Embracing Emerging Technologies:
Insights from the 6th Workshop for Young Scientists in Computer Science & Software Engineering

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Abstract

The 6th Workshop for Young Scientists in Computer Science & Software Engineering showcases cutting-edge research from emerging talents. This volume comprises diverse papers illuminating emerging technologies' profound impact across various domains. Several contributions underscore the pivotal role of telemetry, graph theory, and machine learning in optimising distributed systems, detecting anomalies, and streamlining processes. Others delve into acoustic surveillance techniques for UAV detection, genetic algorithms for university scheduling, and neural network-driven optimisation of chemical synthesis. The proceedings also highlight novel approaches to assessing software architecture reliability, implementing ERP systems, and designing information systems for viral infection data analysis. Thermal resistance calculation software, multimodal distribution data processing methods, and high-performance computing energy consumption modelling are also explored. Moreover, the importance of user experience research in cross-platform application development is emphasised, alongside the design of virtual physics laboratories and Python learning game applications. Notably, predatory conferences are addressed, proposing robust conference management platforms to uphold research integrity. Collectively, these papers exemplify young scientists' innovative spirit and determination to tackle real-world challenges and push the boundaries of their disciplines.

Keywords

emerging technologies, telemetry, graph theory, machine learning, acoustic surveillance, genetic algorithms, neural networks, software reliability, enterprise resource planning, user experience, virtual laboratories, Python learning games, predatory conferences

1. CS&SE@SW 2023: at a glance

Workshop for Young Scientists in Computer Science & Software Engineering (CS&SE@SW) is a peer-reviewed workshop focusing on research advances applications of information technolo-

gies.

CS&SE@SW topics of interest since 2018 [1, 2, 3, 4, 5] are:

1. Software engineering

   - Software requirements [6, 7]
   - Software design [6, 8, 9, 7]
   - Software construction [10, 8, 9]
   - Software testing [6, 11]
   - Software maintenance [6]
   - Software engineering management [8]
   - Software development process [8, 9, 12, 7]
   - Software engineering models and methods [13, 10]
   - Software quality [14, 6, 11]
   - Software engineering professional practice [8]

2. Theoretical computer science

   - Data structures and algorithms [15, 16, 17, 9]
   - Theory of computation [15]
   - Information and coding theory [18, 19]
   - Formal methods [18]

3. Computer systems

   - Computer architecture and computer engineering [16, 17]
   - Computer performance analysis [16]
   - Databases [17]

4. Computer applications

   - Computer graphics and visualization [20, 12]
   - Human-computer interaction [21, 8, 17]
   - Scientific computing [20, 16, 17]
   - Artificial intelligence [22, 20, 13, 9, 19]

This volume represents the proceedings of the 6th Workshop for Young Scientists in Computer Science & Software Engineering (CS&SE@SW 2023), held in Kryvyi Rih, Ukraine, on February 2, 2024. It comprises 17 contributed papers that were carefully peer-reviewed and selected from 42 submissions. At least two program committee members reviewed each submission. The accepted papers present a state-of-the-art overview of successful cases and provide guidelines for future research.

2. CS&SE@SW 2023 Program Committee

- *Nadire Cavus*, Near East University [23, 24]
- *Stuart Charters*, Lincoln University [25, 26]
- *Attila Kertesz*, University of Szeged [27, 28]
- *Nagender Kumar Suryadevara*, University of Hyderabad [29, 30]
- *Orken Mamyrbaeyv*, Institute of Information and Computational Technologies [31, 32]
- *Bongkyo Moon*, QIR [33, 34]
- *Michael J. O'Grady*, University College Dublin [35, 36]
- *Grażyna Paliwoda-Pękosz*, Krakow University of Economics [37, 38]
- *Pedro Valderas*, Universitat Politècnica de València [39, 40]
- *Nataliia Veretennikova*, Lviv Polytechnic National University [41, 42]
- *Xianzhi Wang*, University of Technology Sydney [43, 44]
- *Alejandro Zunino*, ISISTAN - UNCPBA & CONICET [45, 46]

Additional reviewers:

- *Emrah Atilgan*, Eskişehir Osmangazi University [47, 48]
- *Olexander Barmak*, Khmelnytskyi National University [49, 50]
- *Kevin Matthe Caramancion*, University of Wisconsin–Stout [51, 52]
- *Pavlo Hryhoruk*, Khmelnytskyi National University [53, 54]
- *Oleksandr Kolgatin*, Simon Kuznets Kharkiv National University of Economics [55, 56]
- *Valerii Kontsedailo*, Inner Circle [57, 58]
- *Vyacheslav Kryzhanivskyy*, R&D Seco Tools AB [59, 60]
- *Andrey Kupin*, Kryvyi Rih National University [61, 62]
- *Mykhailo Medvediev*, ADA University [63, 64]
- *Vasyl Oleksiuk*, Ternopil Volodymyr Hnatiuk National Pedagogical University [65, 66]
- *Viacheslav Osadchyi*, Borys Grinchenko Kyiv University [67, 68]
- *James B. Procter*, University of Dundee [69, 70]
- *Serhiy Semerikov*, Kryvyi Rih State Pedagogical University [71, 72]
- *Etibar Seyidzade*, Baku Engineering University [73, 74]
- *Andrii Struik*, Kryvyi Rih National University [75, 76]
- *Tetiana Vakaliuk*, Zhytomyr Polytechnic State University [77, 78]
- *Volodymyr Voytenko*, Athabasca University [79, 80]

3. CS&SE@SW 2023 organizers

The 6th edition of the CS&SE@SW was coordinated by the Academy of Cognitive and Natural Sciences (ACNS), a non-governmental organisation dedicated to nurturing the growth of researchers' expertise in the cognitive and natural sciences arena. ACNS's mission encompasses enhancing research, safeguarding rights and liberties, and catering to professional, scientific, social, and other interests.

ACNS is engaged in a spectrum of activities, including:

- Spearheading research initiatives within the cognitive and natural sciences domain and fostering collaborative ties among researchers.
- Orchestrating conferences, workshops, training sessions, internships, and other platforms for exchanging and disseminating knowledge in the realm of cognitive and natural sciences.
- Publishing conference proceedings, collections of scholarly works, and scientific journals (https://acnsci.org/journal):
  - Educational Dimension [81]
  - Educational Technology Quarterly [82]
  - CTE Workshop Proceedings [83]

Among ACNS's prominent publications is the Diamond Open Access *Journal of Edge Computing* (JEC), a peer-reviewed journal covering the science, theories, and practice of IoT, distributed systems, and edge computing [84]. JEC considers scientific research on using and applying edge computing in various fields: education, science, medicine, architecture, etc. [85]. Notably, JEC covers a broad range of topics aligned with CS&SE@SW topics of interest:

- Artificial intelligence [86, 87]
- Computer networks [88]
- Computer performance analysis [89]
- Concurrent, parallel and distributed systems [90, 91, 92]
- Formal methods [93]
- Human-computer interaction [94, 95, 89, 84]
- Mathematical foundations [96]
- Scientific computing [97, 98, 99, 100, 89]

4. CS&SE@SW 2023 keynote

This year, one keynote speaker was selected by the CS&SE@SW 2023 program committee: Dmytro Nechai (Chief architect at PLATMA, CTO at SalesJinn, mentor and lector at National Technical University of Ukraine and "Igor Sikorsky Kyiv Polytechnic Institute") "The future is already here. What is low-code and what to serve it with?" (figure 1).

5. CS&SE@SW 2023 articles overview

5.1. Software engineering

The article "An approach to assessing the reliability of software systems based on a graph model of method dependence" by Krutko et al. [14] proposes a method for evaluating the reliability of software systems. The authors highlight the importance of software quality, particularly reliability, in today's rapidly evolving software development landscape. They observe that existing reliability assessment methods often rely on hardware models, which may not fully capture the intricacies of software systems.
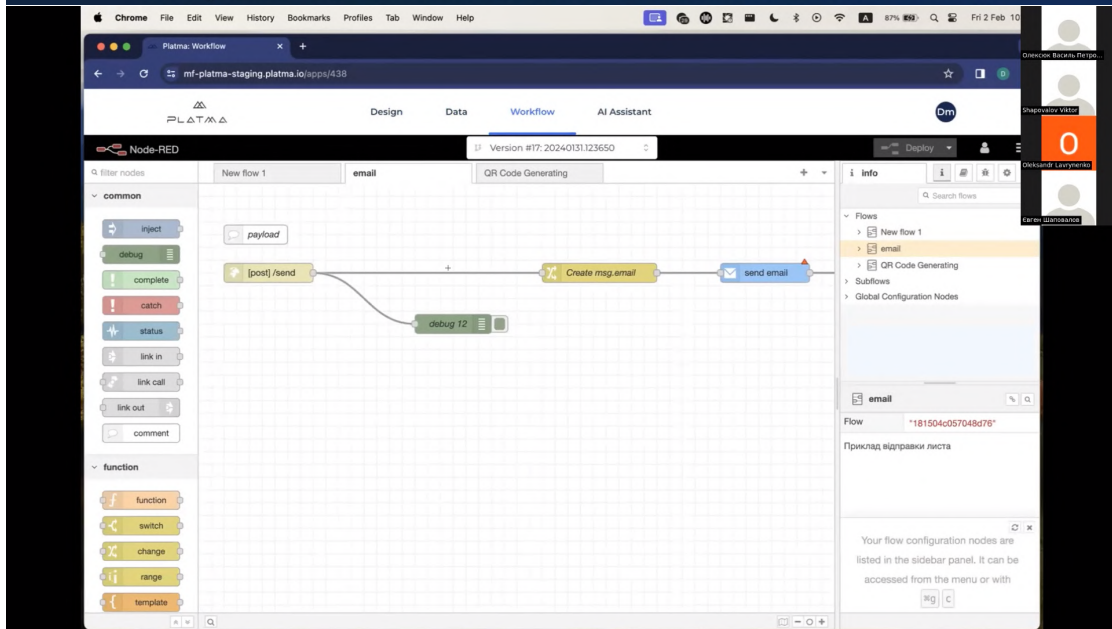
Figure 1: CS&SE@SW 2023 keynote.

The proposed approach introduces a graph model of method dependence, wherein software systems are broken down into smaller structural elements called methods. These methods are then analysed to construct a graph model representing their interdependencies. Stochastic reliability indicators are assigned to each method based on the probability of failure-free operation. These indicators are calculated by analysing method invocations and failures during program execution.
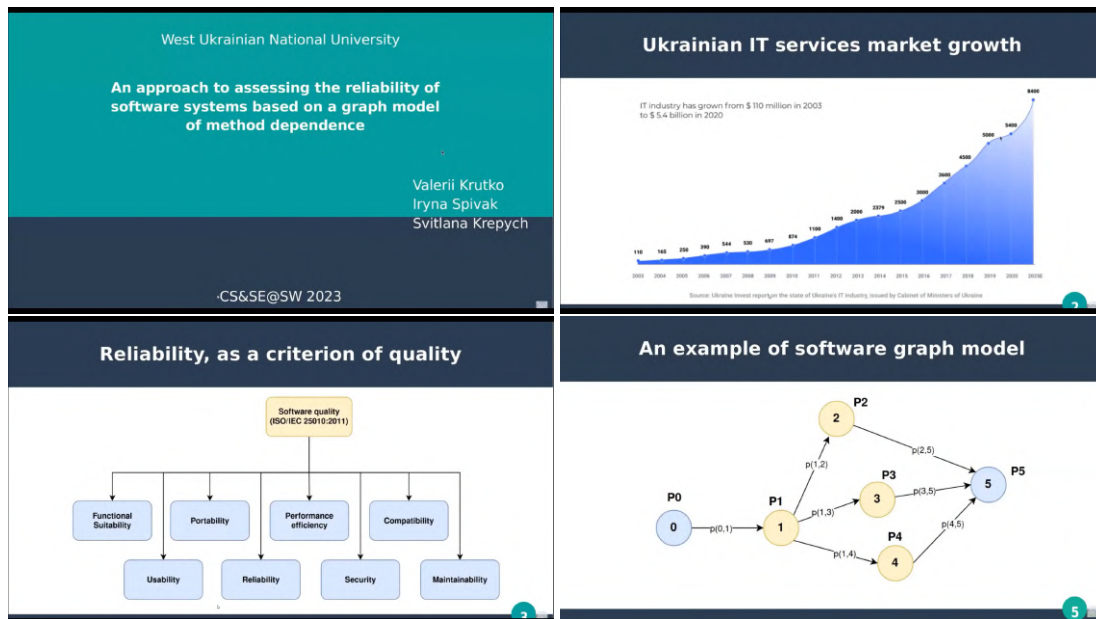
Figure 2: Presentation of paper [14].

The article describes the proposed method, including the steps in constructing the graph model and calculating reliability indicators. It also presents examples demonstrating the application of the approach to simple and complex software systems.

The article "Methodology of implementation of modern information systems at commercial enterprises" [6] provides a comprehensive overview of implementing ERP (Enterprise Resource Planning) systems based on the AIM (Application Implementation Method) methodology, with a focus on Ukrainian realities. Authored by Yurii O. Chernukha, Oksana V. Klochko, and Tetiana P. Zuziak from Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, Ukraine, the article delves into the various stages of implementing ERP systems, including preparation and planning, selecting an ERP system, design, development and testing, training and support, analysis and optimisation, and support and updates.

The authors meticulously detail each phase, providing insights into the tasks, challenges, and considerations associated with implementing ERP systems. They emphasise the importance of careful planning, stakeholder collaboration, and continuous monitoring throughout the implementation process. Furthermore, they highlight the significance of selecting the right ERP system and project management strategies to ensure successful outcomes.

A notable aspect of the article is its discussion on the methodology for implementing ERP systems. It mainly focuses on the Oracle AIM methodology, which divides the project into six phases and encompasses various processes within each phase. The authors provide an in-depth analysis of the documents associated with each process, offering readers a comprehensive understanding of the documentation required for successful ERP implementation.

Moreover, the article addresses the challenges specific to Ukrainian enterprises, such as historical processes, diverse applications, and limited documentation, and provides practical

recommendations for overcoming these challenges. It emphasises the importance of organisational restructuring, business process optimisation, and the active involvement of company management in the implementation process.

Additionally, the article discusses the role of project management tools and communication platforms in facilitating collaboration and coordination among project teams. It highlights the significance of Microsoft Project, Jira, Confluence, and other tools in streamlining project activities and ensuring effective communication among team members.

The article "Information System Module for Analysis of Viral Infections Data Based on Machine Learning" [13] presents a comprehensive exploration of the development and implementation of an information system module designed to analyse viral infection data. Authored by Nickolay Rudnichenko, Vladimir Vychuzhanin, Tetiana Otradskya, and Igor Petrov, the article delves into the significance of automating data analysis processes, particularly in the context of viral diseases, utilising intelligent technologies and machine learning methods.

The article begins by addressing the relevance of data analysis automation in various fields, emphasising the importance of modern tools and approaches in efficiently handling large volumes of data. With a focus on viral diseases, especially in the post-COVID-19 era, the authors highlight the ongoing need for analysing disease patterns, forecasting, and automating symptom detection to prevent further spread.

Key components and technologies used in developing the information system module are described, including using the UML language for system design modelling, client-server architecture, and relational database implementation. The process of creating, training, and testing machine learning models is detailed, along with assessing input features' significance and error matrix evaluation.

The article provides insights into the project structure, outlining the system's functionalities such as authentication, dataset importation, data visualisation, and model parameter modification. It also presents a sequence diagram illustrating the system's operation and a component diagram highlighting its main modules.

Results from implementing five machine learning models – Gaussian Naive Bayes, Decision Tree, Random Forest, Support Vector Machine, and Neural Network – are discussed, along with the performance metrics and analysis of each model's outputs. The authors demonstrate the effectiveness of these models in analysing COVID-19 symptom data, identifying key symptoms indicative of the virus, and assessing model accuracy and speed.

In summary, the article provides a thorough overview of developing and implementing an information system module for analysing viral infection data using machine learning techniques. It underscores the importance of automated data analysis in addressing public health challenges, with implications for improving disease prevention and control strategies. The findings contribute to advancing research in the field of data-driven healthcare and highlight avenues for future exploration, including developing more efficient models and expanding datasets for comprehensive analysis.

The article "Designing a cross-platform user-friendly transport company application" [8] delves into the crucial aspects of developing an application for a transportation company with a focus on cross-platform compatibility user experience (UX) and user interface (UI) design. Authored by Maksym Y. Salohub, Olena H. Rybalchenko, and Svitlana V. Bilashenko from Kryvyi Rih National University, the paper presents a comprehensive approach to creating a scalable
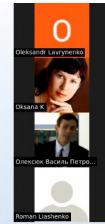
Methodology of implementation of modern Information Systems at Commercial Enterprises

O.V. Klochko
Y.O. Chernukha
T.P Zuziak
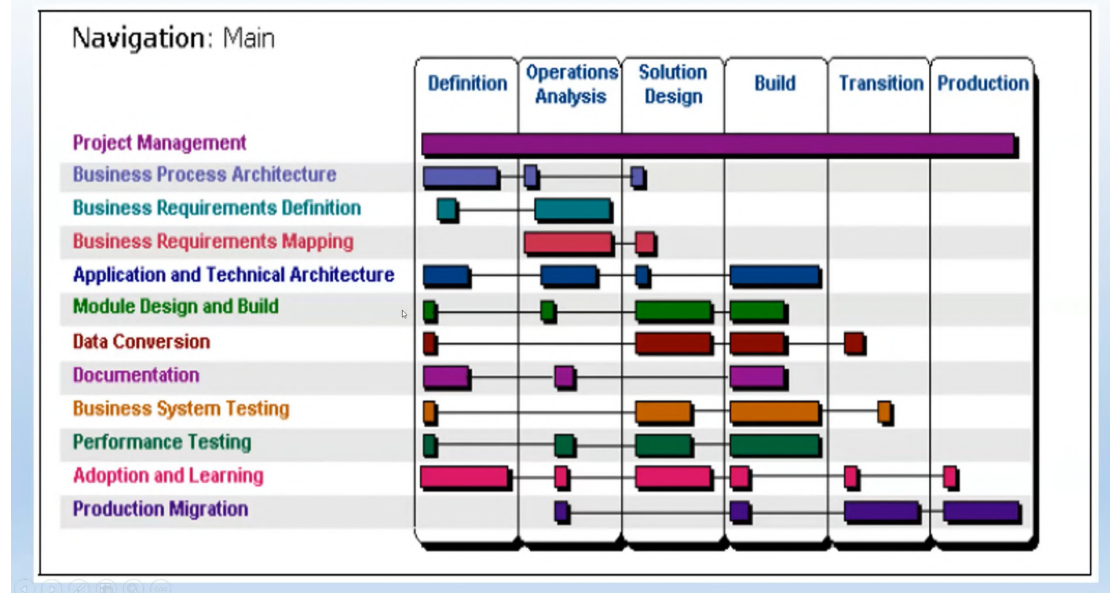Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University

Figure 3: Presentation of paper [6].

and user-centric application.

The methodology includes UX research, competitor analysis, and target audience surveys to identify user preferences and behaviours. Through a thorough analysis of analogous applications like Bolt, Grab, and DiDi Rider, the authors provide insights into the strengths and weaknesses of existing platforms. Additionally, the survey results highlight the importance of features such
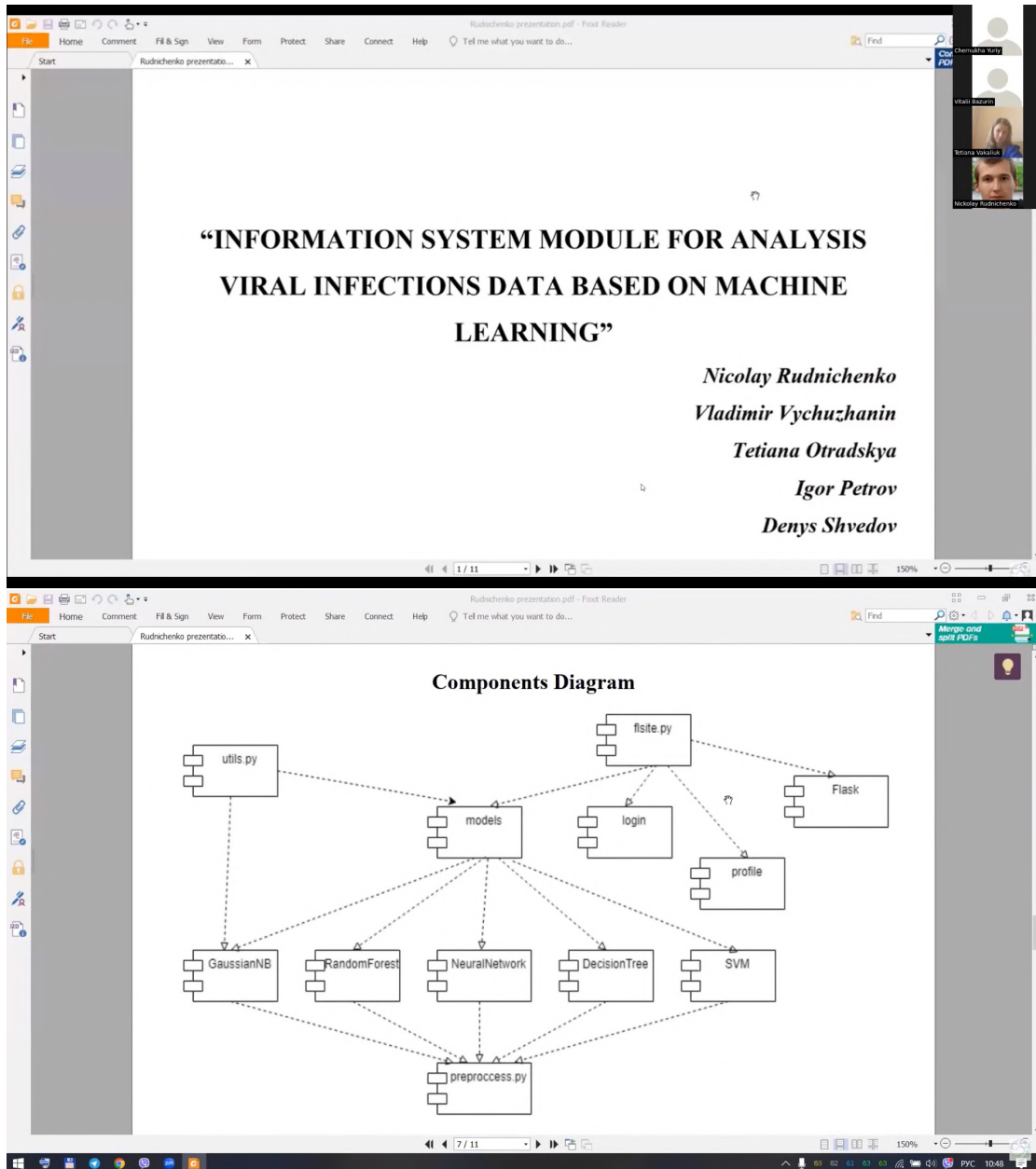
Figure 4: Presentation of paper [13].

as panic buttons, driver selection options, and trip archives for users.

The article discusses various approaches to cross-platform development, emphasising the advantages of using technologies like React Native to streamline the development process and ensure compatibility across different platforms. The authors also address challenges in UI design and propose solutions to create an intuitive and visually appealing interface.
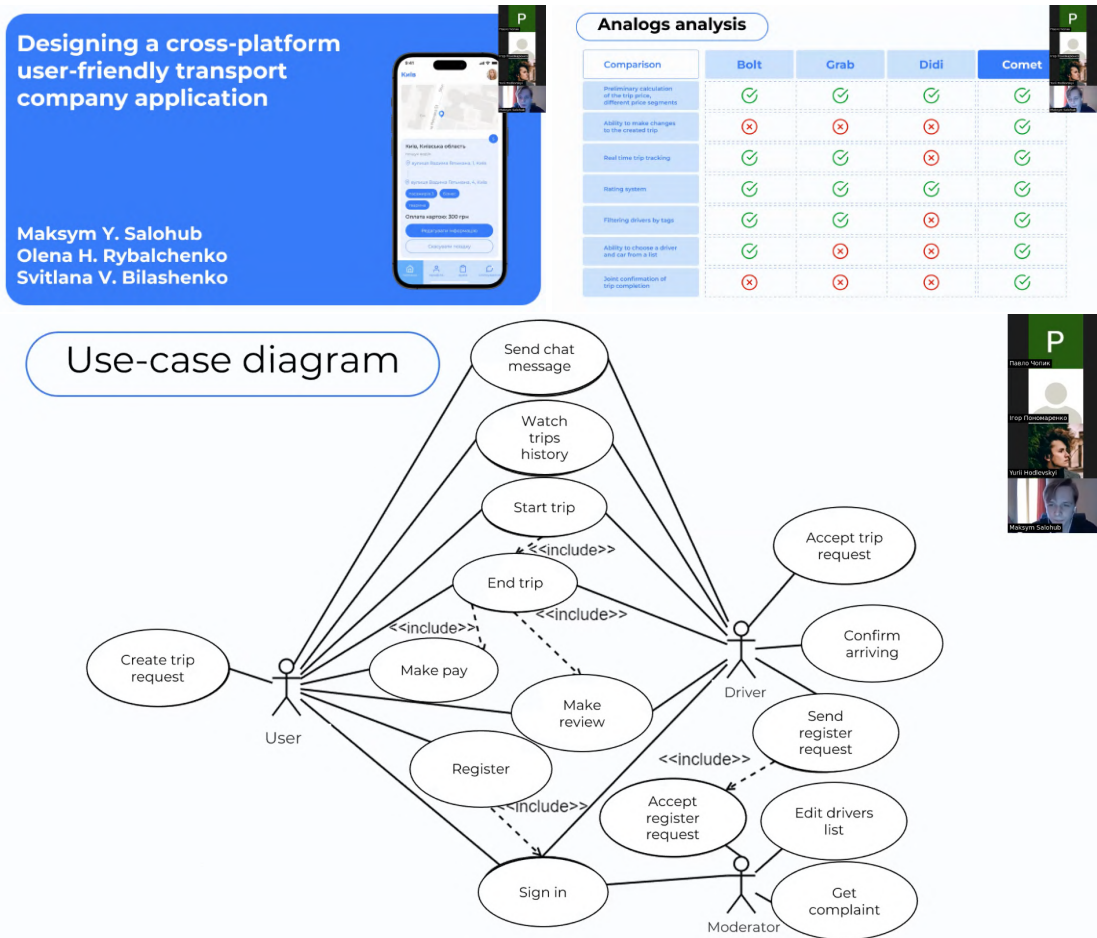
Figure 5: Presentation of paper [8].

Furthermore, the paper outlines the system development process, including using technologies like Express.js for backend development and MongoDB for database management. The integration of Expo CLI facilitates testing and deployment, while the utilisation of Feather Icons enhances the semantic interaction within the application.

The article "Research of the route planning algorithms on the example of a drone delivery system software development" [9] provides an in-depth analysis of various route planning algorithms for drone delivery systems. Authored by Yevhen L. Turchyk, Milana V. Puzino, Olena H. Rybalchenko, and Svitlana V. Bilashenko, the paper delves into the existing drone delivery systems worldwide, examines different route-building algorithms, and discusses the advantages and disadvantages of each approach.

The paper begins with an introduction highlighting the significance of efficient logistics, particularly in urban settings. It introduces the concept of drone delivery as a potential solution to overcome challenges in last-mile delivery. It sets the stage for the research by emphasising the need for quick and convenient operation in drone delivery systems.

The subsequent sections thoroughly review existing drone delivery systems, such as Amazon Prime Air, Starship Technologies, and Zipline, providing insights into their operations, advantages, and limitations. Recent research on drone delivery systems is also analysed, covering topics like multi-physics modelling, cloud-based drone management, and optimisation algorithms for route planning.

A comprehensive review of common approaches and algorithms for drone delivery route planning follows, including the Traveling Salesman Problem algorithm, Dijkstra's algorithm, A* algorithm, and reinforcement learning. Each algorithm is evaluated based on execution speed, scalability, and implementation simplicity. The authors argue that reinforcement learning emerges as the most optimal solution due to its ability to adapt to dynamic environments and optimise delivery routes efficiently.

The paper concludes with a discussion on system development, outlining the general architecture of a drone delivery system, hardware simulation using ArduPilot SITL, and implementing a route-building subprogram using Q-Learning. The provided code snippets offer insights into how reinforcement learning techniques can be applied to optimise delivery routes.

The article "Implementing E2E tests with Cypress and Page Object Model: evolution of approaches" [11] presents a comprehensive exploration of various methodologies for constructing Cypress tests using the Page Object Model (POM). Authored by Inessa V. Krasnokutska and Oleksandr S. Krasnokutskyi from Yuriy Fedkovych Chernivtsi National University, the article delves into different strategies for organising tests with Cypress while utilising the POM design pattern.

The authors begin by introducing the problem of automating tests for a website, using the example of the saucedemo.com website. They emphasise the importance of covering positive and negative test cases, such as successful logins and unsuccessful login attempts resulting in error messages.

The article outlines nine distinct approaches to implementing the Page Object Model with Cypress. These approaches range from tests without POM to utilising POM with various techniques, such as selectors for elements, getters for error messages, and assessor properties. Each approach is discussed in detail, highlighting its advantages, disadvantages, and evolution from simpler to more refined implementations.

The article provides code snippets and examples to illustrate each approach, making it accessible for readers to understand and implement in their projects. The authors also provide insights into the rationale behind each approach, discussing factors such as code maintainability, readability, and adherence to best practices.
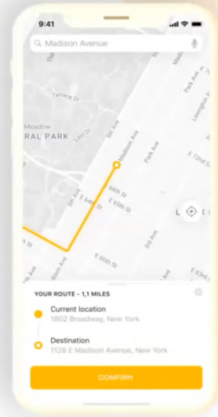
The article "Design and development of a game application for learning Python" by Oleksiuk et al. [7] explores the creation of a Python learning game application and presents the outcomes of meeting its objectives. The authors analyse various game-based learning experiences, establish application requirements, select Unity3D as the game engine, and describe their experience in developing the PythonLeaner game.

The article begins by discussing the significance of game-based learning in teaching programming. It highlights its benefits, such as increased engagement, active participation, hands-on learning, and simulation of real-life scenarios. It then outlines the research objectives, including analysing experiences, describing application requirements, selecting development tools, and analysing key development points.
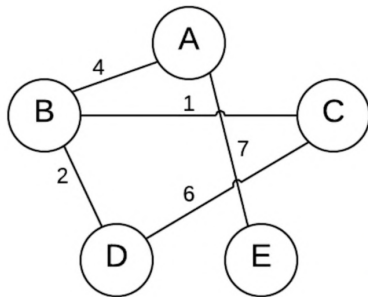
Figure 6: Presentation of paper [9].

The model of the game application for learning Python is described, emphasising the incorporation of educational objectives, game mechanics, hands-on learning, individualised progression, and reporting of learning outcomes. The game model includes modes such as New Game, Continue, Shop, and Exit, emphasising individualised progression through levels.

A comparison of game engines Unity3D, Unreal Engine, and CryEngine is provided, high-
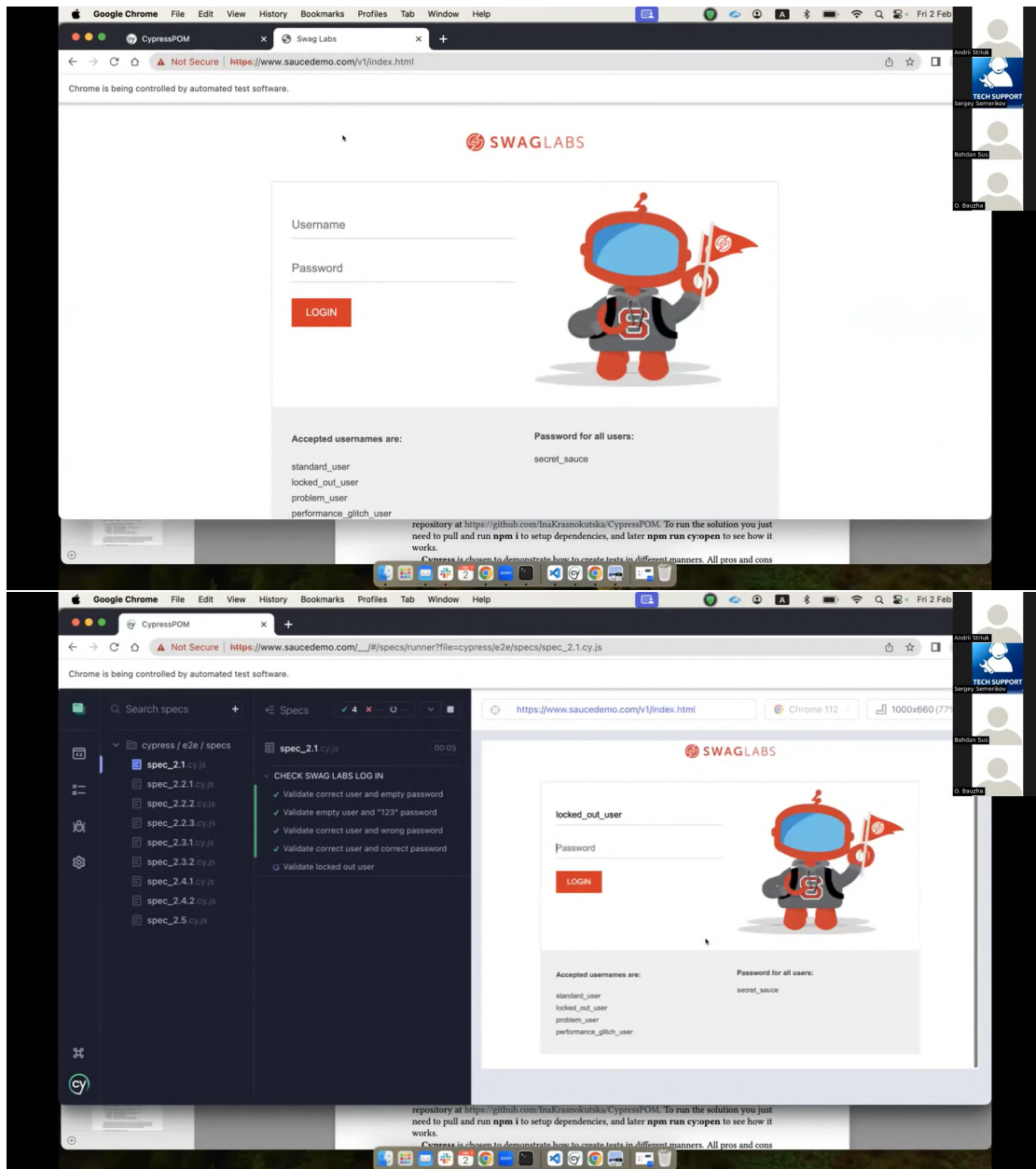
Figure 7: Presentation of paper [11].

lighting Unity3D as the chosen platform for its ease of learning, compatibility, multi-platform support, and active community. The article then analyses key development points, including scene design, script creation, Firebase integration for data storage, and implementation of game features such as animations, user input delay, and task types.

The conclusion summarises the achieved objectives, emphasising the analysis of experiences,
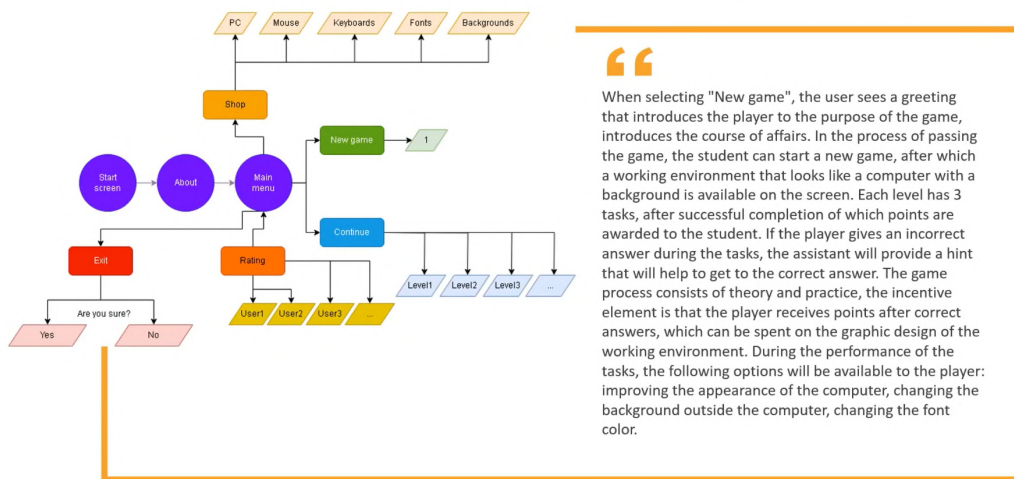
Figure 8: Presentation of paper [7].

the establishment of application requirements, the selection of Unity3D as the game engine, and the description of crucial development points. It also outlines prospects for research, including multiplayer integration, code interpretation, artificial intelligence, and mobile application development.

5.2. Theoretical computer science

The article "Application of Daubechies wavelet analysis in problems of acoustic detection of UAVs" [18] provides an in-depth exploration of the utilisation of Daubechies wavelet analysis for acoustic signal processing in the context of detecting unmanned aerial vehicles (UAVs). Authored by Oleksandr Yu. Lavrynenko et al. from the National Aviation University in Ukraine, the study

addresses the significance of acoustic surveillance in UAV detection. It proposes Daubechies wavelet analysis as a promising method for identifying characteristic features of UAVs' acoustic radiation. The article offers a thorough exploration of Daubechies wavelet analysis in the context of acoustic UAV detection, providing theoretical foundations and practical insights into the application of this method. It bridges the gap between theoretical wavelet analysis and its implementation in real-world problems, making it a valuable resource for researchers and practitioners in signal processing and UAV detection.

The article "Data processing method for multimodal distribution parameters estimation" by Solomentsev et al. [15] describes the synthesis and analysis of a method for processing data to estimate the parameters of multimodal distributions. The proposed approach combines the method of moments and the method of quantiles. The method allows for estimating the parameters of the probability density function even without prior information about the distribution type, which is essential in practical applications, especially in telecommunications and radio engineering.

The key steps of the method include dividing the sample population into subsets corresponding to positive and negative regions, selecting appropriate thresholds based on the distribution characteristics, and employing a combination of moment-based and quantile-based estimation techniques to estimate the parameters of interest. The approach is illustrated with a specific example of the trimodal probability density function, which includes chaotic impulse noise of positive and negative polarity.

The proposed method offers a practical solution for estimating distribution parameters in scenarios where the distribution type is unknown or complex. Future research could explore further refinements and extensions of the method and its application in various real-world data processing tasks.

The article "Application of artificial intelligence in digital marketing" [19] provides a comprehensive analysis of how artificial intelligence (AI) can be utilised to optimise digital marketing strategies for companies. Authored by Ihor V. Ponomarenko, Volodymyr M. Pavlenko, Oksana B. Morhulets, Dmytro V. Ponomarenko, and Nataliia M. Ukhnal, the paper explores various aspects of AI integration into digital marketing tools, emphasising its role in enhancing user engagement, personalisation, content generation, customer support, sentiment analysis, and more.

The authors begin by highlighting the significance of digitisation processes in reshaping consumer behaviour and increasing dependence on innovative technologies. They argue that AI catalyses qualitative transformations in digital marketing, enabling companies to leverage vast amounts of data generated online for strategic decision-making. Through a methodological approach grounded in scientific analysis, the paper outlines the primary sources of information utilised in AI applications for digital marketing, including data from company websites, social media, public sources, and web scraping.

Furthermore, the article delves into the models and methods employed in AI-driven digital marketing, emphasising the importance of data analysis, content personalisation, and customer interaction channels. It discusses the role of machine learning algorithms in processing big data, segmenting target audiences, generating personalised content, and enhancing customer support services. The authors also highlight the significance of sentiment analysis in gauging user attitudes and adjusting marketing strategies accordingly.
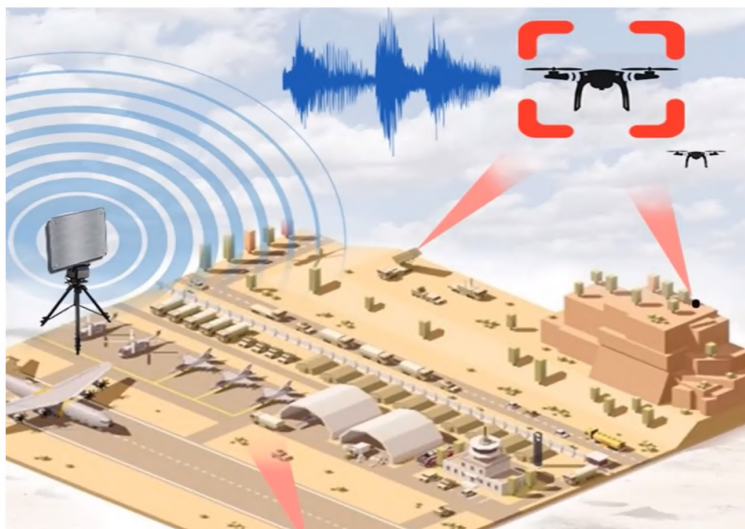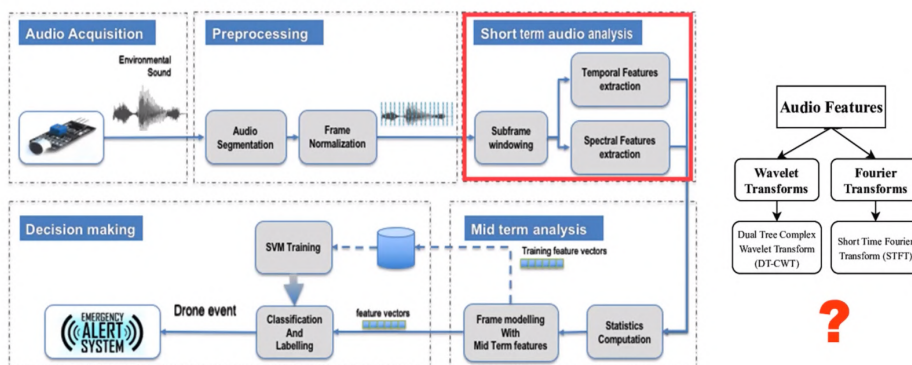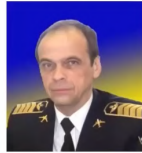
Figure 9: Presentation of paper [18].

In addition to providing insights into current practices, the article identifies future research directions in AI-driven digital marketing. It emphasises the need for ongoing development of machine learning algorithms, specialised programming languages, and innovative methodological approaches to optimise marketing strategies further and enhance user experiences.
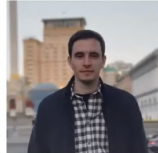
Figure 10: Presentation of paper [15].

5.3. Computer systems

The article "Modern methods of energy consumption optimisation in FPGA-based heterogeneous HPC systems" [16] provides a comprehensive investigation into optimising energy efficiency in heterogeneous High-Performance Computing (HPC) systems, with a focus on integrating Field-Programmable Gate Arrays (FPGAs) into existing architectures. The authors, Oleksandr V. Hryshchuk and Sergiy P. Zagorodnyuk from Taras Shevchenko National University of Kyiv, Ukraine, delve into the parametrisation, modelling, and optimisation techniques necessary for sustainable HPC practices.

The article begins by outlining the growing concern over the escalating energy consumption of HPC systems, highlighting the need for effective optimisation strategies to address sustainability and operational costs. It characterises the heterogeneity within modern HPC environments, incorporating diverse hardware components such as CPUs, GPUs, FPGAs, and accelerators.

The research delves into modelling techniques, leveraging heuristic methods and statistical approaches to construct accurate predictive models for energy consumption. Additionally,

Figure 11: Presentation of paper [19].

integrating dynamic power management strategies, such as Dynamic Voltage and Frequency Scaling (DVFS) and task scheduling, is explored to optimise energy usage without compromising performance.

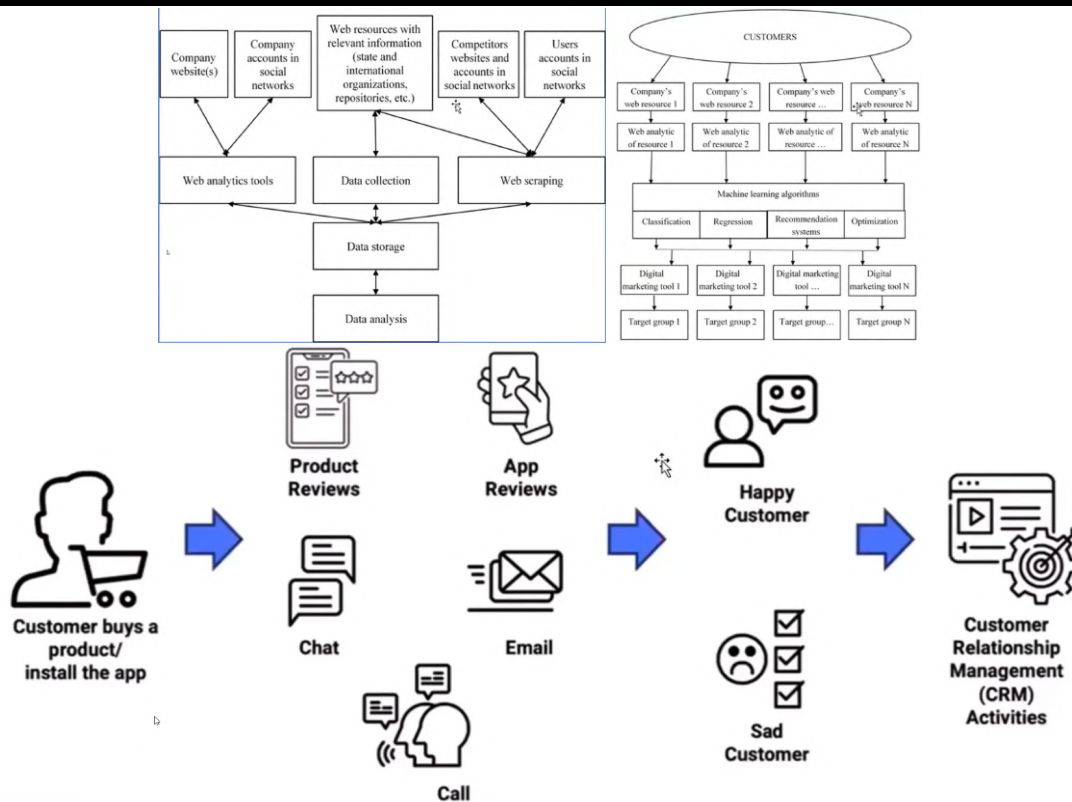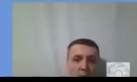The authors provide a theoretical framework for energy optimisation in heterogeneous HPC systems, discussing optimisation problem definitions for task scheduling and outlining optimisation criteria. They compare cluster architectures, focusing on homogeneous Massive Parallel Processor (MPP) systems and heterogeneous systems combining CPUs, GPUs, and FPGAs. The article highlights the emerging field of FPGA-based HPC systems and identifies a research gap in energy optimisation for these systems.

In conclusion, the article emphasises the need for further research and development of energy optimisation techniques tailored to FPGA-based heterogeneous HPC systems. It suggests that future work should amplify existing methods, including heuristic solutions for power consumption planning in FPGA-coupled architectures.

The article "Conference platform metadata and functions: existing platforms analysis and ontology-based approach" by Shapovalov and Shapovalov [17] provides a comprehensive analysis of existing conference management platforms and proposes an ontology-based approach to enhance the structure and functionality of such systems. The review begins by highlighting the rise of predatory conferences and the need for robust platforms to ensure the quality and integrity of scholarly events.

The authors analyse six well-known conference platforms, categorising them into informational-oriented and process-oriented systems. Each platform is detailed, emphasising its unique features and focus areas. The authors identify standard fields and functionalities across these platforms through data collection and processing, revealing insights into user priorities and platform capabilities.

Key findings include the prevalence of search functionality as the most critical feature, followed by peer reviewing, registration, submission, and publication of conference materials. Additionally, identifiers such as DOI and subject-specific databases like DBLP are highlighted for their role in the accurate cataloguing and citation of academic work.

The article proposes an ontology-based approach to organise conference data, leveraging systems like CIT Polyhedron to provide flexible data structures. This approach is a solution to counteract predatory conferences by promoting healthy competition and ensuring structured data entry.

5.4. Computer applications

The article "Dynamic system analysis using telemetry" by Talaver and Vakaliuk [21] provides a comprehensive exploration of dynamic system analysis using telemetry, focusing on detecting harmful architectural practices and anomalous events in distributed information systems. It begins by highlighting the increasing complexity introduced by distributed architectures like microservices, necessitating advanced monitoring and analysis tools to ensure system performance and reliability.

The theoretical background section effectively contextualises the study within the evolution of system observability, particularly emphasising the role of telemetry in providing a holistic view of system behaviour. The discussion on the OpenTelemetry standard and its role in

Figure 12: Presentation of paper [16].

unifying telemetry collection and analysis is informative, highlighting its significance in modern monitoring practices.

The methods section details the approach, covering data collection, storage, and analysis. The choice of Neo4j as the graph database management system for storing system models is justified and the integration of telemetry data into the graph structure is well-explained. Additionally, the
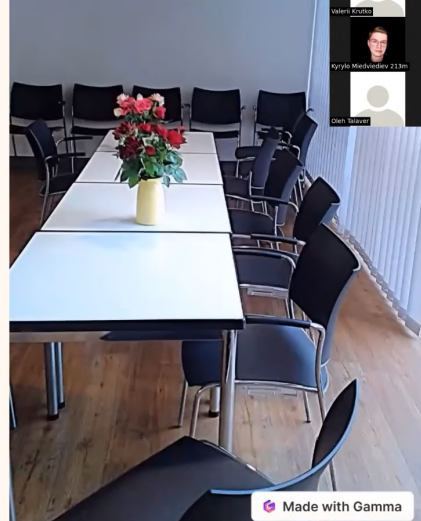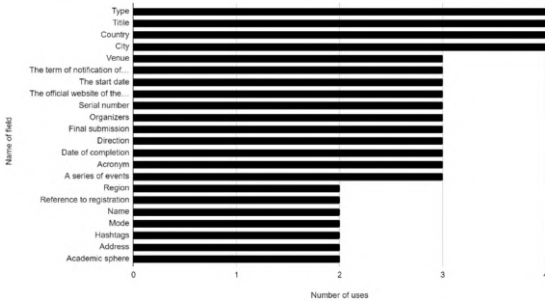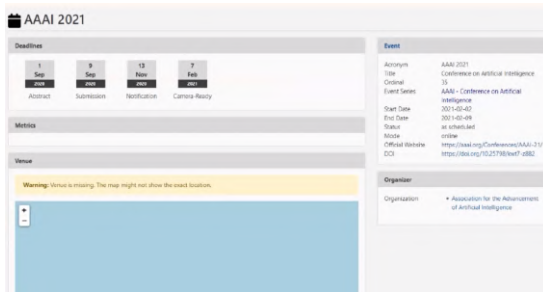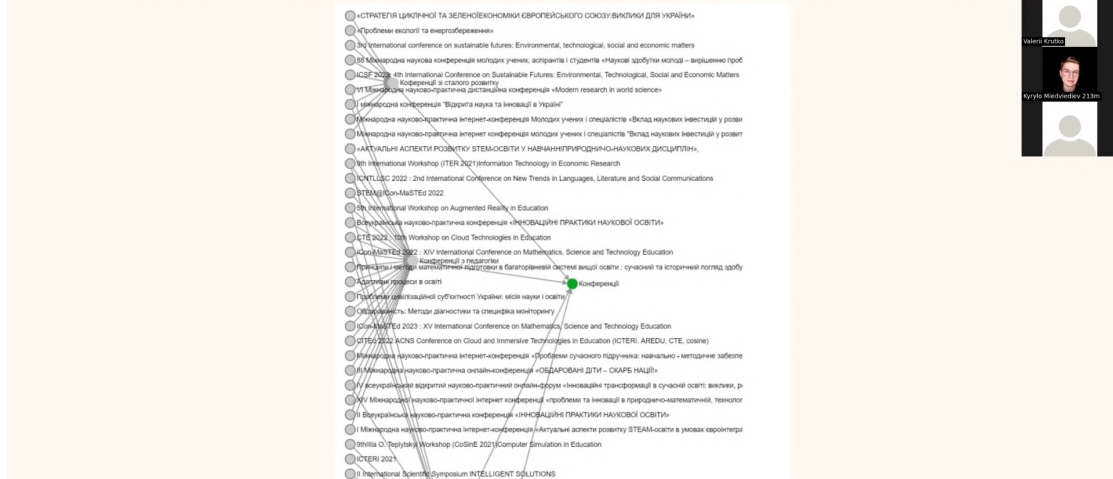
Figure 13: Presentation of paper [17].

explanation of anomaly detection using the PCA algorithm is clear and insightful, showcasing how statistical methods can be leveraged for identifying system irregularities.

Results are presented effectively through visualisations generated from the Neo4j database, demonstrating the practical application of the proposed methodology. Using Neo4j Bloom to visualise service dependencies and anomalies adds clarity to the analysis, making it easier to identify potential areas of improvement in system architecture.

The discussion section provides valuable insights into the advantages of dynamic analysis over static approaches and the potential for further development in telemetry-based analysis. The comparison with existing approaches, such as New Relic, highlights the strengths of the proposed method while acknowledging areas for future enhancement.

The article "Development of a modified genetic method for automatic university scheduling" by Fedorchenko et al. [22] from the National University "Zaporizhzhia Polytechnic" in Ukraine addresses the challenging task of optimising university class schedules, crucial for adequate time and resource management in higher education.

The authors propose a modified genetic algorithm for university scheduling, aiming to minimise conflicts and time intervals between classes while considering recommendations for time and place. The paper outlines the development of sequential and parallel methods for scheduling based on genetic search, incorporating adapted initialisation, crossover, and selection operators.

A comparative analysis between classical and modified genetic algorithms is presented, confirming the efficiency of the proposed approach. The modified algorithm is also compared with different operators and parameters to determine optimal conditions. The results demonstrate effective methods for improving schedule quality and optimising the educational process.

The article provides a detailed literature review, problem statement, and mathematical model development for university scheduling optimisation. It describes the software implementation of the proposed modification and conducts experiments to evaluate its performance.

The article "Predictive machine learning of soybean oil epoxidising reactions using artificial neural networks" by Sus et al. [20] presents an innovative approach to optimising the epoxidation process of soybean oil through the utilisation of artificial neural networks (ANNs). The study employs experimental data to construct a training dataset for the ANN, which then facilitates the optimisation of epoxy curing reaction parameters, monitors its evolution, and refines the epoxy product synthesis process.

The authors discuss the broad applicability of neural networks across various scientific and technological domains, highlighting their importance in predicting outcomes, selecting optimal conditions, and assessing quantities in chemical and biological processes. They emphasise the significance of green chemistry and the growing importance of soybean oil epoxidation in various industrial applications.

The experimental setup involves the epoxidation of soybean oil using a specific hydrogen peroxide system, acetic anhydride, and a catalyst. The study explores various parameters such as concentration of reactants, catalyst amount, temperature, and reaction time. A neural network model is then trained using this experimental data to predict the outcomes of the epoxidation process.

Results indicate that the neural network accurately predicts the epoxy and iodine numbers, crucial indicators of the quality of epoxidised oils, based on the input parameters. The authors
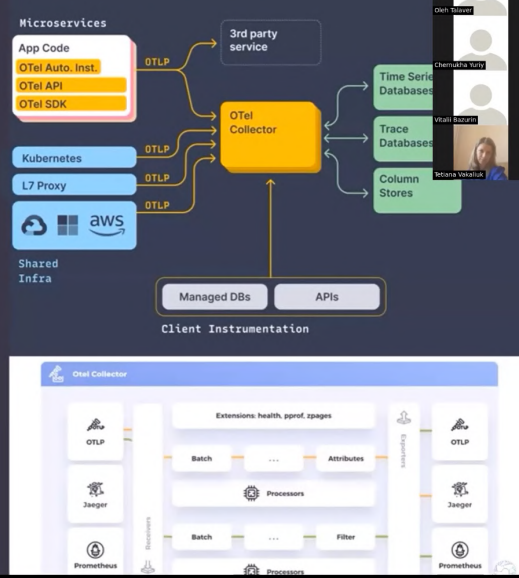
Figure 14: Presentation of paper [21].

demonstrate the network's ability to interpolate experimental data to generate comprehensive dependency graphs, even beyond the scope of available experimental data.

Moreover, the study identifies optimal conditions for maximising the epoxy number and minimising the iodine number during the epoxidation process, showcasing the practical utility of the neural network in process optimisation.

In conclusion, the article presents a robust methodology for optimising soybean oil epoxida-

Figure 15: Presentation of paper [22].

tion using predictive machine learning, offering insights into reaction parameters and paving the way for further advancements in the field. The approach holds promise for soybean oil and other vegetable oils, expanding its applicability across various industrial processes. Overall, the article provides valuable contributions to both the fields of chemical engineering and machine learning.
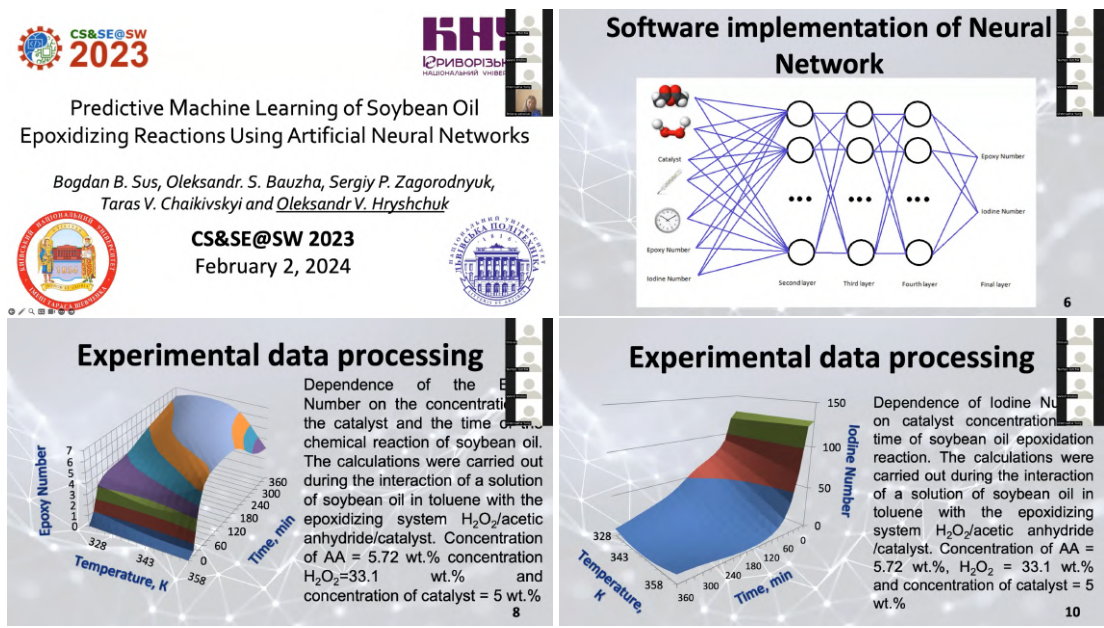
Figure 16: Presentation of paper [20].

The article "Software development of thermal resistance calculator for thermal insulation parameters determines dielectric building structures" by Bazurin et al. [10] presents a detailed review of the software development of a thermal resistance calculator named "ThermoResist" for determining the parameters of thermal insulation in dielectric building structures. The calculator is designed to calculate thermal resistance according to the State Building Regulations of Ukraine, assuming that the contributions of different thermal resistance mechanisms are additive.

The authors provide an in-depth discussion of the computational method involved, which includes formulas and theoretical background related to thermal conductivity and thermal resistance in dielectric materials. They emphasise the importance of accurate prediction of thermal conductivity in construction, particularly in rebuilding efforts post-war in Ukraine. The article also compares existing thermal resistance calculators and identifies their limitations, leading to the development of a specialised tool like "ThermoResist".

The functionalities of "ThermoResist" are described in detail, including modules for calculating the thermal resistance of walls, windows, attic floors, and roof overlaps. The calculator's interface is intuitive, allowing users to easily input relevant data and obtain thermal resistance calculations. The article also provides a class diagram of the program's structure and discusses the choice of programming language (C♯) and development environment (Microsoft Visual Studio 2022).

In conclusion, the authors highlight the significance of digitalisation in society and the importance of tools like "ThermoResist" in the construction industry. They emphasise that the calculator adheres to State Building Regulations and can be beneficial for both educational purposes and practical applications by civil engineers.

Figure 17: Presentation of paper [10].

The article "Using the Three.js library to develop remote physical laboratory to investigate diffraction" [12] presents a detailed examination of the process involved in designing and developing a virtual physics laboratory focused on studying the diffraction effect. Authored by Pavlo I. Chopyk, Vasyl P. Oleksiuk, and Oleksandr P. Chukhrai from Ternopil Volodymyr Hnatiuk National Pedagogical University in Ukraine, the article addresses the requirements,

framework selection, design, and implementation of the virtual laboratory.

The authors begin by outlining the importance of laboratory experiments in physics education, highlighting their role in facilitating understanding, skill development, and critical thinking. They also acknowledge the increasing prevalence of remote training and the need for virtual laboratories to supplement traditional methods, mainly when practical experience is limited or hazardous.

The article systematically discusses the criteria for selecting the appropriate development tools, focusing on 3D graphics libraries. After conducting a comparative analysis, the authors choose the Three.js library for its performance, ease of use, flexibility, feature set, and compatibility. They then describe the stages of designing and developing the virtual laboratory, including formulating the physical problem, selecting tools, creating the laboratory model, and implementing and testing.

Detailed explanations accompanied by code snippets illustrate the creation of the virtual laboratory components, such as scene objects, lighting, cameras, and interactive controls. The authors emphasise the importance of accurately simulating the diffraction phenomenon and providing students with tools for measurement and analysis, ensuring a realistic and educational experience.

The virtual laboratory developed using Three.js allows students to observe diffraction patterns, measure distances, and calculate wavelengths, mimicking real-world experimental setups. The article discusses integrating features such as dynamic screens, rulers, and colour filters, providing students with a comprehensive learning environment.

Finally, the authors compare the results obtained from the virtual laboratory with those from natural experiments, demonstrating the accuracy and effectiveness of the virtual simulation. They also acknowledge limitations such as hardware requirements and outline future research directions, including collaboration features and integration with learning management systems.

6. CS&SE@SW 2023: Conclusion and outlook

The 6th Workshop for Young Scientists in Computer Science & Software Engineering (CS&SE@SW 2023) has once again demonstrated its commitment to fostering the growth of emerging researchers and providing a platform for exchanging innovative ideas and early research findings. The diverse range of papers presented at this year's workshop showcases the breadth and depth of the research undertaken by young scientists, covering various topics within computer science and software engineering.

The vision of CS&SE@SW 2023 has been to create an expert environment where young researchers can present and discuss their cutting-edge work, receive valuable feedback from peers and experienced academics, and establish collaborations that transcend geographical boundaries. The workshop has proven to be a nurturing ground for developing research skills, critical thinking, and the dissemination of knowledge.

The proceedings of CS&SE@SW 2023 reflect the multifaceted nature of the challenges and opportunities that lie ahead in the rapidly evolving fields of computer science and software engineering. From exploring emerging technologies such as telemetry, graph theory, and machine learning for optimising distributed systems and detecting anomalies to investigating
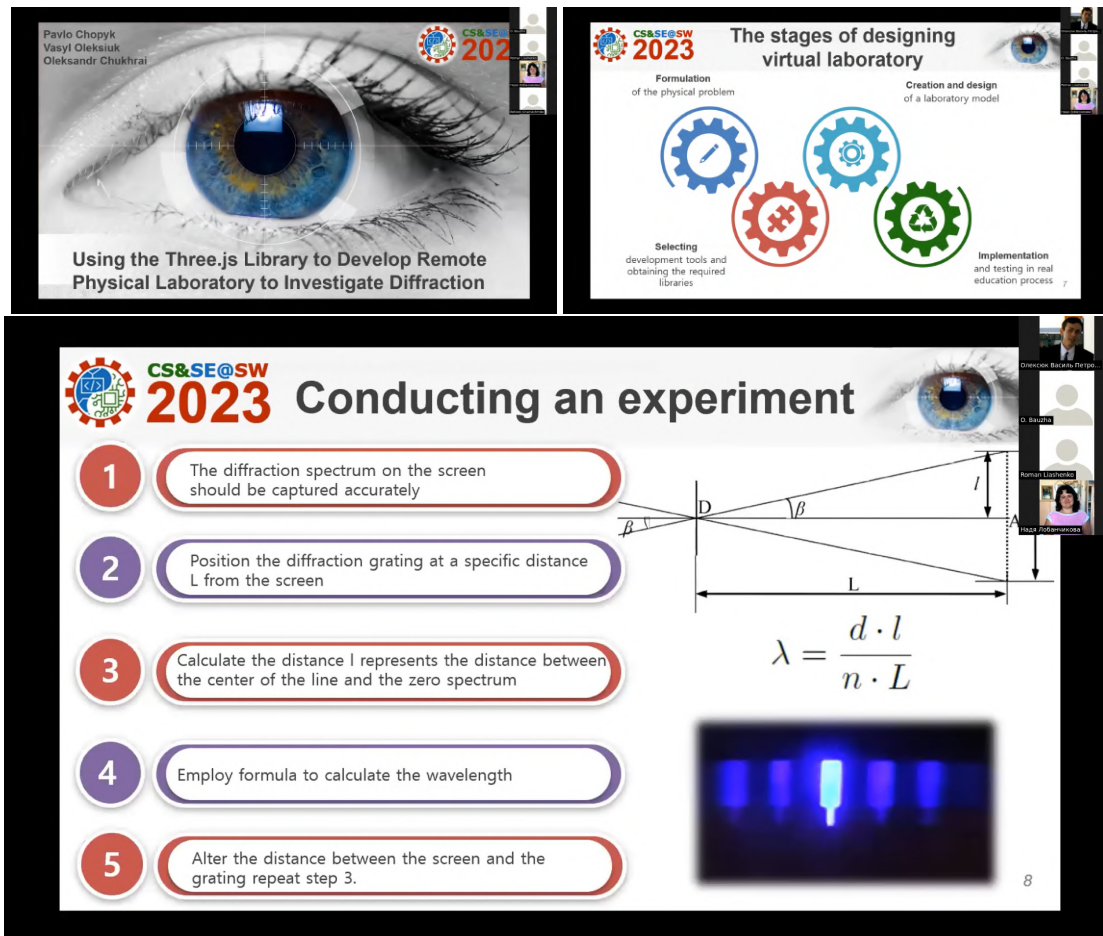
Figure 18: Presentation of paper [12].

acoustic surveillance techniques for UAV detection and employing genetic algorithms for university scheduling, the contributions showcased in this volume demonstrate the remarkable diversity and ingenuity of the research community.

Furthermore, the workshop has delved into software reliability assessment, user experience research in cross-platform application development, virtual physics laboratories, and Python learning game applications, underscoring the importance of interdisciplinary approaches and the fusion of theory and practice.

Looking ahead, CS&SE@SW 2023 has laid the foundation for future collaborations, fostering a spirit of curiosity, innovation, and critical inquiry among young scientists. The insights and findings presented during the workshop will undoubtedly catalyse further exploration, igniting new avenues of research and propelling the fields of computer science and software engineering towards new horizons.

As we conclude this successful edition of the workshop, we extend our gratitude to all the authors, delegates, program committee members, and peer reviewers who have contributed

to its success. Their invaluable efforts and commitment have ensured the high quality and relevance of the presented work, further elevating the standards of academic excellence.

We look forward to the next instalment of CS&SE@SW, scheduled for December 20, 2024, in Kryvyi Rih, Ukraine. This future gathering promises to be an even more enriching and thought-provoking experience, where emerging talents will converge to share their latest discoveries, engage in stimulating discussions, and forge lasting connections that will shape the future of these dynamic and ever-evolving fields.

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