APPLICATION FOR AGRICULTURE SENSOR USING INTERNET OF THING FOR TEMPERATE VEGETABLE CULTIVATION

NUR ATIQAH BINTI ROMLI

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NAME : NUR ATIQAH BINTI ROMLI

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CERTIFIED BY;

DR MUZAFFAR HAMZAH

1. **SUPERVISOR** **SIGNATURE**

DECLARATION

I hereby declare that the material in this thesis (**Application for Agriculture Sensor Using Internet of Thing for Temperate Vegetable Cultivation**) is my own except for quotations, equations, summaries, and references, which have been duly acknowledged.

11 FEBRUARY 2022

NUR ATIQAH BINTI ROMLI

BI1711018

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ABSTRACT

Sabah was in short supply of temperate vegetable for consumption such as shallots, garlic and chillies which make the state are not achieving the self-sufficient level (SSL) when they need to spend on import the vegetables because of the low supply of the products. In order to solve this problem, self-indoor farming need to be spread among people to cover their need in vegetable consumption and smart farming is one the solution for indoor farming monitoring in terms of water irrigation system for the plants. However, to do this self-indoor farming are limited to certain people because they tend to neglect or over watering their plant. So, they need Internet of Thing Technologies to help them to monitor their plants.

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CHAPTER 1

INTRODUCTION

Smart farming is a combination concept of supervise plants by using technologies such as Internet of Thins (IoT), robotics, virtual reality (VR), drones, and artificial intelligence (AI). Along with the purpose is to improve the quantity and quality of product (temperate vegetables) with monitoring the plants through an application even though when user are not around with their plants. On the other hand, parts of tools that will be use in this project are sensor, sensor is a device that will recognize the change in the environment of the plant that are in the container such as the level of moisture of the soil in the container, it will respond to it by give the data to the main board and will transfer the data to the mobile phones or any gadget that have an interface which can control all of the sensor and are readable by human along with other function. The water irrigation systems (soil moisture and temperature sensor) will be put in every pot of the plant in a room, it will read, measure, and monitor the temperature of the plant and level of water level or soil moisture in the container. If the moisturizer level of the soil that the plant needed is less, then the moisture soil sensor will give an information to inform user to alert the automation water nozzles to perform their works. Afterwards the roles of the sensor in smart farming agriculture is to monitor every single thing such as measuring temperature, monitor the humidity, and scanning the soil moisturizer for each plant that we have in the container.

So, this main purpose project are to plan and design a better Application for Agriculture sensor in term of designing an application that can monitor multiple sensors in one place as to developing and improving an agriculture application that can help user to monitor their indoor farm by expanding the scalability range of connection (not limited only to Bluetooth) along with access control for multiple sensors under one application which is user can use more than one sensor to monitor their plants. This agriculture application will use Arduino sensor as hardware and Arduino Ide and Blynk App for software. Expected outcome for this project is to develop a mobile application that can remotely monitor the plants. Other than that, in this chapter it will explain more about problem background, problem statement, and project scope for this project.

1.1 Problem background

Due to short supply of vegetable especially in temperate vegetable such as shallots, garlic, and chilies. People nowadays tend to do indoor farming by their own to counter the problem lack of vegetable for their consumption on their daily meals but some of them does not have time to monitor their plants regularly or may have forgotten about their plants. However, most of the smart farming application are limited to Bluetooth connection where user cannot monitor their plants when they are not around in their house for example when they need go to work or vacation. Other than that, some of the smart farming applications are only focused to monitor on one plant where user can plant as many as they want and need more sensor to monitor it.

1.2 Problem Statement

In order to do this project, an application for sensor to track and monitor the crops will be developed. For now, the main purpose for this project is because of:

1) Cannot view the past data.
2) Limited connection range.
3) Limited to number of plants and sensors.

So, this project is a an improving an Application for Agriculture Sensor especially for self-indoor farming in term of collecting data to show progress of the plants, expanding the range of scalability of the sensor, and applying the multiple sensors using Internet of Thing for Temperate Vegetable Cultivation will be developed.

1.3 Objectives

1) To plan and design a better Application for Agriculture sensor in term of designing an application that can monitor multiple sensors in one place.
2) To implement and test the Application for Agriculture Sensor by using Blynk App that will link to Arduino sensor.
3) To test and evaluate the performance of Application for Agriculture Sensor Using Internet of Thing for Temperate Vegetable Cultivation by User Acceptance Testing.

1.4 Project Scope

This Agriculture Sensor Application Using Internet of Thing for Temperate Vegetable Cultivation project is an improvement on an established agriculture application in terms of presenting details regarding temperate vegetables, expanding the range of sensor connectivity and access control of multiple sensors in one application by using Internet of Things sensors (IoT). Farmer, agriculture student or any person who want to start do the smart self-farming by their own.

Table 1: Modules of the System

Modules/ Phase	Description	Target User
User Authentication	For user to login or sign up	User
Homepage monitoring page	First interface of this application is selection of button to choose on monitoring page or info and tips page. Monitoring page are a page that consist of temperature and humidity of soil along with button to watering the plants and add another plant	User

1.5 Organization of the Report

Short description of each chapter:

Chapter 1: Introduction

This chapter explain more about problem background, problem statement, objectives, and project scope.

Chapter 2: Literature Review

Literature review is a summary of the finding that explains the research that has been done on the topic. This chapter summarises the project's analysis findings as well as current systems, principles, and processes.

Chapter 3: Methodology

Methodology explain about project development phase that includes planning phase, analysis phase, design phase, implementation, and testing phase. It also include hardware and software requirement for this this Agriculture Sensor Application Internet of Things for Temperate Vegetable Cultivation project.

Chapter 4: Data and Implementation

Data and implementation explain about implementation of project development phase that includes implementation, and testing phase. It also include hardware and software requirement for this this Agriculture Sensor Application Internet of Things for Temperate Vegetable Cultivation project.

Chapter 5: Conclusion

Conclusion about the whole project of Application for Agriculture Sensor Using Internet of Thing for Temperate Vegetable Cultivation.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature review is a summary of the finding that explains the research that has been done on the topic. This chapter summarises the project's analysis findings as well as current systems, principles, and processes.

2.2 Internet-of-Things (IoT)-Based Smart Agriculture: Toward Making the Fields Talk

This study is focused on a paper published in the journal Internet-of-Things (IoT)-Based Smart Agriculture: Toward Making the Fields Talk. According to substantial predictions, the global population is expected to reach 9.8 billion people by 2050, up 25% from current levels. Food intake can also be expanded by 2050 in order to feed this population. However, only a small portion of the earth's surface is suitable for temperature, atmosphere, area, and soil fertility, and the vast majority of the suitable area isn't really equal. However, there are several new land scape and plant types that are difficult to measure. Rapid construction today continues to pose a danger to the availability of fertile resources. Agriculture's food yield has decreased over the last ten years. As a result, the difference between food demand and availability is widening, causing increasing anxiety. In reality, food crop production needs to be increased because global demand is in short supply. Farmers must give greater attention to crop conditions in order to do this.

In any case, according to research, each crop has distinct characteristics that could be evaluated differently in terms of quality and quantity. Significant aspects such as type of soil, fertiliser availability, and irrigation flow rate can be used to determine its adequacy and competence for a particular crop. As a result, to deal with the burden with various problems. Growers need modern technology mediums to grow more crops in order to meet the food demands of those who depend on agriculture (farming).

As a result, sustainable farming is becoming more essential, as farmers would spend 70% of their time observing and studying the plant conditions rather than performing real farm work based on outmoded technique, farmers need to visit the agriculture site frequently. Initially, they could locate an undesirable environment in its early stages utilising just technologies such as optical sensors with GPS. This result demonstrates why we need technology; it can assist growers from seeding to crop processing, as well as storage and transportation, by the use of modern agriculture, which includes smart tools and kits such as sensors and applications. Sensors may be quickly mounted and begin gathering data. Remote sensing assists accurate and precise data in any region of crops lands, which benefits seed and site agriculture. This emerging technology (IoT) is beginning to have an influence across a broad range of sectors and markets, including engineering, wellness, connectivity, and agriculture. It can help to reduce inadequacy and brush up the performance across all market. To make it short, figure 2.0 below show the man drivers of technology to agriculture.

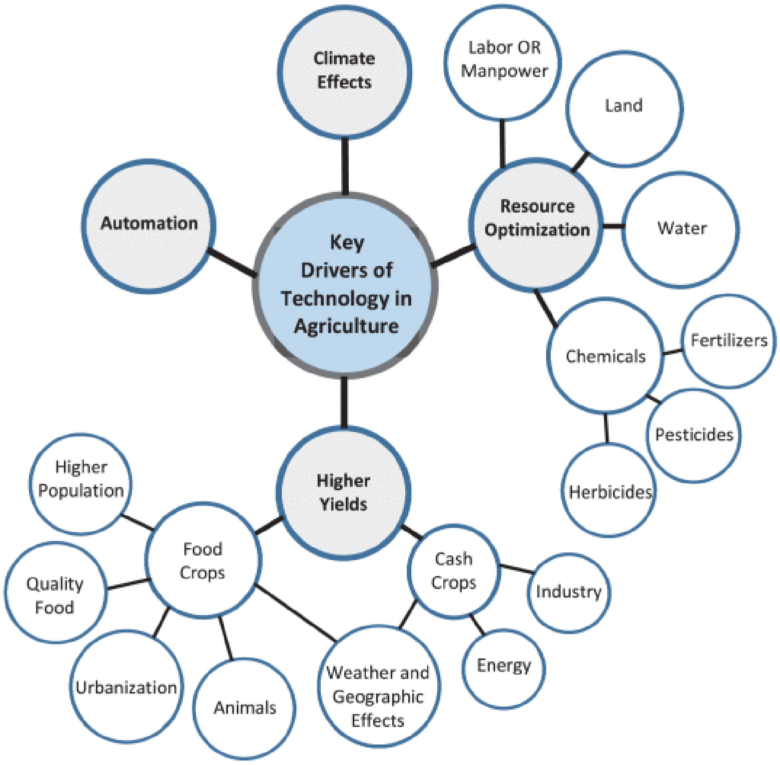

Figure 2.0: Key drivers of technology in agriculture industry.

In agriculture, IoT can solve the traditional farming problem such as soil sampling and mapping, irrigation, fertilizer, crop diseases and pest management, and yield development. Figure 2.1 below show a list hierarchy of major applications, service and wireless sensor that being uses in agriculture.

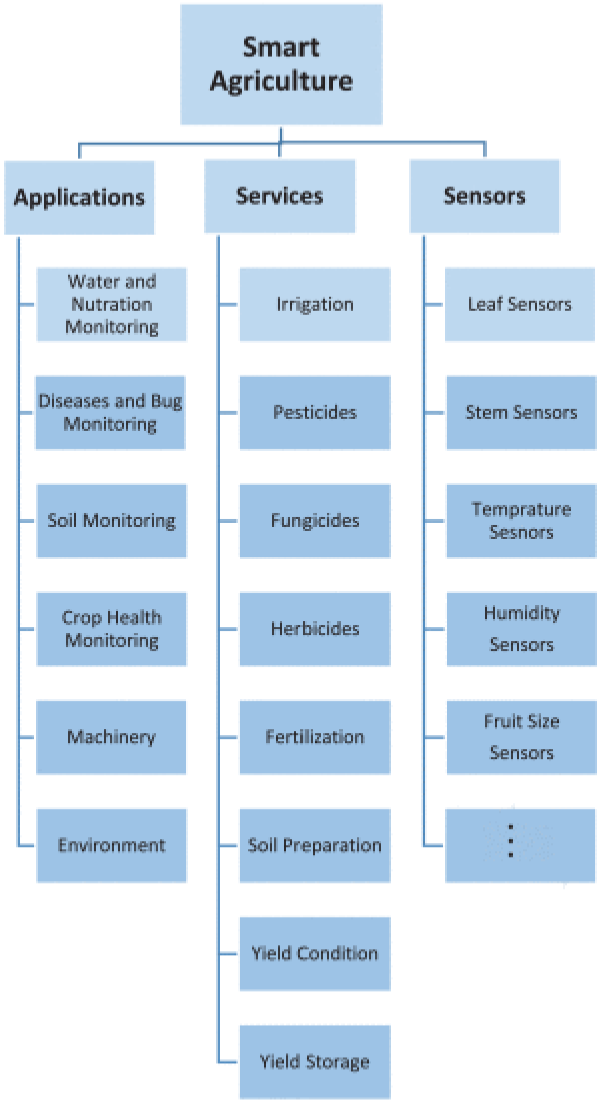

Figure 2.1: General hierarchy of possible applications, services, and sensors for smart agriculture.

a) Soil sampling and mapping

Soil sampling is the first phase in obtaining specific crop information. This move will assist farmers in taking an action for their plants at various stages, including enlarging the management region, increasing the precision of the pace and placement of required inputs, and fertiliser management for optimum crop output. The main goal of this move is to help farmers determine the nutrient measure by assisting them in estimating the pH and nutrient of a field that is required depending on the nutrient's deficits observed in the field, so that changes can be made based on the nutrient deficiency that was identified. Soil inspections are recommended to be performed on a yearly, particularly in the spring, but they should be tested in the fall or winter based on the soil quality and weather. To conduct this test, the farmer was given a variety of toolkits and sensors to monitor the soil quality, especially the key soil sensors, which are the soil sensor and optical sensor. Aside from that, soil sampling allows you to adjust the fertiliser application intensity depending on where you are in the region. It would also have an effect on fertiliser production, nitrogen depletion reduction, and natural resource conservation in the local area.

b) Irrigation

Humanity and agriculture all depend on water. Agriculture consumes about 70% of all fresh water. The root cause of this fresh water uses in 2013 was to keep track of the crops' perceptible observations for irrigation decision-making. However, there are certain water irrigation issues, such as a lack of fresh water, floods, and furrow irrigation (water crises all over the world), which have a negative impact on crop quantity and quality due to a lack of fresh water. It would be a challenge or a mess not only because there is a lack of water, but also when there is an abundance of fresh water. Which would lead to microbial infection divergence and nutrient depletion in the soil.

As a result, estimating the water requirements for crops with crop quality, irrigation process (irrigation is a method of water to the soil by different networks of tubing, valves, and sprays), soil type, crop requirements, and relative humidity is difficult. The usage of Internet of Things (IoT) based methodologies including Crop Water Stress Index (CWSI) based irrigation management could result in a significant increase in crop productivity. CWSI is built on a tracking device in which sensors are attached to collect data regarding crop canopy and air temperature, as well as other data such as weather data and satellite imagery, which is then sent to a processing centre where intelligent software applications are used to analyse the crop data. As a consequence, a precise soil moisture and air moisture measurement system that is linked to a water irrigation control system using wireless sensors has been created, resulting in an efficient use of water for crops with improved crop health and farmers being able to secure their agricultural water supply from pollution.

c) Fertilizer

Plants primarily need three macronutrients: nitrogen (N) for leaf growth, phosphorus (P) for root, crop, and fruit production, and potassium (K) for stem growth and water flow. Despite the fact that crops require certain macronutrients, especially nitrogen, they would only use or consume half of the nitrogen (N) as fertiliser, with the remainder being released into the atmosphere. Agriculture, on the other hand, has several problems when it comes to fertiliser. If fertiliser is insufficient or used improperly, it can damage crops, plant health, and financial losses (excessive use), as well as have negative consequences on the ecosystems by draining soil fertility, contaminating water sources, and contributing to climate change, as declared by about 80% of the world's deforestation is due to agriculture.

Through the introduction of fertilisation under smart agriculture, it would be easier to correctly predict the necessary quantity of nutrient and, as a result, reduce the harmful impact on the ecosystem. With the aid of new IoT-based fertilising, it is now possible to measure the observable trend of nutrient demand with greater precision and with less labour. Fertilization necessitates the determination of soil nutrient amounts at each location depending on various of factors like crop composition, soil quality, soil immersion potential, commodity yield, fertility quality and consumption rate, and climate conditions by examining soil samples at each location because soil nutrient level assessment is costly and time consuming.

Figure 2.2: Processes involved and possible outputs of smart farming.

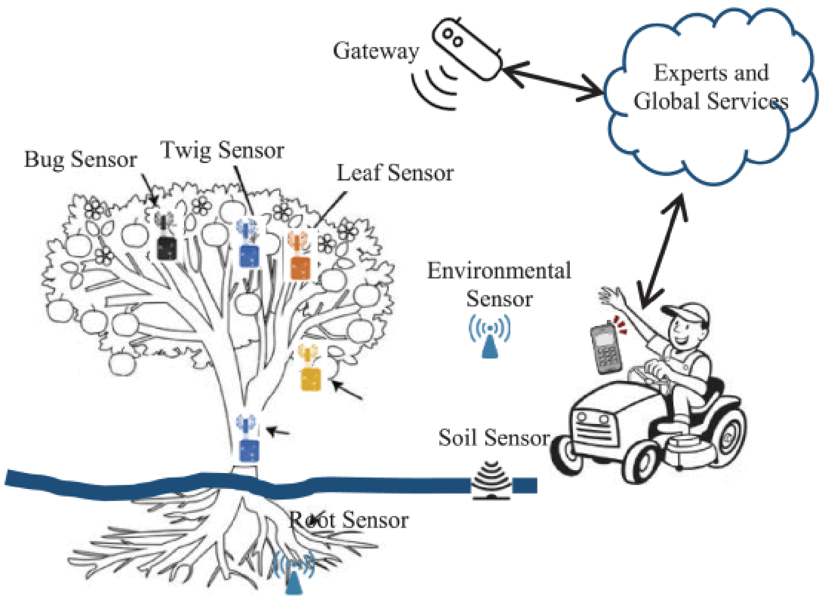

Figure 2.3: An IoT based farm area network (FAN).