Union of Electronics, Electrical Engineering and Telecommunications (CEEC)

Federation of the Scientific-Technical Unions in Bulgaria (FNTS)

Ministry of Transport and Communications

Communications Regulation Commission

Union of Scientists in Bulgaria

Technical University of Sofia - Faculty of Telecommunications

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33rd NATIONAL CONFERENCE
WITH INTERNATIONAL PARTICIPATION

TELECOM 2025

THE WAYS TO CONNECT THE FUTURE

P R O G R A M M E

20 - 21 November 2025
National Science and Technical Centre,
108 Rakovsky St. – Sofia &Virtual room

TELECOM 2025

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Telecom 2025 Sessions Timetable

Date	*Time*	*Sessions*
Thursday 20.11.2025	**10.00 – 12.00**	**Conference Opening, Greetings** **Plenary Session 1, Hall 1 &** Virtual Room 2 Meeting ID: 629 615 7598, Passcode: WZJF1P Chairmen: Assoc. Prof. Plamen Vachkov, PhD Prof. Seferin Mirtchev, DSc **Presentations**: **1. CRC, 2. ATI, 3. Huawei Technologies,** **4. Helen Karatza - Invited Talk** **5. Ivan Ganchev - Invited paper** **6. Kamen Rangelov**
	12.30 - 14.00	**Section Session 1, Hall 1 &** Virtual Room 2 Meeting ID: 629 615 7598, Passcode: WZJF1P **INTERNET OF THINGS (IoT). SMART HOME AND CITIES. EHEALTH. BETTER LIVING WITH ICT.** Chairman: Assoc. Prof. Georgy Petrov, PhD **Presentations**: Papers 1.1, 1.2, 1.3,.1.4, 1.5, 1.6, 1.7, 1.8, 1.9
	14.15 – 15.45	**Section Session 2, Hall 507 &** Virtual Room 2 Meeting ID: 629 615 7598, Passcode: WZJF1P **TELECOMMUNICATIONS NETWORKS AND SERVICES. WIRELESS SYSTEMS. NETWORK SECURITY.** Chairman: Eng. Stefan Patchedjiev, PhD **Presentations**: Papers 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10
	16.00 – 17.30	**Section Session 3, Hall 507 &** Virtual Room 2 Meeting ID: 629 615 7598, Passcode: WZJF1P **ARTIFICIAL INTELLIGENCE IN ICT. EDUCATION METHODOLOGIES IN ICT.** Chairman: Prof. Seferin Mirtchev, DSc **Presentations**: Papers 3.1, 3.2, 3.3,.3.4, 3.5, 3.6, 3.7, 3.8, 3.9
	18.00 – 19.00	**Poster Session 4, Hall 1 &** Virtual Room 2 Meeting ID: 629 615 7598, Passcode: WZJF1P **RESEARCH/EDUCATION METHODOLOGIES IN ICT** Chairmen: Eng. Stefan Patchedjiev, PhD **Posters**: Papers 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9. 4.10, 4.11

Date	*Time*	*Sessions*
Friday 21.11.2025	**08.00 – 09.30**	**Section Session 5, Hall 1 &** Virtual Room 3 Meeting ID: 629 615 7598, Passcode: WZJF1P **TELECOMMUNICATIONS NETWORKS AND SERVICES. BETTER LIVING WITH ICT.** Chairman: Assoc. Prof. Rositsa Goleva, PhD **Presentations**: Papers 5.1, 5.2, 5.3,.5.4, 5.5, 5.6, 5.7, 5.8, 5.9
	09.45 – 11.15	**Section Session 6, Hall 1 &** Virtual Room 3 Meeting ID: 629 615 7598, Passcode: WZJF1P **NETWORK SECURITY. ARTIFICIAL INTELLIGENCE. RESEARCH/EDUCATION METHODOLOGIES IN ICT.** Chairman: Assoc. Prof. Kiril KASSEV, PhD Assoc. Prof. Boncho BONEV, PhD **Presentations**: Papers 6.1, 6.2, 6.3,.6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10
	11.30 – 13.00	**Section Session 7, Hall 1 &** Virtual Room 3 Meeting ID: 629 615 7598, Passcode: WZJF1P **TELECOMMUNICATIONS THEORY. SIGNALS AND SYSTEMS. IMAGE PROCESSING AND CODING.** Chairman: Assoc. Prof. Kamelia Nikolova, PhD **Presentations**: Papers 7.1, 7.2, 7.3,.7.4, 7.5, 7.6, 7.7, 7.8, 7.9
	13.45 – 15.00	**Posters Session 8 Hall 3 &** Virtual Room 3 Meeting ID: 629 615 7598, Passcode: WZJF1P **TELECOMMUNICATIONS THEORY. INTERNET OF THINGS (IoT)** Chairman: Assoc. Prof. Dimitar ARNAUDOV, PhD **Posters**: Papers 8.1, 8.2, 8.3,.8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 8.10, 8.11, 8.12
	15.15 – 15.30	**Education in Electronics and Business Needs. Discussion with leading Companies in Electronics. Hall 3 &** Virtual room 3 Meeting ID: 629 615 7598, Passcode: WZJF1P
	16.00 – 17.30	**Celebration of the Anniversary 60 Years of CEEC Hall 3 &** Virtual Room 3 Meeting ID: 629 615 7598, Passcode: WZJF1P
	17.30 – 20.00	**Informal Meeting Forum - Cocktail – Hall 1**

CONFERENCE PROGRAMME

Thursday, 20.11.2025 г.

NATIONAL SCIENCE AND TECHNICAL CENTRE
Hall 1 & Virtual Room 2 Meeting ID: 836 4436 7937, Passcode: WZJF1P

Conference Opening, Greetings

10.00 – 12.00 20.11.2025 г.

Plenary Session 1, Hall 1 & Virtual Room 2
Meeting ID: 836 4436 7937, Passcode: WZJF1P
Conference Opening, Greetings
Chairmen: Assoc. Prof. Plamen Vachkov, PhD
Prof. Seferin Mirtchev, DSc

1. **"Radio spectrum for 5G and 6G networks and satellite connectivity" -** Presentation
Daniela Aleksieva - Head of the Regulation and Coordination Department, Scarce Resource Management Directorate
Communications Regulation Commission

2. **"The Telecommunications Sector in Bulgaria - Economic Analysis and Consumer Attitudes" -** Presentation
Andreana Atanasova - Chairperson of the Managing Board
Alliance of the Technology Industry (ATI)

3. **"Huawei Technologies"**
Ivan Ivanov - Manager,
Huawei Technologies Bulgaria Ltd

4. **"Cloud, Fog and Mist Computing Collaboration for Scheduling Time - Critical Applications:** State of the Art and Research Challenges**" -** Invited Talk
Helen Karatza - Professor Emeritus, Department of Informatics
Aristotle University of Thessaloniki, Greece

5. **"UAVs as an Interim Communication Solution in Cases of Emergency" -** Invited Paper
Ivan Ganchev – Professor, *University of Plovdiv "Paisii Hilendarski", Plovdiv; Institute of Mathematics and Informatics – Bulgarian Academy of Sciences, Sofia; Telecommunications Research Centre (TRC), University of Limerick, Limerick*

6. **"Notes on Telecommunications – 2025" -** Presentation
Kamen Rangelov – CEEC

12.30 – 14.00 20.11.2025 г.

Section Session 1, Hall 1 & Virtual Room 2
Meeting ID: 836 4436 7937, Passcode: WZJF1P
IINTERNET OF THINGS (IOT). SMART HOME AND CITIES. EHEALTH. BETTER LIVING WITH ICT.
Chairman: Assoc. Prof. Georgy Petrov, PhD

1.1. CORDIC and LUT-Based Acceleration of Special Mathematical Functions in Edge and IoT Systems
Georgi PETROV

1.2. Improving LoRa Interference Immunity through Modulation Parameter Adaptation
Yurii Karaush, Mykola Patlaienko

1.3. Analysis of the Phase Stability of the LoRa Signal when Optimising its Parameters for Reliable Transmission in Conditions of Increased Interference
Yurii Karaush, Mykola Patlaienko

1.4. A review of Infrastructure Integration in Smart Cities Digital Systems
Hristo Grigorov

1.5. Software Architecture Patterns for Real-Time Digital Twin–IoT in Smart Campus Management: A Comparative Study
Erilda Muka, Genta Rexha, Galia Marinova

1.6. Modern Strategies for Failure Analysis and Machinery Predictive Maintenance
Yassen Gorbounov

1.7. Electrochemical Impedance Analyzer Based on AD5933
Krasimir Kostadinov, Yassen Gorbounov

1.8. Integration of MXChip AZ3166 with Home Assistant – IoT Real-time Monitoring and Management System
Serghei Staicov, Snezha Shotarova, Slavi Lyubomirov

1.9. Secure elements for embedded devices and their applications
Stoyan Bogdanov

14.15 – 15.45
20.11.2025 г.

Section Session 2, Hall 307 & Virtual Room 2
Meeting ID: 836 4436 7937, Passcode: WZJF1P
TELECOMMUNICATIONS NETWORKS AND SERVICES. WIRELESS SYSTEMS. NETWORK SECURITY.
Chairman: Eng. Stefan Patchedjiev, PhD

2.1. Development of a Network Traffic Monitoring System
Aleksandar Hristov, Ivan Garnizov, Radoslav Yoshinov

2.2. A Comparative Analysis of IP and Non-IP-Based Network Architectures: Technical Characteristics, Advantages, Limitations, and Prospects
Pavel Dzhunev

2.3. Optimization of Write Operations in SAN Environments through Intelligent Compression, Deduplication and Thin Provisioning
Genka Slavova-Torres

2.4. MEPI Client Application for Wireless Distribution of Information
Lazar Pendov, Ivan Ganchev

2.5. Universal Interpersonal Communication Application – Audio and Video Conversations
Lazar Pendov

2.6. Nonlinear Relationships Analysis of QoS Metrics under Dynamic Network Conditions
Vladimir Vichev

2.7. Penetration Tests on Web Applications Using SQL Injection Attacks
Ivan Ivanov, Todor Grigorov, Semona Kovacheva

2.8. The Role of Ethical Hacking in Healthcare Institutions
Martin Voynov, Ivan Ivanov, Maya Atanasova

2.9. The Prospects of the Political and Financial System Caused by Innovations in Technology
Radoslav Kardziev

2.10. Optical hotel communication system with passive nodes
Boyko Harlov

16.00 – 17.30
20.11.2025 г.

Section Session 3, Hall 307 & Virtual Room 2
Meeting ID: 836 4436 7937, Passcode: WZJF1P
ARTIFICIAL INTELLIGENCE IN ICT. EDUCATION METHODOLOGIES IN ICT.
Chairmen: Prof. Seferin Mirtchev, DSc

3.1. Adaptive Image Segmentation via Valley-Based Centroid and Contrast-Driven Stopping (Fast CPU-GPU Implementation)
Georgi Petrov

3.2. Integral Metrics of HDR Image Quality
Mykola Patlaienko, Olena Osharovska, Andrii Doroshuk, Valentina Solodka, Ivan Tomashevskyi, Oleksandr Hohniak

3.3. A Comparative Study of Trigate FinFET 14 nm with Different Fin Materials for CMOS Circuits
Lazzaz Abdelaziz, Bousbahi Khaled, Beladam Fatiha

3.4. Approaches to Radio-Frequency Regulations for Unmanned Aircraft Systems
Yoana Ivanova, Rosen Pasarelski, Teodora Pasarelska, Krasen Angelov

3.5. Synaptic Weights Clustering in Feedforward Neural Networks
Aleksandar Ivanov

3.6. Python Toolkit for Non-Integer Calculus
Aleksandar Ivanov

3.7. Predicting User Behaviour Using Classification Models in BigQuery Machine Learning
Iviana Hristova

3.8. On Verification of Satellite SAR Oil Spills Imagery Using Ground-based Sensors
Chavdar Alexandrov, Miroslav Tsvetkov, Avgustin Hristov

3.9. Sybil Detection in V2X: From on-Vehicle Features to RSU Graph Reasoning
Ivan Ivanov, Ventsislav Nikolov

Poster Session 4, Hall 1 & Virtual Room 2
18.00 – 19.00 Meeting ID: 836 4436 7937, Passcode: WZJF1P
20.11.2025 г. **TRESEARCH/EDUCATION METHODOLOGIES IN ICT**
Chairmen: Chairman: Eng. Stefan Patchedjiev, PhD

4.1. AI in Computer-Aid Design of Components and Assemblies in Mechanical Engineering Education
Anton A. Bashev, Stanislav Asenov

4.2. Methodology for an ARM-Based k3s Cluster with Integrated AI for HTTPS Traffic Analysis and Filtering
Boyko Karkov, Dimitar Milchev, Petko Stoev

4.3. Evaluating the position accuracy of Sentinel's Interferometric Wide Swath Synthetic Aperture Radar Images in SNAP
Avgustin Hristov

4.4. Application of AI in the education of ICT students: advantages and disadvantages
Marinela Petrova

4.5. Cloud Telephony as a Driver of Digital Transformation in Corporate Telecommunications: An Empirical Study
Anna Bekyarova Tokmakova

4.6. The Impact of Engagement Strategies on the Effectiveness of Loyalty Programs in Telecommunications
Megi Dakova, Djesika Ivanova, Anna Bekyarova Tokmakova

4.7. A Novel Algorithm for Industrial Network Reliability Estimation and AI-Based System Optimization
Daniel Denev, Silvia Nikolova

4.8. Research on Design, Security and Vulnerability Analysis in WEB3 Applications
Stanimir Sadinov, Krasen Angelov, Rosen Pasarelski, Yoana Ivanova

4.9. Evaluation of the Strategic Role of Telecommunications in Human Resource Management within Industry 5.0
Siyka Demirova, Sibel Ahmedova, Mihail Ivanov, Zhulieta Mihaylova, Dzemal Ali, Yordan Yankov, Miglena Pavlova, Desislava Atanasova, Victoriya Miteva

4.10. Machine Learning in Telecommunications: Literature Review by Field of Application
Marija Konjević

4.11. Internet of Things and Process Automation in Bulgarian Information and Communication Technology Sector
Pancho Tomov, Dimitar Damyanov, Siyka Demirova, Sibel Ahmedova

Friday, 21.11.2025 г.

NATIONAL SCIENCE AND TECHNICAL CENTRE
Hall 1 & Virtual Room 1 Meeting ID: , Passcode:

08.00 – 09.30 21.11.2025 г.

Section Session 5, Hall 1 & Virtual Room 3
Meeting ID: 811 5752 6503, Passcode: 018159
TELECOMMUNICATIONS NETWORKS AND SERVICES. BETTER LIVING WITH ICT.
Chairman: Assoc. Prof. Rositsa Goleva, PhD

5.1. Network Monitoring & Observability in Data Center Networks: Comparing the TIG and ELK Stacks
Spas Georgiev, Kamelia Nikolova, Monika Velkova, Viktoria Dimitrova

5.2. Kubernetes Monitoring Stack on Raspberry Pi Cluster
Milen Hrabarov Todorov

5.3. Optimizing Asynchronous Event Dispatch in Modern C++ Publish/Subscribe Systems
Alex I. Tsvetanov

5.4. Development of a smart parking clamp system
Aleksandar Hristov

5.5. Overview of Current Solutions for Ambient Air Monitoring
Veselin Stanchev, Atanas Kostadinov

5.6. Adaptive ESP-NOW Relay Switching Using RSSI-Based Beacon Monitoring
Ivan Bozhilov, Milen Todorov, Boyanka Nikolova

5.7. Comparing different algorithms when predicting loan defaults
Evgeni Evgeniev Dulgerov

5.8. A Study on the Impact of Artificial Intelligence on the Efficiency of the Manufacturing System
Anas Mohammed, Nataliya Koleva, Borislav Nikolov

5.9. Development of a Web Application for Sharing and Geo-Positioning of Video Clips
Angel Chekichev, Ahmed Karaibrahimov, Hristo Kanevski, Stefan Sadkov, Serghei Staicov

5.10. Towards Quantum-Resilient Private Networking: A Public-Key Encapsulation Framework for Encrypted Tunnels
Rumen Doynov, Maria Nenova, Grigor Sotirov

09.45 – 11.15 21.11.2025 г.

Section Session 6, Hall 1 & Virtual Room 3
Meeting ID: 811 5752 6503, Passcode: 018159
NETWORK SECURITY. ARTIFICIAL INTELLIGENCE. RESEARCH/EDUCATION METHODOLOGIES IN ICT.
Chairman: Assoc. Prof. Kiril KASSEV, PhD
Assoc. Prof. Boncho BONEV, PhD

6.1. Security Vulnerabilities of Smart Home: A Case Study of Smart Camera
Ivo Gergov, Georgi Tsochev, Maria Nenova

6.2. Design of Network Infrastructure for Training Students in Cybersecurity
Nikolay Manchev, Krasen Angelov, Hristina Stoycheva, Anatoliy Aleksandrov

6.3. Securing the Edge: A Comparative Analysis of Microsoft Defender for IoT and Nozomi Guardian
Viktoria Dimitrova, Marian Hristov, Kamelia Nikolova, Maria Nenova

6.4. Beyond Perimeter Defense: Technical Approaches to Third-Party Breach Prevention
Monika Velkova, Kamelia Nikolova, Maria Nenova

6.5. Teaching Introductory Programming through a Suggestopedic Approach
Ralitza Raynova

6.6. Testing Vehicle Traction and Braking Control Systems Using GPS Data Logger
Nikolay Pavlov, Lyubomir Vasilev, Diana Dacova

6.7. Gamification and Machine Learning Approaches for Scaling up Working Professionals in ITIL Service Delivery
Anton Genchev

6.8. Data-Driven Process Drift Detection in ICT Testing Using EWMA and CUSUM Methods
Stoyan Daskalov, Stanislav Asenov

6.9. Measurement of the Vehicle Pollution during Fuel Remap Process on a Gasoline Engine
Ilian Damyanov, Rosen Miletiev, Hristo Konakchiev

6.10. Development and Implementation of a 2D Vision-Guided Robotic System for Industrial Inspection and Manipulation
Vladimir Hristov, Dimitar Pepedzhiev

11.30 – 13.00
21.11.2025 г.

Section Session 7, Hall 1 & Virtual Room 3
Meeting ID: 811 5752 6503, Passcode: 018159
TELECOMMUNICATIONS THEORY. SIGNALS AND SYSTEMS. IMAGE PROCESSING AND CODING.
Chairmen: Assoc. Prof. Kamelia Nikolova, PhD

7.1. Generative Markov Chain Model Development for Guitar Melodies Creation
Snezhana G. Pleshkova, Konstantin Kostov

7.2. Neural Network–Driven Markov Chain Model Development for Adaptive Digital Audio Effects
Konstantin Kostov, Snezhana G. Pleshkova

7.3. Comparison of Different Fusion Techniques on Mri and Psma Images of the Prostate Gland
Diana Tsvetkova, Veska Georgieva

7.4. Log-periodic Antenna Modelling for Solar Radio Interferometric Observations
Pavlina Aleksieva, Peter Z. Petkov

7.5. Task Execution and Dynamic Re-Planning with a Mobile Robot and Manipulator: A Real-Robot Study Using RDK X3 and myCobot 320 – Part 1
Danail Slavov, Anastasiya Slavova

7.6. Task Execution and Dynamic Re-Planning with a Mobile Robot and Manipulator: A Real-Robot Study Using RDK X3 and myCobot 320 – Part 2
Danail Slavov, Anastasiya Slavova

7.7. Performance and Economic Analysis of an Automated Assembly Line with Collaborative Robots
Kamen Hristov, Daniel Dinkov

7.8. Integration of a Collaborative Robot with PLC and HMI for an Automated Street Lamp Assembly Line
Kamen Hristov, Daniel Dinkov

7.9. A Wireless Embedded ECG Monitoring System with Neural Network-Based Data Compression
Yuliyan Velchev

13.45 – 15.00
21.11.2025 г.

Poster Session 8, Hall 3 & Virtual Room 3
Meeting ID: 811 5752 6503, Passcode: 018159
TELECOMMUNICATIONS THEORY. INTERNET OF THINGS (IoT).
Chairmen: Assoc. Prof. Dimitar Arnaudov, PhD

8.1. Design and Error Modeling of an Infrared Thermographic Experiment for Monitoring the Throwing Arm in Female Handball Players
Kalin Dimitrov, Dimitar Asenov

8.2. A ROS and MATLAB/Simulink Framework for Modeling and Control of a Robotic Manipulator
Vladimir Hristov, Amtonia De Amorim

8.3. Development of a Remote Control Interface for a Mobile Robot using ROS and LabVIEW
Vladimir Hristov, Amtonia De Amorim

8.4. Grid PV Inverters Operation with Frequency Devations
Dimitar Serafimov

8.5. Remote Monitoring and Control of Environmental Factors in Smart Agriculture
Ivo Dochev, Marin Dochev, Lilyana Docheva, Stoycho Manev

8.6. An approach to Detecting Sources, Distributors, and Re-transmitters in Social Networks
Petar Marinov, Nadejda Angelova

8.7. A Multi-Sensor Platform for Tire Temperature Distribution and Driving Characteristics
Lyubomir Laskov, Kalin Dimitrov, Iliyan Damyanov

8.8. Evolution of Automated Drip Irrigation Systems: From Manual Control to AI-Enabled Solutions
Petar Raykov, Ivo Dochev, Marin Dochev

8.9. Sensitivity Characterization of Zeta DC-DC Converter to Coupling Capacitance Deviations
Plamen Stanchev, Nikolay Hinov, Zoran Zlatev

8.10. Integrating Data Center Infrastructure into Smart Grid Energy Management Systems
Plamen Stanchev, Nikolay Hinov, Zoran Zlatev

8.11. Dynamic Model of the Influence of Information Flows on the Audience
Daniela Gancheva

8.12. Digital Modernization of a Wire Straightening and Cutting Machine in Compliance with Industry 4.0 Principles
Ivan Kirilov Stoyanov, Docho Tsankov Tsankov

15.15 – 15.45
21.11.2025 г.

Education in Electronics and Business Needs.
Discussion with leading Companies in Electronics.
Hall 3 & Virtual room 3

16.00 – 17.30
21.11.2025 г.

Celebration of the Anniversary
60 Years of CEEC
Hall 3 & Virtual room 3

17.30 – 20.00
21.11.2025 г.

Informal Meeting Forum - Cocktail – Hall 1

CONTENTS

UAVs as an Interim Communication Solution in Cases of Emergency

Ivan Ganchev
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In recent years, Unmanned Aerial Vehicles (UAVs) have emerged as a transformative solution for emergency communications, providing versatile, rapid, and adaptable capabilities that extend traditional networks' reach and resilience. This paper* explores the conceptual foundations, technologies, operational models, real-world deployments, regulatory landscapes, challenges, and prospects associated with using UAVs in emergency contexts. Special emphasis is placed on analytic depth, case examples, comparative evaluations with traditional communication systems, and the integration of UAVs with satellite communication systems within wider emergency response ecosystems. The paper also incorporates discussions using real-world examples from China, Japan, Australia, and the United States. It assesses urban versus rural adaptations, comparative effectiveness to traditional methods, and examines key future trends, drawing on a wide spectrum of up-to-date research and case studies.

1.1. CORDIC and LUT-Based Acceleration of Special Mathematical Functions in Edge and IoT Systems

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Efficient evaluation of transcendental functions like sine, logarithm, and square root is critical in Edge and IoT devices, which often lack floating-point hardware and operate under tight power and memory constraints. This paper explores two classic yet highly efficient techniques— CORDIC (Coordinate Rotation Digital Computer) and Look-Up Tables (LUTs)—for implementing special functions in Arduino based embedded systems. A polynomial error model is proposed to compensate for CORDIC approximation errors when using a limited number of iterations, enabling accurate results even on simple microcontrollers. LUT-based methods are evaluated for fast logarithmic and exponential approximations. Experimental results demonstrate that both approaches are suitable for resource-constrained applications, offering an optimal balance of speed, accuracy, and hardware simplicity for on-device signal processing, normalization, and AI preprocessing in Edge systems.

1.2. Improving LoRa Interference Immunity through Modulation Parameter Adaptation

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This paper addresses the problem of improving the noise immunity of LoRa wireless technology in conditions of intense interference. To this end, an analysis was conducted of the influence of modulation parameters—bandwidth (BW) and spread factor (SF)—on communication quality indicators, in particular bit error rate (BER) and data transfer rate. It is shown that, with a fixed SF, an increase in bandwidth has virtually no effect on BER, but leads to an increase in transmission speed. By adapting SF together with BW, the required speed can be achieved while maintaining low BER values. The results obtained allow us to formulate recommendations for selecting modulation parameters to ensure reliable data transmission in conditions of deteriorated electromagnetic environment.

1.3. Analysis of the Phase Stability of the LoRa Signal when Optimising its Parameters for Reliable Transmission in Conditions of Increased Interference

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This article investigates the impact of phase noise on LoRa signal stability in high interference environments. Expanding on previous studies focusing on modulation parameters (SF, BW), it presents a quantitative analysis of phase noise for LoRa signals with high distribution coefficients. MATLAB-based simulations demonstrate how phase noise affects BER at different SF and bandwidth settings. The results show that fixing the number of modulation levels at $M = 2^{12}$ maintains signal stability and improves BER by ~10 dB at SF = 18, ensuring reliable communication even at SNR ≈ −30 dB. The results highlight phase stability as a key factor in modulation optimization, especially in conditions of high noise and narrowband interference. Recommendations are given for the joint tuning of SF, BW, and generator stability to improve reliability in LoRaWAN networks.

1.4. A review of Infrastructure Integration in Smart Cities Digital Systems

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This paper reviews the role of the Internet of Things (IoT) in developing smart homes, smart cities, and eHealth systems, focusing on how information and communication technologies (ICT) enhance quality of life. It outlines recent trends in IoT architecture, infrastructure integration, and data management, emphasising applications in energy, transport, and healthcare. The study highlights key challenges-security, privacy, and interoperability—and discusses emerging solutions using artificial intelligence, edge computing, and blockchain. The paper concludes that sustainable IoT deployment requires secure, standardised, and decentralised frameworks for efficient and ethical data exchange in future digital environments.

1.5. Software Architecture Patterns for Real-Time Digital Twin–IoT in Smart Campus Management: A Comparative Study

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Digital Twin technology links physical assets with virtual models to support real-time monitoring, control, and optimization. While prior work often emphasizes conceptual designs or simulations, fewer studies investigate the impact of software architecture on latency, reliability, and scalability in real-world deployments. This paper examines three software patterns: Edge-first, Hybrid, and Cloudcoordinated applied to a prebuilt DT-enabled IoT prototype for smart campus management. The prototype integrates an ESP8266 microcontroller, environmental sensors, and a Unitybased twin to manage HVAC and lighting in a lecture hall. Each pattern was implemented and assessed in terms of end-toend control latency, synchronization accuracy between physical and digital states, resource efficiency, and operation during network disruptions. In addition, different security mechanisms, from lightweight shared-secret verification to certificate-based authentication, were explored. The study highlights how architectural design choices shape performance, scalability, and secure operation in DT-enabled IoT systems.

1.6. Modern Strategies for Failure Analysis and Machinery Predictive Maintenance

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Predictive maintenance has traditionally been applied to large-scale industrial machinery, but recent advances in edge computing and low-cost sensors make it feasible to extend these techniques to smaller machinery including household appliances, home and even hobbyist applications. This paper presents a machinery health-monitoring framework that integrates affordable MEMS accelerometer with a Raspberry Pi platform equipped with an AI HAT+ for on-device machine learning. The system collects vibration signals from small machines such as DC motors, fans, and white goods, and processes them using lightweight signal analysis and dedicated algorithms. Both classical features, such as RMS and FFT, and advanced methods, are candidates to capture time- and frequency-domain fault signatures. In the current phase, the framework and data acquisition components have been implemented on the Raspberry Pi with the AI HAT+. Python modules from a previous research have been ported for on-device signal processing. This implementation lays the

groundwork for deploying lightweight neural networks using TensorFlow Lite to enable on-device fault classification.

1.7. Electrochemical Impedance Analyzer Based on AD5933

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This paper presents a low cost, wireless and battery operated electrochemical impedance analyzer based on Analog Devices AD5933 integrated circuit. It provides a direct digital synthesis excitation source and on-chip discrete Fourier transform capability, enabling in situ extraction of the real and imaginary components of complex impedance. By extending the specification limits of the device through additional analog front-end circuitry, the elaborated prototype achieves reliable measurement of impedances spanning several orders of magnitude and frequencies across the low-to-mid kilohertz domain. Such measurements are central to the quantitative characterization of electrochemical processes, including charge-transfer resistance, double-layer capacitance, and diffusion-controlled kinetics. Experimental validation, physically performed against a metrological grade LCR meter, confirms that the proposed system achieves accuracy sufficient for rigorous impedance analysis, establishing it as a versatile scientific instrument for electrochemistry, materials research, and bioimpedance studies.

1.8. Integration of MXChip AZ3166 with Home Assistant – IoT Real-time Monitoring and Management System

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This article presents the implementation of an intelligent IoT system for monitoring and managing environmental parameters based on the MXChip AZ3166 microcontroller board, the MQTT communication protocol and the Home Assistant platform. The developed system provides two-way communication between hardware sensors and software infrastructure, allowing the collection, processing and visualization of data on temperature, humidity, pressure, motion and other

parameters. The system includes the possibility of remote control of the built-in RGB LED indicator and local output of information via an OLED display.
Integration with Home Assistant enables real-time visualization, local automation and interactive control through add-ons such as ApexCharts and File Editor. The development demonstrates an accessible and reproducible architecture suitable both for educational purposes and training in IoT technologies, as well as for real applications in the field of microclimate monitoring and control

1.9. Secure elements for embedded devices and their applications

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This paper overview crypto and secure elements and their application in everyday use and industrial application. The large amount of electronics and spare parts usually require some kind of authenticity, validation on the system level, just to be sure it is not counterfeit and it is good to be used. In this case we use secure elements which are sealed from external tampering and can be with unique serial numbers coming from the factory. Crypto elements find their application mainly in IoT where devices on field and over public networks need to be validated on a secure server, this kind of chips provides needed validation and keys. For testing will be used Zephyr RTOS with SAML21 development kit and ATECC608 module.

2.1. Development of a Network Traffic Monitoring System

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Present paper is dedicated to the development of a network traffic monitoring system, which aims to provide a practical and flexible environment for monitoring, analysis and visualization of computer networks' performance. The developed system has the following advantages: usage of affordable and energy-efficient hardware components, application of free software and open-source tools, real-time monitoring capabilities and integration between various software and hardware modules

2.2. A Comparative Analysis of IP and Non-IP-Based Network Architectures: Technical Characteristics, Advantages, Limitations, and Prospects

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The purpose of this scientific report is to systematically compare traditional IP-based network architectures with emerging non-IP approaches, such as Information-Centric Networking (ICN), by evaluating their technical characteristics, advantages, limitations, and prospects regarding scalability, security, and efficiency. The results indicate that while IP-based architectures remain dominant due to their ubiquity and stability, they face growing challenges in areas such as Internet of Things (IoT) scalability, mobility, and security. Non-IP architectures, particularly ICN/NDN, offer built-in security mechanisms, efficient content distribution, and enhanced mobility support, yet they face significant challenges related to compatibility and ecosystem maturity. The comparative analysis emphasizes that the future of networking will likely involve hybrid models and the gradual adoption of non-IP paradigms in niche domains before broader acceptance.

2.3. Optimization of Write Operations in SAN Environments through Intelligent Compression, Deduplication and Thin Provisioning

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Enterprise data growth and rising performance demands place pressure on storage systems. This paper presents an experimental evaluation of write optimization in Storage Area Networks (SAN), focusing on thin provisioning, inline compression, and deduplication. Using IBM Spectrum Virtualize, four volume types were tested under synthetic workloads - 4K random write, 128K sequential write, and 70/30 mixed I/O. Metrics such as IOPS, latency, capacity usage, and CPU load were collected. Results show that thick volumes deliver the highest performance, while thin and compressed volumes offer significant capacity savings with modest overhead. Deduplication achieves up to 3.7× space reduction but adds latency and CPU cost. The study offers guidance for balancing performance and efficiency in virtualized SAN environments.

2.4. MEPI Client Application for Wireless Distribution of Information

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This paper presents a developed client application for wireless distribution of information, e.g., in cases of natural disasters, industrial accidents, terrorist attacks, etc., based on the elaborated Method for EPidemic distribution of Information (MEPI), in a manner similar to the epidemic spread of

biological viruses in the world. Messages (and supplementary files) are initially broadcast by drones, flying over the affected area(s), and further distributed by multiple cooperating user devices located there. The method is particularly relevant in scenarios where conventional communication infrastructures are unavailable or non-functional because of a disaster/accident/attack. MEPI is utilized by an elaborated architecture that can be used to create software applications for wireless distribution of information, working on different platforms, operating systems, and hardware, and satisfying different specialized needs.

2.5. Universal Interpersonal Communication Application – Audio and Video Conversations

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This paper presents the design and implementation of audio and video communication in the Universal Interpersonal Communication Application (UICA). Unified interfaces are defined for the UICA communication categories Audio Conversation and Video Conversation, ensuring interoperability across heterogeneous signaling and media protocols. The paper introduces a method for dynamic evaluation and selection of the 'best' service according to real-time network and device conditions, following the Always Best Connected & Served (ABC&S) paradigm. A minimal, well-defined set of criteria—covering network load, energy consumption, and media quality—is proposed to enable adaptive optimization during active communication sessions.

2.6. Nonlinear Relationships Analysis of QoS Metrics under Dynamic Network Conditions

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Voice over IP (VoIP) services increasingly rely on robust Quality of Service (QoS) management to ensure user satisfaction. Most of the studies have mainly investigated individual QoS parameters independently or explored linear correlations, often neglecting inherent nonlinear interactions under varying congestion conditions [4][5][6]. This research comprehensively examines the nonlinear relationships among critical QoS metrics, including jitter, packet loss, bandwidth utilization, Mean Opinion Score (MOS), and packet inter-arrival time. Through extensive simulations involving widely-used codecs this study employ advanced statistical analyses and techniques [6][8] to identify and model complex nonlinear dependencies. Results reveal substantial nonlinear interactions that significantly affect QoS outcomes under dynamic network congestion, providing critical insights for improving VoIP network management strategies and optimizing user experience [1][2][3].

2.7. Penetration Tests on Web Applications Using SQL Injection Attacks

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Web application penetration testing is essential to ensure the security and reliability of software systems. Penetrating web applications can reveal vulnerabilities that can otherwise be exploited by malicious individuals, which can lead to serious consequences such as data leakage, privacy breaches, and reputation loss. In this document, we look at SQL Injection attacks, paying particular attention to the analysis of the result of the executed attacks, and the mechanisms to protect against SQL Injection.

2.8. The Role of Ethical Hacking in Healthcare Institutions

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With the development of digital technologies, healthcare institutions are becoming increasingly dependent on connected systems, electronic health records and online communication channels. This, of course, opens up wide opportunities for more effective patient care, but at the same time significantly increases the risk of malicious attacks. To ensure real protection, it is no longer enough to use antivirus programs or firewalls - proactive, targeted and realistic security testing is needed. This is where the role of ethical hacking comes into play.

2.9. The Prospects of the Political and Financial System Caused by Innovations in Technology

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The article summarizes trends and cases from the last five years pertaining to the adoption of block chain technology in public government, the financial industry, and associated infrastructures (voting, energy, supply chains, and identities). It makes a distinction between centrally issued digital currencies and decentralized crypto-assets, examines the sustainability and energy efficiency of public block chain, and considers the suitability of immutable registries for official data and election procedures. It provides guidelines for creating a financial-monetary equivalent that would associate physical assets and energy with a distributed ledger value unit. The conclusion is that while block chain is still being institutionalized in certain sectors (traceability, settlement), its usage in politics (voting, identification) remains pilot-stage and context-dependent.

2.10. Optical hotel communication system with passive nodes

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The article analyzes the problems, along with the advantages and disadvantages of a fully optical internal hotel PON (passive optical network) for communication services with about 90 endpoints for television and about 30 for the Internet. Passive optical nodes (converter from optical to radio frequency signal) are not some technical novelty, but their mass use in PON is not a practice Hotel

communication networks are built to provide a television signal to every room, wireless Internet access in the rooms and lobbies on each floor, and wired Internet in certain designated, usually office spaces.
An undeniable advantage of the system is its flexibility, allowing each point to be configured for each service or even to use an ONU (optical terminal device) for both services. The use of passive nodes for television significantly reduces the cost of the system, while preserving the advantages of digital television.

3.1. Adaptive Image Segmentation via Valley-Based Centroid and Contrast-Driven Stopping (Fast CPU-GPU Implementation)

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This paper introduces a fast and efficient method for multilevel image segmentation based on recursive centroid thresholding, accelerated by cumulative histogram-based contrast calculations. The proposed approach enables automatic, adaptive partitioning of gray-level image histograms into multiple classes via recursive centroid computations, where the stopping criterion is governed by local contrast measured directly from the histogram. The methodology is implemented and evaluated on both CPU and GPU platforms, revealing substantial computational speedups for large-scale segmentation tasks. Experimental results on diverse image datasets demonstrate that the method produces accurate and visually meaningful segmentations while significantly reducing processing time, particularly when leveraging GPU parallelism.

3.2. Integral Metrics of HDR Image Quality

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This paper presents a study of the quality metrics influence on a high-dynamic-range image reconstruction from a single low-dynamic-range image. The paper proposes an integrated quality index formed from weighted objective metrics, namely, the peak signal-to-noise ratio, the structural similarity index, and the correlation coefficient. These metrics are calculated for luminance and color-difference signals. Tables of metric values are provided for six intermediate images corresponding to six different exposures, from underexposed to overexposed. The quality index is calculated for each intermediate image involved in the reconstruction of the high-dynamic-range image. Using the set of quality indices, a probability density function is constructed, and statistical metrics are determined. The proposed method allows to predict the quality of the reconstructed high-dynamic-range image, taking into account the contribution of each intermediate image with different exposure times. Based on the analysis of statistical moments, a conclusion is drawn regarding the possibility of optimizing the number of intermediate images.

3.3. A Comparative Study of Trigate FinFET 14 nm with Different Fin Materials for CMOS Circuits

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This paper studies the impact of fin material Silicon and GaN on the performance of tri-gate (TG) FinFET transistors with 14 nm channel length. A comparative study of the electrical characteristics of silicon and gallium nitride (GaN) FinFETs are investigated using Bohm quantum potential (BQP) approach. TCAD ATLAS tools are used in this simulation to plot the electrical characteristics and the structure of the transistor. The novelty of this paper is to adjust the fitting parameter presented in the BQP formula to have a better performance ratio. The results demonstrate that the proposed device with gallium nitride (GaN) fin material is better because it has a better performance ratio.

3.4. Approaches to Radio-Frequency Regulations for Unmanned Aircraft Systems

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The aim of this paper is to present a systematic process for detecting and monitoring Unmanned Aircraft Systems (UAS) in accordance with radio-frequency regulations applicable in Europe, and specifically in the Republic of Bulgaria. The results obtained using AIRSPY SDR Studio v1.0.0.1921 contribute to a better understanding of how receiver parameters, such as gain and bandwidth, influence signal visibility in the radio frequency spectrum. The main contribution of this study is the demonstration of a structured and safe method for monitoring and detecting UAS.

3.5. Synaptic Weights Clustering in Feedforward Neural Networks

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In this paper a comparison of several clustering algorithms is performed for clustering synaptic weights in feedforward neural networks. The algorithms used are DBSCAN, Fuzzy C-means and hierarchical clustering. Algorithms are evaluated using standard metrics such as fuzzy partition coefficient. The effect of each cluster is evaluated by pruning and accuracy tests. The analysis provides insights about underlying patterns in learning as well as approaches to simplify neural architectures without significant loss of performance. The results motivate further exploration of global clustering patterns in artificial neural networks.

3.6. Python Toolkit for Non-Integer Calculus

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Fractional calculus is an important modern tool in modeling related to natural sciences and pure mathematics. In this paper a Python library for non-integer calculus is presented. It is aimed at facilitating calculations in practice. Python Non-Integer order Calculus Toolkit (PyNICT) is a small software bundle that uses symbolic calculations for fractional and distributed fractional order derivatives, numerical methods for ordinary and fractional differential equations, as well as some related mathematical functions such as the Mittag-Leffler. The symbolic approach has an advantage of providing analytical form of calculated derivatives which facilitates understanding.

3.7. Predicting User Behaviour Using Classification Models in BigQuery Machine Learning

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Predicting user behavior is a critical capability for businesses operating in increasingly competitive and digitally driven environments. This paper explores the application of machine learning (ML) within Google BigQuery ML, a cloud-native platform that enables scalable data analysis and predictive modeling directly through SQL. The study demonstrates how classification models,

particularly logistic regression, can be used to forecast user actions. Using a defined dataset, the paper outlines the complete workflow: from data exploration and feature selection to model creation, evaluation and prediction generation. The findings emphasize the accessibility and efficiency of cloud-based ML tools like BigQuery ML, which allow even non-professional users to build and deploy models without complex infrastructure. The integration of predictive analytics into business strategies is shown to support more informed decisions, personalized marketing, and improved customer engagement.

3.8. On Verification of Satellite SAR Oil Spills Imagery Using Ground-based Sensors

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In this article, based on a real signal of the presence of an oil spill in the Bulgarian territorial waters, the entire process of detection and verification of spills and identification of the potential polluter is analyzed. For the purposes of the study, data from vessel traffic management and information systems were used, as well as online applications for subsequent processing and displaying the traffic picture. A methodology for effective spill verification using high-tech ground-based solutions has been proposed.

3.9. Sybil Detection in V2X: From on-Vehicle Features to RSU Graph Reasoning

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This study presents a novel multi-stage algorithm for detecting and mitigating Sybil attacks in vehicle-to-everything (V2X) communications, enhancing the security and reliability of Intelligent Transport Systems. By combining lightweight on-vehicle filtering with infrastructure-assisted temporal and graph-based analysis, the algorithm ensures adaptive risk evaluation under diverse traffic scenarios. Simulation results confirm high detection accuracy, low false positives, and scalable performance, demonstrating the algorithm’s potential for real-world deployment.

4.1. AI in Computer-Aid Design of Components and Assemblies in Mechanical Engineering Education

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This study investigates the impact of Artificial Intelligence (AI) integration on learning outcomes in the education of computer-aided design of components and assemblies in mechanical engineering for students specializing in Mechanical Engineering Technology. Sixteen participants were divided into two equal groups: an experimental group utilizing AI tools (ChatGPT for guidance and AI-powered SolidWorks plug-ins for optimization), and a control group relying entirely on traditional methods. Quantitative results show that the AI-supported group completed tasks 26% faster and made 35% fewer geometric errors, but scored 11,5% lower on tests assessing the acquisition of fundamental knowledge. Qualitative analysis reveals that participants in the AI group developed stronger skills in information filtering but demonstrated weaker abilities in collaborative problem-solving. The study provides evidence-based recommendations for balancing the efficiency gains offered by AI with the development of essential engineering competencies.

4.2. Methodology for an ARM-Based k3s Cluster with Integrated AI for HTTPS Traffic Analysis and Filtering

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This report presents the design, deployment, and analysis of a k3s cluster based on four Raspberry Pi 5 devices, each with 8 GB of RAM. The study focuses on system configuration, load management, network performance, and energy efficiency, providing a comprehensive view of a cluster for home or laboratory environments. Key aspects such as DNS resolution, MTU configuration, power consumption, thermal performance, Pods density, and fault tolerance were evaluated in order to analyze the stability and reliability of the cluster. The report also includes the deployment of containerized applications, the integration of the Kubernetes Dashboard for monitoring, and the development of a machine learning model to detect potentially malicious HTTP(S) requests, demonstrating the ability to expand the application cluster with certainty. The results highlight the practical benefits of using energy - efficient hardware without compromising performance and scalability.

4.3. Evaluating the position accuracy of Sentinel's Interferometric Wide Swath Synthetic Aperture Radar Images in SNAP

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This paper explains the process of measuring position of an object using SNAP application and Sentinel-1 Interferometric Wide Swath Ground Range Detected products. And gives evaluation of measured positions. The satellites "Sentinel-1" are able to work in 4 acquisition modes providing few types of Synthetic Aperture Radar (SAR) products. The most common mode used by "Sentinel-1" is Interferometric Wide Swath (IW). In order to find an object on Earth and measure its position the product type called "Ground Range Detected (GRD)" is usually used. European Space Agency (ESA) claim a specific accuracy of "Sentinel-1" modes and products, but there are additional limitations that will be revised in this paper. The study is conducted using passive radar corner reflectors with known position. The reflectors are positioned in a way they are visible in the SAR image. Their position is then measured using SNAP application. The results from 7 acquisitions are processed and compared. The results are analyzed and provided.

4.4. Application of AI in the education of ICT students: advantages and disadvantages

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Artificial Intelligence (AI) is being used more and more in education and is changing the way students learn Information and Communication Technology (ICT). Today, technology is becoming an important part of learning and helps both teachers and students. More and more schools and universities are using AI systems to make learning more interesting and effective. This leads to changes in the traditional way of teaching and requires new skills from everyone involved. AI opens new opportunities for learning and preparing for the future in the world of technology.

4.5. Cloud Telephony as a Driver of Digital Transformation in Corporate Telecommunications: An Empirical Study

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The paper examines the implementation of cloud telephony in a large industrial enterprise as a key element in the digital transformation of corporate telecommunications. It analyzes the transition from a traditional IP-PBX infrastructure to a modern cloud-based solution integrated with a collaboration and workflow management platform. The methodological approach includes technical and economic analysis, a survey, and a SWOT analysis to assess the impact of the new system. The results show a significant increase in organizational flexibility, reduced operating costs, and improved employee mobility. Along with the established benefits, challenges related to the need for training and a stable network infrastructure have been identified. The case study confirms the role of

cloud telephony as a catalyst for effective, scalable, and sustainable telecommunication solutions in the modern business context.

4.6. The Impact of Engagement Strategies on the Effectiveness of Loyalty Programs in Telecommunications

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The telecommunications sector is establishing itself as a key element of the modern digital economy, the development of which has a profound impact on the technological, social, and economic environment. Within the Bulgarian economy, it represents a strategic factor for growth, innovation, and digital inclusion. This study examines the role of engagement mechanisms to increase the effectiveness of customer loyalty programs in the context of the telecommunications industry. The analysis focuses on transitioning from traditional marketing models to customer-oriented strategies based on engagement, trust, and personalization. The study focuses on the mobile operators A1 Bulgaria, Yettel Bulgaria, and Vivacom, assessing the applicability and impact of their loyalty programs. Through a critical review of the scientific literature and an empirical survey, key factors influencing consumer engagement, satisfaction, and loyalty are identified. The combined methodology — including qualitative and quantitative analysis — allows for an integrated assessment of the effectiveness of existing approaches. The main results indicate that a high level of consumer engagement is achieved through the implementation of personalized communications, interactive digital solutions, and emotional connection with the brand. The development of integrated loyalty programs based on two-way communication, gamification, and value co-creation is recommended. The study contributes to deepening the understanding of the strategic importance of customer engagement and outlines guidelines for improving marketing practices in the Bulgarian telecommunications sector.

4.7. A Novel Algorithm for Industrial Network Reliability Estimation and AI-Based System Optimization

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This scientific paper presents a new mathematical algorithm aimed at improving the process of work and assessing the reliability of industrial networks. The main goal is to develop a more accurate and effective method for predicting and analysing potential failures in complex network systems. The algorithm integrates innovative modelling, data analysis and optimization techniques to ensure better resource planning and minimizing downtime of the risky technical system. The research finds application in various industrial sectors, where network reliability is critical for productivity and safety. Furthermore, the study explores the integration of artificial intelligence techniques for improving the reliability and efficiency of industrial and security systems. By combining mathematical modeling with machine learning, the proposed framework enhances system adaptability, failure prediction accuracy, and overall operational safety in complex network environments.

4.8. Research on Design, Security and Vulnerability Analysis in WEB3 Applications

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The main objective of the report is to demonstrate the creation and vulnerability testing of a web3 application for a decentralized system that integrates three key processes – membership management, automatic revenue distribution, and participation in the governance of the organization – within a secure, transparent, and immutable blockchain infrastructure. An analysis is demonstrated to detect and eliminate potential vulnerabilities and integration tests to confirm the correct interaction between the system modules.

4.9. Evaluation of the Strategic Role of Telecommunications in Human Resource Management within Industry 5.0

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The report examines the strategic role of telecommunications technologies in human resources (HR) management in the context of Industry 5.0. The transformation from Industry 4.0 to 5.0 is characterised by a shift from automation and efficiency to a human-centric approach, sustainability and personalised solutions. In this process, the telecommunications sector provides the infrastructure for the integration of artificial intelligence, remote work, talent management and digital learning platforms. The report presents an analytical model for assessing the impact of telecommunications on human resource practices, based on quantitative and qualitative methods.

4.10. Machine Learning in Telecommunications: Literature Review by Field of Application

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Machine learning (ML) has great potential for application in various areas of telecommunications. This paper presents a review of part of the literature on the application of ML by areas: network management and optimization, prediction and analytics, security and threat detection, signal and data processing, resource allocation and management, mobility management, network planning and design, edge and cloud intelligence, application in next-generation services (5G/6G). The study aims to identify research trends and gaps relevant to regulatory practice, suggesting that the role of machine learning in telecommunications regulation remains largely underexplored and offers promising directions for future investigation.

4.11. Internet of Things and Process Automation in Bulgarian Information and Communication Technology Sector

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The purpose of this report is to understand how the Internet of Things (IoT) and predictive maintenance are impacting productivity and revenue in Bulgaria's Information and Communications technology (ICT) sector. The report examines the theoretical framework, the modeling of manufacturing processes, and the method of determining how well things work. The potential benefits of using intelligent systems are explored using aggregated data and overall equipment effectiveness (OEE) formulas. We also demonstrate the economic and operational effects of IoT and PdM usage. The purpose of the analysis is to provide suggestions on how to use these technologies in a long-term way. In conclusion, this study shows that digitalization, automation and predictive maintenance are essential for modern industrial progress. They make it possible to improve the efficiency of production processes and make Bulgarian businesses more competitive.

5.1. Network Monitoring & Observability in Data Center Networks: Comparing the TIG and ELK Stacks

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As data center networks continue to grow in scale and complexity, the need for effective monitoring and observability solutions has become increasingly critical. Traditional monitoring tools have proven insufficient for capturing high-frequency, distributed events in dynamic network environments. In this paper, two widely adopted open-source observability stacks—TIG (Telegraf, InfluxDB, Grafana) and ELK (Elasticsearch, Logstash, Kibana)—are evaluated with respect to their suitability for network monitoring and telemetry analysis in data center contexts. The architectural components of each stack are examined, and representative network use cases are presented, including interface utilization tracking, anomaly detection, and log correlation. Strengths, limitations, and deployment considerations are discussed to guide the design of scalable observability pipelines for modern data center networks.

5.2. Kubernetes Monitoring Stack on Raspberry Pi Cluster

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As the number of machines in clusters and the services they provide grows, the implementation of systems for monitoring and logging is of extreme importance. Not only because it is impossible to manually monitor a complex infrastructure, but also because maintaining and logging aids the optimization, reconfiguration, and debugging processes. As monitoring is a continuous activity, and data can be of different forms used for different purposes, the use of an analytics platform for monitoring and further analysis is necessary. The novelties in this paper include the methods for deploying a lightweight Kubernetes and its monitoring on top of the cluster that consists of twenty single-board computers Raspberry Pi 5.

5.3. Optimizing Asynchronous Event Dispatch in Modern C++ Publish/Subscribe Systems

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The paper extends the C++20 header-only library pubsub-lib, by integrating two low-overhead asynchronous dispatch strategies: C++ standard execution policies (std::execution::par, par_unseq) and Intel oneAPI TBB. Both reuse thread pools to minimize overhead. Benchmarks on a 12-core AMD Ryzen under Ubuntu/WSL show up to 100× latency reduction and significant throughput gains over std::async, with sub-microsecond per-subscriber times even at 1000 subscribers. The research concludes with guidelines for choosing dispatch strategies based on performance and portability.

5.4. Development of a smart parking clamp system

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The aim of the paper is to show the steps in the development of a complete system for automating the process of removing parking clamps. For this purpose, the following tasks should be taken into consideration: 3D modeling and prototyping the clamp, selection of electronic components, design and implementation of the smart clamp and of cross-platform mobile application and building a network server.

5.5. Overview of Current Solutions for Ambient Air Monitoring

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This paper examines various existing technical methods for estimating, measuring, and monitoring ambient air quality in both outdoor and indoor environments, including suitable solutions for each setting. It presents fundamental technical components and their operational modes. The basic pollutants are listed, along with a summary index, the AQI (Air Quality Index), which allows a quick assessment of air quality. Using the AQI, different types of air conditions are identified and evaluated.

5.6. Adaptive ESP-NOW Relay Switching Using RSSI-Based Beacon Monitoring

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This work presents an adaptive communication system using ESP-NOW on ESP32 microcontrollers. In this system data transmission dynamically switches between direct and relay paths based on Received Signal Strength Indicator (RSSI). Dedicated beacon nodes broadcast periodically, and a beacon receiver compares their RSSI values to instruct the client node to select the optimal route. The performed experimental evaluation shows that this architecture maintains reliable audio data streaming in conditions where frequent path switching is necessary and also extends communication range with minimal latency overhead.

5.7. Comparing different algorithms when predicting loan defaults

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Accurate prediction of loan defaults is essential for risk management and financial stability, yet it remains challenging due to class imbalance, noisy borrower data, and complex patterns in credit behavior. This study presents a comparative analysis of four algorithms—Random Forest (RF), Extreme Gradient Boosting (XGBoost), Long Short-Term Memory networks (LSTM), and Temporal Convolutional Networks (TCN)—to evaluate their effectiveness in predicting loan defaults. RF and XGBoost, as ensemble-based methods, are effective on structured tabular data and provide interpretability and computational efficiency. LSTM and TCN, as sequence-based deep learning models, can capture temporal dependencies in borrowers' payment histories, with TCN offering faster convergence and improved stability compared to LSTM. The evaluation is conducted on a publicly available loan dataset, using precision, recall, F1 score, and false positives to measure performance under realistic imbalanced conditions. Results indicate that ensemble methods achieve strong baseline performance, while deep learning models, particularly TCN, provide superior detection of default events and better balance between precision and recall. These findings offer actionable guidance for selecting algorithms that optimize predictive accuracy and risk assessment in loan default forecasting.

5.8. A Study on the Impact of Artificial Intelligence on the Efficiency of the Manufacturing System

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The article discusses how AI might increase warehouse loading efficiency in modern industries. An approach in which an AI module automates and optimizes loading using real-time WMS data is examined. The AI system uses WMS inventory and shipment data to schedule loading tasks for automated guided forklifts (AGFs) given to the next container. AI uses RFID tags and barcode data to calculate effective AGF navigation patterns, instructing each vehicle to pick up and drop off pallets to the automated Q-Loader. The Q-Loader's sensors align the delivery vehicle, lift the goods onto the ramp, and load the trailer without any operator involvement. The study shows that real-time scheduling and adaptive control in this closed-loop, AI-driven process can minimize loading time and increase throughput.

5.9. Development of a Web Application for Sharing and Geo-Positioning of Video Clips

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The subject of this research is the development of a comprehensive digital solution addressing the challenges of visibility and accessibility faced by creators of geographically oriented video content. Although these challenges appear diverse, they share common characteristics that can be resolved through an integrated web-based approach. The proposed system is a web application designed for sharing and geo-positioning video clips, linking each video to its real-world location on an interactive map. By allowing users to explore videos directly through geographic navigation, the platform enhances the visibility of both the represented locations and the video creators themselves. This approach not only serves as an innovative promotional tool for destinations but also increases viewership and potential monetization opportunities for content authors. The study aims to evaluate

the technological feasibility, usability, and overall effectiveness of such a platform for both users and digital content creators.

5.10. Towards Quantum-Resilient Private Networking: A Public-Key Encapsulation Framework for Encrypted Tunnels

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This article discusses a quantum-resistant approach to private networks based on a public key encapsulation (PKE) framework for creating a secure tunnel. The proposed design integrates a lattice-based encapsulation mechanism to guarantee forward secrecy against quantum-capable adversaries, motivated by the growing impact of quantum computing on classical public-key cryptography. A prototype encrypted tunnel was deployed between two Ubuntu 22.04 virtual machines to evaluate handshake behavior, session key generation, and tunnel stability during post-quantum key exchange. The experimental results confirm the successful establishment of PKE-protected sessions, low negotiation costs, and full interoperability with existing Linux network stacks. The study shows that the adoption of standardized post-quantum PKE mechanisms enables practical quantum-resistant VPN architectures without compromising performance or deploy ability. The results are consistent with the current transition strategies recommended in the EU Roadmap for Post-Quantum Cryptography and support the development of quantum-secure communication infrastructures.

6.1. Security Vulnerabilities of Smart Home: A Case Study of Smart Camera

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During the last decade Internet of Things (IoT) enables people to enhance the security level of home through inter-connected devices. The smart security system can integrate surveillance cameras, motion sensors, door/window sensors, and smart locks, all connected to a central hub. With IoT can be monitored and controlled the security remotely, to receive real-time alerts, and even automate actions based on specific events when un-authorized access is detected. This research is related to the security issues of smart home cameras. The aim of the paper is to make analysis of smart home camera security problems and trends and to show their level of protection.

6.2. Design of Network Infrastructure for Training Students in Cybersecurity

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The paper presents the design and implementation of a specialized laboratory environment that can be used to conduct numerous student exercises and gain knowledge in the area of computer networks and their cybersecurity assurance. It discusses the implementation and management of the network infrastructure, the application of virtualization using VMware ESXI and vCenter Server for centralized management of the virtual infrastructure, and the application of various mechanisms and tools for traffic analysis and operation of various firewalls. The development emphasizes the methods, best practices and experience in building advanced security technologies and systems used in computer networks, with application in large enterprise networks.

6.3. Securing the Edge: A Comparative Analysis of Microsoft Defender for IoT and Nozomi Guardian

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The rapid expansion of the Internet of Things (IoT) and Industrial IoT (IIoT) has created new cybersecurity challenges that traditional security solutions struggle to address. This paper provides a comparative study of two leading platforms in the industrial cybersecurity domain: Microsoft Defender for IoT and Nozomi Guardian. The analysis focuses on their architectural characteristics, deployment options, integration capabilities, anomaly detection methods, scalability, and compliance with industrial standards. Practical use cases are examined to illustrate how each solution performs in real-world scenarios, highlighting their respective strengths and limitations. By offering an in-depth evaluation, this paper supports organizations in selecting the most appropriate platform to meet their operational requirements, risk profiles, and long-term security strategies.

6.4. Beyond Perimeter Defense: Technical Approaches to Third-Party Breach Prevention

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Third-party breaches now represent a dominant intrusion vector, leveraging the implicit trust organizations extend to external vendors, software dependencies, and integrated platforms to bypass traditional security controls. This paper examines the structural weaknesses that enable such breaches and develops a layered mitigation framework grounded in identity hardening, telemetry integration, and resilient system design. Drawing on empirical evidence from Verizon DBIR 2025, IBM Cost of a Data Breach 2025, and NIST SP 800-161r1, the research prioritizes technical interventions over administrative controls, demonstrating how identity isolation, zero-trust enforcement, and automated exposure management can be implemented within existing SOC constraints to substantially reduce organizational exposure to third-party compromise.

6.5. Teaching Introductory Programming through a Suggestopedic Approach

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The present paper sets out a teaching methodology for introductory programming based on a suggestopedic approach, designed for international students enrolled in the English-taught Computer Science and Engineering programme at the Technical University of Sofia. The methodology integrates interactive activities, including puzzles, crosswords and quizzes, with the aim of fostering motivation, active participation and problem-solving skills. Despite the constraints

imposed by institutional frameworks, which hindered the complete implementation of the programme, select components were introduced during the 2025 academic year. A comparative analysis of examination results from two cohorts (2024 and 2025) indicates positive trends. In 2024, the average grade produced by traditional pedagogy was 4.88, with performance concentrated around the 'Very Good' (5) mark. In 2025, under comparable conditions, the partially implemented methodology increased the proportion of Excellent (6) results by approximately 15% and reduced the proportion of students at the minimum passing threshold (Average, 3) by more than half, raising the cohort average to 4.92. While the difference in mean values was not statistically significant, the observed redistribution suggests that suggestopedic elements can optimise outcomes in large international cohorts and hold greater potential under conditions of smaller groups and full implementation.

6.6. Testing Vehicle Traction and Braking Control Systems Using GPS Data Logger

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In this paper vehicle launch and braking road tests were conducted using a GPS data logger. The launch tests were conducted with the traction control system on and off, and the braking tests were conducted with the anti-lock braking system on and off. The test results were compared. The potential for using a GPS data logger with a built-in accelerometer for testing vehicle traction and braking control systems was analyzed.

6.7. Gamification and Machine Learning Approaches for Scaling up Working Professionals in ITIL Service Delivery

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This study explores how gamification and machine learning concepts can enhance IT service delivery training and professional development. A gamified examination platform was developed to improve engagement and personalize ITIL learning for working professionals. Thirty participants aged 20–60, representing diverse IT roles, took part in the pilot. The system applied adaptive, data-driven feedback to simulate machine learning–based personalization, increasing motivation and knowledge retention. Results demonstrate that combining gamification with adaptive instructional design forms an effective hybrid model for heterogeneous learners. The paper further examines how emerging telecommunication technologies (5G, edge computing, and satellite networks) enable scalable, low-latency deployment of gamified learning platforms. These technologies allow

continuous, mobile, and high-quality learning experiences across distributed professional environments. The findings highlight the convergence of educational innovation and telecom infrastructure as a pathway to scalable, data-driven, and lifelong learning in IT service delivery.

6.8. Data-Driven Process Drift Detection in ICT Testing Using EWMA and CUSUM Methods

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This paper presents a lightweight data-driven framework for process drift detection in In-Circuit Testing (ICT) of electronic assemblies using Exponentially Weighted Moving Average (EWMA) and Cumulative Sum (CUSUM) control methods. [1] The proposed solution is implemented in a fully open-source environment combining Bash scripting, Telegraf, InfluxDB 2.0, and Grafana. The architecture enables real-time anomaly detection and historical analysis of component-level measurements collected from ICT equipment. Experimental results show that the proposed approach effectively identifies gradual performance deviations before the process exceeds tolerance limits, providing a foundation for predictive maintenance and continuous process improvement in Industry 5.0 environments.

6.9. Measurement of the Vehicle Pollution during Fuel Remap Process on a Gasoline Engine

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A "fuel remap" refers to economy remap, which is a process that adjusts a vehicle's Engine Control Unit (ECU) to improve fuel efficiency, to reduce the emissions or to increase the power. Regardless of the fuel remap ultimate goal, this process leads to the engine emission change. The current paper discusses a measurement system for a gasoline engine pollution detection during the remap process. The nitrogen oxides, carbon oxide and the hydrocarbons levels are monitored and also the particulate matters (PM) according to the Euro 7 standard requirements. The external temperature and pressure are measured and compared with the gas exhaust temperature and relative humidity to clarify all combustion processes. The accomplished test with the fuel remap process shows

significant increase of the pollution levels of the detected gases and the ultrafine particulate matters with size up to 1 m.

6.10. Development and Implementation of a 2D Vision-Guided Robotic System for Industrial Inspection and Manipulation

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This paper presents the design and implementation of a compact 2D vision-guided robotic system integrating a Cognex In-Sight 7600 smart camera with a Mitsubishi Electric MELFA RV-2FR robot. The system performs high-precision inspection and manipulation through robust geometric pattern matching and deterministic EtherNet/IP communication. A practical N-point calibration aligns the camera and robot coordinate frames with sub-millimeter accuracy. Experimental validation demonstrates mean localization error below 0.3 mm, 96.7% defect detection reliability, and ±0.5 mm repeatability in manipulation. The results confirm that combining commercial 2D vision with industrial robotics provides an accurate, cost-effective, and flexible solution for modern automated manufacturing.

7.1. Generative Markov Chain Model Development for Guitar Melodies Creation

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This study proposes a generative Markov Chain model for creating guitar melodies. The proposed model generates various transition matrices for the Markov chain using multiple chord progressions in different genres. When analyzing the various transition states, separate transition matrices are created for each genre, each with an N-chord sequence used as a context. The purpose of the model is to generate stylistically consistent and accurate guitar chord progressions across various genres for creating guitar melodies.

7.2. Neural Network–Driven Markov Chain Model Development for Adaptive Digital Audio Effects

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This paper introduces a neural network-driven Markov chain model for optimizing a digital transformation model. The proposed model generates adaptive and dynamic delay state transitions by integrating a neural network's predictive capabilities with the stochastic properties of Markov chains. Trained on modified audio samples with multiple delayed segments, it preserves the original signal's timbre and dynamics while introducing musically coherent variations, enabling creative and versatile audio processing.

7.3. Comparison of Different Fusion Techniques on Mri and Psma Images of the Prostate Gland

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Accurate visualization of the prostate gland is essential for effective diagnosis, treatment planning, and disease monitoring in prostate cancer. This study presents a comparative analysis of four image fusion techniques—Principal Component Analysis (PCA), Laplacian Pyramid, Curvelet Transform, and Wavelet Transform—applied to the multimodal fusion of Magnetic Resonance Imaging (MRI) and PSMA PET images of the prostate gland. Both modalities undergo spatial registration and modality-specific denoising according to their noise characteristics prior to fusion. Quantitative assessment of the fused images is performed using image quality metrics, including Peak Signal-to-Noise Ratio (PSNR), Structural Similarity Index (SSIM), Entropy, Pearson Correlation Coefficient (PCC), and Mutual Information (MI). In addition, qualitative visual assessment is performed. The findings provide insights for selecting an optimal fusion strategy for prostate imaging and support the integration of multimodal fusion techniques into clinical prostate cancer workflows.

7.4. Log-periodic Antenna Modelling for Solar Radio Interferometric Observations

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This paper presents initial steps in the creation and use of log-periodic antennas as part of an interferometer for studying and monitoring the Sun at radio frequencies. Calculations are presented

for modeling a basic antenna model, which is then used for optimizations aimed at practical improvement and size reduction - with the least deterioration of parameters.

7.5. Task Execution and Dynamic Re-Planning with a Mobile Robot and Manipulator: A Real-Robot Study Using RDK X3 and myCobot 320 – Part 1

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This paper presents the design and implementation of a cooperative robotic system that integrates a mobile wheeled robot and a fixed manipulator for flexible goods transport and handling in constrained industrial environments. The system employs a low-cost sensor suite consisting of a monocular camera and an ultrasonic sensor and operates on embedded hardware. Two graph-based path-finding algorithms, Breadth-First Search (BFS) and D* Lite, are implemented and adapted for real-time navigation on a grid-based track. The study describes the system architecture, environment setup, and algorithmic integration, emphasizing scalability under limited computational resources. Preliminary experiments demonstrate that both algorithms perform reliably within the embedded controller's limits, with D* Lite showing superior efficiency for dynamic conditions. These results establish the foundation for subsequent experimental validation of dynamic re-planning and manipulator coordination.

7.6. Task Execution and Dynamic Re-Planning with a Mobile Robot and Manipulator: A Real-Robot Study Using RDK X3 and myCobot 320 – Part 2

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This paper presents the experimental evaluation of two graph-based search algorithms – Breadth-First Search (BFS) and D* Lite – implemented on a cooperative robotic system consisting of a mobile wheeled platform (RDK X3) and a six-axis manipulator (myCobot 320). The system performs transport, loading, and unloading tasks on a physical grid-based track using a low-cost sensor suite composed of a camera and an ultrasonic distance sensor. The experiments evaluate algorithm performance in terms of memory consumption, execution time, queue operations, and physical movement duration under both obstacle-free and obstacle-rich conditions. Results show that BFS provides a stable reference baseline for static environments, while D* Lite achieves efficient dynamic re-planning with minimal computational overhead. These findings validate the feasibility of low-cost, real-world autonomous navigation for industrial applications.

7.7. Performance and Economic Analysis of an Automated Assembly Line with Collaborative Robots

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This paper presents a comprehensive performance and economic analysis of an automated assembly line designed for the production of street lamps, integrating a collaborative robot FANUC CRX-10iA/L. The system combines robotic manipulation, automated soldering, dispensing, and screwing stations under the control of a centralized PLC and HMI interface. The study evaluates the productivity, cycle time, and operational efficiency of the system, comparing automated and manual assembly processes. Experimental results demonstrate a significant reduction in assembly time—up to 45%—and a notable improvement in product consistency and safety. The economic evaluation indicates a short payback period due to reduced labor costs and increased throughput, despite the initial investment in automation. The collaborative robot enables flexible task reconfiguration and safe human-robot interaction, making the system adaptable for various product types. The presented analysis confirms that the integration of collaborative robotics and intelligent control systems represents a cost-effective and scalable solution for modern manufacturing environments.

7.8. Integration of a Collaborative Robot with PLC and HMI for an Automated Street Lamp Assembly Line

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This paper presents the integration of a FANUC CRX-10iA/L collaborative robot with a Siemens PLC and WinCC HMI for an automated street lamp assembly line. The system enables real-time coordination between robotic and peripheral operations through a deterministic Modbus/TCP network. The PLC manages process sequencing and interlocks, while the HMI provides intuitive visualization, manual control, and alarm diagnostics. Experimental results demonstrated efficient communication, smooth synchronization, and improved reliability. The integration reduced the assembly cycle time by 31%, decreased downtime by 35%, and shortened operator response time by 43% compared to the pre-integration setup. The proposed control architecture offers a flexible and scalable solution for Industry 4.0 applications, combining collaborative robotics, programmable control, and user-centered interfaces to enhance productivity and safety in modern manufacturing.

7.9. A Wireless Embedded ECG Monitoring System with Neural Network-Based Data Compression

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This work presents a low-power embedded system for real-time wireless monitoring of a single-channel electrocardiogram, targeting remote healthcare applications. A near-lossless electrocardiogram compression pipeline is introduced, combining a neural network-based autoencoder with Rice encoding of the residuals. Compressed data is transmitted using the MQTT protocol, enabling lightweight wireless communication suitable for constrained networks. Implemented on an ESP32 microcontroller, the system achieves a compression ratio of 3.6, demonstrating its feasibility on resource-constrained devices.

8.1. Design and Error Modeling of an Infrared Thermographic Experiment for Monitoring the Throwing Arm in Female Handball Players

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The study introduces a theoretical and simulation-based framework for designing an infrared thermographic experiment to monitor the throwing arm of female handball players. The camera is fixed in a controlled indoor setting, while athletes stay at predetermined positions. The model includes the main sources of uncertainty: detector noise, calibration drift, emissivity variability, and partial pixel filling caused by small body movements. Analytical formulas are developed for each error component using radiometric and geometric principles. Simulation results indicate that the main contributions come from pixel mixing and emissivity fluctuations, while distance and angle effects are negligible with fixed geometry. The framework offers quantitative design guidelines to keep thermal measurement uncertainty below 0.2°C, enabling reliable infrared thermography in sports applications.

8.2. A ROS and MATLAB/Simulink Framework for Modeling and Control of a Robotic Manipulator

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This paper presents an integrated framework combining Robot Operating System (ROS) and MATLAB/Simulink for modeling and control of a robotic manipulator. The approach enables real-time co-simulation, where ROS handles the robot's kinematics and dynamic modeling through Gazebo, and MATLAB executes the control algorithms via the ROS Toolbox. The framework supports bidirectional communication for data exchange and closed-loop testing without physical hardware. Experiments performed on a 6-DOF manipulator demonstrate precise trajectory tracking with a mean position error below 1% and average communication latency under 20 ms. The proposed methodology accelerates controller development, reduces integration complexity, and provides an efficient platform for educational and research applications in robotics and automation.

8.3. Development of a Remote Control Interface for a Mobile Robot using ROS and LabVIEW

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This paper presents a bidirectional communication interface between LabVIEW and the Robot Operating System (ROS) for real-time teleoperation of a mobile robot. The proposed system enables LabVIEW to function as a ROS node capable of publishing velocity commands and subscribing to sensor data, providing a graphical user interface (GUI) for intuitive robot control. The integration is implemented through TCP/IP communication between a Windows-based LabVIEW client and a Linux-based ROS host. The system was validated in the Gazebo simulator using a Clearpath Husky robot model, achieving real-time operation with network latency below 5 ms and smooth trajectory tracking at 10 Hz. The results demonstrate that the developed ROS–LabVIEW interface effectively bridges industrial-grade software with modern robotic frameworks, enabling flexible and user-friendly teleoperation for both simulation and real-world applications.

8.4. Grid PV Inverters Operation with Frequency Devations

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The increasing use of renewable energy sources in the energy mix in Europe power grid is both a blessing and a potential source of problems as the recent blackout in Spain demonstrated. The primary reason of the blackout was shown to be the large percentage of photovoltaic energy, which combined with grid following inverters has low inertia and cannot handle frequency deviations well. In order to demonstrate the problem, the paper considers a simple singlephase inverter with simulated grid deviations and shows its induced power oscillations.

8.5. Remote Monitoring and Control of Environmental Factors in Smart Agriculture

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In recent years, there has been a permanent change in the climate, one of the factors being a decrease in the amount of precipitation. This leads to problems in agriculture, when growing different types of crops. In order to deal with this problem, it is necessary to apply precision (intelligent) agriculture. Precision agriculture allows for improved resource management, which in turn allows for increased yields and quality of agricultural production, which leads to a better economic effect, This article proposes an architecture and operating algorithm for a remote monitoring and control system used in precision (smart) agriculture.

8.6. An approach to Detecting Sources, Distributors, and Re-transmitters in Social Networks

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This paper presents an approach in identifying information dissemination paths on social networks. It comprises the organization of database on the connections between people, visualization of information dissemination flows, and visual analysis of the obtained results to identify information sources and relays. The interrelations between participants give possibility for constructing of corresponding graphs, reflecting the movement of the information flow. This helps for discovering the content distribution paths. The article includes numerical outcomes showing that the described method works fruitfully.

8.7. A Multi-Sensor Platform for Tire Temperature Distribution and Driving Characteristics

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This paper introduces a multi-sensor system for monitoring the temperature distribution of the active tire tread surface and driving behavior. Tire temperature is measured using two multipixel infrared (IR) sensors (MLX90640). Driving characteristics are captured with an accelerometer-gyroscope unit (QMI8658), a magnetometer (QMC6310), and a Global Navigation Satellite System receiver (L76K). Environmental conditions are recorded by a temperature and humidity sensor (BME280). The platform is built on an ESP32 system-on-chip (SoC). The system was tested during urban driving in Sofia and on interurban trips. The paper presents representative results and preliminary analysis, including spatial temperature metrics (mean values, gradients, asymmetry across tread zones) and their relationship to kinematic signals (speed, longitudinal/lateral acceleration, yaw rate). The findings demonstrate the feasibility of combined thermal–dynamics monitoring for characterizing driving and assessing tire and vehicle conditions.

8.8. Evolution of Automated Drip Irrigation Systems: From Manual Control to AI-Enabled Solutions

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Drip irrigation systems have undergone a continuous transformation in response to climate variability and increasing water scarcity. This paper reviews the evolution from manual and timer-based approaches to sensor-driven automation and recent AI-enabled solutions. Particular attention is given to control strategies ranging from rule-based and model-driven approaches to machine learning methods capable of predictive scheduling. Evidence from experimental studies and literature indicates that intelligent irrigation systems can improve water-use efficiency by up to 40% without compromising yields, while also reducing labor and resource consumption.

8.9. Sensitivity Characterization of Zeta DC-DC Converter to Coupling Capacitance Deviations

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This study investigates the sensitivity of the Zeta DC-DC converter to variations in the coupling capacitance, a critical component that directly influences energy transfer, transient behavior, and electromagnetic compatibility (EMC). Through a simulation-based approach in MATLAB/Simulink, the impact of realistic manufacturing deviations in the coupling capacitor is evaluated. A series of frequency-domain analyses are conducted by injecting single current pulses at key nodes of the circuit and observing the resulting voltage responses. The variations in the coupling capacitance, modeled within a commercial tolerance step above and below the nominal value, reveal significant changes in resonant peaks, output ripple, and overall system stability. The findings highlight that even small parameter deviations can induce pronounced shifts in dynamic behavior, necessitating conservative component selection and sensitivity-aware design practices. This work emphasizes the importance of small-signal analysis and node-based spectral evaluation in enhancing the robustness and EMI performance of Zeta converter implementations.

8.10. Integrating Data Center Infrastructure into Smart Grid Energy Management Systems

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The exponential growth of digitalization and artificial intelligence workloads has positioned data centers among the fastest-growing electricity consumers worldwide. Traditionally viewed as passive loads, modern data centers possess advanced energy infrastructures, such as uninterruptible power supply (UPS) systems, battery storage, and intelligent cooling, that can be leveraged as flexible resources for smart grid operation. This paper proposes an integration framework between Data Center Infrastructure Management (DCIM) and Smart Grid Energy Management Systems (SG-EMS) to enable bidirectional energy and information exchange. The proposed architecture coordinates local assets within data centers with grid-level control for demand response, peak shaving, and renewable energy utilization. A case study of a 10 MW data center equipped with a 1 MWh battery and 2 MW photovoltaic plant demonstrates that coordinated control can reduce peak grid demand by up to 18%, lower daily energy costs by approximately 17%, and provide sub-second frequency response without affecting IT service performance. The results confirm the potential of data centers to act as virtual energy storage units and active participants in smart grids. Future developments include AI-driven predictive control, digital twins for co-simulation, and secure interoperability between DCIM and SG-EMS platforms.

8.11. Dynamic Model of the Influence of Information Flows on the Audience

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Breakthroughs in digital technologies, generating new methods for obtaining, processing, storing, and disseminating information are leading to a breakthrough in the mass media system through information flows. Mathematical tools for modeling audience communication are being actively developed. This paper presents the results aiming at exploring new possibilities in studying public behavior influenced by mass media. Based on dynamic systems theory, a model of the dissemination of new views is constructed. It includes parameters that help assess audience attitudes toward this news. Different relationships between these parameters lead to different scenarios for dissemination of information, analysis of which leads to conclusions about society's readiness to change established concepts.

8.12. Digital Modernization of a Wire Straightening and Cutting Machine in Compliance with Industry 4.0 Principles

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This paper presents the Industry 4.0 digital retrofit of a WMW UDARA 6.3 wire straightening and cutting machine, originally manufactured in 1968. The retrofit introduces a modern control system comprising a PLC, frequency converter, servo drive, and HMI visualization, while preserving the mechanical structure. The methodology includes process analysis, identification of critical parameters, and calibration of control logic. Results demonstrate significant improvements in productivity, reliability, maintenance time, and integration with digital production environments. The study fills a research gap in the retrofitting of specialized wire processing machines and highlights the practical application of low-invasive digital modernization for legacy equipment.

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for the participants and guests of Telecom 2025

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