

BI  **ICT**

IT'17
ŽABLJAK

XXII

međunarodni naučno - stručni skup

**INFORMACIONE
TEHNOLOGIJE**

SADAŠNJOST I BUDUĆNOST

Urednik
Božo Krstajić

IT'17

**INFORMACIONE
TEHNOLOGIJE**

- SADAŠNJOST I BUDUĆNOST -

Urednik
Božo Krstajić

*Zbornik radova sa XXII međunarodnog naučno - stručnog skupa
INFORMACIONE TEHNOLOGIJE - sadašnjost i budućnost
održanog na Žabljaku od 27. februara do 04. marta 2017. godine*

Zbornik radova
INFORMACIONE TEHNOLOGIJE - sadašnjost i budućnost 2017

Glavni urednik
Prof. dr Božo Krstajić
Elektrotehnički fakultet Univerziteta Crne Gore

Izdavač
Univerzitet Crne Gore
Elektrotehnički fakultet
Džordža Vašingtona bb., Podgorica
www.etf.ucg.ac.me

Tehnička obrada
Aleksandra Radulović
Centar informacionog sistema Univerziteta Crne Gore

Doc. dr Žarko Zečević
Elektrotehnički fakultet Univerziteta Crne Gore

Ivan Jokić
Elektrotehnički fakultet Univerziteta Crne Gore

Tiraž
150

Podgorica 2017.

Sva prava zadržava izdavač i autori

Organizator

Elektrotehnički fakultet, Univerzitet Crne Gore

Suorganizator

BIO-ICT Centar izvrsnosti

Skup podržao

Institute of Electrical and Electronics Engineers - IEEE

Programski odbor

Dr Novak Jauković, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Ljubiša Stanković, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Zdravko Uskoković, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Vujica Lazović, Ekonomski fakultet, UCG, Podgorica, MNE
Dr Branko Kovačević, Elektrotehnički fakultet, UB, Beograd, SRB
Dr Milorad Božić, Elektrotehnički fakultet, UBL, Banja Luka, RS BIH
Dr Miroslav Bojović, Elektrotehnički fakultet, UB, Beograd, SRB
Dr Zoran Jovanović, Elektrotehnički fakultet, UB, Beograd, SRB
Dr Božidar Krstajić, Elektrotehnički fakultet, UIS, I. Sarajevo, BIH
Dr Milica Pejanović-Đurišić, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Despina Anastasiadou, Research & Development Innovation Academy, Solun, GRC
Dr Dejan Popović, Elektrotehnički fakultet, UB, Beograd, SRB
Dr Gabriel Neagu, National Institute for Research & Development in Informatics, Bucharest, ROU
Dr Božo Krstajić, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Tomo Popović, Fakultet za informacione sisteme i tehnologije, UDG, Podgorica, MNE
Dr Milovan Radulović, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Le Xie, Texas A&M University, College Station, TX, USA
Dr Sašo Gelev, Elektrotehnički fakultet, UGD, Radoviš, MKD
Dr Budimir Lutovac, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Zoran Veljović, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Igor Radusinović, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Alex Sprintson, Texas A&M University, College Station, TX, USA
Dr Nikša Tadić, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Miloš Daković, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Milutin Radonjić, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Ana Jovanović, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Vesna Rubežić, Elektrotehnički fakultet, UCG, Podgorica, MNE
Dr Biljana Stamatović, Fakultet za informacione sisteme i tehnologije, UDG, Podgorica, MNE
Dr Ramo Šendelj, Fakultet za informacione sisteme i tehnologije, UDG, Podgorica, MNE
Dr Stevan Šćepanović, Prirodno-matematički fakultet, UCG, Podgorica, MNE
Dr Goran Šuković, Prirodno-matematički fakultet, UCG, Podgorica, MNE

Organizacioni odbor

Dr Božo Krstajić, Elektrotehnički fakultet, UCG, Podgorica, MNE - Predsjedavajući konferencije

Dr Milovan Radulović, Elektrotehnički fakultet, UCG, Podgorica, MNE - Finansijski rukovodilac konferencije

Dr Zoran Veljović, Elektrotehnički fakultet, UCG, Podgorica, MNE

Dr Ana Jovanović, Elektrotehnički fakultet, UCG, Podgorica, MNE

Dr Saša Mujović, Elektrotehnički fakultet, UCG, Podgorica, MNE

Dr Tomo Popović, Fakultet za informacione sisteme i tehnologije, UDG, Podgorica, MNE - Rukovodilac izdavačke djelatnosti

Dr Žarko Zečević, Elektrotehnički fakultet, UCG, Podgorica, MNE - Tehnički rukovodilac konferencije

Vladan Tabaš, dipl.ing., Čikom, Podgorica, MNE

Aleksandra Radulović, CIS UCG, Podgorica, MNE - Kontakt za informacije

Ivan Jokić, Elektrotehnički fakultet, UCG, Podgorica, MNE - Kontakt za informacije

Amar Kapić, Elektrotehnički fakultet, UCG, Podgorica, MNE - Kontakt za informacije

P R E D G O V O R

Poštovani učesnici i čitaoci,

Iza nas je jedna od uspješnijih konferencija “INFORMACIONE TEHNOLOGIJE – sadašnjost i budućnost” (IT’17) održana od 27. februara do 04. marta 2017. godine na Žabljaku, a ovo je zbornik radova. Programski odbor i recenzentski tim je izvršio selekciju kvalitetnih radova koji su prezentovani na konferenciji i publikovani ovdje, a najbolji će biti prošireni i objavljeni u časopisu Elektrotehničkog fakulteta Univerziteta Crne Gore u Podgorici ("ETF Journal of Electrical Engineering"). Zahvaljujući vama, dragi autori, iz godine u godinu podižemo kvalitet radova koji su sadržani u ovom zborniku, a prvi put smo sponzorisni i od strane IEEE asocijacije.

Pred vama su 72 autorska rada, prezentovana u 11 sekcija, i sažeci 5 predavanja po pozivu koja su realizovana u plenarnom dijelu programa. Radovi, teme i predavači su birani po kvalitetu kao i tematici sadržaja kako bi konferencija razmatrala aktuelne momente u razvoju ICT-a, a šira stručna javnost i svi zainteresovani su bili u prilici da prate dešavanja na Skupu preko videolinka.

Organizator je registrovao oko 170 učesnika širom regiona i Evrope, 100 studenata sa sva 3 crnogorska univerziteta i veliki broj prisutnih i online posjetilaca (po našoj procjeni oko 100). Konferencija je bila dobro medijski ispraćena i podržana od državnih institucija, lokalne samouprave i velikog broja ICT kompanija.

Konačno, i Durmitor je svojim čarima i vremenskim uslovima omogućio svim učesnicima da u potpunosti uživaju u njegovim ljepotama i pružio nezaboravne utiske prirode ovog kraja. Ono što se moglo osjetiti je jedan zajednički duh i sinergija koje su nas vezivali svih 5 dana i nadahnuli novom snagom i voljom za radom i budućim druženjima. Organizator se nada da svi učesnici dijele naše mišljenje da je ovo jedan od najboljih (ako ne najbolji) IT u posljednjih 10 godina. To nas obavezuje da sljedeći IT bude bar kao ovaj, uz dodatni kvalitet, nove teme, nove ljude, nove akcije i isti duh konferencije.

Sve detalje o ovom, prošlim i narednom skupu možete naći na web adresi konferencije www.it.ac.me.

Prof. dr Božo Krstajić

SADRŽAJ

PREDAVANJA PO POZIVU

Др Сениша Влајић Развој софтверских компоненти заснован на генератору кода и софтверским патернима The Development of Software Components Based on the Code Generator and Software Patterns.....	1
Др Душан Савић Развој софтвера заснован на моделу случајева коришћења и MDD приступу Model and Use Case Driven Software Development Process	2
Др Илија Антовић Аутоматско генерисање корисничког интерфејса засновано на случајевима коришћења – SilabUI приступ Automatic User Interface Generation Based on Use Cases – The SilabUI approach.....	3
Dr Saša D. Lazarević Razvoj C# Cross-Platform aplikacija upotrebom .NET Core 1.0 C# Cross-Platform Applications' Development using .NET Core 1.0	4
Tomislav B. Šekara SAVREMENE METODE PROJEKTOVANJA INDUSTRIJSKIH SISTEMA AUTOMATSKOG UPRAVLJANJA MODERN DESIGN METHODS OF INDUSTRIAL AUTOMATIC CONTROL SYSTEMS	5

AUTORSKI RADOVI

Amar Kapić, Žarko Zečević, Milovan Radulović and Božo Krstajić A VARIABLE STEP SIZE PERTURB AND OBSERVE ALGORITHM FOR MAXIMUM POWER POINT TRACKING.....	6
Sreten Ćorić PRIMJER IMPLEMENTACIJE PRIVATNOG CLOUD RJEŠENJA EXAMPLE OF THE IMPLEMENTATION OF PRIVATE CLOUD SOLUTION	10
Milan Zejak, Milovan Radulović HIBRIDNI KONCEPT SMART HOME SISTEMA AN EXAMPLE OF A HYBRID SMART HOME SYSTEM	14
Igor Miljanić CA SISTEM KABLOVSKIH TELEVIZIJA – MEHANIZAM KONTROLE I MONITORING CA SYSTEM WITHIN CABLE OPERATED PROVIDERS - A MECHANISM OF CONTROL AND MONITORING	18

Vladimir Radulović, Milovan Radulović LED RASVJETA TUNELA PRIMJER TUNEL BUDOŠ NA PUTU PODGORICA NIKŠIĆ TUNNEL LIGHTING WITH LED EXAMPLE OF ROAD TUNNEL BUDOŠ ALONG ROAD PODGORICA-NIKŠIĆ.....	22
Ivan Jokić, Žarko Zečević, Zdravko Uskoković, Milovan Radulović, Božo Krstajić A NEW METHOD FOR SYNCHROPHASOR ESTIMATION.....	26
Ivan R. Bulatović, Vladan M. Radulović DEVELOPMENT OF COMBINATION WAVE GENERATORS FOR SIMULATION OF A LIGHTNING SURGES IN LOW-VOLTAGE AC POWER CIRCUITS	30
Milutin Ostojić, Martin Čalasan UTICAJ PLANIRANOG 400KV DALEKOVODA ČEVO - PLJEVLJA, NA DIONICI KROZ OPŠTINU ŽABLJAK, SA ASPEKTA ELEKTRIČNOG I MAGNETNOG POLJA IMPACT OF 400KV TRANSMISSION ČEVO-PLJEVLJA, AT SECTION THROUGH THE MUNICIPALITY OF ZABLJAK, FROM THE ASPECT OF ELECTRIC AND MAGNETIC FIELDS ...	34
Milan Kočović, Zoran Miljanić, Ilija Vujošević USE OF DYNAMIC PROGRAMMING FOR SHORT-TERM HYDRO-THERMAL COORDINATION	38
Mladen Mitkovski, Vlatko Cingoski, Sašo Gelev PERFORMANCE MODELLING OF PV ARRAYS UNDER SPECIFIC WORKING CONDITIONS	42
Boris Miljanić, Martin P. Čalasan, Vladan Vujičić DETERMINATION OF INDUCTION MACHINE PARAMETERS BY USING PARTICLE SWARM OPTIMIZATION WITHOUT CONSIDERING IRON LOSSES	46
Aleksandar Dedić JEDAN PRIMJER KONTROLE INVERTORA NAPONA KORIŠĆENJEM MIKROKONTROLERA ONE EXAMPLE OF VOLTAGE INVERTER CONTROL USING A MICROCONTROLLER	50
Jelena Končar, Sonja Leković, Zita Petrović Katai E-GOVERNMENT AS A BUSINESS MODEL OF ECOMMERCE IN THE REPUBLIC OF SERBIA	54
Tatjana Stanivuk IMPLEMENTACIJA E-UČENJA U POMORSTVU IMPLEMENTATION OF E-LEARNING IN MARITIME AFFAIRS.....	58
Marina Matijević, Ramo Šendelj UNAPREĐENJE ICT INFRASTRUKTURE OBRAZOVNOG SISTEMA CRNE GORE PRIMJENOM CLOUD COMPUTING-A USING CLOUD COMPUTING IN THE EDUCATION SYSTEM OF MONTENEGRO.....	62
Marina Matijević, Ivana Ognjanović ZAŠTITA PODATAKA U OBRAZOVNOM SISTEMU CRNE GORE UPOTREBOM OPENPGP STANDARDA DATA PROTECTION IN THE EDUCATIONAL SYSTEM OF MONTENEGRO USING OPENPGP STANDARD	66

Nataša Popović, Aleksandra Radulović, Isidora Rovčanin Dragović, Oleg Cmiljanić, Sehija Dizdarević IMPACT OF WEB - BASED LEARNING MENAGEMENT SYSTEMS ON EDUCATION AT THE FACULTY OF MEDICINE IN PODGORICA, MONTENEGRO	70
Ana Grbović ICS IN THE HPP PERUCICA AS A NATIONAL CRITICAL INFRASTRUCTURE.....	74
Vladimir Bigović, Sandra Đurović, Snežana Šćepanović TESTIRANJE UPOTREBLJIVOSTI GRAFIČKOG KORISNIČKOG INTERFEJSA OPERATIVNIH SISTEMA ZA MOBILNE UREĐAJE USABILITY TESTING OF GRAPHICAL USER INTERFACE FOR MOBILE OPERATING SYSTEMS.....	78
Sanja Bauk, Tatijana Dlabac O NEKIM ICT RJEŠENJIMA ZA POVEĆANJE BEZBJEDNOSTI NA RADU U INVAZIVNIM OKRUŽENJIMA ON SOME ICT SOLUTIONS FOR INCREASING SAFETY AT WORK IN INVASIVE ENVIRONMENTS	82
Stanko Janković, Biljana Stamatović AUTOMATED CLASSIFICATION OF WEB APPLICATION PARTS FROM A BLACKBOX SECURITY TESTING PERSPECTIVE	86
Marko Č. Bošković, Tomislav B. Šekara, Milan R. Rapaić, Vidan Govedarica TUNING RULES OF PI/PID CONTROLLERS WITH ROBUSTNESS CONSTRAINT FOR INDUSTRIAL PROCESSES WITHOUT DEAD - TIME.....	90
Ivica Vuković SISTEMI ZA NAPAJANJE I HLAĐENJE GREEN DATA CENTRA GREEN DATA CENTER POWER AND COOLING SISTEMS.....	94
Snežana Šćepanović, Ivan Mraković BARRIERS TO ADOPTION AND SUCCESS OF SCRUM IN PRACTICE.....	98
Bojana Tošić, Dragan Đurić, Radovan Sekulić, Jelena Simićević CLOUD COMPUTING SOLUTIONS FOR HEALTHCARE SYSTEM IN ME: CHALLENGES AND ISSUES	102
Jurica A. Žarković OSVRT NA KONTINUIRANI MONITORING GLIKEMIJE KOD PACIJENATA SA DIJABETESOM REVIEW OF THE METHODS OF CONTINUOUS MONITORING OF BLOOD GLUCOSE IN PATIENTS WITH DIABETES	106
Jelena Badnjar, Nataša Popović, Miroslav Radunović, Tomo Popović RETINAL BLOOD VESSEL SEGMENTATION: DIJKSTRA FOREST AND MULTI – SCALE LINE DETECTION METHODS.....	110
Milija Bajčeta, Petar Sekulić, Slobodan Djukanović RETINAL BLOOD VESSELS SEGMENTATION USING NEURAL NETWORKS AND FEATURES BASED ON LINE OPERATORS	114

Salko Kovačić, Emina Đulić, Admir Šehidić IMPROVING THE SECURITY OF ACCESS TO NETWORK RESOURCES USING THE 802.1X STANDARD IN WIRED AND WIRELESS ENVIRONMENTS	118
Armin Lucević, Lejla Taraniš THE USE OF INFORMATION TECHNOLOGY IN THE HEALTHCARE SYSTEMS, CASE OF SERBIA	122
Arsenije Maliković, Dragan Filipović, Budimir Lutovac PROJEKTOVANJE SPREGNUTIH MIKROTRAKASTIH VODOVA DESIGN OF COUPLED MICROSTRIP LINES	126
Dragan Filipović, Vladan Durković POTENCIJAL, ELEKTRIČNO POLJE I PODUŽNA KAPACITIVNOST TANKOG LINIJSKOG PROVODNIKA U UGLU IZMEĐU DVIJE ZEMLJENE PROVODNE POLURAVNI POTENTIAL, ELECTRIC FIELD AND CAPACITANCE OF A THIN LINE CONDUCTOR IN AN ANGLE BETWEEN TWO GROUND HALFPLANES	130
Teodora S. Veljović, Boban P. Bondžulić, Ljubiša D. Tomić, Bojan Č. Milanović, Rade M. Pavlović ODREĐIVANJE ŠIRINE I DIVERGENCIJE LASERSKOG SNOPA LASER BEAM WIDTH AND DIVERGENCE MEASURING	133
Luka Lazović, Vesna Rubežić, Ana Jovanović CPW NAPAJANA MIKROTRAKASTA MONOPOL ANTENNA ZASNOVANA NA MODIFIKOVANOM SIERPINSKI FRAKTALU CPW FEEDED MICROSTRIP MONOPOL ANTENNA BASED ON MODIFIED SIERPINSKI FRACTAL	137
Ana Perošević, Ivana Milašević, Danijela Joksimović, Dragana Drakulović, Dijana Đurović, Slavka Stanković PHYSICAL-CHEMICAL PARAMETERS AND PHYTOPLANKTON IN BOKA KOTORSKA BAY	141
Mandić Milica, Gvozdenović Slađana, Joksimović Aleksandar, Pešić Ana CONDITION OF CULTURED SEA BASS AND SEA BREAM AND OCCURRENCE OF THEIR SPAWNING IN THE CAGES IN BOKA KOTORSKA BAY	145
Marko Nikolić, Slađana Gvozdenović, Sergey Kholodkevich, Tatiana Kuznetsova, Anton Kurakin VALVE MOVEMENTS IN BIVALVES AS A BEHAVIORAL BIOMARKER	149
Nikola Bulatović, Nikola Žarić, Ana Pešić, Mirko Đurović, Trifun Savić, Aleksandar Joksimović REAL-TIME MEASUREMENTS ANALYSIS OF SEAWATER PHYSICAL PARAMETERS WITH SEMAR BUOY SYSTEM	153
Elma Hot, Balša Bajagić ANOMALY DETECTION AND PREPROCESSING OF SOIL DATABASE OF MONTENEGRO	157
Trifun Savić, Balša Bajagić, Mirko Knežević, Milutin Radonjić METHOD FOR MEASURING RELEASED AMOUNT OF WATER IN SMART IRRIGATION SYSTEM	161

Nikola Bulatović, Tanja Vukićević, Rabina Šabotić, Vanja Asanović MEASUREMENTS CALIBRATION ANALYSIS OF NOVEL IOT PLATFORMS	165
Gojko Gogić, Slavica Tomović, Igor Radusinović, IMPLEMENTATION AND PERFORMANCE EVALUATION OF OPENFLOW DATA-CENTRE NETWORK TESTBED	169
Božidar Škrbić, Slobodan Đukanović A BRIEF OVERVIEW OF IOT ARCHITECTURE AND WEB PLATFORMS.....	173
Žarko Zečević, Tomo Popović, Božo Krstajić CLOUD BASED SOLUTION FOR AUTOMATIC IMAGE MOSAICKING AND GEOREFERENCING	177
Nikola Žarić, Boban Melović, Miomir Jovanović ONLINE PROMOCIJA POLJOPRIVREDNIH PROIZVODA: STUDIJA SLUČAJA BIOPORTAL.ME ONLINE PROMOTION OF AGRICULTURAL PRODUCTS: CASE STUDIES BIOPORTAL.ME.....	181
Petar Sekulić, Milija Bajčeta, Slobodan Djukanović RETINAL BLOOD VESSELS SEGMENTATION USING SUPPORT VECTOR MACHINE AND MODIFIED LINE DETECTOR	185
Miljan Bigović, Žarko Zečević, Luka Filipović, Božo Krstajić KOMPARACIJA RAČUNARSKOG MODELA MOLEKULA SA EKSPERIMENTALNIM REZULTATIMA COMPARISON OF COMPUTER MODEL OF MOLECULE WITH EXPERMINTAL RESULTS	189
Bojan Đaković, Budimir Lutovac KEY PERFORMANCE INDICATORS VISUALIZATION THROUGH “BIMP” APPLICATION.....	193
Ivan Mraković KVALITATIVNA KOMPARATIVNA ANALIZA VODOPADNOG, SPIRALNOG I SCRUM MODELA RAZVOJA SOFTVERA QUALITATIVE COMPARATIVE ANALYSIS OF WATERFALL, SPIRAL AND SCRUM SOFTWARE DEVELOPMENT MODELS	197
Branko Džakula VISOKOTEHNOLOŠKI (SAJBER) KRIMINAL I ANATOMIJA BEZBJEDNOSNIH RIZIKA U INFORMACIONOKOMUNIKACIONIM SISTEMIMA CYBER CRIME AND ANATOMY OF SECURITY RISKS IN INFORMATION-COMMUNICATION SYSTEMS	201
Katerina Cekova, Jasna Cekova, Sašo Gelev HOME AUTOMATION SYSTEM CONTROL BASED ON SPEECH COMMANDS.....	205
Darko Naumovski, Sašo Gelev, Vlatko Cingoski and Biljana Petrevska MALOLETNICKA RAČUNARSKA PORNOGRAFIJA U REPUBLICICI MAKEDONIJI JUVENILE COMPUTER PORNOGRAPHY IN MACEDONIA	209

Vasilij N. Kruglov, Andrey V. Chiryshv, Artem V. Kruglov DEVELOPING OF THE SIMULATION SYSTEM TO MODEL THE FILLING LAYER OF SPHERICAL GRANULATED PARTICLES	213
Aleksandar Tudzarov, Goce Stefanov, Sašo Gelev NOVEL TECHNIQUE FOR AUTHENTICATION & ENCRYPTION IN NEXT GENERATION NETWORKS	217
Zoran S. Veličković, Zoran N. Milivojević, Marko Z. Veličković INSERTOVANJE VODENOG ŽIGA SKREMBLOVANOG GMSAT ALGORITMOM U DWT-SVD DOMENU INSERTING THE WATERMARK SCRAMBLED BY GMSAT ALGORITHM IN DWT-SVD DOMAIN	221
Rade M. Pavlović, Vladimir S. Petrović, Ljubiša D. Tomić UPOREDNA ANALIZA MERA ZA DINAMIČKU PROCENU USPEŠNOSTI SJEDINJAVANJA VIDEO SEKVENCI COMPARATIVE STUDY OF DYNAMIC MEASURES FOR VIDEO FUSION.....	225
Miloš Brajović, Miloš Daković, Ljubiša Stanković A HIGHER ORDER TIME-FREQUENCY REPRESENTATION WITH REDUCED CROSS-TERMS	229
Tamara Šević, Milenko Andrić, Boban Bondžulić, Dimitrije Bujaković, Dejan Ivković IZDVAJANJE OBELEŽJA RADARSKIH CILJEVA OBRADOM SPEKTROGRAMA RADAR TARGETS FEATURE EXTRACTION USING SPECTROGRAM	233
Zoran Milivojević, Dijana Kostić, Zoran Veličković, Darko Brodić PERFORMANCE OF THE SERBIAN MATRIX SENTENCE TEST IN PRESENCE OF THE BABBLE NOISE	237
Dragan S. Janković, Eleonora M. Milić, Aleksandar M. Milenković REALIZACIJA MOBILNOG MEDICINSKOG PODSETNIKA INTEGRISANOG SA MEDICINSKIM INFORMACIONIM SISTEMOM MEDIS.NET IMPLEMENTATION OF MOBILE MEDICAL APPOINTMENTS INTEGRATED WITH THE MEDICAL INFORMATION SYSTEM MEDIS.NET.....	241
Aleksa Srdanov, Selena Vasić, Nada Ratković Kovačević, Dragan Milovanović THE APPLICATION OF SIMULATED INTUITION IN MINIMIZING THE NUMBER OF MOVES IN GUESSING THE SERIES OF IMAGINED OBJECTS	245
Stevan Čakić, Aleksandar Popović ALAT UNITY3D U KONCEPTU PROŠIRENE REALNOSTI UNITY3D TOOL IN THE AUGMENTED REALITY CONCEPT	249
Lazar Radinović, Aleksandar Popović GEO-LOKACIJSKI SERVIS ZA JAVNI PREVOZ GEOLOCATION SERVICE FOR PUBLIC TRANSPORT	253
Kosta Pavlović, Goran Šuković DEEP LEARNING TECHNIQUES FOR CLASSIFICATION OF HANDWRITTEN DIGITS	257

Boris Tuponja, Goran Šuković APPLYING NEAT ON THE GAME 2048	261
Aleksa Srdanov, Vladan Đulaković, Dragan Milovanović ČETIRI EKSTREMA VEZANA ZA SUDOKU FOUR EXTREMES RELATED TO SUDOKU	265
Aleksandar Tudzarov, Goce Stefanov, Sašo Gelev CLIENT BASED SELECTION ALGORITHM FOR HYBRID WIRELESS NETWORKS	269
Uglješa Urošević, Zoran Veljović RJEŠENJA ZA POBOLJŠANJE D2D KOMUNIKACIJA U 5G MREŽAMA SOLUTIONS FOR D2D IMPROVEMENTS IN 5G NETWORKS	273
Jelena T. Šuh, Snežana Lj. Stefanovski Pajović ZAŠTITA OD DOS NAPADA PRIMENOM REMOTELY TRIGGERED BLACK HOLE TEHNIKE FILTRIRANJA SAOBRAĆAJA PROTECTION AGAINST DOS ATTACKS USING THE REMOTELY TRIGGERED BLACK HOLE TECHNIQUE FOR TRAFFIC FILTERING	277
Jovana Mrkić, Enis Kočan INDEX MODULATION FOR PERFORMANCE IMPROVEMENT OF OFDM BASED SYSTEMS	281
Aleksandra Lopušina, Enis Kočan, Milica Pejanović - Đurišić MEETING 5G REQUIREMENTS THROUGH MILLIMETER WAVE COMMUNICATIONS.....	285
Vuk Radman, Milutin Radonjić ARDUINO-BASED SYSTEM FOR SOIL MOISTURE MEASUREMENT	289

Home Automation System Control Based on Speech Commands

Katerina Cekova, Jasna Cekova, *Faculty of Computer Science, UGD - Shtip, R.Macedonia;*
Saso Gelev, *Faculty of Electrical Engineering, UGD - Shtip, R.Macedonia*

Abstract — Home automation is one of the major growing industries that can change the way people live. Home automation gives the user the comfortable and easily for using the home devices to control automatically. Typical wireless home automation system allows controlling house appliances from an Android application. Also, home automation helps handicapped and old people which will enable them to control home appliances.

The developed system can be integrated into a single portable unit and allows the user to control appliances like lights, fans, electronic doors, electrical equipment's etc. The main goal of this system is to control home appliances by using voice commands.

The proposed system can recognize the voice commands, convert them into the required data format, and send the data through the Wi-fi on the microcontroller. This paper presents a design and prototype implementation of a home automation system that uses Wi-fi technology. This system is designed to be low cost and allowing different devices to be controlled.

Keywords — Android Application, Arduino Uno, Home Automation, Voice control, Wi-fi module.

I. INTRODUCTION

With advancement of automation technology, life is getting simpler and easier in all aspects. The concept of remote control of house devices over the internet from anywhere, any time in the world today can be a reality, which has changed the way people live.

A smart home is equipped with lighting, heating, and electronic devices that can be controlled remotely by smartphone or via the internet [1]. An internet based home automation system focuses on controlling home electronic devices from inside or outside the home.

Wireless communication based home automation system has high momentum for the last couple of years. Wireless communication decreases the complexity associated with the installation and maintenance compared with wire communication. Bluetooth and Wi-Fi, are the popular choice for the home automation systems [2]. Wireless network based smart home systems have become very popular as they provide comfort, security, and safety.

The goal of this project is to operate home devices smartly through an Android application using IoT(Internet Of Things) [3]. IoT is the network of "things" or physical objects which include electronics, software, sensors, actuators and network connectivity. All these things collect and transfer data between themselves. IoT has increased

significantly in the last few years since it has added a new dimension to the world of information and communication technologies.

Voice controlled home automation systems have drawn considerable attention in the recent years [4]. Also, the purpose of this project is to develop an Android application which controls home appliances via human voice. Google Voice search software will be used as voice capture device. This is a project to produce a system that can control any electrical appliances by using user's voice. User's voice is an input to activate the electrical appliances through this system. Speech recognition software converts spoken words to machine readable input.

This system needs graphical user interface which provided by Android software. The Android application for recognize voice will send data to the Arduino Uno microcontroller [5] to activate or deactivate the electrical appliances that user wants to use.

The system is portable and constructed in a way that is easy to install, configure, run, and maintain. Android mobile phone as a remote control will make the system more user-friendly and portable.

II. RELATED WORK

Shirsath N. S, Dhole P. S, Mohire N. P, Naik S. C & Ratnaparkhi N.S [6] proposes a home automation system that employs the integration of multi-touch mobile devices, cloud networking, wireless communication, and power-line communication to provide the user with remote control of various lights and appliances within their home. This system uses a consolidation of a mobile phone application, handheld wireless remote, and PC based program to provide a means of the user interface to the consumer.

Javale, D., Mohsin, M., Nandanwar, S. and Shingate, M. [7] The objective of this paper is to assist handicapped/old aged people. It gives a basic idea of how to control various home appliances and provide a security using Android phone. The design consists of Android phone with home automation application, Arduino Mega ADK. User can interact with the android phone and send control signal to the Arduino ADK which in turn will control other embedded devices/sensors.

Basil Hamed [8] propose to design and implement a control and monitor system for the smart house. Smart house system consists of many systems that controlled by LabVIEW software as the main controlling system.

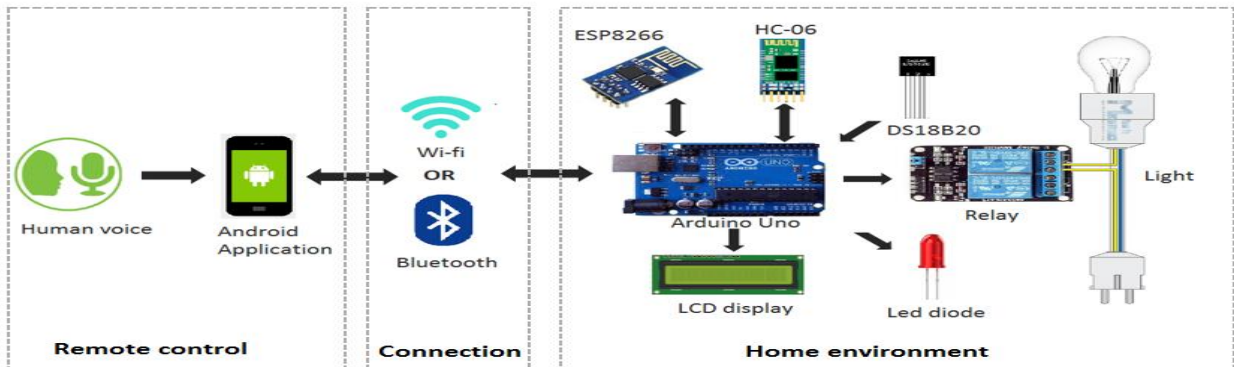


Fig. 1. System architecture of home automation system

I. PURPOSE OF SYSTEM

The purpose of this paper is to design and implement a home automation system using IoT that is capable of controlling and automating most of the house appliances through voice commands. The proposed system has a great flexibility by using Wi-fi technology. This will decrease the deployment cost and will increase the ability of upgrading. Also, the user can control the house appliances via Bluetooth.

II. SYSTEM ARCHITECTURE

The system architecture of the project is shown above in Fig. 1. The system mainly comprises two parts: the remote control and home environment.

Android application is used to recognize voice which is installed to Android phone. Spoken words convert into control commands and send them to the Arduino microcontroller via Wi-fi or via Bluetooth. The microcontroller is connected to the appliances through relays. The home environment is controlled depending on the received command.

A. Hardware design

The hardware consists of the following components:

- Arduino Uno,
- ESP8266 Wi-fi module,
- HC-06 Bluetooth module,
- LCD display,
- DS18B20,
- relay.

The control algorithm runs on Arduino Uno. The Arduino Uno is a microcontroller board based on the ATmega32. It has 14 digital input/output, 6 analogs, ceramic resonator, USB connector, power connector, ICSP, and reset button. Arduino Uno is connected to the ESP8266 module and HC-06 module by I/O points.

The ESP8266 is now one of the leading platforms for the Internet of Things. The ESP8266 Wi-fi module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-fi network. Its parameters can be set by AT command to connect with Wi-fi networks.

The HC-06 module is suitable where wireless data transmission is needed in slave mode. The HC-06 module can reach a range of up to 9 meters.

Relay is used as a switch. A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The microcontroller controls the appliances through relays.

The DS18B20 Digital Thermometer provides 9 to 12-bit readings which indicate the temperature. DS18B20 is used to get the temperature from home. The LCD screen is an electronic display module. A 16x2 LCD display is a very basic module and is very commonly used in various devices and circuits. The temperature and IP address for Wi-Fi connection is displayed on the LCD.

B. Software design

Android operating system is developed for smartphones and tablets. Android is an open-source operating system which means that anyone can use it in their phones free. Android is the most widely used mobile operating system by the people nowadays. Android application is designed by a user-friendly interface. To control the home environment user has to install the Android application.

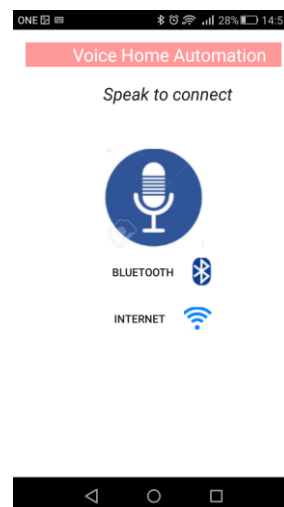


Fig. 2. First Android user interface

Fig.2 illustrate the first Android user interface for communication with the microcontroller. Users can choice Wi-Fi or Bluetooth communication.

For W-fi communication, the user must enter the IP address and port given on LCD display. After establish connection users can choice to control home system by voice commands or with a click on the button to turn on/off the appliance. On Fig. 3 is shown user control interface. The application is designed in Android version 4.2 with API level 17.



Fig. 3. Control interface

C. Activity diagram

In Fig.4 is shown activity diagram for Android application to understand the overall working procedure and properly which will be helpful to operate the project.

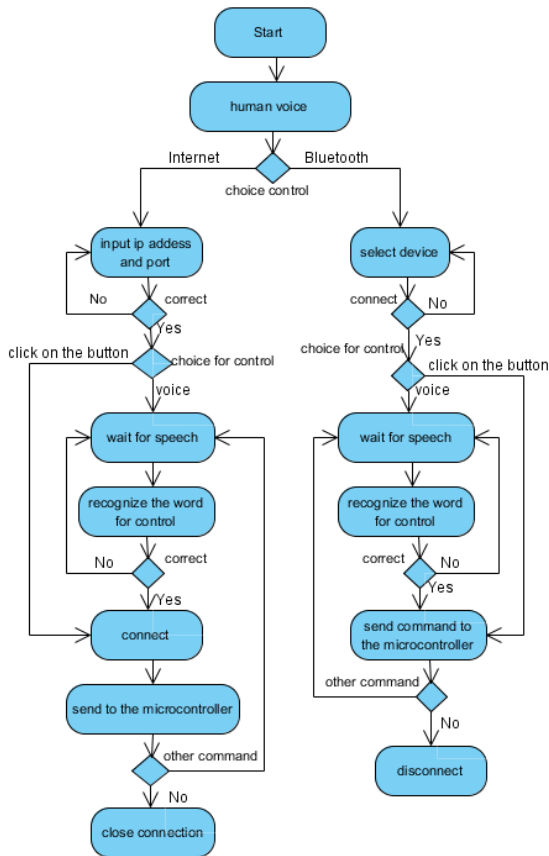


Fig. 4. Activity diagram for Android application

The user can easily manage system locally or remotely home automation system, through voice commands and with a click on the buttons. The user will just have to spoke the command if is chosen voice control. The received voice input, the application will convert this input into byte format and transmit this data to the Arduino microcontroller via Wi-fi module or via Bluetooth.

Activity diagram for Arduino Uno is shown in Fig. 5. after initialization the microcontroller wait for a command. If the command is correct the user command is executed. The activity diagrams show the work-flow of the system.

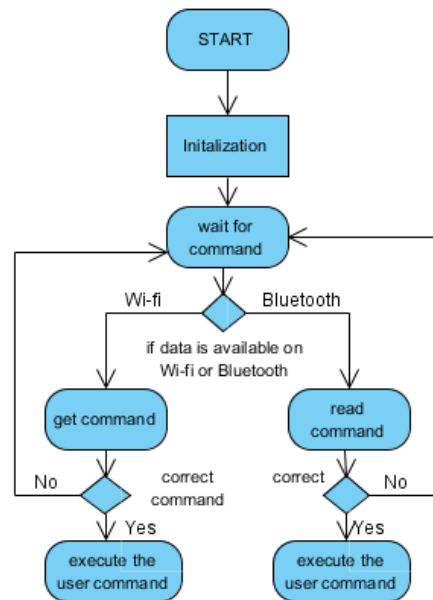


Fig. 5. Activity diagram for the Arduino Uno

D. Test and Results

The proposed system successfully is tested in the home. Android application is tested on a smartphone with operating system version 5.0 (Lollipop). The system is tested with different appliances and Wi-Fi or Bluetooth communication. The Android application gives the information about the temperature of the house. Also gives the status of the controller electrical appliances which we can control remotely. The completed home automation system layout is shown in Fig. 6.

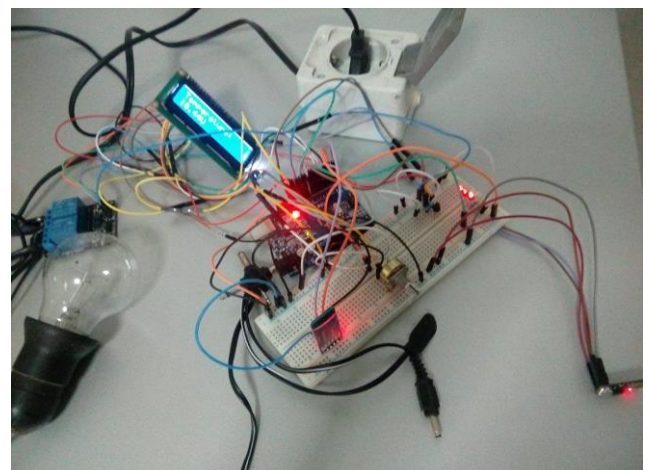


Fig. 6. Home automation system layout

The accuracy of the recognition can be affected by background noise, speed of the speaker, and the clarity of the spoken accent. To get the correct result system was tested in an environment without background noise by five different users. They received instructions for working procedure of the system, and each user perform each command 20 times to determine the percentage of successfully recognized and executed commands. The percentage of success recognized commands is higher in light on, activate and deactivate than the led on and led off. The results (in %) of successfully recognized and executed commands are presented in Table 1.

TABLE 1: TEST OF RECOGNIZED AND EXECUTED COMMANDS

Command	Recognized %	Executed %
Temperature	99	100
Led on	89	100
Led off	85	100
Light on	100	100
Light off	91	100
Turn on	96	100
Turn off	94	100
Activate	100	100
Deactivate	100	100
Disconnect	98	100

From the performed tests for recognition and execution of commands for control is notice different time for execution. As soon as the system receives the voice command from the Android application first checks if the command is correct and changes the status of appliances. To change the status some devices takes a little bit more time to respond to different voice commands respectively. Response time for appliances is almost the same using Wi-fi and Bluetooth connection. Results of the average response time of appliances for both connection together are shown in Fig.7.

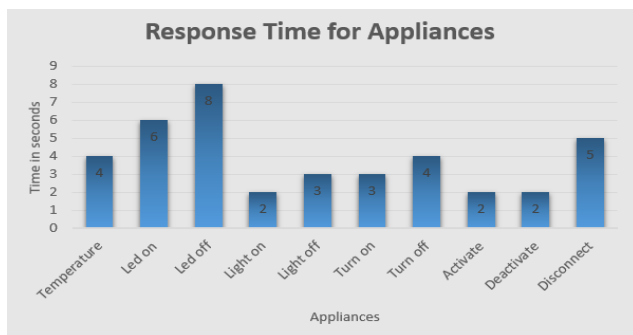


Fig. 7. Response time for Appliances

III. DISCUSSION

The performance test of the project shows the rate of success of the project. This system is controlled in real time and is easy to use. The important feature of the system is the user interface. This determines how the user will interact with the system. The interface is simple to use, the user can simply with voice command or with touch on the icon turn on/off the appliances.

To control home appliances via Bluetooth the user must be in 9 meters from the microcontroller. So the control cannot be achieved from outside this range. With Wi-fi the home appliances can control from anywhere. This project is very helpful for the old people who will not capable of doing works properly.

IV. CONCLUSION AND FUTURE WORK

The home automation using Internet of Things has been experimentally proven to work excellent by connecting simple appliances and the appliances were successfully controlled remotely through internet. This technology makes life easier for the user and saves energy by utilizing devices. The user will have complete control over the appliances of their homes.

This project is based on Android and Arduino platform. We used speech recognition system to implement this work. Recognized commands are used to control the designed home automation system.

The approach discussed in the paper is novel and has achieved the target to control home appliances remotely using the Wi-fi technology. They indicate the real-time switches status. The system is designed in a user-friendly interface. Any Android based mobile can be used to control the home appliances. This low-cost home automation system was successfully designed, implemented and tested.

Using this system as a framework, the system can be expanded to include various other options which could include home security feature like capturing the photo of a person moving around the house and storing it in the cloud.

REFERENCES

- [1] Palaniappan, Satish, Naveen Hariharan, Naren T. Kesh, and S. Vidhyalakshimi. "Home Automation Systems-A Study." *International Journal of Computer Applications* 116, no. 11, 2015.
- [2] Pandya, Bhavik, Mihir Mehta, and Nilesh Jain. "Android Based Home Automation System Using Bluetooth & Voice Command." *International Research Journal of Engineering and Technology (IRJET)* Volume: 03, 2016.
- [3] Vinay Sagar, K. N., and S. M. Kusuma. "Home Automation Using Internet of Things." *International Research Journal of Engineering and Technology (IRJET)* Volume: 02, 2015.
- [4] Akhter, Sonia, Md Faisal Arif, Md Nur-Amin, Nafiz Mustafiz, Roman Khan, Shah Waliullah, and Khalid Hossain. "Voice Controlled Home Appliances: The use of Android Phone." *Journal of Modern Science and Technology* 4, no. 1, 2016.
- [5] David, Nathan, Abafor Chima, Aronu Ugochukwu, and Edoga Obinna. "Design of a Home Automation System Using Arduino." *International Journal of Scientific And Engineering Research* 6, no. 6 (2015).
- [6] Javale, Deepali, Mohd Mohsin, Shreerang Nandanwar, and Mayur Shingate. "Home automation and security system using android adk." *International journal of electronics communication and computer technology (IJECCCT)* 3, no. 2, 2013, 382-385.
- [7] Srisath, N. S., P. S. Dhole, N. P. Mohire, S. C. Naik, and N. S. Ratnaparkhi. "Home Automation using Cloud Network and Mobile Devices." *ITSI Transaction On Electrical and Electronics Engineering* 1, 2013, 785-791.
- [8] Hamed, Basil. "Design & implementation of smart house control using LabVIEW." *International Journal of Soft Computing and Engineering (IJSCE)* 1, no. 6 (2012): 2231-2307.

CIP - Каталогизација у публикацији
Национална библиотека Црне Горе, Цетиње

ISBN 978-86-85775-20-8
COBISS.CG-ID 32715536

ISBN 978-86-85775-20-8



9 788685 775208 >