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Conference Report

Abstracts of the 1st International Conference on Trends and Innovations in Smart Technologies (ICTIST'22) †

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Abstract: The first edition of the International Conference on Trends and Innovations in Smart Technologies (ICTIST'22) was held on 7–8 October 2022, bringing together researchers and experts from the fields of communication networks and security, computational intelligence, and engineering. The conference provided a platform for participants to share their research and discuss the latest trends and innovations in these areas. The present report will start by providing an overview on the keynote speeches and the main axes around which the communication sessions revolved before moving on to more detailed abstracts, presenting each of the topics presented during the ICTIST'22 conference.

Keywords: deep learning (DL); software-defined networks; blockchain; internet of vehicles (IoV); cyber-attacks; internet of medical things (IoMTs); cloud computing; protocols; internet of things (IoTs); COVID-19; healthcare industry; big data; neural networks; machine learning (ML); natural language processing (NLP); engineering; photovoltaic power; artificial neural network

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1. Introduction

The first edition of the International Conference on Trends and Innovations in Smart Technologies (ICTIST'22) was held on 7–8 October 2022, attracting a diverse range of researchers, academics, and industry professionals interested in the latest developments in communication networks and security, computational intelligence, and engineering. The conference aimed to foster collaboration, innovation, and knowledge-sharing in these fields, providing a platform for participants to present and discuss their latest research findings, share best practices, and learn about emerging trends and technologies.

The event was opened by Inam Ullah Khan (visiting researcher at King's College London/Isra University, SEAS, Islamabad Campus, Pakistan), Mariya Ouaissa (Moulay Ismail University, Meknes, Morocco), and Zakaria Boulouard, Hassan University Casablanca, Morocco). Dr. Mariya Ouaissa informed all participants/authors about the conference. Dr. Zakaria Boulouard had given brief overview about overall conference. Dr. Inam Ullah Khan thoroughly explained working mechanism of ICTIST'22.

The conference had a lineup of five keynote speakers. The first keynote speaker, Prof. Dr. Mohammed M. Alani, spoke about "Future Priorities in IoT Security," highlighting the need for effective and comprehensive security measures in the rapidly expanding field of IoT. The second speaker's topic was "Privacy Preservation in Smart Grid". Presented by Dr. Mubashir Husain Rehmani, this speech emphasized the importance of maintaining privacy in the collection and use of data in the increasingly interconnected

energy systems. The third keynote address, titled "Cyber Upshot on economy Leading towards Disaster," was presented by Prof. Dr. Khalid Hussain and drew attention to the dire consequences of cyber-attacks on the global economy. The fourth speaker, Dr. Hajar Moudoud shed light on "Blockchain Integration with New Technologies," discussing how blockchain technology can be integrated with other emerging technologies to enhance their effectiveness and security. Finally, the last keynote address, presented by Dr. Rehmat Ullah, explored "Edge Federated Learning: Recent Advances and Open Research Problems," providing insights into the latest developments in federated learning and the challenges that still need to be addressed.

In addition to the keynote presentations, the conference featured various communication sessions, including paper presentations, and panel discussions, covering a wide range of topics related to three main axes, namely communication networks and security, computational intelligence, and engineering.

The "Communication Networks and Security" axis covers various topics related to improving network security. Advances in deep learning techniques have improved intrusion detection systems, and software-defined networking is used to optimize network performance and security. Blockchain technology has potential in public health, but privacy concerns and security protocols must be addressed. Machine learning is also applied to intrusion detection, especially in the emerging field of internet of vehicles security. Smart cities can leverage machine learning to detect and respond to threats in real time. Optimized machine learning techniques are necessary for accurate and efficient intrusion detection in IoT networks. Researchers are also exploring software-defined networking to manage IoT infrastructure, such as multiprotocol label switching services. Effective intrusion detection systems and network management solutions are critical to IoT networks and smart city initiatives. Participants had the opportunity to engage in lively discussions, exchange ideas, and network with peers and colleagues from around the world. They had the opportunity to explore the latest trends and innovations in smart technologies through exhibits and demonstrations by industry leaders and startups.

The "Computational Intelligence" axis explores different challenges related to AI and big data as well as approaches to facing them. Indeed, advancements in technology have enabled the analysis of large datasets, leading to the creation of predictive models that aid in decision-making. In the realm of power prediction, big data analysis can provide valuable insights into energy usage and supply. By thoroughly analyzing data, researchers can develop more accurate predictive models that can help prevent power outages and improve efficiency. Similarly, machine learning algorithms are being used to improve diagnostic models for high-risk diseases. These models can help physicians identify and treat patients more effectively, potentially saving lives. In cryptography, efficient substitution box design is essential for secure encryption. Researchers are exploring the use of chaotic logistic maps and linear congruential generators to improve the design of substitution boxes. In response to the COVID-19 pandemic, machine learning approaches are being used to analyze clinical data and identify patterns that can aid in diagnosis and treatment. Finally, bilingual propaganda fragment detection and auto-fact-checking technology is being developed to identify false information and combat propaganda. These advancements in technology have the potential to greatly benefit society and improve decision-making across various fields.

The dynamic field of engineering is continuously progressing, with fresh research emerging every day. The "Engineering" axis covers cutting-edge challenges and approaches in various engineering fields, from advanced optical networks to renewable energy sources and innovative materials. Engineers are continuously pushing the boundaries of innovation, such as comparing the performance of hybrid WDM/TDM PONs for 128 users using APD and PIN photodiodes. Additionally, artificial neural networks are being utilized to predict photovoltaic power output, while researchers explore new materials, such as polymer foam FGM core sandwich beams, and investigate alternative energy sources' impact on the environment. Advanced optimization algorithms, such as JAYA, are also being utilized

to find efficient solutions to complex economic problems, especially in electric automotive applications. As the engineering field progresses, innovative approaches, such as implementing artificial neural networks in battery management systems and designing THz slot antennas, are being explored. Meanwhile, flexible manufacturing systems are being made more efficient with the use of combined priority rules and a selection of alternative routing in real-time. Nanosatellites' passive thermal control is being innovatively addressed, and the logistics industry is experiencing a significant impact from blockchain technology's secure and transparent solution to tracking the movement of goods.

The following sections of this report will present abstracts of the communications presented in each of the abovementioned axes.

2. Communication Networks and Security

2.1. Towards More Effective Network Intrusion Detection System Using Deep Learning

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Currently, cyber-attacks are increased due to vulnerabilities in communication networks. Therefore, security measures must be maintained. Intrusion detection systems (IDS) identify possible security attacks. Deep learning techniques can be utilized for intrusion detection system. In this paper, authors demonstrated a novel IDS based on bidirectional long short-term memory (BLSTM). Additionally, principal component analysis and ANOVA f-statistic are used to reduce redundant data. Two popular datasets were used in the simulation—KDD-99 and NSL-KDD.

2.2. Performance Analysis of POX and RYU Controller on Software Defined Network with Dijkstra Algorithm

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The field of software-defined networking (SDN) is relatively new and has seen increasing adoption in both commercial and open-source platforms. Two commonly used SDN controllers are POX and RYU, which are compared in this paper using two performance assessments. The assessments utilize Dijkstra's algorithm to find the shortest path between source and destination as well as quality of service metrics, such as jitter, throughput, packet loss, and packet delivery ratio.

2.3. Blockchain for COVID-19 Pandemic: A Review, Opportunities, Applications and Challenges

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Initially, COVID-19 disease outbreak was spread all around the world. Many countries banned transportation, and a medical emergency was announced. Artificial intelligence and blockchain are quite helpful in improving new technologies regarding COVID-19. AI

has the ability to improve techniques. Drug manufacturing and deadly diseases can be detected using artificial intelligence. This paper was a survey about blockchain and AI technologies related to COVID-19. Integrated technologies regarding blockchain and AI consist of various applications, which were discussed in detail. A case study is incorporated regarding detection of viruses. Furthermore, AI based techniques improve overall processes while analyzing complex data. COVID-19 challenges and future directions were discussed in detail.

2.4. Internet of Vehicles Security: A Survey

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The internet of vehicles (IoV) is a new concept which aims to reduce accidents on roads. Different types of communication are found in the topological structure of the IoV. The internet of vehicles is a novel idea, and therefore, security is considered major concern. Additionally, other issues, such as connectivity, mobility of vehicles, and various structures, must be addressed. In addition, cyber-attack detection, availability, confidentiality, routing, and data authenticity have been observed in IoV networks. This paper gave a detailed overview of IoVs, architecture, protocols, and security countermeasures. The structure of the IoV is non-uniform and dynamic. Therefore, IoV networks are quite vulnerable.

2.5. A Survey on Machine Learning Based Intrusion Detection

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Internets of medical things (IoMTs) have a variety of applications, which include remote monitoring, early disease detection, sensor deployment in patients and real-time data analysis. Wireless communication technologies are utilized as the backbone for IoMTs. Therefore, data confidentiality needs to be ensured. IoT networks are quite vulnerable and exposed to cyber-attacks. Therefore, a machine-learning-based intrusion detection system was designed for IoMTs. Several threats related to internets of medical things are discussed in detail.

2.6. Proposed on Cloud Cyber Security: Attack Analysis Using Risk Assessment and Security Risk Assessment Using Attacks

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Cloud computing has become a prevalent technology for data storage, with online platforms heavily relying on it. In recent years, many individuals and organizations have entered the cloud-storage market, reflecting the acceleration of new technologies in the modern world. As a result, cloud administration and storage are now considered essential aspects of modern life due to their benefits in terms of data safety and accessibility. Governments, corporations, and individual users have increasingly shifted their data to the cloud, recognizing the advantages of cloud computation in ensuring data safety. However, this trend has also attracted the attention of cybercriminals who attempt to breach cloud-based servers. This article focused on the risks of cloud cyber-attacks and security flaws, highlighting the need for robust security measures to protect against these threats.

2.7. Investigation into Privacy Protocols of Blockchain Networks Based on Zero-Knowledge Proofs

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Currently, blockchain technology is widely used in complex networks. Many problems exist in traditional techniques. In every newly born technology, user awareness is especially needed. Additionally, security is considered a great concern in blockchain-based networks. However, confidential transactions are recorded in a distributed ledger. Security and privacy problems must be addressed using ring signatures, neural networks, and blockchain-based protocols. Blockchain techniques provide decentralized approach to secure storage systems. This article gave detailed information about ZKP techniques for private blockchain networks. In addition, transactions, privacy, and implementation of ZKP approaches are discussed in detail.

2.8. Comparative Analysis of Machine Learning Methods to Identify Bot-IoT Attacks

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Currently, IoT is deployed in almost every field of study. IoT topological structures are quite vulnerable, and therefore, intruders deploy cyber-attacks. IoT-enabled physical objects are connected with each other through wireless communication technology. Intrusion detection systems play an important role in detecting unknown data packets. This paper presented detailed comprehensive analysis of machine learning techniques which are used to evaluate performance through feature selection. The Bot-IoT dataset was utilized for simulation. During experimentation, random forest achieved optimal accuracy level in comparison with other techniques.

2.9. Software Level Security and Privacy in Healthcare: Attacks, Challenges, and Mitigation Techniques

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Electronic healthcare technology is widely used across the world. After COVID-19, integrated technologies were introduced, including the internet of things, cloud computing, robotics, and artificial intelligence. Through the mentioned technologies, data collection, analysis, and remote diagnosis of patients can be made possible. Additionally, wireless communication networks can be used in almost every technology. Smart phone applications are quite helpful in the healthcare industry. Cyber-security threats in healthcare systems make the entire network vulnerable. Furthermore, intruders capture personal data which include personal information and use them to attack. Additionally, the health information of patients might be stolen from an IoT-based network. However, cyber-attacks/ransomware can breach the overall system. This paper contained a detailed study about recent security/privacy attacks on the healthcare industry. Additionally, future challenges, security threats, and privacy issues were discussed in detail.

2.10. Smart Cities Enabled Intrusion Detection System for IoT-Networks Using Machine Learning

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Smart cities are a new concept in which wireless communication networks and the IoT play an important role. Sustainable IoT-based networks need to be safeguarded from cyber-attacks. DoS/DDoS security attacks are commonly deployed either inside or outside IoT-based networks. Flooding, Sybil, and DNS attacks are also serious threats to smart cities. Therefore, intrusion detection systems (IDS) easily detect possible security attacks. Furthermore, machine-learning-based IDS is a concrete solution for detection of cyber-attacks. Machine learning classifiers were used to identify attacks from the UNSW-NB15 dataset. ADA Boost, auto encoder classifier, linear support vector machine, quadratic support vector machine, and multilayer perceptron were utilized in the simulation environment. However, AdaBoost presents 98.3% accuracy in comparison with other techniques. In addition, various limitations and security attacks were discussed in detail.

2.11. Optimized Machine Learning Techniques to Detect Cyber-Attacks in IoT-Networks

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The internet of things is considered a promising area of study. Many applications exist, including health care, smart cities, power grid, and many more. Security must be ensured with low computational resources. An intruder's attempt to attack an IoT network can disrupt all communication within the network. Spoofing, DoS/DDoS, and ping of death attacks are commonly used to jam IoT networks. However, traffic monitoring problems must be addressed. In this paper, authors simulated machine learning techniques, such as linear discriminant analysis, quadratic discriminant analysis, XGBoost, KNN, and decision tree, using the UNSW-NB15 dataset. K-nearest neighbor performed better in contrast with other techniques.

2.12. Intrusion Detection System for IoT Infrastructure

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The internet of things (IoTs) can be deployed in many applications, which include smart grid, operational technology, supply chain, healthcare, and environmental monitoring. Integration of cloud service providers (CSP) with IoT is quite helpful in supporting small businesses. IoT networks are vulnerable to cyber-attacks such as denial of service (DoS) and distributed denial of service (DDoS). An intrusion detection system is considered the only possible solution for the mentioned problem. Traditional IDS previously had many problems, such as memory constraints, data processing restrictions, and queues/stacks. Therefore, machine-learning-based intrusion detection systems were introduced to detect possible security attacks. In simulation results, logistic regression performed well in comparison with other techniques, such as decision tress, random forest, naïve Bayes, and support vector machine.

2.13. Study of SDN Solution for MPLS Service

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Internet applications require a network architecture that can react in real time. Network architecture easily classifies different types of data traffic in a short period of time. Due to the rapid growth of cloud computing, many problems related to network management exist. Software-defined networks are used to provide possible solutions. However, SDNs have two units—the control plane and the data plane. These units facilitate implementation to solve complex problems. SDN-based configurations are automated and programmable at any level. An administrator must provide rules for controlling the entire network. MPLS technology provides better solutions for internet-protocol-related issues. Quality of service parameters are used to check overall performance of the network. Virtual private networks (VPNs) are considered the most important service for users. This paper presented implementation related to an MPLS-based VPN model to establish secure communication using open-flow standardization.

2.14. Comparative Study of Homomorphic Encryption Schemes for Secure Cloud Data Storage

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Currently, cloud computing offers many services to companies. Therefore, in cloud computing, power and storage are managed through remote servers. Still, many cybersecurity problems exist. In particular, cyber-attacks make network vulnerable overall.Data encryption in cloud computing can be utilized to secure communication. Additionally, cryptography techniques provide promising solutions. Homomorphic encryption is considered major issue which reduces performance. This paper presented a study related to homomorphic encryption. Comparative analysis was performed, which included popular schemes: RSA, EL Gamal, Paillier, BGV, BFV, and CKKS.

3. Computational Intelligence

3.1. A Thorough Analysis of Big Data's Use in Power Prediction

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Smart grids improve the livelihoods of humans. Therefore, power prediction models are utilized in smart grids for further development. As electricity is considered a need of every human, communication within grids must be improved. Big data and deep learning improve prediction accuracies. Traditional techniques still have many problems in power prediction. Moreover, error is reduced using artificial intelligence. Machine learning techniques are quite helpful in providing possible solutions in smart grids. Data segmentation techniques were properly investigated in this research article. In the near future, big data will improve standards in smart grid and power predication.

3.2. Improved Neural Network-Based Predictive Models for High-Risk Disease Diagnosis

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Overall, death rates have increased worldwide due to deadly diseases. Mostly, patients suffer from breast cancer, diabetes, heart disease, and liver disorder. Medical doctors provide possible suggestions to patients through which human lives can be saved. However, a lack of specialties and experience of medical doctors causes major problems. Additionally, traditional manual systems and machines are not effective. This paper was mainly based on a four-phase methodology used to detect disease in early stages. The four-phase methodology consisted of pre-processing, feature selection, classification, and performance evaluation. Disease-specific datasets were obtained from the UCI Machine Learning Repository for simulation. The CNN technique was preprocessed and used to remove duplicate data packets from dataset. Results presented a high level of accuracy for breast cancer, diabetes, heart problems, and liver disorders.

3.3. Efficient Substitution Box Design with Chaotic Logistic Map and Linear Congruential Generator

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This paper presented a novel scheme for designing a strong substitution box (S-box) with the help of a chaotic logistic map (CLM) and a linear congruential generator (LCG). Additionally, advanced encryption standards (AES) were utilized in this research study. An S-box with an intended use of providing an exhaustive search using a pseudo-random

number generator (PRNG) was designed. Statistical testing is performed to evaluate performance. However, robustness against linear and differential crypt analysis was observed during experimentation. Moreover, bit independence criterion (BIC), strict avalanche criterion (SAC), and nonlinearity were properly calculated. The proposed S-box approach presented better results, which were applicable for symmetric key cryptography.

3.4. Comparative Analysis of Machine Learning Approaches for COVID Pandemic Using Clinical Data

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The impact of COVID-19 on human health has been significant. Machine-learning-based disease prediction has emerged as a valuable tool for medical professionals in making informed decisions. Researchers have developed numerous techniques for the early prediction, classification, diagnosis, and detection of COVID-19. This study evaluated and compared the performance of seven machine learning models, including logistic regression, decision trees, random forest, support vector machine (SVM), k-nearest neighbors (KNN), XGBoost, and neural networks. Clinical datasets were utilized for training and testing purposes. Results showed that random forest, logistic regression, SVM, KNN, and XGBoost achieved the highest accuracies, while neural networks achieved a prediction accuracy of 0.81 based on clinical data.

3.5. Bi-Lingual Propaganda Fragment Detection and Auto-Fact-Check

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Recently, social media platforms have been widely used for news. However, many agencies use propaganda news against their opponents. Therefore, fake news detection is considered major issue. This research study contained information about bilingual propaganda data from various news sources. Natural language processing was utilized in this research study. A novel system was developed which was used for Urdu and English language translation. Neural architectures were explored specifically for a bilingual corpus. However, during experimentation, RoBERTa, BiLSM, CRF, and BiRNN models were used. The RoBERTa model provided better classification in contrast with other traditional models.

4. Engineering

4.1. Performances Comparison of Hybrid WDM/TDM PONs for 128 Users Using APD and PIN Photodiodes

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This paper presented a hybrid wavelength division multiplexing/time division multiplexing passive optical network which consist of 128 users. However, unidirectional optical fibers with data rates of 2.5, 5, and 10 Gbps were used. Additionally, a continuous wave laser with power in the range of −6, 0, and 6 dBm was utilized. Hybrid network performance was tested on P-Insulator-N, Avalanche photodiodes (PIN, APD). Erbium-doped fiber amplifiers (EDFA)

amplified modulated signals. Parameter analysis was performed using Opti-system software to calculate bit error rates (BERs) and quality factor (Q). Q/BER analysis was performed on a large scale of transmission length up to 120 km. Simulation results presented optimal performance using APD and PIN in terms of Q-factor and BER for data rates of about 2.5 and 5 Gbps, respectively, according to the optical network requirements (Q > 6 and BER).

4.2. Coherent Ballistic Transport in Ultra-Thin Film with Breaking Symmetry

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This paper presented a theoretical model which was used to investigate phase field matching theory. However, localized states and local vibrational density of states (LVDOS) were used to perform associated thermal conductivity of a perturbed ultra-thin film quasi-dimensional crystalline lattice. Disruption was found in the system's translational symmetry, which was perpendicular to the Ox axis. The localized state was basically a behavior change, which was present in great amounts. The proposed model has three different cases—softening, homogenous, and hardening. The main purpose was to investigate local dynamics. Total conductance spectra and local vibrational densities were quite different in characteristics.

4.3. Modeling and Prediction of Photovoltaic Power Output Using Artificial Neural Network Considering Ambient Conditions

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PV panels are widely used in comparison with other renewable energy. Due to environmental factors, overall performance is affected. In this research study, prediction of power output through photovoltaic module using artificial neural network was demonstrated. However, various weather conditions, which include speedy wind, ambient temperature, and solar irradiation, affected the output of the model. Moreover, a novel dataset was utilized for two days of experimentation. The first day was easily used to train an ANN model with 70% of the data, and validation/testing was made possible with 15%. Furthermore, various training algorithms are simulated. A scale-conjugated gradient showed optimal results. In addition, trained data were deployed into a network for the prediction of power. Statistical parameters, such as accuracy and prediction, are used for performance evaluation. Additionally, the ANN-based model had reasonable accuracy in predicting the power output of a PV module with a R 2 of 0.97 and MAE of 6.83.

4.4. NLFEA-Based Post-Elastic Modeling of the Bending and Thermal Behavior of Polymer Foam FGM Core Sandwich Beams

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This paper introduced a nonlinear finite element analysis (NLFEA) in order to model the post-elastic behavior of functionally graded (FGM) core sandwich beams. Indeed, the simulated beam's core was based on different PVC foams with a continuous functionally transition; the polypropylene (PP) skins of the beams were bonded using an epoxy resin as adhesive. The numerical simulations were carried out; sandwiches were submitted to bending and thermal loads. The constitutive materials of the core were modeled according to an elastic–plastic model, while an orthotropic elastic model was used for the composite skin's laws. In order to highlight the performances of the studied beams, the recourse to a full 3D model for the modeling of the sandwiches was focused under ABAQUS. The numerical outcomes in terms of global behavior—i.e., force–displacement curves—and local behavior—i.e., visualization of stress and strain cartographies—are emphasized. Finally, the effectiveness of the proposed model in terms of resistance and deformability prediction was confronted with satisfactory agreement with the literature's experimental results.

4.5. Modeling and Dielectric Characterization of RE/BaTiO3/FR Using Time Domain Spectroscopy Technique at Microwave Frequencies

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The aim of this study was to give a thorough examination of the dielectric permittivity at various frequency ranges of new ternary composites based on RE/BaTiO3/FR structure using time domain spectroscopy (TDS). The ferrite (FR) powder was evenly mixed with barium titanate (BaTiO3 or TBa) powder bound by epoxy resin (RE). Over a frequency range of DC to 20 GHz, the dielectric behavior of these composite samples was examined. This study was actually split into two separate sections; the first dealt with the frequency range up to 10 GHz, highlighting the appearance of dielectric permittivity (εs) and quality factor (Q), while the second was focused on increasing the predictive frequency model's performance through a better choice of damping factor. To align theoretical and experimental results, a frequency dispersion behavior model for complex permittivity over frequency range up to 20 GHz was developed. Additionally, the Cole–Cole diagram of RE/BaTiO3/FR was examined in this section. The greatest dielectric permittivity values in this study were approximately 9.29, and the dielectric loss tangents at high frequency up to 10 GHz ranged from 0.004 to 0.029. The goal of this study was to produce new materials for use in the microelectronics industry.

4.6. Fuzzy Control of Antilock Bracking System Based on Backstepping Method

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In this work, we were interested in the control of a very important system of vehicle stability, the antilock braking system (ABS) of an autonomous automobile, combining a nonlinear backstepping control method based on the Lyapunov approach with the fuzzy logic method. First, we proposed the backstepping method to control the system using the Lyapunov function to ensure the system's stability. After that, we introduced the fuzzy logic approach to the system in order to train an objective function that was designed to keep the system at a desired level of stability. A simulation of results was achieved using MATLAB, which shows the accuracy and the efficiency of our proposed method.

4.7. Mechanical and Thermal Properties of Compressed Earth Bricks Stabilized with Biomass Ash

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This research aimed to study the mechanical and thermal behavior of two biomass ashes, BAa and Bab, in compressed earth bricks—BBAa and BBAb, respectively. Several proportions (0, 5, 10, 15, and 20%) of soil substitution were tested. The specimens obtained by compression at 10 MPa were hardened for 28 days in a humid environment with a relative humidity of 100%. The mechanical strength and thermal properties of BBAa and BBAb were measured. The results showed that the partial substitution of the soil leads to an increase in compressive strength values. The highest value of compressive strength occurred during a partial substitution of the soil by BAb in the proportion of 20% by weight, which reached a value of 16.47 MPa. On the other hand, thermal conductivity values were decreased to different soil substitution proportions. Minimum values were achieved for specimens containing 20% by weight of biomass ash, with better thermal insulation at thermal conductivity values ranging from 0.78 W/mK in BBAb and 1 W/mK in BBAa. This improvement is due to the pozzolanic reaction produced between the soil components and the BA as well as the soil microstructure.

4.8. Fusion RGB and HSV Spaces for Cocoa Pod Maturity Identification Using the Random Forest Method

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Obtaining high-quality cocoa beans is a significant challenge in producing higher-end products. The use of computer vision to automate this process can help improve its efficiency. This study proposed a fusion of the RGB (red, green, blue) and HSV (hue, saturation, value) color spaces to create a new image with additional pod characteristics for the first time. The random forest algorithm was utilized to identify the maturity of pods. This technique can aid in optimizing harvests and obtaining better quality beans. The experiment results show that the fusion of RGB and HSV achieved the highest accuracy at 95%, compared to 93% for RGB and 91% for HSV alone. Metrics such as accuracy, recall, F1 score, MSE, and MCC were used to assess the overall performance of the proposed technique. These results demonstrate the promising potential of this approach.

4.9. JAYA Optimization Algorithm for Solving Economic Problem: Efficient Algorithm for the Electric Automotive Applications

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Optimization techniques are widely used in different fields of study under numerous challenges and requirements. Indeed, various research studies proved the favorable impact of the optimization techniques in reducing the amount of consumed energy, the produced noxious emissions, operational cost, and system size to optimum results within different constraints and limits for the electric technologies' applications. However, researchers

tended to simplify the optimization codes and reduce the tuning parameters, which produced better and more robust results. Therefore, this paper gave a brief insight into the optimization approach with examples and applications. Furthermore, examples of the case study of a single objective optimization problem to reduce the operational cost of a parallel hybrid electric vehicle (HEV) using the JAYA algorithm were established. The efficiency of the proposed algorithm was proven by comparing the obtained results with the well-known particle swarm optimization (PSO) algorithm.

4.10. Fuel Consumption Economy and CO_2 Emission Reduction in Hybrid Electric Vehicles

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The Corporate Average Fuel Economy (CAFE) regulation was establishwed by NHTSA for different vehicle types and sizes to set a standard for fuel consumption—and thus CO_2 emission—and impose automobile manufacturers to find new options to reduce the emissions of CO_2 from their vehicles. The switch to hybrid electric vehicles (HEV) was one of the options considered. This paper presents the main architectures used for hybrid electric vehicles (HEV) to show the relation between this architecture change and fuel consumption.

4.11. SOC Estimation Based on Artificial Neural Network Compared with the Ah Method

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Electric vehicles (EVs) are actually being developed in response to the depletion of fossil fuels and environmental crisis concerns. The Li-ion battery is frequently used in cars due to its high energy density and prolonged cycle life. The state of charge (SOC) of the Li-ion battery is fundamental for the BMS design and for lithium-ion batteries to operate safely. However, there is still considerable work to be done, starting with temperature regulation, cell balance within a battery pack, and internal state estimation. The Ah Method and observers based on artificial neural networks are the two methods for state of charge estimation techniques that were compared in this paper. The accuracy, difficulty of implementation, and basic performances of the respective outputs were analyzed and compared.

4.12. Analysis and Design of Terahertz Slot Antenna with Defected Ground Based on Photonic Crystal Substrate

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The purpose of this research was to construct and examine a photonic-band-gap-substrate-based terahertz slot microstrip patch antenna with a defected ground that operates in the frequency range from 0.6 to 0.7 THz. Enhanced antenna performance around 0.65 THz was the objective of this study concerning this prospective type of antennas in order to satisfy the needs of the most recent communication technology. Additionally, wireless communication technologies, medical research, sensing, and imaging are just a few of the intriguing uses of the terahertz band. Terahertz spectra are employed in a

wide range of applications because they have unique qualities, such as a large bandwidth and less diffraction than other wavelengths. These various technical applications have drawn the attention of the research community to antennas. First, a typical patch antenna without a photonic crystal substrate, i.e., an antenna based on homogenous substrate, was constructed and electrically evaluated in this study. Following that, a slot patch antenna with a defected ground was also analyzed. The suggested antenna, Antenna 3, was built with a slot antenna with a defected ground and photonic crystals. According to the results, the proposed antenna has strong radiation qualities at 0.654 THz, a return loss of less than −40.72 dB, and a bandwidth of 209 GHz. The obtained gain was 7.85 dB. The model was investigated using the commercially available CST Microwave Studio simulator, which uses the finite integration approach.

4.13. Combined Priority Rules with a Selection of Alternative Routing in Real Time for Flexible Manufacturing Systems

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Scheduling has been the subject of several research works resulting from operational research. It is an important aspect of production management. Knowledge of scheduling methods helps to avoid significant performance losses. Managing queues using priority rules is one of the simplest and most widely used approaches to scheduling tasks in a flexible production system. The choice of the rule to be applied in this management must be made according to the desired criterion. This article presented the results of a simulation study in a flexible manufacturing system (FMS). The studied FMS model was composed of seven machines, a loading station, and an unloading station and processes six types of parts. Due to the existence of identical machining centers in the system, the part types had alternate routings. To regulate this problem, we combined rules of priorities and scheduling with selection of alternative routings in real time using DMM. This study will make it possible to identify the rankings of the rules in order of effectiveness for the most crucial criteria for evaluating the performance of an FMS. Since the state of the workshop changes during time, we propose to analyze the state of the system each time a decision of scheduling must be taken in order to take into account the real state of the FMS. This approach was simulated by the simulation software ARENA.

4.14. An Innovative Approach to Passive Thermal Control of Nanosatellites

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A nanosatellite must weigh between 1 kg and 10 Kg and operate with minimal power in very harsh space conditions. Passive thermal control approach has been applied to the thermal design of a SmallSat. In this paper, the concept and approaches to thermal control design as applied to the nanosatellite were briefly discussed. In order to accurately simulate heat flow within the nanosatellite, as well as to predict its response to orbital conditions, thermal loads were applied—including solar, albedo, and terrestrial infrared loads—on a simple geometry. As emissivity and absorptivity variables were added, the thermal mathematical model evolved while relying on a well-defined mathematical equation. The final results show that for each possible α/ε ratio, the thermal balance is able to vary widely so that the temperature of some components of the nanosatellite is largely exceeded. Indeed, when the ratio α/ε was lower than the unity, i.e., $\alpha/\varepsilon = 0.23$, the temperature of

the nanosatellite recorded was below -18 °C in both cases both during heat dissipation and not. It was also found that the temperature of the nanosatellite reached an acceptable and bearable value in the structure and the various electronic components of the spacecraft, in particular when the ratio of the optical coating was close to the unity. However, when the ratio exceeded the unity by far, i.e., $\alpha/\varepsilon = 9.2$, it was noticed that the measured temperature—surpassing 221 °C in both cases—was in no case acceptable and that an intervention concerning the choice of the materials or even the application of another form of thermal control technology might be proposed. Lastly, it was found that the temperature of the nanosatellite had an upward evolution as the α/ε ratio also increased. This clearly shows the impact of this parameter, especially when it comes to passive thermal control.

4.15. The Impact of Blockchain in Logistics

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This paper examined the decentralized data storage offered by blockchain technology and the potential for its advancement in supply chain and logistics management. Despite the fact that the advantages of block chain technology have been studied primarily in the financial industry, implementing block chain technology can also help with significant logistical difficulties. This paper presented the current state of the art for the use of block chain technology in supply chain and logistics, including emerging developments.

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