SMART CONTROL OF MUSHROOM HOUSE USING INTERNET OF THING (IOT)

MOHD NUR AKMAL BIN MOHD ROBANI

BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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MOHD NUR AKMAL BIN MOHD ROBANI

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DECLARATION

I declare that this report entitled "SMART CONTROL OF MUSHROOM HOUSE USING INTERNET OF THING (IOT)" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : _____

Name : MOHD NUR AKMAL BIN MOHD ROBANI

Date : 5 JULY 2021

APPROVAL

"I hereby declare that I have read through this report entitled "SMART CONTROL OF MUSHROOM HOUSE USING INTERNET OF THING (IOT)" and found that it complies the partial fulfilment for awarding the degree of Bachelor of Electrical Engineering"

Signature : 

Supervisor's Name : DR FAZLLI BIN PATKAR

Date : 5/7/2021

DEDICATIONS

To my beloved mother

ACKNOWLEDGEMENT

Alhamdulillah, praise to Allah S.W.T our creator. I am so blessed that I have managed to complete the project assignment successfully with Allah's blessing, I would like to thank Him for giving me good health and ability to complete this project assignment peacefully and well.

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ABSTRACT

Mushrooms are classified as vegetables in the food world, but they are actually fungi. Mushrooms provide several important nutrients and they have a very important part in the food market. Mushrooms are rich in nutrients and they able to become medical benefits such as decrease the risk of obesity, decrease the risk of diabetes, and also decrease the risk of heart disease. The main obstacle for the high yield is the defects in traditional methods used now. The research applied the use of Internet of Things with sensors to measure and monitor the temperature, humidity, Carbon dioxide gas in the mushroom farm. The collected data is checked with the bound values and triggers the actuators accordingly. The system utilizes sensor technology to optimize climate condition for optimum growth. This project is presents the element of Internet of Things (IoT) which is can monitor and control the environment for indoor cultivation of oyster mushroom. By using IoT based remote monitoring system not only the labor cost can be reduced for a big cultivation area, but it can improve the productivity of the oyster mushroom by maintaining the most suitable environment for mushroom to grow.

ABSTRAK

Cendawan dikelaskan sebagai sayur-sayuran di dunia makanan. Walaupun bukan sayur-sayuran, cendawan menyediakan beberapa nutrien penting dan mereka mempunyai bahagian yang sangat penting dalam pasaran makanan. Cendawan diperkaya dengan nutrien dan mereka mempunyai manfaat perubatan seperti mengurangkan risiko kegemukan dan kematian keseluruhan, diabetes, dan penyakit jantung. Halangan utama untuk hasil yang tinggi adalah kekurangan kaedah primitif yang sedang digunakan. Penyelidikan ini menggunakan penggunaan Internet of Things dengan sensor untuk mengukur dan memantau suhu, kelembapan, CO2 gas di ladang cendawan. Data yang dikumpulkan diperiksa dengan nilai terikat dan memicu penggerak dengan sewajarnya. Pemantauan yang ketat akhimya menyebabkan peningkatan hasil. Sistem ini menggunakan teknologi sensor untuk mengoptimumkan keadaan iklim untuk pertumbuhan yang optimum. Projek ini memaparkan elemen Internet of Things (IoT) yang dapat memantau dan mengawal persekitaran penanaman cendawan tiram dalam ruangan. Dengan menggunakan sistem pemantauan jarak jauh berasaskan IoT, bukan hanya biaya tenaga kerja dapat dikurangkan untuk kawasan penanaman yang besar, tetapi juga dapat meningkatkan produktivitas cendawan tiram dengan menjaga lingkungan yang paling sesuai untuk tumbuh cendawan.

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CHAPTER 1

INTRODUCTION

1.1 Motivation

The growth and increase of the world's population increases the demand for food production. Furthermore, the reduction of manpower in rural areas and rising production costs are barriers to food production and manufacturing nowadays. Smart farming system is a farm management concept that may use Internet of Things (IoT) technology to overcome challenges during food production and manufacturing aimed at identifying key devices, platforms, network protocols, data processing technology and smart agricultural applications with IoT for agriculture. Reviews show the evolution of the way data has been processed in recent years. The traditional approach mostly uses data manually. But, in newer approaches, the development of new technologies allows the use of data to prevent crop problems and improve the accuracy of crop diagnosis.

1.2 Project Background

Mushrooms are classified as vegetables in the food world, technically not crops. They belong to the fungus. Not only vegetables, mushrooms provide some important nutrients and they have a very important part in the Malaysian food market. Because mushrooms are rich in nutrients, they have medical benefits such as those associated with obesity and overall death, diabetes, and heart disease. They also promote healthy skin and hair, add energy, and lose weight overall. Most mushrooms are cultivated and processed by manual methods such as from seed production to packaging, as a result mushroom growers need more time and must maintain cleanliness in the planting area, which is very difficult and with users the occurrence of pests and diseases is much more sometimes -sometimes damage mushroom crops to the point of severe loss for growers. Mushroom growers grow mushrooms in straw mud houses, where maintaining the temperature and humidity required for mushroom cultivation is very difficult. Because such structures need to be improved with scientific techniques to develop appropriate low cost farm designs. The main obstacle to high yields is the lack of primitive methods currently in use. This research uses the use of the Internet of Things with sensors to measure and monitor temperature, humidity, CO2 in mushroom farms. Scientifically made mushroom farms require a lot of time and therefore cannot be made by small & marginal mushroom growers / farmers. And because mushroom units need to plant their air conditioners most of the year, mushroom farms are charged at high power prices.

1.3 Problem Statement

Currently, mushroom production is increasing due to domestic market demand and high export potential. Although mushroom production is increasing, there are some problems faced by mushroom growers during planting and marketing including lack of planting houses, lack of good crops, uneven growth, lack of capital and even lack of equipment. Therefore, it will affect the growth of mushrooms. Mushroom crops are very picky plants in care. This is because it must take into account the surrounding conditions, namely temperature, humidity and even carbon dioxide gas. Therefore, if all these characteristics are not observed, it will affect the growth of mushrooms.

On average, mushrooms are cultivated using manual methods from spawn production to packaging, which requires growers to spend more time. In such cases, it is difficult to maintain hygiene conditions in the planting area, which can cause pests and diseases and result in complete damage to the crop.

As such, the project presents Internet of Things (IoT) based environmental monitoring and control for indoor mushroom cultivation, which is a smart urban farming system that requires little maintenance, less manpower and saves a lot of space.

By using IoT-based remote monitoring systems, not only can labor costs be reduced to a greater extent, but it can increase mushroom productivity by controlling the most suitable environment for mushroom growth.

1.4 Objective

The objectives of the project are as follows:

1. To develop an apps which can monitor temperature, humidity and carbon dioxide gas of mushroom farm on real time.

2. To monitor the condition in the mushroom house in term of the temperature, humidity and carbon dioxide gas.

3. To develop automatic actuator or conditioning system so that the condition of mushroom farm can be maintained at optimum productivity.

4. To differentiate and analyse the growth of mushroom between in smart mushroom house and indoor cultivation mushroom.

1.5 Scope of Project

The purpose of this project is to analyze and improve the existing mushroom cultivation care system in a more effective way that is smart farming system. The benefits of using a smart agricultural system are that it requires less maintenance, less manpower and saves a lot of space. Further, the project is dedicated to improving the conventional plantation system in general.

In addition, the project presents the implementation of the Internet of Things (IoT) which monitors and controls the environment for indoor mushroom cultivation. This allows users to monitor important factors such as temperature, humidity, humidity and light intensity in the mushroom farm through the end tool.

Mushrooms thrive in temperatures ranging from 22 to 25 degrees Celsius, humidity levels of 70 to 90 percent, and carbon dioxide levels of less than 1000 parts per million. Sensors are installed in predetermined spots throughout the property. The sensor then determines the parameter's status, which is transmitted to the remote monitoring station via the low-power MCU Node (microcontroller). As a result, the information gathered is saved on a cloud platform. Using the Arduino integrated development environment, the controller code is written in the Arduino programming language, debugged, compiled, and burned to the microcontroller. The data indicate the outcomes of monitoring the ambient parameters that allow users to access the Internet from any location.

1.6 Report Outline

For this report it consists of five chapter, Chapter 1 is an introduction about the project which is project background, problem statement, objectives and scope. This chapter will explain and discuss about the reason of the project and also the idea of the project. Other than that, Chapter 2 will explain about the literature review of the related topic which is can be used as reference source to complete the project. This chapter are going to discuss about all the theories and related methods that can be used to complete the project. Next, Chapter 3 is methodology part and this part will discuss the method in developing the project and the flow chart of work will be illustrated from the method used. The process of smart mushroom house work will also be shown in this chapter. Chapter 4 will describe the preliminary result and the discussion from the analysis part and the results obtained will be explained in this chapter. Finally, the conclusion from the overall results obtained and also the work done for Final Year Project 1 will be discussed in Chapter 5.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

This chapter will go over how the necessity for food and the limited area or land available as an agro-economic activity have led to smart farming technology being popular and one of the most promising solutions for ensuring food security [1]. Extreme weather and climate change, on the other hand, have an impact on mushroom production, raising prices and reducing the quality of the harvests produced. This study describes the monitoring and operation of an internet-based (IoT) environment for indoor mushroom production, which is a smart farming system that requires little maintenance, requires little manpower, and saves a significant amount of space [5].Using the IoT platform will enhance the capabilities of current equipment for remote monitoring purposes and at the same time log data for analysis and reference.

2.2 Mushroom Farm Technology Around the World

The global mushroom cultivation market is expected to grow significantly as a result of factors such as mushroom's numerous health benefits, rising per capita mushroom consumption, cost-effective production, rising demand for vegan and natural foods in the diet, and a growing health-conscious population around the world [2]. The lack of technical understanding for spawn production among growers in developing nations, on the other hand, may stymie the market's expansion.

Button mushrooms contributed to the largest market share in 2019. Button mushrooms are a widely used type of mushroom worldwide and potentially offer many health benefits. This type of mushroom is grown commercially in almost all major mushroom producing countries such as China, Japan, the US, the UK, Germany, and Poland. Increased R&D on

white mushrooms to find the potential to prevent cancer, along with its affordable availability compared to typical mushroom types, is projected to increase the demand for button mushrooms during the forecast period. It accounts for more than 40% of global production.

China is the world's greatest edible mushroom producer with an estimated annual yield of 38.42 million tonnes in 2017 [4]. This accounts for around 75% of total global output. Mushroom farming is the country's fifth largest agricultural sector, valued USD 24.0 billion. In the worldwide mushroom production market, Asia Pacific is a significant region. China, the world's largest mushroom producer, has a higher per capita consumption than other countries. Mushroom consumption in Asian countries such as Japan and India is increasing at a significant rate accredited by increased production. Increased vegan populations and changes in the direction of nutrient-rich foods have led to the growth of mushrooms in Asian countries [18].

2.2.1 History of Mushroom Cultivation based on Europe culture

Hippocrates first mentioned the medicinal value of mushrooms. The first mention of mushroom cultivation, which differs from the probability of emergence in the field, is in the year l652. The first record of commercial production throughout the year was in the year l780 [7]. When a French gardener began planting mushrooms in an underground quarry near Paris, gardeners introduced mushrooms growing to North America using dark areas under greenhouse benches to grow mushrooms. In 1894 the first structure designed specifically for growing mushrooms was built in Chester County, Pennsylvania, commonly referred to as the mushroom capital of the world. Since ancient times, mushrooms have been considered the 'Food of the Gods'. The ancient Egyptian pharaohs believed that they had magical powers, while the Chinese used them for property that gave them health [7].

2.2.2 History of Mushroom Cultivation based on Indian culture

The Department of Agriculture in Solan, Himachal Pradesh, has begun small-scale mushroom cultivation. In India, commercial mushroom farming is carried out with the collaboration of scientists and farmers. From 1,000 tonnes in 1981 to 80,000 tonnes in 2006, mushroom production has expanded dramatically. Small and medium production units account for half of this, while industrial organisations account for the balance. In various states including Haryana, Uttar Pradesh, Punjab, Uttarakhand, Himanchal Pradesh, and Tamilnadu, mushroom cultivation is currently one of the key sources of revenue for farmers [8].

2.2.3 Applications of Wireless Sensor Networks in Shiitake Mushroom

Cultivation of using wireless sensor network (WSN) to build decision support system to solve real-time problems. Based on WSN and mobile computing, the greenhouse environment for mushroom cultivation was developed for shiitake mushrooms that are next to buttoned mushrooms in the edible world [4]. Shiitake mushrooms are eaten raw, cooked or dried, making them a versatile food. It offers a large number of health benefits. With increasing demand, output should increase. A large number of mushrooms grow indoors. Environmental factors such as humidity, temperature and carbon dioxide (CO2) in the farm should be properly maintained for optimized growth [9]. Managing these parameters manually will be difficult and therefore developed an automatic control system. Mushroom farms need to change from day to day during different stages of growth. They believe that this need can be achieved through automated solutions. WSN offers a strong combination of sensing, computing and distributed communications [4]. WSN integrates sensor knowledge, control, digital networking, information storage and processing. The shiitake mushroom monitoring system developed in this project called Smart Shiitake Mushroom System (SSMS) will monitor the temperature, humidity and CO2 in the mushroom greenhouse. Furthermore, the system will also collect real-time picture or video data via CCTV cameras and store the data into a database via a web server (Cloud). The application layer provides user requests and display modules for the value of the environment parameters taken [2].

2.2.4 Environment Control for Smart Mushroom House

Building a Smart Mushroom House (SMH) for shiitake mushrooms which is considered popular in Malaysia. The system uses sensor technology with feedback systems to optimize climatic conditions for optimal growth [2]. There are many problems and challenges facing this industry. The challenges for Malaysian mushroom growers are low quality seeds and high production costs. This paper emphasizes solutions to improve mushroom cultivation yields. The most popular mushrooms on the market are Oysters and Shiitake mushrooms . The most important parameters for the mushroom cultivation environment are Carbon Dioxide (CO2), humidity, temperature and light. The most important component is the controller to handle the overall monitoring and control of system functions [8]. The Smart Mushroom House system monitors parameters and controls the device in order to use resources as much as possible. Sensing parameters are Carbon Dioxide (CO2), humidity and temperature. The parameters read by the sensor will be sent wirelessly using XBEE technology to the control panel and the entrance. Control devices such as humidifier fans and circulating fans are to increase humidity, to remove excess CO2, to move air inwards. Growth factors are automatically controlled based on data from sensors to follow the optimal growth climate for mushrooms at different stages of development. Humidity, temperature and CO2 are tracked in real time through sensors inserted into the mushroom cultivation system at significant intervals [9].

2.3 Internet of Things (IoT)

The Internet of Things (IoT) is a network of physical items that use integrated technology to communicate, feel, and interact with their internal and external states [1]. Monitoring, control, forecasting, and logistics are examples of IoT applications in agriculture. Over an internet connection, IoT devices will receive data from installed sensors and deliver it to a database [3]. WiFi modules are the most common IoT connectivity. The platform provider API format must be followed when sending data to the server, and the data will be saved in the database accordingly. The user can view or retrieve data via a browser application on either a smartphone or a computer [6]. The browser will make a request to the server, which the server will fulfil. The control process follows the same path, beginning with user command data delivered to the server, which is then saved in the database. By asking it, the device will

continue to monitor changes to the command storage data. When an IoT device receives command data, the data is processed according to the system developer's instructions. Internet of Things (IoT) is a network of physical things with embedded technology that can communicate, feel, or interact with their internal status or external environment. Monitoring, control, forecasting, and logistics are examples of IoT uses in agriculture. A block diagram of a basic IoT system is shown in Figure 2.1 [8]. Over an internet connection, IoT devices will receive data from installed sensors and deliver it to a database. WiFi modules are the most common IoT connectivity. The platform provider API format must be followed when sending data to the server, and the data will be saved in the database accordingly [7]. The user can view or retrieve data via a browser application on either a smartphone or a computer. The browser will make a request to the server, which the server will fulfil. The control process follows the same path, starting with the user command data provided to the server, which is then restored in the database by the server. By asking it, the device will continue to monitor changes to the command storage data. When an IoT device receives command data, the data is processed according to the system developer's instructions [10].

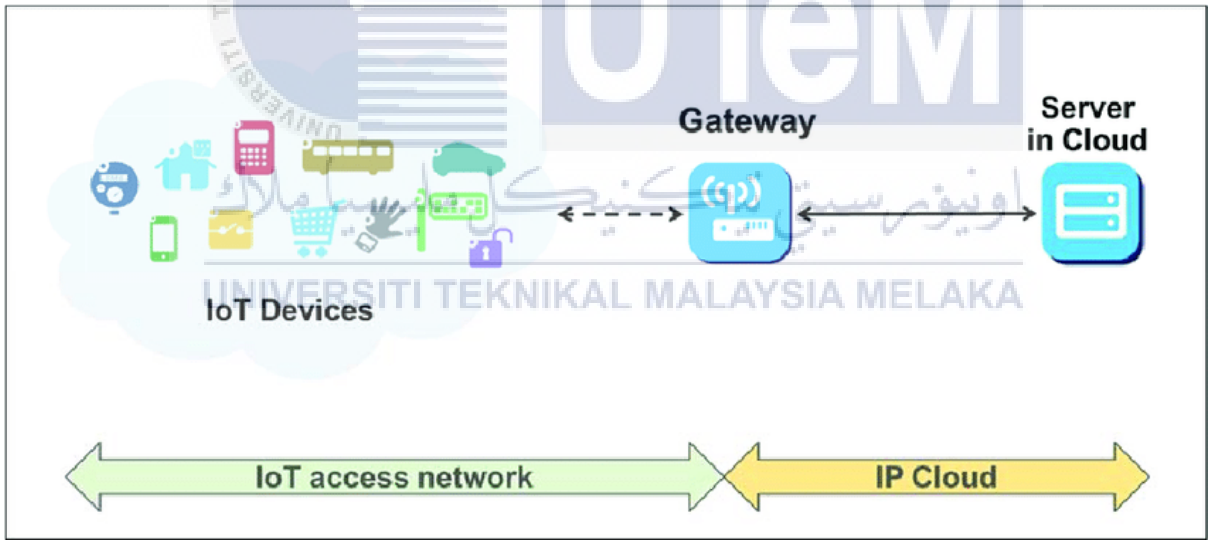

Figure 2.1: Basic topology of IoT system