3rd Workshop for Young Scientists in Computer Science & Software Engineering

Arnold E. Kiv^a, Serhiy O. Semerikov^{b,c,d}, Vladimir N. Soloviev^{b,e} and Andrii M. Striuk^c

^{a}*Ben-Gurion University of the Negev, P.O.B. 653, Beer Sheva, 8410501, Israel*

^{a}*Kryvyi Rih State Pedagogical University, 54 Gagarin Ave., Kryvyi Rih, 50086, Ukraine*

^{b}*Kryvyi Rih National University, 11 Vitalii Matusevych Str., Kryvyi Rih, 50027, Ukraine*

^{c}*Institute of Information Technologies and Learning Tools of the NAES of Ukraine, 9 M. Berlynskoho Str., Kyiv, 04060, Ukraine*

^{e}*Bohdan Khmelnitsky National University of Cherkasy, 81 Shevchenko Blvd., Cherkasy, 18031, Ukraine*

Abstract

This is an introductory text to a collection of selected papers from the 3rd Workshop for Young Scientists in Computer Science & Software Engineering (CS&SE@SW 2020), which was held in Kryvyi Rih, Ukraine, on the November 27, 2020. It consists of short summaries of selected papers and some observations about the event and its future.

Keywords

computer science, software engineering, young scientists

1. CS&SE@SW 2020: 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 technologies.

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

- Computer Science (CS):
  - Theoretical computer science
    * Data structures and algorithms
    * Theory of computation
    * Information and coding theory

- - - * Programming language theory
      * Formal methods
    - Computer systems
      * Computer architecture and computer engineering
      * Computer performance analysis
      * Concurrent, parallel and distributed systems
      * Computer networks
      * Formal methods
      * Databases
    - Computer applications
      * Computer graphics and visualization
      * Human-computer interaction
      * Scientific computing
      * Artificial intelligence
- Software Engineering (SE):
  - Software requirements
  - Software design
  - Software construction
  - Software testing
  - Software maintenance
  - Software configuration management
  - Software engineering management
  - Software development process
  - Software engineering models and methods
  - Software quality
  - Software engineering professional practice
  - Software engineering economics
  - Computing foundations
  - Mathematical foundations
  - Engineering foundations

This volume represents the proceedings of the 3rd Workshop for Young Scientists in Computer Science & Software Engineering (CS&SE@SW 2020), held in Kryvyi Rih, Ukraine, on November 27, 2020. It comprises 9 contributed papers that were carefully peer-reviewed and selected from 15 submissions. Each submission was reviewed by at least 2, and on the average 2.7, program committee members. The accepted papers present the state-of-the-art overview of successful cases and provides guidelines for future research.

2. CS&SE@SW 2020 Program Committee

2.1. Core Program Committee

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- *Vladimir N. Soloviev*, Kryvyi Rih State Pedagogical University, Ukraine

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- *Nataliia Veretennikova*, Lviv Polytechnic National University, Ukraine

3. CS&SE@SW 2020 Article overview

Oleksii R. Rudkovskyi (figure 1) and Galina G. Kirichek in their article [3] implemented a method of organizing a distributed network to launch and support the work of applications. In the process of building the network model, different algorithms were used, at the same time
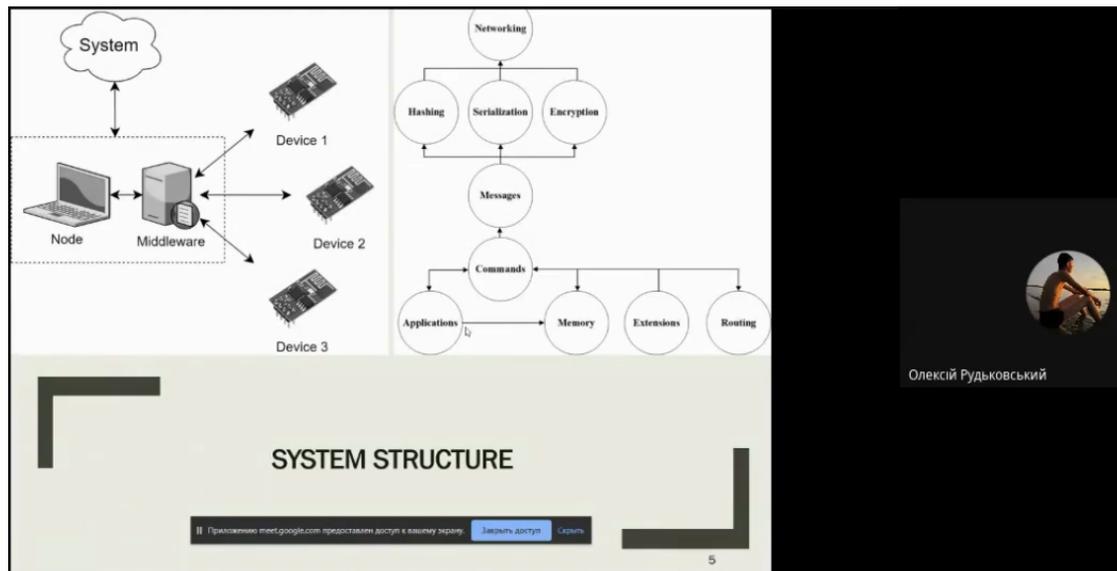
Figure 1: Presentation of paper [3]

encryption algorithms are used (Elliptic curve Diffie–Hellman and Advanced Encryption Standard), Secure Hash Algorithm 1 algorithms for hashing, onion routing algorithm and other. Transmission Control Protocol transport protocol is used to send data between nodes of the network. Methods and application for creating and launching other applications have been implemented in the Java language. Linux containers and Docker are used to isolate different applications running on the network. In this way, different applications written using different programming languages can run without affecting other running applications and client's operation system. Application's data is stored on the network distributed with and without encryption.

Vladimir N. Soloviev, Andrii O. Bielinskyi (figure 2) and Natalia A. Kharadzjan in the article [4] demonstrate the possibility of constructing indicators of critical and crash phenomena on the example of Bitcoin market crashes for further demonstration of their efficiency on the crash that is related to the coronavirus pandemic. For this purpose, the methods of the theory of complex systems have been used. Since the theory of complex systems has quite an extensive toolkit for exploring the nonlinear complex system, authors take a look at the application of the concept of entropy in finance and use this concept to construct 6 effective entropy measures: Shannon entropy, Approximate entropy, Permutation entropy, and 3 Recurrence based entropies. Authors provide computational results that prove that these indicators could have been used to identify the beginning of the crash and predict the future course of events associated with the current pandemic.

Reducing costs is an important part in todays buisness. Therefore manufacturers try to reduce unnecessary work processes and storage costs. Machine maintenance is a big, complex, regular process. In addition, the spare parts required for this must be kept in stock until a machine fails. In order to avoid a production breakdown in the event of an unexpected failure,

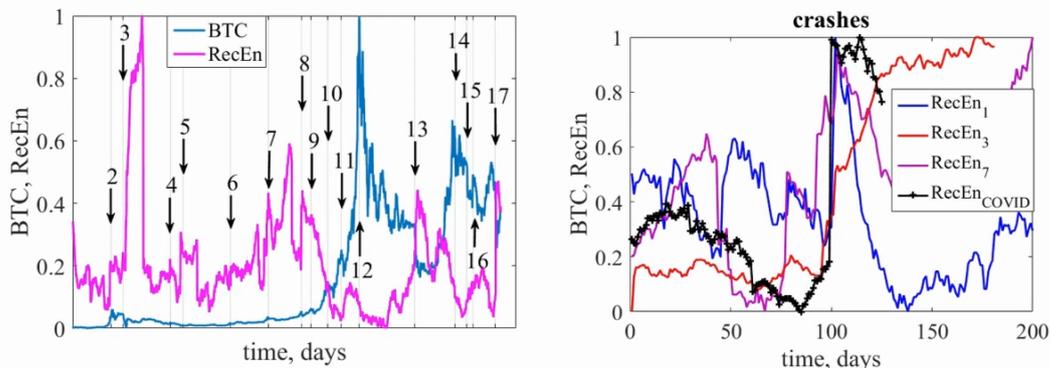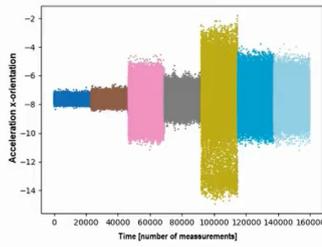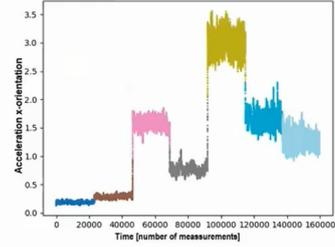# Recurrence entropy (Microstates) (Empirical results)

Figure 2: Presentation of paper [4]

Figure 3: Presentation of paper [5]

more and more manufacturers rely on predictive maintenance for their machines. This enables more precise planning of necessary maintenance and repair work, as well as a precise ordering of the spare parts required for this. A large amount of past as well as current information is required to create such a predictive forecast about machines. With the classification of motors based on vibration, the paper [5] of Christoph Kammerer (figure 3), Micha Küstner, Michael Gaust, Pascal Starke, Roman Radtke and Alexander Jesser deals with the implementation of predictive maintenance for thermal systems. There is an overview of suitable sensors and data processing methods, as well as various classification algorithms. In the end, the best sensor-algorithm combinations are shown.
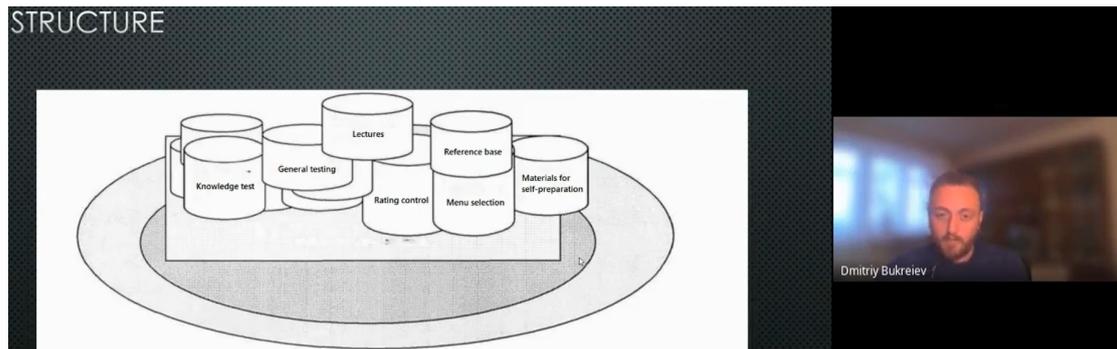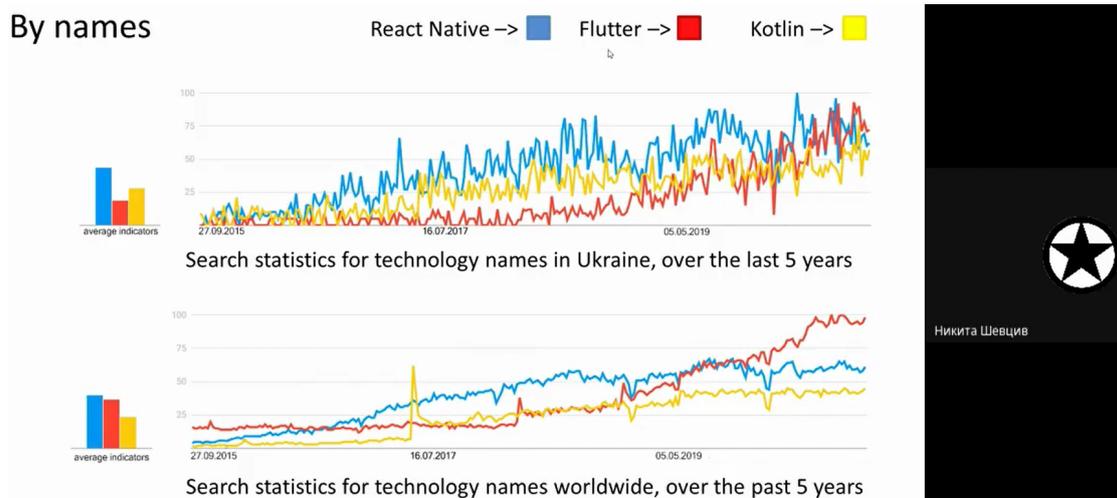
Figure 4: Presentation of paper [6]

Figure 5: Presentation of paper [7]

The paper [6] of Dmitriy Bukreiev (figure 4), Pavlo Chornyi, Evgeniy Kupchak and Andrey Sender reveals the problematic features of developing an automated system for teaching students. The authors emphasize the need to study the specialized needs of the system before the development process and conduct an in-depth analysis of the needs of the modern educational process in order to identify the needs of the future product. In this paper authors develop a model of knowledge representation in the system and reveal the features of the mathematical apparatus for calculating and automating the processes of obtaining and evaluating students knowledge.

The paper [7] of Nikita A. Shevtsiv (figure 5) and Andrii M. Striuk analyzes the advantages and disadvantages of cross-platform and native mobile application development. The conditions are highlighted in which native and cross-platform development reveal their advantages. These conditions include the project size, work comfort, popularity, relevance. It was concluded that a beginner developer should start learning from native development, and then try cross- platform.

Tracking SDK related to WebGL trios

Babylon AR = Babylon.js + OpenCV: QR-codes at WebXR devices
JSARToolKit = ARToolKit + Three.js: bar codes, NFT markers
AR.js = AFrame + JSARToolKit: all in one

```
<a-scene embedded arjs>
 <a-marker preset="hiro">
  <a-box></a-box>
 </a-marker>
 <a-entity camera></a-entity>
</a-scene>
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Figure 6: Presentation of paper [8]

Web augmented reality (WebAR) development tools aimed at improving the visual aspects of learning are far from being visual and available themselves. This causing problems of selecting and testing WebAR development tools for CS undergraduates mastering in web-design basics. The article [8] of Dmytro S. Shepiliev, Yevhenii O. Modlo, Yuliia V. Yechkalo, Viktoriia V. Tkachuk, Mykhailo M. Mintii, Iryna S. Mintii, Oksana M. Markova, Tetiana V. Selivanova, Olena M. Drashko, Olga O. Kalinichenko, Tetiana A. Vakaliuk, Viacheslav V. Osadchyi and Serhiy O. Semerikov (figure 6) is aimed at conducting comparative analysis of WebAR tools to select those appropriated for beginners.

Machine learning is now widely used almost everywhere, primarily for forecasting. The main idea of the article [9] of Pavlo V. Zahorodko, Yevhenii O. Modlo, Olga O. Kalinichenko, Tetiana V. Selivanova and Serhiy O. Semerikov (figure 7) is to identify the possibility of achieving a quantum advantage when solving machine learning problems on a quantum computer.

The paper [10] of Bohdan V. Hrebeniuk (figure 8) and Olena H. Rybalchenko analyzes the existing platforms for conducting programming contests. Possible approaches are analyzed for creating isolated environments and running participants' solutions, advantages and disadvantages of both approaches are highlighted. Requirements for the user interface are defined that must provide quick and convenient work in the system; the system was planned and developed. It was concluded that designed system has a potential for conducting contests and further development.

The paper [11] of Mykola V. Klymenko (figure 9) and Andrii M. Struik considers the typical technical features of GPS-tracking systems and their development, as well as an analysis of existing solutions to the problem. Mathematical models for the operation of hardware and software of this complex have been created. An adaptive user interface has been developed that allows you to use this complex from a smartphone or personal computer. Methods for

Criteria	Indicators
It arises from scientific curiosity about the foundation, the nature or the limits of a scientific discipline	Quantum computation has broadened the fundamental limits of computer science and software engineering
The ability to create new engineering solutions	The physical infrastructure is constantly evolving, each solution is new
Technological continuity	The existence of high level languages and development techniques that can be used by computer scientists and software engineers with only the same style of training they receive today (so, no need to teach the fundamentals of quantum mechanics to all)
Research community support	Support for all interested in new computing paradigms and new levels of computing power
International character of research	This is a new fundamental area of software engineering
It is generally comprehensible, and captures the imagination of the general public, as well as the esteem of scientists in other disciplines	It is not generally understood, but is known for its worldwide interpretation
The problem has a long-standing statement, but has not yet been resolved	Formulated by Richard Feynman in the late 1970s.
It promises to go beyond what is initially possible, and requires development of understanding, techniques and tools unknown at the start of the project	Problems exist on every level, from developing a whole new conceptual paradigm, to building intellectual and simulation tools
It calls for planned co-operation among identified research teams and communities	Research is needed in a number of areas (languages, algorithms, tools, simulation, visualisation, etc.)
It encourages and benefits from competition among individuals and teams, with clear criteria on who is winning, or who has won	There need not be a single "winner", diversity of solutions should be encouraged, as in classical software engineering, to be applicable to a range of application domains
It decomposes into identified intermediate research goals, whose achievement brings scientific or economic benefit, even if the project as a whole fails	There are several components of the problem that can be explored in parallel
It will lead to radical paradigm shift	Quantum computing is a radical paradigm shift

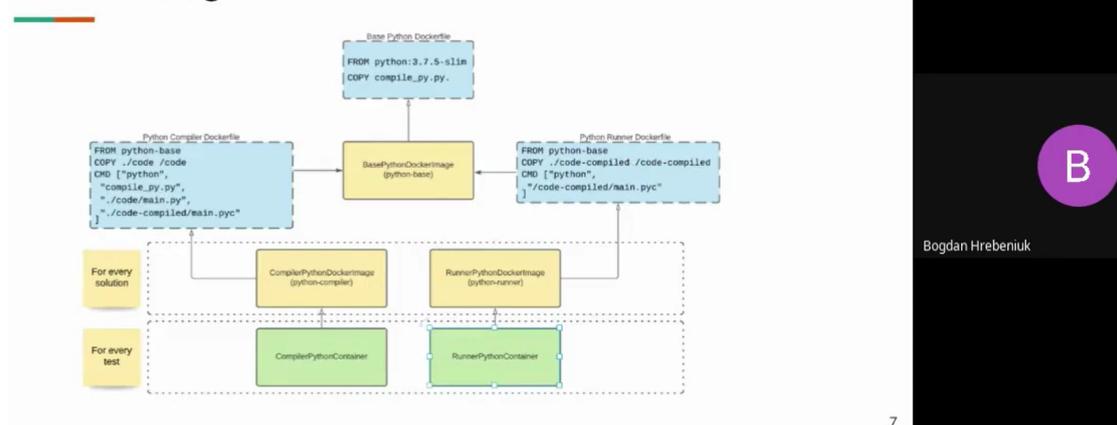**Figure 7:** Presentation of paper [9]

Docker usage

Figure 8: Presentation of paper [10]

displaying the distance traveled by a moving object on an electronic map have been developed. Atmega162-16PU microcontroller software for GSM module and GPS receiver control has been developed. A method of data transfer from a GPS tracker to a web server has been developed. Two valid experimental samples of GPS-trackers were made and tested in uncertain conditions. The GPS-tracking software and hardware can be used to monitor the movement of moving objects that are within the coverage of GSM cellular networks.
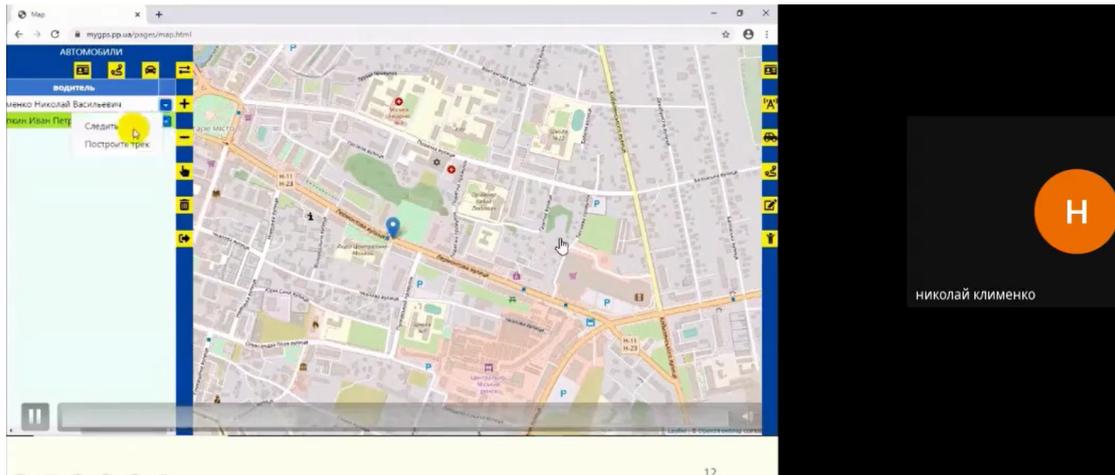
Figure 9: Presentation of paper [11]

4. CS&SE@SW 2020: Conclusion and outlook

The vision of the CS&SE@SW 2020 is provides an expert environment for young researchers, who are at the beginning of their career, to present and discuss the most recent of ideas and early results of research projects. Young researchers, who will join us to take part in discussions and/or present their papers, will be offered an opportunity to exchange and discuss their research ideas with their peers, supervisors, and senior scientists working in the fields that are within the scope of CS&SE@SW.

The third instalment of CS&SE@SW was organised by Kryvyi Rih National University, Ukraine (with support of the rector Mykola I. Stupnik) in collaboration with Kryvyi Rih State Pedagogical University, Ukraine (with support of the rector Yaroslav V. Shramko), Institute of Information Technologies and Learning Tools of the NAES of Ukraine (with support of the director Valeriy Yu. Bykov) and Ben-Gurion University of the Negev, Israel (with support of the rector Chaim J. Hames).

We are thankful to all the authors who submitted papers and the delegates for their participation and their interest in CS&SE@SW as a platform to share their ideas and innovation. Also, we are also thankful to all the program committee members for providing continuous guidance and efforts taken by peer reviewers contributed to improve the quality of papers provided constructive critical comments, improvements and corrections to the authors are gratefully appreciated for their contribution to the success of the workshop.

We hope you enjoy this workshop and meet again in more friendly, hilarious, and happiness of further CS&SE@SW 2021 at Kryvyi Rih, Ukraine on November 26, 2021.

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