Scopus indexed

Q3 Computer Networks and Communications | SJR 2019 0.23 | SNIP 2019 1.358 | CiteScore 2019 1.3

ISSN 2089-3191

Vol. 10 No. 1, February 2021

BULLETIN OF

ELECTRICAL ENGINEERING AND INFORMATICS

http://beei.org

UAD Universitas Ahmad Dahlan

iaes Indonesia Section

BEEI Vol. 10 No. 1, February 2021

Editorial Team

Editor-in-Chief:

Prof. Dr. Ir. Tole Sutikno, ASEAN Eng., Universitas Ahmad Dahlan, Indonesia

co-Editors-in-Chief:

Dr. Arash Hassanpour Isfahani, University of Texas at Dallas, United States
Prof. Dr. Ille C. Gebeshuber, Technische Universitat Wien, Austria
Assoc. Prof. Dr. Vicente Garcia Diaz, University of Oviedo, Spain

Associate Editors:

Prof. Dr. Ahmad Hoirul Basori, King Abdulaziz University, Saudi Arabia
Prof. Dr. Attia El-Fergany, Zagazig University, Egypt
Prof. Dr. Eduard Babulak, National Science Foundation, United States
Prof. Dr. Jasvir Singh, Himachal Pradesh University, India
Prof. Dr. Juan Jose Martinez Castillo, Universidad de Málaga, Spain
Prof. Dr. Xiaoguang Yue, European University Cyprus, Cyprus
Prof. Chuan-Ming Liu, National Taipei University of Technology, Taiwan, Province of China
Prof. Dah-Jing Jwo, National Taiwan Ocean University, Taiwan, Province of China
Prof. Francesco Moscato, University of Salerno, Italy
Prof. Gordana Jovanovic Dolecek, National Institute INAOE, Mexico
Prof. Hui Gao, Beijing University of Posts and Telecommunications, China
Prof. João Crisóstomo Weyl, Universidade Federal do Pará, Brazil
Prof. Jun Cheng, Doshisha University, Japan
Prof. Kamran Arshad, Ajman University, United Arab Emirates
Prof. Kui Xu, Army Engineering University of PLA, China
Prof. Mahdi Imani, Northeastern University, United States
Prof. Massimo Vecchio, Fondazione Bruno Kessler, Italy
Prof. Mohammed El Badaoui, University of Lyon, France
Prof. Muhammad Zubair, Information Technology University (ITU) of the Punjab, Pakistan
Prof. Nandana Rajatheva, University of Oulu, Finland
Prof. Nicola Pasquino, Università degli Studi di Napoli Federico II, Italy
Prof. Stavros Ntalampiras, University of Milan, Italy
Prof. Tao Jiang, Harbin Engineering University, China
Prof. Tomonobu Senjyu, University of the Ryukyus, Japan
Prof. Wei Wei, Shandong University, China
Assoc. Prof. Dr. Denis B. Solovev, Far Eastern Federal University (FEFU) and Russian Customs Academy, Russian Federation
Assoc. Prof. Dr. Hung-Peng Lee, Fortune Institure of Technology, Taiwan
Assoc. Prof. Dr. Mu-Song Chen, Da-Yeh University, Taiwan, Taiwan, Province of China
Assoc. Prof. Dr. Sohrab Mirsaeidi, Beijing Jiaotong University, China
Assoc. Prof. Dr. Yilun Shang, Northumbria University, United Kingdom
Assoc.Prof. Wg.Cdr. Dr Tossapon Boongoen, Aberystwyth University, United Kingdom
Asst. Prof. Dr. Amjad Gawanmeh, University of Dubai, United Arab Emirates
Asst. Prof. Dr. Dinh-Thuan Do, Industrial University of Ho Chi Minh City, Viet Nam
Dr. Anna Formica, Istituto di Analisi dei Sistemi ed Informatica "Antonio Ruberti" National Research Council, Italy
Dr. Arcangelo Castiglione, University of Salerno, Italy
Dr. B. Justus Rabi, Toc H Institute Of Science & Technology, India
Dr. Dahaman Ishak, Universiti Sains Malaysia, Malaysia
Dr. Enrico M. Vitucci, University of Bologna, Italy
Dr. Farouk Zouari, University of Tunis El Manar, Tunisia
Dr. Hamid Alinejad-Rokny, University of New South Wales (UNSW Sydney), Australia
Dr. Haoxiang Wang, Cornell University, United States
Dr. Hazlee Azil Illias, Universiti Malaya, Malaysia
Dr. Jens Klare, Fraunhofer FHR, Germany
Dr. Juan Antonio Martinez, University of Murcia, Spain
Dr. Luca Di Nunzio, University of Rome “Tor Vergata”, Italy
Dr. Lutfu Saribulut, Adana Science and Technology University, Turkey
Dr. Ramón Durán, University of Valladolid, Spain
Dr. Ratheesh Kumar Meleppat, University of California Davis, United States
Dr. Saad Qaisar, National University of Sciences and Technology Pakistan and University of Jeddah, Pakistan
Dr. Safdar Hussain Bouk, Old Dominion University, United States
Dr. Sukumar Senthilkumar, Universiti Sains Malaysia, Malaysia
Dr. Sunil Jha, ICAR-Central Soil Salinity Research Institute, India
Dr. T Vijay Muni, K L Deemed to be University, India
Dr. Taghi Javdani Gandomani, Shahrekord University, Iran, Islamic Republic of
Dr. Thinagaran Perumal, University Putra Malaysia, Malaysia

Dr. Tomoaki Nagaoka, Japan National Institute of Information and Communications Technology, Japan
Dr. Winai Jaikla, King Mongkut's Institute of Technology Ladkrabang, Thailand
Dr. Xiaojun Li, Gotion Inc., United States
Dr. Yuchen Jiang, Harbin Institute of Technology, China
Mr. Yun She, Technical Research Center in Caterpillar, United States
Ahmed Ah-yasari, University of Babylon, Iraq
Nuryono Satya Widodo, Universitas Ahmad Dahlan, Indonesia

Editorial Board:

Prof. Ali Rostami, Tabriz University, Iran, Islamic Republic of
Prof. Andrea Sciarrone, University of Genoa, Italy
Prof. Deepti Mehrotra, AMITY School of Engineering and Technology, India
Prof. Emilio Jiménez Macías, University of La Rioja, Spain
Prof. Enrico Tronci, Sapienza University of Rome, Italy
Prof. Hans Dieter Schotten, University of Kaiserslautern, Germany
Prof. Marco Mugnaini, University of Siena, Italy
Prof. Marco Mussetta, Politecnico di Milano, Italy
Prof. Mohamed El-Shimy Mahmoud Bekhet, Ain Shams University, Egypt
Prof. Mohamed Hadi Habaebi, International Islamic University Malaysia (IIUM), Malaysia
Prof. Mohamed S. Hassan, American University of Sharjah, United Arab Emirates
Prof. Pawel Rozga, Lodz University of Technology, Poland
Prof. Pedro S. Moura, University of Coimbra, Portugal
Prof. Priya Ranjan, SRM University, India
Prof. Saeed Olyaee, Shahid Rajaee Teacher Training University, Iran, Islamic Republic of
Prof. Sergio Takeo Kofuji, University of São Paulo, Brazil
Prof. Tapas Kumar Maiti, Dhirubhai Ambani Institute of Information and Communication Technology, Japan
Prof. Yu Song Meng, National Metrology Centre, A*STAR, Singapore
Dr. Afida Ayob, The National University of Malaysia, Malaysia
Dr. Ahmad Fairuz Omar, Universiti Sains Malaysia, Malaysia
Dr. Ai-ichiro Sasaki, Kindai University, Japan
Dr. Alessandro Carrega, National Inter-University Consortium of Telecommunications (CNIT), Italy
Dr. Andrews Samraj, Mahendra Engineering College, India
Dr. Ankan Bhattacharya, Hooghly Engineering & Technology College, India
Dr. Arun Sharma, Indira Gandhi Delhi Technical University for Women, India
Dr. Arvind R Singh, University of Pretoria, India
Dr. Asan Gani Abdul Muthalif, Qatar University, Qatar
Dr. Ashraf A. Tahat, Princess Sumaya University for Technology, Jordan
Dr. Asrulnizam Abd Manaf, Universiti Sains Malaysia, Malaysia
Dr. Azilah Saparon, Universiti Teknologi MARA, Malaysia
Dr. Baharuddin Ismail, Universiti Malaysia Perlis, Malaysia
Dr. Chockalingam Aravind Vaithilingam, Taylor's University, Malaysia
Dr. Christoph Hintermüller, Johannes Kepler University Linzdisabled, Austria
Dr. Dhananjay Singh, Hankuk University of Foreign Studies, Korea, Republic of
Dr. Dheeraj Joshi, Delhi Technological University Delhi, India
Dr. Donato Impedovo, Università degli Studi di Bari, Italy
Dr. Emmanouil G. Spanakis, University of Maryland, United States
Dr. Erwan Sulaiman, Universiti Tun Hussein Onn Malaysia, Malaysia
Dr. Farhan Ahmed Siddiqui, Dickinson College, United States
Dr. Fazirulhisyam Hashim, University Putra Malaysia, Malaysia
Dr. Gulivindala R. Suresh, Saveetha School of Engineering, India
Dr. Guillermo P. Falconí, Technische Universität München, Germany
Dr. Hamzah Ahmad, University Malaysia Pahang, Malaysia
Dr. Haytham Elmiligi, Thompson Rivers University, Canada
Dr. Hemant Kumar Rath, TCS Research and Innovation, Bhubaneswar, India, India
Dr. Hüseyin Kemal Çakmak, Karlsruhe Institute of Technology (KIT), Germany
Dr. Jahariah Sampe, Institute of Microengineering and Nanoelectronics, Malaysia
Dr. Jing-Sin Liu, Institute of Information Science, Academia Sinica, Taiwan, Province of China
Dr. João Paulo Barraca, Universidade de Aveiro, Portugal
Dr. Jose-Luis Sanchez-Romero, Universitat d'Alacant, Spain
Dr. Kalaivani Chellappan, Universiti Kebangsaan Malaysia, Malaysia
Dr. Kandarpa Kumar Sarma, Gauhati University, India
Dr. Kang Song, Qingdao University, China
Dr. Khalil Hassan Sayidmarie, Ninevah University, Iraq
Dr. Lalit Garg, University of Malta, Malta
Dr. Leo Yi Chen, Newcastle University, United Kingdom
Dr. Liang-Bi Chen, National Penghu University of Science and Technology, Taiwan, Province of China
Dr. M. Udin Harun Al Rasyid, Politeknik Elektronika Negeri Surabaya (PENS), Indonesia
Dr. Mahmoud Hassaballah, South Valley University, Egypt
Dr. Maaruf Ali, Epoka University, Albania
Dr. Manar Mohaisen, Northeastern Illinois University, United States
Dr. Manoj Kumar Taleja, University School of Information, Communication and Technology, India
Dr. Marco Carratù, Università degli Studi di Salerno, Italy
Dr. Md. Farhad Hossain, Bangladesh University of Engineering and Technology (BUET), Bangladesh

Dr. Md. Rajibul Islam, Bangladesh University of Business and Technology, Bangladesh
Dr. Mohamad M. Awad, National Council for Scientific Research, Lebanon
Dr. Mohammed Abdel-Megeed Mohammed Salem, German University in Cairo, Egypt
Dr. Mohammad Lutfi Othman, University Putra Malaysia, Malaysia
Dr. Mohd Anwar Zawawi, Universiti Malaysia Pahang, Malaysia
Dr. Mohd Hafizi Ahmad, Universiti Teknologi Malaysia, Malaysia
Dr. Mohd Khair Hassan, Universiti Putra Malaysia, Malaysia
Dr. Muhammad Haroon Yousaf, University of Engineering and Technology Taxila, Pakistan
Dr. Muhammad Irfan, Najran University Saudi Arabia, Saudi Arabia
Dr. Muzamir Isa, Universiti Malaysia Perlis, Malaysia
Dr. Mritha Ramalingam, Universiti Malaysia Pahang, Malaysia
Dr. Natarajan Prabaharan, SASTRA Deemed University, India
Dr. Narottam Das, Central Queensland University, Australia
Dr. Nasrul Humaimi Mahmood, Universiti Teknologi Malaysia, Malaysia
Dr. Nico Saputro, Universitas Katolik Parahyangan, Indonesia
Dr. Norashid Aziz, Universiti Sains Malaysia, Malaysia
Dr. Norizam Sulaiman, Universiti Malaysia Pahang, Malaysia
Dr. Olympia Nikolaeva Roeva, Institute of Biophysics and Biomedical Engineering, Bulgarian Academy of Science, Bulgaria
Dr. Omar Alfandi, Zayed University, United Arab Emirates
Dr. Orhan Ekren, Ege University Solar Energy Institute, Turkey
Dr. Peyman Kabiri, Iran University of Science and Technology, Iran, Islamic Republic of
Dr. Pramod Kumar Singh, ABV-Indian Institute of Information Technology and Management, India
Dr. Pushpendra Singh, JK Lakshmipat University, India
Dr. Radek Fujdiak, Brno University of Technology, Czech Republic
Dr. Rahman Dashti, Persian Gulf University, Iran, Islamic Republic of
Dr. Riccardo Pecori, Mercatorum University, Italy
Dr. Rodrigo Nava, Luxembourg Institute of Science and Technology, Luxembourg
Dr. Sanjay Singh, Manipal Institute of Technology, India
Dr. Siti Anom Ahmad, Universiti Putra Malaysia (UPM), Malaysia
Dr. Shailesh Chaudhari, Samsung Semiconductor, Inc., United States
Dr. Shao Ying Zhu, Birmingham City University, United Kingdom
Dr. Shaode Yu, Communication University of China, United States
Dr. Shibiao Wan, University of Nebraska Medical Center, United States
Dr. Sobia Baig, COMSATS University Islamabad Lahore Campus, Pakistan
Dr. Soo Siang Yang, Universiti Malaysia Sabah, Malaysia
Dr. Subhasis Bhattacharjee, Adobe Systems India Private Limited, India
Dr. Sudhir Routray, CMR Institute of Technology, Bangalore, India
Dr. Syed Muslim Shah, Capital University of Science and Technology, Pakistan
Dr. Tanmoy Maitra, Kalinga Institute of Industrial Technology, India
Dr. Teerapat Sanguankotchakorn, Asian Institute of Technology, Thailand
Dr. Theofilos Chrysikos, University of Patras, Greece
Dr. Vicente Ferreira De Lucena, Federal University of Amazonas, Brazil
Dr. Vivek Kumar Sehgal, Jaypee University of Information Technology, India
Dr. Vladislav Skorpil, Brno University of Technology, Czech Republic
Dr. Xin Li, University of Florida, United States
Dr. Ying-Ren Chien, National I-Lan University, Taiwan, Province of China
Dr. Zeashan Hameed Khan, Bahria University, Pakistan
Dr., Eng., Ph.D. Crescenzo Pepe, Dipartimento di Ingegneria dell'Informazione, Università Politecnica delle Marche, Italy
Ph.D. Juan L. Navarro-Mesa, Universidad de Las Palmas de Gran Canaria, Spain
Mr. Cheng-Lian Liu, University of Pacific, United States
Mr. E Hari Krishna, Kakatiya University, India
Mr. Kamal Kant Sharma, Chandigarh University, India

Vol 10, No 6

December 2021

DOI: https://doi.org/10.11591/eei.v10i6

Table of Contents

Single phase inverter fed through a regulated SEPIC converter
Adil Hasan Mahmood, Mustafa F. Mohammed, Mohammed Omar Ali, Ali H. Ahmad

Mathematical modeling of a solid oxide fuel cell operating on biogas
Wandercleiton Cardoso, Renzo di Felice, Raphael Colombo Baptista

Modeling and analysis: power injection model approach for high performance of electrical distribution networks
Baraa Jalil Abdulelah, Yousif Ismail Mohammed Al-Mashhadany, Sameer Algburi, Gozde Ulutagay

Personal air-conditioning system using evapolar as heat waste management
Nor Azazi Ngatiman, Abdul Qaiyum Mohd Shariff, Tole Sutikno, Suparje Wardiyono, Mustafa Manap, Mohd Hatta Jopri

A single-phase simplified DC-AC converter using DC-link capacitors and an H-bridge
Sai Divya Sindhura Nunna, Akhilesh Ketha, Srivastav Sai Goud Padamat, K. Rambabu, Ujwala Anil Kshirsagar, Abhilash Tirupathi

A cascaded converter using hybrid cells and H-bridge structure
Satya Subrahmanya Ajay Dangeti, Chaitanya Kishore Patnaik Sekharamantry, Venkata Kowshik Bayanti, B. A. Raju Ch, KVS Ramachandra Murthy, Abhilash Tirupathi

Power quality disturbances classification using complex wavelet phasor space reconstruction and fully connected feed forward neural network
R. Likhitha, A. Manjunatha

Effect of repeated electrical breakdowns on mineral and natural ester insulating oils
Sharin Ab Ghani, Mohd Shahril Ahmad Khiar, Imran Sutan Chairul, Muhammad Imran Zamir

Hybrid islanding detection method based on the rate of change of frequency and load impedance
Hasmaini Mohamad, Zuhaila Mat Yasin, Nur Ashida Salim, Bibi Norasiqin Sheikh Rahimullah, Kanendra Naidu

Prediction of passenger train using fuzzy time series and percentage change methods
Solikhin Solikhin, Septia Lutfi, Purnomo Purnomo, Hardiwinoto Hardiwinoto

Lifting and stabilizing of two-wheeled wheelchair system using interval type-2 fuzzy logic control based spiral dynamic algorithm
N. A. A. Razali, Nor Maniha Abdul Ghani, Bifta Sama Bari

Wheelchair controlled by human brainwave using brain-computer interface system for paralyzed patient
Norasyimah Sahat, Afishah Alias, Fouziah Md Yassin

Brake by wire control with pedal feedback and brake boost
W. A. Shanaka P. Abeysiriwardhana, A. M. Harsha S. Abeykoon

Design and implementation of internet of things-based electrical monitoring system
Jumana A. Hassan, Basil H. Jasim

Implementation of high-voltage kicker system for “ROSTU” middle-size league robot soccer
Dzikri Hasbialloh, Simon Siregar, Muhammad Ikhsan Sani

Detection roasting level of Lintong coffee beans by using euclidean distance
Yohanssen Pratama, I Gde Eka Dirgayussa, Paian Fernando Simarmata, Mia Hotmaria Tambunan

A review paper on memory fault models and test algorithms
Aiman Zakwan Jidin, Razaidi Hussin, Lee Weng Fook, Mohd Syafiq Mispan

A 9T FinFET SRAM cell for ultra-low power application in the subthreshold regime
Shilpi Birla, Neha Singh, Neeraj K. Shukla, Sidharth Sharma

Symptoms based endometriosis prediction using machine learning
Visalaxi Sankaravadivel, Sudalaimuthu Thalavaipillai

Key performance requirement of future next wireless networks (6G)
Ahmad A. A. Solyman, Khalid Yahya

Transforming data-centric eXtensible markup language into relational databases using hybrid approach
Su-Cheng Haw, Emyliana Song

Design of a dual-band antenna for energy harvesting application
Maizatul Alice Meor Said, Syed Mohd Iqwan Naqiuddin Syed Jaya, Zahriladha Zakaria, Mohamad Harris Misran, Mohd Muzafar Ismail

Exact secure outage probability performance of uplinkdownlink multiple access network under imperfect CSI
Dinh-Thuan Do, Minh-Sang Van Nguyen

The calculation of the field of an antenna located near the human head
Hamood Shehab Hamid, Raad Farhood Chisab

Implementation of double-layer loaded on octagon microstrip yagi antenna
Kamelia Quzwain, Alyani Ismail, Yudiansyah Yudiansyah, Nadia Media Rizka, Aisyah Novfitri, Lia Hafiza

Wireless HART stack using multiprocessor technique with laxity algorithm
A. Manjunathan, E. D. Kanmani Ruby, W. Edwin Santhkumar, A. Vanathi, P. Jenopaul, S. Kannadhasan

Comparing the performance of linear regression versus deep learning on detecting melanoma skin cancer using apple core ML
Herry Sujaini, Enriko Yudhistira Ramadhan, Haried Novriando

Twin support vector machine using kernel function for colorectal cancer detection
Zuherman Rustam, Fildzah Zhafarina, Jane Eva Aurelia, Yasirly Amalia

On detecting and identifying faulty internet of things devices and outages
Feng Wang, Eduard Babulak, Yongning Tang

Development of 3D convolutional neural network to recognize human activities using moderate computation machine
Malik A. Alsaedi, Abdulrahman Saeed Mohialdeen, Baraa Munqith Albaker

Frequency based edge-texture feature using Otsu's based enhanced local ternary pattern technique for digital image splicing detection
Vikas Srivastava, Sanjay Kumar Yadav

E-commerce online review for detecting influencing factors users perception
Irvan Krisna Arsad, Djoko Budiyanto Setyohadi, Paulus Mudjihartono

Micro hydropower plant potential study based on Landsat 8 operational land imager satellite data
Yuliana Susilowati, Pudji Irasari, Yugo Kumoro, Wawan Hendriawan Nur, Yunarto Yunarto

Assessing mangrove deforestation using pixel-based image: a machine learning approach
Ahmad Yahya Dawod, Mohammed Ali Sharafuddin

A multi-task learning based hybrid prediction algorithm for privacy preserving human activity recognition framework
Vijaya Kumar Kambala, Harikiran Jonnadula

Quality of service performances of video and voice transmission in universal mobile telecommunications system network based on OPNET
Sameer A. S. Lafta, Mohaned Mahdi Abdulkareem, Raed Khalid Ibrahim, Marwah M. Kareem, Adnan Hussein Ali

Parking detection system using background subtraction and HSV color segmentation
Awang Hendrianto Pratomo, Wilis Kaswidjanti, Alek Setiyo Nugroho, Shoffan Saifullah

An approach of re-organizing input dataset to enhance the quality of emotion recognition using the bio-signals dataset of MIT
Van-Dung Pham, Thanh-Long Cung

Modeling climate phenomenon with software grids analysis and display system in the development of the global warming module
Afrizal Mayub, Leni Hendraini, Henny Johan, Fahmizal Fahmizal, Rendy Wikrama Wardana

Noise resistance territorial intensity-based optical flow using inverse confidential technique on bilateral function
Darun Kesrarat, Vorapoj Patanavijit

Prototype mobile contactless transaction system in traditional markets to support the covid-19 physical distancing program
Irawan Afrianto, Mouhamad Hatta Hiroshi Sasmita, Sufa Atin

Understanding the role of individual learner in adaptive and personalized e-learning system
Alva Hendi Muhammad, Dhani Ariatmanto

Customized moodle-based learning management system for socially disadvantaged schools
Ika Qutsiati Utami, Muhammad Noor Fakhruzzaman, Indah Fahmiyah, Annaura Nabilla Masduki, Ilham Ahmad Kamil

Timetabling problem solving based on best-nests cuckoo search
Mohammed A. Jebur, Hasanen S. Abdullah

Plant leaf identification system using convolutional neural network
Amiruzzaki Taslim, Sharifah Saon, Abd Kadir Mahamad, Muladi Muladi, Wahyu Nur Hidayat

A secure and energy saving protocol for wireless sensor networks
Aso Ahmed Majeed, Baban Ahmed Mahmood, Ahmed Chalak Shakir

Handling concept drifts and limited label problems using semi-supervised combine-merge Gaussian mixture model
Ibnu Daqiqil Id, Pardomuan Robinson Sihombing, Supratman Zakir

Supervised machine learning based liver disease prediction approach with LASSO feature selection
Saima Afrin, F. M. Javed Mehedi Shamrat, Tafsirul Islam Nibir, Mst. Fahmida Muntasim, Md. Shakil Moharram, M. M. Imran, Md Abdulla

Hyper-parameter optimization of convolutional neural network based on particle swarm optimization algorithm
Zainab Fouad, Marco Alfonse, Mohamed Roushdy, Abdel-Badeeh M. Salem

Square transposition: an approach to the transposition process in block cipher
Magdalena A. Ineke Pekereng, Alz Danny Wowor

An effective classification approach for big data with parallel generalized Hebbian algorithm
Ahmed Hussein Ali, Royida A. Ibrahem Alhayali, Mostafa Abdulghafoor Mohammed, Tole Sutikno

An empirical assessment of different kernel functions on the performance of support vector machines
Isaac Kofi Nti, Owusu Nyarko-Boateng, Felix Adebayo Adekoya, Benjamin Asubam Weyori

Android mobile application for wildfire reporting and monitoring
Rony Teguh, Fengky F. Adji, Benius Benius, Mohammad Nur Aulia

Using particle swarm optimization to solve test functions problems
Issa Ahmed Abed, May Mohammed Ali, Afrah Abood Abdul Kadhim

Cucumber disease recognition using machine learning and transfer learning
Md. Jueal Mia, Syeda Khadizatul Maria, Shahrun Siddique Taki, Al Amin Biswas

The calculation of point quantity for lighting based on android OS using ionic framework and rule based expert system
Mufadhol Mufadhol, Budi Hartono, Sulartopo Sulartopo, Maya Utami Dewi, Danang Danang, Guruh Aryotejo

Non-linear behavior of root and stem diameter changes in monopodial orchid
Mohd Khairi Nordin, Mohammad Farid Saaid, Nooritawati Md Tahir, Ahmad Ihsan Mohd Yassin, Megat Syahirul Amin Megat Ali

Successful factors determining the significant relationship between e-governance system and government operational excellence
Almahdy Alhaj Saleh, Imad Fakhri Taha Alyaseen

Online medical consultation: covid-19 system using software object-oriented approach
Ali Yahya Gheni, Hiba Adil Yousif, Yusmadi Yah Jusoh

The development and implementation of an android-based saving and loan cooperative application
Moechammad Sarosa, Devi Khanthi Dwi Bhakti, Putri Elfa Mas'udia, Yunia Mulyani Azis, Nailul Muna, Ekananda Sulistyo Putra

Comparative review on information and communication technology issues in education sector of developed and developing countries: a case study about Pakistan
Aasma Akram, Mohsin Nazir, Tayyaba Batool, Muhammad Imran Zulfiqar, Maria Nazir, Habiba Azhar, Sadia Murawwat

An improved feature selection approach for chronic heart disease detection
S. J. Sushma, Tsehay Admassu Assegie, D. C. Vinutha, S. Padmashree

Remote sensing and GIS application for monitoring drought vulnerability in Indonesia: a review
Khalifah Insan Nur Rahmi, Muhammad Dimyati

Bulletin of Electrical Engineering and Informatics
Vol. 10, No. 6, December 2021, pp. 3303~3312
ISSN: 2302-9285, DOI: 10.11591/eei.v10i6.3205

Prototype mobile contactless transaction system in traditional markets to support the covid-19 physical distancing program

Irawan Afrianto, Mouhamad Hatta Hiroshi Sasmita, Sufa Atin
Department of Informatics Engineering, Universitas Komputer Indonesia, Bandung, Indonesia

Article Info

Article history:

Received Aug 9, 2021
Revised Oct 10, 2021
Accepted Oct 21, 2021

Keywords:

Contactless transaction
Covid-19
Digital payment
Prototype
QR code
Traditional market

ABSTRACT

One way to prevent and reduce the spread of the covid-19 pandemic is through physical distancing program. This research aims to develop a prototype contactless transaction system using digital payment mechanisms and QR code technology that will be applied in traditional markets. The method used in the development of electronic market systems is a prototype approach. The application of QR code and digital payments are used as a solution to minimize money exchange contacts that are common in traditional markets. The results showed that the system built was able to accelerate and facilitate the buying and selling transaction process in traditional market environment. Alpha testing shows that all functional systems are running well. Meanwhile, beta testing shows that the user can very well accept the system that was built. The results of the study also show acceptance of the usefulness of the system being built, as well as the optimism of its users to be able to take advantage of this system both technologically and functionally, so its can be a part of the digital transformation of the traditional market to the electronic market and has become one of the solutions in reducing the spread of the current covid-19 pandemic.

This is an open access article under the CC BY-SA license.

Corresponding Author:

Irawan Afrianto
Department of Informatics Engineering
Universitas Komputer Indonesia (UNIKOM)
112-116 Dipati Ukur Street, Bandung 40132, Indonesia
Email: irawan.afrianto@email.unikom.ac.id

1. INTRODUCTION

The development of traditional markets or people's markets has contributed greatly to increasing employment opportunities, economic growth, and people's income [1]. The number of traditional markets in Indonesia reached 14,182 units in 2018, making traditional markets one of the basic foundations for regional economies in Indonesia [2].

Traditional markets are markets that in practice are still traditional in nature where sellers and buyers can fully interact and use cash payments in their transactions. The use of cash when transacting takes more time to prepare money that fits your needs and time to wait for changes from sellers. In addition, by transacting using cash, there is the potential for the spread of various diseases, this is because viruses and bacteria can be attached to the exchange of money during the buying and selling process. In the face of Indonesia's shifting cash-to-non-cash transaction trend, a new mechanism in the conventional market environment is required to address these issues. Digital transformation can change business processes [3], provide added value, and increase productivity [4], [5] can be used as a solution to these problems. In addition, the current covid-19 virus outbreak has become a momentum for the acceleration of digital transformation with various technologies that support it [6]. Research carried out in the context of

accelerating digital transformation in the covid-19 pandemic era includes changes in cash to non-cash transactions in cities [7], changes in education models and methods [8], [9] as well as the role of e-wallets during the covid-19 pandemic [10].

Electronic money-based digital payments in Indonesia are now starting to get the attention and trust of their users. Electronic money is a means of payment in electronic form where the value of money is stored in certain electronic media [11]. The user must first deposit the money to the publisher and keep it in electronic media before using it for transaction purposes [12]. Electronic money is divided into two types, namely e-money and e-wallet. E-money is a type of electronic money in the form of cards (chip-based). Examples of e-money products include Flazz BCA, Brizzi BRI, JakCard Bank DKI. Meanwhile, e-wallets are electronic money in the form of applications (server-based). Examples of e-wallet products include T-Cash, Go-Pay, OVO, etc. E-wallets are a type of electronic money that can be accessed via smartphones [13].

E-wallets allow transactions to be carried out more quickly and safely without requiring change. So, sellers can focus more on serving buyers and transaction activities are completed more quickly. In previous research with the integration of a mobile payment system with NFC, it is proven that transactions between two android smartphones can be completed quickly, namely 141.50 ms and transactions with NFC assistance take 270.87 ms [14]. In other studies on mobile payments, it is revealed that since smartphones are an inseparable part of the lives of all humans, the use of mobile payments will continue to increase in the future [15].

QR code was chosen as a medium for data interaction between two android smartphones because all smartphones have cameras. So that it allows all smartphones to interact with the data needed in transaction activities. Previous research has implemented QR code as a document licensing tool which contains important information and enables fast and safe access to that information [16]. In other studies also revealed that QR code has several advantages such as speed of access, storing more information, and the presence of pattern recognition that allows the orientation of the QR code to be scanned in all positions [17], [18]. The application of QR code technology and e-wallet payment has been implemented in areas such as public transportation where QR codes and e-Wallets are used as a substitute for travel tickets, which are paid automatically via e-wallets of passengers [19], [20]. Another application is in research [21], where QR codes are used as a substitute for tickets for parking areas and are integrated with IoT devices and digital payments. The use of QR codes and E-Wallet is also used in menu ordering and food payments at restaurants [22]. Another aspect that needs to be considered is the acceptance of the use of QR code technology and electronic payments [23], both in terms of convenience [24] and how to create a sense of trust and usefulness of this technology by users [25].

However, previous research that has been done, takes the theme of activities and environments that are easy to adapt to new technologies. Meanwhile, the research developed leads to a traditional market ecosystem, where users are ordinary people and still use traditional transactions. The aims of this research is to integrate digital payments (e-wallets) and QR code by developing a prototype non-cash transaction system which can be accessed on smartphones owned by sellers and buyers in traditional markets, as an alternative of payment that can make transactions more practical, fast and secure. Furthermore, the prototype developed will be tested as part of digital transformation in the traditional market environment, evaluated usefulness and optimism the direct impacts on intention to adopt by users, and it is hoped that it can reduce the spread of the covid-19 virus because the system used in transactions is contactless.

2. RESEARCH METHOD

To achieve the objectives of the research carried out, researchers used a prototyping approach. The activities carried out in this study include problem identification, communication processes, planning processes, rapid modeling and design, development processes, implementation and feedback, and finally making conclusions and recommendations. Figure 1 shows the activities of the research activities carried out. The first stage of this research is the problem identification activity, where the researcher identifies the phenomena that become the problem and the potential solutions that can be used to solve the problem. The second stage is communication, where the activity is by conducting interviews and observations, giving questionnaires and conducting literature reviews, which are intended to get a clearer picture of the problem and solutions that have been done before. The third stage is rapid planning, modeling, and design. This activity begins with a system analysis in which the process includes analysis of current conditions and analysis of system requirements to be developed, followed by system modeling, which aims to provide a functional description of the software that will be built, as well as the functional design of the system to be developed. The fourth stage of this research includes the stages of system development by coding the software using the appropriate programming language and framework, implementing and testing the system being built, and providing feedback on the system that has been built. The final stage of this research is to provide conclusions and provide recommendations from the research that has been done.

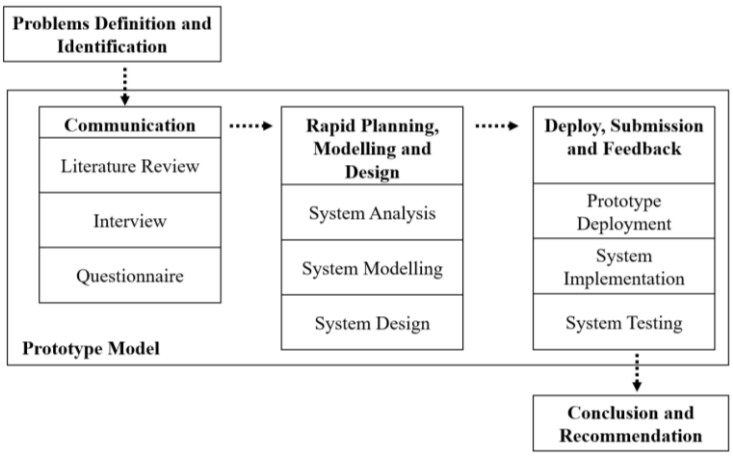

Figure 1. The research methodology

3. RESULTS AND DISCUSSION

3.1. Proposed system architecture

The modeling stage of a system is used to make it easier for system developers to translate it into the next stage. System modeling can use the rich picture mechanism as the first step towards system design [26]. The proposed system consists of frontend and backend systems. The backend is made as a website-based application while the frontend is made as an android based application. The frontend system consists of two types of sub-systems, namely sub-systems for sellers and buyers, while the backend system is intended for market managers. As an interactive tool for the two types of frontend systems for sellers and buyers in sharing detailed shopping information on this system, QR code technology is used. And the payment instrument used in this application is the Go-Pay e-wallet from Go-Jek based on the payment gateway. The proposed system shows in Figure 2. The application involved in the transaction system architecture is the frontend application of sellers and buyers. This architecture describes a series of processes Figure 3.

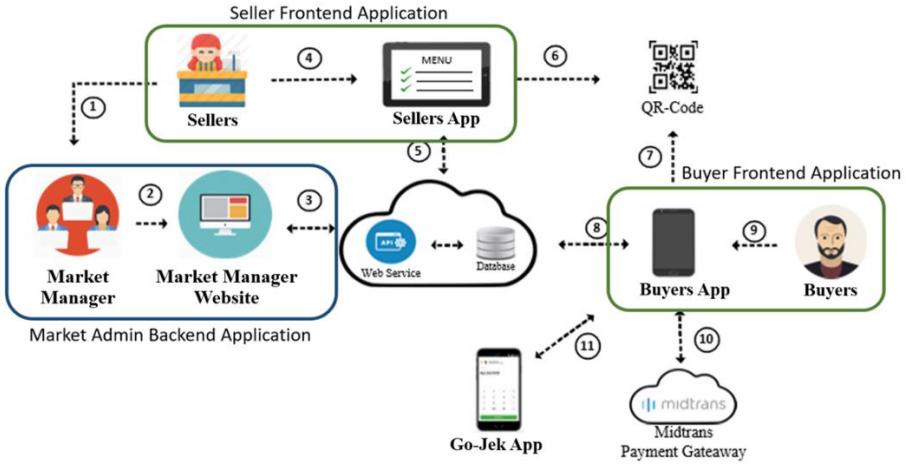

Figure 2. Proposed system architecture

Figure 3 explanation:

1) The buyer initializes the details of the shopping the buyer will buy.
2) The merchant application generates a transaction id that has been obtained from the data that has just been stored into the database into a QR-Code.
3) The buyer scans the QR-Code on the merchant's device screen using the buyer application.
4) The buyer checks the shopping details on the application.
5) The buyer makes a payment from the buyer's application.
6) The system changes the transaction status concerned to "Paid".

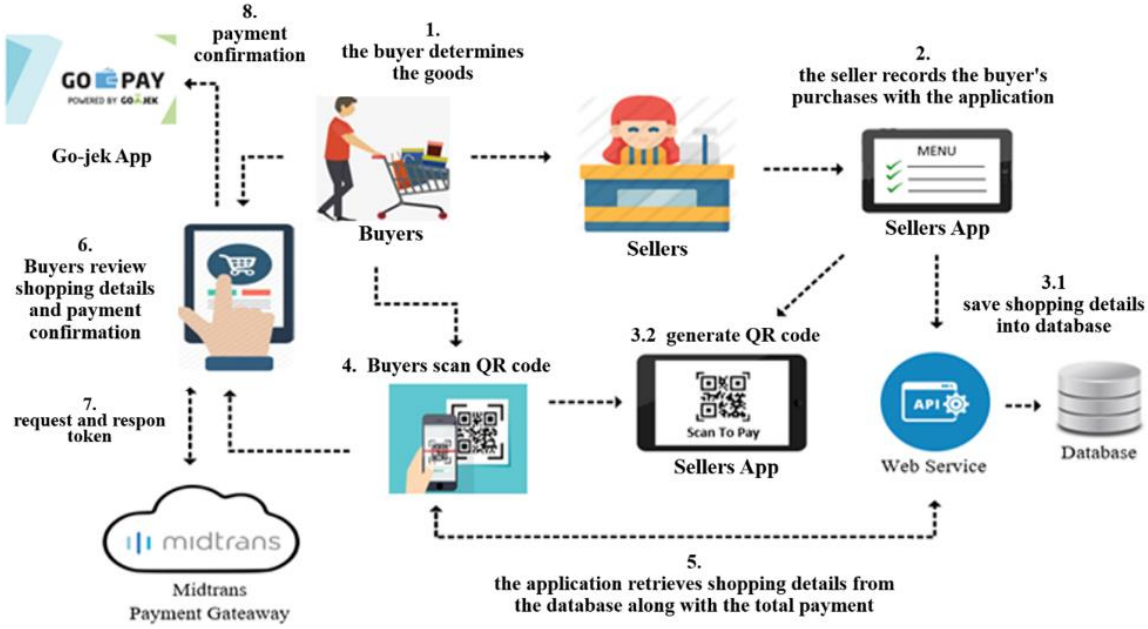

Figure 3. Transaction system architecture

3.2. Functional requirements analysis

Functional requirements analysis describes the process of activities that will be applied in a system and explains the requirements needed by the system for the system to run well [27]. Use case diagrams to describe an interaction between one or more actors with the system to be created. Roughly, use cases are used to find out what functions are in a system and who has the right to use these functions. Analysis of use case diagrams on the system to be built can be seen in Figure 4.

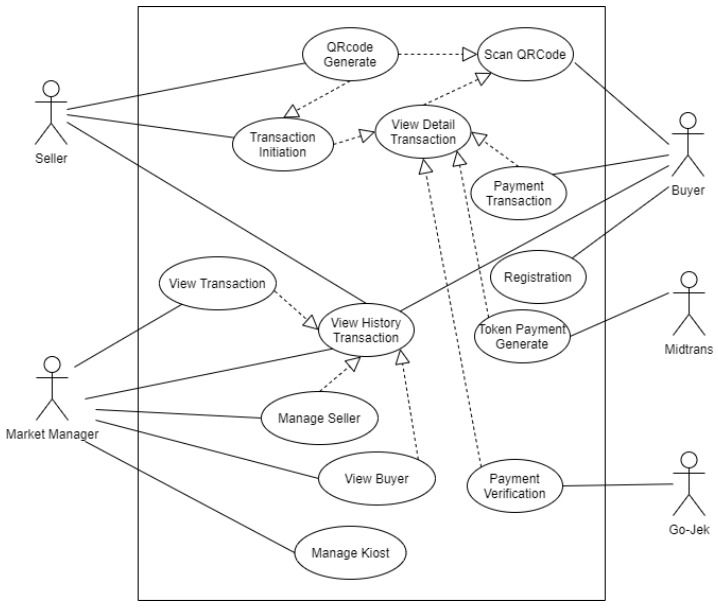

Figure 4. Use case diagram of contactless system

The QR code in this system is used as a mechanism for sending transaction IDs from the merchant application to the buyer's application. So that sellers and buyers can access the same transaction data in the

database according to the transaction id that has been raised. A general description of how QR code works in the system is shown in Figure 5.

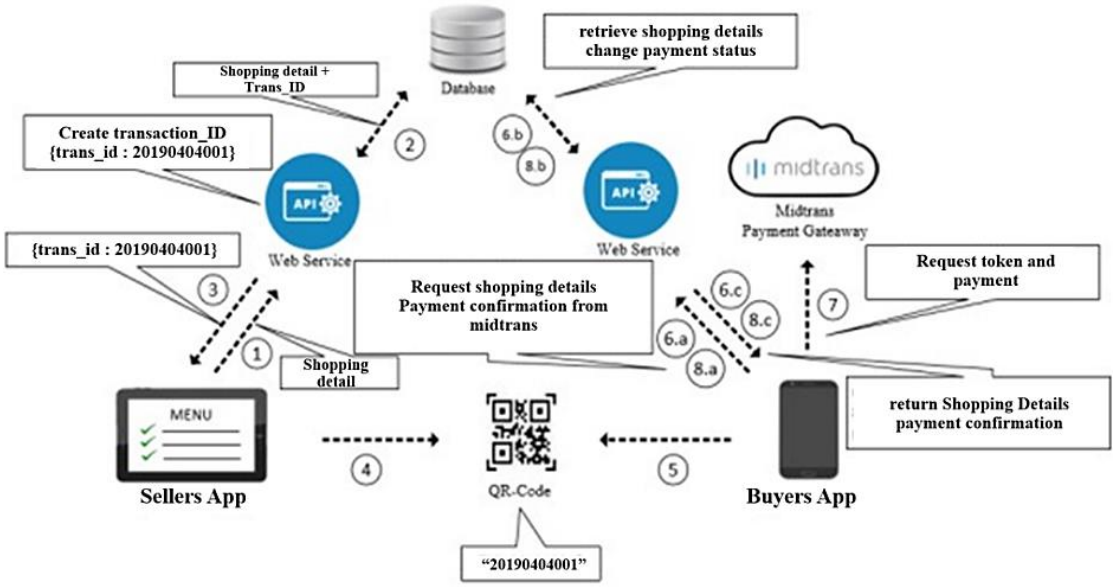

Figure 5. QR code analysis of contactless system

The payment gateway used in this system is the Midtrans payment gateway. Midtrans is used as an intermediary so the system can make payments using Go-Pay. The architectural description of how midtrans payment gateway and Go-Pay work can be seen in Figure 6.

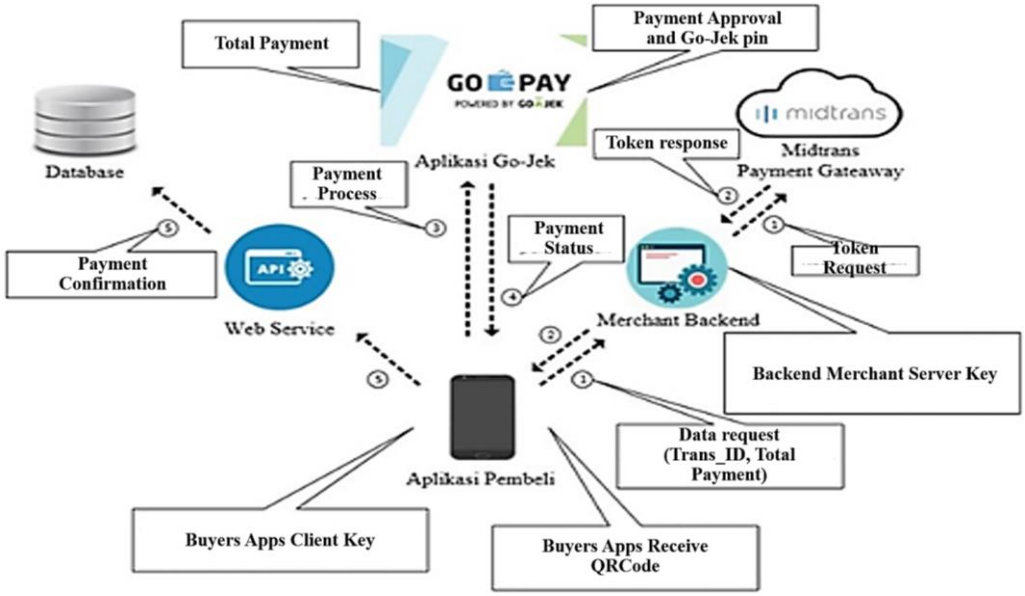

Figure 6. Payment gateway analysis of contactless system

The payment mechanism that occurs uses an authentication token by utilizing the client key and server key provided by the Midtran payment gateway. The transfer of payment transactions from the buyer's application to the Go-Jek application will be carried out directly when the buyer's application has received the transaction token from Midtrans.

3.3. System implementation

The interfaces implemented in the system built are divided into three different parts, namely: backend interfaces for a market manager: Figure 7 shows the application interface used by market managers to manage data sellers, kiosks, and financial transaction data in their market.

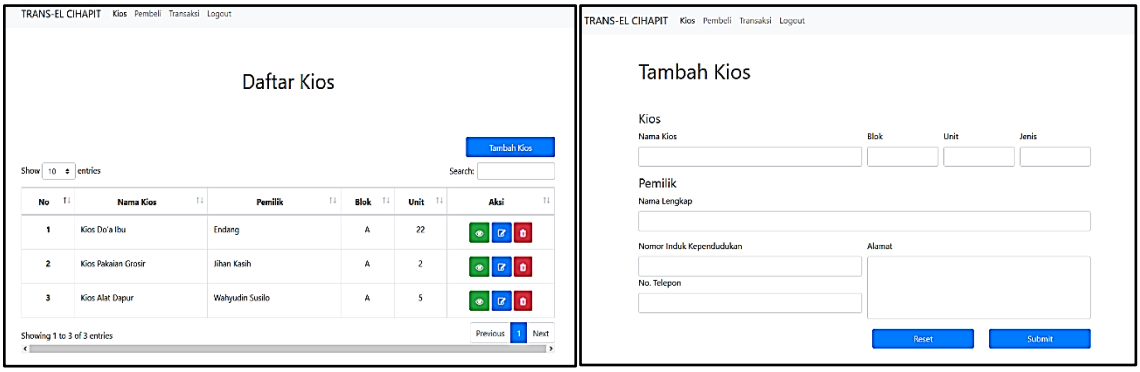

Figure 7. Backend application for market manager

Frontend application for sellers: Figure 8 shows the application interface from the seller's side. This interface is used to store data on products sold, prices, generate QR codes, and find out about financial transactions at the kiosk. Frontend application for buyers: Figure 9 shows the interface from the buyer's side. This interface is used to make transactions, scan the QR code of purchased goods, and pay for them using the e-wallet it owns.

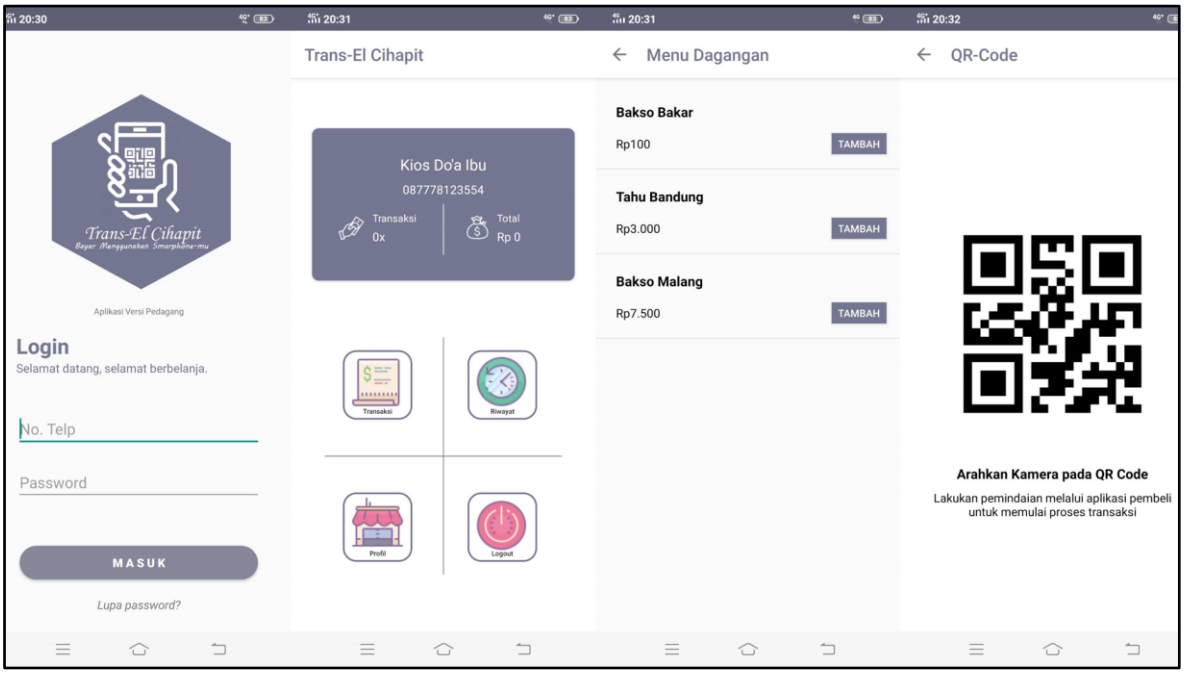

Figure 8. Frontend application for sellers

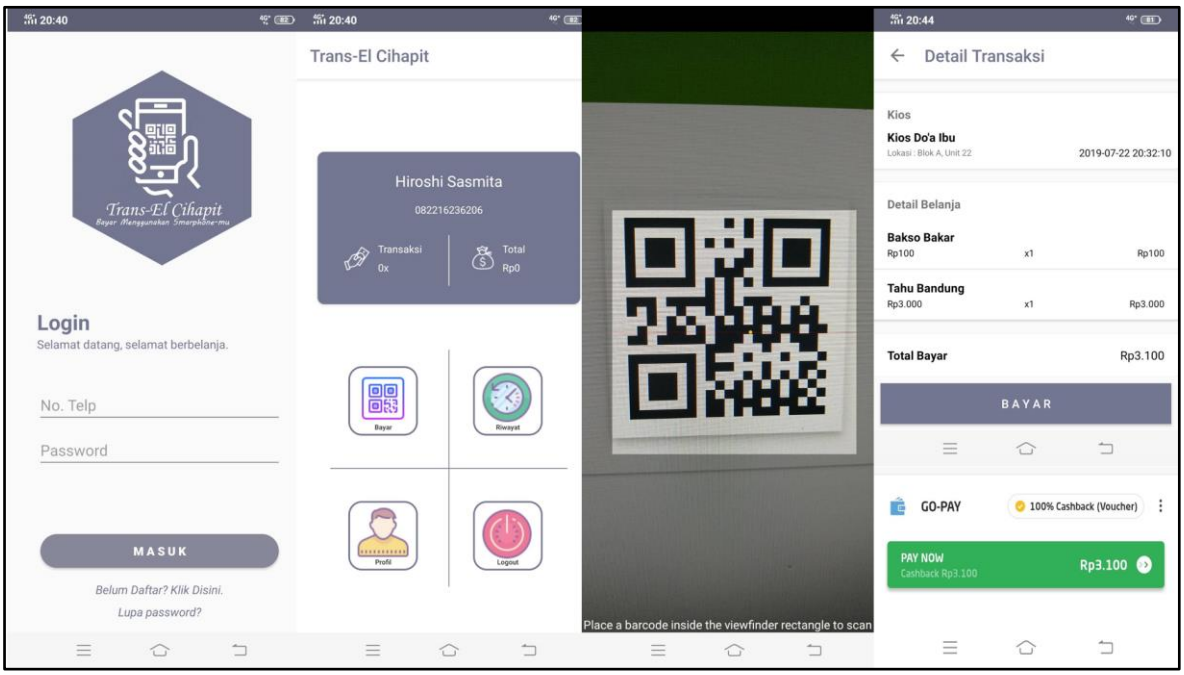

Figure 9. Frontend application for buyers

3.4. Discussion

Application testing is carried out using two test methods, namely the black box method and using a questionnaire. Blackbox testing is focused on system testing activities that are built to see the extent to which each function in the application has been running correctly, as expected, and free from errors. In addition to testing the application from a functional side, system testing is also carried out by users who will take advantage of the application. Acceptance of the use of applications is conducted with a questionnaire to obtain conclusions about acceptance of application use from the user's side [28]. The black box test results show that all functions from the perspective of market managers, sellers, and buyers have been able to run properly according to their functions and there are no errors in the transactions. Meanwhile, Figure 10 shows the results of the user acceptance test with a questionnaire, processed using a Linkert scale consisting of 5 intervals and 6 questions, the conclusion is that the average user acceptance, namely traders, is 86.04% and buyers are 89%. This shows that the system has been very well received by its users. QRcode-based transaction modules and payments using e-wallet have worked well to provide contactless transaction services between sellers and buyers.

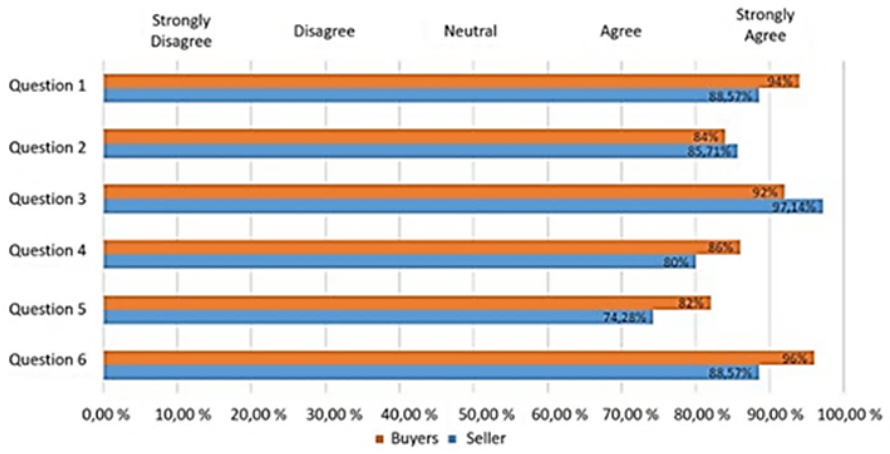

Figure 10. Result of user acceptance test

The implementation of a payment gateway in the system makes this service have a transaction authentication process as well as ease of data processing, where the monitoring process can be carried out in real-time, making it easier to confirm every incoming fund, make sales reports, and find out customer details. However, the security of the electronic payment system is also something that needs to be considered by applying multiple security methods [29], as well as considering factors related to its advantages and disadvantages when used [30]. In addition, the prototype that was built still only uses one e-wallet service where this limits the flexibility of users in the payment process for their transactions, as well as the trust of users who are still unfamiliar with the use of e-wallet in their transactions.

4. CONCLUSION

The system that has been built can be used as a contactless transaction medium for transactions in the traditional market environment. Transaction activities can be done quickly and instantaneously by implementing the QR code feature and digital payments via smartphones. The use of alternative e-wallet payments and features of sharing transaction details between sellers and buyers can increase the convenience and speed of transactions. The existence of a payment gateway in the system makes it easier for users to find out transactions in real-time, create reports, to their financial transactions. The measurements taken also show acceptance of the usefulness of the system being built, as well as the optimism of its users to be able to take advantage of this system both technologically and functionally. However, this research still has the potential for development related to the strategy for implementing this technology so that the system and architecture can increase trust in its use, especially the use of digital payments which are still not commonly used by people in traditional market environments. As a result, digital transformation in traditional markets can be done using this prototype. QR code and the use of e-wallet can be done as an alternative transaction medium to replace traditional transactions. This study demonstrates how digital transformation may be used in traditional market transactions such as buying and selling. By utilizing this technology, conventional money exchanges can be minimized because they can be replaced with electronic payments so that the spread of the covid-19 virus pandemic can be reduced. The next step of this research is to develop a smart traditional market model where the digital transaction data that has been obtained will be used as the basic of market big data and its analysis using artificial intelligence and business intelligence mechanisms.

ACKNOWLEDGEMENTS

The researcher expresses his deepest gratitude to the sellers and buyers in Cihapit traditional market in Bandung who are willing to be a pilot project for system development and testing, as well as the Indonesian Computer University (UNIKOM) who provided funding assistance for this research.

REFERENCES

[1] N. N. Ardhiansyah and T. Mahendarto, "Revitalizing And Reimagining The Indonesian Traditional Market (Case Study : Salaman Traditional Market Indonesia)," *IOP Conference Series: Earth and Environmental Science*, vol. 436, no. 1, 2020, doi: 10.1088/1755-1315/436/1/012010.

[2] D. Ferricha and H. Fauzan, "How The Policy And Empowerment Of Traditional Markets In Indonesia?," *International Journal Of Scientific & Technology Research*, vol. 9, no. 4, pp. 3649–3652, 2020.

[3] N. T. H. Giang, P. T. T. Hai, N. T. T. Tu and P. X. Tan, "Exploring The Readiness For Digital Transformation In A Higher Education Institution Towards Industrial Revolution 4.0.," *International Journal of Engineering Pedagogy*, vol. 11, no. 2, 2021.

[4] S. J. Berman, "Digital Transformation: Opportunities To Create New Business Models," *Strategy & Leadership.*, vol. 40, no. 2, pp. 16-24, 2012, doi: /10.1108/10878571211209314 .

[5] C. Ebert and C. H. C. Duarte, "Digital Transformation.," *Ieee Softw.*, vol. 35, no. 4, pp. 16–21, 2018.

[6] S. Kudyba, "Covid-19 And The Acceleration Of Digital Transformation And The Future Of Work," *Information Systems Management*, vol. 37, no. 4, pp. 284–287, 2020, doi: 10.1080/10580530.2020.1818903.

[7] Z. Allam, "The Forceful Reevaluation Of Cash-Based Transactions By Covid-19 And Its Opportunities To Transition To Cashless Systems In Digital Urban Networks," *Surveying the Covid-19 Pandemic and its Implication*, pp. 107–117, 2020, doi: 10.1016/B978-0-12-824313-8.00008-5.

[8] N. Iivari, S. Sharma and L. Ventä-Olkkonen, "Digital Transformation Of Everyday Life–How Covid-19 Pandemic Transformed The Basic Education Of The Young Generation And Why Information Management Research Should Care?," *International Journal of Information Management*, vol. 55, 2020, doi: 10.1016/j.ijinfomgt.2020.102183.

[9] I. Mustapha, N. T. Van, M. Shahverdi, M. I. Qureshi and N. Khan, "Effectiveness Of Digital Technology In Education During Covid-19 Pandemic. A Bibliometric Analysis.," *International Journal of Interactive Mobile Technologies*, vol. 15, no. 8, 2021.

[10] H. M. Aji, I. Berakon and M. M. Husin, "Covid-19 And E-Wallet Usage Intention: A Multigroup Analysis Between

Indonesia And Malaysia," *Cogent Business & Management*, vol. 7, no. 1, pp. 1-6, 2020, doi: 10.1080/23311975.2020.1804181.
[11] Y. Zhu, "The Development Of E-Commerce Practice Teaching Software Based On Online Payment And Settlement," *International Journal of Online Engineering (iJOE)*, vol. 10, no. 2, pp. 4–9, 2014.
[12] T. Pambudi, A. Raden and S. T. Rahadi, "The Impact Of Pandemic Covid-19 On Digital Payment: Case Study On Electronic Money In Indonesia," *International Journal of Advanced Research in Economics and Finance*, vol. 3, no. 1, pp. 70–79, 2021.
[13] D. A. Pramesti, E. K. Pratiwi, Z. B. Pambuko, F. Medias, A. Triyanto and N. Usman, "Digital Payment: User Experience In Indonesia," *Test Engineering & Management*, pp. 22536–22541, 2020.
[14] E. Husni and A. Ariono, "Development of integrated mobile money system using Near Field Communication (NFC)," *2014 8th International Conference on Telecommunication Systems Services and Applications (TSSA)*, 2014, pp. 1-6, doi: 10.1109/TSSA.2014.7065959.
[15] Z. Bezovski, "The Future Of The Mobile Payment As Electronic Payment System," *European Journal of Business and Management*, vol. 8, no. 8, pp. 127–132, 2016.
[16] A. Wibiyanto and I. Afrianto, "Qr Code And Transport Layer Security For Licensing Documents Verification," *IOP Conference Series: Materials Science and Engineering*, vol. 407, no. 1, 2018, doi: 10.1088/1757-899x/407/1/012069.
[17] S. K. Chatterjee, S. Saha, Z. Khalid, H. N. Saha, P. Paul and R. Karlose, "Space effective and encrypted QR code with sender authorized security levels," 2018 IEEE 8th Annual Computing and Communication Workshop and Conference (CCWC), 2018, pp. 439-443, doi: 10.1109/CCWC.2018.8301640.
[18] W. Widyasari, H. Sutopo and M. Agustian, "Qr Code-Based Learning Development: Accessing Math Game For Children Learning Enhancement," *International Journal of Interactive Mobile Technologies (iJIM)*, 2019, doi: 10.3991/ijim.v13i11.10976.
[19] N. Anwar, R. Rasjidin, D. S. Najoan, C. Rolando and H. L. H. S. Warnars, "E-Payment For Jakarta Smart Public Transportation, Using The Point System For E-Commerce," *Journal Of Physics: Conference Series*, vol. 1477, no. 2, 2020, doi: 10.1088/1742-6596/1477/2/022035.
[20] H. L. H. S. Warnars, Y. Lanita, A. Prasetyo and R. Randriatoamanana, "Smart Integrated Payment System For Public Transportation In Jakarta," *Bulletin of Electrical Engineering and Informatics*, vol. 6, no. 3, pp. 241–249, 2017, doi: 10.11591/eei.v6i3.655.
[21] A. A. Saleem, H. U. R. Siddiqui, R. Shafique, A. Haider and M. Ali, "A Review On Smart Iot Based Parking System," *International Conference On Soft Computing And Data Mining*, Springer, Cham, pp. 264–273, 2020, doi: 10.1007/978-3-030-36056-6_26.
[22] S. A. A. Tarmazi, W. R. W. Ismail, N. A. S. N. Azmin and A. R. A. Bakar, "Consumer Purchase Intention Toward Online Food Delivery Service: The Implication For Future Research," *Malaysian Journal of Social Sciences and Humanities (MJSSH)*, vol. 6, no. 9, pp. 347–354, 2021, doi: 10.47405/mjssh.v6i9.972.
[23] V. Chang, W. Chen, Q. A. Xu and C. Xiong, "Towards The Customers' Intention To Use Qr Codes In Mobile Payments," *Journal of Global Information Management (JGIM)*, vol. 29, no. 6, pp. 1–21, 2021, doi: 10.4018/JGIM.20211101.oa37.
[24] R. Liu, J. Wu and G. F. Yu-Buck, "The Influence Of Mobile Qr Code Payment On Payment Pleasure: Evidence From China," *International Journal of Bank Marketing*, vol. 39, no. 2, pp. 337-356, 2021, doi: 10.1108/IJBM-11-2020-0574.
[25] G. F. Djayapranata and A. Setyawan, "Trust Or Usefulness? Qr Code Payment Among Millennials In A Disrupted Market," *18th International Symposium on Management (INSYMA 2021)*. Atlantis Press, pp. 194–199, 2021.
[26] I. Afrianto, A. Heryandi, A. Finandhita and S. Atin, "E-Document Autentification With Digital Signature Model For Smart City In Indonesia"*Journal of Engineering Science and Technology*, vol. 15, pp. 28-35, 2020.
[27] A. Heryandi and I. Afrianto, "Online Diploma Supplement Information System Modelling For Indonesian Higher Education Institution," *IOP Conference Series: Materials Science And Engineering*, vol. 662, no. 2, 2019, doi: 10.1088/1757-899x/662/2/022092.
[28] S. Basak And M. S. Hosain, "Software Testing Process Model From Requirement Analysis To Maintenance," *International Journal of Computer Applications*, vol. 107, no. 11, 2014.
[29] G. Ali, M. Ally Dida and A. Elikana Sam, "Two-Factor Authentication Scheme For Mobile Money: A Review Of Threat Models And Countermeasures," *Future Internet*, vol. 12, no. 10, 2020, doi: 10.3390/fi12100160.
[30] S. Yakean, "Advantages And Disadvantages Of A Cashless System In Thailand During The Covid-19 Pandemic," *The Journal of Asian Finance, Economics, and Business*, vol. 7, no. 12, pp. 385–388, 2020, doi: 10.13106/jafeb.2020.vol7.no12.385.

BIOGRAPHIES OF AUTHORS

Irawan Afrianto is a lecturer at the Department of Informatics, Universitas Komputer Indonesia (UNIKOM) Bandung. Currently completing the Computer Sci-ence Doctoral program at IPB University Bogor with the research field of Blockchain Technology in agroindustry.

Mouhamad Hatta Hiroshi Sasmita is an alumni of Informatics Department, Universitas Komputer Indonesia (UNIKOM) Bandung. Currently working as an Android Developer at PT. Nostra Technology.

Sufa Atin is a lecturer at Informatics Department, Universitas Komputer Indonesia (UNIKOM) Bandung. The areas of research undertaken are in information systems, software project management and socio-informatics.