



May 22 - 26, 2023 Opatija, Croatia

Lampadem tradere



mipro - innovative promotional partnership

minro proceedings

My profession. My organization. My IEEE.

Discover the benefits of IEEE membership.

Join a community of more than 365,000 innovators in over 150 countries. IEEE is the world's largest technical society, providing members with access to the latest technical information and research, global networking and career opportunities, and exclusive discounts on education and insurance products.

Join today www.ieee.org/join





MIPRO 2023

46th ICT and Electronics Convention

May 22 – 26, 2023 Opatija, Croatia

Proceedings

Conferences:

Human-Computer Interaction /HCI Smart Industries and Digital Ecosystems /SIDE Microelectronics, Electronics and Electronic Technology /MEET **Optoelectronics and Photonics /OPHO Data Science and Biomedical Engineering /DS-BE Telecommunications & Information /CTI Computers in Education /CE Distributed Computing and Cyber-Physical Systems /DC-CPS Artificial Intelligence Systems /AIS Information Systems Security /ISS Business Intelligence Systems / miproBIS Digital Economy and Digital Society /DE-DS** Information and Communication Technology Law /ICTLAW **Engineering Education /EE** Software and Systems Engineering /SSE **MIPRO Junior - Student Papers /SP**

> Edited by: Karoli Skala

International Program Committee

Karolj Skala, General Chair (Croatia), Lejla Abazi-Bexheti (North Macedonia), Enis Afgan (United States), Saša Aksentijević (Croatia), Slaviša Aleksić (Germany), Slavko Amon (Slovenia), Krešo Antonović (Croatia), Zoran Aralica (Croatia), Michael E. Auer (Austria), Viktor Avbelj (Slovenia), Dubravko Babić (Croatia), Snježana Babić (Croatia), Dinko Bačić (United States), Darinko Bago (Croatia), Tadej Bajd (Slovenia), Ante Bakić (Croatia), Hrvoje Balen (Croatia), Marko Banek (Croatia), Mirta Baranović (Croatia), Bartosz Bebel (Poland), Nina Begičević Ređep (Croatia), Ladjel Bellatreche (France), Boris Blumenschein (Croatia), Damir Boras (Croatia), Darko Bosnar (Croatia). Adrian Boukalov (Belgium), Lovro Božičević (Croatia), Ricardo Branco (Portugal), Laura Brandimarte (United States), Mario Brčić (Croatia), Karla Brkić (Croatia), Ljiljana Brkić (Croatia), Marian Bubak (Poland), Andrea Budin (Croatia), Željko Butković (Croatia), Domenico Caputo (Italy), Željka Car (Croatia), Jesús Carretero Pérez (Spain), Constantinos K. Coursaris (Canada), Bojan Cukic (United States), Alfredo Cuzzocrea (Italy), Duško Čakara (Croatia), Stipo Čelar (Croatia), Marina Čičin-Šain (Croatia), Dragan Čišić (Croatia). Marko Čupić (Croatia), Davor Davidović (Croatia), Vlado Delić (Serbia), Matjaž Depolli (Slovenia), Saša Dešić (Croatia), Dražen Dragičević (Croatia), Marin Karuza (Croatia), Ivan Kaštelan (Serbia), Zlatko Katalenić (Slovenia), Ana Katalinić Mucalo (Croatia), Tihomir Katulić (Croatia),

Marko Đurasević (Croatia), Todd Eavis (Canada), Maurizio Ferrari (Italy), Tiziana Ferrari (Netherlands), Renato Filjar (Croatia), Matteo Francia (Italy), Andreja Gajović (Croatia), Tihana Galinac Grbac (Croatia), Enrico Gallinucci (Italy), Dragan Gamberger (Croatia), Gordan Gledec (Croatia), Matteo Golfarelli (Italy), Stjepan Golubić (Croatia), Miran Gosta (Croatia), Vera Gradišnik (Croatia), Simeon Grazio (Croatia), Andrej Grgurić (Croatia), Stjepan Groš (Croatia), Matija Gulić (Croatia), Nina Gumzej (Croatia), Marjan Gusev (North Macedonia), Jaak Henno (Estonia), Željko Hocenski (Croatia), Tatjana Holjevac (Croatia), Marko Horvat (Croatia), Vlasta Hudek (Croatia), Darko Huljenić (Croatia), Robert Inkret (Croatia), Ivo Ipšić (Croatia), Mile Ivanda (Croatia), Marina Ivašić-Kos (Croatia), Hannu Jaakkola (Finland), Tomislav Jagušt (Croatia), Domagoj Jakobović (Croatia), Vojko Jazbinšek (Slovenia), Leonardo Jelenković (Croatia), Jeffrey L. Jenkins (United States), Bojan Jerbić (Croatia), Dragan Jevtić (Croatia), Andrej Jokić (Croatia), Alan Jović (Croatia), Alen Jugović (Croatia), Admela Jukan (Germany), Nenad Jukić (United States), Oliver Jukić (Croatia), Irena Jurdana (Croatia), Ozren Jureković (Croatia), Marko Jurić (Croatia), Đani Juričić (Slovenia), Nikola Kadoić (Croatia), Jurij Matija Kališnik (Slovenia), Mirko Poljak (Croatia), Tonka Poplas Susič (Slovenia), Aleksandra Rashkovska (Slovenia), Robert Repnik (Slovenia), Libuša Révészová (Slovakia),

Tonimir Kišasondi (Croatia), Zalika Klemenc-Ketiš (Slovenia), Tihomir Knežević (Croatia), Dragi Kocev (Slovenia), Mario Konecki (Croatia), Marko Koričić (Croatia), Gregor Kosec (Slovenia), Igor Kotenko (Russia), Božidar Kovačić (Croatia), Zdenko Kovačić (Croatia), Miklos Kozlovszky (Hungary), Danica Kragić Jensfelt (Sweden), Dieter Kranzlmüller (Germany), Marjan Krašna (Slovenia), Đorđe Krivokapić (Serbia), Lene Krøl Andersen (Denmark), Ashwinee Kumar (India/Belgium), Nadica Kunštek (Croatia), Benjamin Kušen (Croatia), Marko Lacković (Croatia), Erich Leitgeb (Austria), Jadran Lenarčič (Slovenia), Hrvoje Lisičar (Croatia), Dražen Lučić (Croatia), Duško Lukač (Germany), Igor Ljubi (Croatia), Ruizhe Ma (United States), Goran Marković (Croatia), Leslie Martinich (United States), Romana Matanovac Vučković (Croatia), Ludek Matyska (Czech Republic), Mladen Mauher (Croatia), Igor Mekterović (Croatia), Željka Mihajlović (Croatia), Branko Mikac (Croatia), Anđelko Milardović (Croatia), Hrvoje Mlinarić (Croatia), Mladen Mrvelj (Croatia), Gorana Mudronja (Croatia), Neeta Nain (India), Jadranko F. Novak (Croatia). Dario Ogrizović (Croatia), Vladimir Olujić (Croatia), Predrag Pale (Croatia), Dana Paľová (Slovakia), Panče Panov (Slovenia), Branimir Pejčinović (United States), Nedjeljko Perić (Croatia), Ana Perić Hadžić (Croatia), Dana Petcu (Romania), Juraj Petrović (Croatia), Duc Truong Pham (UK), Stjepan Picek (Netherlands), Damir Pintar (Croatia), Vincenzo Piuri (Italy), Mihaela Vranić (Croatia), Miroslav Vrankić (Croatia), Neven Vrček (Croatia), Boris Vrdoljak (Croatia). Yingwei Wang (Canada),

Slobodan Ribarić (Croatia), Dubravko Sabolić (Croatia), Ioan Sacala (Romania), Davor Salamon (Croatia), Saonee Sarker (Sweden), Christoph Schneider (Spain), Jörg Schulze (Germany), Bruno Siciliano (Italy), Sandro Skansi (Croatia), Zoran Skočir (Croatia), Tadej Slapnik (Slovenia), Mladen Sokele (Croatia), Ana Sović Kržić (Croatia), Matija Srbić (Croatia), Vlado Sruk (Croatia), Hrvoje Stančić (Croatia), Uroš Janez Stanič (Slovenia), Mario Stipčević (Croatia), Vjeran Strahonja (Croatia), Tomislav Suligoj (Croatia), Aleksandar Szabo (Croatia), Marija Šćulac Domac (Croatia), Dina Šimunić (Croatia), Frano Škopljanac-Mačina (Croatia), Dejan Škvorc (Croatia), Zorislav Šojat (Croatia), Andreja Špernjak (Slovenia), Vitomir Štruc (Slovenia), Marija Šutina (Croatia), Marko Švaco (Croatia), Velimir Švedek (Croatia), Darko Švelec (Croatia), Viktor Švigelj (Slovenia), Zheng-Hua Tan (Denmark), Nikola Tanković (Croatia), Jason Thatcher (United States), Antonio Teixeira (Portugal), Edvard Tijan (Croatia), A Min Tjoa (Austria), Ivan Tomašić (Sweden), Mladen Tomić (Croatia). Roman Trobec (Slovenia), Joe S. Valacich (United States), Mladen Varga (Croatia), Lucija Vejmelka (Croatia), Domen Verdnik (Croatia), Matjaž Veselko (Slovenia), Linda Vicković (Croatia), Ivan Vidaković (Croatia), Marijana Vidas-Bubanja (Serbia), Marko Vidović (Croatia), Slavko Vidović (Croatia), Davor Vinko (Croatia), Ernest Vlačić (Croatia), Goran Vojković (Croatia), Mario Weber (Croatia), Markus Weinmann (Germany), David Wilson (United States), Roman Wyrzykowski (Poland), Kristijan Zimmer (Croatia)

organized by

MIPRO Croatian Society

technical cosponsorship

IEEE Region 8 IEEE Croatia Section IEEE Croatia Section Computer Chapter IEEE Croatia Section Devices/Solid-State Circuits Joint Chapter IEEE Croatia Section Education Chapter IEEE Croatia Section Communications Chapter CroSI Association

under the auspices of

Ministry of Science and Education of the Republic of Croatia Ministry of the Sea, Transport and Infrastructure of the Republic of Croatia Ministry of Economy and Sustainable development of the Republic of Croatia Ministry of Regional Development and EU Funds of the Republic of Croatia Ministry of Foreign and European Affairs of the Republic of Croatia Ministry of Tourism and Sport of the Republic of Croatia Ministry of Agriculture of the Republic of Croatia Central State Office for the Development of Digital Society Primorje-Gorski kotar County City of Rijeka City of Opatija Croatian Regulatory Authority for Network Industries - HAKOM Croatian Power Exchange – CROPEX

patrons

University of Zagreb University of Rijeka Juraj Dobrila University of Pula Ruđer Bošković Institute, Zagreb Jožef Stefan Institute, Ljubljana, Slovenia University of Zagreb, Faculty of Electrical Engineering and Computing University of Zagreb, Faculty of Organization and Informatics, Varaždin University of Rijeka, Faculty of Maritime Studies University of Rijeka, Faculty of Engineering University of Rijeka, Faculty of Economics and Business Josip Juraj Strossmayer University of Osijek, Faculty of Education Zagreb University of Applied Sciences Croatian Academy of Engineering - HATZ Cybernetics Society, Rijeka Ministry of the Sea, Transport and Infrastructure of the Republic of Croatia Croatian Regulatory Authority for Network Industries - HAKOM Ericsson Nikola Tesla, Zagreb T - Croatian Telecom, Zagreb Končar - Electrical Industry, Zagreb Hrvatska elektroprivreda, Zagreb

sponsors

Hrvatska elektroprivreda, Zagreb Končar - Electrical Industry, Zagreb Telemach, Zagreb Storm Group, Zagreb InfoDom, Zagreb dSPACE Engineering, Zagreb Ericsson Nikola Tesla, Zagreb Altpro, Zagreb Adnet, Zagreb Siemens Energy, Zagreb Mjerne Tehnologije, Zagreb All papers are published in their original form

For Publisher:

Karolj Skala

Publisher:

Croatian Society for Information, Communication and Electronic Technology – MIPRO Office: Jadranski trg 1/II, HR-51000 Rijeka, Croatia Phone/Fax: (+385) 51 423 984

> Printed by: GRAFIK, Rijeka

ISSN 1847-3946

Copyright © 2023 by MIPRO

All rights reserved. No part of this book may be reproduced in any form, nor may be stored in a retrieval system or transmitted in any form, without written permission from the publisher.

CONTENTS

LIST OF PAPER REVIEWERS

LIST OF AUTHORS

FOREWORD

HUMAN-COMPUTER INTERACTION

Measuring State and Trait Attention Control Using Mouse Movements D. Wilson, J.L. Jenkins, J.S. Valacich	5
Getting What You Paid For: Assessing Participant Experience Parameters for Amazon Mechanical Turk (MTurk) Workers on Survey Response	
Quality M. Kumar, D. Kim, P.A. Weisgarber, J.S. Valacich, J.L. Jenkins	11
Detecting Goal-Oriented vs. Browsing Users Through Behavior Analysis J.L. Jenkins, A. Denison, J.S. Valacich, D. Wilson	17
Physiological and Socio-Behavioral Determinants of Viral Video User Engagement D. Bačić, C.A. Gilstrap, N. Jukić	23
Exploring Pie Charts and Part-To-Whole Alternatives: Eye-tracking Approach D. Bačić, A. Krbanjević, N. Jukić	29
Parental Trust in Automated Detection of Cyberpredators L. Brandimarte	34
Mobile Technologies and Live Streaming Commerce: A Systematic Review and Lexical Analysis C.A. Gilstrap, C.M. Gilstrap	40
Dehumanized Avatars: Unethical Behavior in the Metaverse C. Castagna, S. Demir, M. Weinmann	49
Tangible Data Exploration: Creating Card Games for Sensemaking A. Wolff, A. Knutas	54
Analytics Dashboards and User Behavior: Evidence from GitHub J. Schilpp, F. Pethig, H. Hoehle	60

Using Hobbies as Proxy for Gamification Player Types S. Rantanen, A. Knutas, J. Kasurinen	66
An Eye-Tracking Solution Using Consumer Grade Webcams for Potential Concussion Diagnosis and Evaluation N. Caporusso, G. Sanders, B. Thaman, E. Hall	71
Do I Trust My Medical Professional on a Virtual Consultation? Biosensors, Human Computer Interaction and Trust-Building B. Ye, C. Milewicz, S. Mujumdar, M. Khayum	77
The Influence of the Internet and Social Networks on Behavioral Problems of Primary and Secondary School Students in Croatia N. Flego, L. Josipović Deranja, T. Orehovački	80
Cloud Accounting as a Factor in Protection from Cyber Attacks and Theft of Accounting Data V. Vinšalek Stipić, M. Vičić	86
Principles for Designing for Data Exploration for a Non-Expert Audience N. Tylosky, A. Knutas, A. Wolff	92
Stranded Away: Implementation and User Experience Evaluation of an Indie Platformer Game Developed Using Unity Engine L. Blašković, A. Žužić, T. Orehovački	96
Analyzing the Impact of Digitality and AI on HCI: Four Dimensions of Intelligent Digitality That Afford Innovative Designs D. Te'eni	102
Evaluating the Impact of Different User Engagement Elements on Software Applications M. Hajarian, P. Diaz, I. Aedo	107
Interaktivna potpuno imerzivna virtualna stvarnost računalne simulacije brodske strojarnice D. Ogrizović	113

SMART INDUSTRIES AND DIGITAL ECOSYSTEMS

PAPERS

Digitalization of Innovation Networks: Theoretical and Empirical Issues V. Omelyanenko, I. Pidorycheva, H. Shevtsova, O. Omelianenko, N. Rudenko, O. Yurchenko	121
Sensor System for Real-time Water Quality Monitoring E. Simonoska, D. Capeska Bogatinoska, I. Dimitrievski, R. Malekian	126
Proposal of Prediction Model for Smart Agriculture Based on IoT Sensor Data J. Fondaj, M. Hamiti, S. Krrabaj, B. Selimi, E. Idrizi	132
BIM Based Information Management in Renewable Energy Projects M. Ljuban, M. Curavić, L. Budin, I. Duilo, M. Delimar	138
Case Management Model Design for Obtaining Documentation Using FieldWork 4 RES Application in Renewable Energy Sources Projects Z. Tolvajčić, T. Ugrina, M. Curavić, I. Duilo, L. Budin, M. Delimar	145
Influence of Personal Recommendations towards Electricity Consumption on Consumer Behavior J. Héjjová, J. Bucko	150
Advanced and Smart Maintenance of Induction Motors Based on an Algorithm for Motor Faults Recognition S. Tvorić, T. Đuran, V. Jančić, D. Sente	158
Analytics Use Cases for Landside Traffic Optimization in the Catchment Area of the Airport: Case Study of Zagreb Airport M. Tica, I. Štimac, K. Vidović, S. Vojvodić, I. Stipanović	165

MICROELECTRONICS, ELECTRONICS AND ELECTRONIC TECHNOLOGY

PAPERS

Back-Hopping in Ultra-Scaled MRAM Cells M. Bendra, S. Fiorentini, J. Ender, R.L. de Orio, T. Hadámek, N.P. Jørstad, B. Pruckner, S. Selberherr, W. Goes, V. Sverdlov 175

Tunneling Attenuation and Leakage Current in MoS2 Nanoribbon MOSFETs I. Prevarić, M. Matić, M. Poljak	179
Transport Properties and Device Performance of Quasi-One-Dimensional MoS2 FETs M. Matić, M. Poljak	184
Bandgap Narrowing in Silicene Nanoribbons with Metal Edge Contacts M. Poljak, M. Matić	189
Determining Graphene and Substrate Quality from the Coupled Hall Mobility Measurements and Theoretical Modeling K. Japec, M. Matić, R. Lukose, M. Lisker, M. Lukosius, M. Poljak	195
Stress-dependent MOSFET Model for Use in Circuit Simulations A. Žamboki, L. Gočan, J. Mikulić, N. Bako, G. Schatzberger, T. Marković, A. Barić	200
Low-Power Frequency-Locked Loop Circuit with Static Frequency Offset Cancellation L. Gočan, A. Žamboki, N. Bako, J. Mikulić, G. Schatzberger, T. Marković, A. Barić	206
Low-Power CMOS Frequency Comparator M. Kováč, M. Potočný, D. Arbet, R. Ondica, R. Ravasz, V. Stopjaková	212
Measurement System for Characterization of a Resistor Array in 180-nm CMOS Technology I. Franković, F. Mikić, J. Mikulić, N. Bako, G. Schatzberger, A. Barić	218
Performance Analysis of 1-MHz Voltage-Controlled Ring Oscillator Designed in 180-nm CMOS Technology for Phase-Locked Loop A. Traživuk, A. Barić	224
Analysis of Energy Consumption for SPI and I2C Communications in Ultra-Low Power Embedded Systems J. Zidar, I. Aleksi, T. Matić	229
Genetic Algorithm Based Optimization of Circular Planar Coil Geometry with Homogeneous Magnetic Field Distribution D. Bilandžija, D. Vinko, L. Filipović	234
Analysis of the Effect of Differential-Mode and Common-Mode Impedance Matching on the Common-Mode Rejection Ratio of a Differential Electro-Optical Voltage Probe H. Štimac, A. Barić	239

Measurement Setup for Characterizing Immunity of Integrated Circuits to Pulsed Electric Fields Using the IC Stripline C. Cetin, M. Magerl, C. Stockreiter	245
Characterization of Ground Bounce and Conducted Emissions of Integrated Isolated DC-DC Converter A. Križanić, R. Blečić, A. Broznić, A. Barić	250
Characterization of Class-E Resonant Converter Operating in MHz-Range I. Krois, A. Barić	255
Design and Characterization of the Output Network of a High-Current Buck Converter K. Šolaja, R. Blečić, A. Broznić, A. Barić	258
Developing a Model of Buck Converter for EMI Filter Optimization by Circuit Simulations J. Baća, R. Blečić, A. Broznić, A. Barić	263
Implementation of Voltage Regulation in a Spread-Spectrum-Clocked Buck Converter J. Kundrata, A. Barić	269
Uninterruptible Power Supply System for Railway Infrastructure with Power Factor Correction and Immunity to Energy Strike A. Hećimović, L. Patrlj, V. Šunde, Ž. Ban	275
Reduction of Current Harmonics in Data Center Power System Using Single-Phase Shunt Active Power Filter V. Zeleničić, M. Miletić, K. Raič Raguž, D. Sumina, I. Erceg	281

OPTOELECTRONICS AND PHOTONICS

INVITED PAPER

Polarisation Based Entanglement Distribution Quantum Networking M.J. Clark, R. Wang, S. Bahrani, M. Peranić, O. Alia, M. Lončarić, Ž. Samec, A. Radman, M. Stipčević, R. Nejabati, D. Simeonidou, J. Rarity, S.K. Joshi	291
PAPERS	
Monolithic Receiver with Nine Single-Photon Avalanche Diodes A. Kuttner, S. Marschner, B. Steindl, K. Schneider-Hornstein, M. Hofbauer, H. Zimmermann	297
Occupancy Determination by Backscattered Visible Light Sensing O. El Ouahabi, C. Fragner, A.P. Weiss, E. Leitgeb	302

DATA SCIENCE AND BIOMEDICAL ENGINEERING

PAPERS

DATA SCIENCE

T. Tadić, P. Ćurković

Missing Values Interpolation in PurpleAir Sensor Data Based on a Correlation with Neighboring Locations Using KNIME Analytics Platform S. Omanović, A. Midžić, Z. Avdagić, D. Pozderac, A. Toroman	319
Spectral Analysis, Agglomerative, Mean Shift and Affinity Propagation Algorithms, Use on the Content from Social Media for Low-Resource Languages M.H. Hoti, J. Ajdari, X. Zenuni, M. Hamiti	324
Interactive Redescription Set Mining and Exploration I. Kozjak, M. Mihelčić	331
Fake News Detection: A Comprehensive Survey E. Tata, J. Ajdari, N. Besimi	337
Graphical User Interface to Perform Glacier Simulations with PISM M. Urbanč, M. Depolli	343
Computational Performance Aspects of CROCO-BFM Coupling F. Strniša, M. Vodopivec, G. Kosec	349
OpenMP Offloading and OpenACC Programming Model Approach for Object-Oriented Plasma Device Algorithms E. Krishnasamy, I. Vasileska, L. Kos, P. Bouvry	354
Benchmark DPC++ Code and Performance Portability on Heterogeneous Architectures N. Mijić, D. Davidović	359
A View into the Future of Academic Publishing Z. Šojat, K. Skala	366
ROBOTICS TECHNOLOGIES AND APPLICATIONS	
Biped Robot Walking Based on Deep Reinforcement Learning	375

Human Intention Recognition in Collaborative Environments Using RGB-D Camera J. Marić, L. Petrović, I. Marković	381
ROS Framework for Distributed Control of Networks of Dynamical Systems M. Rossi, A. Jokić	387
BIOMEDICAL ENGINEERING	
Heart Rate Variability Monitoring with Savvy ECG Sensor during Dental Surgery I. Tomašić, A. Prkić, A. Lesin, D. Kalibović Govorko, N. Tomašić, I. Medvedec Mikić	397
Optimizing Heartbeat Classification Using Bézier Interpolation M. Gusev, N. Petrovski, L. Tonkovikj	403
Fetal Monitoring: Multi-Channel Fetal ECG Denoising Based on Artificial Intelligence Approach D.D. Taralunga	409
ECG Compression Based on Successive Differences M. Gusev, M. Jovanov, A. Shekerov, G. Temelkov	413
Smart Glasses for Gait Analysis of Parkinson's Disease Patients I. Kiprijanovska, F. Panchevski, S. Stankoski, M. Gjoreski, J. Archer, J. Broulidakis, I. Mavridou, B. Hayes, T. Guerreiro, C. Nduka, H. Gjoreski	419
Attention-based U-net: Joint Segmentation of Layers and Fluids from Retinal OCT Images M. Melinščak	425
Recognizing Activities of Daily Living Using Multi-sensor Smart Glasses S. Stankoski, B. Sazdov, J. Broulidakis, I. Kiprijanovska, B. Sofronievski, S. Cox, M. Gjoreski, J. Archer, C. Nduka, H. Gjoreski	431
Reconstruction of Short Genomic Sequences with Graph Convolutional Networks L. Vrček, X. Bresson, T. Laurent, M. Schmitz, M. Šikić	437
Fortuna Detects Novel Splicing in Drosophila scRNASeq Data B. Borozan, L. Borozan, D. Ševerdija, D. Matijević, S. Canzar	444
Using De Novo Metagenome Assembly for Improved Metagenomic Classification J. Lipovac, K. Križanović	450

Hyperparameter Optimization of Graph Neural Networks for mRNA Degradation Prediction V. Vodilovska, S. Gievska, I. Ivanoska	457
Examination of Different Representations of Proteins Using Protein Ray-based Descriptor and Deep Learning Models G. Mirceva, A. Naumoski, A. Kulakov	463
Enabling Hyperparameter-Tuning of AI Models for Healthcare Using the CoE RAISE Unique AI Framework for HPC M. Riedel, C. Barakat, S. Fritsch, M. Aach, J. Busch, A. Lintermann, A. Schuppert, S. Brynjólfsson, H. Neukirchen, M. Book	469

TELECOMMUNICATIONS & INFORMATION

PAPERS

NEW INFORMATION AND COMMUNICATION TECHNOLOGIES IN PRACTICE

Smart Work Order Z. Bosić, P. Gusić, M. Zubčić, M. Marković, T. Žitnik	481
Bringing Children Closer to Science and the Universe with New Technology P. Lahovsky, A. Ljubek, K. Mišura, M. Žilak	488
An Overview of 3D Holographic Visualization Technologies and Their Applications in Education A. Kešelj, K. Žubrinić, M. Miličević, M. Kuzman	494
COMMUNICATION PROTOCOLS AND SYSTEM PERFORMANCE	E
An Analysis of the TR069 (CWMP) Protocol I. Bašičević	503
Implementation of Automated Testing Solution for Voice Services M. Ivančić, N. Štokić, T. Žilić	509
RFID Inventory Management System Sampling Optimization Based on Zebra Android Framework I. Benke, I. Heđi, E. Ciriković	515
DATA MANAGEMENT	
Study of Data Transfor Nodas Infrastructure in Enabling Pig Data	

Study of Data Transfer Nodes Infrastructure in Enabling Big Data	
Movement between Research and Cloud Storage Networks	523
D. Regvart, M. Mikuc, V. Dakić	

Using Low Power Wide Area Networks to Provide out of BandManagement for Data Centers5J. Redžepagić, Z. Morić, D. Regvart5	528
Establishing the Guidelines for Using Refurbished Hardware in Creating New Data Centers to Lower the Amount of E-Waste J. Redžepagić, V. Dakić, Z. Morić	532
INFORMATION QUALITY AND SECURITY	
The Challenges to Information Security in Croatian Chamber of Economyduring COVID-19 Pandemic5D. Lučić5	539
Do Croatian Citizens Want the Digitalization of Elections? Differences in Socio-Demographic Characteristics 5 V. Pavlović Vinogradac, B. Cerin, D. Vanđelić, A. Prišćan	544
 PAPA for IoT - Role of Data Accuracy in IoT Deployment and Data-centric Decision-Making M. Vermanen, J. Naskali, V. Harkke, J. Koskinen 	548
DATA PROCESSING AND SIGNAL TRANSMISSION	
User Input Search - Custom Motion Estimation Algorithm Optimized for UAVs J. Benjak, D. Hofman	557
FOGO - An Optimized Fog and Edge Computing Method for VANETs5R. Ćorluka, I. Matoš, D. Damjanović, J. Balen	562
On Signal Attenuation in 5G Higher Frequencies Transmissions with Different Area Scenario5T. Iliev, I. Stoyanov, I. Penkov, G. Mihaylov, A. Fazylova, G. Balbayev, I. Beloev, S. Kosunalp5	568
Outage Probability Determining for Wireless Systems in the Presence ofBeaulieu-Xie Fading and Co-channel Interference Rayleigh Modeled5D. Krstić, S. Suljović, D.S. Gurjar, S. Yadav	574

COMPUTERS IN EDUCATION

PAPERS

Applying TAM (Technology Acceptance Model) to Predict Effective ICT Use of Preschool Teachers during the COVID-19 Pandemic T. Velki, M. Miočić

Data Acquisition and Corpus Creation for Phishing Detection I. Dunđer, S. Seljan, M. Odak	589
Information Extraction from Security-Related Datasets S. Seljan, N. Tolj, I. Dunđer	595
A Gamified Learning Scenario for Introducing Pupils to the Scientific Method through Experimentation and Programming D. Kager, A. Marinšek	601
The Reality of Digital Teaching of History in Croatia M. Hajdarović	607
Increasing Students' Motivation and Improving Outcome by Changing the Course Examination from Test to Project on a University Course D. Bele, D. Kučak, Đ. Pašić	611
Model for Assessing E-Learning Courses Considering Multiple Visual and Technical Indicators M. Bankovska, D. Borissova, K. Rasheva-Yordanova	616
Teaching Computer Security in a Secondary School J. Mottl	622
What Do We Know about Learning – Conversations with chatGPT J. Henno, H. Jaakkola, J. Mäkelä	628
A Treasure Trove at Your Fingertips: Analysis of Contents from Europeana with Regard to Their Copyright Status M. Duić	634
QR Codes as an Educational Tool for Implementing the BYOD Approach in Physics Lessons M. Drushlyak, Y. Sabadosh, P. Mulesa, E. Diemientiev, A. Yurchenko, O. Semenikhina	640
Windows Admin GUI Model for Learning PowerShell Commands D. Tuličić, D. Delija, G. Sirovatka, M. Mrkoci	646
Education of Teachers at Higher Education towards Changing Education Expectations D. Pal'ová, I. Korobaničová	652
Simulation of Corporate Work-life as a Part of Higher Education D.Paľová, M. Vejačka	658
Potential Implementation of Augmented Reality Technology in Education M. Brizar, D. Kažović	664

Challenges of Adoption of Cloud Computing Solutions in Higher Education: Case Study Republic of Kosovo L. Shala Riza, J. Ajdari, M. Hamiti	669
Augmenting Student Education Using the RealityScan Application for Generating 3D Content V.V. Kozov, B. Ivanova	675
Implementation of a Facilitative Approach to Teaching Mathematical Disciplines to Future Mathematics Teachers by Means of the MAPLE Package I.V. Shyshenko, Y.O. Chkana, O.V. Martynenko, O.M. Udovychenko, I.I. Stotskyi, O. Semenikhina	681
Digital Technologies in the Activities of Physical Culture and Sports Specialists: Features of Professional Training P. Rybalko, O. Shukatka, S. Lazorenko, V. Kyselov, N. Skachedub, Y. Kozeruk Paryshkura	687
Exploring the Pedagogical Use of AI-Powered Chatbots Educational Perceptions and Practices E. Rakovac Bekeš, V. Galzina	692
Automatic Evaluation of Student Software Solutions in a Virtualized Environment M. Fabijanić, G. Đambić, B. Skračić, M. Kolarić	698
Digital Literacy of Students at the Faculty of Humanities and Social Sciences Zagreb: An Empirical Study R. Vrana	704
Effective Educational Ukrainian Practices of the Formation of Media Literacy Y. Rudenko, S. Ahadzhanova, K. Ahadzhanov-Honsales, O. Bieliaieva, A. Korovai, O. Semenikhina	710
The Formation of Infomedia Literacy of Students in a Media Tournament M. Yachmenyk, I. Kharchenko, O. Semenog, N. Kyrylenko, M. Ostroha, S. Bohoslavskyi, O. Semenikhina	716
Digital Technologies in Teaching Physics: An Analysis of Existing Practices A. Yurchenko, Y. Khvorostina, V. Shamonia, M. Soroka, O. Semenikhina	722
Fostering Critical and Computational Thinking in the Field of Primary and Secondary Education in non-STEM Subjects by Using Data Sets and Applications I. Vlahović, I. Ogrizek Biškupić	728
Gamification in Education: Building an Escape Room Using VR Technologies A. Staneva, T. Ivanova, K. Rasheva-Yordanova, D. Borissova	734

The Ubiquity of Mathematics in the Practical Basics of Computing and Programming M. Bednjanec, D. Bednjanec, B. Kuhar	740
From Classroom to Online Environment – The Comparison Analysis of the E-Learning Standards before and during the COVID-19 Pandemic K. Aleksić-Maslać, P. Vranešić, B. Sinković	744
Validating a Model of Smart Service System, Supporting Teachers to Create Educational Maze Video Games A. Antonova	749
STREAM Education - Potential for Engaging Students in Generating Innovative Green Ideas and Development of Transversal Skills K. Dyulgerova, D. Atanasova, M. Milanova	755
When User Experience Design Meets LMS Desktop Users: How to Mitigate Mobile-Oriented Interface? M. Banek Zorica, J. Klindžić	761
Survey of Recent Research Topics on Effective Use of Communication Tools in Higher Education M. Nurminen, HM. Järvinen, J. Viteli, M. Saari, P. Rantanen	766
Does Daily Use of Digital Technologies Influence the Reading and Information Literacy of 15-year-old Students? V. Lang, A. Špernjak, A. Šorgo	772
Self-Assessment of Pre-service English Teachers' Digital Competence T.K. Harakchiyska	778
Examining the Relationship Between Students' Social Media Usage, Smartphone Checking During Lessons/Studying, and Academic Achievement (GPA) M. Kućar, V. Vidaček Hainš, R. Kovačić	784
Face-to-Face and Online Communication and Etiquette in Secondary Education E. Martinčević, V. Vidaček-Hainš	790
Non-Formal Education: Dynamics of Changes in the Popularity of Mass Open Online Courses N. Dehtiarova, O. Zhmud, V. Makarova, O. Hontar, M. Zakharevych	795
Comparison of Pandemic and Post-Pandemic Education at Higher Education Computer Science Course D. Paľová, J. Štofa, M. Vejačka	800

AI Comics as Art: Scientific Analysis of the Multimedia Content of AI Comics in Education K. Bedi	806
Teenagers' Gaming Practices and Their Performance in STEM Courses M. Homen, V. Juričić	810
Education via ICT Due to Corona Crisis – Our View on Pros and Cons L. Révészová	816
Comparative Analysis of Student Assessment during the COVID-19 Crisis A. Pongrac Pavlina, K. Pavlina	821
ICT Support for Successful Face-to-Face and Online Teaching Process T. Alajbeg, M. Sokele, S. Morić, F. Brkić	825
Programmable Questions in Edgar I. Mekterović, Lj. Brkić, V. Krstić	831
Inclusion of Digital Competence in Educational Physics Study in Croatia and Slovenia F.M. Grgurin, R. Repnik	837
The Influence of the COVID 19 to the Future of Learning M. Krašna, T. Bratina	843
How to Measure Co-Creation in the Digital Environment of Higher Education? T. Mijač, M. Jadrić, M. Ćukušić	847
Classification of Text, Image and Audio Messages Used for Cyberbullying on Social Medias E. Idrizi, M. Hamiti	853
International Cooperation for Digital Innovations in Primary Schools B. Denys, B. Klimczuk	859
The Role of Informatics Textbooks in Primary School in Croatia A. Glavaš, D. Marković	863
The Use of Smartphones and Tablets for Teaching Biology at a Distance: A Comparison between Rural and Urban Schools V. Lang, A. Šorgo	869
Using VIDI-X Microcomputers in High School and College Education B. Balon, A. Skendžić, M. Simić	873
How Well Students Perceive Their Understanding of Logic Programming Course Content? S. Lovrenčić, V. Sekovanić	880

Prototyp of an Optical - Electrical Measuring System for the Determination of the Gravitational Constant for Teaching Purposes C. Ungermanns, W. Werth, A. Schöndorfer, C. Madritsch	885
Computers in Education H. Jaakkola, J. Henno, J. Mäkelä	889
ICT and Changes in Education and Professional Activity of Journalists M. Galić	896
Physics-Electronics Practical Work Model Accessible and Manipulable Remotely via the Web L. Yade, A.D. Gueye, P.L.T. Sow, A. Ndiaye	901
How to Use E-Learning App in Education and Presentation of Erasmus Project M. Sertić, T. Ćosić, M. Kerstner	906
Educational Processor with Single-cycle Instructions SVEU16 S. Ribić, K. Hodžić	911
Student Perspectives on Source-Code Plagiarism: Case Study of Three Programming Courses M. Novak	917
Utilizing Robotics in Maths in Primary Education: A Case Study A. Goltsiou, C. Sofianopoulou	923
Web Application for Learning Mathematics N. Stojkovikj, L.K. Lazarova, M. Ananieva	928
Teachers' Expectations for Digivisio 2030 – A Joint Higher Education Digital Transformation Project in Finland J. Multisilta, T. Mattila, K. Lempinen	933
Digital Culture and Students' Awareness of Their Participation in This Phenomenon L. Bandić, P. Perić, T. Babić	938
Students' Perception of Influencer Marketing on Instagram D. Blažević, T. Babić	944
Tolerance for Disagreement in Communication via Instagram D. Njegovan, B. Frigan, T. Babić	950
Using Drones in Teaching Computer Science P. Voštinár	955

A Critical Analysis of Students' Cheating in Online Assessment in Higher Education: Post-COVID-19 Issues and Challenges Related to Conversational Artificial Intelligence G. Bubaš, A. Čižmešija	961
The Development of Smart E-Portfolio Generator System for University Students: An SDLC Approach A. Shuhaiber, A. Alkuwaiti, M. Alremeithi, H. Almenhali	967
A Smart Desk: A Smart Solution for Young Students A. Shuhaiber, R. Hiyasat, A. Abuelsamen, N. Ghanem, M. Alhammadi, A. Alghafri	975
Pair Programming Education Aided by ChatGPT B. Banić, M. Konecki, M. Konecki	981
Evaluating Learners' Reactions to an Online Training Programme: A Case Study of Maldives National University I. Balaban, J. Badari, I. Ružić	986
The Impact of Short and Very Short Videos on the Effectiveness of Teaching and the Principles of Their Development J. Žufić, S. Bodiš	992
Teacher's Motivation for Applying the Unplugged MEMA Method for Early Programming Teaching S. Babić, M. Čičin-Šain	996
Formativno vrednovanje u online okruženju nastave matematike R. Soldo, D. Kurtić	1000
Modeliranje linearnom funkcijom u osnovnoj školi I. Nađ	1005
Rješavanje jednadžbi u osnovnoj školi uz Geogebru I. Nađ	1009
Industrijski IT certifikati iz područja računalnih mreža D. Valenčić, M. Miholjek, A. Skendžić	1013
Projekt GAMMA: Igranje ili učenje? K. Brleković, D. Ivanović-Ižaković	1021
Čarobni svijet snjegovića knjigoljubaca – izrada digitalne slikovnice S. Barbarić	1025
Stavovi i percepcije učenika i studenata prema plagiranju M. Mirković, D. Možnik	1029

Medijski tehničari – nositelji projekata za mlade Lj. Ille, R. Fic	1035
Digitalni alati u inkluzivnom odgoju i obrazovanju J. Bistrović, T. Pavičić Zajec, T. Ređep	1039
Suvremene metode poučavanja robotike i umjetne inteligencije I. Ružić	1045
Motivacija nastavnika za usvajanje znanja vezanih uz nove tehnologije A. Tihomirović, S. Šišić	1049
Primjena e-učenja u visokoškolskoj nastavi: pristupi instrukcijskom dizajnu, pedagoški scenariji, modeli hibridnog poučavanja i razine kompleksnosti u primjeni G. Bubaš	1054
Umjetna inteligencija kao izvor potpore nastavnicima u pripremi i izvođenju nastave K. Maček Blažeka	1060
Knjižnica u Glideu K. Udina	1066
Digitalni alati i filozofija uma: Može li stroj razmišljati? M. Kerstner, M. Sertić	1070
eTwinning – što kažu učenici? I. Naranđa	1075

DISTRIBUTED COMPUTING AND CYBER-PHYSICAL SYSTEMS

Comparing the Use of Custom-built and Commercial Off-the-shelf Data Gathering Devices in IoT Systems M. Saari, J. Harjamäki, M. Nurminen, P. Rantanen	1083
Challenges of Combining Open and Commercial Data Sources in Visitor Mobility Estimations J. Grönman, P. Rantanen, P. Sillberg, T. Pohjola, T. Jönkkäri	1088
An Overview of Diffusion Models for Text Generation H. Čeović, M. Šilić, G. Delač, K. Vladimir	1094

An Overview of State-of-the-Art Solutions for Scene Text Detection M. Džida, D. Vukadin, M. Šilić, G. Delač, K. Vladimir	1100
A Transfer Learning Method for Hate Speech Detection E. Šmuc, G. Delač, M. Šilić, K. Vladimir	1106
Detection of Shilling Attacks on Collaborative Filtering Recommender Systems by Combining Multiple Random Forest Models V. Grozdanić, K. Vladimir, G. Delač, M. Šilić	1112
High-Performance Serverless Request Generator: Capable of Generating a Hundred Thousand Requests Per Second D. Mileski, M. Gusev	1117
Future Dynamic Computing and User Profile Execution Considering User Migration in Social Media Contexts A. Abiola Periola, A.A. Alonge, K.A. Ogudo	1123
Brief Introduction to Active Noise Control D. Miljković	1130
Active Noise Control Using Waveform Synthesis with Improved Convergence and Tracking D. Miljković	1136
Higher-Level Experimental Prototype of a Control Device for Dynamic Beverage-Cooling Process T. Špoljarić, B. Vuletić Komljen, Lj. Cvitaš, G. Malčić, J. Matuško, M. Miletić	1141
Artificial Intelligence-based Predictive Fuel Blending Control for Flare Gas Mitigation J. Kir Hromatko, Š. Ileš, R. Huljev, V. Vučković	1147
Program Solution for Regulation and Monitoring of Evaporator Section in Individual Quick-Freezing Process T. Špoljarić, D. Gadže, I. Šulekić	1153
Electrical Profile of User with Photovoltaic System I. Petrović, D. Koprivanac, E. Ciriković	1159
Analiza rada fotonaponske elektrane radi optimizacije potrošnje energenata D. Koprivanac, I. Petrović, I. Heđi	1163

ARTIFICIAL INTELLIGENCE SYSTEMS

PAPERS

ARTIFICIAL INTELLIGENCE THEORY

Binary Dynamic Models of Structural Synthesis of Programs G.A. Oparin, V.G. Bogdanova, A.A. Pashinin	1173
The Concept of Cognition as Categorization in the Development of New Metaheuristics and Algorithms Inspired by Nature D. Tuličić, N. Ivković	1179
Speeding up the Solving of Logical Equivalence Checking Problems with Disjunctive Diagrams V. Kondratiev, I. Otpuschennikov, A. Semenov	1184
Empirical Analysis of the RC2 MaxSAT Algorithm S. Kochemazov, V. Kondratiev, I. Gribanova	1190
Challenges in Collective Intelligence: A Survey K. Poje, M. Brčić, M. Kovač, D. Krleža	1196
The Study of the Target Set Selection Problem under Deterministic Linear Threshold Model Using Evolutionary Algorithms M. Smirnov, S. Kochemazov, A. Semenov	1202
Neuroevolution for the Sustainable Evolution of Neural Networks E. Otović, J. Lerga, D. Kalafatović, G. Mauša	1208
IMAGE AND VIDEO PROCESSING AND ANALYSIS	
Influence of Quality of Pixel Level Annotations on Text Detection Performance in Natural Images I. Dorkić, M. Brisinello, R. Grbić, M. Herceg	1217
Effects of Applying Identified Road Lane Lines on Vehicle Autopilot Model Driving Performance V. Diklić, F. Matković, K. Pardon	1222
Estimating a Nonradial Vignetting Shape D. Potoč, D. Petrinović	1228
The Impact of Image Processing on Perceptual Hash Values M. Ferenčak, P. Grd, I. Tomičić	1235

Usporedba funkcija gubitka za semantičku segmentaciju objekata u prometu G. Oreški, S. Aničić	1241
NATURAL LANGUAGE PROCESSING	
The Role of Knowledge Management in Transition to Industry 5.0 S. Lovrenčić	1249
Learning Translation Model to Translate Croatian Dialects to Modern Croatian Language B. Penkova, M. Mitreska, K. Ristov, K. Mishev, M. Simjanoska	1256
Sentiment of the Tweets on Russo-Ukrainian War: The Social Network Analysis A. Poleksić, S. Martinčić-Ipšić	1262
Compressing Sentence Representation with Maximum Coding Rate Reduction	1269
D. Ševerdija, T. Prusina, A. Jovanović, L. Borozan, J. Maltar, D. Matijević	1209
DistilBERT and RoBERTa Models for Identification of Fake News A. Kitanovski, M. Toshevska, G. Mirceva	1275
Analysis of Pro-Russian Tweets during Russian Invasion of Ukraine J. Katalinić	1280
Syllable and Morpheme Segmentation of Macedonian Language M. Mitreska, K. Zdravkova	1286
Multilingual Named Entity Recognition Solution for Optimizing Parcel Delivery in Online Commerce: Identifying Person and Organization Names M. Pajas, A. Radovan, I. Ogrizek Biškupić	1292
Augmentacija podataka za klasifikaciju kratkih tekstova I. Hrga	1298
MACHINE LEARNING APPLICATIONS	
Using Generated LIBS Data as a Base for Neural Network Architecture Development J. Lehtonen, T. Aaltonen	1307
Imitation Learning for Financial Applications S. Goluža, T. Bauman, T. Kovačević, Z. Kostanjčar	1312
The Comparison of Different Feature Extraction Methods in Musical Instrument Classification N. Rodin, D. Pinčić, K. Lenac, D. Sušanj	1318

OTHER TOPICS

Driven by Artificial Intelligence (AI) – Improving Operational Efficiency and Competitiveness in Business K. Šiber Makar	1327
A Survey on Usage of Multimedia Databases for Emotion Elicitation: A Quantitative Report on How Content Diversity Can Improve Performance M. Horvat, P. Jerčić	1333
AI Chatbot for Job Interview N. Boudjani, V. Colas, C. Joubert, D. Ben Amor	1340
Consumer Class Side Scanning Sonar Dataset for Human Detection T. Aaltonen	1346
Network Model of Multiagent Communication of Traffic Inspection for Supervision and Control of Passenger Transportation in Road and City Traffic A. Đukić, R. Bjelošević, M. Stojčić, M.K. Banjanin	1352
Closed-loop Artificial Pancreas Development: A Review S. Glumčević, Z. Mašetić, B. Viteškić	1358

INFORMATION SYSTEMS SECURITY

The Forensic Significance of Indexing Applications on the Windows Operating System I. Špoljarić, D. Delija, G. Sirovatka	1369
Implementation of Biometric Verification of a Fingerprint Whose Image is Taken from a Glass Surface M. Knezović, M. Žagar, D. Delija, G. Sirovatka, D. Možnik	1373
The Latest Developments and Future Perspectives of Artificial Intelligence Systems for In-Vehicle Communication Intrusion Detection G. Marvin	1379
Deep Learning within the Web Application Security Scope – Literature Review M. Kaniški, J. Dobša, D. Kermek	1385
Social Engineering Aspects of Email Phishing: An Overview and Taxonomy I. Tomičić	1391

Data Leaks to Third Parties in Web Services for Vulnerable Groups R. Carlsson, S. Rauti, T. Heino	1398
Privacy in Popular Children's Mobile Applications: A Network Traffic Analysis R. Carlsson, S. Rauti, S. Laato, T. Heino, V. Leppänen	1403
Analysis of DMARC Implementation in Republic of Croatia D. Pranić	1409
Towards Improving Online Security Awareness Skills with Phishing and Spoofing Labs A. Kerr, T. Hynninen	1415
Secure, Accessible, Virtual Voting Infrastructure (SAVVI): Reducing Barriers for Disabled and Overseas Voters T. Selker, J.M. Pelletier	1420
JavaScript Library Version Detection V. Pagon, B. Skendrović, I. Kovačević, S. Groš	1430
Detecting JavaScript Libraries Using Identifiers and Hashes S. Lončarević, B. Skendrović, I. Kovačević, S. Groš	1436
Detection and Analysis of Obfuscated and Minified JavaScript in the Croatian Web Space T. Dujmović, B. Skendrović, I. Kovačević, S. Groš	1442
Forensic Implication of a Cyber-Enabled Fraud Taking Advantage of an Offline Adversary-in-the-Middle (AiTM) Attack D.O. Lawal, D.W. Gresty, D.E. Gan, T.C. Durojaiye	1448

BUSINESS INTELLIGENCE SYSTEMS

Metrics for Estimating Accuracy, Reliability, and Bias in Peer Assessment M. Fertalj, Lj. Brkić, I. Mekterović	1459
Exploring the Relationship between Indoor Playrooms and Population in Skopje A. Naumoski, G. Mirceva, K. Mitreski	1465
Predicting Customer Behavior in Support Channels Using Machine Learning M. Begović, E. Avdagić-Golub, B. Memić, A. Kosovac	1470

Modeling Tennis Matches Using Monte Carlo Simulations Incorporating Dynamic Parameters J. Krčadinac, E.M. Maruševec, L. Jerković, I. Kovač, J. Zloić, A. Šarčević, M. Vranić	1476
Data Warehouse-Based Analytical System in Private Higher Education Institution M. Fabijanić, D. Ružak, A. Novosel, T. Hlupić	1482
Opinion Mining on E-commerce Live Broadcast of Agricultural Products Based on WLDA-Apriori Model B. Wang, Y. Wang, Z. Wang	1488
CroStats — Visualization of Population in Croatia V. Perković, F. Belac, K. Boroš, M. Kos, L. Humski, D. Pintar	1494
A New Approach to Semantic Parsing of Metonymic Phrases by a Business Intelligence System V.A. Fomichov	1500
A Common Pentest Output Schema for Business Intelligence System Ingestion S. Sharma, J.M. Pelletier, B. Stackpole	1506
Partial SQL Query Assessment M. Fabijanić, I. Mekterović	1512

DIGITAL ECONOMY AND DIGITAL SOCIETY

Risk Management in Development of Croatian Maritime Cargo Single Window System S. Aksentijević, E. Tijan, K. Nikolozo, A. Perić Hadžić	1523
E-Accounting System as a Service (E-ASaaS): A Conceptual Overview N. Vlahović	1528
A Preliminary Survey into the Use of Business Process Tools in Croatian Companies Lj. Milanović Glavan	1534
The Importance of ITIL4 Adoption for IT Service Management in Insurance Companies A. Ćerimagić Hasibović, A. Tanović, A. Granulo	1541

Classifying Relevant Causes of Employee Absenteeism Using Machine Learning I. Fosić, A. Živković, I. Fosić	1547
Application of Blockchain Technology and NFTs in a Museum Environment M. Bilogrivić, H. Stublić	1553
Digital Strategies of Service Sector Enterprises: Promising B2B Decisions O. Omelianenko, V. Omelyanenko, O. Kudrina, I. Zihunova, D. Kostyrko, S. Lytvynenko	1559
Factoring Economic Biases Out of Tokenomics T. Baldo, M. Migliardi	1564
Adaptation of European Enterprises to COVID-19 Pandemic: Cluster Analysis Findings M. Pejić Bach, B. Jaković, I. Jajić	1570
The 5G-supported Unmanned Aerial Vehicles for Emergency Cases Response Z. Paladin, Ž. Lukšić, N. Kapidani, M. Montagud, M. Fernández-Dasí, S. Srinidhi, T. Wöllert, G. Boustras	1576
Implementation and Cost-Effectiveness of Blockchain Technology within the IP Ecosystems P. Karanikić	1582
Factors Affecting the Use of Online Recommendation Systems in E-Commerce in Croatia V. Šebek, S. Antolović, C. Kramarić	1587
Co-creating Community-level Indicators: Involving Communities in the Digitalization of Energy for Empowering Energy Citizenship A. Kumar, A. Wolff, B. Naqvi	1592
Exploring Regional Innovation Dynamics Using Directed Acyclic Graphs F. Molinari, D. Čišić, B. Kovačić	1598
Methodological Framework for the Comparative Evaluation of the Emission Footprint of Virtual Remote Work and Travel by Autonomous Electric Vehicle to the Workplace M. Berković, A. Omerhodžić, A. Džananović	1605
Internet of Behavior – The Transformation of Customer Relationship Management in Logistics A. Agatić, E. Tijan, S. Aksentijević, A. Pucihar	1611

Auto-generated Plans and Decisions as an Instrument of Crisis Management D. Labaš, M. Galić, M. Pejić Bach	1616
The Legal Status of Digital Nomads H. Arbutina, Z. Šinković, L. Pribisalić	1622
Comparative Analysis of Machine Learning Algorithms on Data Sets of Different Characteristics for Digital Transformation D. Oreški, I. Pihir, D. Višnjić	1628
Clustering of Croatian Software Development Companies Based on Their Financial Indicators I. Konecki, D. Oreški, N. Kadoić	1634
Artificial Intelligence in Healthcare Services – Regulation, Implementation and Future Challenges M. Boban, M. Klarić	1640

INFORMATION AND COMMUNICATION TECHNOLOGY LAW

Comparative Analysis of the AI Regulation of the EU, US and China from a Privacy Perspective	1651
V. Gábor Rádi	
Algorithmic Contracts in European and United States Contract Law – A Comparative Legal Analysis K. Biczysko-Pudełko	1657
Medical Data in the Digital Era - Legal Challenges Related to Providing Information Security, Applying GDPR and Respecting the Professional Secrecy K. Świtała	1662
Technical Solutions Supporting the Online RTBF in the CJEU and ECHR Jurisprudence N. Gumzej	1672
Legal Assessment of the National Cybersecurity System in Poland in the Light of the New Developments in the NIS2 Directive A. Besiekierska	1679

Online Audiovisual Content, Video Sharing Platforms and Regulation under DSA and AVMSD H. Lisičar, T. Katulić, M. Jurić	1683
Interplay of Gatekeepers' Obligations and Consumer Rights under the Digital Markets Act I. Kanceljak	1689
Analysis of IoT Devices Security for Household Applications M. Milenković, R. Nikolić, S. Čelan, P. Petrošanec	1695
Privacy Notice Informativeness: in a Search for Benchmark M. Alić	1701
DeShame Croatia: Student Reactions and Consequences of Online Sexual Harassment in High Schools L.Vejmelka, R. Matković, M. Rajter, T. Ramljak	1706
Capacities of Western Balkan Economies (and Their Public Sectors) to Respond to Ransomware Attacks Ð. Krivokapić, A. Nikolić, I. Živković	1713
Status of Open Data (Sub)Ecosystem in Croatia: National Open Data Portal A. Musa, P. Đurman	1720
Information Security among SMEs in Hungary - An Overview N. Mike, E. Krén, T. Kecskeméti	1726
Anti-corruption Measures in the New Croatian Public Administration Office Management Regulation G. Vojković, T. Katulić	1731
Privacy Paradox and Generation Z M. Alić, L. Sopić	1737
Zračna luka kao osnova za uvođenje inovativnih tehnoloških rješenja u postupku kreiranja pametnog grada zračne luke M. Milenković	1743

ENGINEERING EDUCATION

Hybrid Agile Approach in Software Engineering Education – A Case Study M. Kaluža, S. Čandrlić, M. Ašenbrener Katić	1758
Computer-supported Education of the Reserve Officers of the Armed Forces M. Čolić	1764
Design, Development and Control of a Ball-on-Beam Control System Using Industrial Equipment N. Muškinja	1770
Using the Matlab Programming Environment in the Course of Student Training in the Electrical Machines Discipline V.S. Ruseva, A.H. Krasteva	1776
Exploring Pre-scoring Clustering for Short Answer Grading L. Petricioli, K. Skračić, J. Petrović, P. Pale	1782
Identifying Higher Software Engineering Education's Design-Reality Gaps in Rural India P. Spiesberger, L. Bürstmayr, R. Vallon, T. Grechenig	1787
Understanding the Teamwork Challenges of Software Engineering Students L. Dorić, N. Luburić, J. Slivka, A. Kovačević	1793
Stimulating (Open) Data Literacy at the Basis of Society: Approaches for Active Learning and Teaching to Young Children I. Bosnić, A. Kuveždić Divjak, B. van Loenen	1799
The Relationship between Extracurricular Activities and Student Achievement in the Affective Domain: The Case of a Vocational Electrical Engineering School D. Delač, D. Purković	1805
Academic Motivation of Sophomore and Junior Electrical Engineering Students A. Gero, B. Catz	1810
Teaching and Assessing Ethics in a Specialized Professional Skills Course B. Pejčinović	1814
Levels and Differences in Professional Identity in Engineering Undergraduates V. Putarek, J. Petrović	1819
Virtual and Augmented Reality in Mechanical Engineering Education G. Ivanova, A. Ivanov, L. Zdravkov	1827
Video Creation as a Catalyst of Value Change in Engineering Education R. Habash, N.M. Abdulkadir	1833

Ensuring Global Perspectives within Reading Lists to Increase Students' Engagement G.J. Collins	1839
Virtual Electric Machines Laboratory, Requirements and Practical Realization P.J. van Duijsen, D.C. Zuidervliet	1845
Hierarchical Approach in Modeling and Simulation of Power Electronics for Education P.J. van Duijsen, D.C. Zuidervliet	1851
Teaching Introductory Parallel Programming Using Two-Player Online Games S. Manoharan, X. Ye	1857
Curriculum Development for Socially Responsible and Sustainably Acting Engineers M. Derda, M. Wedel, M. Albrecht	1862
Income Prospects of Engineering Graduates in Croatia A. Tecilazić	1868
Vertikalna i horizontalna usklađenost inženjerskog obrazovanja u Hrvatskoj: rezultati istraživanja EUROGRADUATE A. Tecilazić, L. Mršić	1873

SOFTWARE AND SYSTEMS ENGINEERING

Role, Importance and Significance of Software Quality F. Témolé, D. Atanasova	1883
Identification of Code Properties that Support Code Smell Analysis S. Prokić, N. Luburić, J. Slivka, A. Kovačević	1889
Migrating to a Microservice Architecture: Benefits and Challenges S. Salii, J. Ajdari, X. Zenuni	1895
Optimization and Parallelization of Object-Relational Mappers F. Jovanov, V. Zdraveski, M. Gusev, M. Kostoska	1903
A Survey of End-to-End Congestion Mechanisms in the Field of IoT D. Fonović, S. Sovilj, N. Tanković	1909

Security and Privacy Concerns Associated with the Internet of Things (IoT) and the Role of Adapting Blockchain and Machine Learning - A Systematic Literature Review E. Leka, E. Hoxha, G. Rexha	1915
Applying Balanced Scorecard in Software Process Improvement: A Case Study of Small Software Organization B. Karahodža, E. Avdagić-Golub, A. Čolaković	1922
Application of Hybrid Project Management Methodology in Development of Software Systems	1928

of Software Systems S. Urlić, Ž. Car

MIPRO JUNIOR - STUDENT PAPERS

Analyzing Sentiment of Reddit Posts for the Russia-Ukraine War A. Krivičić, S. Martinčić-Ipšić	1939
Classification of Crimes Using Machine Learning Techniques for National Crime Data M. Trpchevska, A. Dedinec	1945
Optimizing Vision Transformer Performance with Customizable Parameters E. Ibrahimović	1951
Cardano - What Is It and How to Start Working with It S. Barac, I. Botički, G. Perković, V. Radošević, I. Terzić	1957
Keeping Drivers Alert: A Solution for Monitoring Driver Attention in Assisted-Driving Vehicles R. Jutreša, P. Peer, Ž. Emeršič, J. Kim	1963
Teaching Programming and Microcontrollers with an Arduino Remote Laboratory Application A. Bukovac, E. Pleše, U. Maravić, P. Petrović, T. Jagušt	1968
Awareness of Croatian Citizens about the Advantages and Disadvantages of IoT Devices and Their Safety P. Petrošanec, S. Čelan, R. Nikolić, M. Milenković	1972
Device for Testing the Windings of Electrical Machines M. Lonić, V. Zuppa Bakša, G. Vujisić	1978

Electrical Scheme Digitization Using Deep Learning Methods M. Putak, V. Zuppa Bakša, A. Bednjanec	1984
Body Fat Percentage Calculation: A Linear Regression Model on Croatian Tennis Players Morphology M. Vasilj, V. Vučetić, M. Sukreški, D. Bojanjac	1990
Visualization of Three-Dimensional Ultrasound Data H. Hrženjak, Ž. Mihajlović	1995
Istraživanje izazova i problema suradnje dizajnera i razvojnih programera tijekom procesa razvoja digitalnog proizvoda A. Ilić, M. Čarapina, V. Uglješić	2001

Web Application for Learning Mathematics

N. Stojkovikj*, L.K. Lazarova * and M. Ananieva**

* Goce Delcev University/Faculty of Computer Science, Stip, North Macedonia ** Goso Vikentiev Vocational School/ Kocani, North Macedonia e-mail address: <u>natasa.stojkovik@ugd.edu.mk</u> <u>limonka.lazarova@ugd.edu.mk</u>,

Abstract – Web application which assists in the process of learning mathematics is presented in the paper. The application and its functionalities will be explained in detail. Also, there will be presented parts from the web application using diagrams such as the E-R diagrams and the UML diagrams.

Keywords - web application, professor, student.

I. INTRODUCTION

In today's modern way of living, dependent on technology, mathematics has become more important than ever before. Mathematics is a critical tool in the modern world. A deep understanding of mathematics is required in many fields such as science, engineering, finance, medicine, and many other fields. Learning mathematics has many benefits for students in schools, but also in Critical thinking. collaboration. evervdav life. communication, and creativity skills are very important skills required in the 21st century and all of them can be acquired by learning mathematics, [1]. Many real-life problems can be solved by using mathematical concepts, so the deep understanding of mathematical concepts can be very helpful. Being able to think logically can help to make analysis and separation of the problem into smaller pieces for better understanding, analysis and finding appropriate solution in detail, [2]. Despite the abstract nature of mathematics, its teaching is scientific thinking among students. The process of teaching should be taken very seriously by the teachers, and they should try to explain all mathematical concepts in an easy and understandable way. With the development of ICT tools created to satisfy the needs in education, the whole education system had changed [3,4]. ICT is a tool that supports the learning process and helps in finding new solutions to all the challenges that education is facing, [5]. Students have many difficulties with learning and understanding mathematical concepts. In [6] the authors have analyzed the types of students' difficulties in learning and understanding mathematical concepts in primary schools. Thus, the integration of the ICT tools in the process of teaching and learning mathematics is necessary in order to decrease and eliminate the difficulties for the students and teachers at the same time, [7]. The author in [8] has given examples of ICT-based activities developed in UK secondary schools. They use readily available software and other ICT tools and have proved inspiring for both students and teachers. In [9] the authors have compared the PISA test scores obtained by students using ICT more intensively with the PISA test scores of an appropriate control group and have showed that show that the number of activities irrespective of the

intensity of ICT use, is positively correlated with students' PISA scores in the three domains in the most countries. ICT supports mathematics teachers to improve their designation of lessons, teaching learning tactics, updated to subjective and pedagogical knowledge and expansion of other several relevant skills [10]. The use of ICT makes mathematics teaching healthier and helps to increase the achievement of students [11, 12].

For similar purposes many web applications for teaching and learning mathematics have been developed. The most of them have aim to provide proficiency in mathematics which stands at the top of educational priorities in many countries. Sophisticated web-based learning environments are being developed also for mathematics education, some offering authoring tools for creating courseware, assignments, and exams, some being used for training, assessment, and contests [13, 14, 15].

Many mathematicians, mathematics educators, and researchers have developed many web-based and webassisted mathematics and mathematics education courses [16]. Web-based Virtual Learning Environments (VLEs) such as Web CT, Blackboard, and eCollege are programs that have been developed to provide online mathematics courses [17]. There are many web applications and educational platforms for teaching and learning mathematics and most of them improve learners' motivation, facilitate their search competence formation, and identifies gaps in basic knowledge of mathematics as a subject. Some of them are interactive [18, 19] and they are designed to help students learn Mathematics, with a focus on high-school algebra and calculus drills, [20]. In [21] the author has selected some mathematics learning applications. In much research it is concluded that the use of web and mobile applications in the educational process for teaching and learning mathematics helped enhanced students' achievement and learning mathematics, [22, 23].

In this paper we have described a web-based application for studying mathematics for students in secondary schools.

II. FUNCTIONALITY OF THE WEB APPLICATION

The developed web-based application is devoted for students in secondary schools who are in the final year of secondary education and who are in the process of preparation for taking mathematics as subject for graduation exam. This web application has only been developed as a tool for learning mathematics and is not available for users to visit and use it. The web application covers the areas covered by mathematics's syllabus for graduation's exam at basic level. It is designed to facilitate the process of learning mathematics and solving mathematical problems through solved examples, additional exercises for practice and necessary formulas.

On the Fig. 1, the home page of the web application is given. By clicking on the button "For us", can be read what is the intend of the page. Information for the administrator (teacher who maintains the page) can be found by click on the button "Contact". The login of teachers and login of students can be done by clicking on the button "Login teacher" and "Login student", accordingly.



Figure 1. Home page

A. Functionality for teacher

The web page is maintained by administrator. The role of the administrator is to full fill the content with solved examples and additional exercises for practicing for every topic which can be found at the graduation exam in mathematics. Also, the administrator gives ID code for every new professor who wants to be registered at the web application and to use it. The ID code of the professor has the following format: @0000 0000.

For regular use of the application, the teachers should be registered first. After teachers' registration, they have the same privileges as the other registered teachers (can attach contents, solved examples and problems for exercises). For registration, the professor must enter the following data: Name, surname, age, sex, state, city, address, telephone number (in format (000)000-000), ID code, e-mail address and password. If the registration is successful, the message "Successful registration" will be written, else the message "Please, fill up all necessary fields" will appear. The teachers input email address and password for signing in. If username and password are valid, the professor can used web application (Fig. 2), else the message "E-mail address is not in database. Try again" or "The invalid password is input. Try again" will appear.

At the web application the teachers have the following options:

- to write notes;
- to take student's search;
- to create list of the enrolled students;

- to write statements;
- to answer to the students' questions.



Figure 2. Home page for teacher

The teacher can use the option "Notes" as reminder. By using of the option" Student's search", the teacher will be able to search each student who uses this application. By using of this option, the teacher can do quick and precise searching for every student. If the written student's name exists in the database, the following information for the searched student will be displayed: name, surname, city, mobile phone, e-mail address and password. The option "Student's list" at the web application will show all the students who are in the database, and all data for them.

For registration of a new student, the teacher needs to choose the option "Enter a new student". All needed data for enrolment of a new student are name, surname, date of birth, address and password. The teacher can delete a student if needed. After deleting, the deleted students are not members of web application anymore. For deleting of student, teacher should input his name, surname, and date of birth.

With the option "Student", the teacher will have access to the student's home page. Here, the teacher can read the discussions of the students and the solutions of the exercises. Also, the teacher can give answers to the students' questions.

In option "Statement", the teacher posts a statement to the students. It can be a useful link, information for lessons, additional literature, etc. In the field "Statement Title", the teacher writes the title of the statement. There is a button "Send statement", and by clicking of this button the teacher sends the statement to the enrolled students at the web application.

By choosing the option "Answer the questions", the teacher reads a question from the student in the "Title" field and answers the question in the "Answer" field. After this, the teacher sends the answer to the student by clicking on the "Send answer" button.

• to enter a new student;

B. Functionality for student

This web application is designed for students who are preparing to take graduation exam in secondary school for the subject mathematics. On this web application, students can easily find materials for learning and exercises for practice. Also, the web application gives the students opportunity to communicate with their teachers (Fig. 3).



Figure 3. Home page for student

The students can use this web application, only if they are registered by the teacher. For login, the student should write his e-mail and password. After login, the student has access to all topics for preparing the graduation exam in mathematics from a secondary school. By choosing any topic, all the materials in that topic will be opened together with solved examples and additional exercises for practice.

The topics which are included at the web application are the following:

- *Algebra* contains the following topics:
 - Basic number sets.
 - Algebraic rational expressions.
 - Linear function, linear equation and linear inequalities.
 - System of linear equations and system of linear inequalities.
 - Quadratic equations.
- *Geometry* contains the following topics:
 - Geometric figures in a plane.
 - Perimeter and area of 2D figures.
 - Geometric figures in space.
 - Surface area and volume of 3D shapes.
- *Analytic geometry* contains the following topics:
 - Coordinate system.
 - Equations of (straight)line.
 - Relative position of two lines.
- Probability contains:
 - Experiment and event.
 - Statistical probability and random events.
 - Operations with random events.

- Discrete probability space.
- Classical definition of probability.
- Properties of probability.
- Formula for probability of random events.
- *Progressions* contains:
 - Arithmetic progression.
 - Geometric progression.
 - Infinity geometric progression.

Also, the web application has the following options:

- Questions.
 - In the field "Questions" students can ask questions. The web application does not show which student sends the question. On this way, students have more freedom to discuss for some problems related to the exercises.
- Answers
 - After clicking on the field "Answers" the question from the students and the appropriate answers from the teacher will be shown.
- Statements
 - By clicking on this field, the fields "Title", "Statement" and "Date and time" that are previously filled by the teacher will be displayed.
- C. Functional requirements
 - Registration of a new member is done by entering the following basic data for the potential member: name, surname, date of birth, country, city, residential address, telephone number, e-mail and password.
 - Login of an existing member is done by entering the two basic data username and password. With this data the system will recognize the member.
 - Student' search. The system searches by student's name. So, it is enough for the teacher to write the student's name. In the table, all students with this name will be displayed.
 - Questions and answers. To solve some exercises, the web application allows the student to write the problem in filed "Questions" and send this question to the teacher. In the field "Answers" student can search solution of some previously asked question from the other students.
- D. Non-Functional requirements
 - **Requirement of simplicity**. This application should be structured in such a way that can easily satisfy the requirements of its users. So, the login and registration fields should be clearly located for easily finding. Also, the option

"Student' search", should take central place. Also, the results should be based without much additional information. On this way the web application can perform the requests precisely and correctly.

- **Requirement for speed.** It is expected that the system will perform the actions with a satisfactory speed, with a maximum response time of a few seconds. It should be considered that the database grows with the increasing number of teachers and students. So, the system needs to work with large capacity (in gigabytes) and according to the size of database and speed's performance.
- **Implementation requirements.** Following the world trends, the largest number of internet users work on the Google Chrome browser. So, the application is expected to have the best functionality and adaptability using this browser.

III. DIAGRAMS

With the use of diagrams, various components of the web-based application will be presented.

A. UML diagrams

The Unified Modeling Language (UML) enables the organization of the design process in a manner that allows for clear understanding and agreement among all parties involved in the development of the software, including the client, analyst, programmer, and others.[24]

Use case diagrams illustrate the connection between an actor and a use case. These diagrams are utilized to represent the system's functions, processes, and the framework in which a solution to a problem is being sought. In Fig. 4, Use Case diagram illustrating the interaction and exchange of information between the student and the teacher through the implementation of a question-and-answer functionality is shown.

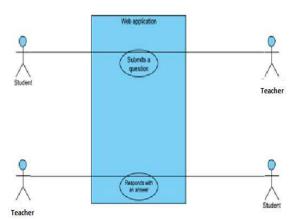


Figure 4. Use Case diagram for question and answer between the teacher and the student.

An activity diagram shows the steps that must be taken (each step is called an "activity") in a specific user scenario to achieve a certain goal or functionality. Activity diagram for functionality user login is shown on Fig. 5.

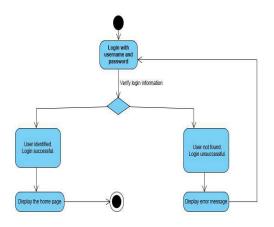


Figure 5. Activity Diagram for the user login functionality

The Entity-Relationship (E-R) diagram define conceptual view of the database and it is utilized in the early phase of database design, known as stage of the conceptual modelling of data.[25] Entity-Relationship (E-R) diagram is shown on Fig. 6.

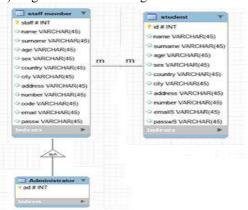


Figure 6. Entity-Relationship (E - R) Diagram

IV. CONCLUSION

In present times, people are gravitating towards utilizing the benefits of new technologies that simplify their daily lives. Computer-aided communication has a crucial place in both individuals' and companies' daily activities. With such advancements, the amount of information and data being stored and exchanged is growing at a big speed rate. Although these technological advancements provide countless advantages, they also pose new challenges to both individuals and organizations. Organizations must continuously evolve and adapt to these developments in order to maintain their effectiveness.

The Internet, as a global network, holds a crucial place in ensuring the smooth and efficient functioning of various processes. It has revolutionized our lifestyle in every way. Not only has it made various tasks easier, but it has also altered the way people perceive things. The Internet has become an indispensable part of our lives and there is scarcely any task that does not involve modern technology and the Internet in some manner.

The presented web application aims to simplify the work of students through the utilization of the Internet. By utilizing this system, the amount of time and effort required to achieve the same results as with traditional methods is reduced. Also, this web application facilitates the process of learning mathematics which is one of the not very popular subject between the students. This application is integrated with a database that stores information for both students and teachers.

REFERENCES

- A. Setyarto and B. Murtiyasa, Sumardi, "Development of 21st century skills in mathematics learning with STEAM in MTs Negeri 2 Wonogiri," Universal Journal of Educational Research, vol.8, no.11, pp.5513 – 5528, 2020, DOI: 10.13189/ujer.2020.081155
- [2] L M Rizki and N Priatna, "Mathematical literacy as the 21st century skill", J. Phys.: Conf. Ser., 2019, 1157 042088.
- [3] K. Das, "Role of ICT for better mathematics teaching," Shanlax International Journal of Education, vol. 7, no. 4, pp. 19-28, 2019, DOI: https://doi.org/10.34293/ education.v7i4.641.
- [4] G.M. Chao, "Impact of teacher training on information communication technology integration in public secondary schools in Mombasa County," Human Resource Management Research, vol. 5, no. 4, pp. 77-94, 2015.
- [5] Oduma, C.A and Ile, C.M. "ICT education for teachers and ICT supported instruction: problems and prospects in the Nigerian education system." African Research Review. vol. 8, no. 2, pp. 199-216, 2014.
- [6] H. Van Steenbrugge, M. Valcke and A. Desoete, "Mathematics learning difficulties in primary education: Teachers' professional knowledge and the use of commercially available learning packages," Educational Studies vol.36, no.1, February 2010, DOI: 10.1080/03055690903148639.
- [7] O. Shestopalova, T. H. Kramarenko, B. Kateryna, "The ICT usage in teaching mathematics to students with special educational needs," Journal of Physics Conference Series, February 2021, DOI: 10.1088/1742-6596/1840/1/012009.
- [8] A. Oldknow, "ICT bringing mathematics to life and life to mathematics," Invited papers, 2008.
- [9] F. Biagi and M. Loi, "ICT and learning: results from PISA 2009," European Commission JRC Scientific and Policy Report, 2012.

- [10] D. Raj Joshi, "Influence of ICT in mathematics teaching," International Journal for Innovative Research in Multidisciplinary Field, vol.3, no.1, pp.7-11, January 2017.
- [11] A. Safdar, M. I. Yousuf, Q. P. Malik and G. Behlol, "Effectiveness of information and communication technology (ICT) in teaching mathematics at secondary level," International Journal of Academic Research, vol.3, no.5, I Part, pp.67-72, 2011.
- [12] M. Gera, and S. Verma, "Role of ICT in teaching to reduce learned helplessness in mathematics," International Journal of Science and Research, vol.3, no.10, pp.2012–2014, 2012.
- [13] R. O. Isidro, J. Sousa Pinto, and A. Batel Anjo, "SA3C platform of evaluation system and computer assisted learning," WEAS Transactions on Advances inEngineering Education 1:2, pp.1–6, 2005.
- [14] FP6-Project "LeActiveMath": language enhanced user adaptive, interactive learning for mathematics, 2004/2006. (http://www.dfki.de/leactivemath/).
- [15] J. Sierra, P. Moreno-Ger, I. Martinez-Ortiz, and B. Fernandez-Manjon, "A highlymodular and extensible architecture for an integrated IMS-based authoring system: the <e-Aula> experience," Softw., Pract. Exper. 37:4, pp.441–461, 2007.
- [16] D. A. Thomas, and Q. Li, "From Web 2.0 to Teacher 2.0," Computers in the Schools, vol. 25, no. (3-4), pp. 199-210, 2008.
- [17] J. Engelbrecht and A. Harding, "Technologies involved in the teaching of undergraduate mathematics on the Web," Journal of Online Mathematics and its Applications, Retrieved August 2, 2011, from <u>http://science.up.ac.za/muti/technologies.pdf</u>.
- [18] E. G. Sabirova, T. V. Fedorova, N. N. Sandalova, "Features and advantages of using websites in teaching mathematics (Interactive Educational Platform UCHI.ru)," EURASIA Journal of Mathematics, Science and Technology Education, vol.15, no.5, pp.1-14, 2019.
- [19] M. Hossain, R. J. Quinn "Interactive features of Web 2.0 technologies and their potential impact in teaching-learning mathematics," Society for Information Technology & Teacher Education International Conference, Austin, Texas, USA. Mar 05, 2012.
- [20] A. P. Tomas1, J. P. Leal and M. A. Domingues, "A Web application for mathematics education", Conference: Advances in Web Based Learning - ICWL 2007, 6th International Conference, Edinburgh, UK, August 15-17, 2007.
- [21] I. K. Namukas, "Selection of mathematics learning apps," Conference: OAME 2016At: Barrie, Ontario, Project: Classroom inovation, technologies and online educational curriculum materials (OECM) in mathematics education, May 2016.
- [22] J. O. Etcuban, L. D. Pantinople, "The effects of mobile application in teaching high school mathematics," International Electronic Journal of Mathematics Education, e-ISSN: 1306-3030, vol. 13, no. 3, pp. 249-259, 2018, https://doi.org/10.12973/iejme/3906.
- [23] M. Al-Aali, "A study of mathematics web-based learning in schools," American Journal of Applied Sciences, vol.5, no.11, pp.1506-1517, 2008.
- [24] G. Booch, J. Rumbaugh and I. Jacobson, Unified Modeling Language User Guide, 2nd ed., Addison- Wesley Professional, 2017
- [25] S. Bagui and R. Earp, Database Desing Using Entity Relationship Diagrams, 2nd ed., Auerbach Publications, 2011.