PROCEEDINGS

ICACSIS 2014

2014 International Conference on Advanced Computer Science and Information Systems

October 18th and 19th 2014
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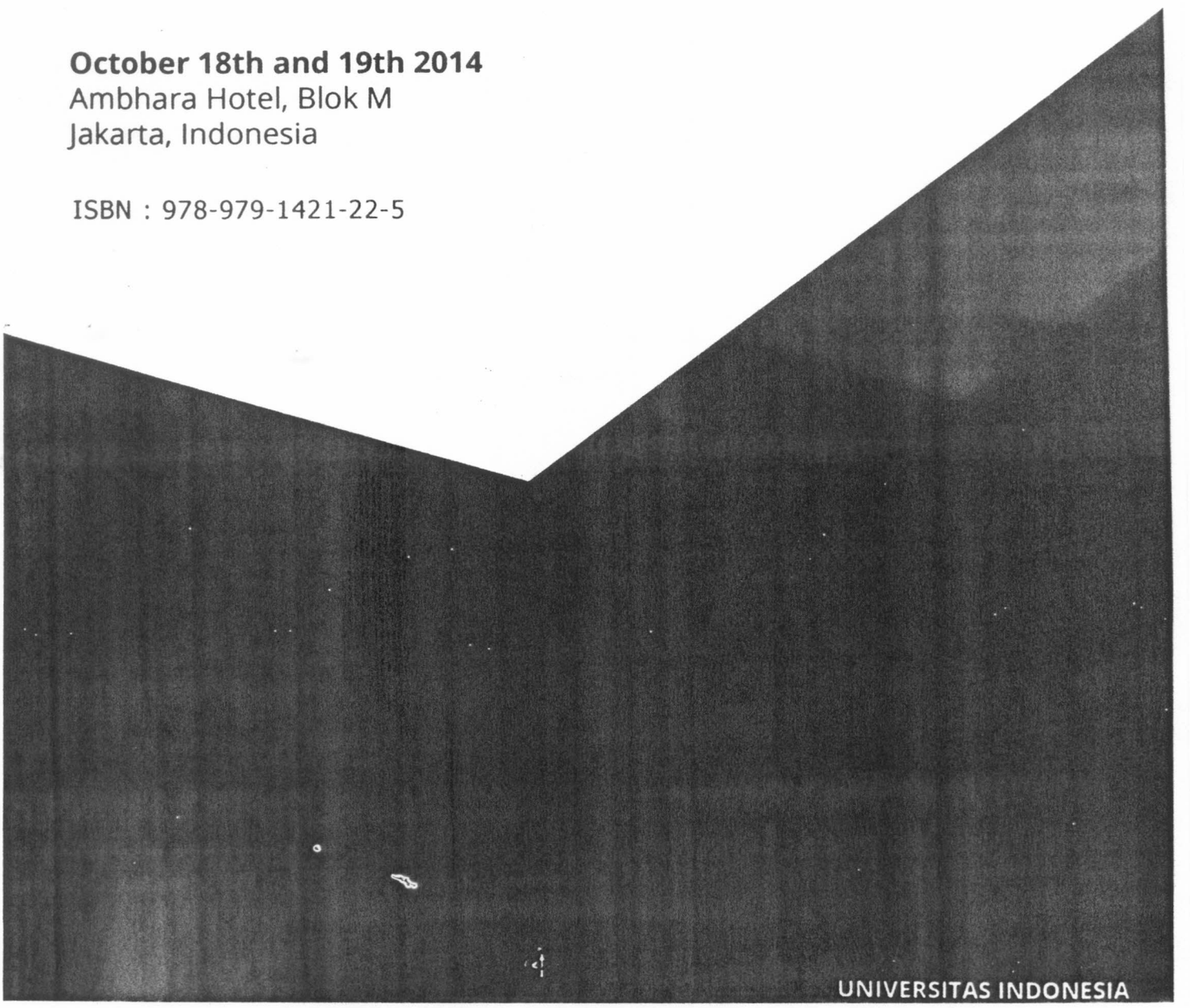

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Advanced Computer Science and Information Systems

(Proceedings)

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Welcome Message from General Chairs

On behalf of the Organizing Committee of this International Conference on Advanced Computer Science and Information Systems 2014 (ICACSIS 2014), we would like to extend our warm welcome to all of the presenter and participants, and in particular, we would like to express our sincere gratitude to our plenary and invited speakers.

This international conference is organized by the Faculty of Computer Science, Universitas Indonesia, and is intended to be the first step towards a top class conference on Computer Science and Information Systems. We believe that this international conference will give opportunities for sharing and exchanging original research ideas and opinions, gaining inspiration for future research, and broadening knowledge about various fields in advanced computer science and information systems, amongst members of Indonesian research communities, together with researchers from Germany, Singapore, Thailand, France, Algeria, Japan, Malaysia, Philippines, United Kingdom, Sweden, United States and other countries.

This conference focuses on the development of computer science and information systems. Along with 4 plenary and 2 invited speeches, the proceedings of this conference contains 71 papers which have been selected from a total of 132 papers from twelve different countries. These selected papers will be presented during the conference.

We also want to express our sincere appreciation to the members of the Program Committee for their critical review of the submitted papers, as well as the Organizing Committee for the time and energy they have devoted to editing the proceedings and arranging the logistics of holding this conference. We would also like to give appreciation to the authors who have submitted their excellent works to this conference. Last but not least, we would like to extend our gratitude to the Ministry of Education of the Republic of Indonesia, the Rector of Universitas Indonesia, Universitas Tarumanagara, Bogor Agricultural Institute, and the Dean of the Faculty of Computer Science for their continued support towards the ICACSIS 2014 conference.

Sincerely yours,
General Chairs

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Welcome Message from The Dean of Faculty of Computer Science, Universitas Indonesia

On behalf of all the academic staff and students of the Faculty of Computer Science, Universitas Indonesia, I would like to extend our warmest welcome to all the participants to the Ambhara Hotel, Jakarta on the occasion of the 2014 International Conference on Advanced Computer Science and Information Systems (ICACSIS).

Just like the previous five events in this series (ICACSIS 2009, 2010, 2011, 2012, and 2013), I am confident that ICASIS 2014 will play an important role in encouraging activities in research and development of computer science and information technology in Indonesia, and give an excellent opportunity to forge collaborations between research institutions both within the country and with international partners. The broad scope of this event, which includes both theoretical aspects of computer science and practical, applied experience of developing information systems, provides a unique meeting ground for researchers spanning the whole spectrum of our discipline. I hope that over the next two days, some fruitful collaborations can be established.

I also hope that the special attention devoted this year to the field of pervasive computing, including the very exciting area of wireless sensor networks, will ignite the development of applications in this area to address the various needs of Indonesia's development.

I would like to express my sincere gratitude to the distinguished invited speakers for their presence and contributions to the conference. I also thank all the program committee members for their efforts in ensuring a rigorous review process to select high quality papers.

Finally, I sincerely hope that all the participants will benefit from the technical contents of this conference, and wish you a very successful conference and an enjoyable stay in Jakarta.

Sincerely,
Mirna Adriani, Dra, Ph.D.
Dean of the Faculty of Computer Science
Universitas Indonesia

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CONFERENCE INFORMATION

Dates	October 18th (Saturday) – October 19th (Sunday) 2014
Organizer	Faculty of Computer Science, Universitas Indonesia
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	Faculty of Information Technology, Universitas Tarumanegara
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ADVANCED PROGRAM *ICACSIS 2014*

PROGRAM SCHEDULE

Saturday, October 18th, 2014-CONFERENCE			
Time	**Event**	**Event Details**	**Rooms**
08.00-09.00	Registration		Dirgantara Room, 2nd Floor
09.00-09.30	Opening	Opening from the Dean of Faculty of Computer Science Universitas Indonesia/General Chair of ICACSIS 2014	
09.30-10.15	Plenary Speech I	Dr. Ir. Basuki Yusuf Iskandar, MA from Ministry of Communication and Information	
10.15-10.30	Coffee Break		
10.30-11.15	Plenary Speech II	Prof. Dame Wendy Hall from Southampton University, UK	
11.15.12.30	Lunch		
12.30-14.00	Parallel Session I : Four Parallel Sessions	**See Technical (Parallel Session I Schedule)**	Elang, Kasuari, Merak, Cendrawasih Room, Lobby Level
14.00-15.30	Parallel Session II: Four Parallel Sessions	**See Technical (Parallel Session II Schedule)**	Elang, Kasuari, Merak, Cendrawasih Room, Lobby Level
15.30-16.00	Coffee Break		
16.00-17.30	Parallel Session III : Four Parallel Sessions	**See Technical (Parallel Session III Schedule)**	Elang, Kasuari, Merak, Cendrawasih Room, Lobby Level
17.30-19.00	Break		
19.00-22.00	Gala Dinner	Dinner, accompanied by music performance and traditional dances	Dirgantara Room, 2nd Floor

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ADVANCED PROGRAM *ICACSIS 2014*

Sunday, October 19th, 2014-CONFERENCE			
Time	**Event**	**Event Details**	**Rooms**
08.00-09.00	Registration		Dirgantara Room, 2nd Floor
09.00-10.00	Plenary Speech III	Drs. Harry Waluyo, M.Hum from Directorate General of Media, Design, Science & Technology Based Creative Economy	
10.00-10.15	Coffee Break		
10.15-11.30	Plenary Speech IV	Prof. Masatoshi Ishikawa from University of Tokyo, JP	
11.30-12.30	Lunch		
12.30-14.00	Parallel Session IV : Four Parallel Sessions	**See Technical (Parallel Session IV Schedule)**	Elang, Kasuari, Merak, Cendrawasih Room, Lobby Level
14.00-15.30	Parallel Session V : Four Parallel Sessions	**See Technical (Parallel Session V Schedule)**	Elang, Kasuari, Merak, Cendrawasih Room, Lobby Level
15.30-16.00	Coffee Break		
16.00-16.30	Closing Ceremony	Awards Announcement and Photo Session	Dirgantara Room, 2nd Floor

ISBN : 978-979-1421-225

ISBN : 978-979-1421-225

Table of Contents

Welcome Message from General Chairs i

Welcome Message from Dean of Faculty of Computer Science University of Indonesia iii

Committees v

Conference Information ix

Program Schedule x

Table of Contents xiii

Computer Networks, Architecture & High Performance Computing

Multicore Computation of Tactical Integration System in the Maritime Patrol Aircraft using Intel Threading Building Block 1

Muhammad Faris Fathoni, Bambang Sridadi

Immersive Virtual 3D Environment based on 499 fps Hand Gesture Interface 7

Muhammad Sakti Alvissalim

Improve fault tolerance in cell-based evolve hardware architecture 13

Chanin Wongyai

A New Patients' Rights Oriented Model of EMR Access Security 19

YB Dwi Setianto, Yustina Retno W. Utami

Element Extraction and Evaluation of Packaging Design using Computational Kansei Engineering Approach 25

Taufik Djatna, Fajar Munichputranto, Nina Hairiyah, Elfira Febriani

Integrated Information System Specification to Support SSTC 33

Ahmad Tamimi Fadhilah, Yudho Giri Sucahyo, Denny

A Real Time Simulation Model Of Production System Of Glycerol Ester With Self Optimization 39

Iwan Aang Soenandi, Taufik Djatna

ISBN : 978-979-1421-225

Development of University of Indonesia Next Generation Firewall Prototype and Access Control With Deep Packet Inspection 45

Harish Muhammad Nazief, Tonny Adhi Sabastian, Alfan Presekal, Gladhi Guarddin

Reliable Data Delivery Mechanism on Irrigation Monitoring System 51

Junaidy Budi Sanger, Heru Sukoco, Satyanto Saptomo

E-Government

Evaluation on People Aspect in Knowledge Management System Implementation: A Case Study of Bank Indonesia 55

Handre Duriana, Ida Ayu Trisnanty, and Putu Wuri Handayani

Government Knowledge Management System Analysis: Case Study Badan Kepegawaian Negara 65

Elin Cahyaningsih, Sofiyanti Indriasari, Pinkie Anggia, Dana Indra Sensuse, Wahyu Catur Wibowo

Shared Service in E-Government Sector: Case Study of Implementation in Developed Countries 73

Ravika Hafizi, Suraya Miskon, Azizah Abdul Rahman

GIS-based DSS in e-Livestock Indonesia 81

Arief Ramadhan, Dana Indra Sensuse, Muhammad Octaviano Pratama, Vina Ayumi, Aniati Murni Arymurthy

Influence Of Presidential Candidates E-Campaign Towards Voters In 2014 Presidential Election In Republic Of Indonesia 87

Yani Nurhadryani, Anang Kurnia, Irsyad Satria

Information Security Risk Management Planning: A Case Study at Application Module of State Asset Directorate General of State Asset Ministry of Finance 93

Sigit Prasetyo, Yudho Giri Sucahyo

Campaign 2.0: Analysis of Social Media Utilization in 2014 Jakarta Legislative Election 99

Dean Apriana Ramadhan

ISBN : 978-979-1421-225

Towards Maturity Model for E-Government Implementation Based on Success Factors 105

Darmawan Baginda Napitupulu

The Critical Success Factors to Develop an Integrated Application of Tuna Fishing Data Management in Indonesia 111

Devi Fitrianah, Nursidik Heru Praptono, Achmad Nizar Hidayanto, Aniati Murni Arymurthy

A Conceptual Paper on ICT as National Strategic Resources toward National Competitiveness}{Basuki Yusuf Iskandar and Fadhilah Mathar 117

Basuki Yusuf Iskandar and Fadhilah Mathar

Enterprise Computing

Quality Evaluation of Airline's E-Commerce Website, A Case Study of AirAsia and Lion Air Websites 123

Farah Shafira Effendi, Ika Alfina

Hotspot Clustering Using DBSCAN Algorithm and Shiny Web Framework 127

Karlina Khiyarin Nisa

Analysis of Trust Presence Within E-Commerce Websites: A Study of Indonesian E-Commerce Websites 131

Muhammad Rifki Shihab, Sri Wahyuni, Ahmad Nizar Hidayanto

The Impact of Customer Knowledge Acquisition to Knowledge Management Benefits: A Case Study in Indonesian Banking and Insurance Industries 137

Muhammad Rifki Shihab, Ajeng Anugrah Lestari

A System Analysis and Design for Sorghum Based Nano–Composite Film Production 143

Belladini Lovely, Taufik Djatna

Moving Towards PCI DSS 3.0 Compliance: A Case Study of Credit Card Data Security Audit in an Online Payment Company 149

Muhammad Rifki Shihab, Febriana Misdianti

ISBN : 978-979-1421-225

An Analysis and Design of Traceability In FrozenVanname Shrimp Product based on Digital Business Ecosystem 155

Taufik Djatna and Aditia Ginantaka

Bayesian Rough Set Model in Hybrid Kansei Engineering for Beverage Packaging Design 163

Azrifirwan and Taufik Djatna

Predicting Smart Home Lighting Behaviour from Sensors and User Input using Very Fast Decision Tree with Kernel Density Estimation and Improved Laplace Correction 169

Ida Bagus Putu Peradnya Dinata, and Bob Hardian

Visual Usability Design for Mobile Application Based On User Personality 175

Riva Aktivia, Taufik Djatna, and Yani Nurhadryani

Formal Method Software Engineering

Interaction between users and buildings: results of a multicreteria analysis 181

Audrey Bona and Jean-Marc Salotti

Digital watermarking in audio for copyright protection 187

Hemis Mustapha and Boudraa Bachir

An Extension of Petri Network for Multi-Agent System Representation 193

Pierre Sauvage

Enhancing Reliability of Feature Modeling with Transforming Representation into Abstract Behavioral Specification (ABS) 199

Muhammad Irfan Fadhillah

Making "Energy-saving Strategies": Using a Cue Offering Interface 205

Yasutaka Kishi, Kyoko Ito, and Shogo Nishida

Extending V-model practices to support SRE to build Secure Web Application 211

Ala Ali Abdulrazeg

ISBN : 978-979-1421-225

Social Network Analysis for People with Systemic Lupus Erythematosus using R4 Framework 217

Arin Karlina and Firman Ardiansyah

Experiences Using Z2SAL 223

Maria Ulfah Siregar, John Derrick, Siobhan North, and Anthony J.H. Simons

Information Retrieval

Relative Density Estimation using Self-Organizing Maps 231

Denny

Creating Bahasa Indonesian - Javanese Parallel Corpora Using Wikipedia Articles 237

Bayu Distiawan Trisedya

Classification of Campus E-Complaint Documents using Directed Acyclic Graph Multi-Class SVM Based on Analytic Hierarchy Process 245

Imam Cholissodin, Maya Kurniawati, Indriati, and Issa Arwani

Framework Model of Sustainable Supply Chain Risk for Dairy Agroindustry Based on Knowledge Base 253

Winnie Septiani, Marimin, Yeni Herdiyeni, and Liesbetini Haditjaroko

Physicians' Involvement in Social Media on Dissemination of Health Information 259

Pauzi Ibrahim Nainggolan

A Spatial Decision Tree based on Topological Relationships for Classifying Hotspot Occurences in Bengkalis Riau Indonesia 265

Yaumil Miss Khoiriyah, and Imas Sukaesih Sitanggang

Shallow Parsing Natural Language Processing Implementation for Intelligent Automatic Customer Service System 271

Ahmad Eries Antares, Adhi Kusnadi, and Ni Made Satvika Iswari

SMOTE-Out, SMOTE-Cosine, and Selected-SMOTE: An Enhancement Strategy to Handle Imbalance in Data Level 277

ISBN : 978-979-1421-225

Fajri Koto

Adaptive Information Extraction of Disaster Information from Twitter 283

Ralph Vincent J. Regalado, Jenina L. Chua, Justin L. Co, Herman C. Cheng Jr., Angelo Bruce L. Magpantay, and Kristine Ma. Dominique F. Kalaw

Citation Sentence Identification and Classification for Related Work Summarization 287

Dwi Hendratmo Widyantoro, and Imaduddin Amin

Experiments on Keyword List Generation By Term Distribution Clustering For Social Media Data Classification 293

Wilson Fonda and Ayu Purwarianti

Tourism Recommendation Based on Vector Space Model and Social Recommender Using Composite Social Media Extraction 299

Husnul Khotimah, Taufik Djatna, and Yani Nurhadryani

Learning to Rank for Determining Relevant Document in Indonesian-English Cross Language Information Retrieval using BM25 305

Syandra Sari and Mirna Adriani

Pattern Recognition & Image Processing

Forecasting the Length of the Rainy Season Using Time Delay Neural Network 311

Agus Buono, Muhammad Asyhar Agmalaro, and Amalia Fitranty Almira

Hybrid Sampling for Multiclass Imbalanced Problem: Case Study of Students' Performance Prediction 317

Wanthanee Prachuabsupakij and Nuanwan Soonthornphisaj

Multi-Grid Transformation for Medical Image Registration 323

Porawat Visutsak

Model Prediction for Accreditation of Public Junior High School in Bogor Using Spatial Decision Tree 329

Endang Purnama Giri and Aniati Murni Arymurthy

ISBN : 978-979-1421-225

Application of Decision Tree Classifier for Single Nucleotide Polymorphism Discovery from Next-Generation Sequencing Data 335

Muhammad Abrar Istiadi, Wisnu Ananta Kusuma, and I Made Tasma

Alternative Feature Extraction from Digitized Images of Dye Solutions as a Model for Algal Bloom Remote Sensing 341

Roger Luis Uy, Joel Ilao, Eric Punzalan, and Prane Mariel Ong

Iris Localization using Gradient Magnitude and Fourier Descriptor 347

Stewart Sentanoe, Anto S Nugroho, Reggio N Hartono, Mohammad Uliniansyah, and Meidy Layooari

Multiscale Fractal Dimension Modelling on Leaf Venation Topology Pattern of Indonesian Medicinal Plants 353

Aziz Rahmad, Yeni Herdiyeni, Agus Buono, and Stephane Douady

Fuzzy C-Means for Deforestration Identification Based on Remote Sensing Image 359

Setia Darmawan Afandi, Yeni Herdiyeni, and Lilik B Prasetyo

Quantitative Evaluation for Simple Segmentation SVM in Landscape Image 365

Endang Purnama Giri and Aniati Murni Arymurthy

Identification of Single Nucleotide Polymorphism using Support Vector Machine on Imbalanced Data 371

Lailan Sahrina Hasibuan

Development of Interaction and Orientation Method in Welding Simulator for Welding Training Using Augmeneted Reality 377

Ario Sunar Baskoro, Mohammad Azwar Amat, and Randy Pangestu Kuswana

Tracking Efficiency Measurement of Dynamic Models on Geometric Particle Filter using KLD-Resampling 381

Alexander A S Gunawan, Wisnu Jatmiko, Vektor Dewanto, F. Rachmadi, and F. Jovan

Nonlinearly Weighted Multiple Kernel Learning for Time Series Forecasting 385

Agus Widodo, Indra Budi, and Belawati Widjaja

ISBN : 978-979-1421-225

Distortion Analysis of Hierarchical Mixing Technique on MPEG Surround Standard 391

Ikhwana Elfitri, Mumuh Muharam, and Muhammad Shobirin

A Comparison of Backpropagation and LVQ : a case study of lung sound recognition 397

Fadhilah Syafria, Agus Buono, and Bib Paruhum Silalahi

ArcPSO: Ellipse Detection Method using Particle Swarm Optimization and Arc Combination 403

Aprinaldi, Ikhsanul Habibie, Robeth Rahmatullah, and A. Kurniawan

3D Virtual Pet Game "Moar" With Augmented Reality to Simulate Pet Raising Scenario on Mobile Device 409

Cliffen Allen, Jeanny Pragantha, and Darius Andana Haris

Automatic Fetal Organs Segmentation Using Multilayer Super Pixel and Image Moment Feature 415

R. Rahmatullah, M. Anwar Masum, Aprinaldi,P. Mursanto, B. Wiweko, and Herry

Integration of Smoke Dispersion Modeling with Earth`s Surface Images 423

A. Sulaiman, M. Sadly

Performance of Robust Two-dimensional Principal Component for Classification 429

Diah E. Herwindiati, Sani M. Isa, and Janson Hendryli

Pareto Frontier Optimization in Soccer Simulation Using Normalized Normal Constraint 437

Darius Andana Haris

Fully Unsupervised Clustering in Nonlinearly Separable Data Using Intelligent Kernel K-Means 445

Teny Handayani and Ito Wasito

Robust Discriminant Analysis for Classification of Remote Sensing Data 449

Wina, Dyah E. Herwindiati, and Sani M. Isa

Automatic Fetal Organs Detection and Approximation In Ultrasound Image Using Boosting Classifier and Hough Transform 455

ISBN : 978-979-1421-225

M. Anwar Ma'sum, Wisnu Jatmiko, M. Iqbal Tawakal, and Faris Al Afif

Particle Swarm Optimation based 2-Dimensional Randomized Hough Transform for Fetal Head Biometry Detection and Approximation in Ultrasound Imaging 463

Putu Satwika, Ikhsanul Habibie, M. Anwar Ma'sum, Andreas Febrian, Enrico Budianto

Digital Library & Distance Learning

Gamified E-Learning Model Based on Community of Inquiry 469

Andika Yudha Utomo, Afifa Amriani, Alham Fikri Aji, Fatin Rohmah Nur Wahidah, and Kasiyah M. Junus

Knowledge Management System Development with Evaluation Method in Lesson Study Activity 477

Murein Miksa Mardhia, Armein Z.R. Langi, and Yoanes Bandung

Designing Minahasa Toulour 3D Animation Movie as Part of Indonesian e-Cultural Heritage and Natural History 483

Stanley Karouw

Learning Content Personalization Based on Triple-Factor Learning Type Approach in E-learning 489

Mira Suryani, Harry Budi Santoso, and Zainal A. Hasibuan

Adaptation of Composite E-Learning Contents for Reusable in Smartphone Based Learning System 497

Herman Tolle, Kohei Arai, and Aryo Pinandito

The Case Study of Using GIS as Instrument for Preserving Javanese Culture in a Traditional Coastal Batik, Indonesia 503

Tji beng Jap and Sri Tiatri

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Reliable Data Delivery Mechanism on Irrigation Monitoring System

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***Abstract*—Monitoring activity is one of implementation of automatically irrigation system. This activity is closely related to data transmission. Wireless communication channels are not free of noise interferences. This paper proposes the development of monitoring irrigation system with a reliable data delivery mechanisms in which TCP protocol handles senders sending their data to a receiver. The research designs an irrigation system architecture consisting of main and field controllers. The main controller is a receiver as a server that designs with concurrent and connection-oriented mode. The field controller consist of gateway (Raspberry Pi) as a sender, sensor node (Arduino Leonardo), sensor and actuator. In order to ensure the design of the data delivery architecture is well defined, analysis is carried out to calculate throughput, packet loss ratio, and packet delay to verify the design. In addition, the error control features will be added to complement these mechanisms in further research.**

I. Introduction

Irrigation is an effort to fulfill water needs of plants so that can grow optimally with the provision of additional water [2]. The water resources if used continuously will be limited so it will need to do an effort in the management of water use efficiency in agriculture, especially for irrigation so that no crisis of water resources in the future. The irrigation system is widely applied especially in Indonesia is a conventional irrigation system. In practice, it is very time-consuming and labor. Therefore, it is necessary to have an irrigation system that can create an environment that fits the needs of plants automatically. It means the system is able to provide the amount and timing of water as needed. One implementation of an automatic irrigation system is monitoring.

The monitoring activity is closely related to data transmission. The most crucial thing in data transmission is how to transmit data from one place to another place, where the data received it should be same to data sent. Irrigation monitoring data is important because it will be used in the decision-making process. This process is the further process of automatic irrigation itself, such as how to control setting of irrigation network, how to open or close the floodgates, and how much flow of water to be used so that it can conserve water usage later.

In recent years, there has been increasing demand for digital data transmission system that is efficient and reliable [6]. Currently, one of the communication channels for the transmission of digital data that has been growing very rapidly is the internet. With the internet, everyone in Indonesia and even around the world that can send data and information with each other without any constraints of time and distance. There are several interference that can cause errors in data transmission which is white noise or thermal noise, impulse noise, crosstalk, echo, jitter, distortion, and attenuation [9]. Internet or other communication channels will also not free from noise interference. This situation can lead to the information received does not same to the information sent. There are many solutions that can be offered to resolve the above problem, one is to try to detect and correct errors from the data that has been damaged by noise.

At present, the development of computer technology has significant influence in human life. Many new breakthroughs that also appear to consider need for more capacity as that of the computer. One of them is microcontroller. It is a single chip computer that has the ability to be programmed for a variety of tasks aimed at the control-oriented. It will arise due to market requirements is the need of current electronic products will be smart devices to the data controller, and the development of new technology that enables very fast computation, small size and cheap. Besides of its, other breakthroughs are also mini-sized PC, one of which is Raspberry Pi. It is a single board computer, size of a credit card and using open source Linux-based [5]. This mini-sized computer can work like a desktop computer for example create a document, process data with spreadsheets, watch movies, play games, internet, and of course can be used to write programs (coding).

This paper is a part of our research that aims to establish a reliable data delivery mechanism by applying error detection and correction, and setting

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traffic data, so that this mechanism is expected to reduce the error rate of data delivery in monitoring irrigation systems.

II. Related Works

Several studies related to this research to be conducted, in [15], the authors has develop an automated irrigation system using a WSN and GPRS module, the system has potential to be useful in water limited geographically isolated areas. It was found to cost effective for optimizing water resources for agricultural production. In [10], the authors has proposed a fast mechanism for retransmission solution on TCP. The aim of this mechanism is to avoid waiting time too long. A detailed model of the ARQ protocol and TCP using standard Markov techniques is reconfigurable protocol has been developed to improve TCP over wireless [3]. The design optimization of real-time applications in wireless network with the combination of FEC and ARQ to reduce retransmission had developed [1]. In [8], authors has developed an approach to data transmission over wireless networks broadcast on ZigBee. The solutions propose to improve performance of wireless TCP [12 – 14] which involves ARQ protocol, link layer retransmission and FEC. The Authors [11] has develope an implementation, simulation and analysis of TCP with FEC. And over Rayleigh fading channel, the authors [4] has conducted experiments to compare the performance of RS code and BCH code.

III. Research Method

A. Data Acquisition

The data used in this study is data from soil moisture sensor. It is shown in (Fig. 1). The process of data acquisition is performed on the Arduino Leonardo using XBee then stored on the Raspberry Pi. The Arduino Leonardo using Xbee is shown in (Fig. 2). The Raspberry Pi is shown in (Fig. 3). The data of sensor node that will be used as an informational message to be sent to the receiver. The data consists of datetime, set point lower limit, set point upper limit, name of sensor, value of sensor, and actuator status and it stored in the form of a text file. Data Structure of sensor node is shown in (Fig. 4). And the architecture of data acquisition is shown in (Fig. 5).

B. Design System Architecture

System designed consists of two parts namely main and field controller. The main controller is a server and it acts as a receiver and field controller as a sender. The Field controller consist of gateway (sender), sensor node, sensor, and actuator. The architecture is shown in (Fig. 6).

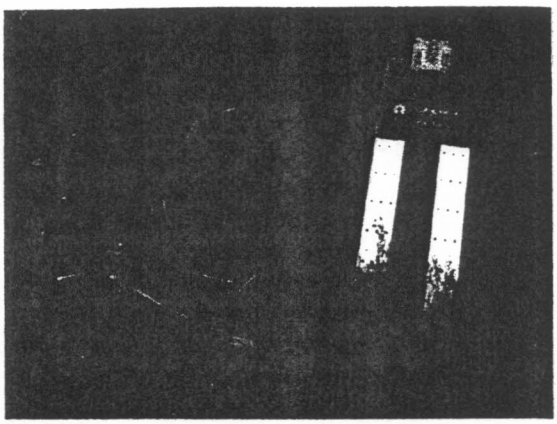

Fig. 1. Sensor soil moisture

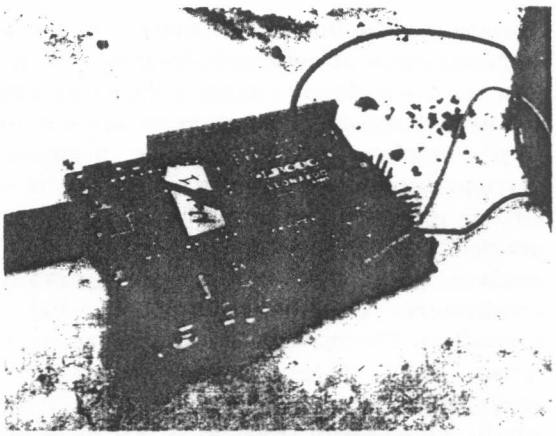

Fig. 2. Arduino Leonardo + XBee (sensor node)

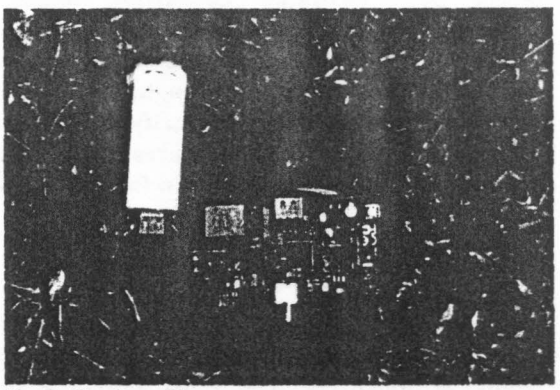

Fig. 3. Raspberry Pi

Datetime	Set point Lower Limit	Set point Upper Limit	Name of Sensor	Value of Sensor	Actuator Status

Fig. 4. Data structure of sensor node

The number of gateway that use one or more than one. Gateway using Raspberry Pi. Sensor node using Arduino Leonardo and sensor used is soil moisture sensor. The protocol used for communication between sender and receiver to establish reliable data communication is TCP. It is a standard protocol communication in Internet.

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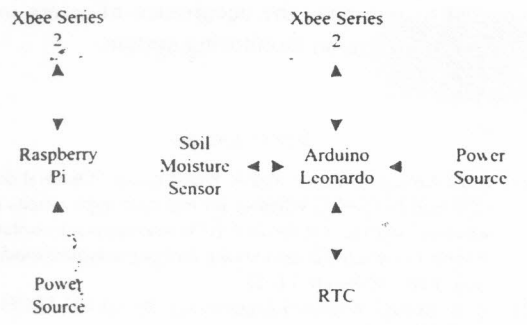

Fig. 5. Data acqusition architecture

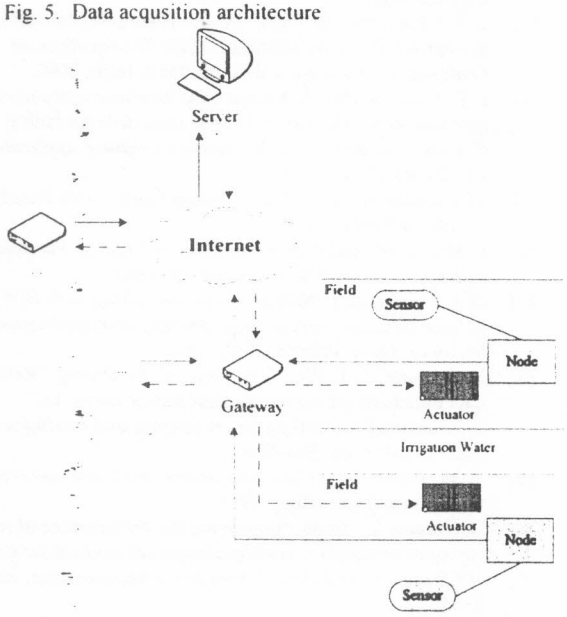

Fig. 6. The system architecture

The system architecture is designed to involve one or more than one sender to send data to receiver. It means the server must be able to handle the concurrency that will occur, and problem of congestion and collision in data transmission.

Concurrent processing is fundamental to distributed computing and occurs in many form among machines on a single network, many pairs of application programs can communicate concurrently. Concurrency among client programs occurs when users execute them on multiple machines simutaneously or when a multitasking operating system allows multiple copies to execute concurrently on a single computer [7].

C. Design Error Control Data (For the Further Research)

The error control of data that will be designed using the BCH code. It consist of encoding and decoding. The encoding process is a process to perform calculations of checkbit that inserted into information messages. This process performed on the sender. The process steps of encoding using BCH code [6] are form a galois field GF(2^m), determining $2^m - 1$ minimal polynomial, generator polynomial is the least common multiple of multiplying all the minimal polynomial are selected, adding binary bits 0 behind of bits information message, perform binary division of the combined operation of information message and bits 0 with generator polynomial, and then the bits of information message included check bits are transmitted. And the decoding process are calculating the value of syndrome of the received polinomial, determining error location polynomial, and determining error location numbers and correction error occurs. Error can be detected on the step calculating value of syndrome. If the residual of division operation on the information message include check bits by generator polynomial is 0 then no error occurs, and otherwise if not 0, then an error has occured.

IV. EXPERIMENT AND RESULTS

There is a receiver as server and senders. Port receiver used is 20000, size of length buffer is 512. Server running in C with command ./server,

```
Port: 20000,
length buffer: 512
...
Waiting for incoming connection
...
New_socket = accept()
Begin thread
...
Looping block size packet
...
End thread (closesocket(sender))
...
Waiting for incoming connection
  ...
```

and senders to send data with command ./client,

```
length buffer: 512
...
Recv(new_socket, ...)
Send(new_socket, ...)
Closesocket(new_socket, ...)
End_thread
...
```

The test of this system is using 3 sender and the scenario: Data sent every 15 minutes, and data consist of 3 record sensor every 5 minutes. Total data that can send by sender is 96 in one day. The calculation formula is as follow in (1). The delay time sensor to sender is according to user needs.

Total data (per day) = n devices * 24 hours * (60 minutes / delay time sensor to sender)

(1)

Format of monitoring data is shown in (Fig. 7).

```
15:40:55 7/6/2014 300 800 1 783 OFF
15:40:55 7/6/2014 300 800 2 693 OFF
15:40:55 7/6/2014 300 800 3 344 OFF
```

Fig. 7. Monitoring data

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Throughput

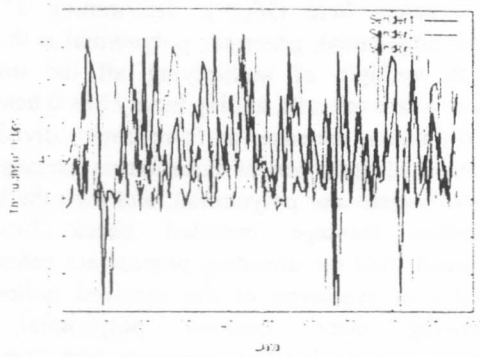

Fig. 8. Throughput transmission of monitoring data over ADSL network

Based on test results, the average of throughput monitoring data transmission all sender to receiver via ADSL network (testing network) is 41.9334 Kbps for 331 bytes of text file. Sender 1 is 43.23465 Kbps, sender 2 is 41.53512 Kbps, and sender 3 is 41.03043 Kbps. The throughput is shown in (Fig. 8).

Packet loss ratio

Based on test result, total per sender is 96 monitoring data sent succesfully, there is no packet loss.

Packet Delay

Based on test results, the average of packet delay monitoring data transmission all sender to receiver via ADSL network is 0.034018 second for 331 bytes of text file. It is shown in (Fig. 5). Sender 1 is 0.034418 second, sender 2 is 0.034206 second, and sender 3 is 0.033431 second. The delay is shown in (Fig. 9).

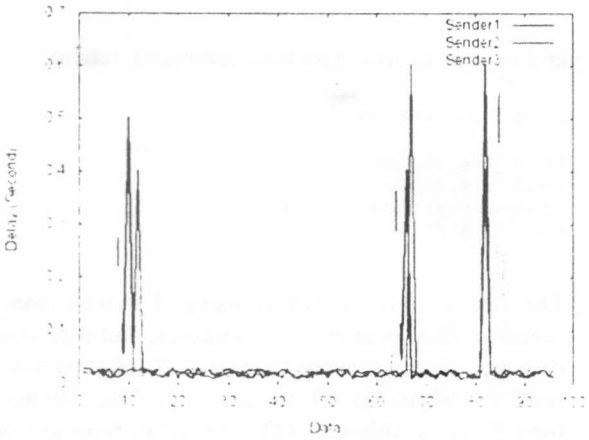

Fig. 9. Packet delay transmission of monitoring data over ADSL network

V. Conclusion and Future Works

We have proposed implementation of data delivery mechanism using TCP protocol from one or multiple sender to receiver. For the future, we will continue to be develop the delivery mechanism that will be equipped with error detection and correction methods. For the next implementation, data sent over 3G GSM network. TCP protocol and error control features are expected to minimize the occurrence of errors in data delivery on irrigation monitoring system.

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