UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SMART AUTO PLANT MONITORING SYSTEM USING GSM

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

by

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APPROVAL

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ABSTRACT

All plants need enough and sufficient water or food resources to stay fertile and healthy. Plant may be wither and die if the plant is supplied with excess or a lot of amount of water or less and too little amount of water. Previous research has highlight on the method and way on how to water the plant on the right time with the right amount of water. This research focused on how to create an auto watering system using GSM that can help to water the plant at the right time with the suitable amount of water. This home based system is to facilitate human in watering plant without involving any manpower or energy. In developing a fully automated system that intelligently measures the soil moistures, different approaches of methods and ways used in varying fields were studied. The most suitable system has been chose to be a source of guidance and ideas. An own ideas proposed to improve the existing systems. The final materials and components needed to support an efficient auto watering system are obtained by analyzing and testing the prototypes. A plant auto watering and fertilizing system using GSM and Arduino is a system that facilitates human in watering the plant.

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ABSTRAK

Tanaman memerlukan sumber air dan makanan yang mencukupi dan memandai untuk menjadi subur dan sihat. Tanaman boleh layu dan mati sekiranya disiram oleh lebihan air atau dengan air yang tidak mencukupi. Kajian yang lepas telah member fokus kepada kaedah untuk menyiram tanaman pada masa yang sesuai dengan jumlah air yang betul. Kajian ini tertumpu kepada cara untuk memcipta sistem penyiraman automatik menggunakan Arduino supaya tumbuh-tumbuhan disiram pada masa yang sesuai dengan jumlah air yang betul dan sesuai. Sistem berasaskan suasana rumah adalah untuk memudahkan manusia dalam menyiram tumbuhan tanpa melibatkan mana-mana usaha atau tenaga manusia. Untuk membangunkan sistem automatik sepenuhnya yang pintar untuk mengukur kelembapan tanah, cara yang berbeza digunakan dalam bidang berbeza telah dikaji semula. Sistem yang paling bersesuaian telah dipilih untuk menjadi sumber bimbingan dan idea. Idea sendiri ditekankan untuk meningkatkan pendekatan sistem yang telah sedia ada. Bahan-bahan dan komponen akhir yang diperlukan untuk menyokong sistem penyiraman automatik yang cekap telah diperolehi dengan menguji dan menganalisis prototaip. Sistem penyiraman tumbuhan yang automatik dengan menggunakan Arduino dan GSM adalah satu sistem yang membantu untuk memudahkan manusia dalam aktiviti menyiram dan membaja tumbuhan.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

In this chapter, simple explanation about the study is explained. The project background presented the main ideas of the thesis. Besides, this chapter will stress about the problem statement, project objectives, scope of project, methodology and thesis structure. All related data on the study is presented.

1.1 Background

Plants are a please home decorations for greener interior, it can be an interesting decorating ideas for homes too. Besides, growing plants in indoor spaces naturally help purify the air human breath and also acts as little oxygen supplier which is beneficial to human being. It is proven in a study by NASA and the Associated Landscape Contractors of America.

However, most people faced difficulties in maintaining their plant healthy and alive. According to some research, people often tend to forget to nurture their plant(s), between daily activities. The plant need to be watered with an adequate amount of water and fertilizer to keep them fertile. The previous research said that, the environmental needs for plants to grow include adequate space for root and canopy development, enough water, oxygen, carbon dioxide and mineral elements, light and suitable temperature for essential physiologic processes. Therefore, watering and fertilizing is an important activity in plants care. Each plant needs enough quantity of water and also fertilizer because too much water or fertilizer can damage plant roots and too little water and fertilizer causes growth to become erratic and stunted.

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1.2 Problem Statement

The plant needs the care taker to always sensitive with it needs. Watering plants at the suitable and appropriate rate for the plant is essential. However, many people forget about this routine. People always forget to care the plants due to their tight schedule.

For those who always travelled and have a tight daily schedule, they cause to always forget the desire to have indoor planting for fear bound by watering schedule and thought it was a burdensome and tiring task to do. Even though, there are other alternate ways such as hiring someone to water the plant periodically but this way could swallow a lot of cost. Besides that, they also may have some trust issue to let other people entering their house when they are absence. They are concerned about their house safety and does not trust the outsider without supervise them. Additionally, watering plants are tedious repetitive tasks and may cause exhaustion to busy people.

Besides that, people usually not able to predict the sufficient amount of water and accurate amount of fertilizer needed by plant to maintain the soil moisture level and nutrients needed by plants. Then, there was a situation where even the plant is watered or fertilized periodically but still dies. This happened because the plant may have over water or less water or also over or less amount of fertilizer. People that do not have experiences always have a problem with the watering and fertilizing routines.

Thus, in order to resolve these problems, an automatic watering system is proposed. The automatic watering system is designed to be assistive to the user. This automatic system is one of the solutions to do the watering and fertilizing independently without need human to supervise the system regularly. Even in horticultural activities and production, there are research conducted, focused on the automation of the most tedious and repetitive tasks.

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1.3 Project Objectives

The objectives of developing this system are:

(a) To identify the suitable materials and components needed to support the auto watering.

(b) To design and implement an auto watering system using soil moisture sensor.

(c) To develop an auto watering systems that help and facilitates human in the watering task using Arduino software and GSM module.

1.4 Scope of Project

This project is an improvement of conventional method of watering plants to the auto watering. The project commonly focuses on the farmer or gardener that plants trees in a farm, garden or in house yard. This project also can be used by the officer or workers who has tight schedule. The officer may not have enough time to care about the plants due to the full-time working hours.

The watering activity is suitable done in the morning because at that time, photosynthesis process is occurs by most of the plants. By watering the plants, it will make the plants become more fresh and hard to tilt while the fertilizing routine will give enough nutrients to the plants body. The watering activity also can be done in the evening and depends on the moisture of the soil. If the soil is dry, it will be great to water the plants but if the soil is already moist, the plant taker should not water the plant to avoid the overdose of water in the soil. The fertilizing activity is best done once a week or at any required time.

This project of auto watering system will help to ease both water and fertilize work during the peak hours or at the time that the owner of the plants is not available. The owner can avoid from forgetting to water and fertilize the plant by setting the project to send SMS updating the condition of the plants.

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1.5 Expected results

This section will discuss about the expected outcome after the project has been done and submit. It will also focus on the factors that affect each of the steps taken during the project is running.

First of all, the project is totally automated system and there is no need of human energy or manpower in controlling the system. Arduino is used to control the process and GSM module is used to send alert messages to user on the cell phone. In this auto plant watering system, soil moisture sensor will check the moisture level in the soil. If the low moisture level is detected then, Arduino will switch on the water pump to supply water to the plant. Water pump gets automatically off when the sensor detects enough moisture in the soil. Whenever system switches on or off both pumps, a message is sent to the plant owner via GSM module, updating the status of water pump and also the moisture of the soil. The mode of both water pump is also displayed on the LCD screen. This system is very useful in gardens, farms or any planting yards.

1.6 Thesis outlines

There are five (5) chapters in this thesis report which included of introduction, literature review, methodology, results and discussion and finally a conclusion and recommendation. Each chapter will discuss its own aspects that related to the project.

Chapter one is the introduction to the project or study. There are the problem statements, objectives and scopes of the project along with the summary of flow works that have been discussed and presented in this chapter.

Previous studies are reviewed in chapter 2. This chapter discussed about the methods and approaches used in previous studies. The differences of strength and weakness can be used as the guidelines to develop a more efficient automatic watering system. The own ideas also proposed and justified in this chapter.

Proceed to chapter three, this chapter focuses on the methodology and approaches on the project. The software implementation and hardware development of the project is included in this chapter.

Results and discussion about the expected results are presented in chapter four. The discussion about the updated results will be discuss and focus in this chapter.

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Lastly is the chapter five that presents a comprehensive conclusion of the project. The suggestions and recommendations for future improvement in the functional also mentioned.

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CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In this chapter, more detailed discussion on the related past studies which gives more enlightenment to this project, smart auto plant moisture monitoring system using GSM or closely related system are discussed. There is a wide source of information of the related areas published in the web about moisture monitoring system. The gathered information gives recommendations on the method and sample current opinion. Thus, the idea supported and justified with significant past research.

2.1 Research on Existing System

2.1.1 Automatic Soil Moisture Sensing Water Irrigation System with Water Level Indicator (Marien M. Medalla, 2015).

This project designed to aim on the condition of soil of a certain area of plantation and also to determine the accurate time the plants need to water with adequate amount of water.

This project focused solely in build a water irrigation system controlled by a device that will aware of the soil moisture condition and will trigger the system to start running. An adequate amount of water will be automatically released by the drip hose if the moisture sensor senses a dry soil condition.

The project composes of Arduino board, driver module, relay module, real time clock module, soil moisture sensor, water level sensor and power supply. Each channel has its own drip hose and water valve that flow water to the plants when the sensor detects the dry condition of the soil. The sensor is located at the middle of the single channel and is able to sense the soil moisture level.

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The result of program is obtained to operate the automatic irrigation system, update by the scheduling process that is provided by the RTC, the amount of suitable water based on range of its soil moisture needed to deliver for the plants is being controlled so there is no exceed of water. [1]

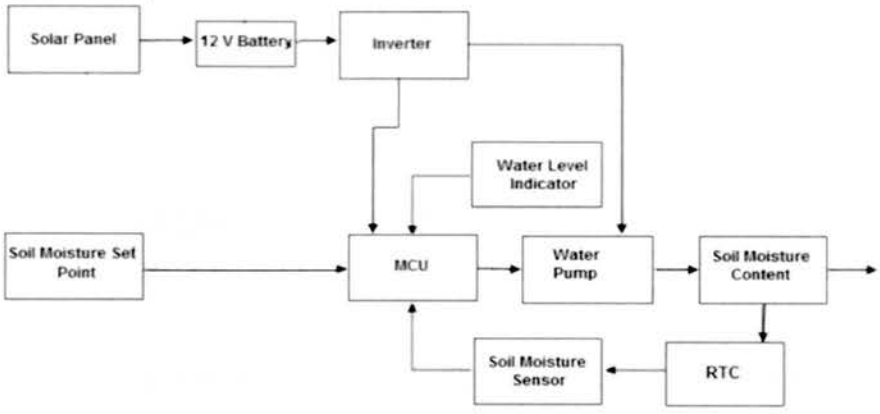

Figure 2.1.1 Block Diagram of Automatic Irrigation System

2.1.2 Design and Implementation of Automatic Plant Watering System (Priya R, Archana P, 2016)

The main propose of this technique is development for measure level of soil moisture in real time method. A model of automatic irrigation system which is based on controller and solar power was used only for source of power supply. Various sensors are placed in rice field. Sensors sense water level regularly and give the information to farmer through cellular phone. Farmer controls the motor using cellular phone without going in rice or paddy field. If the water level reaches at danger level, automatically motor will be stop.

The research is Arduino based design which controls the water supply for plants and the field to be irrigated. The moisture sensor will not be activated without the presence of water. Once the plants gets dry, soil moisture sensors sense the dry level. In case when there is more than one signal for water requirement, then the microcontroller will prioritize the first come first service basics. [2]

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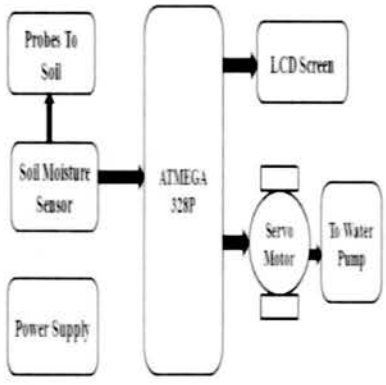

Figure 2.1.2 Block Diagram of Hardware Configuration

2.1.3 Smart Agriculture Monitoring System (Dr.N.Suma, Sandra Rhea Samson, 2017)

This system is build to develop devices to manage and display the users using wireless sensor network system. This project system idea proposes a methodology for smart farming by using sensing system and irrigator system through wireless communication technology. It provides a low cost and efficient wireless sensor network to detect the moisture of the soil and temperature of the soil from various locations of garden.

In the field, many sensors are deployed such as temperature sensor, PIR sensor and moisture sensor. The information collected from all these sensors are transferred to the microcontroller. In manual mode, gardener has to switch ON and OFF the microcontroller by tapping the button in the android application. This is done with the GSM module that has connections with the application. In automatic mode, the microcontroller is switched ON and OFF automatically but itself if the value sense by the sensor exceeds the threshold set point. [3]

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2.1.4 Smart Precision based Agriculture using Xbee Application (K. Lakshmisudha, Swathi Hegde, Neha Kale, 2013)

The proposed model targets to develop a system that will provide an ideal environment for the plants. The sensor used will detect the soil moisture and humidity level and send the information gathered via Zigbee application to a remote computer. The computer is able to control the motor and humidity fan located at the plants site. This will reduce human energy and also ensures that an optimal environment is provided for the crops thus improving crop quality.

The soil moisture sensor will detect the soil moisture level. A notification will be send to the owner when the moisture level reaches below permissible level. The owner can turn on the motor by using their smart phone. The water will start flowing out of the tubes when the relay turns on the motor.

Once it reaches the required water level, the motor will turn off automatically and the same notification will be send to the owner. The sensor data obtained from the sensor will be display in the user interface. [4]

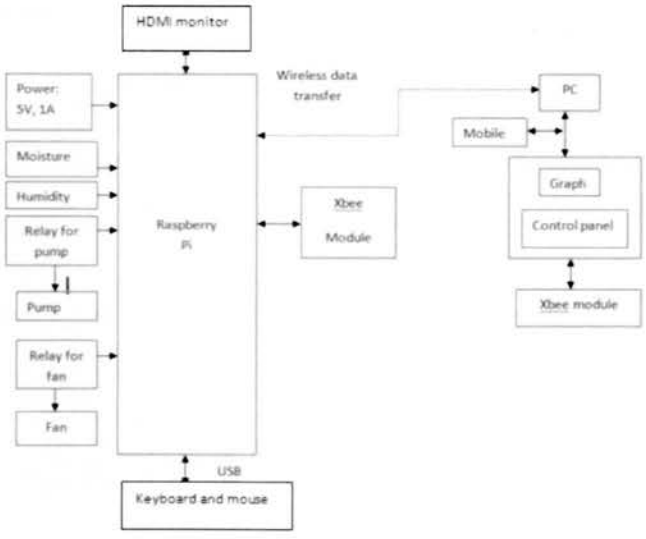

Figure 2.1.4 Block Diagram of System Model

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2.1.5 Smart Nursery Monitoring System using IoT (D. Ramya, C. Monica, K. Praveen Kumar, 2017)

This project purposed on building a monitored nursery in which the information about temperature, soil moisture and status appliance such as fan, lights and water pump that have connections with a circuit that controlled the nursery parameters which includes temperature, humidity and water supply for the plants. Atmega328 will turn on and off the appliances automatically. In these days, IOT is mostly used in monitoring nursery. In this project, the information about the effects of climate in plants is collected using WiFi module.

The main intention of this project is to collect various parameters like moisture, temperature, light intensity and provide web interface (IOT) to the user by using ESP8266 (WiFi module).Then the user can easily monitor the crop and minimize human interaction and to reduce the wastage of water by saving the natural resources. The water contents in the soil is measured by using the moisture sensor. When the soil moisture is below the defined level then the soil moisture sensor sends the measured value to ATMEGA328 for corrective action. All the values from sensors are read by Atmega328.

As the results, the values of temperature and soil moisture are displayed on the LCD .Here the moisture content is displayed by using water level in the soil. [5]

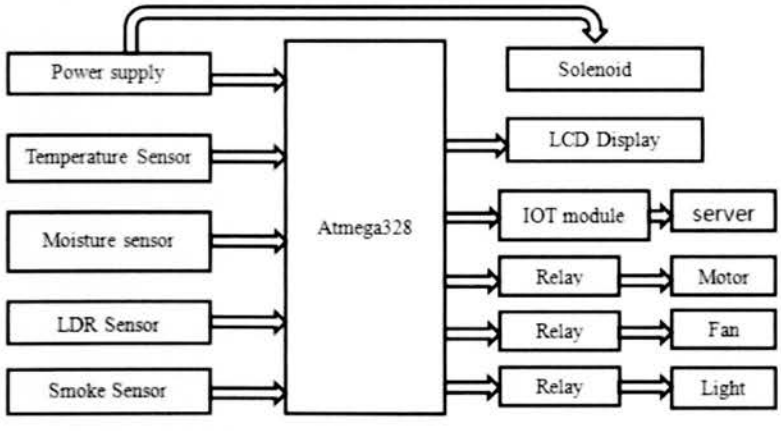

Figure 2.1.5 Block Diagram of Nursery Monitoring System

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2.1.6 Smart Watering System for Gardens using Wireless Sensor Networks (Maya Medhat Mohammed, Eman Adel Ahmed, 2011)

A smart watering system is present in this project which could be used in fields or gardens. While running this project, the behavior of the clay soil is studied under variety levels of humidity, its speed to react to the presence of water and its capability to hold the water in a long period of time. The behavior of the sandy soil also has been studied. The sandy soil cannot hold water as long as the clay soil can hold. The response of the soil moisture in the clay soil to the presence of water is slower compared to the response of the sandy soil to the presence of water.

The waiting time of detection after irrigation for the sandy soil is expected to be less than the response time for clay soil. Obviously, the timing parameters should be changed based not only on the soil type but also plant type because the irrigation requirements for every plant are different from each other.

In this experiment, wireless sensor network is the main component used. Sometimes the user cannot get the data from the network. So, no communication will occur. The user will be alerted by the system about the disturbance occurred in the link quality between the nodes in the network. This could be caused by an animal that has walk passing through the node or by the leafy plants which may cause a further destruction such as antenna defect. User has to take immediate action to repair the break node or move it to the other better place. [6]

2.1.7 Remote Plant Watering and Monitoring System Based On Iot (Hemant Kuruva, Balumuri Sravani, 2016)

Remote plant watering and monitoring system can help people with growing and monitoring it. As the system is remotely controllable, the owner can moderate the watering according to the atmospheric conditions existing at that point of time. Remote plant watering and monitoring system waters the plant, monitors the temperature and humidity of the surroundings, measures moisture of the soil and estimates the amount of water required for the plant and waters the plant remotely.

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The values received from water level sensor and soil moisture sensors are analog. Connecting them directly to Raspberry Pi can be inefficient, hence we prefer to use Arduino to input analog values from these sensors and then send them to Raspberry Pi as digital values. Raspberry Pi updates the Arduino source code.

The web application can also control the water pump remotely. Whenever the user clicks "Start" or "Stop" button, it registers an event to IoT platform. Raspberry Pi inputs this event and processes to starts or stops the pump as per the user action.

The data collected is visualized using graphs and charts to give a better understanding of the plant's life and watering statistics to the user. All the sensors, actuators and water pump are controlled by Raspberry Pi running a node.js application. [7]

2.1.8 Low-Cost Wireless Soil Moisture Monitoring System (J. Burrell, T. Brooke, R. Beckwith, 2014)

Soil moisture is measured by electrical resistance sensors. There are two types of electrical resistance sensors which are granular matrix sensor and gypsum blocks. Freezing environment can cause a cracked and premature aging to gypsum blocks sensors but take more longer time to crack the granular matrix sensors.

The water movement between the soil and sensors provide a different result in electrical resistance between the electrodes placed in the sensors. It will result in decreasing the resistance value if the soil moisture is increase. The system is control by a remote and also a PC based. So, the real time reading number and data collected are display on a custom made PC application such as virtual instrument. The sensing node and the base unit are connected through radio frequency communication. Both the sensing node and the base unit are classified as the main functional units. [8]

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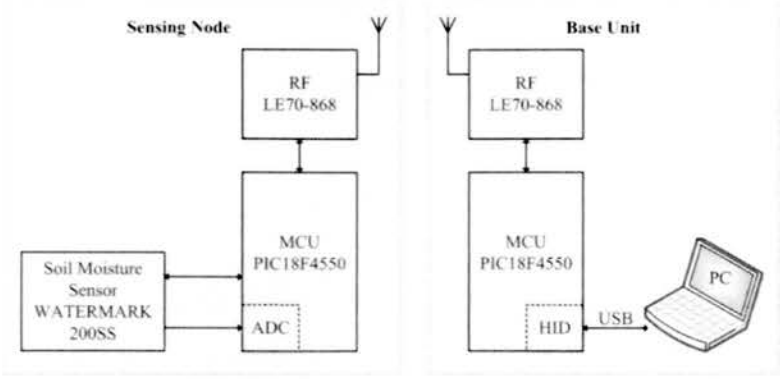

Figure 2.1.8 Block Diagram of Hardware Design

2.1.9 Wireless Monitoring of Soil Moisture, Temperature & Humidity Using Zigbee in Agriculture (Prof C. H. Chavan, Mr.P. V.Karande, 2014)

The system provides low cost budget and low power consumption so that, many agricultures have no problem to afford the system. The server will help to collect and save the data. This system is most suitable to be use in any precision farming. Precision farming has concept based on observe, measure and respond to inter and intra variable field in crops site.

The agricultures can easily monitor the different parameters of the soil such as acidity, moisture and salinity of the soil from time to time. Each of them has to check the pump house even at the night during the irrigation period because the electric supply is not consistent. The soil moisture sensor used is capacitive type. The sensor produces analog output of 0V when there is 100% moisture and 5V for 0% moisture.

The humidity, moisture and temperature sensors will produce the monitored results and the real times monitored results are recorded on the server. The humidity, moisture and temperature sensors value will be plotted in a graph for the month of observation. [9]

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CHAPTER 3

METHODOLOGY

3.0 Introduction

This chapter defines clearly about the research methods used to conduct the study. The researcher explains how the important information and data to address the objectives and problem statement was collected, presented and analyzed. The first section describes the project procedure involve, follows by project sequence representation. The third part describes the hardware and software used to complete the project.

3.1 Project Procedure

In project progressing, the main part is make a systematic plan and arranged some steps to present clearly the procedure of the project. The procedure is presented in a concise flowchart to make it more understandable to be illustrated. Figure 3.2.1 shows the flowchart on how the title of the project is selected. Figure 3.2.2 forecast the flowchart of the project procedure.

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3.2 Project Sequence

This section will elaborate about the process applied to maintain the progress of the purposed project in order to achieve the expected result. Figure 3.3.1 shows the brief explanation of the project basic system.

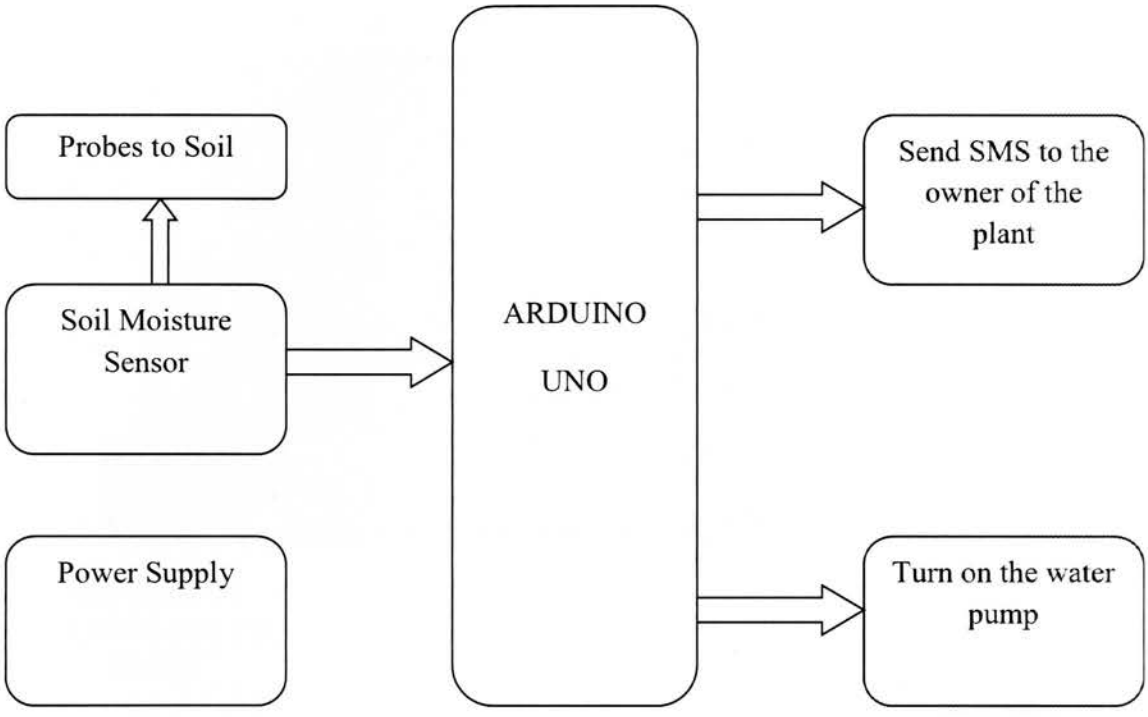

Figure 3.3.1 Block diagram of the project sequence

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