# PROCEEDINGS

## 2017 3rd International Conference on Science in Information Technology (ICSITech)

*"Theory and Application of IT for Education, Industry and Society in Big Data Era"*

**Universitas Pendidikan Indonesia**
Department of Computer Science Education
Bandung, Indonesia, October 25-26, 2017

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# 2017 3ʳᵈ International Conference on Science in Information Technology (ICSITech)

October 25-26, 2017

Bandung, Indonesia

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# PROCEEDING

# 2017 3ʳᵈ International Conference on Science in Information Technology (ICSITech)

**"Theory and Application of IT for Education, Industry, and Society in Big Data Era"**

Version: 2017-10-20

October 25-26, 2017

Bandung, Indonesia

# Foreword from Conference Chair

Dear distinguished guests, keynote speakers, and participants,

Welcome to ICSITech 2017!
Universitas Pendidikan Indonesia is honored to be the host of this year's Conference on Science in Information Technology (ICSITech). The ICSITech is jointly organized with Universitas Ahmad Dahlan, Universitas Mulawarman, UPN "Veteran" Yogyakarta, Universitas Muhammadiyah Surakarta, UTM Big Data Centre, Universiti Teknologi Malaysia, Universiti Putra Malaysia, Universiti Malaysia Sabah, and Universitas Budi Luhur. Since this is the third conference, we wish to repeat the success of the two previous conferences. We do hope this annual conference will continue to be held in the next coming years (2018 in Malaysia, 2019 in Yogyakarta, etc.) with increasing quality. For this year's conference, we proudly present the theme of ICSITech 2017, "Theory and Application of IT for Education, Industry, and Society in Big Data Era". The theme is taken from our university's identity as a university which consistently takes part in education and responds to the development of science, technology, art, society demands, and global change.

Ladies & gentlemen,
We are pleased to inform you that the ICSITech 2017 has been approved by IEEE for technical co-sponsorship; therefore, the papers which are accepted and presented will be further considered to be published in the IEEE Xplore Digital Library. I wish to extend a warm welcome to Prof. Dr. Ir. Fitri Yuli Zulkifli, S.T., M.Sc., as IEEE Indonesia Section Chair. There are 406 papers from 17 countries submitted to the ICSITech 2017 with about 34.7% acceptance ratio. Congratulations for all authors and presenters whose papers are accepted. Thank you for choosing ICSITech 2017 and disseminating your research here.

Today, we are lucky to have three keynote speakers who will broaden our insights about Big Data Era in IT Perspective. They will talk about their expertise and we do hope this event could bring many benefits, especially in the fields of education, industry, and society. We are honored for the presence of Prof. Dr. Tsukasa Hirashima (Hiroshima University), Prof. Dr. Halimah Badioze Zaman (Universiti Kebangsaan Malaysia), and Prof. Ir. Dwi Hendratmo Widyantoro, M.Sc., Ph.D (Institut Teknologi Bandung), thank you very much.

The previous conferences were held in Yogyakarta and Samarinda, respectively. This year, the ICSITech 2017 is taking place in Bandung. The city is nicknamed Parijs van Java. Bandung is one of the favorite travel destinations, especially in Java, with many wonderful tourism destinations and delightful culinary creations. Please enjoy your stay in Bandung.

Finally, we thank all keynote speakers, participants, sponsors, associations, and partners for being a part of this conference. On behalf of the organizing committee, we wish to express our highest appreciation and sincere thanks to all of you who attend this event and we wish you have valuable discussion and networking. I also thank the committee for all efforts to make ICSITech 2017 successful.


Thank you.

**General Chair**
Prof. Dr. Munir, M.IT.
Department of Computer Science Education
Universitas Pendidikan Indonesia, West Java – Indonesia

# Welcome Message from the Dean of FPMIPA
# Universitas Pendidikan Indonesia

I am honored and delighted to welcome all distinguished guests, keynote speakers, and participants to the Conference on Science in Information Technology (ICSITech) 2017. Since 2015, Universitas Pendidikan Indonesia has taken part in organizing the ICSITech. It is our pleasure and honor to get the opportunity of being a host for this year's conference with Computer Science Education Department as the organization in charge. Especially for the Department of Computer Science Education, even though this event is the first experience, the commitment to make this event successful is proved today. Congratulations!

As the dean, I am pleased that our institution has been networking with other partner institutions incorporated in the ICSITech. Together we have learned and worked to organize a high quality conference which can build a relationship between researchers and may create opportunities for joint research or other collaborations. This conference has brought us from various countries and institutions to disseminate our research and have a valuable discussion. We wish a delightful event and networking here.

We are very grateful the ICSITech 2017 is attended by keynote speakers who have expertise related to our conference's theme. Please accept my sincere thanks and appreciation to all of you. We believe that the talks will inspire us and give insight or new idea for doing the next research. Moreover, I also would like to express my gratitude to IEEE for the technical co-sponsorship and the Ministry of Research, Technology, and Higher Education (RISTEKDIKTI) of the Republic of Indonesia for the funding, Indonesian Association of Higher Education in Informatics and Computer Science (APTIKOM) of West Java Region for the support, and our partner institutions for their cooperation and contribution to the ICSITech 2017.

Thank you.

**Dean of FPMIPA Universitas Pendidikan Indonesia**
Siti Fatimah, M.Si., Ph.D.

# Welcome Message from the Rector of Universitas Pendidikan Indonesia (UPI)

I am extremely proud and happy to welcome you to the 2017 3rd International Conference on science in Information Technology (ICSITech) organized by Universitas Pendidikan Indonesia (UPI) as a host, Universitas Ahmad Dahlan (UAD), MULAWARMAN University, UPN "Veteran" Yogyakarta, Universitas Muhammadiyah Surakarta (UMS), UTM Big Data Centre, Universiti Teknologi Malaysia (UTM), Universiti Putra Malaysia (UPM), Universiti Malaysia Sabah (UMS), and Universitas Budi Luhur (UBL).

Since UPI is one of the leading university in computer science education, this conference was held to provide as an event for IT expertise to disseminate their knowledge on the development of computer science education and expand the network connection on the research activities. Furthermore we intend to make the existence of this conference as a motivation for researchers to publish their ideas about theory and aplication of IT for education, industry, and society in international forums. In line with UPI vision to become a leading and outstanding university in education, producing, developing, and disseminating science and technology to improve people's welfare has become one of our goal along with collaborating in research activities with other universities. Therefore, we are looking forward to collaborating in various research areas.

I am finally welcome the 2017 3rd International Conference on Science in Information Technology (ICSITech) participants who delegates their institutions to UPI, hopefully the distinguished participant can participate actively in this conference and enjoy the services we are provide.

Thank you.

**Rector of Universitas Pendidikan Indonesia**
Prof. Dr. H.R. Asep Kadarohman, M.Si.

# Opening Message

Dear Distinguished Guests, Colleagues, researchers, professionals, ladies and gentlemen,
Good morning, a prosperous and warm greeting.

On behalf of IEEE Indonesia section, I would like to express my sincere gratitude and welcome you to the 2017 International Conference on Science in Information Technology (ICSITech). ICSITech is hosted by Universitas Pendidikan Indonesia and is jointly organized with Universitas Ahmad Dahlan, Universitas Mulawarman, UPN "Veteran" Yogyakarta, Universitas Muhammadiyah Surakarta, UTM Big Data Centre, Universiti Teknologi Malaysia, Universiti Putra Malaysia, Universiti Malaysia Sabah, and Universitas Budi Luhur. ICSITech 2017 is technically co-sponsored by the IEEE Indonesia Section with conference record number #40947.

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 current development and innovation in the advanced of research area on Science in Information Technology. Accepted and presented papers will be published in the conference proceedings, and those that are within the scope of IEEE will be submitted to the IEEE Xplore digital library.

Ladies and gentlemen,
IEEE Indonesia Section has conducted many activities over 29 years in Indonesia. In terms of collaboration, IEEE Indonesia section has a good and mutual relationship with ICT organizations, Industries, universities as well as the government in Indonesia. IEEE Indonesia Section has contributed and sponsored about 60 different International conferences annually, and this conference is one of the conferences which were sponsored by IEEE Indonesia Section. I do hope in the near future, some high-quality conferences will be continued and strengthened, so the result will give more benefits and positive impacts to the human being, especially to Indonesian people. Cooperation with international conferences is only one activity among many other activities in IEEE Indonesia section. Some of our other activities are public lectures, intellectual gatherings and workshops, humanitarian and research grants, and many more. Please check our website at ieee.org and ieee.id for more complete information. We hope with many activities conducted by IEEE Indonesia Section, we can help our government to decrease the digital divide in Indonesia.

Ladies and gentlemen,
In this occasion, I would also like to say welcome to Bandung, which serves beautiful heritages, culinary, 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 conference event. Please share your best knowledge in your area of research and professional activities.

Thank you.

**IEEE Indonesia Section Chair**
Prof. Dr. Ir. Fitri Yuli Zulkifli, ST., MSc.

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Zuwairie bin Ibrahim (Universiti Malaysia Pahang, Malaysia)

# Keynote Speakers Biography

**Prof. Dr. Tsukasa Hirashima (Hiroshima University, Japan)**

Prof. Tsukasa Hirashima received his Ph.D. in 1991 from Osaka University, Japan. He worked at The Institute of Scientific and Industrial Research, Osaka University as a research associate and lecturer from 1991 to 1997. During 1997-2003, he worked in Department of Artificial Intelligence at Kyushu Institute of Technology as an associate professor. He has been a professor of Graduate School, Department of Information Engineering, Hiroshima University since 2004. Prof. Hirashima's contributions in Computers in Education, especially, in artificial intelligence in education include modeling of problem-solving process, error-visualization for error-awareness, information filtering, question/problem generation, learning by problem posing and design method of learning game. Recently, he is interested in Kit-Build concept map on formative assessment, Educational Externalization of Thinking Task by Kit, and Effects of Error-Based Simulation as a Counterexample for Correcting MIF Misconception.

**Prof. Dr. Halimah Badioze Zaman (Universiti Kebangsaan Malaysia, Malaysia)**

Professor Dato' Dr Halimah Badioze Zaman received her Ph.D. from Loughborough University, United Kingdom, in 1983. She joined Universiti Kebangsaan Malaysia in 1983 and was one of the founders of the Faculty of Information Science and Technology, UKM. She became the Founding Head of Department of Information Science and later Deputy Dean of Research and Development Affairs of the Faculty from 2002-2005. She became a full Professor in Multimedia Technology since 1999. In July 2005-August 2007, she became Visiting Professor at the Department of Computer and Information Engineering, Tamkang University, Taiwan and Guest Writer at Chengchi National University, Taiwan. She is also currently a conjoint Professor at Newcastle University, Australia, and Honorary Professor at Nottingham University, UK and Malaysia Campus. She became the Founding Director of the first Computer Science and Information Technology Centre of Excellence in UKM called Institute of Visual Informatics (IVI) since 2010. She is very active in research in the field of computer science and ICT specifically in Visual Informatics. She was responsible for the creation of the ICT niche in UKM, and is Lead Scholar and Head of the Visual Informatics Research Group. She has worked extensively in the areas of visual informatics namely, multimedia software development, virtual reality, augmented reality, virtual learning, virtual Islamic banking, various virtual, haptic and voice recognition systems for the special population: such as the visually impaired, the physically ill patients as well learners of down syndrome, dyslexia, deaf and autism. She is also active in the field of visualization of big data and data analytics.

**Prof. Ir. Dwi Hendratmo W., M.Sc., Ph.D. (Institut Teknologi Bandung, Indonesia)**

Prof. Ir. Dwi Hendratmo W., M.Sc., Ph.D. received his Ph.D. from Texas A&M University, USA. He work as a professor of School of Electrical Engineering and Informatics Institut Teknologi Bandung. One of his professional memberships is ACM (Association for Computing Machinery) memberships. Prof. Dwi's field of expertise, especially, in machine learning, information retrieval and management, information summarization, information extraction, text mining, sentiment analysis, and e-Learning. Some of his recent publication are vehicle detection and tracking based on corner and lines adjacent detection features, comparison study of neural network and deep neural network on repricing GAP prediction in Indonesian conventional public bank, Fisheye zoom and semantic zoom on citation network visualization, and design of knowledge for conversational recommender system based on product functional requirements. Curently, he is interested in conversational recommender system, text translator machine, and chatbot speaking development.

# 2017 3rd ICSITech Schedule

## Day 1: Wednesday, October 25, 2017

| | |
|---|---|
| 07.00 – 07.30 | Hospitality & Registration Desks Open |
| 07.30 – 08.30 | Opening Ceremony: |
| | 1. National Anthem – Indonesia Raya |
| | 2. Culture Performance |
| | 3. Welcome Address – ICSITech 2017 Chairperson |
| | 4. Supporting Address – IEEE Indonesia Section |
| | 5. Welcome Address – Rector of Universitas Pendidikan Indonesia |
| 08.30 – 09.00 | Coffee Break |
| 09.00 – 10.20 | Keynote Speaker 1 – Tsukasa Hirashima |
| | Keynote Speaker 2 – Halimah Badioze Zaman |
| 10.20 – 12.00 | Keynote Speaker 3 – Abdurrazag Ali Aburas |
| | Keynote Speaker 4 – Dwi Hendratmo |
| 12.00 – 13.00 | Lunch and Prayer Time |
| 13.00 – 15.00 | Parallel Session 1 (presented by 72 speaker) |
| 15.00 – 15.20 | Coffee Break |
| 15.20 – 17.40 | Parallel Session 2 (presented by 84 speaker) |
| 17.40 – 18.30 | Break |
| 18.30 – 19.00 | Invitation to ICSITech 2018 |
| 19.00 – 19.15 | Best Paper & Best Moderator |
| 19.15 – 19.30 | MoU Signing Ceremony |
| 19.30 – 19.45 | Closing Ceremony |
| 19.45 – 20.00 | Miscellaneous Information |
| 20.00 – 21.30 | Gala Dinner |

## Day 2: Thursday, October 26, 2017

| | |
|---|---|
| 07.30 – 08.30 | City Tour Registration |
| 08.30 – 12.30 | City Tour (Dusun Bambu and Cihampelas Walk) |
| 12.30 – 13.30 | Back to Hotels |

# 2017 3rd ICSITech Schedule

## Parallel Class 1 – Room: Ballroom
## Moderator: Enjun Junaeti

13.00 - 13.20    **(1570370412)** Edit Distance Weighting Modification using Phonetic and Typographic Letter Grouping over Homomorphic Encrypted Data
*Tohari Ahmad (Institut Teknologi Sepuluh Nopember, Indonesia), Kukuh Indrayana (Institut Teknologi Sepuluh Nopember, Indonesia), Waskitho Wibisono (Institut Teknologi Sepuluh Nopember, Indonesia), Royyana M. Ijtihadie (Institut Teknologi Sepuluh Nopember, Indonesia)*

13.20 - 13.40    **(1570329954)** Design of Authentication Process for RESTful Web Service Using Seed Based Authentication
*Auliak Amri (Bandung Institute of Technology, Indonesia), Budi Rahardjo (Bandung Institute of Technology, Indonesia)*

13.40 - 14.00    **(1570325250)** Implementation of RFID, GSM and GPS technologies for motorcycle security system
*Anna Nur Nazilah Chamim (Universitas Muhammadiyah Yogyakarta, Indonesia), Rofiq Mubarok (Universitas Muhammadiyah Yogyakarta, Indonesia), Dwi Verdy Firmansyah (Universitas Muhammadiyah Yogyakarta, Indonesia), Dheny Haryanto (Universitas Muhammadiyah Yogyakarta, Indonesia), Noor Pratama Apriyanto (Universitas Muhammadiyah Yogyakarta, Indonesia), Umniyatul Mahmudah (Universitas Muhammadiyah Yogyakarta, Indonesia), Nia Maharani Raharja (Universitas Muhammadiyah Yogyakarta, Indonesia), Iswanto (Universitas Muhammadiyah Yogyakarta, Indonesia)*

14.00 - 14.20    **(1570390569)** Using Capture the Flag in Classroom: Game-based Implementation in Network Security Learning
*Harsa Wara Prabawa  (Universitas Pendidikan Indonesia, Indonesia), Enjun Junaeti  (Universitas Pendidikan Indonesia, Indonesia), Yana Permana (Universitas Pendidikan Indonesia, Indonesia)*

14.20 - 14.40    **(1570348787)** Team Based Learning in Computer Science Students
*Brilly Andro Makalew (Bina Nusantara University, Indonesia), Bens Pardamean (Bina Nusantara University, Indonesia)*

14.40 - 15.00    **(1570382972)** Physical Document Validation With Perceptual Hash
*Prasetyo Adi Wibowo Putro (National Crypto Institute, Indonesia)*

15.30 - 15.50    **(1570346138)** Designing of Quantum Random Number Generator (QRNG) for Security Application
*Meilana Siswanto (State Polytechnic of Jember, Indonesia), I Gusti Bagus Baskara Nugraha (State Polytechnic of Jember, Indonesia)*

15.50 - 16.10      **(1570384185)** Enhancing Data Security Using DES-based Cryptography and DCT-based Steganography
*Achmad Solichin (Budi Luhur University, Indonesia), Erwin Wahyu Ramadhan (Budi Luhur University, Indonesia)*

16.10 - 16.30      **(1570384398)** Information Security Awareness Level Measurement for Employee: Case Study at Ministry of Research, Technology, and Higher Education
*Doni Dwi Hantyoko Wahyudiwan (Universitas Indonesia, Indonesia), Yudho Giri Sucahyo (Universitas Indonesia, Indonesia), Arfive Gandhi (Universitas Indonesia, Indonesia)*

16.30 - 16.50      **(1570331971)** Music Mood Classification Using Audio Power and Audio Harmonicity Based on MPEG-7 Audio Features and SVM
*Johanes Andre Ridoean (Institut Teknologi Sepuluh Nopember, Indonesia), Riyanarto Sarno (Institut Teknologi Sepuluh Nopember, Indonesia), Dwi Sunaryo (Institut Teknologi Sepuluh Nopember, Indonesia), Dedy Rahman Wijaya (Telkom University, Indonesia)*

16.50 - 17.10      **(1570370657)** A Secure Data Sharing Using Identity-Based Encryption Scheme for e-Healthcare System
*Amang Sudarsono (Polytechnic Institute of Surabaya, Indonesia), Mike Yuliana (Polytechnic Institute of Surabaya, Indonesia), Haryadi Amran Darwito (Polytechnic Institute of Surabaya, Indonesia)*

## Parallel Class 2 – Room: Lombardy 1
## Moderator: Yaya Wihardi

13.00 - 13.20      **(1570346186)** Analyzing Knowledge Management in Research Laboratories Based on Organizational Culture
*Izzah Fadhilah Akmaliah ( University of Indonesia, Indonesia ), Dana Indra Sensuse ( University of Indonesia, Indonesia ), Ika Arthalia Wulandari ( University of Indonesia, Indonesia ), Isnaeni Nurrohmah ( University of Indonesia, Indonesia ), Rahmi Imanda ( University of Indonesia, Indonesia ), Handrie Noprisson ( Universitas Mercu Buana, Indonesia), Elin Cahyaningsih ( University of Indonesia, Indonesia )*

13.20 - 13.40      **(1570331900)** Music Tempo Classification Using Audio Spectrum Centroid, Audio Spectrum Flatness, and Audio Spectrum Spread based on MPEG-7 Audio Features
*Alvin Lazaro (Institut Teknologi Sepuluh Nopember, Indonesia), Riyanarto Sarno (Institut Teknologi Sepuluh Nopember, Indonesia), Johanes Andre R. (Institut Teknologi Sepuluh Nopember, Indonesia), Muhammad Nezar Mahardika (Institut Teknologi Sepuluh Nopember, Indonesia)*

13.40 - 14.00      **(1570331296)** Heuristic Evaluation Of Learning Object Repository Interfaces
*Shah Mohd Irwan Mat Ishak (National University of Malaysia, Malaysia), Siti Fadzilah Mat Noor (National University of Malaysia, Malaysia)*

14.00 - 14.20      **(1570345104)** Knowledge Management Practices in e-Government
*Pudy Prima (University of Indonesia, Indonesia), Dana Indra Sensuse (University of Indonesia, Indonesia), Handrie Noprisson (University of Indonesia, Indonesia), Elin Cahyaningsih (University of Indonesia, Indonesia), Yudho Giri Sucahyo (University of Indonesia, Indonesia)*

14.20 - 14.40      **(1570332157)** The Role of Knowledge Management in The Success Rate of IT Investment and Its Impact on The Organization Performance A Survey in the Ministry Agencies, Local Governments, Universities and Banks in Indonesia
*Donny Maha Putra (University of Padjadjaran, Indonesia), Dedy Wahyu Winoto (Institut Teknologi Bandung, Indonesia)*

14.40 - 15.00      **(1570345115)** Analysis of Knowledge Management Readiness in the Government Institution
*Wahyu Indra Satria (Universitas Indonesia, Indonesia), Irwan Munandar (Universitas Indonesia, Indonesia), IGK Rizal (Universitas Indonesia, Indonesia), Elin Cahyaningsih (Universitas Indonesia, Indonesia), Dana Indra Sensuse (Universitas Indonesia, Indonesia), Handrie Noprisson (Universitas Mercu Buana, Indonesia)*

15.30 - 15.50    **(1570350843)** Performance Evaluation of Harmony Search Algorithm on GPU-Based System
*Ebrahim Khajeh ( Universiti Teknologi Malaysia, Malaysia), Shafaatunnur Hassan ( Universiti Teknologi Malaysia, Malaysia), Siti Mariyam Shamsuddin ( Universiti Teknologi Malaysia, Malaysia)*

15.50 - 16.10    **(1570344897)** Privacy Risk Assessment of Responding to the Financial Field in Japan
*Sanggyu Shin (Advanced Institute of Industrial Technology, Japan ), Yoichi Seto (Advanced Institute of Industrial Techonology, Japan), Kei Sakamoto (Advanced Institute of Industrial Technology, Japan), Mayumi Sasako (Advanced Institute of Industrial Technology, Japan)*

16.10 - 16.30    **(1570330265)** A Model Design of Information Technology Investment for The Government Sector
*Endah Susilawati (Institut Teknologi Bandung, Indonesia), Kridanto Surendro (Institut Teknologi Bandung, Indonesia)*

16.30 - 16.50    **(1570340854)** Software Reliability Measurement Base On Failure Intensity
*Bambang Krismono Triwijoyo (STMIK Bumigora Mataram, Indonesia), Ford Lumban Gaol (STMIK Bumigora Mataram, Indonesia), Benfano Soewito (STMIK Bumigora Mataram, Indonesia), Harco Leslie Hendric Spits Warnars (STMIK Bumigora Mataram, Indonesia)*

16.50 - 17.10    **(1570332009)** Reusability Metric on Procurement of Goods and Services
*Meida Cahyo Untoro (Institut Teknologi Sepuluh Nopember, Indonesia), Riyanarto Sarno (Institut Teknologi Sepuluh Nopember, Indonesia)*

17.10 - 17.30    **(1570332114)** Knowledge-Based Graph Compression using Graph Property On Yago
*Wahyudi (Institut Teknologi Bandung, Indonesia), Masayu Leylia Khodra (Institut Teknologi Bandung, Indonesia), Ary Setijadi Prihatmanto (Institut Teknologi Bandung, Indonesia), Carmadi Machbub ( Institut Teknologi Bandung, Indonesia)*

## Parallel Class 3 – Room: Lombardy 2
## Moderator: Muhammad Nursalman

13.00 - 13.20      **(1570369392)** Performance Testing of M2M Middleware Platform
*Fitra Zul Fahmi (Telkom University, Indonesia), Maman Abdurohman (Telkom University, Indonesia)*

13.20 - 13.40      **(1570369402)** Seamless Presence System in Classroom
*Muhammad Sofyan Qusyairi (Telkom University, Indonesia), Maman Abdurohman (Telkom University, Indonesia), Asep Mulyana (Telkom University, Indonesia)*

13.40 - 14.00      **(1570352878)** Software Development Evaluation Process Using CMMI-Dev on Limited Resources Company
*I Made Sugi Ardana (Bina Nusantara University, Indonesia), Suharjito (Bina Nusantara University, Indonesia)*

14.00 - 14.20      **(1570370003)** Food safety knowledge and practices on food virtual shop A case study from Indonesia's young adult
*Fransisca Dini Ariyanti ( Bina Nusantara University, Indonesia), Siti Hadita ( Bina Nusantara University, Indonesia)*

14.20 - 14.40      **(1570355789)** Dashboard System for Measuring Green Software Design
*Noraini Che Pa (Universiti Putra Malaysia, Malaysia), Faizal Karim (Universiti Putra Malaysia, Malaysia), Sa'adah Hassan (Universiti Putra Malaysia, Malaysia)*

14.40 - 15.00      **(1570371748)** Analysis of Factors Influencing The Quality of Intranet Website Based on WebQual Approach Case Study In Agency X
*Jimmy Abdel Kadar (Indonesian Institute of Sciences, Indonesia), Darmawan Napitupulu (Indonesian Institute of Sciences, Indonesia), Rahmi Kartika Jati (Indonesian Institute of Sciences, Indonesia)*

15.30 - 15.50      **(1570383335)** Factors Affecting Awareness and Attitude of IT Governance Implementation in The Higher Education Institution: A Literature Review
*Uky Yudatama (Universitas Indonesia, Indonesia), Bobby A.A.Nazief (Universitas Indonesia, Indonesia), A.N. Hidayanto (Universitas Indonesia, Indonesia), Muhammad Mishbah (Universitas Indonesia, Indonesia)*

15.50 - 16.10      **(1570370349)** A sourcing decision model for application maintenance services
*Hanif-ur-Rehman (Stockholm University, Sweden), Shah Nazir (University of Swabi, Pakistan), Sara Shahzad (University of Peshawar, Pakistan), Thomas Hodosi (Stockholm, Sweden)*

16.10 - 16.30      **(1570371726)** IT Service Management Based on Service-Dominant Logic: Case Academic Information System State University of Malang
*Armanda Prastiyan Pratama (Universitas Negeri Malang, Indonesia), Nukleon Jefri Nur Rahman (Universitas Negeri Malang, Indonesia), Aji Prasetya Wibawa (Universitas Negeri Malang, Indonesia), Tinton Dwi Atmaja (Pusat Penelitian Tenaga Listrik dan Mekatronik Lembaga Ilmu Pengetahuan Indonesia, Indonesia)*

16.30 - 16.50      **(1570371616)** SIPOC Business Model Process to Prevent Plagiarism in an Electronic Journal
*Muhammad Rizki Irwanto (Universitas Negeri Malang, Indonesia), Sulu Basthiyan Zamara (Universitas Negeri Malang, Indonesia), Roni Herdianto (Universitas Negeri Malang, Indonesia), Aji Prasetya Wibawa (Universitas Negeri Malang, Indonesia)*

16.50 - 17.10      **(1570356698)** Cognitive Age And Chronological Age of the Technostress That Effect On Satisfaction, Performance, And Intention To Continue The Use Of Information Technology In The University
*Hario Jati Setyadi (Universitas Mulawarman, Indonesia), Putut Pamilih Widagdo (Universitas Mulawarman, Indonesia), Tony Dwi Susanto (Institut Teknologi Sepuluh Nopember, Indonesia)*

## Parallel Class 4 – Room: Sicilia
## Moderator: Adhi Prahara

13.00 - 13.20      **(1570391467)** Color and Texture Features Extraction on Content-based Image Retrieval
*Rahmaniansyah Dwi Putri (Universitas Pendidikan Indonesia, Indonesia), Harsa Wara Prabawa (Universitas Pendidikan Indonesia, Indonesia), Yaya Wihardi (Universitas Pendidikan Indonesia, Indonesia)*

13.20 - 13.40      **(1570392174)** A Study on the Current Practices of Software Development Processes in Malaysia
*Yusmadi Yah Jusoh (Universiti Putra Malaysia, Malaysia), Rozi Nor Haizan Nor (Universiti Putra Malaysia, Malaysia), Nor Zakiah Gorment (Universiti Putra Malaysia, Malaysia), Siti Aishah Md Nor (Universiti Putra Malaysia, Malaysia), Suhazli Muhamad (Universiti Putra Malaysia, Malaysia)*

13.40 - 14.00      **(1570384866)** Developers' Coordination Issues and its Impact on Software Quality: A Systematic Review
*A.J. Suali (Universiti Teknologi MARA, Malaysia), S.S.M. Fauzi (Universiti Teknologi MARA, Malaysia), W. A. W. M. Sobri (Universiti Teknologi MARA, Malaysia), M.H.N.M.Nasir (University of Malaya, Malaysia)*

14.00 - 14.20      **(1570388618)** Image Enhancement Using Piecewise Linear Contrast Stretch Methods based on Unsharp Masking Algorithms for Leather Image Processing
*Murinto (Universitas Ahmad Dahlan, Indonesia), Sri Winiarti (Universitas Ahmad Dahlan, Indonesia), Dewi Pramudi Ismi (Universitas Ahmad Dahlan, Indonesia), Adhi Prahara (Universitas Ahmad Dahlan, Indonesia)*

14.20 - 14.40      **(1570384079)** Analysis of Knowledge Management Implementation Readiness in A Technology Services Company
*Prastyawan Aji Nugraha (Universitas Indonesia, Indonesia), Indra Budi (Universitas Indonesia, Indonesia)*

14.40 - 15.00      **(1570389362)** A Development of Cloud-Based PHP Learning System
*Eddy Prasetyo Nugroho (Universitas Pendidikan Indonesia, Indonesia), Wahyudin (Universitas Pendidikan Indonesia, Indonesia), Rizki Cahyana (Universitas Pendidikan Indonesia, Indonesia)*

15.30 - 15.50      **(1570383760)** Utilisation of Down and Upsample in Pre-Processing to Enhance Quality of Kinect Depth Compression
*Christin Erniati Panjaitan (Institut Teknologi Del (IT Del)), Chung-An Shen (National Taiwan University of Science and Technology), Shanq-Jang Ruan (National Taiwan University of Science and Technology)*

15.50 - 16.10      **(1570391404)** Depth Inpainting Scheme Based on Edge Guided Non Local Means
*Adhi Prahara (Universitas Ahmad Dahlan, Indonesia), Andri Pranolo (Universitas Ahmad Dahlan, Indonesia)*

16.10 - 16.30      **(1570390827)** Knowledge Management System (KMS) Readiness Level Based on Group Areas of Expertise To Improve Science Education and Computer Science Quality (Cross-Fertilization Principle) (Case Study: Computer Science Program Course FPMIPA UPI)
*Rizky Rachman Judhie Putra (Indonesia University of Education, Indonesia), Budi Laksono Putro (Indonesia University of Education, Indonesia)*

16.30 - 16.50      **(1570383504)** Dissecting University Employee Attendance Log: A Case Study
*Mohammad Arif Rasyidi (Universitas Internasional Semen Indonesia, Indonesia)*

16.50 - 17.10      **(1570391474)** A Model of Geographic Information System using Graph Clustering Methods
*Tedy Setiadi (Universitas Ahmad Dahlan, Indonesia), Andri Pranolo (Universitas Ahmad Dahlan, Indonesia), Muhammad Aziz (Universitas Ahmad Dahlan, Indonesia), Sukrisno Mardiyanto (Institut Teknologi Bandung, Indonesia), Bayu Hendrajaya (Institut Teknologi Bandung, Indonesia)*

17.10 - 17.30      **(1570384171)** Externalization of Tacit Knowledge in a Knowledge Management System Using Chat Bots
*Narendra U P (Reva University Mangalore Institute of Tech & Engg, India), Dr. Pradeep B S (ACS College of Engineering, India), Dr. M Prabhakar (Reva University, India)*

## Parallel Class 5 – Room: Palermo
## Moderator: Rosa Ariani Sukamto

13.00 - 13.20      **(1570371268)** Imagineering: Fostering Constructivism among Pre-service Teachers
*Dexter M. Balajadia (University of the Assumption, Philippines)*

13.20 - 13.40      **(1570371652)** Community and Important Actors Analysis with Different Keywords in Social Network
*Nanang Cahyana, S.ST (Bandung Institute of Technology, Indonesia), Dr. Ir. Rinaldi Munir, MT. (Bandung Institute of Technology, Indonesia)*

13.40 - 14.00      **(1570369409)** Design of a System for Detection of Environmental Variables Applied in Data Centers
*Leonel Hernández (Institucion Universitaria, Colombia), Yuliana Calderon (Institucion Universitaria, Colombia), Hugo Martinez (Institucion Universitaria, Colombia)*

14.00 - 14.20      **(1570345827)** Question Answering System with HMM Speech Recognition
*Hobert Ho (Tarumanagara University, Indonesia), Viny Christanti Mawardi (Tarumanagara University, Indonesia), Agus Budi Dharmawan (Tarumanagara University, Indonesia)*

14.20 - 14.40      **(1570345821)** Development and Evaluation of Software for Smart Devices to Support Educational Experiments on Acceleration
*Takahiro Hoshino (Nihon University, Japan), Yuki Ota (Nihon University, Japan), Kohei Tomaru (Nihon University, Japan), Yoshio Hamamatsu (Nihon University, Japan)*

14.40 - 15.00      **(1570370554)** Social Bookmarking Systems to Enhance Students' Learning Process
*Ching-Chieh Kiu (Taylor's University, Malaysia), Eng-Lye Lim (Taylor's University, Malaysia)*

15.30 - 15.50      **(1570352497)** The Application of ADDIE Model in Developing Adventure Gamebased Multimedia Learning to Improve Students' Understanding of Basic Programming
*Dimas Restu Hidayanto (Indonesia University of Education, Indonesia), Munir (Indonesia University of Education, Indonesia), Eka Fitrajaya Rahman (Indonesia University of Education, Indonesia), Jajang Kusnendar (Indonesia University of Education, Indonesia)*

15.50 - 16.10      **(1570363163)** The Influences of Video Streaming Media Based on Cloud Mobile Learning Against Learning Interests in Every Student Learning Styles
*Munir (Indonesia University of Education, Indonesia ), Cepi Riana (Indonesia University of Education, Indonesia ), Misrina (Indonesia University of Education, Indonesia )*

16.10 - 16.30      **(1570349064)** The Performance Comparison of Forwarding Mechanism between IPv4 and Named Data Networking (NDN). Case Study: A Node Compromised by The Prefix Hijack
*Yunita Noor Rohmah (Telkom University, Indonesia), Dodi Wisaksono Sudiharto (Telkom University, Indonesia), Anton Herutomo (Telkom University, Indonesia)*

16.30 - 16.50      **(1570332257)** Improved Image Quality on Surveillance Embedded IP Camera by Reducing Noises
*Setiya Purbaya (Telkom University, Indonesia), Endro Ariyanto (Telkom University, Indonesia), Dodi Wisaksono Sudiharto (Telkom University, Indonesia), Catur Wirawan Wijiutomo (Telkom University, Indonesia)*

16.50 - 17.10      **(1570331711)** Learners Mood Detection using Convolutional Neural Network (CNN)
*Rosa Ariani Sukamto (Universitas Pendidikan Indonesia, Indonesia), Munir (Universitas Pendidikan Indonesia, Indonesia), Siswo Handoko (Universitas Pendidikan Indonesia, Indonesia)*

17.10 - 17.30      **(1570384253)** Analogy Mapping for Different Learning Style of Learners in Programming
*Rosa Ariani Sukamto (Universitas Pendidikan Indonesia, Indonesia), Rani Megasari (Universitas Pendidikan Indonesia, Indonesia)*

## Parallel Class 6 – Room: Perugia
## Moderator: Harsa Wara P.

13.00 - 13.20      **(1570371834)** The Development and Usability Testing of Game Based Learning as A Medium to Introduce Zoology to Young Learners
*Gustara Sapto Ajie (Universitas Padjadjaran, Indonesia), M. Azhari Marpaung (Universitas Padjadjaran, Indonesia), Agung Kurniawan (Universitas Padjadjaran, Indonesia), Mira Suryani (Universitas Padjadjaran, Indonesia), Ino Suryana (Universitas Padjadjaran, Indonesia), Erick Paulus (Universitas Padjadjaran, Indonesia)*

13.20 - 13.40      **(1570384252)** Analysis of the Concept Mapping style in EFL Reading Comprehension Comparison between Kit-build and Scratch-build Concept Mapping from the Viewpoint of Paragraph Structure of Text
*Banni Satria Andoko (State Polytechnic of Malang, Indonesia), Yusuke Hayashi (Hiroshima University, Japan), Tsukasa Hirashima (Hiroshima University, Japan)*

13.40 - 14.00      **(1570371405)** The Effects of Simulation Aided Learning with Various Multimedia Instructional Message Strategies on Polytechnic Malaysia Students' Achievement
*Mohd Syahrizad Elias (Politeknik Seberang Perai, Malaysia), Ahmad Zamzuri Mohamad Ali (Universiti Pendidikan Sultan Idris, Malaysia)*

14.00 - 14.20      **(1570371611)** Burnout and Mobbing in IT Students
*Juwita Annisa Fauzi (Universitas Negeri Malang, Indonesia), Dhaniyar (Universitas Negeri Malang, Indonesia), Aji Prasetya Wibawa (Universitas Negeri Malang, Indonesia), Eki Nugraha (Universitas Pendidikan Indonesia, Indonesia)*

14.20 - 14.40      **(1570371504)** Implementation and Performance Measurement of Microcomputer as Multimedia Server to Supporting E-Learning Infrastructure
*Puspanda Hatta (Sebelas Maret University, Indonesia), Agus Efendi (Sebelas Maret University, Indonesia), Ahmad Fauzan Aji (Sebelas Maret University, Indonesia), Yoni Yuliawan S (Sebelas Maret University, Indonesia)*

14.40 - 15.00      **(1570371671)** Blended Learning in Postgraduate Program
*Cahya Wahyuning Ilahi (Universitas Negeri Malang, Indonesia), Dyah Ayu Fladya Rizky (Universitas Negeri Malang, Indonesia), Aji Prasetya Wibawa (Universitas Negeri Malang, Indonesia), Eki Nugraha (Universitas Pendidikan Indonesia, Indonesia)*

15.30 - 15.50    **(1570371556)** Comparing the Characteristics of Undergraduate Program of Information System in Public and Private Universities
*Umi Kholifah (Universitas Negeri Malang, Indonesia), Roshina Hila Dini (Universitas Negeri Malang, Indonesia), Aji Prasetya Wibawa (Universitas Negeri Malang, Indonesia), Eki Nugraha (Universitas Pendidikan Indonesia, Indonesia)*

15.50 - 16.10    **(1570384267)** Finding the Suitable Process Modeling for AIS Teaching: An Experimental Study
*Aisya Noor Husni (Universitas Padjadjaran, Indonesia), Hamzah Ritchi (Universitas Padjadjaran, Indonesia), Zaldy Adrianto (Universitas Padjadjaran, Indonesia)*

16.10 - 16.30    **(1570371863)** Designing Scaffolding System in a Problem-Posing Learning Environment
*Ahmad Afif Supianto (Brawijaya University, Indonesia), Yusuke Hayashi (Hiroshima University, Japan), Tsukasa Hirashima (Hiroshima University, Japan)*

16.30 - 16.50    **(1570332619)** Utilizing Autonomous Mobile Robot to Increase Interest in STEM
*Tee Tiong Tay (Tunku Abdul Rahman University College, Malaysia), Zhi Zhang Lim (Tunku Abdul Rahman University College, Malaysia), Yaw Long Chua (University Tenaga Nasional, Malaysia)*

16.50 - 17.10    **(1570390477)** Gamification with Concept Attainment Model to Improvement Student Understanding
*Rasim (Universitas Pendidikan Indonesia, Indonesia), Harsa Wara Prabawa (Universitas Pendidikan Indonesia, Indonesia), Munir (Universitas Pendidikan Indonesia, Indonesia), Ulfah Husnun (Universitas Pendidikan Indonesia, Indonesia)*

17.10 - 17.30    **(1570382512)** EFL Learning Media for Early Childhood Through Speech Recognition Application
*Fajar Satria (Universitas Padjadjaran, Indonesia), Hafiz Aditra (Universitas Padjadjaran, Indonesia), Mohamad Dean Aji Wibowo (Universitas Padjadjaran, Indonesia), Hilmi Luthfiansyah (Universitas Padjadjaran, Indonesia), Mira Suryani (Universitas Padjadjaran, Indonesia), Erick Paulus (Universitas Padjadjaran, Indonesia), Ino Suryana (Universitas Padjadjaran, Indonesia)*

## Parallel Class 7 – Room: Tuscany 1.1
## Moderator: Lala Septem Riza

13.00 - 13.20      **(1570345969)** Student Graduation Time Prediction Using Intelligent K-Medoid Algorithm
*Leonardo Cahaya (Tarumanagara University, Indonesia), Lely Hiryanto (Tarumanagara University, Indonesia), Teny Handhayani (Tarumanagara University, Indonesia)*

13.20 - 13.40      **(1570361355)** Evaluating the Emission of CO2 at Traffic Intersections for the Purpose of Reducing Emission Rate, Case Study: The University of Nigeria, Nsukka
*Chinedu Duru (University of Nigeria, Nigeria), Nathan David (University of Nigeria, Nigeria), Mamilus Ahaneku (University of Nigeria, Nigeria)*

13.40 - 14.00      **(1570386159)** Indonesian Document Retrieval Using Vector Space Method
*Novi Sofia Fitriasari (Universitas Pendidikan Indonesia, Indonesia), Khalifa Esha Iftitah (Universitas Pendidikan Indonesia, Indonesia), Rizky Rachman Judhie P (Universitas Pendidikan Indonesia, Indonesia)*

14.00 - 14.20      **(1570331716)** Taxi Passenger Hotspot Prediction using Automatic ARIMA Model
*Mohammad Sabar Jamil (Bandung Institute of Technology, Indonesia), Saiful Akbar (Bandung Institute of Technology, Indonesia)*

14.20 - 14.40      **(1570373794)** Identifying Irregularity Electricity Usage of Customer Behaviors using Logistic Regression and Linear Discriminant Analysis
*Armin Lawi (Universitas Hasanuddin, Indonesia), Supriyadi La Wungo (Universitas Hasanuddin, Indonesia), Salama Manjang (Universitas Hasanuddin, Indonesia)*

14.40 - 15.00      **(1570384264)** Speed Control Implementation of BLDC Motor using Sliding Mode Two-Steps LMI Design
*Muhammad R. A. R. Santabudi (Institut Teknologi Bandung, Indonesia), Arief Syaichu Rohman (Institut Teknologi Bandung, Indonesia), Hanif F. Prasetyo (Institut Teknologi Bandung, Indonesia)*

15.30 - 15.50      **(1570384294)** Implementation of Model Predictive Control using Algorithm-3 on Arduino Mega2560 for Speed Control of BLDC Motor
*Hanif Fauzan Prasetyo (Institut Teknologi Bandung, Indonesia), Arief Syaichu Rohman (Institut Teknologi Bandung, Indonesia), M. R.A.R. Santabudi (Institut Teknologi Bandung, Indonesia)*

15.50 - 16.10    **(1570392603)** Upkabs: A Prototype App to Extract Internal Data Potential for Future Interest
*Herbert Siregar (Universitas Pendidikan Indonesia, Indonesia), Rosa Ariani Sukamto (Universitas Pendidikan Indonesia, Indonesia), Tandry Syawaludin Soedijanto (Universitas Pendidikan Indonesia, Indonesia)*

16.10 - 16.30    **(1570375383)** Intelligent Diagnosis System for Acute Respiratory Infection in Infants
*Subiyanto (Malang, Indonesia), Anggraini Mulwinda (Universitas Negeri Semarang, Indonesia), Dwi Andriani (SMK Gajah Mada Purwodadi, Indonesia)*

16.30 - 16.50    **(1570384380)** Forecasting Time Series with Trend and Seasonal Patterns Based on SSA
*Winita Sulandari (Universitas Gadjah Mada, Universitas Sebelas Maret, Indonesia), Subanar (Universitas Gajah Mada, Indonesia), Herni Utami (Universitas Gajah Mada, Indonesia), Suhartono (Institut Teknologi Sepuluh Nopember, Indonesia)*

16.50 - 17.10    **(1570345797)** Application of Artificial Neural Network for Predicting Company Financial Performance in Indonesia Stock Exchange
*Givaldi Ramadhan (Universitas Indonesia, Indonesia), Arian Dhini (Universitas Indonesia, Indonesia), Isti Surjandari (Universitas Indonesia, Indonesia), Reggia Aldiana Wayasti (Universitas Indonesia, Indonesia)*

17.10 - 17.30    **(1570382646)** Analysis on Anomalous Short Term Load Forecasting Using Two Different Approaches
*Ade Gafar Abdullah (Universitas Pendidikan Indonesia, Indonesia), Bahtiar Hasan (Universitas Pendidikan Indonesia, Indonesia), Yadi Mulyadi (Universitas Pendidikan Indonesia, Indonesia), Dadang Lukman Hakim (Universitas Pendidikan Indonesia, Indonesia), Hasbullah (Universitas Pendidikan Indonesia, Indonesia)*

## Parallel Class 8 – Room: Tuscany 1.2
## Moderator: Yudi Wibisono

13.00 - 13.20      **(1570345095)** The Distribution System Simulation Model Of Each Zone Freight Transportation Movement Based On Unlimited The Gravity Model Algorithm
*Juang Akbardin (Universitas Pendidikan Indonesia, Indonesia), Danang Parikesit (Universitas Gadjah Mada, Indonesia), Agus Taufik Mulyono (Universitas Gadjah Mada, Indonesia), Bambang Riyanto (Universitas Diponegoro, Indonesia)*

13.20 - 13.40      **(1570332044)** Non-Linear Optimization of Critical Path Method
*Yutika Amelia Effendi (Institut Teknologi Sepuluh Nopember, Indonesia), Riyanarto Sarno (Institut Teknologi Sepuluh Nopember, Indonesia)*

13.40 - 14.00      **(1570332047)** Discovering Optimized Process Model using Rule Discovery Hybrid Particle Swarm Optimization
*Yutika Amelia Effendi (Institut Teknologi Sepuluh Nopember, Indonesia), Riyanarto Sarno (Institut Teknologi Sepuluh Nopember, Indonesia)*

14.00 - 14.20      **(1570332072)** Petri Net Arithmetic Models for Scalable Business Processes
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# QUESTION ANSWERING SYSTEM WITH HMM SPEECH RECOGNITION

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*Abstract*—**Question answering system is a system that can give an answer to the question that asked by the user. Two inputs can be given to Question Answering (QA) System, namely text and speech input. To process a speech input, a Speech Recognition system is needed. This paper reports the result from Question Answering System that built with HMM Speech Recognition System as the recognizer for speech input. The HMM Speech Recognition will use the feature value obtained from MFCC method. The Question Answering System will use Vector Space Model from Lucene Search engine to retrieve relevant documents. The result shows that HMM Speech Recognition System's success rate in recognizing words is 83.31% which obtained from 13 tested questions and Question Answering System can answer 4 out of 6 questions that correctly identified by Speech Recognition System.**

*Keywords*—**Question Answering System; Speech Recognition; Hidden Markov Model; MFCC; Vector Space Model;**

## I. INTRODUCTION

Question Answering is one of the topics in Natural Language Processing. To understand the question from a user, the system needs the ability to process natural language as an input. Natural languages that usually used as input are text and speech input. In order to process speech input, the system must recognize the text form from given speech, which can be done by using a Speech Recognition System.

There are lots of research about speech recognition and the question answering systems. One of the example for speech recognition is "Automatic Speech and Speaker Recognition by MFCC, HMM, and Vector Quantization" by S.Desmukh and M.Bachute [1] and "Using Vector Space Model in Question Answering System" by Hartawan et al. [2]. Although those research yield good results, they were studied independently, separated from each other. This paper tries to combine those systems into one big system and analyze the results to see the impact caused by connecting those systems.

The objective of speech recognition is to determine what word does the speaker says. Several techniques have been proposed for reducing the mismatch between the testing and training environments. First, human speech is converted to a digital signal to produce digital data representing signal each time step. Second, The digitized speech then processed using MFCC to extract its features and stored in a vector. Third, the feature vectors that extracted by MFCC are quantized

using Vector Quantization to produce discrete feature vectors. The last step is to classify these feature vectors using Hidden Markov Model and store the HMM Parameter that produced to a database. Those parameters will be utilized in Viterbi algorithm when new speech input is given to system to be recognized.

After a question in text form is obtained, the system will search the answer by searching and retrieving 10 Top documents related to the question using Vector Space Model provided by Lucene. After documents retrieved, these document will be split into many passages. One passage contains five sentences, with the last sentence of the passage is repeated in the first sentence in next passage [3]. All of these passages will be ranked based on the scoring table, and top 5 passage will be retrieved for answer extraction. Answer candidates are obtained and ranked using the distance between question keyword and answer candidate position in the passages. Only top-ranked answer will be retrieved as an answer.

This paper reports the findings of speech recognition study using MFCC and Hidden Markov Model and question answering study using Lucene Vector Space Model. Assessing answer is done by checking the related document and determine whether the answer is correct or not.

## II. SPEECH RECOGNITION SYSTEM

The first thing to do before classify speech using Hidden Markov Model is to extract its feature and store it in a vector. This can be done by using Mel Frequency Cepstrum Coefficients method (MFCC). The MFCC process as follows [4]:

1) Frame the signal into short frames (20-40 ms)
2) For each frame calculate the Discrete Fourier Transform
3) Compute the Mel-spaced filter-bank
4) Take the logarithm of all filter-bank energies
5) Take the DCT of the log filter-bank energies.
6) Keep 13 DCT Coefficients and discard the rest.

The next step after obtaining feature vectors is quantized the feature vectors using Vector Quantization. Vector Quantization quantizes the continuous feature vectors to discrete feature vectors that can be processed by discrete Hidden Markov Model.

## A. Hidden Markov Model

The hidden Markov model (HMM) is a very powerful statistical method of characterizing the observed data samples of a discrete-time series [4]. This model describes all the possible paths through the state space and assigns a probability to each one. To understand the concepts of HMM, the following elements are defined as: [1]

1) N : No of states in HMM
2) M :Total different symbol per state
3) $\pi$ : Initial State Distribution $(\pi = \pi_i)$
4) A : State Transition Probability Distribution $A = [a_{ij}]$
5) B : Observation Symbol Probability Distribution

$\pi$, A and B from elements above are called HMM Model and notated by $\lambda(\lambda = (A, B, \pi))$.

In order to apply HMM, there are 3 things that need to be done: [5]

1) Calculate Parameter
   The main purpose of this step is to compute probability of observation sequence $O = \{O1, O2, , O_T\}$ given the Model . The Algorithm that used in this step is Forward and Backward Algorithm.
2) Find Optimal State Sequence
   The most common solution to find optimal state sequence is Viterbi Algorithm. Viterbi algorithm is a dynamic programming algorithm that calculates transition state path given observation sequence of symbols [6].
3) Estimating the Model parameters
   Estimation of model parameters is needed in order to adjust the model parameter $(A, B, \pi)$, according to a certain optimally criteria. Baum-Welch Algorithm is one of the techniques that used to solve this problem. It is an iterative method to estimate the new values for the model parameters.

## B. Voice Activity Detection

Another important issue in speech recognition system is to determine active speech periods and silent periods within a given speech signal [7]. Speech can be characterized as discontinue signal because information is present only if someone is speaking. The regions where information presents called active region and the pauses between talking are called inactive or silence region. An algorithm employed to detect the presence or absence of speech is referred to as a Voice Activity Detector (VAD) [7].

In general, VAD takes the feature from an input signal, spit those signals into frames (5-40ms), and then compare those value with threshold taken from the region that only contains noise. A sound is present (VAD = 1) if the value exceeds the threshold and not present or silent if the value is lower the threshold (VAD = 0). The success of VAD algorithm in splitting the speech depends on the threshold value.

VAD algorithm that used in this system is an Energy-based VAD. A threshold value is calculated by averaging first 40 frames (10ms per frame) with the assumption that user will not speak in first 0.4 seconds after record button is clicked.

Assume that x(i) is $i_{th}$ speech sample. If frame length is N, then the $j_{th}$ frame can be written as follows:

$$f_j = \{x(i)\}_{i = (j-1)N+1}^{j.N} \tag{1}$$

Energy value can be calculated by using the following equation:

$$E_j = \frac{1}{N} \sum_{i=(j-1)N+1}^{j.N} x^2(i) \tag{2}$$

Where $E_j$ is energy at $j^{th}$ frame and $x_i$ is speech sample at $j^{th}$ frame.

## III. QUESTION ANSWERING SYSTEM

Question Answering System is a system that produces an answer from a question that asked by the user. Three types of question usually posed by the user is Factoid, List and Definition question. This system limits the question type to Factoid question. Factoid question is a question where the answer is a simple fact and usually short.

Question Answering System also can be categorized into two categories based on its scope. There are Open Domain Question Answering (the system can answer any question given by the user) and Closed Domain Question Answering (system only respond to the question in a limited topic). This system limits the scope to Closed Domain Question Answering with Indonesia's History as its topic.

## A. Preprocessing

Preprocessing in text mining consists of 4 steps: Tokenization, Stopword removal, stemming, and Indexing [8]. Tokenization removes symbols, lowercase the text and tokenizes it. Stopword Removal removes words that not necessary like conjunctions. Stemming converts the words into its base form without affix.

This system uses Lucene Search Engine function to remove stopwords and stem words in Indonesian. The algorithm that Lucene used to stem Indonesian words is Porter Algorithm that based on Fadillah Z Tala's "A Study of Stemming Effects on Information Retrieval in Bahasa Indonesia." The Porter stemmer was chosen based on the consideration that its basic idea seems appropriate for the morphological structure of words in Bahasa Indonesia [9].

## B. Question Analysis

To obtain the correct answer, the question that asked by the user must be analyzed. The main purpose is to determine what kind of answer that the question wants. Table 1 shows the relation between question mark and the answer type that question wants.
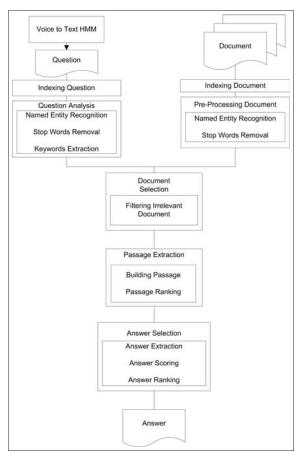
Fig. 1.  Question Answering System Scheme

TABLE I
QUESTION MARK AND ANSWER TYPE RELATIONS

| Answer Type | Question Mark |
|-------------|---------------|
| Name | *Siapa...? Siapakah...? Apa...?* |
| Location | *Dimana..? Darimana..? Kemana..?* |
| Time | *Kapan..? Berapa..?* |

### C. Named Entity Recognition

Named Entity Recognition is a subproblem of information extraction and involves processing structured and unstructured documents and identifying expressions that refer to peoples, places, organizations and companies [10]. This task can be done by using many tools, one of them that applied in this system is Stanford Named Entity Recognizer. Stanford NER is developed by The Stanford Natural Language Processing Group at Stanford University. One of the main advantages from Stanford NER is that this tool has good documentation and run on JAVA, which can run in many OS platform.

Stanford NER classifies the document by using CRF Model to build a classifier. CRF model is chosen because it represents state of the art in sequence modeling, allowing both discriminative training and bi-directional flow of probabilistic

information across the sequence [11]. CRFClassifier builds probabilistic models to segment and labels sequential data. CRFClassifier needs to be trained before classifies the document to build classifier file. A classifier is a machine learning tool that will take data items and place them into one of k classes.

### D. Vector Space Model

Vector Space Model is a way of representing documents through the words that they contain [12]. This model is created based on thought that meaning in document formed by its term and vector is the suitable form to represent that meaning. Since this method represents meaning in a document using a vector, the similarity between document and query can be obtained by calculating the degree that formed between document vector and query vector. This method is called Cosine Similarity and formulated as follows: [13]

$$SC\left(Q, D_i\right) = \frac{\sum_{j=1}^{t} W_{qj} d_{ij}}{\sqrt{\sum_{j=1}^{t} \left(d_{ij}\right)^2 \ \sum_{j=1}^{t} \left(W_{qj}\right)^2}} \qquad (3)$$

Where:
t = total term; $W_{qj}$ = weight of $j^{th}$ term in query; $d_{ij}$ = weight of $j^{th}$ term in document

Weight of term in document can be calculated from its frequency. This method called TF IDF. IDF can be calculated by:

$$d_{ij} = tf_{ij} \times idf_j \qquad (4)$$

$$idf_j = \log_2 \frac{d}{df_j} \qquad (5)$$

Where:
t = total term in document; $tf_{ij}$ = frequency of term $t_j$ in Di document (term frequency); $df_j$ = total document that contains term $t_j$; $idf_j$ = inverse from document frequency; d = total document

The weakness of this TF-IDF method is that if the length of each document isn't equal, then the weight of document with less length will be more smaller than longer document. In order to solve this, TF IDF weight score need to be normalized. The equation used to normalize the weight is:

$$w\left(word_i\right) = \frac{w\left(word_i\right)}{\sqrt{\sum_{i=1}^{n} w^2\left(word_i\right)}} \qquad (6)$$

Where:
$w(word_i)$ = weight from $i^{th}$ term; n = total term each document

### E. Passage Retrieval

A passage is the smallest part of the document. Passage retrieval works with the assumption that in the small parts of each relevant document contains information that relevant to the query. To obtain more accurate result, the document is split into passages. This short passage will be treated as

a single document. In this system, one passage will contain five sentences with the last sentence of the passage will be repeated at first sentence of next passage [3].

*F. Passage Ranking*

The next step after forming passage is to rank the passage. In this step, Named Entity Recognition will be executed again to determine which passage that contains the answer. The passage which had the same entities with the question will be used to the next step. The chosen passage then would be ranked based on following features [14]:

1) Total of relevant entity in passage
2) Total of keyword in passage
3) Total of the longest word from question keyword in document
4) The document rank which the passage come from.

*G. Answer Extraction*

The last step in question answering system is answer extraction. After ranking the passage and take Top N Passage (which in this system is five passage), those passages will be processed to get the answer. The process is as follows [14]:

1) Count the word distance between answer candidate and each keyword from question.
2) The answer candidate that has more keyword from question will be prioritized.
3) If there are some answer candidate that have same distances, then the answer candidate that has higher document rank will be prioritized.
4) If there are some answer candidate that have same document rank, then the answer candidate that has more frequency in answer candidate list will be prioritized.
5) If there are answer candidate that have same frequencies, then answer candidate that processed first will be prioritized.

## IV. EXPERIMENT

All the experiments were done in Indonesia. The configuration that used by speech recognition system in this testing is two states, 1024 codebook, 400 samples per frame with 160 samples overlap. Speech data that trained into the system was taken from one source (Hobert's speech). Total speech data that trained into the system is 900 data, with the composition of 30 words and each word repeated 30 times. Speech data recorded and stored in WAV data format.

The classifier Stanford NER that used in Named Entity Recognition was trained using 20 documents that randomly chosen from document collections with total words are 24489 words. Each word was tagged by reading the content of document manually and determine the correct tag each word based on the context in the document.

The configuration that used by question answering system takes 10 top document from Lucene search results, 5 top passage after ranking the passage, and 1 top answer from all answer candidates. The documents that used as knowledge are 402 Indonesia's History which taken from 11th and 12th-grade

high school material. The document obtained from 5 websites as follows:

1) http://www.materisma.com (151 documents)
2) http://www.gurusejarah.com (127 documents)
3) http://pengertiansejarah.com (84 documents)
4) http://sejarah-interaktif.blogspot.com (35 documents)
5) https://fatihsaputro.wordpress.com (5 documents)

## V. RESULTS AND DISCUSSION

TABLE II
SPEECH RECOGNITION RESULTS (QUESTION NO.5 TO 10)

| Experiment No. | Spoken Word | Recognized Word | Correct |
|---|---|---|---|
| 5 | *kapan* | *kapan* | true |
| | *budi* | *budi* | true |
| | *utomo* | *utomo* | true |
| | *didirikan* | *didirikan* | true |
| 6 | *kapan* | *kapan* | true |
| | *diponegoro* | *utomo* | false |
| | *wafat* | *wafat* | true |
| 7 | *kapan* | *kapan* | true |
| | *hayam* | *hayam* | true |
| | *wuruk* | *wuruk* | true |
| | *wafat* | *wafat* | true |
| 8 | *kapan* | *taman* | false |
| | *konferensi* | *konferensi* | true |
| | *asia* | *sriwijaya* | false |
| | *afrika* | *afrika* | true |
| | *diselenggarakan* | *kerajaan* | false |
| 9 | *kapan* | *taman* | false |
| | *perjanjian* | *perjanjian* | true |
| | *saragosa* | *sriwijaya* | false |
| | *terjadi* | *terjadi* | true |
| 10 | *kapan* | *kapan* | true |
| | *taman* | *taman* | true |
| | *siswa* | *siswa* | true |
| | *didirikan* | *didirikan* | true |

**Table II** shows the speech recognition experiment results for question no.5 to 10. The complete list of speech recognition results can be seen in **Table III**. In each experiment, the speaker (Hobert) speaks the question in one try, then the speech data is split with VAD algorithm into speech token, and each speech token is recognized using speech recognition system. The success rate of Speech Recognition System is 82.31%, obtained by calculating each question's success rate and then average it with other question's success rate. These mistakes occur because of some factors like speech tone variations that still not trained to the system, errors in splitting speech (VAD mistakes) or tone of speech of one word is nearly same with other words.

The example of the tone of speech of one word is almost same with other words can be seen at experiment no. 9 in **Table II**. At that experiment, the system fails to recognize *"kapan"* and *"saragosa"* speech and recognize those words as *"taman"* and *"sriwijaya."* The intonation *"kapan"* is quite

similar with intonation *"taman"* in Indonesian since the suffix of the words contains "an." This tone of spelling makes viterbi algorithm think that *"kapan"* speech as *"taman"* word. For more details look at **Figure 2**.
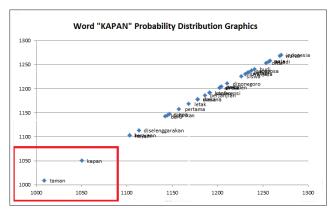


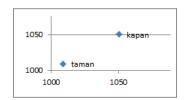Fig. 2. Word *"kapan"* probability Distribution Graphics



Fig. 3. Word *"kapan"* probability Distribution Graphics (Zoomed)

**Figure 2** shows the distribution of word's probability from Viterbi algorithm result. More close the word to center (0,0) means that word has more probability as a correct representation of the speech. From the figure can be seen that word *"kapan"* probability is lower than word *"taman"* since the word *"taman"* is more close to center than word *"kapan"*. Viterbi algorithm decide that word *"taman"* is more suitable as word representation for speech *"kapan"*. n this case, because the intonation when word *"kapan"* is spelled is more similar to the intonation of word *"taman"* trained data than the intonation of word *"kapan"* trained data.

**Table III** shows that when speech recognition result is incorrect, the answer from question answering system also wrong. The failure of speech recognition makes the relevant keyword from the question is lost, and question answering system becomes unable to look for the correct answer. The example of this failure can be seen at question no.6 *"kapan diponegoro wafat"*. In this case, speech recognition failed to recognize speech *"diponegoro"* and recognize it as *"utomo"*. The important keyword from that question is *"diponegoro"* which is person's name. Because of this failure, question answering system is not looking at document about *"diponegoro"* but at *"utomo"* related document, which is certainly incorrect, and produce the wrong answer.

Speech recognition also fails to recognize the question mark words like shown at question 8 and 9 in **Table III**.

TABLE III
EXPERIMENT RESULTS

| No | Questions | Speech Recognition Results | Question Answering Results |
|---|---|---|---|
| 1 | *dimana budi utomo didirikan* | *dimana budi utomo didirikan* | *batavia* |
| 2 | *dimana konferensi asia afrika diselenggarakan* | *dimana konferensi asia afrika masa* | *jenewa* |
| 3 | *dimana letak kerajaan sriwijaya* | *dimana letak kerajaan sriwijaya* | *palembang* |
| 4 | *dimana taman siswa didirikan* | *saragosa taman siapa didirikan* | *mahasiswa* |
| 5 | *kapan budi utomo didirikan* | *kapan budi utomo didirikan* | *tahun 1911* |
| 6 | *kapan diponegoro wafat* | *kapan utomo wafat* | *tahun 1920* |
| 7 | *kapan hayam wuruk wafat* | *kapan hayam wuruk wafat* | *1350 1389* |
| 8 | *kapan konferensi asia afrika diselenggarakan* | *taman konferensi sriwijaya afrika kerajaan* | NO ANSWER |
| 9 | *kapan perjanjian saragosa terjadi* | *taman perjanjian sriwijaya terjadi* | NO ANSWER |
| 10 | *kapan taman siswa didirikan* | *kapan taman siswa didirikan* | *1922* |
| 11 | *siapa pendiri taman siswa* | *siapa pendiri taman siswa* | *pawiyatan wanito* |
| 12 | *siapa presiden pada masa orde baru* | *siapa presiden diselenggarakan masa orde baru* | NO ANSWER |
| 13 | *siapa presiden pertama indonesia* | *siapa presiden pertama indonesia* | *orang indonesia orisinil* |

This failure makes question answering system becomes unable to determine which type of answer that question asks and resulting in "NO ANSWER" verdict.

In case that speech recognition can recognize the question correctly but still produce the wrong answer, like in question no. 5, 11, and 13, the failure is caused by question answering system. The following are the reasons why question answering systems are unable to produce a correct result:

1) Classifier Stanford Named Entity Recognizer fail to recognize answer's name entity, either the correct answer are not tagged, or the answer only half tagged. This failure happened because the training data for creating the classifier is too few.

2) The method used to look for the answers in the document only looks syntactically. This kind of method only seeks the answer based on its position in a document, not based on its meaning. That is why the system cannot look the answer if the answer using substitute words like pronoun or synonym.

3) The scoring mechanism in passage retrieval is not strong enough to rank the passage. The scoring method that used in this system makes the passage that doesn't contain the answer can have the same score or higher than the passage that contains the answers.

## VI. CONCLUSION

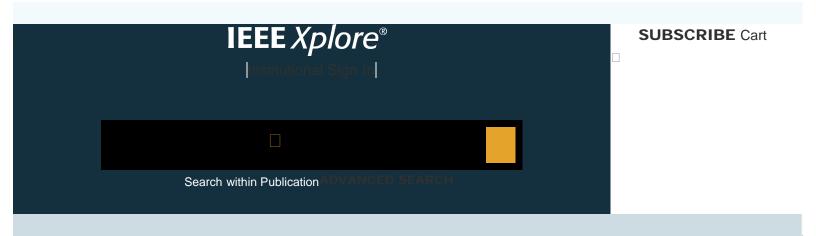There are some points that can be concluded from this experiment:

1) Speech Recognition System's success rate is 82.31%.
2) Question Answering System are able to answer 4 out of 6 questions that correctly recognized by Speech Recognition System.

For the future works, there are some aspects that can be improved in order to archive better results:

1) Use more better sound classification method like Dynamic Time Warping (DCT) or Artficial Neural Network (ANN).
2) Increase the amount of speech training data.
3) Find other way to determine threshold in Voice Activity Detection Algorithm.
4) Increase the knowledge document that used in question answering system.
5) Redesign the scoring mechanism for passage retrieval.
6) Use syntactic and semantic method for looking the answer in document.

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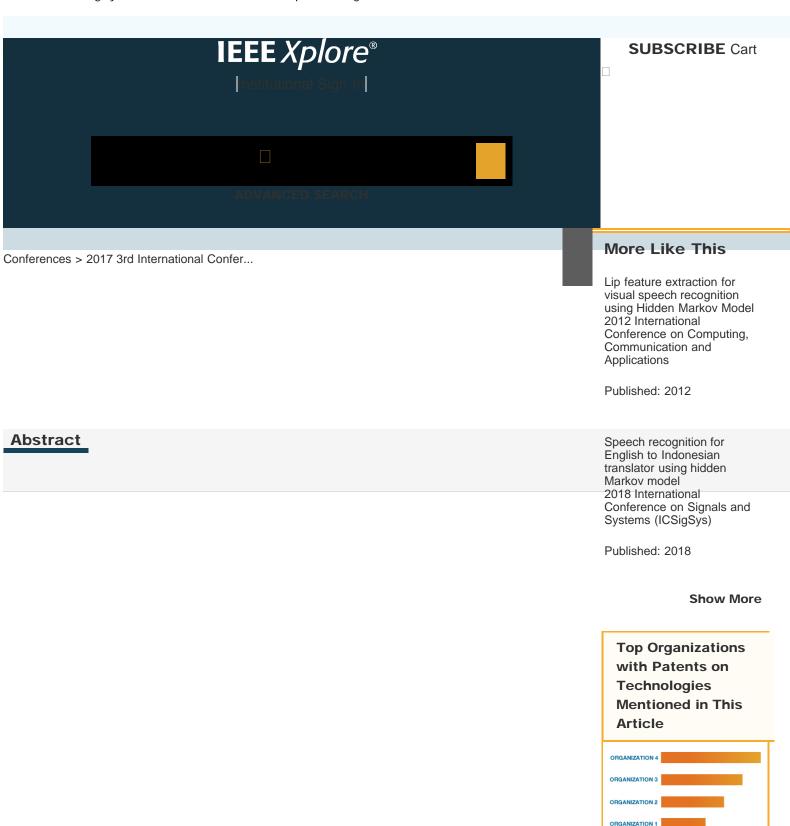WORLDWIDE: +1 732 981 0060
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