paper ID- ICWTNS-2025\_155**

**Paper Tile- Price Prediction of Cryptocurrency**

Jyoti Yaduvanshi, Utkarsh Upadhyay, Saurav Rana

*jyoti.singh.2k21@gmail.com, upadhyayutkarsh2003@gmail.com, ranasaurav878@gmail.com*

*Department of Computer Science and Engineering (CSE), Galgotias University, Greater Noida, Uttar Pradesh, India*

**Abstract-** Predicting cryptocurrency prices is tough because the market is highly unpredictable and influenced by many factors. However, many machine learning and statistical methods have been developed to try and forecast future prices. These methods usually use historical pricing trends, market volumes, and analytical indicators to discern patterns. Cryptocurrencies, which are digital currencies not controlled by governments or banks, are becoming more popular despite their unpredictable behavior. This makes it hard for investors to decide when to buy or sell. To tackle this challenge, we need a smarter system that uses machine learning to analyze past price trends, trading data, and other factors like regulations, economic changes, and even social media buzz. Such a system would be flexible and quick to adapt to the constantly changing cryptocurrency market, helping investors make better decisions. This study reviews the latest methods for predicting cryptocurrency prices, evaluating their strengths, weaknesses, and how well they work in real life. It also explores the difficulties in making accurate predictions and highlights suggested areas for future research to enhance these techniques.

**Keywords-**Cryptocurrency , Machine Learning , Blockchain,Data Analysis, Time Series Forecasting, Deep Learning , Algorithmic Trading Models, Sentiment Analysis, Market Forecasting, Volatility Analysis, Investment Strategies.

**Paper ID- ICWTNS-2025\_164**

**Paper Tile- Enhancing Oil-Water Separation: Impact of Nanoparticle Coatings on Quartz Particles**

Nthabiseng J. Ramanamane<sup>1\*</sup>, Mothibeli Pita<sup>2</sup>

*<sup>1,2</sup> Department of Mechanical Engineering, Bioresources and Biomedical Engineering, School of Engineering and the Built Environment, University of South Africa, Florida 1710, Private Bag X06, South Africa,*

*ramannj@unisa.ac.za, pitam@unisa.ac.za*

**Abstract-** Efficient separation of oil-water emulsions is critical for addressing environmental pollution caused by industrial wastewater. This study investigates the application of quartz material coated with hydrophobic nanoparticles to enhance oil-water separation efficiency. Quartz samples were prepared and analysed under different conditions: raw, washed, and coated with one to four layers of hydrophobic nanoparticles. Surface morphology was evaluated using Scanning Electron Microscopy (SEM), revealing the impact of nanoparticle distribution, surface roughness, and inter-particle separation on wettability. The first coating demonstrated optimal nanoparticle distribution, resulting in superior wettability and oil rejection efficiency, reducing oil and grease concentration to 29.3 mg/L. Successive coatings led to clustering and irregular surface morphology, adversely affecting separation performance. Mathematical models were developed to quantify key parameters, including oil rejection efficiency, nanoparticle uniformity, and separation efficiency. The findings highlight the potential of quartz material with a single hydrophobic nanoparticle coating as a low-cost, efficient solution for oil-water separation, providing insights into optimizing coating processes for environmental applications.

**Keywords:** Oil-water separation, Quartz material, Hydrophobic nanoparticles, Wettability, Surface morphology, Scanning Electron Microscopy (SEM), Oil rejection efficiency, Nanoparticle Coating, Wastewater treatment.

**Paper ID- ICWTNS-2025\_166**

**Paper Title- A Comparative Analysis of Electrical Parameters in PVA/Zn Dust and PVDF/Zn Dust ionic Membranes**

Poonam Raturi<sup>1\*</sup>, Antima Chamoli<sup>2\*</sup>, Dr. Himanshi Sharma<sup>3\*</sup>, Amjad Ali<sup>4\*</sup>

<sup>1</sup>*Department of Electrical and Communication Engineering Graphic Era Deemed to be University*

<sup>2</sup>*Department of Humanities and Social Science (English Programme)*

<sup>3</sup>*Department of Humanities and Social Science Assistant Professor*

<sup>4</sup>*Department of Management Associate Professor Graphic Era deemed to be University*

*Abstract-* A study of the electrical characteristics of PVDF/Zn dust and PVA/Zn dust ionic membranes is provided in this paper. The materials used in the matrices are polyvinyl alcohol (PVA) and polyvinylidene fluoride (PVDF), each complemented by zinc dust to improve ionic conductivity. The study includes structural characterization, synthesis methods, and an extensive assessment of electrical characteristics such as conductivity, dielectric behaviour, dissipation loss and impedance. The results demonstrate significant differences between performance both the ionic membrane, which can be attributed to the inherent characteristics of the polymer matrices along with the way they interact with zinc dust. While the PVDF/Zn dust membranes exhibit better dielectric stability, the PVA/Zn dust membranes have higher ionic conductivity. This comparative research opens up the path for enhanced membrane design in electrochemical devices by providing essential insights into the material selection procedure for applications demanding specific electrical properties.

**Paper ID- ICWTNS-2025\_169**

**Paper Title- Evaluating Low-Cost Absorbent Materials to Develop Selection Criteria for Advanced Oil-Water Separation Devices**

Nthabiseng J. Ramanamane<sup>1\*</sup>, Mothibeli Pita<sup>2</sup>

<sup>1,2</sup> *Department of Mechanical Engineering, Bioresources and Biomedical Engineering, School of Engineering and the Built Environment, University of South Africa, Florida 1710, Private Bag X06, South Africa,*

*ramannj@unisa.ac.za, pitam@unisa.ac.za*

*Abstract-* The development of efficient and low-cost oil-water separation technologies is crucial for addressing environmental challenges posed by industrial oily wastewater. This study evaluates a range of low-cost absorbent materials, including quartz sand, kaolin, bauxite, activated carbon, clay, coal gangue, cellulose, and fly ash, to establish a selection framework for fabricating advanced oil-water separation devices. A comprehensive methodology was developed incorporating key criteria such as availability, cost-effectiveness, oil absorption capacity, hydrophobicity, surface area, porosity, and sustainability. Novel mathematical models were integrated into the framework to systematically analyze and rank materials based on their performance. The study revealed that quartz sand and kaolin demonstrate exceptional potential due to their abundance, modifiability, and high separation efficiency. The framework also highlights the trade-offs between cost, environmental impact, and scalability, providing actionable insights for optimizing material selection. This research paves the way for scalable, eco-friendly, and cost-effective solutions for oil-water separation, addressing both industrial and environmental needs.

**Keywords:** Oil-water separation, low-cost materials, absorbent materials, selection criteria, quartz sand, hydrophobicity, sustainability, wastewater treatment

**Paper ID- ICWTNS-2025\_181**

**Paper Title- Smart Grain Dryer For Moisture Control Using Solar Power**

Prasanta Pratim Bairagi<sup>1</sup>, Baharul Islam<sup>2</sup>, Manash Jyoti Borah<sup>2</sup>

<sup>1</sup> Faculty of Computer Technology, Assam down town University, Guwahati, Assam-781026

<sup>2</sup> Faculty of Engineering, Assam down town University, Guwahati, Assam-781026

*Abstract-* This work aims to address the time-consuming and ineffective traditional method of sun-drying rice grain, which increases the likelihood of shattering. To achieve this, a solar dryer was designed and developed, consisting of a solar collector, drying chamber, and airflow system. The optimal moisture content for good quality rice is between 11% to 15%, but traditionally, rice grains have about 21% moisture content. The solar dryer includes a microcontroller-based digital system, namely a GSM module and buzzer, to indicate when the moisture content has been sufficiently reduced. The experiments involved placing 2kg of rice grain on a tray, and using four load cells to monitor the weight change of the grains on an LCD display. The microcontroller-based system continuously monitored the change in weight, calculated the equivalent grain moisture content, and displayed it on the LCD display. On a bright, sunny day, the solar dryer can reach a maximum temperature of 55°C. The results show that, depending on the weather, this method helps lessen the amount of moisture in rice grains upto 5% in just 2 to 3 hours, achieving a moisture level comparable to the 15% regulation moisture level.

**Keywords:** Microcontroller, Load Cell, GSM Module, Moisture Controlling, Solar Power

**Paper ID- ICWTNS-2025\_201**

**Review on Dam Monitoring: Bridging the Gap Between Maintenance and Fish Conservation**

Tasneem Bano Rehman<sup>1</sup>, Nusrah Khan<sup>1</sup>, G. Sailaja<sup>2</sup>, Iram Fatima<sup>1</sup>, Nuha Naser<sup>1</sup>

<sup>1</sup> Computer Science Engineering Department, Muffakham Jah College of Engineering and Technology, Hyderabad

<sup>2</sup> Mechanical Engineering Department, Muffakham Jah College of Engineering and Technology, Hyderabad

Tasneem.bano@mjcollege.ac.in, khannusrah0@gmail.com, sailajasinha@mjcollege.ac.in, iramf5085@gmail.com, nuha.naser185@gmail.com

*Abstract-* Dams and weirs are essential components of modern water management systems that provide benefits such as hydroelectric power generation, flood control and irrigation. However, these structures pose significant challenges to aquatic ecosystems, particularly migratory fish species. The obstruction of natural migration routes can lead to increased mortality rates. The Internet of Things (IoT) plays a significant role in enhancing dam maintenance and protecting aquatic life through innovative monitoring and management strategies. IoT enables real-time monitoring and management of water levels in dams, which is fundamental for effective maintenance and safety. It was concluded that the range of death rates for fish associated with dam operation without mitigation measures was between 12% and 42%. Therefore, an innovative approach is required to address the ecological consequences of dam operations, which have been inadequately addressed by previous systems. The integration of advanced technologies, such as edge computing, IoT, and AI, in dam management is crucial for preserving aquatic ecosystems while balancing human needs.

**Keywords:** Dams, Fish mortality, aquatic ecosystem, IoT, artificial intelligence.

**Paper ID- ICWTNS-2025\_177**

**Paper Title- Binary Classification of Facial Features for Robust Deepfake Identification**

Gaurav Aggarwal<sup>1</sup>, Gaurav Sharma<sup>2</sup>, Pooja Joshi<sup>3</sup>, Ashutosh Bhatt<sup>4</sup>, Parul Saini<sup>5</sup>  
<sup>1</sup>Swami Rama Himalayan University, Dehradun, India, gauravaggarwal@srhu.edu.in  
<sup>2</sup>Swami Rama Himalayan University, Dehradun, India, gauravsharma@srhu.edu.in  
<sup>3</sup>Swami Rama Himalayan University, Dehradun, India, poojajoshi.baloni@gmail.com  
<sup>4</sup>Swami Rama Himalayan University, Dehradun, India, ashutoshbhatt15@gmail.com  
<sup>5</sup>DIT University, Dehradun, India, parul.saini@dituniversity.edu.in

*Abstract-* Deepfake technology has emerged as a significant challenge in the realm of digital media due to its potential misuse in misinformation, privacy violations, and security breaches. This study focuses on the binary classification of facial features as a means of enhancing Deepfake identification. By using the natural differences between real and fake facial features, we proposed a strong framework that uses deep learning models to look at small differences in texture, lighting, and facial movement. Our approach involves pre-processing facial data to isolate key regions prone to manipulation, such as the eyes, mouth, and skin texture. We employ multiple convolutional neural networks (CNNs) and dense layers to extract high-dimensional features, subsequently classifying them into two categories: real or fake. To improve robustness, the model incorporates data augmentation and ensemble techniques to handle variations in quality and environmental factors. We validate the framework on the Kaggle dataset, achieving state-of-the-art accuracy while maintaining computational efficiency. Our results demonstrate the potential of the binary classification of facial features as a reliable and scalable solution for deepfake detection, paving the way for practical applications in media forensics and digital security.

**Keywords:** Deepfake image, CNN, Deepfake detection.

**Paper ID- ICWTNS-2025\_115**

**Paper Title- The Efficiency of Small Language Models: A Comparative Analysis of BERT Models**

Peeyush Chaurasia<sup>1</sup>, Ishan Kashyap<sup>2</sup>, Disha Sharma<sup>3</sup>, Karan Nagpal<sup>4</sup>  
<sup>1,2,3,4</sup>Department of Computer Science Chandigarh University, Mohali, India

*Abstract—*This research paper aims at exploring the effectiveness of small language models (SLMs) in natural language processing, with special emphasis on their suitability for optimization for resource-limited environments because of the way they are designed. Overall, we look at the measurements of accuracy, inference time, and model size, when comparing SLMs to the more extensive BERT or Distil BERT models. Using this, our work reveals that although the proposed SLMs achieve considerable improvements in terms of inference time and model size, performance degradation has also been observed as a major issue. The paper also outlines specific areas of concern in this case including data quality, interpretability and architecture of models. Besides, we describe possible future research directions which include; refining existing domain-specific adaptations and effective ways of evaluating them. This work adds to the current discussion on effective NLP models, particularly regarding contradicting goals of high performance and practical solutions. In conclusion, our study seeks to help chart the course for improving the development and application of small models in other domains.

**Keywords:** Small Language Models (SLMs), Natural Language Processing (NLP), efficiency, model accuracy, inference time, resource management, optimization techniques, data quality, interpretability.

**Paper ID- ICWTNS-2025\_535**

**Paper Title- A QR Code-Based Mobile Application for Modernizing Library Operations in College/University Libraries: A Technical Approach**

Prasanta Pratim Bairagi<sup>1</sup>, Joseph A. Patacsil<sup>2</sup>, Kishore Medhi<sup>3</sup>, Seema Devi<sup>4</sup>, Mahendra Kumar Modi<sup>5</sup>, Mostaque Md. Morshedur Hassan<sup>6</sup>

<sup>1</sup>*Assistant Professor, Faculty of Computer Technology, Assam down town University, Guwahati, Assam, India*

<sup>2</sup>*Associate Professor, College of Information Technology, Don Mariano Marcos Memorial State University, La Union, Philippines*

<sup>3</sup>*Assistant Professor, Department of Computer Application, Assam Don Bosco University, Guwahati, Assam, India*

<sup>4</sup>*Library Incharge, Kamrup Polytechnic, Guwahati, Assam, India*

<sup>5</sup>*Executive Dean, Assam down town University, Guwahati, Assam, India*

<sup>6</sup>*Assistant Professor, Department of Computational Sciences, Brainware University, Kolkata, India*

**Abstract-** Library users expect more from libraries, particularly from academic libraries, not only for intellectual advancement but also for today's information demand, which will undoubtedly increase day by day. The conventional library management system often applies manual procedures for managing operations like book issue, renew and return etc which leads to inefficiencies and unnecessary human errors. To overcome these limitations, we developed an app based "Smart Library Management System" using the QR code technology. This innovative approach incorporates the QR code in all library operations such as issue, return, etc., through a mobile application to enhance the overall efficiency and user experiences.

**Keywords:** Library, Library Operations, QR Code, Mobile Application.