UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF A SMART ANTI-INTRUDER SYSTEM FOR MALAYSIAN FARMING COMMUNITY USING RASPBERRY PI

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunications) with Honours.

By

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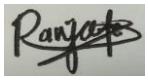

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Internet of Things (IoT) telah menjadikan kehidupan orang lebih mudah dan praktikal di mana ia membenarkan sesiapa sahaja untuk berhubung dengan apa sahaja, di mana sahaja, melalui Internet. Pertanian pintar membolehkan petani mengawasi ladang dengan hanya menggunakan telefon pintar, di mana hal ini dapat meningkatkan pendapatan dari produktiviti dan menjaga ladang. Penceroboh, tidak kira serupa atau sifatnya, seperti manusia atau haiwan akan mencuri ternakan di dalam ladang atau merosakkannya. Oleh itu, projek ini menerangkan sistem anti-penceroboh yang pintar untuk membantu petani mengesan kehadiran penceroboh. Sistem ini disertakan sensor gerakan untuk mengesan, kamera untuk mengambil gambar dan Raspberry Pi untuk memproses data. Hasil yang berlaku dari sistem ini ialah sistem ini dapat mengesan kehadiran penceroboh dan menghantar informasi ke telefon pintar petani mengenai kehadirannya. Kesimpulannya, sistem ini dapat membantu petani untuk memantau keselamatan ladang.

ABSTRACT

Internet of Things (IoT) has made people's life more convenient and practical where it supports any person to be connected to any things, anywhere, via the Internet. Smart farming enables farmers to monitor the farmhouse by just using a smartphone, thus increase income from productivity and maintain the farm. Intruders, in any kind, such as humans or animals tend to steal the livestock or spoil it. Therefore, this project describes a smart anti-intruder system to help farmers to detect the presence of intruders. This system is embedded in a motion sensor to detect, camera to capture and Raspberry Pi to process the data. The outcome of this system is that it is be able to detect the presence of intruders and send a notification to the farmer's smartphone about the presence. In conclusion, this system will help farmers to monitor the security of the farmhouse.

DEDICATION

This project is dedicated to my loved ones and poultry farmers.

ACKNOWLEDGEMENTS

I would like to express my gratitude to my supervisor, Dr AKM Zakir Hossain for endlessly giving guidance and support to complete this project. I would like to thank my loved ones for their encouragement and moral support.

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LIST OF ABBREVIATIONS

Rpi – Raspberry Pi

GSM – Global system for mobile communication

IoT – Internet of Things

PLF – Precision Livestock Farming

RFID – Radio Frequency Identification

GPRS – General Packet Radio Service

SMS – Short Messaging Service

WSN – Wireless Sensor Network

PIR – Passive Infrared

LAN – Local Area Network

GPIO – General Purpose Input Output

ADC - Analog to Digital Converter

LED – Light Emitting Diode

LCD – Liquid Crystal Display

CHAPTER 1

INTRODUCTION

1.1 Research Background

According to a global population forecast by the United Nations, the current world population is 7.8 billion as of March 2020, and the human population will continue to grow and it is expected to exceed approximately 11 billion by the year 2100. Due to this, the agricultural sector, particularly poultry farming faces a serious challenge to feed this ever-growing human population. In Malaysia, the most consumed protein content by humans is in the form of chicken meat. Therefore, it is important to develop long term measures that will significantly increase output to meet the demands of the growing global population. According to the website "The Poultry Site", there will be 35 percent more demand for animal protein in the next 20 years, where poultry will be expanding about 2 percent. (Ghazal, Al-khatib and Chahine, 2017) stated that precision livestock farming (PLF) is an integration of advanced technologies with software, hardware, processes, and management. Thus, the production runs efficiently to give better output concerning quantity and quality. There are so many smart poultry farming being introduced and embedded to help the farmers to monitor the food consumption, ventilation control, and cleaning system.

Nevertheless, farmers also face problems when their crops or poultry are stolen by an intruder or eaten by other animals. The security of a farm also needs to be given importance. To solve this issue, the development of a smart anti-intruder system for Malaysian farming is proposed. This system consists of Raspberry Pi, a motion detector,

a camera, a buzzer, and a smartphone. Raspberry Pi is an inexpensive, small-sized computer that plugs into a computer and uses standard keyboard and mouse. The motion detector senses any movement and alerts the farmer via smartphone and the image is captured via the camera. This system will help the farmer to know if someone is trying to enter the farm, while indirectly helps to monitor the condition and environment of the farm.

1.2 Problem Statement

Smart poultry farming has been around and many researchers have done developments to help the farmers in terms of feeding, temperature control, and ventilation system. On the other hand, the anti-theft system for agricultural sector must also be given priority as in housing area to protect the surrounding from intruders In the paper done by (Islam *et al.*, 2019), fire protection and anti-theft features were done but there is no notification process. (Phiri, Kunda and Phiri, 2018) stated that the cheapest solution to ensure security of a farm is to have a homestead nearby the poultry house, but it does not provide notification to the farmer during any intrusion.

By using features of the Internet of Things (IoT), farmers can keep track and monitor the environment, thus take action when necessary. Therefore, to aid the local poultry farming community to be aware of the farm and get notified about intrusion, a smart anti-intruder system for the Malaysian farming community is proposed.

1.3 Objectives

1. To develop a smart anti-intruder system for the Malaysian farming community using Raspberry Pi.
2. To detect the presence of an intruder or stray animals and alert the farmer using a smartphone.

3. To analyze the performance of the developed system towards poultry farming.

1.4 Scope of Research

The scope of this project focuses only on using Raspberry Pi to communicate with a motion detector, camera, buzzer, and smartphone application which is Telegram Bot to alert the farmer if there is an unknown person or stray animal that tries to enter the farm. The presence of intruder will be detected by the motion sensor, which will be connected to Raspberry Pi and the camera will capture the image of the intruder. The buzzer will be activated to scare the intruder away. Telegram Bot is used to receive notification from Raspberry Pi. Lastly, this project is dedicated to poultry farming only. The performance of the system is analysed by observing the speed of detection in a range of time and distance.

1.5 Thesis Organization

Chapter 1 provides the background of the smart anti-intruder system and poultry farming. A problem statement is stated and objectives are listed to set as a benchmark to be achieved to solve the problems. Lastly, this chapter covers the scope of research and thesis organisation.

Chapter 2 discusses the related research done by researchers based on project implementation and functionality. A comparison between the projects is done to identify the main idea, theory, and provide a wider view of the type of implementation which will be suitable for this project.

Chapter 3 gives an overview of the methodology done to complete this project. The methodology is done by taking specific steps to develop the project while obeying the objectives stated. A flow chart is designed to show the procedures taken.

Details of results are provided in Chapter 4. The data or output of the project will be analysed and discussed in detail. Figures of output will be attached.

Chapter 5 concludes and summarizes the main ideas and states whether the project output has achieved the objectives. This chapter also gives suggestions on further improvement of the project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter discusses the important information and details which are found by study and research from related previous study. The discussion starts with the study of smart farming and smart security concepts. It is important to study these concepts because they are the main idea of this project. Next, as this project comprises the Internet of Things (IoT) technology, it is vital to study the concept of the IoT to have a clear vision of the concept. Lastly, this chapter ends with the comparison of the related previous papers and the type of implementation that will be done in this project.

2.2 Concept of Smart Farming

In general, smart refers to technology that is data-driven, sensor-based, and more automatic or programmable, which also involves artificial intelligence. Smart farming is a method where traditional farming is incorporated with innovative technologies. Smart farming benefits in many ways such as increase production, reduce human force and improve the quality of agricultural products. Adequate irrigation, fertilization and pesticides are important for better farming and food production. It is much simpler if we create an automatic system to automatically perform all these tasks (Mahbub, 2020). Due to that, this technology has done many changes in the farming sector such as:

1. Automatic feeding and watering system
2. Real-time monitoring system
3. Real-time security system

According to (Wolfert *et al.*, 2017), smart farming concept consists of smart devices that are connected to the Internet are able to control a farm. With that, smart devices are devices that are built-in with sensors and intelligence to perform autonomous tasks. Besides, robots will be seen to take part in the control system and machines will be helping humans in planning and analysis. This will cause all operations to be automatic.

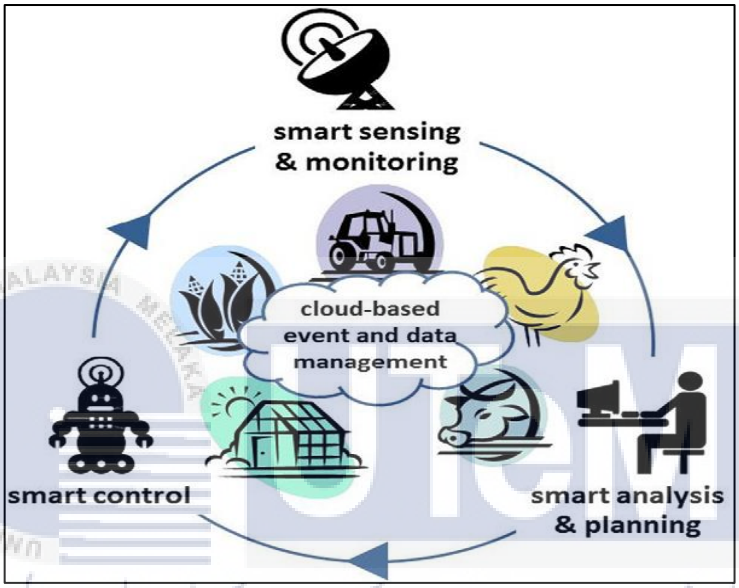

Figure 2.1: The cyber-physical management cycle of Smart Farming enhanced by cloud-based event and data management (Wolfert *et al.*, 2017)

(Bauer and Aschenbruck, 2018) stated that the idea of precision agriculture came from the integration of digital novelties in the agricultural field. Lately, the Internet of Things (IoT) has widened its scope of precision agriculture by adding smart sensors and technologies that are already present in other industrial and home automation. This is considered as Smart Farming which includes data collecting, data processing, analysis and storage. Analytic results can be viewed through the IoT frame to assist farmers to take better actions. (Dagar, Som and Khatri, 2018) mentioned that smart farming enables the

process of farming to be economical, less difficult, reduce the cost of labour, thus produce yields that are of good quality.

The usage of a tractor in agriculture has become the starting point of a new transition of traditional farming. Tractors were used to plough, haul loads and live stocks and perform many other tasks. Now, the transition changes to automation and data-centred management. This new evolution is possible to be developed by including fundamental technologies such as the Internet of Things and artificial intelligence (Charania and Li, 2020). Table 2.1 below shows in detail about fundamental technologies in enabling technologies of smart farming.

Table 2.1: Fundamental technologies of smart farming

Internet of Things (IoT)	Micro sensors	Combination of these sensors can measure multiple aspects. For example, sensors that measure liquid levels are now united with sensors that measure temperature that also gives output in digital format. Furthermore, data that was previously unapproachable can now be measured and analysed, such as ammonia level in a poultry farm.
	Networking technology	Output from the sensors must be sent over a network for analysis and processing. Networking technologies have significantly improved such as an increase in bandwidth and range while reducing cost and power.

	Cloud computing	With cloud computing, data from the sensor has a destination where assembly and analysis can happen at greater scale and speed.
	Single-board microcontrollers and computers	Single-board computing devices consist of microprocessors, memory, and input-output pins on a single printed circuit board. It is normally used in industrial applications and embedded with other devices to provide control and interfacing. Arduino and Raspberry Pi are examples of a single-board computer.
Robots	Robots are employed for tasks that are tedious for humans. These machines are designed or assembled of a controller, communication system and autonomy.	

With the growing population worldwide, it is essential to improvise the method of agriculture and farming to the next level. Smart farming has all the opportunities to be implemented with the help of fundamental technologies such as the Internet of Things and robotics. This implementation requires less human involvement and capable of monitoring a farm from all aspects.

2.3 Concept of Smart Security

A smart security system is a system that uses personal smartphones to monitor the house, office or farm wirelessly to ensure it is secured. It is a network that is combined with electronic devices and sensors to protect against thieves and intruders, and can be