



ICOMITEE 2021 PROCEEDING

The 2021 International Conference on Computer Science, Information Technology and Electrical Engineering (ICOMITEE)

October
27th – 28th, 2021
El Hotel Royale, Banyuwangi

Co-Host :



Sponsorship :



IEEE
The Indonesia Section
Computer Society Chapter



ICOMITEE
2021



PROCEEDINGS

**2021 International Conference on Computer Science, Information
Technology, and Electrical Engineering (ICOMITEE 2021)**

October, 27th - 28th 2021, Banyuwangi, Indonesia

Editors:

Slamin, University of Jember, Jember, Indonesia

Antonius Cahya Prihandoko, University of Jember, Jember, Indonesia

Fahrobby Adnan, University of Jember, Jember, Indonesia

Ryan Randy Suryono, Universitas Teknokrat Indonesia, Lampung, Indonesia

Endang Sulistiyani, Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia

Eka Mistiko Rini, Politeknik Negeri Banyuwangi, Banyuwangi, Indonesia

Technical Program Committee

Technical Program Committee

| | | |
|-----------------------|--|-----------|
| Sasikumar A | K Ramakrishnan College of Technology | India |
| Sharul Kamal A. Rahim | Universiti Teknologi Malaysia | Malaysia |
| Ab Al-Hadi Ab Rahman | Universiti Teknologi Malaysia | Malaysia |
| Shahliza Abd Halim | University of Technology Malaysia | Malaysia |
| Abu Bakar Abd Rahman | Universiti Malaysia Sabah | Malaysia |
| Abdul Abdul | Federal Urdu University of Arts, Science & Technology Islamabad Pakistan | Pakistan |
| Sakena Abdul Jabar | Universiti Malaysia Sarawak | Malaysia |
| Antar Abdul-Qawy | Faculty of Science, SUMAIT University, Zanzibar | Tanzania |
| Dahlan Abdullah | Universitas Malikussaleh | Indonesia |
| Nelly Adiwijaya | Universitas Jember | Indonesia |
| Fahrobby Adnan | University of Jember | Indonesia |
| Shobit Agarwal | University of Bologna | Italy |
| Sandeep Agrawal | RJIT Tekanpur | India |
| Anita Ahmad | University of Technology Malaysia | Malaysia |
| Mohd Ashraf Ahmad | Universiti Malaysia Pahang | Malaysia |
| Hani Ahmed | Universiti Malaysia Perlis | Malaysia |
| Ruma Ajeena | University of Babylon | Iraq |
| Oryina Akputu | Admiralty University of Nigeria | Nigeria |
| Omar Al saif | Northern Technical University | Iraq |

| | | |
|------------------------|---|----------------------|
| Qusay Al-Doori | University of Technology | Iraq |
| Mohammad Al-Mashhadani | Al-Maarif University College | Iraq |
| Ahmed Al-Naib | Northern Technical University | Iraq |
| Yahiea Al-Naiemy | Budapest University of Technology and Economics | Hungary |
| Karim Al-Saedi | Mustansiriyah University | Iraq |
| Atallah AL-Shatnawi | Al-albayt University | Jordan |
| Maher Alasaady | Northern Technical University | Iraq |
| Hamid Alasadi | IRAQ- BASRA | Iraq |
| Mudrik Alaydrus | Universitas Mercu Buana | Indonesia |
| Mihaela Albu | Politehnica University of Bucharest | Romania |
| Mohammed Alghamdi | Al-Baha University | Saudi Arabia |
| Qutaiba Ali | University of Mosul | Iraq |
| Wisam Ali | University of Technology | Iraq |
| Farah Alkhalid | University of Technology | Iraq |
| Mohammad AlShabi | University of Sharjah | United Arab Emirates |
| Ahmed Alsheikhy | Northern Border University | Saudi Arabia |
| Abdulkader Alwer | Istanbul Aydin University | Turkey |
| Ghada Amer | Faculty of Engineering - Benha University | Egypt |
| Manilal Amipara | Gujarat Technological University | India |
| Khairul Anam | University of Jember | Indonesia |

| | | |
|--|---|-----------------------------------|
| Santhanakrishnan Anand | New York Institute of Technology | USA |
| Rakan Antar | Northern Technical University | Iraq |
| Anna Antonyová | University of Prešov in Prešov | Slovakia |
| Intan Sari Areni | Hasanuddin University | Indonesia |
| Ezendu Ariwa | University of Bedfordshire | United Kingdom (Great Britain) |
| Farrukh Arslan | Purdue University | USA |
| Ernesto Arzabala-Contreras | Universidad Tecnologica de Chihuahua | Mexico |
| Mehdi Asadi | Islamic Azad University, Khamneh Branch | Iran |
| Carlos Astudillo | State University of Campinas | Brazil |
| Irfan Bahiuddin | Universitas Gadjah Mada | Indonesia |
| Bakhyt Bakiyev | Suleyman Demirel University | Kazakhstan |
| M'hamed Bakrim | University of Cadi Ayyad Marrakesh | Morocco |
| Younes Balboul | ENSA, Sidi Mohamed Ben Abdellah University | Morocco |
| Maushumi Barooah | Gauhati University | India |
| Bikash Behera | International Institute of Information Technology Bhubaneswar | India |
| Dinesh Bhatia | Biomedical Engineering Department, North Eastern Hill University | India |
| Subhasis Bhattacharjee | Adobe Systems India Private Limited | India |
| Anamiya Bhattacharya | Indian Space Research Organization | India |
| Parameshachari Bidare Divakarachari | GSSSIETW, Mysuru | India |

| | | |
|---------------------------|--|-----------|
| Tuğçe Bilen | Istanbul Technical University | Turkey |
| Shilpi Birla | Manipal University Jaipur | India |
| Angelo Bruno | Senior Member | Italy |
| Saiful Bukhori | Universitas Jember | Indonesia |
| Rodrigo Campos Bortoletto | Instituto Federal de São Paulo | Brazil |
| Alessandro Carrega | CNIT | Italy |
| Chung-Liang Chang | National Pingtung University of Science and Technology | Taiwan |
| Abhay Chaudhary | Vellore Institute of Technology, AP | India |
| Tai-Chen Chen | MAXEDA Technology | Taiwan |
| Ahmed Chitnalah | Cadi Ayyad University EST Laboratory | Morocco |
| Tien Han Chua | Universiti Teknologi Malaysia | Malaysia |
| Jose Cordeiro | School of Technology of Setubal / I. P. S. | Portugal |
| Siriporn Dachasilaruk | Naresuan University | Thailand |
| D Dafik | University of Jember | Indonesia |
| Sarada Dakua | Hamad Medical Corporation | Qatar |
| Luca Davoli | University of Parma | Italy |
| Sorin Ioan Deaconu | Politechnica University Timisoara | Romania |
| Tresna Dewi | Politeknik Negeri Sriwijaya | Indonesia |
| Tio Dharmawan | Universitas Jember | Indonesia |
| Nagaraj Dharwadkar | Rajarambapu Institute of Technology, Islampur | India |
| Nishant Doshi | PDP | India |

| | | |
|---------------------------------|--|-----------|
| Nikolaos Doukas | Hellenic Army Academy | Greece |
| Ke-Lin Du | Concordia University | Canada |
| Nabil Elmarzouqi | Mohammed V University in Rabat | Morocco |
| Nibal Farman | Univrstity of Baghdad | Iraq |
| Philipp Fechteler | Fraunhofer HHI | Germany |
| Smain Femmam | University UHA | France |
| Muftah Fraifer | IDC-CSIS-UL | Ireland |
| Miguel Franklin de Castro | Federal University of Cear | Brazil |
| Franco Frattolillo | University of Sannio | Italy |
| Muhammad Furqon | Universitas Jember | Indonesia |
| Dharmendra Ganage | Sinhgad College of Engineering | India |
| Thittaporn Ganokratanaa | King Mongkut's University of Technology Thonburi | Thailand |
| Antonios Gasteratos | Democritus University of Thrace | Greece |
| Mihai Gavrilas | Technical University of Iasi | Romania |
| Amirreza Ghadimi Avval | University of Arkansas | USA |
| Alireza Ghasempour | ICT Faculty | USA |
| Hossein Ghodosi | James Cook University | Australia |
| Amin Gholoobi | Open University of Cyprus | Cyprus |
| Diogo Gomes | Universidade de Aveiro | Portugal |
| Renaldi Gondosubroto | GReS Studio | Indonesia |
| Visvasuresh Victor Govindaswamy | Concordia University | USA |

| | | |
|-----------------------------|--|------------|
| Agustinus Bimo Gumelar | Institut Teknologi Sepuluh Nopember | Indonesia |
| Brij Gupta | National Institute of Technology Kurukshetra | India |
| Eisuke Hanada | Saga University | Japan |
| Seng Hansun | Universitas Multimedia Nusantara | Indonesia |
| Hao Hao | RMIT University | Australia |
| Triwahju Hardianto | University of Jember | Indonesia |
| Shanmugasundaram Hariharan | Shadan Women's College of Engineering and Technology | India |
| Suneeta Harlapur | Vemana Institute of Technology | India |
| Maha Harzallah | ISITCOM | Tunisia |
| Mohd Zamri Hasan | University Malaysia Perlis | Malaysia |
| Rini Hasanah | Brawijaya University | Indonesia |
| S. M. Shakil Hassan | Eastern University | Bangladesh |
| Teguh Herlambang | University of Nahdlatul Ulama Surabaya | Indonesia |
| Roberto Carlos Herrera Lara | National Polytechnic School | Ecuador |
| Paramate Horkaew | Suranaree University of Technology | Thailand |
| Hanim Hussin | Universiti Teknologi MARA | Malaysia |
| Ba Dieu Huynh | Duy Tan University | Vietnam |
| Duy Huynh | Ho Chi Minh City University of Technology (HUTECH) | Vietnam |
| Hamidah Ibrahim | Universiti Putra Malaysia | Malaysia |
| Nazrita Ibrahim | Universiti Tenaga Nasional | Malaysia |

| | | |
|--------------------------|---|--------------|
| Sallehuddin Ibrahim | Universiti Teknologi Malaysia | Malaysia |
| Fakrulradzi Idris | Universiti Teknikal Malaysia Melaka | Malaysia |
| Asif Iqbal | KTH Royal Institute of Technology | Sweden |
| Zafar Iqbal | PMAS, Arid Agriculture University, Rawalpindi | Pakistan |
| Ismahafezi Ismail | Universiti Sultan Zainal Abidin | Malaysia |
| Mohd Zain Ismail | Universiti Kuala Lumpur British Malaysian Institute | Malaysia |
| Mohd. Israil | Aljouf University, KSA | Saudi Arabia |
| Hossein Jafari | Intelligent Fusion Technology, Inc. | USA |
| Ramkumar Jaganathan | Dr NGP Arts and Science College | India |
| Norziana Jamil | Universiti Tenaga Nasional, MALAYSIA | Malaysia |
| Emilio Jiménez Macías | University of La Rioja | Spain |
| Jin Jin | University of Toronto | Canada |
| Siti Amely Jumaat | Universiti Tun Hussein Onn Malaysia | Malaysia |
| Mohammed Kaabar | Washington State University | USA |
| Sandeep Kakde | Y C College of Engineering | India |
| Dimitrios Kallergis | University of West Attica | Greece |
| S Kannadhasan | Cheran College of Engineering | India |
| Lavish Kansal | Lovely Professional University | India |
| Mahdi Karami | Universiti Putra Malaysia | Malaysia |
| Inderpreet Kaur | Director IGEN Edu Solutions India | India |
| Mohammad Khalily Dermany | Islamic Azad University, Khomein Branch | Iran |

| | | |
|-------------------------|---|--------------------------------|
| Nor Hisham Khamis | Universiti Teknologi Malaysia | Malaysia |
| Talha Khan | University of Illinois at Chicago | USA |
| Zeashan Khan | Air University | Pakistan |
| Nikhil Khanna | University of Delhi | India |
| Fayez Khazalah | Al al Bayt University | Jordan |
| Dong W. Kim | Inha Tech College | Korea (South) |
| Sandeep Kumar | Central Research Laboratory, Bharat Electronics Ltd. | India |
| Montree Kumngern | King Mongkut's Institute of Technology Ladkrabang | Thailand |
| Yeni Kustiyahningsih | University of Trunojoyo | Indonesia |
| Otavio Lavor | UFERSA | Brazil |
| Trong Nghia Le | Ho Chi Minh City University of Technology and Education | Vietnam |
| Gyu Myoung Lee | Liverpool John Moores University | United Kingdom (Great Britain) |
| Yih-Jiun Lee | Chinese Culture University | Taiwan |
| Narkedamilly Leelavathy | Jawaharlal Nehru Technological University | India |
| Xia Li | Apple | USA |
| Marco Listanti | University of Rome "La Sapienza" | Italy |
| Chuan-Ming Liu | National Taipei University of Technology | Taiwan |
| Renato Lopes | Universidade de Brasília | Brazil |
| Pascal Lorenz | University of Haute Alsace | France |

| | | |
|--------------------------------------|--|-----------------------------------|
| Nadir Mahammed | Ecole Supérieure en Informatique 08 mai 1945 Sidi Bel Abbès | Algeria |
| Ahmed Mahmood | University of Guelph | Canada |
| Haitham Mahmoud | Birmingham City University (BCU) | United Kingdom (Great Britain) |
| Massudi Mahmuiddin | Universiti Utara Malaysia | Malaysia |
| Wayan Mahmudy | Universitas Brawijaya | Indonesia |
| As Mansur | Medan State University (Unimed) | Indonesia |
| Syed Manzoor Qasim | King Abdulaziz City for Science and Technology | Saudi Arabia |
| Evgeny Markin | Bauman State Technical University | Russia |
| Israel Martin-Escalona | Universitat Politècnica de Catalunya (UPC) | Spain |
| Warsuzarina Mat Jubadi | Universiti Tun Hussein Onn Malaysia | Malaysia |
| Ebrahim Mattar | University of Bahrain | Bahrain |
| Michael McGuire | University of Victoria | Canada |
| Artis Mednis | Institute of Electronics and Computer Science | Latvia |
| Zahéra Mekkioui | University of tlemcen | Algeria |
| Charles Miers | Santa Catarina State University | Brazil |
| Dan Milici | University of Suceava | Romania |
| Thippeswamy MN | Nitte Meenakshi Institute of Technology | India |
| Khairul Anuar Mohamad | Universiti Tun Hussein Onn Malaysia | Malaysia |
| Amjed Sid Ahmed Mohamed Sid Ahmed | Global College of Engineering and Technology | Oman |
| Suraya Mohammad | University Kuala Lumpur - British Malaysian Institute | Malaysia |

| | | |
|----------------------------------|---|-----------|
| Negar Mohammadi-Koushki | none | USA |
| Amir Hossien Mohammadzadeh Niaki | Niroo Research Institute (NRI) | Iran |
| Khalil Azha Mohd Annuar | Universiti Teknikal Malaysia Melaka | Malaysia |
| Azrul Mohd Ariffin | Universiti Tenaga Nasional | Malaysia |
| Mona Riza Mohd Esa | Universiti Teknologi Malaysia | Malaysia |
| Shukor Sanim Mohd Fauzi | Universiti Teknologi Mara, Perlis Campus | Malaysia |
| Norhaida Mohd Suaib | Universiti Teknologi Malaysia | Malaysia |
| Nur Razia Mohd Suradi | Universiti Selangor | Malaysia |
| Mohd Yuzri Mohd Yusop | Universiti Kuala Lumpur | Malaysia |
| Hamed Mojallali | University of Guilan | Iran |
| Roberto Montemanni | University of Modena and Reggio Emilia | Italy |
| Rodrigo Montufar-Chaveznava | Facultad de Ingeniería, Universidad Nacional Autónoma de Mexico | Mexico |
| Pedro Moura | University of Coimbra | Portugal |
| Mohamed Moussaoui | Abdelmalek Esaadi University | Morocco |
| Waseem Mufti | Aalborg University Denmark | Pakistan |
| Munawir Munawir | Universitas Pendidikan Indonesia | Indonesia |
| T Vijay Muni | K L University | India |
| Rinaldi Munir | Institut Teknologi Bandung | Indonesia |
| Sarhan Musa | Prairie View A&M University | USA |
| Mas Rina Mustaffa | Universiti Putra Malaysia | Malaysia |

| | | |
|----------------------------|--|-----------|
| Marwan Nafea | University of Nottingham Malaysia | Malaysia |
| Ali Nahar | University of Technology -Iraq | Malaysia |
| Muhammad Nasir | Universitas Andalas | Indonesia |
| Amirjan Nawabjan | Universiti Teknologi Malaysia | Malaysia |
| Paniti Netinant | Rangsit University | Thailand |
| Nik Noordini Nik Abd Malik | Universiti Teknologi Malaysia | Malaysia |
| Mohd Natashah Norizan | Universiti Malaysia Perlis | Malaysia |
| I Gde Dharma Nugraha | Universitas Indonesia | Indonesia |
| Nurdin Nurdin | Universitas Malikussaleh | Indonesia |
| Nurdin Nurdin | Universitas Islam Negeri (IAIN) Datokarama Palu | Indonesia |
| Ahmad Fairuz Omar | Universiti Sains Malaysia | Malaysia |
| Nor Azlan Othman | Universiti Teknologi MARA (UiTM) Cawangan Pulau Pinang | Malaysia |
| Siti Othman | Universiti Teknologi Malaysia (UTM) | Malaysia |
| Varun P. Gopi | National Institute of Technology | India |
| Arindam Pal | CSIRO | Australia |
| Rosaura Palma-Orozco | Instituto Politécnico Nacional | Mexico |
| Shashikant Patil | Mumbai University | India |
| Tarakanath Paul | ICFAI University Jharkhand | India |
| Yesaya Paulus | Dipa Makassar University | Japan |
| Vanita Pawar | DIAT, Pune | India |
| Bujjibabu Penumutchi | JNTUK Kakinada | India |

| | | |
|----------------------|--|-----------------------------------|
| Prashant Pillai | University of Wolverhampton | United Kingdom (Great Britain) |
| Rajesh Pindoriya | Indian Institute of Technology Mandi | India |
| Petra Poulova | University of Hradec Kralove | Czech Republic |
| Andri Pranolo | Universitas Ahmad Dahlan | Indonesia |
| Beny Prasetyo | Jember University | Indonesia |
| Eko Prasetyo | PT. PLN (Persero) | Indonesia |
| Emil Pricop | Petroleum-Gas University of Ploiesti | Romania |
| Antonius Prihandoko | University of Jember | Indonesia |
| Salita Ulitia Prini | Indonesian Institute of Sciences | Indonesia |
| Cong Pu | Marshall University | USA |
| Sameerchand Pudaruth | University of Mauritius | Mauritius |
| Pakawan Pugsee | Chulalongkorn University | Thailand |
| Yogesh Pundlik | Kamala Institute of Technology and Science, Singapur- | India |
| Asep Purnomo | Universitas Gadjah Mada | Indonesia |
| Fitri Maya Puspita | University of Sriwijaya | Indonesia |
| Januar Adi Putra | Universitas Jember | Indonesia |
| Junfei Qiu | University of York | United Kingdom (Great Britain) |
| Fika Rachman | University of Trunojoyo Madura | Indonesia |
| Ema Rachmawati | Telkom University | Indonesia |
| Indra Raharjana | Universitas Airlangga | Indonesia |

| | | |
|----------------------|---|-----------------------------------|
| Abdul Rahim Bepar | Annamacharya Institute of Technology & Sciences | India |
| Gautham Rajagopal | Medtronic | USA |
| Harikumar Rajaguru | Bannari Amman Institute of Technology | India |
| Grienggrai Rajchakit | Maejo University | Thailand |
| Ramadiani Ramadiani | Mulawarman University | Indonesia |
| Shuvendu Rana | SRM University AP | United Kingdom (Great Britain) |
| Priya Ranjan | SRM University, Amaravathi | India |
| Nadana Ravishankar | VelTech High Tech Dr Rangarajan Dr Sakunthala Engineering College | India |
| Windi Retnani | Universitas Jember | Indonesia |
| Alireza Rezvanian | Amirkabir University of Technology | Iran |
| Indra Riyanto | Universitas Indonesia | Indonesia |
| Zairi Rizman | Universiti Teknologi MARA | Malaysia |
| Nuno Rodrigues | Instituto Politécnico de Bragança | Portugal |
| Siti Hawa Ruslan | Universiti Tun Hussein Onn Malaysia | Malaysia |
| Vahideh Sadeghi | Isfahan University of Technology | Iran |
| Mohd Sadiq | Jamia Millia Islamia | India |
| Ahmed Saeed | Future University in Egypt | Egypt |
| Basil Saied | Formerly at University of Mosul | Iraq |
| Arun Saini | The ICFAI University, Jaipur | India |
| Sandeep Saini | The LNM Institute of Information Technology, Jaipur | India |

| | | |
|-------------------------|---|-----------------------------------|
| Wael Salah | Palestine Technical University - Kadoorie | Palestine |
| Hussain Saleem | University of Karachi | Pakistan |
| Azmi Saleh | Jember University | Indonesia |
| Azahari Salleh | Universiti Teknikal Malaysia Melaka (UTeM) | Malaysia |
| Roselina Sallehuddin | University Technology Malaysia | Malaysia |
| Andrews Samraj | Mahendra Engineering College | India |
| Tomonobu Sato | Hitachi ICT Business Services, Ltd. | Japan |
| Alfredo Satriya | University of Florida | USA |
| Vaibhav Saundarmal | Marathwada Institute of Technology, Aurangabad | India |
| Toufik Sebbagh | University of Skikda | Algeria |
| Sandeep Sengar | Indian Institute of Technology (ISM) Dhanbad | India |
| Tomonobu Senjyu | Faculty of Engineering, University of the Ryukyus | Japan |
| Amel Serrat | USTO MB | Algeria |
| Ahmad Zuri Sha'ameri | Universiti Teknologi Malaysia | Malaysia |
| Nadheer Shalash | Al-Mamon University College | Iraq |
| Aditi Sharma | Quantum University, Roorkee, Uttarakhand | India |
| Durga Prasad Sharma | AMUIT, MOSHE FDRE under UNDP & Adviser (IT) ILO-UN | India |
| Sachin Sharma | Technological University Dublin | Ireland |
| Akbar Sheikh-Akbari | Leeds Beckett University | United Kingdom (Great Britain) |
| Divya Rishi Shrivastava | Manipal University Jaipur | India |

| | | |
|-----------------------------|---|--------------|
| Khairul Azami Sidek | International Islamic University Malaysia | Malaysia |
| Joni Simatupang | President University | Indonesia |
| Pramod Singh | ABV-IIIITM Gwalior | India |
| Ramesh Singh | DTU Delhi | India |
| Simar Preet Singh | Bennett University, Greater Noida | India |
| Vivek Singh | Shambhunath Institute of Engineering and Technology, Prayagraj, UP, INDIA | India |
| Shefali Singhal | none | India |
| Jee Siong | Multimedia University | Malaysia |
| Rostyslav Sklyar | Independent Professional | Ukraine |
| Slamin Slamin | University of Jember | Indonesia |
| Nikolaos Sofianos | Democritus University of Thrace | Greece |
| Viranjay M. Srivastava | University of KwaZulu-Natal | South Africa |
| Sritrusta Sukaridhoto | Politeknik Elektronika Negeri Surabaya | Indonesia |
| Heni Sulistiani | Universitas Teknokrat Indonesia | Indonesia |
| Ahmed Sultan | Baghdad - Iraq | Iraq |
| Ryan Suryono | Universitas Teknokrat Indonesia | Indonesia |
| Sutrisno Sutrisno | Universitas Diponegoro | Indonesia |
| Mujtaba Mahdi Mudassir Syed | Osmania University | India |
| Robert Szabolcsi | Óbuda University | Hungary |
| Pooya Taheri | SFU | Canada |
| Thitinan Tantidham | Mahidol University | Thailand |

| | | |
|-------------------------|--|--------------------------------|
| Pham Thanh Thuy | MICA Institute (HUST - CNRS/UMI 2954 - INP Grenoble) | Vietnam |
| Hua Nong Ting | Universiti Malaya | Malaysia |
| Huong Yong Ting | University College of Technology Sarawak | Malaysia |
| Said Touati | Nuclear Center Research Of Birine | Algeria |
| Nguyen Tri-Hai | Chung-Ang University | Korea (South) |
| Rahmat Trialih | Brawijaya University | Indonesia |
| Muharrem Tümçakır | Gebze Technical University | Turkey |
| Munirul Ula | Universitas Malikussaleh | Indonesia |
| Mohd Umar Farooq | Muffakham Jah College of Engineering and Technology | India |
| Madhur Upadhayay | Shiv Nadar University | India |
| Y. V. Pavan Kumar | Vellore Institute of Technology - Andhra Pradesh (VIT-AP) University | India |
| Panagiotis Varzakas | University of Thessaly | Greece |
| Jami Venkata Suman | GMR Institute of Technology | India |
| Chitra Venugopal | Oregon Institute of Technology | USA |
| Rima Wahyuningrum | University of Trunojoyo Madura | Indonesia |
| Carlos Becker Westphall | Federal University of Santa Catarina | Brazil |
| Widjonarko Widjonarko | Universitas Jember | Indonesia |
| Widodo Widodo | Universitas Negeri Jakarta | Indonesia |
| Tianhua Xu | SoE University | United Kingdom (Great Britain) |

| | | |
|--------------------------|---|-----------|
| Abid Yahya | Botswana International University of Science and Technology (BIUST) | Botswana |
| Azli Yahya | Universiti Teknologi Malaysia | Malaysia |
| Srihari Yamanoor | Self | USA |
| Chong Yen Fook | Universiti Malaysia Perlis | Malaysia |
| Thaweesak Yingthawornsuk | King Mongkut's University of Technology Thonburi | Thailand |
| Sumendra Yogarayan | Multimedia University (MMU) | Malaysia |
| Aws Yonis | Ninevah University | Iraq |
| Pujianto Yugopuspito | Universitas Pelita Harapan | Indonesia |
| Efil Yusrianto | UIN IMAM BONJOL PADANG | Indonesia |
| Noor Zaman | Taylor's University | Malaysia |
| Qi Zhao | University of California, Los Angeles | USA |

Committees

Iwan Taruna

Steering Committee

Iwan Taruna (University of Jember, Indonesia)

Saiful Bukhori

Conference Chair

Saiful Bukhori (Universitas Jember, Indonesia)

Windi Eka Yulia Retnani

reviewer

Windi Eka Yulia Retnani (Universitas Jember, Indonesia)

Treasurer

Windi Eka Yulia Retnani (Universitas Jember, Indonesia)

Antonius Cahya Prihandoko

Technical Program Chair

Antonius Cahya Prihandoko (University of Jember, Indonesia)

Fahrobby Adnan

Publication Chair

Fahrobby Adnan (University of Jember, Indonesia)

Beny Prasetyo

Secretary

Beny Prasetyo (Jember University, Indonesia)

Januar Adi Putra

Publicity and Local Arrangement

Januar Adi Putra (Universitas Jember, Indonesia)

Sasikumar A

member

Sasikumar A (K Ramakrishnan College of Technology, India)

Sharul Kamal A. Rahim

Sharul Kamal A. Rahim (Universiti Teknologi Malaysia, Malaysia)

Ab Al-Hadi Ab Rahman

Ab Al-Hadi Ab Rahman (Universiti Teknologi Malaysia, Malaysia)

Shahliza Abd Halim

Shahliza Abd Halim (University of Technology Malaysia, Malaysia)

Dahlan Abdullah

Dahlan Abdullah (Universitas Malikussaleh, Indonesia)

Shobit Agarwal

Shobit Agarwal (University of Bologna, Italy)

Anita Ahmad

Anita Ahmad (University of Technology Malaysia, Malaysia)

Hani Ahmed

Hani Hazza ALi Ahmed (Universiti Malaysia Perlis, Malaysia)

Ruma Ajeena

Ruma Ajeena (University of Babylon, Iraq)

Oryina Akputu

Oryina K. Akputu (Admiralty University of Nigeria, Nigeria)

Ahmed Al-Naib

Ahmed M.T. Ibraheem Al-Naib (Northern Technical University, Iraq)

Mudrik Alaydrus

Mudrik Alaydrus (Universitas Mercu Buana, Indonesia)

Mohammed Alghamdi

Mohammed Ibrahim Alghamdi (Al-Baha University, Saudi Arabia)

Farah Alkhalid

Farah Alkhalid (University of Technology, Iraq)

Abdulkader Alwer

Abdulkader Omar Alwer (Istanbul Aydin University, Turkey)

Santhanakrishnan Anand

Santhanakrishnan Anand (New York Institute of Technology, USA)

Ernesto Arzabala-Contreras

Ernesto A Arzabala-Contreras (Universidad Tecnologica de Chihuahua, Mexico)

Mehdi Asadi

Mehdi Asadi (Islamic Azad University, Khamneh Branch, Iran)

Anamiya Bhattacharya

Anamiya Bhattacharya (Indian Space Research Organization, India)

Ahmed Chitnalah

Ahmed Chitnalah (Cadi Ayyad University EST Laboratory, Morocco)

Tien Han Chua

Tien Han Chua (Universiti Teknologi Malaysia, Malaysia)

Nagaraj Dharwadkar

Nagaraj V. Dharwadkar (Rajarambapu Institute of Technology, Islampur, India)

Ke-Lin Du

Ke-Lin Du (Concordia University, Canada & Xonlink Inc., China)

Nibal Farman

Nibal Fadel Farman, AL-Hialy (Univrstiy of Baghdad & Engineering College, Iraq)

Miguel Franklin de Castro

Miguel Franklin de Castro (Federal University of Ceará, Brazil)

Franco Frattolillo

Franco Frattolillo (University of Sannio, Italy)

Diogo Gomes

Diogo Gomes (Universidade de Aveiro & Instituto de Telecomunicações, Portugal)

Visvasuresh Victor Govindaswamy

Visvasuresh Victor Govindaswamy (Concordia University, USA)

Eisuke Hanada

Eisuke Hanada (Saga University, Japan)

Hao Hao

Hao Hao (RMIT University, Australia)

Maha Harzallah

Maha Harzallah (ISITCOM, Tunisia)

S. M. Shakil Hassan

S. M. Shakil Hassan (Eastern University, Bangladesh)

Sallehuddin Ibrahim

Sallehuddin Ibrahim (Universiti Teknologi Malaysia, Malaysia)

Mohd. Israil

Mohd. Israil (Aljouf University, KSA, Saudi Arabia)

Jin Jin

Jin Jin (University of Toronto, Canada)

Mohammed Kaabar

Mohammed K A Kaabar (Washington State University, USA)

Nor Hisham Khamis

Nor Hisham Khamis (Universiti Teknologi Malaysia, Malaysia)

Sandeep Kumar

Sandeep Kumar (Central Research Laboratory, Bharat Electronics Ltd., India)

Evgeny Markin

Evgeny Markin (Bauman State Technical University, Russia & Richemar LLC, USA)

Israel Martin-Escalona

Israel Martin-Escalona (Universitat Politècnica de Catalunya (UPC), Spain)

Artis Mednis

Artis Mednis (Institute of Electronics and Computer Science, Latvia)

Mona Riza Mohd Esa

Mona Riza Mohd Esa (Universiti Teknologi Malaysia, Malaysia)

Norhaida Mohd Suaib

Norhaida Mohd Suaib (Universiti Teknologi Malaysia, Malaysia)

Roberto Montemanni

Roberto Montemanni (University of Modena and Reggio Emilia, Italy)

Waseem Mufti

Waseem Akhtar Mufti (Aalborg University Denmark, Pakistan)

Muhammad Nasir

Muhammad Nasir (Universitas Andalas, Indonesia)

Amirjan Nawabjan

Amirjan Nawabjan (Universiti Teknologi Malaysia, Malaysia)

Nik Noordini Nik Abd Malik

Nik Noordini Nik Abd Malik (Universiti Teknologi Malaysia, Malaysia)

I Gde Dharma Nugraha

I Gde Dharma Nugraha (Universitas Indonesia, Indonesia & Chonnam National University, Korea (South))

Nurdin Nurdin

Nurdin Nurdin (Universitas Malikussaleh, Indonesia)

reviewer

Nurdin Nurdin (Universitas Islam Negeri (IAIN) Datokarama Palu, Indonesia)

Siti Othman

member

Siti Hajar Othman (Universiti Teknologi Malaysia (UTM) & UTM, Malaysia)

Varun P. Gopi

Varun P. Gopi (National Institute of Technology, India)

Arindam Pal

Arindam Pal (CSIRO & Data61, Australia)

Bujjibabu Penumutchi

Bujjibabu Penumutchi (JNTUK Kakinada & UCEK, India)

Prashant Pillai

Prashant Pillai (University of Wolverhampton, United Kingdom (Great Britain))

Andri Pranolo

Andri Pranolo (Universitas Ahmad Dahlan, Indonesia)

Junfei Qiu

Junfei Qiu (University of York, United Kingdom (Great Britain))

Abdul Rahim Bepar

Abdul Rahim Bepar (Annamacharya Institute of Technology & Sciences, India)

Gautham Rajagopal

Gautham Rajagopal (Medtronic & University of Southern California, USA)

Alireza Rezvani

Alireza Rezvani (Amirkabir University of Technology, Iran)

Siti Hawa Ruslan

Siti Hawa Ruslan (Universiti Tun Hussein Onn Malaysia & Faculty of Electrical and Electronic Engineering, Malaysia)

Mohd Sadiq

Mohd Sadiq (Jamia Millia Islamia, India)

Azahari Salleh

Azahari Salleh (Universiti Teknikal Malaysia Melaka (UTeM), Malaysia)

Roselina Sallehuddin

Roselina Sallehuddin (University Technology Malaysia, Malaysia)

Vaibhav Saundarmal

Vaibhav Dudhaji Saundarmal (Marathwada Institute of Technology, Aurangabad, India)

Ahmad Zuri Sha'ameri

Ahmad Zuri Sha'ameri (Universiti Teknologi Malaysia, Malaysia)

Durga Prasad Sharma

Durga Prasad Prasad Sharma (AMUIT, MOSHE FDRE under UNDP & Adviser (IT) ILO-UN, India & Research Adviser, VUB Belgium, Academic Ambassador for Cloud Computing under IBM (AI) USA, Ethiopia)

Robert Szabolcsi

Robert Szabolcsi (Óbuda University & Faculty of Mechanical and Safety Engineering, Hungary)

Said Touati

Said Touati (Nuclear Center Research Of Birine, Algeria)

Nguyen Tri-Hai

Nguyen Tri-Hai (Chung-Ang University, Korea (South))

Munirul Ula

Munirul Ula (Universitas Malikussaleh & Yayasan Munirul Ula, Indonesia)

Y. V. Pavan Kumar

Y. V. Pavan Kumar (Vellore Institute of Technology - Andhra Pradesh (VIT-AP) University, India)

Azli Yahya

Azli Yahya (Universiti Teknologi Malaysia, Malaysia)

Aws Yonis

Aws Zuheer Yonis (Ninevah University, Iraq)

Efil Yusrianto

Efil Yusrianto (UIN IMAM BONJOL PADANG & Fafi Group Reserach, Indonesia)

Abu Bakar Abd Rahman

reviewer

Abu Bakar Abd Rahman (Universiti Malaysia Sabah, Malaysia)

Abdul Abdul

Abdul Mateen Abdul (Federal Urdu University of Arts, Science & Technology Islamabad Pakistan & International Islamic University Islamabad Pakistan, Pakistan)

Sakena Abdul Jabar

Sakena Abdul Jabar (Universiti Malaysia Sarawak, Malaysia)

Antar Abdul-Qawy

Antar Shaddad Hamed Abdul-Qawy (Faculty of Science, SUMAIT University, Zanzibar, Tanzania)

Nelly Adiwijaya

Nelly Adiwijaya (Universitas Jember, Indonesia)

Sandeep Agrawal

Sandeep Kumar Agrawal (RJIT Tekanpur, India)

Mohd Ashraf Ahmad

Mohd Ashraf Ahmad (Universiti Malaysia Pahang, Malaysia)

Omar Al saif

Omar Ibrahim Al saif (Northern Technical University, Iraq)

Qusay Al-Doori

Qusay Al-Doori (University of Technology & The University of Technology, Iraq)

Mohammad Al-Mashhadani

Mohammad Abdulrahman Al-Mashhadani (Al-Maarif University College, Iraq)

Yahiea Al-Naiemy

Yahiea Al-Naiemy (Budapest University of Technology and Economics, Hungary)

Karim Al-Saedi

Karim Hashim Al-Saedi (Mustansiriyah University & College of Science, Iraq)

Atallah AL-Shatnawi

Atallah AL-Shatnawi (Al-albayt University, Jordan)

Maher Alasaady

Maher Talal Alasaady (Northern Technical University & Technical Institute / Mosul, Iraq)

Hamid Alasadi

Hamid Alasadi (IRAQ- BASRA & basra UNIV., Iraq)

Mihaela Albu

Mihaela Albu (Politehnica University of Bucharest, Romania)

Qutaiba Ali

Qutaiba Ibrahim Ali (University of Mosul, Iraq)

Wisam Ali

Wisam Ali (University of Technology & Design Co, Iraq)

Mohammad AlShabi

Mohammad AlShabi (University of Sharjah, United Arab Emirates)

Ahmed Alsheikhy

Ahmed Alsheikhy (Northern Border University & School of Engineering, Saudi Arabia)

Ghada Amer

Ghada Mohammed Amer (Faculty of Engineering - Benha University & Vice Preseident - Arab Science and Technology Foundation, Egypt)

Manilal Amipara

Manilal Amipara (Gujarat Technological University, India)

Khairul Anam

Khairul Anam (University of Jember, Indonesia)

Technical Program Chair

Khairul Anam (University of Jember, Indonesia)

Rakan Antar

reviewer

Rakan Khalil Antar (Northern Technical University, Iraq)

Anna Antonyová

Anna Antonyová (University of Prešov in Prešov, Slovakia)

Intan Sari Areni

Intan Sari Areni (Hasanuddin University, Indonesia)

Ezendu Ariwa

Ezendu Ifeanyi Ariwa (University of Bedfordshire, United Kingdom (Great Britain))

Farrukh Arslan

Farrukh Arslan (Purdue University, USA)

Carlos Astudillo

Carlos A. Astudillo (State University of Campinas, Brazil)

Irfan Bahiuddin

Irfan Bahiuddin (Universitas Gadjah Mada, Indonesia)

Bakhyt Bakiyev

Bakhyt Bakiyev (Suleyman Demirel University, Kazakhstan)

M'hamed Bakrim

M'hamed Bakrim (University of Cadi Ayyad Marrakesh & Faculty of Sciences and Techniques, Morocco)

Younes Balboul

Younes Balboul (ENSA, Sidi Mohamed Ben Abdellah University, Morocco)

Maushumi Barooah

Maushumi Barooah (Gauhati University, India)

Bikash Behera

Bikash Behera (International Institute of Information Technology Bhubaneswar, India)

Dinesh Bhatia

Dinesh Bhatia (Biomedical Engineering Department, North Eastern Hill University & Shillong, Meghalaya, India)

Subhasis Bhattacharjee

Subhasis Bhattacharjee (Adobe Systems India Private Limited, India)

Parameshachari Bidare Divakarachari

Parameshachari Bidare Divakarachari (GSSSIETW, Mysuru & Visvesvaraya Technological University, India)

Tuğçe Bilen

Tuğçe Bilen (Istanbul Technical University, Turkey)

Shilpi Birla

Shilpi Birla (Manipal University Jaipur, India)

Angelo Bruno

Angelo Bruno (Senior Member & Leonardo, Italy)

Rodrigo Campos Bortoletto

Rodrigo Campos Bortoletto (Instituto Federal de São Paulo, Brazil)

Alessandro Carrega

Alessandro Carrega (CNIT, Italy)

Chung-Liang Chang

Chung-Liang Chang (National Pingtung University of Science and Technology, Taiwan)

Abhay Chaudhary

Abhay Chaudhary (Vellore Institute of Technology, AP, India)

Tai-Chen Chen

Tai-Chen Chen (MAXEDA Technology, Taiwan)

Jose Cordeiro

Jose A M Cordeiro (School of Technology of Setubal / I. P. S., Portugal)

Siriporn Dachasilaruk

Siriporn Dachasilaruk (Naresuan University, Thailand)

D Dafik

D Dafik (University of Jember, Indonesia)

Sarada Dakua

Sarada Prasad Dakua (Hamad Medical Corporation, Qatar)

Luca Davoli

Luca Davoli (University of Parma, Italy)

Sorin Ioan Deaconu

Sorin Ioan Deaconu (Politechnica University Timisoara, Romania)

Tresna Dewi

Tresna Dewi (Politeknik Negeri Sriwijaya, Indonesia)

Tio Dharmawan

Tio Dharmawan (Universitas Jember, Indonesia)

Nishant Doshi

Nishant Doshi (PDP, India)

Nikolaos Doukas

Nikolaos Doukas (Hellenic Army Academy, Greece)

Nabil Elmarzouqi

Nabil Elmarzouqi (Mohammed V University in Rabat, Morocco)

Philipp Fechteler

Philipp Fechteler (Fraunhofer HHI, Germany)

Smain Femmam

Smain Femmam (University UHA, France)

Muftah Fraifer

Muftah Fraifer (IDC-CSIS-UL, Ireland)

Muhammad Furqon

Muhammad Ariful Furqon (Universitas Jember, Indonesia)

Dharmendra Ganage

Dharmendra G. Ganage (Sinhgad College of Engineering & Savitribai Phule Pune University, India)

Thittaporn Ganokratanaa

Thittaporn Ganokratanaa (King Mongkut's University of Technology Thonburi, Thailand)

Antonios Gasteratos

Antonios Gasteratos (Democritus University of Thrace, Greece)

Mihai Gavrilas

Mihai Gavrilas (Technical University of Iasi, Romania)

Amirreza Ghadimi Avval

Amirreza Ghadimi Avval (University of Arkansas, USA)

Alireza Ghasempour

Alireza Ghasempour (ICT Faculty, USA)

Hossein Ghodosi

Hossein Ghodosi (James Cook University, Australia)

Amin Gholoobi

Amin Gholoobi (Open University of Cyprus, Cyprus)

Renaldi Gondosubroto

Renaldi Gondosubroto (GReS Studio, Indonesia)

Agustinus Bimo Gumelar

Agustinus Bimo Gumelar (Institut Teknologi Sepuluh Nopember, Indonesia)

Brij Gupta

Brij Gupta (National Institute of Technology Kurukshetra, India)

Seng Hansun

Seng Hansun (Universitas Multimedia Nusantara, Indonesia)

Triwahju Hardianto

Triwahju Hardianto (University of Jember, Indonesia)

Shanmugasundaram Hariharan

Shanmugasundaram Hariharan (Shadan Women's College of Engineering and Technology, India)

Suneeta Harlapur

Suneeta Harlapur (Vemana Institute of Technology & Vishweswaraya Technological University, India)

Mohd Zamri Hasan

Mohd Zamri Hasan (University Malaysia Perlis, Malaysia)

Rini Hasanah

Rini Nur Hasanah (Brawijaya University & Faculty of Engineering, Indonesia)

Teguh Herlambang

Teguh Herlambang (University of Nahdlatul Ulama Surabaya & PT Indo Dynamisc Technology, Indonesia)

Technical Program Chair

Teguh Herlambang (University of Nahdlatul Ulama Surabaya & PT Indo Dynamisc Technology, Indonesia)

Roberto Carlos Herrera Lara

reviewer

Roberto Carlos Herrera Lara (National Polytechnic School & Electricity Company of Quito, Ecuador)

Paramate Horkaew

Paramate Horkaew (Suranaree University of Technology, Thailand)

Hanim Hussin

Hanim Hussin (Universiti Teknologi MARA, Malaysia)

Ba Dieu Huynh

Ba Dieu Huynh (Duy Tan University, Vietnam)

Duy Huynh

Duy C Huynh (Ho Chi Minh City University of Technology (HUTECH), Vietnam)

Hamidah Ibrahim

Hamidah Ibrahim (Universiti Putra Malaysia, Malaysia)

Nazrita Ibrahim

Nazrita Ibrahim (Universiti Tenaga Nasional, Malaysia)

Fakrulradzi Idris

Fakrulradzi Idris (Universiti Teknikal Malaysia Melaka, Malaysia)

Asif Iqbal

Asif Iqbal (KTH Royal Institute of Technology & ACFE, ISACA, IIA, ISC2, Sweden)

Zafar Iqbal

Zafar Iqbal, Qazi (PMAS, Arid Agriculture University, Rawalpindi & Comsates Institute of Information Technology, Pakistan)

Ismahafezi Ismail

Ismahafezi Ismail (Universiti Sultan Zainal Abidin, Malaysia)

Mohd Zain Ismail

Mohd Zain Ismail (Universiti Kuala Lumpur British Malaysian Institute, Malaysia)

Hossein Jafari

Hossein Jafari (Intelligent Fusion Technology, Inc., USA)

Ramkumar Jaganathan

Ramkumar Jaganathan (Dr NGP Arts and Science College, India)

Norziana Jamil

Norziana Jamil (Universiti Tenaga Nasional, MALAYSIA, Malaysia)

Emilio Jiménez Macías

Emilio Jiménez Macías (University of La Rioja, Spain)

Siti Amely Jumaat

Siti Amely Jumaat (Universiti Tun Hussein Onn Malaysia, Malaysia)

Sandeep Kakde

Sandeep Kakde (Y C College of Engineering, India)

Dimitrios Kallergis

Dimitrios Kallergis (University of West Attica, Greece)

S Kannadhasan

S Kannadhasan (Cheran College of Engineering & Raja College of Engineering and Technology, India)

Lavish Kansal

Lavish Kansal (Lovely Professional University, India)

Mahdi Karami

Mahdi Karami (Universiti Putra Malaysia, Malaysia)

Inderpreet Kaur

Inderpreet Kaur (Director IGEN Edu Solutions India & Guru Nanak Dev Engineering College Ludhiana, India)

Mohammad Khalily Dermany

Mohammad Khalily Dermany (Islamic Azad University, Khomein Branch, Iran)

Talha Khan

Talha Masood Khan (University of Illinois at Chicago, USA)

Zeashan Khan

Zeashan Hameed Khan (Air University, Pakistan)

Nikhil Khanna

Nikhil Khanna (University of Delhi & Motilal Nehru College, India)

Fayez Khazalah

Fayez Khazalah (Al al Bayt University, Jordan)

Dong W. Kim

Dong W. Kim (Inha Tech College, Korea (South))

Montree Kumngern

Montree Kumngern (King Mongkut's Institute of Technology Ladkrabang, Thailand)

Yeni Kustiyahningsih

Yeni Kustiyahningsih (University of Trunojoyo, Indonesia)

Otavio Lavor

Otavio P. Lavor (UFERSA, Brazil)

Trong Nghia Le

Trong Nghia Le (Ho Chi Minh City University of Technology and Education, Vietnam)

Gyu Myoung Lee

Gyu Myoung Lee (Liverpool John Moores University, United Kingdom (Great Britain))

Yih-Jiun Lee

Yih-Jiun Lee (Chinese Culture University, Taiwan)

Narkedamilly Leelavathy

Narkedamilly Leelavathy (Jawaharlal Nehru Technological University, India)

Xia Li

Xia Li (Apple, USA)

Marco Listanti

Marco Listanti (University of Rome "La Sapienza", Italy)

Chuan-Ming Liu

Chuan-Ming Liu (National Taipei University of Technology, Taiwan)

Renato Lopes

Renato V Lopes (Universidade de Brasília, Brazil)

Pascal Lorenz

Pascal Lorenz (University of Haute Alsace, France)

Nadir Mahammed

Nadir Mahammed (Ecole Supérieure en Informatique 08 mai 1945 Sidi Bel Abbès, Algeria)

Ahmed Mahmood

Ahmed Badr Mahmood (University of Guelph, Canada)

Haitham Mahmoud

Haitham Hassan Mahmoud (Birmingham City University (BCU) & British University in Egypt (BUE), United Kingdom (Great Britain))

Massudi Mahmuddin

Massudi Mahmuddin (Universiti Utara Malaysia, Malaysia)

Wayan Mahmudy

Wayan Firdaus Mahmudy (Universitas Brawijaya, Indonesia)

As Mansur

As Mansur (Medan State University (Unimed), Indonesia)

Syed Manzoor Qasim

Syed Manzoor Qasim (King Abdulaziz City for Science and Technology, Saudi Arabia)

Warsuzarina Mat Jubadi

Warsuzarina Mat Jubadi (Universiti Tun Hussein Onn Malaysia, Malaysia)

Ebrahim Mattar

Ebrahim Abdulla Mattar (University of Bahrain & IET Bahrain Local Network, Bahrain)

Michael McGuire

Michael McGuire (University of Victoria, Canada)

Zahéra Mekkioui

Zahéra Mekkioui (University of tlemcen & Faculty of Sciences, Algeria)

Charles Miers

Charles Christian Miers (Santa Catarina State University, Brazil)

Dan Milici

Dan L. Milici (University of Suceava, Romania)

Thippeswamy MN

Thippeswamy MN (Nitte Meenakshi Institute of Technology, India)

Khairul Anuar Mohamad

Khairul Anuar Mohamad (Universiti Tun Hussein Onn Malaysia, Malaysia)

Amjed Sid Ahmed Mohamed Sid Ahmed

Amjed Sid Ahmed Mohamed Sid Ahmed (Global College of Engineering and Technology, Oman)

Suraya Mohammad

Suraya Mohammad (University Kuala Lumpur - British Malaysian Institute, Malaysia)

Negar Mohammadi-Koushki

Negar Mohammadi-Koushki (USA)

Amir Hossien Mohammadzadeh Niaki

Amir Hossien Mohammadzadeh Niaki (Niroo Research Institute (NRI), Iran)

Khalil Azha Mohd Annuar

Khalil Azha Mohd Annuar (Universiti Teknikal Malaysia Melaka, Malaysia)

Azrul Mohd Ariffin

Azrul Mohd Ariffin (Universiti Tenaga Nasional, Malaysia)

Shukor Sanim Mohd Fauzi

Shukor Sanim Mohd Fauzi (Universiti Teknologi Mara, Perlis Campus, Malaysia)

Nur Razia Mohd Suradi

Nur Razia Mohd Suradi (Universiti Selangor & UNISEL, Malaysia)

Mohd Yuzri Mohd Yusop

Mohd Yuzri Mohd Yusop (Universiti Kuala Lumpur, Malaysia)

Hamed Mojallali

Hamed Mojallali (University of Guilan, Iran)

Rodrigo Montufar-Chaveznava

Rodrigo Montufar-Chaveznava (Facultad de Ingeniería, Universidad Nacional Autónoma de México, Mexico)

Pedro Moura

Pedro Moura (University of Coimbra, Portugal)

Mohamed Moussaoui

Mohamed Moussaoui (Abdelmalek Essaadi University & ENSAT : National School of Applied Sciences of Tangier, Morocco)

Munawir Munawir

Munawir Munawir (Universitas Pendidikan Indonesia, Indonesia)

T Vijay Muni

T Vijay Muni (K L University, India)

Rinaldi Munir

Rinaldi Munir (Institut Teknologi Bandung, Indonesia)

Sarhan Musa

Sarhan M. Musa (Prairie View A&M University, USA)

Mas Rina Mustaffa

Mas Rina Mustaffa (Universiti Putra Malaysia, Malaysia)

Marwan Nafea

Marwan Nafea (University of Nottingham Malaysia, Malaysia)

Ali Nahar

Ali Nahar (University of Technology -Iraq, Malaysia)

Paniti Netinant

Paniti Netinant (Rangsit University & Graduate School, Thailand)

Mohd Natashah Norizan

Mohd Natashah Norizan (Universiti Malaysia Perlis, Malaysia)

Ahmad Fairuz Omar

Ahmad Fairuz Omar (Universiti Sains Malaysia, Malaysia)

Nor Azlan Othman

Nor Azlan Othman (Universiti Teknologi MARA (UiTM) Cawangan Pulau Pinang, Malaysia)

Rosaura Palma-Orozco

Rosaura Palma-Orozco (Instituto Politécnico Nacional, Mexico)

Shashikant Patil

Shashikant Shantilal Patil (Mumbai University & ViMEET Khalapur Raigad MS India, India)

Tarakanth Paul

Tarakanth Paul (ICFAI University Jharkhand, India)

Yesaya Paulus

Yesaya Tommy Paulus (Dipa Makassar University, Japan)

Vanita Pawar

Vanita Pawar (DIAT, Pune & Lekha Wireless Solutions Ltd, India)

Rajesh Pindoriya

Rajesh M Pindoriya (Indian Institute of Technology Mandi & IIT Mandi, Kamand Campus, Himachal Pradesh, India)

Petra Poulova

Petra Poulova (University of Hradec Kralove, Czech Republic)

Eko Prasetyo

Eko Prasetyo (PT. PLN (Persero), Indonesia)

Emil Pricop

Emil Pricop (Petroleum-Gas University of Ploiesti, Romania)

Salita Ulitia Prini

Salita Ulitia Prini (Indonesian Institute of Sciences, Indonesia)

Cong Pu

Cong Pu (Marshall University, USA)

Sameerchand Pudaruth

Sameerchand Pudaruth (University of Mauritius, Mauritius)

Pakawan Pugsee

Pakawan Pugsee (Chulalongkorn University & Department of Mathematic and Computer Science, Faculty of Science, Thailand)

Yogesh Pundlik

Yogesh Yashwant Pundlik (Kamala Institute of Technology and Science, Singapur- & Jawaharlal Nehru Technological University Kakinada, India)

Asep Purnomo

Asep Wahyudin Purnomo (Universitas Gadjah Mada & SEICE TECH INDONESIA, Indonesia)

Fitri Maya Puspita

Fitri Maya Puspita (University of Sriwijaya, Indonesia)

Fika Rachman

Fika Rachman (University of Trunojoyo Madura, Indonesia)

Ema Rachmawati

Ema Rachmawati (Telkom University, Indonesia)

Indra Raharjana

Indra Kharisma Raharjana (Universitas Airlangga & Institut Teknologi Sepuluh Nopember, Indonesia)

Harikumar Rajaguru

Harikumar Rajaguru (Bannari Amman Institute of Technology & ECE, India)

Grienggrai Rajchakit

Grienggrai Rajchakit (Maejo University, Thailand)

Ramadiani Ramadiani

Ramadiani Ramadiani (Mulawarman University, Indonesia)

Shuvendu Rana

Shuvendu Rana (SRM University AP, United Kingdom (Great Britain))

Priya Ranjan

Priya Ranjan (SRM University, Amaravathi, India)

Nadana Ravishankar

Nadana Ravishankar, T (VelTech High Tech Dr Rangarajan Dr Sakunthala Engineering College, India)

Indra Riyanto

Indra Riyanto (Universitas Indonesia, Indonesia)

Zairi Rizman

Zairi Ismael Rizman (Universiti Teknologi MARA, Malaysia)

Nuno Rodrigues

Nuno Rodrigues (Instituto Politécnico de Bragança & Instituto de Telecomunicações,

Portugal)

Vahideh Sadeghi

Vahideh Sadat Sadeghi (Isfahan University of Technology, Iran)

Ahmed Saeed

Ahmed Saeed (Future University in Egypt, Egypt)

Basil Saied

Basil Mohammed Saied (Formerly at University of Mosul, Iraq)

Arun Saini

Arun Kumar Saini (The ICFAI University, Jaipur, India)

Sandeep Saini

Sandeep Saini (The LNM Institute of Information Technology, Jaipur, India)

Wael Salah

Wael A. Salah (Palestine Technical University - Kadoorie, Palestine)

Hussain Saleem

Hussain Saleem, Engr. (University of Karachi, Pakistan)

Azmi Saleh

Azmi Saleh (Jember University, Indonesia)

Andrews Samraj

Andrews Samraj (Mahendra Engineering College, India)

Tomonobu Sato

Tomonobu Sato (Hitachi ICT Business Services, Ltd., Japan)

Alfredo Satriya

Alfredo Satriya (University of Florida, USA & Universitas Jember, Indonesia)

Toufik Sebbagh

Toufik Sebbagh (University of Skikda, Algeria)

Sandeep Sengar

Sandeep Singh Sengar (Indian Institute of Technology (ISM) Dhanbad, India)

Tomonobu Senjyu

Tomonobu Senjyu (Faculty of Engineering, University of the Ryukyus, Japan)

Amel Serrat

Amel Serrat (USTO MB, Algeria)

Nadheer Shalash

Nadheer A. Shalash (Al-Mamon University College, Iraq & University Malaysia Pahang, Malaysia)

Aditi Sharma

Aditi Sharma (Quantum University, Roorkee, Uttarakhand & Jai Narayan Vyas University UTU AICTE, India)

Sachin Sharma

Sachin Sharma (Technological University Dublin, Ireland)

Akbar Sheikh-Akbari

Akbar Sheikh-Akbari (Leeds Beckett University, United Kingdom (Great Britain))

Divya Rishi Shrivastava

Divya Rishi Shrivastava (Manipal University Jaipur, India)

Khairul Azami Sidek

Khairul Azami Sidek (International Islamic University Malaysia, Malaysia)

Joni Simatupang

Joni W. Simatupang (President University, Indonesia & NTUST, Taiwan)

Pramod Singh

Pramod Kumar Singh (ABV-IIIITM Gwalior, India)

Ramesh Singh

Ramesh Singh (DTU Delhi, India)

Simar Preet Singh

Simar Preet Singh (Bennett University, Greater Noida, India)

Vivek Singh

Vivek Singh (Shambhunath Institute of Engineering and Technology, Prayagraj, UP, INDIA,

India)

Shefali Singhal

Shefali K Singhal (India)

Jee Siong

Jee Kian Siong (Multimedia University, Malaysia)

Rostyslav Sklyar

Rostyslav Sklyar (Independent Professional, Ukraine)

Slamin Slamin

Slamin Slamin (University of Jember, Indonesia)

Steering Committee

Slamin Slamin (University of Jember, Indonesia)

Nikolaos Sofianos

reviewer

Nikolaos Sofianos (Democritus University of Thrace, Greece)

Viranjay M. Srivastava

Viranjay M. Srivastava (University of KwaZulu-Natal, South Africa)

Sritrusta Sukaridhoto

Sritrusta Sukaridhoto (Politeknik Elektronika Negeri Surabaya, Indonesia)

Heni Sulistiani

Heni Sulistiani (Universitas Teknokrat Indonesia, Indonesia)

Publication Chair

Heni Sulistiani (Universitas Teknokrat Indonesia, Indonesia)

Ahmed Sultan

reviewer

Ahmed Jasim Sultan (Baghdad - Iraq & Middle Technical University, Iraq)

Ryan Suryono

Ryan Randy Suryono (Universitas Teknokrat Indonesia, Indonesia)

Technical Program Chair

Ryan Randy Suryono (Universitas Teknokrat Indonesia, Indonesia)

Sutrisno Sutrisno

reviewer

Sutrisno Sutrisno (Universitas Diponegoro, Indonesia)

Mujtaba Mahdi Mudassir Syed

Mujtaba Mahdi Mudassir Syed (Osmania University, India)

Pooya Taheri

Pooya Taheri (SFU & Langara College, Canada)

Thitinan Tantidham

Thitinan Tantidham (Mahidol University, Thailand)

Pham Thanh Thuy

Pham Thanh Thuy (MICA Institute (HUST - CNRS/UMI 2954 - INP Grenoble), Vietnam)

Hua Nong Ting

Hua Nong Ting (Universiti Malaya, Malaysia)

Huong Yong Ting

Huong Yong Ting (University College of Technology Sarawak, Malaysia)

Rahmat Trialih

Rahmat Trialih (Brawijaya University, Indonesia & University College Cork, Ireland)

Muharrem Tümçakır

Muharrem Tümçakır (Gebze Technical University & ASELSAN, Turkey)

Mohd Umar Farooq

Mohd Umar Farooq (Muffakham Jah College of Engineering and Technology & Muffakham Jah College of Engineering & Tech, India)

Madhur Upadhayay

Madhur D Upadhayay (Shiv Nadar University, India)

Panagiotis Varzakas

Panagiotis Varzakas (University of Thessaly, Greece)

Jami Venkata Suman

Jami Venkata Suman (GMR Institute of Technology, India)

Chitra Venugopal

Chitra Venugopal (Oregon Institute of Technology, USA)

Rima Wahyuningrum

Rima Tri Wahyuningrum (University of Trunojoyo Madura, Indonesia)

Carlos Becker Westphall

Carlos Becker Westphall (Federal University of Santa Catarina, Brazil)

Widjonarko Widjonarko

Widjonarko Widjonarko (Universitas Jember, Indonesia)

Widodo Widodo

Widodo Widodo (Universitas Negeri Jakarta, Indonesia)

Tianhua Xu

Tianhua Xu (SoE University, United Kingdom (Great Britain))

Abid Yahya

Abid Yahya (Botswana International University of Science and Technology (BIUST) & University Malaysia Perlis, Botswana)

Srihari Yamanoor

Srihari Yamanoor (Self, USA)

Chong Yen Fook

Chong Yen Fook (Universiti Malaysia Perlis, Malaysia)

Thaweesak Yingthawornsuk

Thaweesak Yingthawornsuk (King Mongkut's University of Technology Thonburi, Thailand)

Sumendra Yogarayan

Sumendra Yogarayan (Multimedia University (MMU), Malaysia)

Pujianto Yugopuspito

Pujianto Yugopuspito (Universitas Pelita Harapan, Indonesia)

Noor Zaman

Noor Zaman (Taylor's University, Malaysia)

Qi Zhao

Qi Zhao (University of California, Los Angeles, USA)

Wahyudi Hasbi

Steering Committee

Wahyudi Hasbi (National Research & Innovation Agency (BRIN), Indonesia)

Achmad Jazidie

Achmad Jazidie (Institut Teknologi Sepuluh Nopember, Indonesia)

Ford Lumban Gaol

Ford Gaol (Bina Nusantara University, Jakarta, Indonesia)

Gamantyo Hendrantoro

Gamantyo Hendrantoro (Institut Teknologi Sepuluh Nopember, Indonesia)

Son Kuswadi

Son Kuswadi (Politeknik Elektronika Negeri Surabaya & Politeknik Negeri Banyuwangi, Indonesia)

Ryan Randy Suryono

Technical Program Chair

Ryan Randy Suryono (Universitas Teknokrat Indonesia, Indonesia)

Endang Sulistiyani

Publication Chair

Endang Sulistiyani (Universitas Nahdlatul Ulama Surabaya, Indonesia)

Ima Kurniastuti

Ima Kurniastuti (University of Nahdlatul Ulama Surabaya & Unusa, Indonesia)

Dedi Darwis

Dedi Darwis (Universitas Teknokrat Indonesia, Indonesia)

Eka Mistiko Rini

Eka Mistiko Rini (Politeknik Negeri Banyuwangi, Indonesia)

Ford Gaol

Steering Committee

Ford Gaol (Bina Nusantara University, Jakarta, Indonesia)

Organizing Committee of ICOMITEE 2021

Steering Committee

- Iwan Taruna, University of Jember, Jember, Indonesia
- Wahyudi Hasbi, National Institute of Aeronautics & Space (LAPAN), Indonesia
- Ford Lumban Gaol, IEEE Indonesia Section Computer Society Chapter
- Son Kuswadi, Politeknik Negeri Banyuwangi, Banyuwangi, Indonesia
- Slamain, University of Jember, Jember, Indonesia
- Achmad Jazidie, Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia
- Gamantyo Hendrantoro, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

Conference Chair

- Saiful Bukhori, University of Jember, Jember, Indonesia

Treasurer

- Windi Eka Yulia Retnani, University of Jember, Jember, Indonesia

Technical Program Committee Chairs

- Antonius Cahya Prihandoko, University of Jember, Jember, Indonesia
- Khairul Anam, University of Jember, Jember, Indonesia
- Teguh Herlambang, Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia
- Ryan Randi Suryono, Universitas Teknokrat Indonesia, Lampung, Indonesia

Publication Chairs

- Fahrobby Adnan, University of Jember, Jember, Indonesia
- Endang Sulistiyani, Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia
- Ima Kurniastuti, Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia
- Heni Sulistiani, Universitas Teknokrat Indonesia, Lampung, Indonesia
- Dedi Darwis, Universitas Teknokrat Indonesia, Lampung, Indonesia
- Eka Mistiko Rini, Politeknik Negeri Banyuwangi, Banyuwangi, Indonesia

Publicity and Sponsorship Chairs

- Januar Adi Putra, University of Jember, Jember, Indonesia

Secretary

- Beny Prasetyo, University of Jember, Jember, Indonesia

Technical Program Members

- Sasikumar A, K Ramakrishnan College of Technology, India
- Sharul Kamal A. Rahim, Universiti Teknologi Malaysia, Malaysia
- Ab Al-Hadi Ab Rahman, Universiti Teknologi Malaysia, Malaysia
- Shahliza Abd Halim, University of Technology Malaysia, Malaysia
- Dahlan Abdullah, Universitas Malikussaleh, Indonesia
- Shobit Agarwal, University of Bologna, Italy
- Anita Ahmad, University of Technology Malaysia, Malaysia
- Hani Ahmed, Universiti Malaysia Perlis, Malaysia

- Ruma Ajeena, University of Babylon, Iraq
- Oryina Akputu, Ritman University, Nigeria
- Ahmed Al-Naib, Northern Technical University, Iraq
- Mudrik Alaydrus, Universitas Mercu Buana, Indonesia
- Mohammed Alghamdi, Al-Baha University, Saudi Arabia
- Farah Alkhalid, University of Technology, Iraq
- Abdulkader Alwer, Istanbul Aydin University, Turkey
- Santhanakrishnan Anand, New York Institute of Technology, USA
- Ernesto Arzabala-Contreras, Universidad Tecnologica de Chihuahua, Mexico
- Mehdi Asadi, Islamic Azad University, Khamneh Branch, Iran
- Anamiya Bhattacharya, Indian Space Research Organization, India
- Ahmed Chitnalah, Cadi Ayyad University EST Laboratory, Morocco
- Tien Han Chua, Universiti Teknologi Malaysia, Malaysia
- Nagaraj Dharwadkar, Rajarambapu Institute of Technology, Islampur, India
- Ke-Lin Du, Concordia University, Canada
- Nibal Farman, Univrsity of Baghdad, Iraq
- Miguel Franklin de Castro, Federal University of Ceará, Brazil
- Franco Frattolillo, University of Sannio, Italy
- Diogo Gomes, Universidade de Aveiro, Portugal
- Visvasuresh Victor Govindaswamy, Concordia University, USA
- Eisuke Hanada, Saga University, Japan
- Hao Hao, RMIT University, Australia
- Maha Harzallah, ISITCOM, Tunisia
- S. M. Shakil Hassan, Eastern University, Bangladesh
- Sallehuddin Ibrahim, Universiti Teknologi Malaysia, Malaysia
- Mohd. Israil, Aljuf University, KSA, Saudi Arabia
- Jin Jin, University of Toronto, Canada
- Mohammed Kaabar, Washington State University, USA
- Nor Hisham Khamis, Universiti Teknologi Malaysia, Malaysia
- Sandeep Kumar, Central Research Laboratory, Bharat Electronics Ltd., India
- Evgeny Markin, Bauman State Technical University, Russia
- Israel Martin-Escalona, Universitat Politècnica de Catalunya (UPC), Spain
- Artis Mednis, Institute of Electronics and Computer Science, Latvia
- Mona Riza Mohd Esa, Universiti Teknologi Malaysia, Malaysia
- Norhaida Mohd Suaib, Universiti Teknologi Malaysia, Malaysia
- Roberto Montemanni, University of Modena and Reggio Emilia, Italy
- Waseem Mufti, Aalborg University Denmark, Pakistan
- Muhammad Nasir, Universitas Andalas, Indonesia
- Amirjan Nawabjan, Universiti Teknologi Malaysia, Malaysia
- Nik Noordini Nik Abd Malik, Universiti Teknologi Malaysia, Malaysia
- I Gde Dharma Nugraha, Universitas Indonesia, Indonesia
- Nurdin Nurdin, Universitas Malikussaleh, Indonesia
- Siti Othman, Universiti Teknologi Malaysia (UTM), Malaysia
- Varun P. Gopi, National Institute of Technology, India
- Arindam Pal, CSIRO, Australia
- Bujjibabu Penumutchi, JNTUK Kakinada, India
- Prashant Pillai, University of Wolverhampton, United Kingdom (Great Britain)
- Andri Pranolo, Universitas Ahmad Dahlan, Indonesia
- Junfei Qiu, University of York, United Kingdom (Great Britain)
- Abdul Rahim Bepar, Annamacharya Institute of Technology & Sciences, India
- Gautham Rajagopal, Medtronic, USA
- Alireza Rezvanian, Amirkabir University of Technology, Iran
- Siti Hawa Ruslan, Universiti Tun Hussein Onn Malaysia, Malaysia
- Mohd Sadiq, Jamia Millia Islamia, India
- Azahari Salleh, Universiti Teknikal Malaysia Melaka (UTeM), Malaysia

- Roselina Sallehuddin, University Technology Malaysia, Malaysia
- Vaibhav Saundarmal, Marathwada Institute of Technology, Aurangabad, India
- Ahmad Zuri Sha'ameri, Universiti Teknologi Malaysia, Malaysia
- Durga Prasad Sharma, AMUIT, MOSHE FDRE under UNDP & Adviser (IT) ILO-UN, India
- Robert Szabolcsi, Óbuda University, Hungary
- Said Touati, Nuclear Center Research Of Birine, Algeria
- Nguyen Tri-Hai, Chung-Ang University, Korea (South)
- Munirul Ula, Universitas Malikussaleh, Indonesia
- Y. V. Pavan Kumar, Vellore Institute of Technology - Andhra Pradesh (VIT-AP) University, India
- Azli Yahya, Universiti Teknologi Malaysia, Malaysia
- Aws Yonis, Ninevah University, Iraq
- Efil Yusrianto, UIN IMAM BONJOL PADANG, Indonesia

Reviewers

- Abu Bakar Abd Rahman, Universiti Malaysia Sabah, Malaysia
- Abdul Abdul, Federal Urdu University of Arts, Science & Technology Islamabad Pakistan, Pakistan
- Sakena Abdul Jabar, Universiti Malaysia Sarawak, Malaysia
- Antar Abdul-Qawy, Faculty of Science, SUMAIT University, Zanzibar, Tanzania
- Nelly Adiwijaya, Universitas Jember, Indonesia
- Sandeep Agrawal, RJIT Tekanpur, India
- Mohd Ashraf Ahmad, Universiti Malaysia Pahang, Malaysia
- Omar Al saif, Northern Technical University, Iraq
- Qusay Al-Doori, University of Technology, Iraq
- Mohammad Al-Mashhadani, Al-Maarif University College, Iraq
- Yahiea Al-Naiemy, Budapest University of Technology and Economics, Hungary
- Karim Al-Saedi, Mustansiriyah University, Iraq
- Atallah AL-Shatnawi, Al-albayt University, Jordan
- Maher Alasaady, Northern Technical University, Iraq
- Hamid Alasadi, IRAQ- BASRA, Iraq
- Mihaela Albu, Politehnica University of Bucharest, Romania
- Qutaiba Ali, University of Mosul, Iraq
- Wisam Ali, University of Technology, Iraq
- Mohammad AlShabi, University of Sharjah, United Arab Emirates
- Ahmed Alsheikhy, Northern Border University, Saudi Arabia
- Ghada Amer, Faculty of Engineering - Benha University, Egypt
- Manilal Amipara, Gujarat Technological University, India
- Khairul Anam, University of Jember, Indonesia
- Rakan Antar, Northern Technical University, Iraq
- Anna Antonyová, University of Prešov in Prešov, Slovakia
- Intan Sari Areni, Hasanuddin University, Indonesia
- Ezendu Ariwa, University of Bedfordshire, United Kingdom (Great Britain)
- Farrukh Arslan, Purdue University, USA
- Carlos Astudillo, State University of Campinas, Brazil
- Irfan Bahiuddin, Universitas Gadjah Mada, Indonesia
- Bakhyt Bakiyev, Suleyman Demirel University, Kazakhstan
- M'hamed Bakrim, University of Cadi Ayyad Marrakesh, Morocco
- Younes Balboul, ENSA, Sidi Mohamed Ben Abdellah University, Morocco
- Maushumi Barooah, Gauhati University, India
- Bikash Behera, International Institute of Information Technology Bhubaneswar, India
- Dinesh Bhatia, Biomedical Engineering Department, North Eastern Hill University, India
- Subhasis Bhattacharjee, Adobe Systems India Private Limited, India
- Parameshachari Bidare Divakarachari, GSSSIETW, Mysuru, India
- Tuğçe Bilen, Istanbul Technical University, Turkey
- Shilpi Birla, Manipal University Jaipur, India

- Angelo Bruno, IEEE Senior Member, Italy
- Rodrigo Campos Bortoletto, Instituto Federal de São Paulo, Brazil
- Alessandro Carrega, CNIT, Italy
- Chung-Liang Chang, National Pingtung University of Science and Technology, Taiwan
- Abhay Chaudhary, Vellore Institute of Technology, AP, India
- Tai-Chen Chen, MAXEDA Technology, Taiwan
- Jose Cordeiro, School of Technology of Setubal / I. P. S., Portugal
- Siriporn Dachasilaruk, Naresuan University, Thailand
- D Dafik, University of Jember, Indonesia
- Sarada Dakua, Hamad Medical Corporation, Qatar
- Luca Davoli, University of Parma, Italy
- Sorin Ioan Deaconu, Politechnica University Timisoara, Romania
- Tresna Dewi, Politeknik Negeri Sriwijaya, Indonesia
- Tio Dharmawan, Universitas Jember, Indonesia
- Nishant Doshi, PDPU, India
- Nikolaos Doukas, Hellenic Army Academy, Greece
- Nabil Elmarzouqi, Mohammed V University in Rabat, Morocco
- Philipp Fechteler, Fraunhofer HHI, Germany
- Smain Femmam, University UHA, France
- Muftah Fraifer, IDC-CSIS-UL, Ireland
- Muhammad Furqon, Universitas Jember, Indonesia
- Dharmendra Ganage, Sinhgad College of Engineering, India
- Thittaporn Ganokratanaa, King Mongkut's University of Technology Thonburi, Thailand
- Antonios Gasteratos, Democritus University of Thrace, Greece
- Mihai Gavrilas, Technical University of Iasi, Romania
- Amirreza Ghadimi Avval, University of Arkansas, USA
- Alireza Ghasempour, ICT Faculty, USA
- Hossein Ghodsi, James Cook University, Australia
- Amin Gholoobi, Open University of Cyprus, Cyprus
- Renaldi Gondosubroto, GReS Studio, Indonesia
- Agustinus Bimo Gumelar, Institut Teknologi Sepuluh Nopember, Indonesia
- Brij Gupta, National Institute of Technology Kurukshetra, India
- Seng Hansun, Universitas Multimedia Nusantara, Indonesia
- Triwahju Hardianto, University of Jember, Indonesia
- Shanmugasundaram Hariharan, Shadan Women's College of Engineering and Technology, India
- Suneeta Harlapur, Vemana Institute of Technology, India
- Mohd Zamri Hasan, University Malaysia Perlis, Malaysia
- Rini Hasanah, Brawijaya University, Indonesia
- Teguh Herlambang, University of Nahdlatul Ulama Surabaya, Indonesia
- Roberto Carlos Herrera Lara, National Polytechnic School, Ecuador
- Paramate Horkaew, Suranaree University of Technology, Thailand
- Hanim Hussin, Universiti Teknologi MARA, Malaysia
- Ba Dieu Huynh, Duy Tan University, Vietnam
- Duy Huynh, Ho Chi Minh City University of Technology (HUTECH), Vietnam
- Hamidah Ibrahim, Universiti Putra Malaysia, Malaysia
- Nazrita Ibrahim, Universiti Tenaga Nasional, Malaysia
- Fakrulradzi Idris, Universiti Teknikal Malaysia Melaka, Malaysia
- Asif Iqbal, KTH Royal Institute of Technology, Sweden
- Zafar Iqbal, PMAS, Arid Agriculture University, Rawalpindi, Pakistan
- Ismahafezi Ismail, Universiti Sultan Zainal Abidin, Malaysia
- Mohd Zain Ismail, Universiti Kuala Lumpur British Malaysian Institute, Malaysia
- Hossein Jafari, Intelligent Fusion Technology, Inc., USA
- Ramkumar Jaganathan, Dr NGP Arts and Science College, India
- Norziana Jamil, Universiti Tenaga Nasional, MALAYSIA, Malaysia
- Emilio Jiménez Macías, University of La Rioja, Spain

- Siti Amely Jumaat, Universiti Tun Hussein Onn Malaysia, Malaysia
- Sandeep Kakde, Y C College of Engineering, India
- Dimitrios Kallergis, University of West Attica, Greece
- S Kannadhasan, Cheran College of Engineering, India
- Lavish Kansal, Lovely Professional University, India
- Mahdi Karami, Universiti Putra Malaysia, Malaysia
- Inderpreet Kaur, Director IGEN Edu Solutions India, India
- Mohammad Khalily Dermany, Islamic Azad University, Khomein Branch, Iran
- Talha Khan, University of Illinois at Chicago, USA
- Zeashan Khan, Air University, Pakistan
- Nikhil Khanna, University of Delhi, India
- Fayez Khazalah, Al al Bayt University, Jordan
- Dong W. Kim, Inha Tech College, Korea (South)
- Montree Kumngern, King Mongkut's Institute of Technology Ladkrabang, Thailand
- Yeni Kustiyahningsih, University of Trunojoyo, Indonesia
- Otavio Lavor, UFERSA, Brazil
- Trong Nghia Le, Ho Chi Minh City University of Technology and Education, Vietnam
- Gyu Myoung Lee, Liverpool John Moores University, United Kingdom (Great Britain)
- Yih-Jiun Lee, Chinese Culture University, Taiwan
- Narkedamilly Leelavathy, Jawaharlal Nehru Technological University, India
- Xia Li, Apple, USA
- Marco Listanti, University of Rome "La Sapienza", Italy
- Chuan-Ming Liu, National Taipei University of Technology, Taiwan
- Renato Lopes, Universidade de Brasília, Brazil
- Pascal Lorenz, University of Haute Alsace, France
- Nadir Mahammed, Ecole Supérieure en Informatique 08 mai 1945 Sidi Bel Abbès, Algeria
- Ahmed Mahmood, University of Guelph, Canada
- Haitham Mahmoud, Birmingham City University (BCU), United Kingdom (Great Britain)
- Massudi Mahmuddin, Universiti Utara Malaysia, Malaysia
- Wayan Mahmudy, Universitas Brawijaya, Indonesia
- As Mansur, Medan State University (Unimed), Indonesia
- Syed Manzoor Qasim, King Abdulaziz City for Science and Technology, Saudi Arabia
- Warsuzarina Mat Jubadi, Universiti Tun Hussein Onn Malaysia, Malaysia
- Ebrahim Mattar, University of Bahrain, Bahrain
- Michael McGuire, University of Victoria, Canada
- Zahéra Mekkioui, University of tlemcen, Algeria
- Charles Miers, Santa Catarina State University, Brazil
- Dan Milici, University of Suceava, Romania
- Thippeswamy MN, Nitte Meenakshi Institute of Technology, India
- Khairul Anuar Mohamad, Universiti Tun Hussein Onn Malaysia, Malaysia
- Amjed Sid Ahmed Mohamed Sid Ahmed, Global College of Engineering and Technology, Oman
- Suraya Mohammad, University Kuala Lumpur - British Malaysian Institute, Malaysia
- Negar Mohammadi-Koushki, none, USA
- Amir Hossien Mohammadzadeh Niaki, Niroo Research Institute (NRI), Iran
- Khalil Azha Mohd Annuar, Universiti Teknikal Malaysia Melaka, Malaysia
- Azrul Mohd Ariffin, Universiti Tenaga Nasional, Malaysia
- Shukor Sanim Mohd Fauzi, Universiti Teknologi Mara, Perlis Campus, Malaysia
- Nur Razia Mohd Suradi, Universiti Selangor, Malaysia
- Mohd Yuzri Mohd Yusop, Universiti Kuala Lumpur, Malaysia
- Hamed Mojallali, University of Guilan, Iran
- Rodrigo Montufar-Chaveznavia, Facultad de Ingeniería, Universidad Nacional Autónoma de México, Mexico
- Pedro Moura, University of Coimbra, Portugal
- Mohamed Moussaoui, Abdelmalek Essaadi University, Morocco
- Munawir Munawir, Universitas Pendidikan Indonesia, Indonesia

- T Vijay Muni, K L University, India
- Rinaldi Munir, Institut Teknologi Bandung, Indonesia
- Sarhan Musa, Prairie View A&M University, USA
- Mas Rina Mustaffa, Universiti Putra Malaysia, Malaysia
- Marwan Nafea, University of Nottingham Malaysia, Malaysia
- Ali Nahar, University of Technology -Iraq, Malaysia
- Paniti Netinant, Rangsit University, Thailand
- Mohd Natashah Norizan, Universiti Malaysia Perlis, Malaysia
- Nurdin Nurdin, Universitas Islam Negeri (IAIN) Datokarama Palu, Indonesia
- Ahmad Fairuz Omar, Universiti Sains Malaysia, Malaysia
- Nor Azlan Othman, Universiti Teknologi MARA (UiTM) Cawangan Pulau Pinang, Malaysia
- Rosaura Palma-Orozco, Instituto Politécnico Nacional, Mexico
- Shashikant Patil, SVKM NMIMS Mumbai India, India
- Taraknath Paul, ICFAI University Jharkhand, India
- Yesaya Paulus, Dipa Makassar University, Japan
- Vanita Pawar, DIAT, Pune, India
- Rajesh Pindoriya, Indian Institute of Technology Mandi, India
- Petra Poulouva, University of Hradec Kralove, Czech Republic
- Eko Prasetyo, PT. PLN (Persero), Indonesia
- Emil Pricop, Petroleum-Gas University of Ploiesti, Romania
- Salita Ulitia Prini, Indonesian Institute of Sciences, Indonesia
- Cong Pu, Marshall University, USA
- Sameerchand Pudaruth, University of Mauritius, Mauritius
- Pakawan Pugsee, Chulalongkorn University, Thailand
- Yogesh Pundlik, Kamala Institute of Technology and Science, Singapur-, India
- Asep Purnomo, Universitas Gadjah Mada, Indonesia
- Fitri Maya Puspita, University of Sriwijaya, Indonesia
- Fika Rachman, University of Trunojoyo Madura, Indonesia
- Ema Rachmawati, Telkom University, Indonesia
- Indra Raharjana, Universitas Airlangga, Indonesia
- Harikumar Rajaguru, Bannari Amman Institute of Technology, India
- Grienggrai Rajchakit, Maejo University, Thailand
- Ramadiani Ramadiani, Mulawarman University, Indonesia
- Shuvendu Rana, SRM University AP, United Kingdom (Great Britain)
- Priya Ranjan, SRM University, Amaravathi, India
- Nadana Ravishankar, VelTech High Tech Dr Rangarajan Dr Sakunthala Engineering College, India
- Windi Retnani, Universitas Jember, Indonesia
- Indra Riyanto, Universitas Indonesia, Indonesia
- Zairi Rizman, Universiti Teknologi MARA, Malaysia
- Nuno Rodrigues, Instituto Politécnico de Bragança, Portugal
- Vahideh Sadeghi, Isfahan University of Technology, Iran
- Ahmed Saeed, Future University in Egypt, Egypt
- Basil Saied, Formerly at University of Mosul, Iraq
- Arun Saini, The ICFAI University, Jaipur, India
- Sandeep Saini, The LNM Institute of Information Technology, Jaipur, India
- Wael Salah, Palestine Technical University - Kadoorie, Palestine
- Hussain Saleem, University of Karachi, Pakistan
- Azmi Saleh, Jember University, Indonesia
- Andrews Samraj, Mahendra Engineering College, India
- Tomonobu Sato, Hitachi ICT Business Services, Ltd., Japan
- Alfredo Satriya, University of Florida, USA
- Toufik Sebbagh, University of Skikda, Algeria
- Sandeep Sengar, Indian Institute of Technology (ISM) Dhanbad, India
- Tomonobu Senjyu, Faculty of Engineering, University of the Ryukyus, Japan
- Amel Serrat, USTO MB, Algeria

- Nadheer Shalash, Al-Mamon University College, Iraq
- Aditi Sharma, Quantum University, Roorkee, Uttarakhand, India
- Sachin Sharma, Technological University Dublin, Ireland
- Akbar Sheikh-Akbari, Leeds Beckett University, United Kingdom (Great Britain)
- Divya Rishi Shrivastava, Manipal University Jaipur, India
- Khairul Azami Sidek, International Islamic University Malaysia, Malaysia
- Joni Simatupang, President University, Indonesia
- Pramod Singh, ABV-IIITM Gwalior, India
- Ramesh Singh, DTU Delhi, India
- Simar Preet Singh, Bennett University, Greater Noida, India
- Vivek Singh, Shambhunath Institute of Engineering and Technology, Prayagraj, UP, INDIA, India
- Shefali Singhal, none, India
- Jee Siong, Multimedia University, Malaysia
- Rostyslav Sklyar, Independent Professional, Ukraine
- Slamun Slamun, University of Jember, Indonesia
- Nikolaos Sofianos, Democritus University of Thrace, Greece
- Viranjay M. Srivastava, University of KwaZulu-Natal, South Africa
- Sritrusta Sukaridhoto, Politeknik Elektronika Negeri Surabaya, Indonesia
- Heni Sulistiani, Universitas Teknokrat Indonesia, Indonesia
- Ahmed Sultan, Baghdad - Iraq, Iraq
- Ryan Suryono, Universitas Teknokrat Indonesia, Indonesia
- Sutrisno Sutrisno, Universitas Diponegoro, Indonesia
- Mujtaba Mahdi Mudassir Syed, Osmania University, India
- Pooya Taheri, SFU, Canada
- Thitinan Tantidham, Mahidol University, Thailand
- Pham Thanh Thuy, MICA Institute (HUST - CNRS/UMI 2954 - INP Grenoble), Vietnam
- Hua Nong Ting, Universiti Malaya, Malaysia
- Huong Yong Ting, University College of Technology Sarawak, Malaysia
- Rahmat Trialih, Brawijaya University, Indonesia
- Muharrem Tümcakır, Gebze Technical University, Turkey
- Mohd Umar Farooq, Muffakham Jah College of Engineering and Technology, India
- Madhur Upadhyay, Shiv Nadar University, India
- Panagiotis Varzakas, University of Thessaly, Greece
- Jami Venkata Suman, GMR Institute of Technology, India
- Chitra Venugopal, Oregon Institute of Technology, USA
- Rima Wahyuningrum, University of Trunojoyo Madura, Indonesia
- Carlos Becker Westphall, Federal University of Santa Catarina, Brazil
- Widjonarko Widjonarko, Universitas Jember, Indonesia
- Widodo Widodo, Universitas Negeri Jakarta, Indonesia
- Tianhua Xu, Tianjin University, China
- Abid Yahya, Botswana International University of Science and Technology (BIUST), Botswana
- Srihari Yamanoor, Self, USA
- Chong Yen Fook, Universiti Malaysia Perlis, Malaysia
- Thaweesak Yingthawornsuk, King Mongkut's University of Technology Thonburi, Thailand
- Sumendra Yogarayan, Multimedia University (MMU), Malaysia
- Pujianto Yugospito, Universitas Pelita Harapan, Indonesia
- Noor Zaman, Taylor's University, Malaysia
- Qi Zhao, University of California, Los Angeles, USA

Foreword from Conference Chair ICOMITEE 2021

In the name of Allah, the Most Beneficent and the Most Merciful.

On behalf of the organizing committees, I would like to welcome all of you to Banyuwangi, Indonesia for the 2021 International Conference on Computer Science, Information Technology and Electrical Engineering (ICOMITEE).

2021 has been a very challenging year due to the COVID-19 pandemic. With the safety and well-being of our participants as our top priority, ICOMITEE, originally planned to be hold in Banyuwangi, Indonesia, has been converted to a hybrid conference. Nevertheless, while we may all be physically distant, we hope we can still connect intellectually. I would like to express my hearty gratitude to all participants for sharing and presenting your experiences in this hybrid conference. Only high-quality selected papers are accepted to be presented in this event, so we are also thankful to all the international reviewers and steering committee for their valuable works. I would like to give a compliment to all partners in publications and sponsorships for their valuable supports.

ICOMITEE 2021 is the international conference hosted by University of Jember (UNEJ), co-hosted by Nahdlatul Ulama University of Surabaya (UNUSA), Teknokrat Indonesia University and Banyuwangi State Polytechnic. ICOMITEE 2021 is officially approved by IEEE Indonesia Section and IEEE Indonesia Computer Society Chapter for technical co-sponsored.

This event is intended to provide technical forum and research discussion related to advance engineering on electrical & electronics, computer science and informatics. The Conference is aimed to bring researchers, academicians, scientists, students, engineers and practitioners together to participate and present their latest research finding, developments and applications related to the various aspects of Information System Management, Data Analytics & Big Data, IT Infrastructure and Security, Electrical and Telecommunication

Allow me to express my deepest gratitude to those who have made this conference possible. My thanks go to the Rector of the University of Jember. I would also like to thank the invited speakers: Prof. Md Saidur Rahman from Bangladesh University of Engineering and Technologi, Prof. Anton Satria Probuwono from King Abdulaziz University and Assoc. Prof. Dr. Ford Lumban Gaol from IEEE Indonesia Computer Society Chapter for accepting our invitation in the conference.

At this conference, the committee received total 77 full manuscripts from various cities in Indonesia and abroad such as China, Malaysia, Ireland, Australia, Poland, Srilanka, Kazakhstan, and India. But, after the review process, 38 full manuscripts were accepted.

I also want to thank and appreciate to all committee members, all TPC Sponsors and Financial Sponsors, all TPC members, and 393 high reputable reviewers from various countries, for all your dedications to the ICOMITEE 2021.

I look forward to having a successful conference, and we hope that all the attendees enjoy and get benefits from this conference.

Prof. Saiful Bukhori ST., M.Kom.
Conference Chair of ICOMITEE 2021



Foreword from IEEE Indonesia Section

Dear distinguished guests, keynote speakers, colleagues, researchers, professionals, ladies and gentlemen, good morning, a prosperous, warm, and spirited greeting.

On behalf of IEEE Indonesia Section, we would like to extend our warmest welcome to all keynote speakers, presenters, and participants to the 2021 International Conference on Computer Science, Information Technology and Electrical Engineering (ICOMITEE). The conference aims to bring together researchers and experts in information systems to share their ideas, experiences and insights. The conference is organized by Universitas Jember (UNEJ) and technically co-sponsored by IEEE Indonesia Section.

IEEE Indonesia Section has conducted many activities over 33 years in Indonesia. IEEE Indonesia has more than 2,600 members and more than 50 senior members from industry professionals, academia and government. In terms of collaboration, IEEE Indonesia section has a good and mutual relationship with ICT organizations, Industries, Government, Universities as well as the Community in Indonesia. IEEE Indonesia also sponsors more than 50 high quality international conferences indexed by Scopus every year held by various universities in Indonesia. Since its formation in 1988, IEEE Indonesia has sponsored the publication of more than 20,000 publications of IEEE international conferences and more than 260 publications of IEEE international journals by Indonesian authors.

The ICOMITEE shows its sustainability due to the hard work of the conference organizers, well organized conference and high quality papers. We do hope in the near future some high quality conferences will be continued and strengthened, so the result will give more benefit and positive impact to the human being, especially to Indonesian people.

In this occasion, I would also like to say welcome to Banyuwangi, which serves beautiful heritages, culture, with warm, polite and friendly people, a vibrant culture and lifestyle.

Finally, we do hope all of you will have enjoyable and valuable experience during this event. You may share your best knowledge in your area of research and professional activities.

Thank you.

Dr. Ing. Wahyudi Hasbi
Chairman, IEEE Indonesia Section



Foreword from the IEEE Computer Society Chapter

Greetings!

It is our great pleasure and honor to welcome you to The 2021 International Conference on Computer Science, Information Technology, and Electrical Engineering (ICOMITEE) that will be held in El Royal Hotel Banyuwangi, 27-28 Oktober 2021.

In this event we will have the opportunities to exchange knowledge and information on latest researches and strengthening relationships amongs us, while enjoying the relaxing yet entertaining environment of Banyuwangi.

ICOMITEE is the international conference that will be held on the Faculty of Computer Science, University of Jember that collaborate with IEEE (Institute of Electrical and Electronics Engineers) Indonesia Section & IEEE Computer Society Indonesia Chapter.

The accepted papers will be published and presented Paper on the IEEE Xplore that will be indexed in SCOPUS.

Previously, ICOMITEE already held on October 2019 with the number of articles with 84 papers from 4 countries, that already held with Blind-Review by more than 300 reviewers

Yours sincerely,

Dr Ford Lumban Gaol
IEEE Computer Society Chapter - Chair
Bina Nusantara University, Indonesia



Foreword from Rector of University of Jember

In the name of Allah, the Most Gracious and the Most Merciful.

First of all, I would like to welcome you all to the University of Jember, Indonesia. I am delighted to have you here to participate and attend the 2021 International Conference on Computer Science, Information Technology, and Electrical Engineering (ICOMITEE 2021). Thank you for joining and participating in the present conference that held in Banyuwangi during 27-28 October 2021

As almost occurring in every country, the COVID-19 outbreak resulted in a hard impact on some human development aspects, including human health, education, research, and social-economic. This situation has forced us to find an innovative and creative way in adapting the running situation, including how we carry out the international conference without interfering the participants health and safety. Therefore, this conference has been changed into hybrid method in order to harmonize between the continuation of conference agenda and the currently COVID-19 pandemic situation worldwide.

The conference is aimed to provide a forum for presentation and discussion among academics, researchers, and policymakers in this region relating to the current progresses in some topics like telecommunication, electrical, data analytics & big data, IT infrastructure & security, also management information system. I expect that all scientific papers resulted in and shared during this conference will inspire us to be more productive in this field and also enable further improvement of our work.

The hard work and valuable contributions of both the organizing and scientific conference committee members have made this conference organization possible. I thank everybody who in one way or other has contributed to make this international conference a success. Additional thanks is also delivered to our sponsors (IEEE Indonesian Section and IEEE Computer Society Indonesian Chapter) for providing support and assist us for this conference

Dr. Ir. Iwan Taruna, M.Eng, IPM.
Rector of University of Jember, Indonesia



Papers by title

A B C D E H I L M O P R S T W

A

A B C D E H I L M O P R S T W

A Study of Conveyor System with UV Light for Vegetable and Fruit Sterilization for Farmer

Academic Dishonesty (Cheating) In Online Examination: A Literature Review

Analysis of Frequency Stability with SCES's type of Virtual Inertia Control for The IEEE 9 Bus System

Analysis of The Effect of Promotion an Technology Acceptance Model on Purchase Interest in Tokopedia

Application Of Unmanned Aircraft Pid Control System For Roll, Pitch And Yaw Stability On Fixed Wings

Application The Method Direct Effect Piezoelectric (DEP) Using Vibrator Engine Diesel

B

A B C D E H I L M O P R S T W

BER Performance Comparison on Single versus Dual LED for Visible Light Communication

Blind Decryption for Preserving Privacy in the DRM System

C

A B C D E H I L M O P R S T W

Color Feature Extraction of Fingernail Image based on HSV Color Space as Early Detection Risk of Diabetes Mellitus

Combination of Modified LSB Steganography and Huffman Compression for Data Security

Comparison of Market Basket Analysis to Determine Consumer Purchasing Patterns Using Fp-Growth and Apriori Algorithm

Computer-aided Translation Based on Lampung Language as Low Resource Language

D

A B C D E H I L M O P R S T W

Decision Support System for Temporary Shelter Selection Using Hybrid AHP and TOPSIS

Decision-making Support via Fuzzy Programming for Order Allocation and Production Planning: Static Case

Designing An Attendance System Model for Work From Home (WFH) Employees Based on User-Centered

Detection Hand Tremor Through Each Finger Movement Based On Arduino For Parkinson's Patient

Digital Literacy vs Nomophobia: Which One is More Dominant in Online Learning?

E **A B C D E H I L M O P R S T W**

E-Government Maturity Assessment Using COBIT5 Framework in APO Domain

E-Government Roadmap for Smart Governance: A Study from Banyuwangi Smart Village

EndorseGram: Interactive Visualization of Influencer Endorsement Marketplace

Evaluation of IBSI Education System Use ISOIEC 9126 Quality Model: How is the Quality?

Exploring Usability Dimension of Smart Regency Service with Indonesian Adaptation of The System Usability Scale (SUS) and User Experience Questionnaire (UEQ)

H **A B C D E H I L M O P R S T W**

How Affect Autonomous and Controlled Motivation using Massive Open Online Course?

I **A B C D E H I L M O P R S T W**

Implementation of Certainty Factor Method to Diagnose Diseases in Pineapple Plants

Implementation of Fuzzy Logic in PLC for Three-Story Elevator Control System

Implementation of PCA and KNN Algorithms in the Classification of Indonesian Medicinal Plants

Internal Social Media Acceptance in Government Organizations

L **A B C D E H I L M O P R S T W**

LINE-based Virtual Friend Development for Borderline Personality Disorder

Lung Cancer Classification in X-Ray Images Using Probabilistic Neural Network

M **A B C D E H I L M O P R S T W**

Mechanical Ventilator Control System Using Low-cost Pressure Sensors

MultiPhiLDA for Detection Irrelevant Software Requirement Specification

O **A B C D E H I L M O P R S T W**

Optimal Control Model of Two Dimensional Missile Using Forward Backward Sweep Method (FBSM)

P **A B C D E H I L M O P R S T W**

Prediction of Yuan to IDR Exchange Rate using General Regression Neural Network

R **A B C D E H I L M O P R S T W**

Redesigning User Interface on Halal Tourism Application with User-Centered Design Approach

S **A B C D E H I L M O P R S T W**

Sentiment Analysis Of Online Lecture Opinions On Twitter Social Media Using Naive Bayes Classifier

T **A B C D E H I L M O P R S T W**

Text Mining in Chat Room of Online Learning for Detection Emotion using Artificial Intelligence

The clever ant: Using Video-based learning media to explain diagonal cuboid

W **A B C D E H I L M O P R S T W**

Why do People Continue using the Webinar Application? Insight in the New Normal Period

List of Papers

A

A Study of Conveyor System with UV Light for Vegetable and Fruit Sterilization for Farmer
Academic Dishonesty (Cheating) In Online Examination: A Literature Review
Analysis of Frequency Stability with SCES's type of Virtual Inertia Control for The IEEE 9 Bus System
Analysis of The Effect of Promotion an Technology Acceptance Model on Purchase Interest in Tokopedia
Application Of Unmanned Aircraft Pid Control System For Roll, Pitch And Yaw Stability On Fixed Wings
Application The Method Direct Effect Piezoelectric (DEP) Using Vibrator Engine Diesel

B

BER Performance Comparison on Single versus Dual LED for Visible Light Communication
Blind Decryption for Preserving Privacy in the DRM System

C

Color Feature Extraction of Fingernail Image based on HSV Color Space as Early Detection Risk of Diabetes Mellitus
Combination of Modified LSB Steganography and Huffman Compression for Data Security
Comparison of Market Basket Analysis to Determine Consumer Purchasing Patterns Using Fp-Growth and Apriori Algo
Computer-aided Translation Based on Lampung Language as Low Resource Language

D

Decision Support System for Temporary Shelter Selection Using Hybrid AHP and TOPSIS
Decision-making Support via Fuzzy Programming for Order Allocation and Production Planning: Static Case
Designing An Attendance System Model for Work From Home (WFH) Employees Based on User-Centered
Detection Hand Tremor Through Each Finger Movement Based On Arduino For Parkinson's Patient
Digital Literacy vs Nomophobia: Which One is More Dominant in Online Learning?

E

E-Government Maturity Assessment Using COBIT5 Framework in APO Domain
E-Government Roadmap for Smart Governance: A Study from Banyuwangi Smart Village
EndorseGram: Interactive Visualization of Influencer Endorsement Marketplace
Evaluation of IBSI Education System Use ISOIEC 9126 Quality Model: How is the Quality?
Exploring Usability Dimension of Smart Regency Service with Indonesian Adaptation of The System Usability Scale (SU: Questionnaire (UEQ)

H

How Affect Autonomous and Controlled Motivation using Massive Open Online Course?

I

Implementation of Certainty Factor Method to Diagnose Diseases in Pineapple Plants
Implementation of Fuzzy Logic in PLC for Three-Story Elevator Control System
Implementation of PCA and KNN Algorithms in the Classification of Indonesian Medicinal Plants
Internal Social Media Acceptance in Government Organizations

L

LINE-based Virtual Friend Development for Borderline Personality Disorder
Lung Cancer Classification in X-Ray Images Using Probabilistic Neural Network

M

Mechanical Ventilator Control System Using Low-cost Pressure Sensors
MultiPhiLDA for Detection Irrelevant Software Requirement Specification

O

Optimal Control Model of Two Dimensional Missile Using Forward Backward Sweep Method (FBSM)

P

Prediction of Yuan to IDR Exchange Rate using General Regression Neural Network

R

Redesigning User Interface on Halal Tourism Application with User-Centered Design Approach

S

Sentiment Analysis Of Online Lecture Opinions On Twitter Social Media Using Naive Bayes Classifier

T

Text Mining in Chat Room of Online Learning for Detection Emotion using Artificial Intelligence
The clever ant: Using Video-based learning media to explain diagonal cuboid

W

Why do People Continue using the Webinar Application? Insight in the New Normal Period

LINE-based Virtual Friend Development for Borderline Personality Disorder

Oey, Lysbeth Venella
Information Systems Department
Soegijapranata Catholic University
Semarang, Indonesia
18n10008@student.unika.ac.id

Ridwan Sanjaya
Information Systems Department
Soegijapranata Catholic University
Semarang, Indonesia
ridwan@unika.ac.id

Christin Wibhowo
Psychology Department
Soegijapranata Catholic University
Semarang, Indonesia
christine@unika.ac.id

Abstract—During the COVID-19 pandemic situation, the Indonesian government has declared various restrictions on human daily activities to minimize physical contact between people and reduce the transmission of COVID-19. After a very long time, these restrictions may be felt like “eating a simalakama fruit” as not only does it cause a positive result by breaking the chain of virus transmission between humans, but the restriction may also decrease the financial stability and increase people’s level of stress. Meanwhile, it is known that Borderline Personality Disorder (BPD) as well as other mental health disorders, may happen to people with high fragility to stress. The original purpose of the development of LINE chatbot discussed in this paper, named “Sovi Lau” which is an acronym that stands for “Sobat Virtual Anti Galau” or “Anti-Stress Virtual Friend” is mainly to make a chatbot that can act as a friend who is always able to talk with and to discuss with. People suffering from BPD can also use it whenever they need. The use of LINE Messenger and Program-O is found to be the simplest way to develop a chatbot that can be used by psychologists to provide a good communication for people suffering from BPD.

Keywords— *anti-stress, borderline personality disorder, chatbot, virtual friend*

I. INTRODUCTION

The prolonged COVID-19 pandemic that comes along with various restrictions on human activities and public anxiety about the pandemic situation ultimately resulted in various negative impacts in the health, economic, tourism, socio-cultural, and other sectors. Especially for mentally fragile people, the ongoing COVID-19 pandemic situation may cause stress that ultimately leads to physical health problems as well as mental health issues [1]. This fragile group includes those people with borderline personality disorder whose fragility is caused by an act of overreaction to stress compared to normal people [2]. It is necessary to fully understand that borderline personality disorder as well as any other types of mental disorder can happen to anyone, even to some people who may think they have a tough personality or considered to have always been mentally strong.

Borderline personality disorder (BPD) is a mental disorder characterized by extreme mood swings and followed by impulsive behavior. According to the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV), BPD is commonly found in late adolescence and early adulthood. The main factor in BPD is childhood trauma and inappropriate parenting patterns, while the rest is heredity and other factors in adulthood. People with BPD also commonly shows unhappy childhood and difficulties to develop an interpersonal relationship with other people. However, as the number of people with BPD keeps increasing, the lack of research regarding borderline personality disorder in Indonesia sadly makes the number of people with BPD

unclearly known [3].

Nevertheless, although the actual number of people with BPD in Indonesia is not yet being known, according to the Rencana Aksi Kegiatan 2020-2024 of Directorate General of P2P and Ministry of Health, the number of people with mental disorders in Indonesia has reached 236 million people and only fewer than 15% of people with mental disorders get mental health services they need because of not only the income problems but also the wrong stigma to mental illness. There is also lack of awareness and public knowledge on the symptoms of mental disorders that causes people with mental disorders to become unaware of their actual mental health situation, so that they are treated late by psychiatrists.

Unfortunately, delay in BPD treatments can be dangerous for the sufferer. The existence of impulses for impulsive and self-destructive behavior in people with BPD may cause them to tend to doing reckless things, such as promiscuity and substance abuse. As many as 50% of people with BPD in the United States are known to consume alcohol and illicit substances. Even worse, about 60-78% people in United States who suffer from BPD also showed suicidal tendencies, while 90% of them showed self-harm behavior [4]. The suicidal tendencies will continue increasing until they reach their highest percentage in the 20s. Meanwhile, the mortality rate of BPD patients reaches its highest percentage in the 30s. These problems certainly require special attention, considering the ages that are most vulnerable in people with BPD are at the age of 20 to 30 years old who are actually still at the age of the productive workforce and are naturally expected to have a good mental health condition to be able to live well.

In general, most people with BPD in Indonesia are known to avoid treatment due to various factors, such as the expensive cost of mental health treatments as well as the public perception that people who suffer any kind of mental disorders bring disgrace and embarrassment on their family [5]. People found to have mental disorders are often being underestimated, considered strange, and deserve to be ostracized from the society, so that people who experience symptoms of mental disorders tend to ignore their condition and choose not to seek any mental health experts or psychologists just so their conditions not being realized by their communities.

Meanwhile, the rapid development of technology and the massive use of gadgets in Indonesia can certainly be used to develop a chatbot that is easily accessible to the public in a broad range to identify symptoms of mental disorders and get the necessary recommendations from the psychiatric experts that can be used by people as an initial treatment for their

psychological condition. The chatbot referred in this paper is a LINE chatbot named “Sovi Lau” which is an acronym that stands for “Sobat Virtual Anti Galau” or “Anti-Stress Virtual Friend”.

According to Lexico Dictionaries, a chatbot is a computer program designed to have conversations with humans, especially over the internet. Chatbots allow humans to interact with technology using various kinds of voice, text, and touch input, and can be activated 24/7 [6]. Chatbots work by analyzing the user input, considering the appropriate response, and sending it to the user by using various outputs in the form of voice, text, or by completing a task ordered by the user. While from the user’s perspective, users generally use the chatbots to increase productivity and other factors, such as entertainment factors, social factors, or just to try new things. Chatbots are also often being used to replace the role of personal assistants by adopting the characteristics of human behavior.

Sovi Lau is a LINE chatbot developed using the LINE Messaging API and can be accessed easily via LINE Messenger application. LINE Messaging API is an application programming interface (API) feature on LINE Messenger that allows two-way communication between the bot server service and LINE Messenger application. It is known to be reliable, easy to use and modify, and has various features that can make chats feel more realistic. LINE Messenger is chosen to run the chatbot because of its flexibility to be used freely on various platforms, such as smartphones and PCs with no additional charges. Besides, LINE Messenger is currently one of the most popular cross-platform social media with 167 million active users worldwide every month [7].

Considering the fact that there is slightly more than one-half of BPD patients that can be fully recovered by having at least one stable and supportive relationship with a friend or partner [8], Sovi Lau’s purpose is to be such a friend to the people with BPD so they have someone to talk with and they do not feel being alone. Sovi Lau is being equipped with the knowledge about BPD symptoms and treatments from a psychologist. Hopefully, the user can talk to Sovi Lau like talking to a friend as well as consulting with psychologist. This way, people suffering from BPD—who are commonly known to face struggle while establishing an interpersonal relationship with another—can have a virtual friend without having to directly being in touch with anyone if they do not want to while also getting the proper initial psychotherapy to their BPD symptoms from the psychologist.

II. CONCEPT OVERVIEW

Nowadays, we live in a digitalization era where so many kind of human daily activities can easily be done online. Our works these days are now hard to being separated to the use of an intelligent machine that make our life to be easier, even including our private lives. This digitalization trends can also affect the development of clinical psychology and psychotherapy, for example, chatbots can be used increasingly as the next generation of psychological interventions [9]. Using the same context, chatbots are computer programs that can have conversations with users, which technically based on dialog scripts that should be created by psychologists [10].

In Indonesia, patients with severe mental disorders have reached the number of 0.46% or about 1 million people. Of the total risk population of 1,093,150 people, only about 3.5% or 38,260 served in mental hospitals, general hospitals, or

health center communities with sufficient mental health facilities [5]. These numbers are still to small and undeniably shows that many Indonesian people suffering from mental disorders not getting the necessary treatments for their condition. Lately be known, the main reason for this phenomenon is that people with mental disorders in Indonesia are oftenly being negatively stigmatized by their society, even by their families and closest relatives. Not only that their families labelled them as “strange” and “disgraced”, but the families of people with mental disorders also face complex financial problems to pay for expensive costs of mental health treatments or hospitals. The minimum knowledge about mental health problems also cause them to be close-minded enough to assume that people with mental disorders can not be cured and deserve to be excluded froma society.

Meanwhile, psychological internet interventions have been evaluated and viewed as an independent medium that does not depend on time and has no place limitations [11]. These can bridge to help to reduce treatment barriers and expand the availability of mental health care [12]. There should be no doubts on using an AI to take care of any mental health disorders, including the BPD, since numerous studies have also shown that this kind of interventions using cognitive-behavior AI have the same effectiveness as traditional face-to-face psychotherapy [13]. By the use of Sovi Lau chatbot, people with BPD are being able to have independent psychotherapy whenever necessary without having to worry about treatment costs, places, time, society stigmas, or any other matters simply just by accessing Sovi Lau through LINE Messenger application.

Sovi Lau is being built by combining the use of LINE Messaging API and Program-O AIML (Artificial Intelligence Markup Language) Interpreter. According to Github, Program-O was initially developed by Elizabeth Perreau and Dave Morton in 2014 using PHP and MySQL to store chatbot informations and AIML files. AIML itself is being defined as a scripting interpreter language that is one of the derivatives of XML (Extensible Markup Language) with more specific functions, one of which is to create a knowledge-based stimulus-response system [14]. While LINE Messaging API works by granting user requests from LINE Messenger and sending those requests in a form of Javascript Object Notation (JSON) to our bot server [15], Program-O that has been installed to the bot server helps to manage, store, add, delete, and edit Sovi Lau’s knowledge from the external AIML files using MySQL as the database [16]. These activities are made possible since the Program-O itself has a control panel for the *botmaster* to do such things easily and overtime it can help to develop Sovi Lau to be a more intelligent and interactive chatbot with minimum time and risks.

Chatbots made on LINE, Telegram, and Facebook Messenger chat applications are not really different from the genuine applications in presenting questions and answers interactively in the form of text [17]. Below are some basic steps in the development of Sovi Lau chatbot using LINE Messenger :

A. Setting Up the Program-O

Program-O works as an AIML interpreter whose job is to run bots and provide bot responses for user input. The latest version of Program-O can be downloaded through <https://github.com/Program-O/Program-O>. After being downloaded, Program-O has to be installed on the webserver

that supports PHP and MySQL, then the botmaster has to finish all the configuration.

B. Writing AIML

The AIML program contains a series of categories, patterns, and templates that determine the response of Sovi Lau to user chat input. The AIML files must be uploaded to the Program-O to run and are used as a reference for Sovi Lau's response to requests sent by users through LINE Messaging API.

C. Creating LINE Official Account

In the making process of LINE chatbots, a registered LINE OA is required to log into <https://developers.line.biz/>. To do so, researchers have to visit <https://account.line.biz/login> to login with their pre-owned OA or visit <https://account.line.biz/signup> to create a new LINE OA.

D. Creating a New Channel for LINE Chatbot

Next step, researchers have to go to <https://developers.line.biz/en/> and click the "Console" button. Researchers will have to log into their registered LINE OA in the previous step and then click the "Create" button to create a new LINE chatbot channel provider and enter the desired provider name. Right after that, simply researchers have to click "Create a Messaging API Channel" button to create a new LINE chatbot channel for Sovi Lau.

E. Setting Up the LINE Messaging API

One of the most crucial steps of the making of LINE chatbots is entering the webhook URL of researchers' original bot server. This webhook URL serves as the location where requests from LINE Messaging API are sent to chatbots. Basically, through a webhook URL, LINE Messenger intends to connect researchers' bot server to their LINE OA. Technically, after entering the webhook URL, researchers' have to click the "Verify" button and check the "Use Webhook" button after making sure the webhook URL is correct.

F. Writing PHP Program

Researchers can use PHP, Python, Java, or any other programming languages. The researchers must follow the Application Programming Interface (API) of LINE Messenger at <https://developers.line.biz/en/docs/messaging-api> [18].

III. STRATEGIES

This section will mainly discuss the knowledge base of Sovi Lau chatbot that is written in Artificial Intelligence Markup Language (AIML). The main function of AIML is to make a stimulus-response system based on knowledge [14]. Theoretically, AIML files commonly consist of some important elements, such as:

A. Category

A category usually consists of other AIML elements, such as patterns and templates. Basically, when a category is loaded in AIML memory, the chatbot will respond to a question written in the pattern tag with the answer written in the template tag. Below is an example of simple AIML category.

```
<category>
<pattern>SAMPAI JUMPA</pattern>
<template>makasih obrolannya teman! Sampai jumpa lagi :)</template>
</category>
```

Fig. 1. Example of AIML Category

When the user sends a message "Sampai jumpa" (transl. "See you soon"), the chatbot will immediately reply with "makasih obrolannya teman! Sampai jumpa lagi ☺" (transl. "thankyou for the chats buddy! See you again ☺").

B. Pattern

Pattern contains a series of letters that are expected to match user input. Wildcards (*) can also be applied to the patterns to extend the compatibility of a pattern to the user input. Below is an example of simple AIML pattern.

```
<category>
<pattern>* NAMAMU</pattern>
<template>Nama saya Lysbeth</template>
</category>
```

Fig. 2. Example of AIML Pattern

When the user sends a message such as "Siapa namamu" (transl. "Who is your name?"), "Boleh tanya namamu" (transl. "May I know your name?"), or any other phrases or sentences with similar meanings, the chatbot will immediately reply with "nama saya Lysbeth" (transl. "My name is Lysbeth").

C. Template

A template determines the response of the corresponding pattern. Templates may contain pure texts, variables, or passing a pattern to another using the AIML elements called <srail>. If a pattern is equipped with a <srail> element, user questions contained in the same <srail> element will be considered to have the same meaning so that they will get the same response too. The use of a <srail> element can also be supplemented with a <random> element, so that the chatbot can answer questions in the same category with a variety of different answers so as not to be monotonous. Below is an example of simple AIML template.

```
123 <category>
124 <pattern>* HELLO *</pattern>
125 <template>*srail>HALO/<srail></template>
126 </category>
127 <category>
128 <pattern>HALO</pattern><!-- patokan untuk template SRAI-nya disini -->
129 <template>
130 <random>
131 <li>Halo, nama saya Vanika, Virtual Assistant Unika! Ada yang bisa saya bantu?</li>
132 <li>Hai, nama saya Vanika, Virtual Assistant Unika! Apa yang ingin kamu tanyakan?</li>
133 </random>
134 </template>
135 </category>
136 #-----#
```

Fig. 3. Example of AIML Template

When the user sends a message that contains words like "Hey" or "Hello", the chatbot will assume that the two combinations of words are the same, and then the chatbot will immediately answer both of them with two choices of answers provided, such as "Halo, nama saya Vanika, Virtual Assistant Unika! Ada yang bisa saya bantu?" (transl. "Hello, my name is Vanika, Virtual Assistant Unika! Is there anything I can help?") or "Hai, nama saya Vanika, Virtual Assistant Unika! Apa yang ingin kamu tanyakan?" (transl. "Hi, my name is Vanika, Virtual Assistant Unika! What would you like to ask?").

D. That

A <that> element in AIML refers to the previous response of the chatbot. By using a <that> element inside a category, the chatbot will respond to the user input with an answer that is still correlated to the previous response of the chatbot. This element is one of the most crucial component of the development of Sovi Lau discussed in this paper because researchers need to educate Sovi Lau users to be clearer with a kind of probably long statements in some categories, but

researchers definitely do not want the users to find these long statements boring or hard to understand.

In the AIML file of Sovi Lau, the <that> element is being used to shorten Sovi Lau's response to user input by dividing these long statements to two parts; the "brief answer" part and the "explanation part", and letting the users to decide if they want a further explanation from Sovi Lau simply by typing one to two provided keywords.

Below is the sample of a category that combines pattern, templates, and <that> element in the AIML file of Sovi Lau.

```
<category>
  <pattern>* SEPI *</pattern>
  <template>
    <srai>TAKUT</srai>
  </template>
</category>
<category>
  <pattern>TAKUT</pattern>
  <template>Wah, Sovi paham banget karena pernah
    merasakan hal ini. Mau tahu yang Sovi lakukan kalau
    merasa begitu? (Boleh/Ga)</template>
</category>
<category>
  <pattern>BOLEH</pattern>
  <that>Wah, Sovi paham banget karena pernah merasakan
    hal ini. Mau tahu yang Sovi lakukan kalau merasa
    begitu? (Boleh/Ga)</that>
  <template>Beberapa hal yang Sovi lakukan yaitu melihat
    dan menikmati awan, daun, sungai. Mendengarkan
    gemerisik daun, burung berkicau, penjual roti, suara
    kendaraan. Merasakan hangat matahari, daun basah
    dan merasakan langkahmu saat berjalan. Jangan
    lupa untuk mencium bau bunga, masakan tetangga
    atau makananmu. Kamu pernah melakukan itu?
    (Pernah/Belum)</template>
</category>
<category>
  <pattern>PERNAH</pattern>
  <template>Dengan melakukan seperti yang Sovi ceritakan
    tadi, kamu makin sadar bahwa ada banyak hal di
    sekeliling kita yang sering kita abaikan. Padahal
    semua itu ada untuk kita. Demikian pula saat ini.
    Kamu tidak sendirian walau mungkin orang yang
    kamu harapkan tidak bersamamu. Rasakan
    kehadiran teman-teman lain yang menunggu kamu
    kunjungi atau kamu sapa. Contohnya seperti apa?
    Coba ketik "sapa"...</template>
</category>
```

The above AIML program mainly show that when users type a message that contains word "Sepi" (transl. "Lonely"), such as "Aku sedang kesepian saat ini" (transl. "I'm currently feeling lonely"), "Aku merasa sepi" (transl. "I feel lonely"), "Aku takut kesepian" (transl. "I'm afraid to feel lonely") or any other similar messages, Sovi Lau will assume

those user inputs as template "Takut" (transl. "Afraid") and then it will be responded by saying, "Wah, Sovi paham banget karena pernah merasakan hal ini. Mau tahu yang Sovi lakukan kalau merasa begitu? (Boleh/Ga)" (transl. "Wow, Sovi really understands what you feel because Sovi has ever experienced those feelings too before. Wanna know what Sovi does whenever Sovi feels that way? (Okay/No)").

After that, if the user replies by "Boleh" (transl. "Okay"), Sovi will continue sending her tips to the user by saying, "Beberapa hal yang Sovi lakukan yaitu melihat dan menikmati awan, daun, sungai. Mendengarkan gemerisik daun, burung berkicau, penjual roti, suara kendaraan. Merasakan hangat matahari, daun basah dan merasakan langkahmu saat berjalan. Jangan lupa untuk mencium bau bunga, masakan tetangga atau makananmu. Kamu pernah melakukan itu? (Pernah/Belum)" (transl. "Some of the things that Sovi does are viewing and enjoying the view of clouds, leaves, rivers. Listening to the rustling of the leaves, bird chirping, bakers, the sound of vehicles. Feeling the warm sun, wet leaves, and feeling my steps as Sovi walks. Don't forget to smell the flowers, your neighbors' cooking or your meals. Have you ever done them? (Never/Ever)").

Next, if the user replies by "Pernah" (transl. "Ever"), Sovi will answer by "Dengan melakukan seperti yang Sovi ceritakan tadi, kamu makin sadar bahwa ada banyak hal di sekeliling kita yang sering kita abaikan. Padahal semua itu ada untuk kita. Demikian pula saat ini. Kamu tidak sendirian walau mungkin orang yang kamu harapkan tidak bersamamu. Rasakan kehadiran teman-teman lain yang menunggu kamu kunjungi atau kamu sapa. Contohnya seperti apa? Coba ketik "sapa"..." (transl. "By doing what Sovi has explained before, you will realize that there are so many things around us that we have ignored although they exist for us. The same thing goes right now. You are not alone eventhough some people that you are expecting to be around are not currently being there with you. Feel the existences of your other buddies that may have waited for you to visit or to greet. What can be the example? Try to send me "greeting"..."). And so on.

The same logic goes to if a user rejects Sovi Lau's offers by saying "No" in the provided answer choices at the end of Sovi Lau's message, Sovi Lau will not force to send further explanations to the corresponding user. Not only are these kinds of strategies practically simple, but they are also the easiest and understandable ways to communicate with people, especially to people with BPD simply through text messages.

IV. IMPLEMENTATION

Building a chatbot using Program-O is considered easy since it does not require any advanced programming skill and a programmer does not need to be an expert in Artificial Intelligence to work well with Program-O [18]. Using Program-O, anyone including the psychologists themselves with basic computer literacy can even easily build a chatbot without a programmer.

The main component of building a chatbot using Program-O is the AIML file. To make an interactive chatbot, a botmaster just has to write a communicative compilation of question and answer keywords using the syntax written in section III. As long as the program can direct user's questions to Program-O and the Program-O can direct responses to the

user, the work is done [18]. Below is the text flow that occurs between LINE Messenger and Program-O.

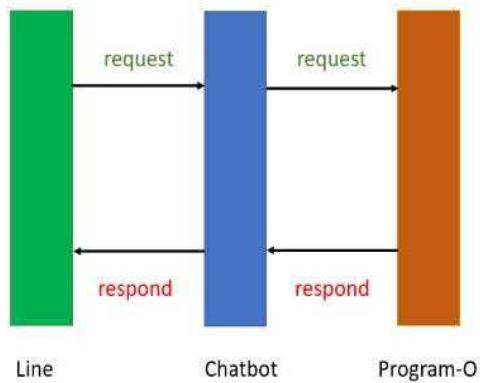


Fig. 4. Text Flow between LINE Messenger and Program-O

Fig. 4 depicts how a request sent by user from LINE Messenger application is being directed to the chatbot that will forward the request to Program-O. Furthermore, Program-O sends a respond to the chatbot that will direct it to LINE Messenger user.

Finally, using the flow displayed in Fig. 4, the Sovi Lau chatbot in screenshots below has been done.

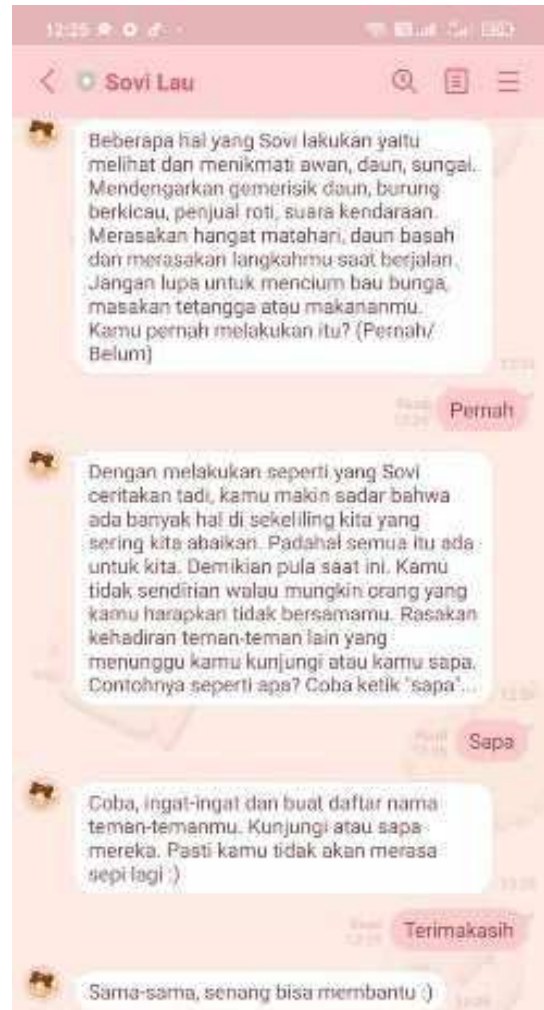
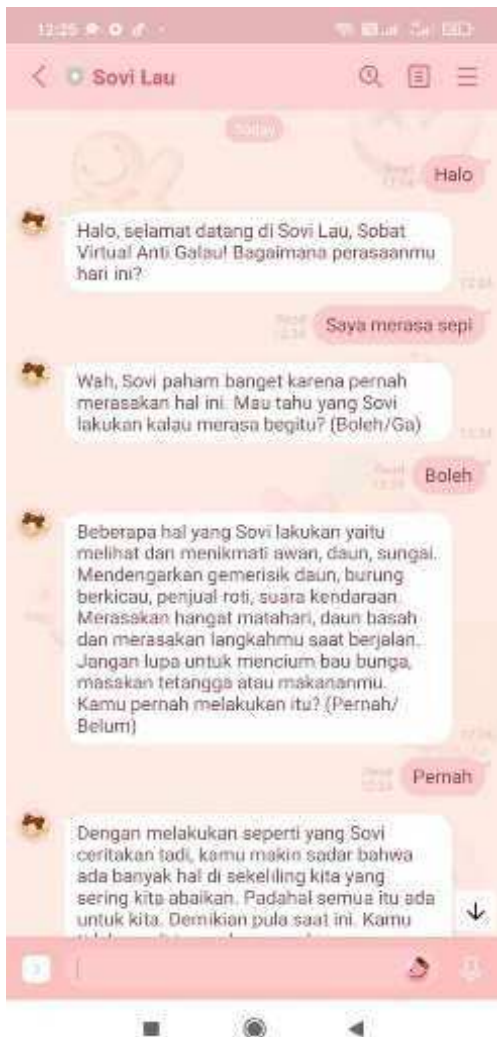


Fig. 5. Conversations with Sovi Lau

All questions and answers provided in the AIML file of Sovi Lau are all being extracted originally from the psychologist. Sovi Lau chatbot is also under the supervision and approval of the psychologist. Therefore, every response sent by Sovi Lau to the user is considered valid, credible, and reliable. All conversations are saved on the database for further research. It is privately secured, and can only be viewed by three responsible parties such as the users, psychologist, and researcher/programmer as the botmaster.

V. CONCLUSION

The purpose of functional development of a LINE chatbot named "Sovi Lau" is to provide a virtual friend for people, especially people with borderline personality disorder who commonly indicate risky symptoms such as feeling lonely, easily overwhelmed, fear of abandonment, unstable relationship, and difficulties to involve in interpersonal relationship, explosive anger, impulsive behaviors, and self-harm. Sovi Lau chatbot is equipped with the knowledge of a psychologist as the BPD expert to make sure that all the conversations between users and Sovi Lau is being handled and supervised by a credible party.

Meanwhile, the use of LINE Messenger and Program-O is considered to be the easiest and simplest way to develop a chatbot that can be used by psychologists to communicate with people suffering from BPD. The psychologists only need to prepare the possible conversations with the users and

provide the necessary responses for the users, especially the people suffering from BPD, stated with friendly statements like a real friend. These keywords will be extracted into AIML to send the response to the user anytime needed.

ACKNOWLEDGMENT

This research was funded by the Indonesian Ministry of Research and Higher Education under the scheme of Higher Education Fundamental Research Excellence Grant on 2021 which is titled as Borderline Personality Disorder Assistance Model using Virtual Assistant Technology.

REFERENCES

- [1] D. Banerjee *et al.*, "Impact of the COVID-19 pandemic on psychosocial health and well-being in South-Asian (World Psychiatric Association zone 16) countries: A systematic and advocacy review from the Indian Psychiatric Society," *Indian J. Psychiatry*, vol. 62, no. Suppl 3, pp. S343-S353, September 2020.
- [2] K. Wingenfeld, C. Spitzer, N. Rullkötter, and B. Löwe, "Borderline personality disorder: Hypothalamus pituitary adrenal axis and findings from neuroimaging studies," *Psychoneuroendocrinology*, vol. 35, no. 1. Pergamon, pp. 154–170, January 2010.
- [3] C. Wibhowo, "Faktor penyebab kepribadian ambang," *PSIKODIMENSLA*, vol. 15, no. 1, pp. 107–122, 2016.
- [4] R. S. Biskin, J. Paris, "Diagnosing borderline personality disorder," *CMAJ*, vol. 184, no. 16, pp. 1789-1794, 2012.
- [5] N. Lubis, H. Krisnani, M. Fedryansyah, "Pemahaman masyarakat mengenai gangguan jiwa dan keterbelakangan mental" *SHARE Social Work Journal*, vol. 4, no. 2, pp. 137-144, 2014.
- [6] E. Tate, "Chatbots: the definitive guide" *Artificial Solutions*, 2020. [Online]. Available: <https://www.readkong.com/page/chatbots-the-definitive-guide-2020-4048256>. [Accessed: 08-May-2021].
- [7] Statista Research Department, "LINE – statistics & facts," *Statista*, 2021. [Online]. Available: <https://www.statista.com/topics/1999/line/>. [Accessed: 11-May-2021].
- [8] R. S. Biskin, "The lifetime course of borderline personality disorder," *CanJPsychiatry*, vol. 60, no. 7, pp. 303-308, 2015.
- [9] E. Beindeeg, B. Erb, L. Schulze-Thuesing, H. Baumeister, "The next generation: chatbots in clinical psychology and psychotherapy to Foster Mental Health – a scoping review," *Karger Transl. German*, 2019. doi:10.1159/000501812. [*Verhaltenstherapie*, vol. 29, no. 4, pp. 266-280, December 2019].
- [10] M. Dowling, D. Rickwood, "Online counseling and therapy for mental health problems: a systematic review of individual synchronous interventions using chat," *J Technol Hum Serv.*, vol. 31, no. 1, pp. 1-21, 2013.
- [11] P. Carlbring, G. Andersson, P. Cuijpers, H. Riper, E. Hedman-Lagerlöf, "Internet-based vs. Face-to-face cognitive behavior therapy for psychiatric and somatic disorders: an updated systematic review and meta-analysis," *Cogn Behav Ther.*, vol. 47, no. 1, pp. 1-18, January 2018.
- [12] H. Baumeister, C. Grässle, D. D. Ebert, L. V. Krämer, "Blended psychotherapy – verzahnte Psychotherapie: Das Beste aus zwei Welten?" *Psychother Dialog*, vol. 19, no. 4, pp. 33-8, 2018.
- [13] G. Andersson, N. Topooco, O. Havik, T. Nordgreen, "Guided Internet-supported versus face-to-face cognitive behavior therapy for psychiatric and somatic disorders: a systematic review and meta-analysis," *World Psychiatry*, vol. 16, no. 1, pp. 288-95, October 2014.
- [14] W. C. Pamungkas, "Internet relay chatbot dengan menggunakan artificial intelligent markup language (AIML)," *Jurnal Informatika*, vol. 4, no. 1, pp. 54-60, 2008.
- [15] Y. I. Chandra, Kosdiana, "Rancang bangun aplikasi chat bot Line menggunakan pendekatan agile process dengan model extreme programming berbasis web (studi kasus di STMIK Jakarta STI&k)," *Seminar Nasional Teknologi Informasi STI&K*, vol. 3, no. 1, pp. 149-160, 2019.
- [16] D. Suryani, E. L. Amalia, "Aplikasi chatbot objek wisata Jawa Timur berbasis AIML," *Smartics*, vol. 3, no. 2, pp. 47-54, 2017.
- [17] D. Gunadi, R. Sanjaya, and B. Harnadi, "Examining the acceptance of virtual assistant-Vanika for university students," in 2019 3rd International Conference on Informatics and Computational Sciences (ICICoS), 2019, pp. 1–4.
- [18] C. Wibhowo and R. Sanjaya, "Virtual assistant to suicide prevention in individuals with borderline personality disorder," in International Conference on Computer and Information Science, 2020.