Health Care Monitoring System Based-on Internet of Things

To cite this article: Taryudi et al 2019 J. Phys.: Conf. Ser. 1413 012008

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Health Care Monitoring System Based-on Internet of Things

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Abstract. The development of technology in the era of the industrial revolution 4.0 have led to the emergence of the Internet of Things (IoT). IoT allows an electronic devices to send and capture data through the internet and provides more methods of data interoperability. Nowadays, IoT plays an important role not only in communication, but also in monitoring, recording, storage and display. Currently, the application of IoT in health monitoring system to monitor conditions in the vital signs of the human body becomes interesting issues as an effort to prevent disease. In this article, a system that can monitor vital sign parameters and transmits data through wireless communication was developed, then those data transferred to the network via Wi-Fi modules. Data can be accessed at any time and represent the patient's current condition. So that a nurse or doctor can monitor the patient's data in real time through an application software on smartphone. Overall the system developed consists of DFRobot Firebeetle ESP32 as a controller that has been equipped with Wi-Fi modules, Sensor MAX30100 as a pulse detector and MLX90614 sensor as a body temperature detector. Also added is a GPS (Global Positioning System) module to detect patient locations in real time and an OLED (Organic light-emitting diode) module as data viewer.

The test results show that the overall system was worked properly with a 6.5% error for pulse detection, 4% for oxygen detection and 1.7% for body temperature. As for the accuracy of the position generated by GPS that is 7 meters.

1. Introduction

Development in society in somehow have a negative impact on the health condition. For example, currently, more people consume fast food, smoke, drink alcohol, and lack of physical activity, that become the major reason of increased heart disease. Heart disease is one of the main health problems and the leading cause of death in the world. Data from the World Health Organization (WHO) in 2018 stated that more than 17 million people worldwide died from heart and blood vessel disease [1]. More than 75% of deaths from heart and blood vessel disease occur in developing countries with low to moderate income [1]. It’s interesting that the current trend of heart disease is not only suffered by the elderly population, but also has been found at a young age. In Indonesia, according to the National Basic Health survey in 2018 showed that 1.5% or 15 out of 1,000 Indonesians suffer from coronary heart disease [2].

Prevention of heart disease can be done by detecting vital signs on the body. It is urgently needing a manufacture and development of tools that can monitor vital sign includes heart rate and body temperature in more effective ways, real time, anytime without complex equipment. Internet of Thing (IoT) become major interesting issues to be applied for patients monitoring in real-time without complex equipment and can be documented well-in the mobile phone.

Previous study conducted by Agung and Achmad, design human body temperature using a Bluetooth communication [3]. The system of sending health condition data information to the user uses the Bluetooth module, but the device does not have a wide range of health condition data sending...
information to the user using Bluetooth, so there is limited distance for sending data information. In a study by Marti and Setia that development of heartbeat monitoring applications through finger test using Arduino [4]. Application monitoring on this system is accessed using a computer, so it will be difficult to be carried anywhere, where in the era of industry 4.0 almost everything can be done anywhere. Previous studies have shown that remote patient monitoring has a positive impact on the prevention of infectious diseases such as tuberculosis [5] and monitoring the temperature and toxic gas conditions in the room [6]. Therefore, this study aimed to develop an IoT-based health monitoring system that can be accessed anywhere online using a smartphone.

![System architecture](image)

**Figure 1.** System architecture

2. **Materials and Method**

2.1. **System Architecture**

This study was conducted using research and development with four steps to design a hardware and software system. The first stage was searching for definitions, specifications, theories, datasheets, and application notes to determine the specifications of prototype. The results of the analysis in phase 1 were used to determine the specifications of each sub-system of hardware and software. Step three was designed a prototype, then in the final stage this prototype was tested using the specific criteria. The architectural system for monitoring patient health is shown in Error! Reference source not found. which consists of two sensors to detect body temperature, heart rate and oxygen levels in the body, GPS module to detect patient location, and OLED to display the pulse and body temperature data directly in mobile application. While, the microcontroller was used DFRobot Firebeetle ESP32 to receive data from sensors using serial communication, then process and display it, and send the data wirelessly to the IoT cloud system. In detail the diagram of the system is shown in Figure.

2.2. **Hardware System Design**

This health monitoring hardware system consists of MAX30100 sensor to detect heart rate, MLX90614 sensor to detect body temperature, and Neo-6M GPS module to detect the location. Besides these sensors, an OLED SSD1306 data viewer is also used to display the pulse and body temperature data directly in mobile application. While, the microcontroller was used DFRobot Firebeetle ESP32 to receive data from sensors using serial communication, then process and display it, and send the data wirelessly to the IoT cloud system. In detail the diagram of the system is shown in Figure.
2.3. Software System Design
Software development in the health monitoring system was carried out in two parts, namely on the microcontroller and smartphone. In the microcontroller, Arduino IDE software is used to read sensor data and process it, then display the data and perform communication with the IoT cloud system. In the smartphone application, a user interface is developed to monitor the location of the system used in accordance with the data generated from the GPS module as shown in Figure and displays the pulse and body temperature data. In detail the program algorithm is explained in the next section and the user interface design of the blink application is shown in Figure.

- **Microcontroller System algorithm**
  1. Initialization system
  2. Connect to internet access point until connected.
  3. Read data from all sensors then save to buffer data sensor
  4. Read data from GPS, then save to buffer Location data
  5. Formatting all data sensors and location
  6. Send all data to IoT cloud system
  7. In Blynk application system, read all data package from IoT cloud then display it to the GUI.
3. Results and Discussion
The results of the design and development of the system were prototype hardware controller and the hand-band system as shown in Figure and Figure. While the results of the development of the user interface on an IoT-based application using the Blynk application are shown in Figure. Overall, the system has been integrated and tested on each sub-system and calibrated. The system showed good performance with a 6.5% error for pulse detection, 4% for oxygen detection and 1.7% for body temperature detection. As for the accuracy of the position generated by GPS that is 7 meters.

However, each sub-system of sensors and GPS as well as the controller still not integrated in a single package, the life time used of power supply was not taken into consideration yet, and the accuracy of the sensor is less accurate. Therefore, further development needs to be done in order to be used at clinical setting.

While the results of software development, still using IoT-based applications that are already on the market, so that data security and system reliability are still dependent on the application. For this reason, it is necessary to develop software independently with better system reliability.
4. Conclusion
In conclusion, this study showed that the prototype of monitoring vital sign using IoT had a proper function with a 6.5% error for pulse detection, 4% for oxygen detection and 1.7% for body temperature detection. As for the accuracy of the position generated by GPS that is 7 meters. However, the prototype system still uses sub-system modules separately. Further research need to integrate system in one device such as in a smart watch.

5. References
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Acknowledgements
The authors would like to express their appreciation and extremely grateful to the student in running this study for their gracious participation.
This is to certify that
Taryudi, Ph.D.
as author of a paper entitled
Health Care Monitoring System Based-on Internet of Things

Has participated in the International Conference on Electrical, Electronics, Informatics, and Vocational Education (ICE-ELINV0) organized by Yogyakarta State University on September, 14th, 2019

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INTRODUCTION

Background:

For the last two decades, the environmental deterioration caused by both human and industry activities has been increasing at alarming level. Numerous efforts have been carried out to alleviate the damage to the environment including the campaign of Green Technology (Greentech) or Clean Technology (Clentech) or Environmental Technology (Envitotech) utilization worldwide. Greentech is an integration between modern technology and environmental science which is applied to preserve the fulfillment of future community needs without harming the environment. Advanced innovation and education are needed to develop the Greentech. Innovation is set as foundation on invention of environmentally-friendly technological alternatives to meet human needs, while education is channeled as an attempt to improve human awareness in implementing the Greentech which in the long run, leads to a sustainable environment. Therefore, the industries as the inventors of technological innovation and vocational education as the end users of technology must...
be able to work hand in hand in implementing and evolving the Greentech. This international seminar was initiated to contribute cutting-edge ideas to the Greentech growth.

Theme:

ADVANCING GREEN TECHNOLOGY APPLICATION IN INDUSTRY AND VOCATIONAL EDUCATION

CONFERENCE DATE:

Saturday, September 14th, 2019

SPEAKERS:

1. **Prof. Emeritus Lance C.C. Fung, Ph.D.**
   - Discipline of IT, Mathematics & Statistics
   - College of Science, Health, Engineering and Education
   - Murdoch University

2. **Prof. Herman Dwi Surjono, Ph.D.**
   - Professor of IT Education
   - Electronics and Informatics Educ. Engineering Department
   - Universitas Negeri Yogyakarta

3. **Assoc. Prof. Thavatchai Tayjasanant, Ph.D.**
   - Power System Research Lab
   - Departement of Electrical Engineering Faculty of Engineering
   - Chulalongkorn University
About Universitas Negeri Yogyakarta

Universitas Negeri Yogyakarta (UNY) is a university conveniently located in Sleman District of the Yogyakarta Special Territory. Despite its relatively new status as a university, UNY still maintains a strong reputation as an educational institution which not only produces professional teachers and instructors for the education sector but has now expanded into the fields of non-educational sector together in each faculty. In view of that, in order to have scientific encounters of inter-disciplines in educational and non-educational fields and to produce professional and qualified teachers besides qualified graduates of non-educational programs, UNY consciously and responsibly continues to improve itself, both internally and externally. Internally, the academic members of UNY continually work to consolidate and qualitatively improve its human and non-human resources. Externally, UNY tries to extend the cooperation networks to related to stakeholders in local, regional, national, and international levels.

Universitas Negeri Yogyakarta (UNY) has been established as part of the dynamic organizational development of Indonesian higher educational institutions in response to fast-changing societal demands. It is shown in the dynamic changes of its organization structure, starting from its establishment in 1964 until nowadays.

In accordance with the Strategic Plan of UNY Year 2015-2019, UNY will become a World Class University within the scope of Education Universities that can achieve in increasing collaboration, competitive and comparative competitiveness in local, national, regional and international levels in the fields of education, culture, research, and community service while still considering identity locally and nationally in the Indonesian context. The successfulness indicators of this achievement are measured based on the ranking of Ministry of Research, Technology, Higher Education (MRTHE), Webometrics, Greenmetric and QS World University Ranking. Targeted in 2020, UNY is expected to be ranked as the world’s top 1,000 education university, ranked 300 in Asia, ranked 70 in the Southeast Asia version of QS. In 2021, UNY is expected to be ranked in the education university version of QS: 750 in the world, ranked 250 in Asia, ranked 50 in Southeast Asia.
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Preface

To cite this article: 2019 J. Phys.: Conf. Ser. 1413 011001

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Preface

On behalf of the ICE-ELINVO organizing committee, I am honoured to welcome you to the 2nd International Conference on Electrical, Electronics, Informatics, and Vocational Education held today, 14th September 2019. This conference is organized by Department of Electrical Engineering Education in cooperation with Department of Electronic and Informatic Education, Faculty of Engineering, Universitas Negeri Yogyakarta.

This conference takes theme “ADVANCING GREEN TECHNOLOGY APPLICATION IN INDUSTRY AND VOCATIONAL EDUCATION”. As we know, For the last two decades, the environmental deterioration caused by both human and industry activities has been increasing at alarming level. Numerous efforts have been carried out to alleviate the damage to the environment including the campaign of Green Technology (Greentech) or Clean Technology (Clentech) or Environmental Technology (Envitotech) utilization worldwide.

Greentech is an integration between modern technology and environmental science which is applied to preserve the fulfillment of future community needs without harming the environment. Advanced innovation and education are needed to develop the Greentech. Innovation is set as foundation on invention of environmentally-friendly technological alternatives to meet human needs, while education is channeled as an attempt to improve human awareness in implementing the Greentech which in the long run, leads to a sustainable environment. Therefore, the industries as the inventors of technological innovation and vocational education as the end users of technology must be able to work hand in hand in implementing and evolving the Greentech.

This conference provides a forum for knowledge and experience exchange and we encourage researchers, lectures, teachers, scholars, practitioners, decision maker including the government, and stakeholder to contribute cutting-edge ideas to the Greentech growth.

I realize that you are fully dedicated to the session that will follow but I do hope you will also take time to enjoy the fascinating Yogyakarta city with a vibrant history, friendly people, delicious cuisines, and traditions of Indonesia, which is also renowned as a center of education.

Finally, I would like to express our heartfelt thanks to the committee for enabling this to take place and to everybody who comes to this conference. I wish we will have productive and successful conference

Thank you

Yogyakarta, 14th September 2019
Conference Chairperson
Dr. phil. Nurhening Yuniarti, M.T
Conference Timetable

International Conference on Electrical, Electronics, Informatics and Vocational Education

2nd ICE-ELINVO Annual Conference
### Saturday, September 14th, 2019

| Venue | Time | Activity |
|-------|------|----------|
| **Eastparc Hotel Lobby, Yogyakarta, Indonesia** | 07.30 – 08.00 WIB | Registration and Material Collection |
| **Opening Ceremony** | 08.00 – 08.30 WIB | - Traditional Dance  
- National Anthem  
- Opening speech by Rector |
| | 08.30 – 09.00 WIB | MoU and Group Photo |
| | 08.55 – 10.05 WIB | **Keynote Speech**  
Emeritus Prof. Lance C. C. Fung, Ph.D.  
Prof. Dr. Dr. h. c. George Spottl, M.A. |
| | 10.05 – 10.20 WIB | Coffee Break |
| **Eastparc Hotel Hall Room, Yogyakarta, Indonesia** | 10.20 – 12.00 WIB | **Invited Speakers**  
**Speaker 1**  
Prof. Herman Dwi Surjono, Ph.D.  
Yogyakarta State University - Indonesia  
Field: Online and Blended Learning  
**Speaker 2**  
Assoc. Prof. Thavatchai Tayjasanant, Ph.D.  
Chulalongkorn University - Thailand  
Field: Power System-Electrical Engineering  
**Speaker 3**  
Prof. Dr. Ramlee bin Mustapha  
Sultan Idris Education University - Malaysia  
Field: Vocational Education  
**Speaker 4**  
Prof. Dr. Moch Bruri Triyono, M.Pd.  
Yogyakarta State University - Indonesia  
Field: Technology Vocational Education and Training (TVET) |
| **Eastparc Hotel Restaurant, Yogyakarta, Indonesia** | 12.00 – 13.00 WIB | Lunch and Break |
| **Parallel Session** | 13.00 – 16.00 WIB | Room Chair: Dr. Istanto Wahyu Djatmiko  
Papers will be presented by their respective authors for 15 min each. |
| | 13.00 – 16.00 WIB | Room Chair: Dr. Edy Supriyadi, M.Pd  
Papers will be presented by their respective authors for 15 min each. |

- **Lavender Room**
- **Violet Room**
| Venue | Time | Activity |
|-------|------|----------|
| 13.00 – 16.00 WIB at Room #3 (Orchid Room) | Room Chair: Ariadie Chandra Nugraha, M.T. Papers will be presented by their respective authors for 15 min each. |
| 13.00 – 16.00 WIB at Room #4 (Lotus Room) | Room Chair: Dr. Ratna Wardani Papers will be presented by their respective authors for 15 min each. |
| 16.00 – 16.15 WIB | Coffee Break |
| 16.15 – 17:00 WIB | Parallel Session |

**Note:** The conference certificate will be awarded after all parallel sessions have been completed.

**Sunday, September 15\(^{th}\), 2019**

| Venue | Time | Activity |
|-------|------|----------|
| Depart from Eastparc Hotel | 09.00 – 16.00 WIB | City tour will be optionally held at the participant's expense (not included in the conference fee) and will be arranged by tour agent. |