

**Lucian Blaga University of Sibiu, Romania**  
**Faculty of Sciences**  
**Research Center in Informatics and Information Technology**

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# **ICDD 2021**

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**5<sup>th</sup> International Conference on Applied Informatics**  
**Imagination, Creativity, Design, Development**

**Volume of Abstracts and Program**

**November 4-6, 2021**

**Sibiu, Romania**

**Lucian Blaga University**

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**Fifth International Conference on Applied Informatics**  
**Imagination, Creativity, Design, Development**  
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**5<sup>th</sup> International Conference on Applied Informatics**

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**Editor: Assist. Cristina Răulea**

## **Motto:**

*“There are no limits, only your imagination”*

## **TOPICS**

- Algorithms and data structures
- Graph theory and applications
- Formal languages and compilers
- Cryptography
- Modeling and simulation
- Computer programming
- Computer vision
- Computer graphics
- Game design
- Data mining
- Distributed computing
- Artificial Intelligence
- Service oriented applications
- Networking
- Grid computing
- Mobile operating systems
- Scientific computing

- Software engineering
- Bioinformatics
- Robotics
- Computer Architecture
- Evolutionary Computing
- Multimedia Systems
- Internet Communication and Technologies
- Web Applications

## **OBJECTIVES**

The conference is mainly addressed to young researchers from all over the world. The conference gives the participants the opportunity to discuss and present their research on informatics and related fields (like computational algebra, numerical calculus, bioinformatics, etc.). The conference welcomes submissions of original papers on all aspects of informatics and related fields ranging from new concepts and theoretical developments to advanced technologies and innovative applications. Paper acceptance and publication will be judged on the basis of their relevance to the conference topics, clarity of presentation, originality and accuracy of the results and proposed solutions. The presentation has to include also a practical application. The conference will include regular presentations (20 min.), short IT Companies presentations and a session of multimedia posters.

## CONFERENCE COMMITTEES

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**Organized by:**

Research Center in Informatics and Information Technology

Department of Mathematics and Informatics

Faculty of Sciences

Lucian Blaga University of Sibiu

**Chair of the conference**

Prof. Dr. Dana Simian

Director of the Research Center in Informatics and Information Technology

Faculty of Sciences

Lucian Blaga University of Sibiu, Romania

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## **OFFICIAL LANGUAGE**

The official language of the conference is English.

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**Keep Calling**



**Nagarro**

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**NTT Data**



**PAN FOOD**



**Omeron Technologies, Romania**



**ProIT**



**ROPARDO**



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**VISMA**

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**P R O G R A M**

**THURSDAY, November 04, 2021**

*International Conference on Applied Informatics – ICDD 2021*

organized by

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$9^{30} - 10^{00}$	<b>Opening ceremony</b>
$10^{00} - 10^{20}$	<b>IT Company Scientific Presentation</b> <i>Steps for development a detector (prototype) for aortic disease,</i> <b>Gabriela Candea</b> , ROPARDO, Romania
$10^{20} - 10^{30}$	<b>Coffee break</b>
$10^{30} - 11^{30}$	<b>Papers presentation. Session chair Milan Tuba</b>
$10^{30} - 10^{50}$	<ul style="list-style-type: none"> <li>• <i>System of modeling the spreading of infectious diseases,</i> <b>Yulian Kuryliak</b>, Lviv Politechnic National University, Ukraine</li> </ul>
$10^{50} - 11^{10}$	<ul style="list-style-type: none"> <li>• <i>Smart Parking System,</i> <b>Rares Tamaian, Sergiu Topan</b>, Technical University of Cluj-Napoca - North University Center Baia Mare, Romania</li> </ul>
$11^{10} - 11^{30}$	<ul style="list-style-type: none"> <li>• <i>Design and Implementation of a Node.js Framework for the Development of RESTful APIs,</i> <b>Matthias Keckl</b>, University of Applied Sciences Würzburg-Schweinfurt, Germany</li> </ul>
$11^{30} - 11^{50}$	<b>Coffee break</b>
$11^{50} - 13^{10}$	<b>Papers presentation. Session chair Daniel Hunyadi</b>
$11^{50} - 12^{10}$	<ul style="list-style-type: none"> <li>• <i>Decentralized open-source cryptocurrency portfolio tracking hybrid application,</i> <b>Adoris-Elian Doran</b>, Lucian Blaga University of Sibiu, Romania</li> </ul>
$12^{10} - 12^{30}$	<ul style="list-style-type: none"> <li>• <i>Digitization in medical teaching,</i> <b>Susanna Götz</b>, University of Applied Sciences Würzburg-Schweinfurt, Germany</li> </ul>
$12^{30} - 12^{50}$	<ul style="list-style-type: none"> <li>• <i>A comparative study of growing microgreens. Human supervision VS Agritech/Automation,</i> <b>Felix Husac</b>, Lucian Blaga University of Sibiu, Romania</li> </ul>
$12^{50} - 13^{10}$	<ul style="list-style-type: none"> <li>• <i>IoTHub for smart devices management,</i> <b>Cristian-Valentin</b></li> </ul>

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	<b>Alexandru</b> , University of Bucharest, Romania
<b>13<sup>10</sup> – 14<sup>30</sup></b>	<b>Lunch break</b>
<b>14<sup>30</sup> – 15<sup>30</sup></b>	<b>Papers presentation. Session chair Nicolae Constantinescu</b>
14 <sup>30</sup> – 14 <sup>50</sup>	• <i>Kiosk web application - integrated multimedia information system</i> , <b>Martin Dzhurov</b> , University of Rousse “Angel Kanchev”, Bulgaria
14 <sup>50</sup> – 15 <sup>10</sup>	• <i>An analysis of primary and secondary constraints used in the automated university timetabling</i> , <b>Gabriel Marius Tcaciuc</b> , Petroleum-Gas University of Ploiesti, Romania
15 <sup>10</sup> – 15 <sup>30</sup>	• <i>Improving the overall user experience for applications generating traffic mix over 4G networks</i> , <b>Vasile Horia Muntean</b> , Lucian Blaga University of Sibiu, Romania
<b>15<sup>30</sup> – 15<sup>50</sup></b>	<b>Coffee break</b>
<b>15<sup>50</sup> – 17<sup>10</sup></b>	<b>Papers presentation. Session chair Dana Simian</b>
15 <sup>50</sup> – 16 <sup>10</sup>	• <i>Fuzzy Clustering of Monolingual Embedding Spaces</i> , <b>Kowshik Bhowmik, Anca Ralescu</b> , University of Cincinnati, USA
16 <sup>10</sup> – 16 <sup>30</sup>	• <i>Empirical Study on the Sustainability of Knowledge Transfer on Information Security Awareness Via Virtual Reality Videos Compared to Conventional Videos</i> , <b>Jana Gawrilow, Jule Schumann, Lui Ruck, Patrick Haase</b> , University of Applied Sciences Würzburg-Schweinfurt, Germany
16 <sup>30</sup> – 16 <sup>50</sup>	• <i>Hybrid Classifier based Fall Detection in the Elderly Using Still Image</i> , <b>Srianuradha Kandavel, Anca Ralescu</b> , University of Cincinnati, USA
16 <sup>50</sup> – 17 <sup>10</sup>	• <i>Automated testing for smart access system in automotive</i> , <b>Robert Sebastian Kiss</b> , Politehnica University of Timișoara, Romania

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**FRIDAY, November 05, 2021**

*International Conference on Applied Informatics – ICDD 2021*

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<b>10<sup>00</sup> – 11<sup>40</sup></b>	<b>Papers presentation. Session chair Florin Stoica</b>
10 <sup>00</sup> – 10 <sup>20</sup>	• <i>Pure Pursuit Controller</i> , <b>Răzvan Gheorghe Filea</b> , Babeş-Bolyai University of Cluj Napoca, Romania
10 <sup>20</sup> – 10 <sup>40</sup>	• <i>Apparent personality analysis based on robust estimation</i> , <b>Milić Vukojičić, Mladen Veinović</b> , Singidunum University of Belgrade, Serbia
10 <sup>40</sup> – 11 <sup>00</sup>	• <i>Keep it Safe!</i> , <b>Marin Matei</b> , Gheorghe Lazar National College, Sibiu, Romania
11 <sup>00</sup> – 11 <sup>20</sup>	• <i>4G LTE and 5G NR - An overview; Technical aspects of the Air interface</i> , <b>Vasile Horia Muntean</b> , Lucian Blaga University of Sibiu, Romania
11 <sup>20</sup> – 11 <sup>40</sup>	• <i>Education platform for cyber-physical systems</i> , <b>Alexandra Ciobanu, Gianina Ignat, Nicolae Sideriaş</b> , Lucian Blaga University of Sibiu, Romania
<b>11<sup>40</sup> – 12<sup>00</sup></b>	<b>Coffee break</b>
<b>12<sup>00</sup> – 13<sup>15</sup></b>	<b>Multimedia posters presentation. Session chair Dana Simian</b>
12 <sup>00</sup> – 12 <sup>15</sup>	• <i>The Chaos Game – An iterative approach to fractal generation</i> , <b>Vlad Oleksik</b> , Gheorghe Lazar National College, Sibiu, Romania
12 <sup>15</sup> – 12 <sup>30</sup>	• <i>Eclipse Wars</i> , <b>Matei Cristian Steavu</b> , Radu Negru National College, Fagaras, Romania
12 <sup>30</sup> – 12 <sup>45</sup>	• <i>Fractions Quiz - Applied mathematics</i> , <b>Pavel Buta, Denisa Gabriela Tucă, Tudor Terian-Dan, Adina-Mihaela Stănculescu</b> , Gheorghe Lazar National College, Sibiu, Romania
12 <sup>45</sup> – 13 <sup>00</sup>	• <i>The Trials of Harap-Alb</i> , <b>Bogdan-Stefan Aron, Darius-Ioan Aron, Stefania-Cristina Mozacu, Elisa-Maria Aron, Adina-Mihaela Stănculescu</b> , Gheorghe Lazar National College, Sibiu, Romania
13 <sup>00</sup> – 13 <sup>15</sup>	• <b>Elisei Daniel Prală</b> , Lucian Blaga University of Sibiu, Romania
<b>13<sup>15</sup> – 14<sup>15</sup></b>	<b>Virtual tours</b>
<b>14<sup>15</sup></b>	<b>Closing ceremony</b>

**ABSTRACTS**  
**Papers section**

**IoTHub for smart devices management**

*Cristian-Valentin ALEXANDRU*

The Internet of Things (IoT) has become a defining paradigm of today's world, an element of revolutionary transformation, qualitative and quantitative, of our knowledge and interaction with the environment in which we live and work daily. In recent years, numerous intelligent object interconnection solutions have been developed in systems with different scales and objectives.

My project, "IoTHub for smart devices management", addresses the challenges of monitoring and creating smart devices. From a management point of view, each device often comes with its own application. This makes it difficult to access multiple devices. The proposed project brings an interface where you can create, interactively and easily, devices defined by different characteristics, thus offering the possibility to access from the same place, all the designed solutions. The application also aims to simplify the process of developing, by programmers and engineers, smart solutions. This is done concretely by the possibility of "bringing to life" a device through a minimum lines of code, providing support for communication, storage and interpretation of data. Developers can write code directly through the provided interface, without having to worry about the "game behind the scenes" (server, database, etc.).



## **Fuzzy Clustering of Monolingual Embedding Spaces**

*Kowshik BHOWMIK, Anca RALESCU*

Mapping-based methods of learning a cross-lingual word embedding are based on the assumption that independently trained word embeddings of different languages are isomorphic to one another. The isomorphic assumption implies that learning a linear transformation from one language space to another is possible using known translation word pairs. This does not always hold, especially for typologically distant language pairs. While cross-lingual embedding spaces containing resource-rich and related languages have produced impressive results in downstream tasks, the same is not the case for typologically distant or low-resource languages. This discrepancy of performance is an indication that independently trained word embeddings retain linguistic properties. The presented research aims to divide a set of monolingual word embedding spaces into clusters. The degree of isomorphism between the language spaces is utilized as the pairwise inter-lingual distance. Fuzzy C-Means clustering is then applied on the pairwise distances between all the languages in dataset. The objective of this paper is to investigate the extent to which real-world relationships between languages can be captured from monolingual embedding spaces. The use of Fuzzy C-Means algorithm is crucial in quantifying the degree of membership of a language to the language families formed as a cluster of languages.

## **Education platform for cyber-physical systems**

*Alexandra CIOBANU, Gianina IGNAT, Nicolae SIDERIAȘ*

In the contemporary world, there is major progress in the development of advanced technologies that aims to automate the devices used daily and to improve the standard of today's society. The paper addresses the development of an educational robotic platform to bring students nearer to hardware and software technologies in the perspective of IoT solutions. It is presented an incremental approach, starting from designing robot parts for 3D printing to advanced technologies by creating a platform that links software and external environments. Topics that are covered during this paper include several aspects of technologies that are integrated by examples developed to demonstrate the use of sensor data capturing and analyzing in applications for line following, environment monitoring, obstacle detection, intelligence path following and autonomous navigation.

## **Decentralized open-source cryptocurrency portfolio tracking hybrid application**

*Adoris-Elia DORAN*

Considering the recent rapid expansion of the cryptocurrency world, it has become increasingly more difficult for the average investor to keep track of the performance of their investment, considering the large number of assets and different accounts. This article explores a possibility to track the performance of a cryptocurrency portfolio by automatically retrieving

portfolio data from various cryptocurrency exchanges and wallets, as well as tracking the price evolution of different cryptocurrency assets.

## **Kiosk web application - integrated multimedia information system**

*Martin S. DZHUROV*

This paper presents kiosk web application developed for the needs of the multimedia information system, located in the campus of University of Rousse “Angel Kanchev”. The paper aims to show the flaws of the previously used software for this purpose and to show the benefits of the newly developed one. These days more and more institutions are aiming to automate everyday tasks, thus making the workflow easier for the personnel and the client. One way of automating the process of giving and spreading information in any modern institution is integrating kiosk-terminals with suitable kiosk-software [1]. This idea was implemented successfully by my university over 15 years ago, and since then the kiosk-terminals have been a huge information-helper for students, staff and university visitors. For example: students can search fast and easily their weekly schedule, they can orientate themselves in the university campus thanks to the interactive campus map, they can read news from the university newsfeed and many others. The idea and the implementation were perfect, but in the coming years many of the old programmers who created the old kiosk-application left the university, leaving the software with little to none options for updates and support. As a young and enthusiastic person, I saw a huge problem in the now dying information

system, so I rolled my sleeves up and got to work in order to create a new modern and fully supported kiosk web application from ground zero. In this paper I will discuss the stages of development of a whole new system, starting with the lowest level - the hardware, building to OS level, and finalizing with a whole new web application with full support and no paid licenses. I will present to you the application structure, views, layers of access and the content management system, providing a dynamic content editing environment.

## **Pure Pursuit Controller**

*Răzvan Gheorghe FILEA*

This work describes the implementation of a Pure Pursuit Controller and the tools used to design it. Pure Pursuit is a tracking algorithm, most often used in robotics, that computes the target velocities based on the error of the robot's current position and some target position. It allows the robot to follow a path quickly, smoothly and accurately using only the vehicle's position. On top of that, the algorithm's flexibility and dynamic nature allow it to efficiently deal with any path deviations.

**Empirical Study on the Sustainability of Knowledge  
Transfer on Information Security Awareness Via Virtual  
Reality Videos Compared to Conventional Videos**

*Jana GAWRILOW, Jule SCHUMANN, Lui RUCK, Patrick HAASE*

In today's information society, security plays a significant role. Increasing importance is being attached to information security and data protection. It is therefore in the interest of companies, but also of private individuals, to demonstrate the best possible Information Security Awareness (ISA). To expand and promote awareness of ISA among individuals, appropriate knowledge transfer is required. Since Virtual Reality (VR) is becoming increasingly important in education, we investigated the learning effect on ISA using informative VR video training. At the same time, this work represents a continuation of "360 Degrees of Security" by Fertig et al. [9]. We determined how a didactic-oriented VR learning video compares to a simple VR video in terms of learning success. Likewise, a comparison of the knowledge transfer with a conventional two-dimensional video is drawn. The evaluation of the learning success was realized by questionnaires, which the test persons filled out in time intervals. The results show that the learning video based on didactic guidelines generally performs better. Based on these findings, we developed guidelines for the optimal creation of a VR learning video.

## **Digitization in medical teaching**

*Susanna GÖTZ*

From the research on digitalization in medical education, an application emerges that is intended to make it easier for prospective physicians to get started with infarct localization. The Easy ECG app was developed for this purpose; it shows the correlations between ECG signals and the anatomically correct heart. The user can display different infarcts and thus learn about differences and similarities between the infarcts. It is also possible to plot the conduction of impulses to the heart, which is closely related to the localization of the infarct. This helps to understand infarcts and their effects on the heart as a function of time. Because Easy ECG can provide an immersive and accessible learning experience for medical students, the app is an impetus to bring a breath of fresh air and change to conservative medical teaching through digitization.

## **A comparative study of growing microgreens. Human supervision VS Agritech/Automation**

*Felix HUSAC*

According to a CNBC report, agritech companies raised around 5 billion USD in 2020, and as a whole, the agriculture industry is worth around 1.109 trillion USD in the US alone.

From lifestyle gurus to haute cuisine world renowned chefs, microplants are gaining attention and interest, being regarded as a superfood. Growing

microplants is a really lucrative business, as an article from growcycle.com mentions, and the return on investment for a pound of final product is the most expensive legal plant crop.

This paper aims to study the different types of growth mediums and conditions possible for microplants, creating a special environment for their development as a cheap alternative to the expensive and sometimes incomplete solutions already on the market. The future of agriculture is heading towards automation, hydroponic cultures and vertical scalability, because of both cost and environmental concerns.

The proposed techniques and technologies used are scalable, and a future development is automating a whole greenhouse, from planting the seeds to harvesting the results and to analyzing the data generated for future optimization.

## **Hybrid Classifier based Fall Detection in the Elderly Using Still Images**

*Srianuradha KANDAVELA, Anca RALESCU*

According to WHO, senior citizens who are above 60 years of age are more prone to falling and these falls could be fatal. This arises a need to monitor the activities of elderly and carefully assess them for immediate detection of fall. Video surveillance has proven useful in literatures, however, might cost additional memory space and computation. In this paper, a hybrid classifier that uses still images to identify the human body without bounding boxes and detect fall action is proposed. VGG-19

Network is used as a feature extractor and the extracted features are classified using KNN classifier. This hybrid classifier has shown approximately 60% accuracy when compared with other classifiers and shows improvement in performance when optimized with hyper tuning of parameters.

## **Design and Implementation of a Node.js Framework for the Development of RESTful APIs**

*Matthias KECKL*

Roy Fielding published his doctoral thesis in 2000, in which he developed the Representational State Transfer (REST) architectural style. Although REST was not widely used to build web services for the first few years after its release, nowadays, most new public-facing APIs are at least trying to follow the REST ideas and principles [2, xvii]. But, unfortunately, although the resulting APIs claim to be REST-compliant, they are often not, as Fielding criticised in his blog post [4]. To ensure REST compliant development, we propose a new Node.js framework that should make it harder to harm the REST constraint than comply with them. We also provide an analysis of currently available Node.js frameworks to demonstrate the lack of tools in the Node.js ecosystem. The conducted empirical study in this work indicates that the proposed framework offers significantly better support for REST API development than existing frameworks.



## **Automated testing for smart access system in automotive**

*Robert Sebastian KISS*

In last years, the automotive industry reached a great increase of the used technologies inside each car. One of the newest features in automobiles is smart access. Testing the smart access system need to be very accurate, to avoid any bugs. For this, should be created a tool for automated testing, which supports BLE (Bluetooth Low Energy) and UWB (Ultra-Wideband). Without developing the SAB (Stand Alone Board), the testers need to test the smart access system only with smartphones. This manual testing is not really correct, because it cannot be hit small timings between two BLE/UWB commands, negative test cases cannot be run and another more unreachable scenarios.

## **System of modeling the spreading of infectious diseases**

*Yulian KURYLIAK*

This paper describes open source software that is designed to predict an outbreak. The system is developed in the Python programming language and allows simulations for such epidemiological models as SI, SIS, SIR and SEIR, as well as models of the Erdős–Rényi, Watts-Strogatz and Barabási–Albert networks. The system has a large number of parameters, which allows for research activities, and at the same time a simple interface in the form of a dashboard. Such parameters are the number of

nodes and edges in the network, the disease infection rate, times of staying in the states, the demographic distribution, and statistics of the disease. The simulation of an epidemic outbreak is performed using the Gillespie algorithm.

## **Keep it Safe**

*Matei MARIN*

KEEP IT SAFE! is a tower defense strategy game, whose main purpose is to defend the base at the end of the road. While the base is being attacked by enemy tanks or planes, the player must find the best strategic positions in which to place the towers that can provide protection against the waves of attacking enemies. The game is powered by AI and Machine Learning, so that the gameplay enhances the fun and becomes more interactive. The game is created in Unity and is based on their Tower Defense Template which includes all of the 3D models and audios and some of the scripts. KEEP IT SAFE! is available on WebGL, Windows and MacOS. Thus, it is available online and the players can play in any browser or download it. These actions can be carried out free of charge on the online platform itch.io at <https://jamglass.itch.io/keep-it-safe>. For a better quality of the graphics and the game, it is recommended to download the game.

## **Improving the overall user experience for applications generating traffic mix over 4G networks**

*Vasile Horia MUNTEAN*

Regardless of the transmission environment used, when improving the overall experience perceived by the final user with regards to an application generating rich media content, it is important to take into consideration the users' particular set of characteristics. If the transmission environment is a wireless medium, then the challenge of delivering satisfactory media content is even harder. To achieve this goal by addressing the user satisfaction problem, an adaptive algorithm centred on the user requirements was developed, DQOAS – Dynamic Quality Oriented Adaptation Scheme [1]. The present article shows that the good performances observed for DQOAS algorithm in IEEE 802.11 standard and in 4G LTE environment by applying a special mapping scheme for Quality-of-Service parameters, can be replicated even in the scenarios where the users connected to an LTE network are mobile, moving with speeds higher than average pedestrian speed. Using the proposed mapping scheme will provide the possibility to modify stream priorities, and by doing so, avoid any changes done by the LTE scheduler on the decisions made by the above-mentioned algorithm. Since LTE system scheduler is a highly important part in the LTE quality assurance process, multiple LTE scheduling strategies are also analysed in the mobility context. Results presented in the final section are showing that in a mobility scenario, using DQOAS and the proposed mapping scheme together with the Proportional

Fair scheduling strategy yields better results than Round Robin or Max Throughput schedulers, all this while reaching the highest number of satisfied users.

### **4G LTE and 5G NR - An overview; Technical aspects of the Air interface**

*Vasile Horia MUNTEAN*

During last years, we all witness and take part in shaping of the new connectivity paradigm: instant data access, reduced delays, high throughput, maximized user experience, increased mobility and rich media content consumption. The fast shift in the way network-based services evolved based on the above users' requirements is mainly possible due to the quick development of wireless access technologies. But providing high throughput, low delay connectivity on an anywhere-anytime basis is a challenging task that can only be achieved through a global deployment of real mobile broadband connectivity. Some of the first technologies developed to accommodate these new user behaviours – provisioning of high-quality voice, data and multimedia services on mobile devices while keeping user costs accessible – were WiMAX (Worldwide Interoperability for Microwave Access) and LTE (3GPP Long Term Evolution). If ten years ago WiMAX technology had the advantage over LTE due to a larger real-world deployment and more mature specifications, nowadays it is clear that LTE was the winner of that battle, most likely due to the reduced migration costs for the operators, increased flexibility in terms of

frequency band options and adaptive antenna systems, higher peak data rates and uplink/downlink performances plus the high advantage offered by it being able to support higher mobility scenarios. But new technologies like IoT are emerging and user demands keep adding more and more pressure on the existing LTE infrastructure, so therefore new wireless networks are developing, and the most important is the 5G NR (New Radio) mobile broadband network. This paper investigates 4G LTE and 5G NR technologies with regards to their architectural differences, focusing mainly on the performance of their first two layers. It also tries to determine if 5G will eventually replace the 4G LTE networks or if they will work together, complementing each other in such a way that all current and future user demands will be carried through.

## **Smart Parking System**

*Rareş TAMAIAN, Sergiu TOPAN*

Smart Parking System is a project that not only comes to help the process of urban digitalisation but also contributes to solving our society's contemporary problems efficiently. The application has the following modus operandi: a small electric vehicle equipped with a video camera and an image processing system is driven on the side of the road or in parking lots, having the purpose of filming the parked vehicles. The images captured are then processed by an algorithm which uses artificial intelligence to recognize the car plates and then extract the number within them. These numbers are then checked in the parking system databases to

determine whether the owners of the vehicles paid the parking fee. For this application to work in an optimal way, using a pretrained artificial intelligence network was not considered a viable option. Instead, a personalized training has been used, specifically designed for Romanian number plates. Furthermore, the project uses fine-tuned algorithms in order to cope with the particular input set that we have.

### **An analysis of primary and secondary constraints used in the automated university timetabling**

*Gabriel Marius TCACIUC*

Due to the complexity of the data needed to be taken into account when making an university timetable, the process of managing university timetables is still done manually in some university institutions. This manual process is time consuming and, therefore, a solution for the automatic generation of the university timetables is preferred. Research on the automatic timetabling is a subject of interest nowadays, a topic that is in continuous development. In this article, an analysis of constraints that must be taken into account in the process of automatically generating lecture schedules was made. Constraints are very different, they may differ from one educational institution to another, and research in the literature shows that each approach, each algorithm has its own way of considering a restriction.

## **Apparent personality analysis based on robust estimation**

*Milić VUKOJIČIĆ, Mladen VEINOVIĆ*

Apparent trait prediction is one of the hardest tasks in the domain of computer science. Multimodal approaches where the traits are extracted from various sources are giving the best prediction when we compare results to the NEO-PI-R model. Multimodal apparent trait personality based on text, images, audio, and handwriting can give us a wide range of estimation for each of the Big Five properties (extraversion, agreeableness, openness to experience, conscientiousness, neuroticism). This problem can be solved by using the aggregation function at the end of the model. The problem that this paper tries to overcome is to introduce nonlinearity to the final prediction of the model. Aggregation functions such as Max and Min are linear functions and they are creating outliers at the end of the model. The aim of this paper is to use nonlinear functions such as the Huber function to get better results from the outliers and minor deviations from the NEO-PI-R model.

## **Multimedia posters section**

### **The Trials of Harap-Alb**

*Bogdan-Stefan ARON, Darius-Ioan ARON, Stefania-Cristina  
MOZACU, Elisa-Maria ARON*

We created an educational software consisting of 11 interactive games and an interesting trailer, all being based on the fairy tale "The Story of Harap-Alb" by Ion Creanga. Each game is different and has its own challenges. The codes of the games were implemented in Visual Studio, while the sceneries were designed in Alice3 with their own set of codes, used to animate them. The settings were then recorded and assembled in a trailer and pieces of them were used in the games as well. Both students and teachers can benefit from the application in their lessons within the school area.

### **Applied mathematics – Fractions quiz**

*Pavel BUTA, Denisa Gabriela TUCĂ, Tudor TERIAN-DAN,  
Adina STĂNCULESCU*

This document introduces an educational application created in Visual Studio using the C # programming language. The app is intended for middle school students and aims to help them better understand math knowledge in an original, interactive and fun way. Users can answer up to



twenty multiple choice questions, which are presented in an attractive graphical interface and receive feedback on their choices at the end of the quiz.

## **The Chaos Game – An iterative approach to fractal generation**

*Vlad OLESIK, Adina STĂNCULESCU*

This paper presents the theoretical and the practical implications of an iterative method used for generating fractals while avoiding the constraints of a recursive process, such as a stack overflow. The program is designed as a collection of fractals realised using the iterative method, known as „The chaos game”, as it includes a pseudo-random element used for uniformizing a choice distribution in the context of an “anti-greedy” memory optimization. The presented algorithm provides us with a set of parameters that can be used to mathematically describe a fractal. As this approach uses a set of mathematically describable functions for the point selection and generation process, the increasingly complex nature of these functions can lead to any existing, but informally defined fractal. Thus, it is possible to reduce any fractal entropy-wise until a set of less than 10 “generator” parameters is reached. The user interface of the application, the menus and the fractal drawing are realised entirely in the C++ programming language, using the “graphics.h” graphic library. The program stores several sets of previously defined “generator” parameters which can be used to produce some well-known fractals, such as the

Sierpiński Triangle, the Sierpiński Carpet, the Koch Snowflake and the Barnsley Fern. Apart from these pre-defined fractals, a dedicated menu allows the user to generate a new one, starting either from a set of user-defined parameters, or by randomly generating a valid set of such parameters. The application also enables user settings that affect the appearance of the generated fractals as well as the menus and the user interface.

## **Customized website based on weather forecast**

*Elisei Daniel PRALĂ*

This project is a weather web page that brings some unique features. The customer can compare the weather from different cities around the world, by adding cities in a list with display the weather for added cities.

## **Eclipse Wars**

*Matei Cristian STEAVU*

The original developer team consisted of 8 members, each assigned a certain part that he would have to do for the game, but in the end, I'm the only active developer left, I was assigned the whole coding part. Just because I was assigned the coding part, that does not mean that I only did coding, in fact a whole part of the game is built by my and I've also created a map from 3. The other 2 maps were created by other developers I met

online, I only stepped in to create the spawn areas and to set up the health pads.

The goal of this game was to create something that we would all enjoy playing on the Roblox Studio game engine, since we all met each other by playing a certain game. We wanted to be the first to make a really complicated Roblox game, but it didn't end out like that. Since I'm the only developer left, my goals changed to more modest ones, I've always enjoyed creating maps, coding, so I want to learn from this experience as much as I can and also publish the game.

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