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PROCEEDINGS

"GREEN TECHNOLOGY STRENGTHENING IN INFORMATION TECHNOLOGY, ELECTRICAL, AND COMPUTER ENGINEERING IMPLEMENTATION"

IEEE

2015 2nd International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE)

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Foreword from General Chair of ICITACEE 2015
Universitas Diponegoro, Semarang – Indonesia

Dear Colleagues,

On behalf of Technical Committee and Organizing Committee of ICITACEE 2015, I am honored to welcome you to **The 2nd International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE 2015)**. The conference is planned to be conducted annually. This conference program is organized by Computer Engineering Department, together with Electrical Engineering Department, Faculty of Engineering, Diponegoro University, Semarang. The main theme of the conference is "Green Technology Strengthening in Information Technology, Electrical and Computer Engineering Implementation".

The conference aims to provide a forum for researchers, academicians, professionals, and industries to expose and exchange innovative ideas, methods, and experience in information technology, computer engineering, as well as in electrical engineering, and their applications, related with the aspects of green technology. This conference also provides forum for researchers, scientists, and engineers to exchange ideas and their current achievements.

In this year we have received more than 120 paper submissions from various universities, research centers, and as well as from industries from many countries. However, after in-depth review, the Technical Committee accepted 80s high quality papers to be selected and presented in this conference. The accepted papers are categorized into five groups, there are: Information Technology and System, Signal and Circuit, Power and Control Engineering, General Papers, and Interdisciplinary Papers related to Green Technology. All accepted and presented papers will be submitted for uploading to the IEEE Xplore digital library.

We thank all authors and all parties which cannot be mentioned here who have contributed and participated in presenting their works at this conference. Thank you for IEEE Indonesia Section for supporting this conference. We also gratefully acknowledge the important review supports provided by members of Conference Committee from Indonesia or abroad. Their efforts were crucial to the success of the conference. We are also so blessed by the presence of 3 (three) invited Keynote Speakers from different institutions which will address the important trends relating to green technology strengthening in information technology, electrical and computer engineering implementation.

Finally, we wish you all can enjoy two days discussion through this conference and could spend to enjoy the beauty of Semarang City in one day City Tour that will be held after closing ceremony. We hope to meet you again in the next conference, the 3rd International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE 2016).

Dr. R. Rizal Isnanto

General Chair of ICITACEE 2015

Foreword from Dean of Engineering Faculty
Universitas Diponegoro, Semarang – Indonesia

The 2nd International Conference on Information Technology, Computer, and Electrical Engineering 2015 (ICITACEE 2015) is now held again as a part of 57th Faculty of Engineering Dies Natalis and 58th Diponegoro University Dies Natalis agenda.

The aims of the conference are to obtain and to extend the knowledge of the recent issues, opinions, bright ideas about the development of a comprehensive green technology. ICITACEE 2015 invites the scholars and encourages the researchers to submit high quality manuscripts and papers to this conference. It is also to share extensively and exchange of ideas, thoughts and discussions on all aspect of information technology, information systems, power systems, signal processing, electronics, micro-electronics, biomedical engineering, and communication systems as well as other field that corresponds, such as intelligent systems, intelligent transportation applications, health care applications, and environmental protection to facilitate the formation of networks among participants of the conference for improving the quality and benefits of the research.

It is a great pleasure to welcome all the participants of this conference in Semarang. I also would like to welcome several members from Technology University of Malaysia (UTM), Diponegoro University, Bandung Institute of Technology, Gadjah Mada University, and so on.

I do hope that this conference to be a valuable forum for engineers and scientists to share their precious researches and this event will give significant contributions to the development of Information Technology, Computer, and Electrical Engineering and it will raise the awareness of scientific community members in bringing better life.

I hope that the conference will be stimulating and memorable for you. So, enjoy your time in Semarang.

Ir. M. Agung Wibowo, MM, MSc, PhD
Dean of Faculty of Engineering
Diponegoro University, Semarang-Indonesia

Foreword from IEEE Indonesia Section Chair

Dear colleagues, Professors, researchers, ICT professionals, ladies and gentlemen, good morning.

On behalf of IEEE Indonesia section, I would like to express my sincere gratitude and welcome you to the 2nd International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE 2015). The conference is an annual event, organized in collaboration between Computer Engineering Department and Electrical Engineering Department, Diponegoro University. In this year, the conference is organized by Computer Engineering Department, Diponegoro University, Semarang Indonesia.

ICITACEE 2015 with the theme Green Technology Strengthening in Information Technology, Electrical and Computer Engineering Implementation, has been approved and technically co-sponsored by IEEE Indonesia Section, with the conference No. #36226. The previous conferences in 2014 were also technically co-sponsored by the IEEE and successfully held in Semarang on 07 Nov 2014. The ICITACEE 2014 publication has been indexed by IEEE Xplore® Digital Library and Scopus.

As we may aware, IEEE is one of the largest professional associations in the world. Having been founded over 130 years ago, nowadays it brings together over 432,000 active members in more than 160 countries. This is the world's largest technical professional society, dedicated to fostering technological innovation and excellence for the benefit of humanity. IEEE provides more than 3.5 million digital libraries and currently has organized about 1,300 annual conferences, worldwide.

IEEE Indonesia section, which is a part of IEEE global, has already been established for 28 years. It currently has about 1,395 active members, with activities in 6 society chapters, namely Computer Society Chapter, Communications Society Chapter, Circuits and Systems Chapter, Engineering in Medicine and Biology Chapter, Solid State Circuits Society Chapter, and Power and Energy Chapter. Moreover, IEEE Indonesia section also has 4 joint chapters, namely Joint chapter of Microwave Theory / Antennas & Propagation, Joint chapter of Aerospace & Electronics Systems Society / Geoscience & Remote Sensing Society, Joint chapter of Control System Society / Robotics & Automation Society, and Join Chapter of Education Society / Electron Devices Society / Power Electronics Society / Signal Processing Society.

IEEE Indonesia Section has 25 student branches in several universities in Java, Sumatera, Bali and Sulawesi islands and three Affinity Groups, namely Women in Engineering, SIGHT in Telemedicine, and SIGHT in Humanitarian Technology.

IEEE Indonesia section has organized several activities almost weekly. Its activities are related to Technical, Education, and Social Activities, such as ICT Training, Workshop, International Seminar, Focus Group discussion, and Distinguish Lecturer Tour (DLT) activities all around Indonesia. The main discussed topics are related to the technology for humanity, such as Internet of Things (IoT), Artificial Intelligent, Robotic technology, Biomedicine Technology, Antenna and Microwave, Circuit and Device, Renewable Energy, etc. Recently, IEEE Indonesia section organized two days 5G training; with the trainer is the one of the worldwide recognized professor in the field of Wireless Communication. We believed that it was the first 5G training activities in the Asia Pacific region.

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 also participated in the preparation of forming a new regulation related to the ICT in Indonesia.

Through this opportunity, I would also like to highlight that Indonesia is an emerging country, one of the fastest growing countries in South East Asia and Pacific. Based on International Data Corporation, Indonesia has become the largest spender on ICT in South East Asia and is ranked 19th by spending globally. This is related to the Indonesia Economic Masterplan to 2025 (MP3EI) that Indonesia has ambitious plans and strategies to accelerate the economic development through ICT infrastructures.

As a critical hub to the Sub-Districts and Villages, the Palapa Ring Development Project connects 34 provinces and 440 cities/districts, stitching a circumference of 36,000 km fiber optics cable. The National Backbone Network, the Palapa Ring, will be completed with the last implementation in the submarine cable in the most eastern part, Papua Province. The National Network capacity and speed would be much improved with its completion. A network failure or disconnection in the Ring would be compensated by rerouting traffic through the other side.

However, the challenge is how to make these plans come into fruition and provide greater access to ICT beyond Jakarta and the Island. Palapa Ring connects Provinces and all Districts, as a critical hub to the Sub-Districts and Villages. The capacity is practically unlimited (Tbps), cheaper access and better guarantee of continuity.

The Palapa Ring could easily provide Network Transit for Asia and Pacific Region, between the Indian and Pacific Oceans and the three (3) Continents (Asia-Australia-Americas). It would be easy to access our neighboring ASEAN countries, Singapore, Brunei Darussalam, Malaysia, Philippines, and Thailand.
The ICITACEE 2015 conference provides a forum for researchers, academicians, professionals, and students from various engineering fields and with cross-disciplinary working or interested in the development and design of information technology, computer system, and electrical engineering to interact and disseminate the latest issues and researches. It also offers opportunity to enjoy the heritage and the beauty of Semarang.

I do hope in the near future the event will be continued and strengthened, so the result will give more benefit and positive impact to the Indonesian people. Technology drives innovation, people can do more, do better. Technology drives higher quality of life, people can live better.

In this occasion, I would also like to say welcome to Semarang, one of the famous destinations in Indonesia. Semarang serves beautiful heritages, mountain and scenery with warm and friendly people, a vibrant culture and lifestyle.

Finally, we do hope all of you will have enjoyable and valuable experience. During this 3 days conference, you may share your best knowledge in your area of research and professional activities.

Thank you.
Semarang, 16 October 2015.

IEEE Indonesia Section Chair

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Design of Multi-sensor IMU for Land Vehicle

Wahyudi, Ngatelan
Department of Electrical Engineering, Faculty of Engineering
Diponegoro University
Semarang, Indonesia
wahyudielektro@undip.ac.id, ngatelan@undip.ac.id

***Abstract*—Inertial Measurement Unit (IMU) to measure the angular rate and acceleration in three axes is an important part of the land vehicle navigation control system. Land vehicle motion has more wide range of acceleration in x axis and angular rate in z axis than the other axis. A sensor with high sensitivity has a short range of measurement, and vice versa. To get the optimum sensitivities of all sensors, multi-sensor system should be applied in wide range of motion. The main components of IMU are microcontroller, gyroscope, and accelerometer. Micro-controller received two accelerations data in x axis and two anguler rate data in z axis. Selecting algorithms of sensor data are used to obtain six Degree of Freedom (6-DOF) of land vehicle. IMU was tested using variation of acceleration and angular rate motion, and shown that the proposed method gives the angular rate and acceleration data with the higher sensitivity. IMU has good linearity of measurement in acceleration and angular rate. This system can be used to look at the driver when he accelerate or brake suddenly.**

Keywords—IMU; multi-sensor; selecting algorithm; sensitivity

I. INTRODUCTION

IMU which be applied in many navigation systems such as for mobile platforms [1], spin-stabilized of sounding rocket [2], autonomous of vehicle navigation [3], and personal navigator [4] uses either the accelerometer or the gyroscope or both as the main component. Gyroscope, the angular rate sensor, and accelerometer, the acceleration sensor, are used to detect the rotational motion and the translational motion, respectively. In general, sensor has limited range of measurement, so a sensor with high sensitivity has a short range of measurement, and vice versa. The land vehicle IMU requires a high sensitivity and wide range of measurement therefore we proposed multi-sensor system that should be applied in IMU design. Various methods to get wide range of measurement have been proposed in the literature using free gyro system from 9 accelerometers [5,6] to 13 accelerometers [7]. Kalman filter has been used to estimate sensor parameter [2], error of parameter [3], and to remove noise [8]. Exponential filter is used to remove noise [9] and double exponential smoothers run faster than Kalman filter in equivalent prediction performance [10]. This paper propose methode for width range mesurement and improve the sensitivity. This paper is organized as follows. The underlying is presented in Section II. Section III details the design of hardware and software of IMU proposed in this paper. Experimental results are given in Sections IV. Finally, Section V summarizes the main conclusions of this paper.

II. THE UNDERLYING

A. Motion of Land Vehicle

The land vehicle has 6-DOF, translational and rotational, along and about the land vehicle axes. The acceleration and angular rate sensors are used to detect the translational and rotational motions, respectively. The wide range of acceleration in x axis and rotation in z axis can be divided into 2 segments proportionally as shown in Fig. 1 and Fig. 2.

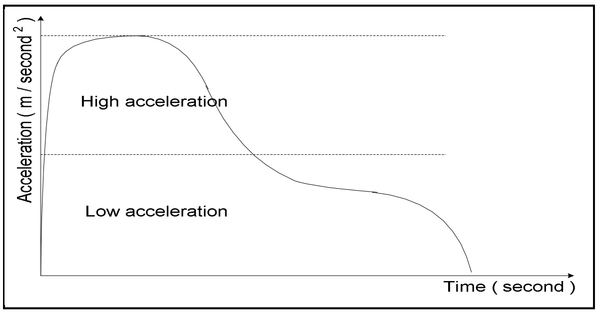

Fig. 1. Acceleration level.

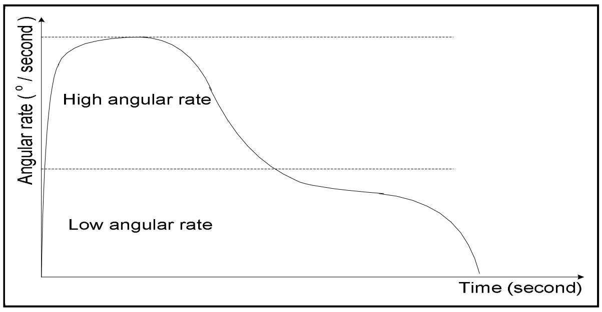

Fig. 2. Angular rate level.

B. Sensors

Design of multi-sensor IMU used 2 types of gyroscope, i.e. LPR503AL and LPR530AL, and an accelerometer, i.e. MMA7361L. The gyroscopes are low cost, low current, and has good resistance to shock. LPR503AL and LPR530AL are

2-axis gyroscope sensor with angular velocity ± 30°/s and 1-axis gyroscope sensor with angular velocity ± 300°/s respectively. The sensors can be operated by a voltage range between 2.7 V and 3.6 V and a temperature range between -40° C and +125° C. Sensor will damages despite of the shock acceleration is up to ±3000 g. The MMA7361L has signal conditioning, a 1-pole low pass filter, temperature compensation, and g-select which allows for the selection between 2 sensitivities. Sensitivity can be selected between 800 mV/g and 206 mV/g at maximum acceleration to ± 1.5 g and at maximum acceleration to ± 6g, respectively. Sensor will not be damaged despite the shock acceleration up to ± 500g and be operated at a temperature of -40° C to +125° C.

C. Microcontroller

XMega128A1 is a microcontroller which has a speed of 1 million instructions per second (MIPS) per 1 MHz crystal frequency. This microcontroller is equipped with an internal crystal with a frequency of 32 MHz and has six 8-bit ports, i.e. port A to port F. There are 2 ports, namely A and B ports, which can be used as an ADC input. There are 4 ports that can be used as serial ports, i.e. C, D, E, and F ports respectively.

III. Design of IMU

Design of IMU have been done for two steps: (1) Design of hardware and (2) Design of software.

A. Design of Hardware

IMU employs 4 gyroscopes and 4 accelerometers. Two gyroscopes and 2 accelerometers are in z axis and in x axis, respectivelly, and in the other axes, we use a gyroscope and an accelerometer. Outputs of 4 accelerometer and 4 gyroscopes are received by microcontroller via port A and port B, respectively. However, the outputs of sensor have much noise and to reduce it used the analog low pass filter. Digital data of sensors are selected to obtain of 6 DOF and filtered digitally by exponential filter. Design of IMU is shown in Fig. 3.

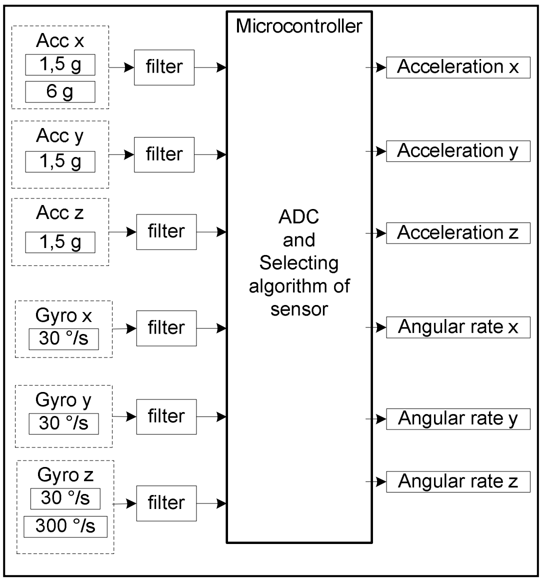

Fig. 3. Design of IMU.

Hardware of multi-sensor IMU is shown in Fig.4.

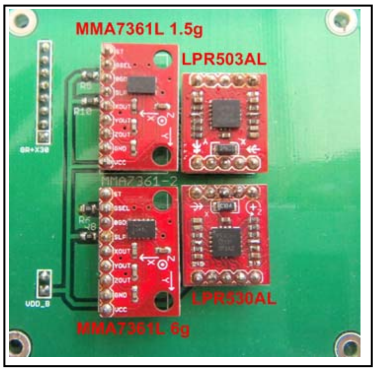

Fig. 4. Hardware of IMU.

Before applied in land vehicle, IMU shoud be calibrated. The three-axis motion simulator model ST-3176-TC-10 was used to calibrate IMU. This simulator is a high accuracy position and rate system designed for the test and calibration of high performances inertial guidance systems, combined technology guidance equipments, inertial grade sensors. The fist axis, inner or roll axis has a max rate 1000 °/s. The second axis, middle or pitch axis has a max rate 600 °/s. The third axis, outer or yaw axis has a max rate 400 °/s. The resolutions of all axes are 0.00001. Calibration process was done under the room temperature. Before calibration, IMU should be installed in chamber of standard device and connected with all data cable and power supply to computer via DB 25 connector. Fig. 5 shows three-axis motion simulator.

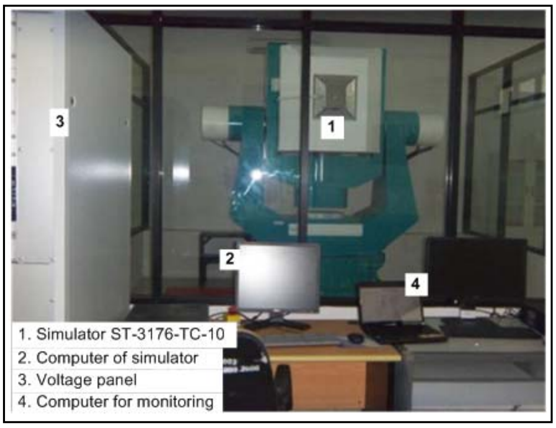

Fig. 5. Three-axis motion simulator.

Experiment setup of gyroscope and accelerometer calibration was divided into two steps which calculate scale factors and run test the calibrated sensors. Algorithm to calculate scale factors is as following; 1) rotate the chamber as the axis and angle target determined, 2) read all sensor data and calculate the sensitivity and scale factor. The algorithm to run test of IMU can be summarized in the following steps; 1) use the calibration result of each sensor, 2) rotate the chamber in three-axis as the angle target determined, 3) compare the measurement angle using IMU and the angle target.

B. Design of Sofware

Algorithm of Selecting the Sensor Data (SSD) is used to select sensors with higher sensitivity. The SSD algorithms for angular rate and acceleration are shown as flowchart in Fig.6 and Fig.7, respectively. The microcontroller reads all of acceleration and angular rate data of all the sensors that are used. The data were taken from the sensor with higher sensitivity, in order to obtain more accurate of measurement results.

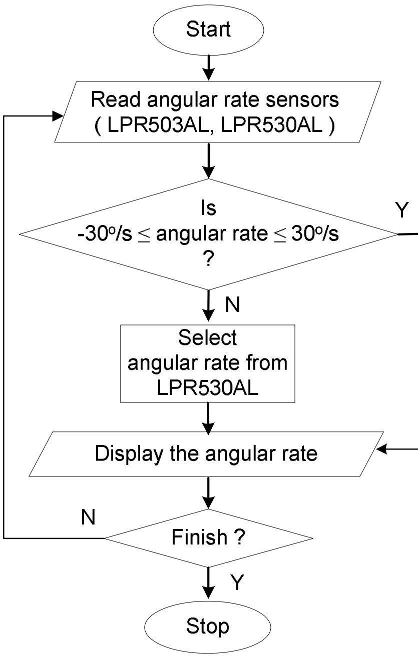

Fig. 6. Flowchart of selecting anguler rate data.

Microcontroller read angular rate data from LPR503L and LPR530L. If angular rate is more or equal than -30° or less or equal 30°, angular rate data will be display from LPR503L.

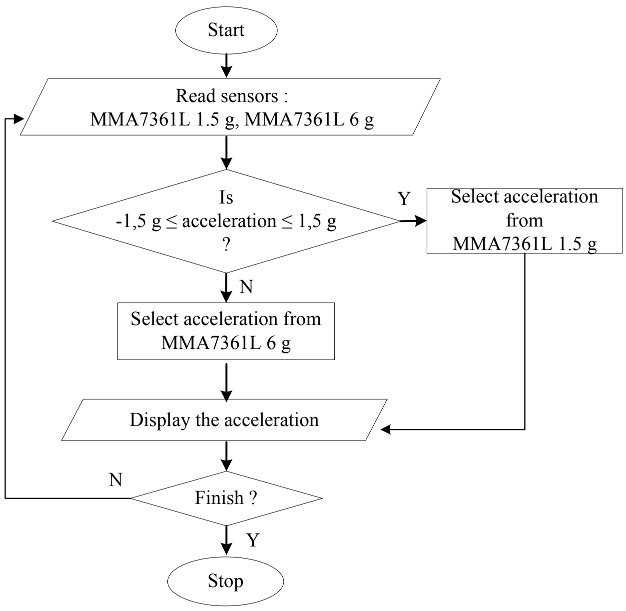

Fig. 7. Flowchart of selecting acceleration data.

Microcontroller acceleration data from MMA7361L 1.5 g and MMA7361L 6 g. If acceleration is more or equal than -1.5 g or less or equal 1.5 g, acceleration data will be display from MMA7361L 1.5 g.

IV. Experiment Results

Testing of SSD algorithm with certain acceleration is done on MMA7361L 1.5 g and MMA7361L 6 g. Testing of IMU with certain acceleration is worked by giving shocks to the sensor when the sensor has an acceleration of 1 g and -1 g until acceleration data of MMA7361L 1.5 g is clipped. Fig. 8 shows the testing of the SSD algorithm on certain acceleration. Result shows that MMA7361L 1.5 g is limited to a certain value, while MMA7361L 6 g can still detect the acceleration. Fig. 9 shows the result of the selection of acceleration sensors which is shown in Fig. 8 by using the SSD algorithm.

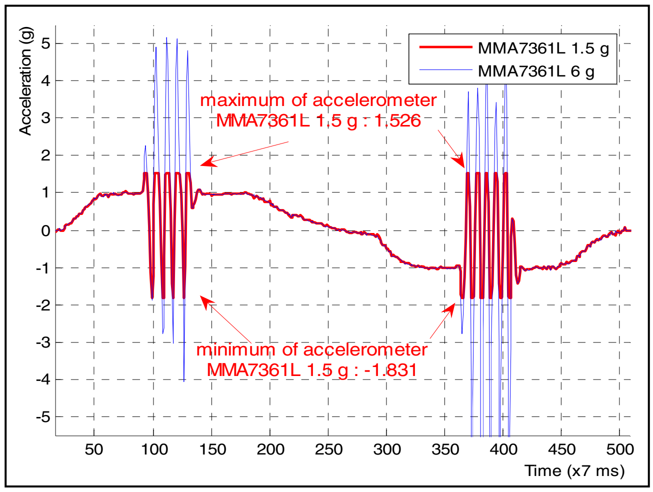

Fig. 8. Acceleration on the test of SSD algorithm.

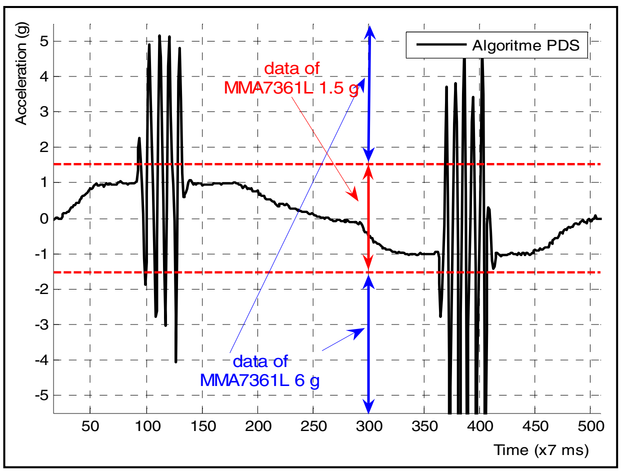

Fig. 9. Acceleration by SSD algorithm.

SSD algorithm selects the sensor data from MMA7361L 1.5 g when the acceleration is between -1.5 g and 1.5 g. When MMA7361L 1.5 g and 1.5 g MMA7361L can detect acceleration that is between -1.5 g and 1.5 g, SSD algorithm selects the data from the sensor with higher sensitivity. When acceleration is greater than or equal to 1.5 g or acceleration is smaller or equal to -1.5 g, SSD algorithm selects the data from MMA7361L 6 g. MMA7361L 1.5 g was used in normally drive of land vehicle and MMA7361L 6 g can be used to look at the driver when he accelerate or brake suddenly.

Testing of SSD algorithm with a certain angular rate is applied to LPR503AL and LPR530AL. Testing is done by rotating the IMU in the clockwise (CW) and counterclock-wise (CCW) with certain angular velocity, until LPR503AL and LPR530AL reach the minimum and maximum limits. Fig. 10 shows the angular rate of the three gyroscopes when given certain angular rate. LPR503AL has been cut, while LPR530AL still be able to detect certain angular rate. Fig. 10 also shows that the minimum angular rate and maximum angular rate of LPR503AL and LPR530AL are different. The selection of angular rate of sensor data using the SSD algorithm from Fig. 10 is shown in Fig. 11.

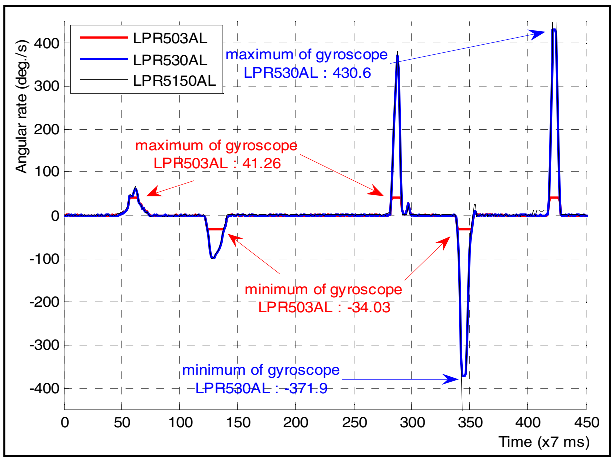

Fig. 10. Angular rate on the test of SSD algorithm.

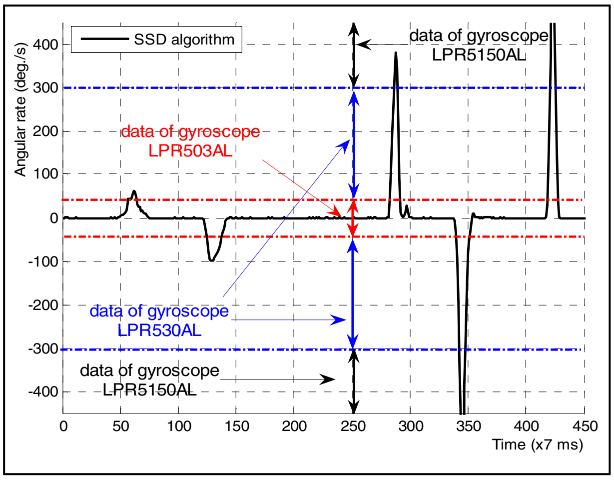

Fig. 11. Angular rate on the test of SSD.

If an angular rate is between -30°/s and 30°/s, then the SSD algorithm selects the angular rate data from LPR503AL. If an angular rate is greater than -300°/s and less than or equal to -30°/s, or greater than or equal to 30°/s and smaller than 300°/s, then the angular rate data is taken from LPR530AL. LPR503AL was used in normally drive of land vehicle and LPR503AL can be used to detect of driver when he rotates steering of land vehicle suddenly.

V. Conclusion

Testing of SSD algorithm with certain acceleration and angular rate is done on multi-sensor of accelerometer and gyroscope, respectively. SSD algorithm can be used to select sensor with higher sensitivity. Sensors with short range, MMA7361L 1.5 g and LPR503AL are used in normally drive.

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2015 ICITACEE

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(ICITACEE 2015)

Department of Computer Engineering, Diponegore University

Semarang, October 16th, 2015

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Autoregressive Integrated Moving Average Modeling In the Financial Sector

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peihaoli1014@gmail.com liangtian19930810@163.com

***Abstract*—Time series modelling has long been used to make forecast in different industries with a variety of statistical models currently available. Methods for analyzing changing patterns of stock prices have always been based on fixed time series. Considering that these methods have ignored some crucial factors in stock prices, we use ARIMA model to predict stock prices given the stock-trading volume and exchange rate as independent variables to achieve a more stable and accurate prediction process. In this paper we will introduce the modeling process and give the estimate SSE (Shanghai Stock Exchange) Composite Index to see the model's estimation performance, which proves to be feasible and effective.**

Keywords-Time series; Statistical moeling; ARIMA;

I. INTRODUCTION

Autoregressive moving average model (ARIMA) is a statistical analysis model which utilizes time series data to predict future data. It is a form of regression analysis that seeks to predict future movements along the seemingly random walk taken by stocks and the financial market by examining the differences between values in the series instead of using the actual data values. Lags of the differenced series are referred to as "autoregressive" and lags within forecasted data are referred to as "moving average." The general model includes autoregressive as well as moving average parameters, and explicitly includes differencing in the formulation of the model. Specifically, the three types of parameters in the model are: the autoregressive parameters (p), the number of differencing passes (d), and moving average parameters (q) [1]. These models are fitted to time series data either to better understand the data or to predict future points in the series (forecasting). They are applied in some cases where data show evidence of non-stationarity, where an initial differencing step (corresponding to the "integrated" part of the model) can be applied to reduce the non-stationarity [2]. ARIMA modeling can take into account trends, seasonality, cycles, errors and non-stationary aspects of a data set when making forecast.

II. MODELING PROCESS

A. Time Series

A time series is a sequence of data points, typically consisting of successive measurements made over a time interval, which are very frequently plotted via line charts. Time series are used in statistics, signal processing, pattern recognition, econometrics, mathematical finance, weather forecasting, intelligent transport and trajectory forecasting [3].

Time series analysis comprises methods for analyzing time series data in order to extract meaningful statistics and other characteristics of the data. Time series forecasting is the use of a model to predict future values based on previously observed values [4].

Models for time series data can have many forms and represent different stochastic processes. When modeling variations in the level of a process, three broad classes of practical importance are the autoregressive (AR) models, the integrated (I) models, and the moving average (MA) models. These three classes depend linearly on previous data points [5]. Combinations of these ideas produce autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) models. The autoregressive fractionally integrated moving average (ARFIMA) model generalizes the former three.

Notations:

$$X = \{X_1, X_2, \dots, X_T, \dots\}$$

T is the index set.

B. Model Definition

Supposing that there is a sequence of time series of data X_t where t is an integer index and the X_t(t=1,2,…) are real numbers, then an ARMA(p' ,q) model is given by:

$$\left(1-\sum_{i=1}^{p'}\alpha_i L^i\right)X_t = \left(1+\sum_{i=1}^{q}\theta_i L^i\right)\epsilon_t \quad (1)$$

where L is the lag operator, the α_i are the autoregressive parameters of the model, the $\theta_i$are the parameters of the moving average part and the ϵ_t are error terms. The terms ϵ_t are generally assumed to be independent, identically distributed variables sampled from a normal distribution with zero mean.

Assuming now that the polynomial $\left(1-\sum_{i=1}^{p'}\alpha_i L^i\right)$ has a unitary root of multiplicity d. Then it can be rewritten as:

$$\left(1-\sum_{i=1}^{p'}\alpha_i L^i\right)X_t = \left(1-\sum_{i=1}^{p'-q}\Phi_i L^i\right)(1-L)^d \quad (2)$$

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A Mobile Diabetes Educational System for Fasting Type-2 Diabetics in Saudi Arabia

Mohammed Alotaibi
Faculty of Computer Science and Information Technology
University of Tabuk
Tabuk, Saudi Arabia
Email: mmalotaibi@ut.edu.sa

***Abstract*—The diagnosis and management of Diabetes is often a complicated process. The complications especially increases during the month of Ramadan wherein Muslim patients are obliged to observe fasting. Recent mobile health technologies are increasingly used in improving the self-management of chronic diseases such as diabetes and several studies have proven its efficiency. Further, research has shown that increased awareness of the disease helps the diabetics to effectively manage their disease and consequently reduce the complications arising due to diabetes. In this paper, an education program for fasting diabetes patients in Kingdom of Saudi Arabia is presented. The education program makes use of an intelligent mobile diabetes management system named SAED, tailored for Type-2 diabetes patients in Kingdom of Saudi Arabia to increase the awareness of the disease amongst the patients. The aim of the education program is to empower the diabetics with relevant knowledge about disease management during the fasting period in particular and improve their awareness about the disease in general. The proposed structure of the education program is presented in this paper which will be tested and evaluated extensively in a randomized controlled trial in Saudi Arabia.**

Keywords*—m-health; mobile diabetes management; diabetes mellitus; telemedicine; e-health; Kingdom of Saudi Arabia, fasting Diabetes educational program.

I. Introduction

Globally, Diabetes Mellitus is one of the most common chronic diseases. It has been estimated that approximately 382.8 million people between the ages of 20 and 79 are suffering with this condition around the world. The worldwide costs for treatment of diabetes and its related complications in 2013 was estimated to be around $548 billion [1]. Specifically, the Kingdom of Saudi Arabia (KSA) has the seventh highest prevalence of diabetes in the world with over one-fifth of its population suffering with the disease [2]. Clearly, Diabetes is a serious public health concern and hence requires significant attention for better diagnosis and management.

One of the most important criteria for better Diabetes management is the diet of the patient. A diabetic patient is advised to and expected to consume food at regular intervals in order to maintain the level of insulin, failing which the patient‘s health condition might get severely affected. Maintaining this strict diet structure becomes especially difficult during the month of Ramadan. In many Muslim countries it is obligatory to fast during the holy month of Ramadan. During this month, people do not consume any sort of food, drinks or medication from dawn until sunset. Although fasting does not have any harmful effects on people‘s health in general, it is well known that it usually introduces some complications for diabetics which are explained in the following:

- In the fasting period, during the daytime the hypoglycemia levels in the patient may potentially increase. Some studies conducted on fasting Type-2 Diabetes (T2D) patients found that hypoglycemia levels increased up to four times in the patients during the fasting period [3].
- Further, it was also found that severe hyperglycemia [requiring hospitalization] levels increased fivefold in T2D patients and approximately threefold in type 1 diabetic (T1D) during Ramadan period
- T1D patients are at higher risks of developing Diabetic Ketoacidosis. The reason for this higher risk is because of excessive reduction in insulin dosage as the food intake is reduced [4].

Several studies have shown that with better diabetes education and training, the diabetes self-management of the patients can be improved and thereby reduce the complications arising due to the fasting practice. For instance, in [5], the authors studied the effectiveness of providing health education to people during the fasting period. The patients in the study were divided into two groups. The first group received a structured diabetes education program about meal planning, physical activity, hypoglycemia, glucose monitoring, dosage, and timing of medications using traditional education methods, such as presentations, workshops, and lectures. The second group continued to receive their usual care without educational program. The results of the study showed that health education during Ramadan helped the fasting diabetics to change their lifestyles easily. Moreover, health education plays a crucial role in reducing the risks of hypoglycemic events and precludes weight gain during Ramadan.

Recently, there has been an increase in the use of mobile-health technologies, especially for chronic disease management. A significant amount of research and a large number of pilot studies have evaluated the implementation of mobile health for chronic disease management. A majority of these studies indicate that the use of mobile health technology in chronic disease management, in particular diabetes management can significantly improve the diagnosis and management of the disease in both Type-1 and Type-2 diabetic patients which in turn improve their quality of life [6], [7].

Some studies have also evaluated the impact of using

Two Phase Flow Imaging Using Infra Red Tomography

Sallehuddin Ibrahim, Mohd Amri Md Yunus
and Mohd Taufiq Md Khairi
Faculty of Electrical Engineering,
Universiti Teknologi Malaysia,
Johor Bahru, Johor, Malaysia
salleh@fke.utm.my

Muhammad Abu Bakar Sidik[1,2]
[1]Institut of High Voltage and High Current (IVAT),
Faculty of Electrical Engineering,
Universiti Teknologi Malaysia,
Johor, Malaysia
[2]Department of Electrical Engineering,
Faculty of Engineering, Universitas Sriwijaya,
Ogan Ilir, Sumatera Selatan, Indonesia

***Abstract*—Data on flow regimes is important in measuring and analyzing industrial process flow. This paper presents an investigation on the use of an infra red tomography system using 16 x 16 infra red sensors to monitor solid particles conveyed by a pneumatic conveyor in a vertical gravity flow rig. The sensor output is processed by a signal conditioning circuit followed by a data acquisition system before being displayed by a computer. The operation of the whole measurement is controlled by a digital timing controller. Four types of flow models i.e. single pixel, multiple pixels, half flow and full flow were experimented with. The system has been tested with solid particles at various flow rates using several algorithms and has shown to be capable of providing images of the flow concentration profiles.**

***Keywords*—flow; image; infra red; tomography**

I. Introduction

Tomography derives from the two Greek words i.e. tomo which means slice and graph which means picture [1]. The history of tomography dated back to the discovery of x-ray. The discovery of x-ray by Wilhelm Roentgen in 1895 proved to be a significant contribution in modern medicine. Such invention enabled us to probe both non-living and living objects without invading the subject itself [2]. However this type of projection still has some flaws as the images were formed by superimposing all planes normal to the direction of X-ray propagation. Beginning from 1930s conventional tomography made use of the tomographic method based on the X-ray radiation which provided two and three dimensions of images [3]. In the late 1960s the use of tomography attracted the interest of those in the process industries including those involved in flow measurement [3]. They began to explore ways of exploiting tomography to extract vital data on flow.

In multi-phase flow measurement both the phase distribution fluctuates with temporal and spatial resolution. This occurred because various phases positioned themselves in various manners. The flow regimes are mainly functions of the volumetric fluxes of all phases. The flow regimes are functions of velocities or pressure drops and are shown as flow profiles. Information on flow profiles is valuable in designing heat and mass transfer equipment and in designing fluid-based conveying processes.

There are various methods for measuring two phase flow. Nonetheless, it is important that sensors being employed for measurement purposes do not in any way perturb the flow being measured. The use of point sensors are not suitable as they disturb the flow. Non-intrusive techniques has the advantage of not altering the flow regime and they are suitable for laboratory as well as industrial tests.

An infra red tomography system can be utilized to obtain the spatial distribution of materials with various optical densities in a volume. This paper describes the results of concentration measurements of solid particles in a vertical flow rig using an infra red tomography system. The infra red tomography system is utilized to reconstruct images obtained from several sensors placed around the measurement section of a hydraulic flow rig. Various materials resulted in different values of attenuation and it is this concept that is utilized in optical tomography. Data on the optical characteristics of a flow can be obtained if a view comprising an optical transmitter and receiver pair are located opposite of each other of the measurement section. By combining several views in order to form a projection a larger area can be interrogated. Useful images of the flow can be reconstructed if several different projections are used.

II. System Configuration

The tomography system utilized 16 x 16 set of infra red sensors configured in orthogonal and diagonal parallel position with each having 16 sensors installed outside a flow pipe with an outer diameter of 82mm and an inner diameter of 78mm as shown in Fig. 1. Both the orthogonal projection has 32 sensors and the diagonal projection has an identical number of sensors i.e. 32 sensors. The sensors are arranged in a parallel manner to create two upstream and downstream sensing arrays with four parallel projections (at angles of 0°, 45°, 90°, and 135°) with 16 pairs of sensors for each projection. The distance between the upstream sensors and the downstream sensors is 0.1 meter. This value of distance was chosen based on the value of the sampling rate utilized in the

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Assessment of TRV Parameters and Overvoltages in Three-Phase Ungrounded Faults

Alejandro Marmolejo[1)], Mirko Palazzo[2)]
ABB Switzerland Ltd.
Zurich, Switzerland
[1)]alejandro.marmolejo@ch.abb.com
[2)]mirko.palazzo@ch.abb.com

***Abstract*—The transient recovery voltage requirements laid down in IEC/IEEE 62271-37-013 for testing generator circuit-breakers are determined for the first-pole-to-clear in case of a three-phase grounded fault despite it is recognized that the rate-of-rise in such case is somewhat smaller and therefore less severe than the rate-of-rise in case of ungrounded faults. The occurrence of a three-phase ungrounded fault in power stations is rare but cannot be completely ruled out. Such fault may arise, for example, inside the panel of MV-switchgear with non-segregated busducts or when active arc mitigation devices which transform an arc fault into a three-phase ungrounded bolted short-circuit are employed. The transient recovery voltage requirements for three-phase ungrounded faults are assessed in the present work. Also the voltage transients occurring at the fault location and generator neutral are investigated.**

***Index Terms*—generator circuit-breaker, ungrounded fault, overvoltages.**

I. Introduction

The requirements imposed on generator circuit-breakers (GenCBs) greatly differ from the requirements imposed on general purpose transmission and distribution circuit-breakers. Due to the location of installation, high technical requirements are imposed on GenCBs with respect to rated normal currents, short-circuit currents and fault currents due to out-of-phase conditions. Furthermore, the currents of very high magnitude which GenCBs have to deal with are associated with very steep transient recovery voltages (TRVs). The standard which covers the requirements for GenCBs is IEC/IEEE 62271-37-013 [1].

The TRV requirements laid down in [1] for testing GenCBs are determined for the first-pole-to-clear in case of a three-phase grounded fault despite that in [2] it is recognized that the rate-of-rise of the TRV (RRRV) in such case is somewhat smaller and therefore less severe than the RRRV in case of ungrounded faults.

The occurrence of a three-phase ungrounded fault in power stations is rare but cannot be completely ruled out. Such fault may arise, for example, inside the panel of MV-switchgear with non-segregated busducts or when active arc mitigation devices which transform an arc fault into a three-phase ungrounded bolted short-circuit are employed.

The TRV requirements for three-phase ungrounded faults are assessed in the present work. Also the voltage transients occurring at the fault location and generator neutral are investigated.

II. Transformer and Generator Classes

A. Transformer Classes

Standard values for TRV parameters for system-source faults are listed in Table 3 of [1], and classified in seven groups depending upon the rated power of the transformer. For each of these groups, a transformer class has been defined and characterized by corresponding parameters of rated power, S_{n_t}, symmetrical system-source short-circuit current, $I_{SC_{sys}}$, and voltage, V_t. For each class, S_{n_t} was chosen as the highest of the range specified in [1]. The corresponding values of $I_{SC_{sys}}$ and V_{sys} for a given transformer rated power were obtained from the results of a comprehensive survey [3]. U_{sys} was assumed equal to the maximum terminal voltage of a generator with same rated power. Transformer classes and their parameters are summarized in Table I.

B. Generator Classes

Standard values for TRV parameters for generator-source faults are listed in Table 4 of [1], and classified in five groups depending upon the rated power of the generator. For each of the transformer classes previously specified, a generator class has been defined and characterized by corresponding parameters of rated power, S_{n_g}, symmetrical generator-source short-circuit current, $I_{SC_{gen}}$, and maximum generator voltage, U_{gm}. For each generator class, S_{n_g} was chosen so as to match S_{n_t} of the corresponding transformer class. The values of $I_{SC_{gen}}$ and U_{gm} for a given generator rated power were also obtained from the results of a comprehensive survey [3]. Generator classes and their parameters are summarized in Table II.

TABLE I: Transformer Classes

Class	Transformer Rating acc. to [3] (MVA)	Transformer Class Parameters		
		S_{n_t} (MVA)	$I_{SC_{sys}}$ (kA_{RMS})	U_{sys} (kV_{RMS})
1	10-50	50	44.7	14.5
2	51-100	100	51.9	15.8
3	101-200	200	65.9	18.0
4	201-400	400	92.4	21.5
5	401-600	600	117.0	23.8
6	601-1000	1000	160.6	26.1
7	1001 or more	1200	179.5	26.5