ANALYSIS OF SENSOR ACCURACY ON IOT BASED PADDY CROPPING MONITORING SYSTEM

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This report is submitted in partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering with Honours

Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

2019

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Analysis of sensor accuracy on IoT based paddy cropping monitoring system

Sesi Pengajian : 2018/2019

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To my beloved parents, siblings, and friends.

ABSTRACT

Nowadays, the high demand for rice is one of the issues facing globally. In order to increase the production of the rice, heavy manpower is needed to ensure the environmental parameters of the paddy filed are maintain at the optimum level. In the process of monitoring, some of the farmers will complete their daily job base on their experience. However, this may cause them suffer from financial loss and wasting of fertilizer. Thus, a monitoring system based on Arduino Uno as microcontroller was developed to overcome this problem. In this project, a long-range paddy cropping monitoring system based on Arduino Uno and LoRa was developed to monitor a real-time environmental information included surrounding temperature, air humidity, water level and pH value. This system performs the function to monitor the environmental parameters at multiple parts of the paddy field in real time. Then, the system interchanges the data between nodes through the network protocol provided by LoRa in the range of 2 kilometer and upload to the cloud database via GPRS module. When the environment parameters over the threshold value, a notification will send to the user in the form of SMS. In the other hand, analysis of sensor accuracy was study with implementation at Kalman filter technique to the system. Base on the experimental result, LoRa sender will provide a new reading of the environmental

parameters every 5 seconds to the receiver and receiver will upload the reading to the IoT platform every 20 seconds. Besides, the Kalman filter technique has improved the accuracy of the temperature sensor with tolerance $\pm 1\%$ when compare to the actual reading. In conclusion, this monitoring system able to help user improve the production of the paddy field with less man power involve in practice work.

ABSTRAK

Pada masa kini, permintaan yang tinggi untuk beras adalah salah satu isu yang dihadapi oleh global. Demi meningkatkan penghasilan beras, tenaga kerja amat diperlukan untuk memastikan parameter alam sekitar sawah padi dikekalkan dalam julat optimum. Dalam proses pemantauan parameter alam sekitar, sebahagian daripada petani akan menjalankan pekerjaan harian mereka melalui pengalaman. Namum, hal ini akan menyebabkan kerugian kewangan dan pembaziran baja. Oleh itu, satu sistem pemantauan dengan menggunakan Arduino Uno sebagai mikropengawal telah dibangunkan untuk mengatasi masalah ini. Dalam projek ini, sistem pemantauan padi jarak jauh dengan menggunakan Arduino Uno dan LoRa telah dibangunkan untuk memantau maklumat parameter persekitaran semasa termasuk suhu, kelembapan udara, paras air dan nilai pH. Sistem ini diapasang pada beberapa bahagian sawah padi untuk melaksanakan fungsi bagi memantau parameter alam sekitar semasa. Kemudian, sistem ini akan menukar data antara nod dalam lingkungan 2 km melalui protokol rangkaian yang disediakan oleh Lora dan memuat naik data tersebut ke pangkalan data melalui modul GPRS. Apabila persekitaran parameter melebihi nilai tertentu, notifikasi akan dihantar kepada pengguna dalam bentuk SMS. Selain itu, analisis ketepatan sensor telah dijalankan dengan pelaksanaan penapis Kalman. Berdasarkan keputusan eksperimen, penghantar Lora akan memberikan bacaan baru parameter alam sekitar kepada penerima setiap 5 saat dan penerima akan memuat naik bacaan tersebut ke platform IOT setiap 20 saat. Selain itu, teknik penapis Kalman telah

meningkatkan ketepatan sensor suhu dengan toleransi ± 1% apabila dibandingkan dengan bacaan sebelum. Sebagai kesimpulan, sistem pemantauan ini dapat membantu pengguna meningkatkan penghasilan sawah padi dengan mengurangkan tenaga kerja.

ACKNOWLEDGEMENTS

First of all, I am grateful to the God that giving me a good health along the duration completing my project and thesis. Next, I would like to express my depth gratitude to Faculty of Electronic and Computer Engineering for giving me an opportunity to study the knowledge of engineering.

Besides, I am highly indebted to my supervisor Dr. Abd Shukur Bin Jaafar for the continuous support for my degree study and project. He always giving me guidance and advises from the beginning of the project until the completion of this report.

Other than supervisor, I would like to thank to my panels of my final year project Dr.Imran Bin Mohd Ibrahim and Mr A.Nasoruddin Bin Mohamad for giving me some suggestions to improve my project and thesis writing. I also like to offer my special thanks to technicians Mr. Imran Bin Mohamed Ali who guide me in the fabrication process.

Last but not least, I wish to thanks my parents and my lovely friends who give me support and encouragement during my study life. I would like to thanks my course -mates who have helped me along the work complete.

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LIST OF SYMBOLS AND ABBREVIATIONS

IoT	:	Internet of Thing
GPRS	:	General Packet Radio Service
SIM	:	Subcriber Identity Card
SMS	:	Short Message Service
GSM	:	Global System of Mobile
pH	:	Potential of Hydrogen
LoRa	:	Long Range
LPWAN	:	Low Power Wide Area Network
LoRaWan	:	Long Range Wide Area Network
MCMC	:	Malaysia Communication and Multimedia Commision
LCD	:	Liquid crystal Display
ADC	:	Analog to Digital converter
DAC	:	Digital to analog converter
3G	:	Third generation of Wireless Mobile Telecommunications Technology
LAN	:	Local Area Network
NTC	:	Negative Temperature Coefficient
CTD	:	Conductivity, Temperature and Depth
RAM	:	Random Access Memory

ROM	:	Read Only Memory
CPU	:	Central Processing Unit
RTC	:	Real time clock
PWM	:	Pulse Width Modulation
USB	:	Universal Serial Bus
IDE	:	Integrated development environment

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CHAPTER 1

INTRODUCTION

1.1 Background of project

From the year 2017's, population of Malaysia recorded at 32 million and increase to 32.4 million in year 2018. The population growth around 1.1% each year[1]. The increasing of the population in Malaysia will cause the food consumption increases. In fact, most of the people who stay in Malaysia will always choose rice as their first choice of the food. In this case, population increase will cause the rice demand increase.

In order to increase the production of paddy field, a monitoring system should introduce to the agricultural field. This system should consists of a few parameters of the paddy field to observe and analyze the growth of paddy field. Besides, the

monitoring system can implement the concept of internet of thing (IoT) to ease the researches and farmers during monitoring and obtaining the data. These features will maximize the crop of paddy field with minimum resources such as water and fertilizer used.

Internet of thing (IoT) is data collecting from the world through network device or router that connected and ability of sensing and collecting the data and then share the data across internet to cloud which certain people can read the data for various purposes. The continuous growth of technology and internet in the world, the versatility of Internet of thing (IoT) has become more popular. Internet of thing (IoT) was applied into various fields such as industry automation, smart cities, health care and smart agriculture.

Since the application of Internet of thing (IoT) demand is very high among the community, this project is applied in agricultural field which is paddy monitoring system. The implementation of Internet of thing (IoT) will help user to monitor the condition of paddy field all the time. This can improve the quality and quantity of yield. The monitoring system include a few physical parameters such as water level, pH level of the soil, temperature and air humidity of the paddy field. The data collect from different sensors will be read by microcontroller and transmit to another node by implement the concept of long-range technique and upload the data to cloud database via internet base on General Packet Radio Service (GPRS) network. At the same time, an alert message will be sent to user via Short Message Service (SMS) once the parameters excess or less than the threshold value.