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Plant Watering System using Mobile Application

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ABSTRACT

Manual plant watering system bring many problems to plants especially for indoor plants. Lack of knowledge for the method of watering plants and measuring soil moisture are among the reasons plants fail to grow before they can be harvested. Improper attention to watering of plants and maintenance of soil moisture may expose the plants to some diseases. Home residential or agriculture institution sometimes miss their schedule of watering activity and soil moisture maintenance for several reasons. In this paper, a solution is provided to help them take care of their plants more efficiently. A mobile application is developed to automatically perform watering activity automatically based on soil moisture measurement. The application displays tank water level and soil moisture level in real-time. Wi-Fi communication technology is used so that users can monitor and perform watering activity even though they are mobile and quite far away from their plants. The system is also developed based on discussions and requirements given by a local farming and agriculture office..

Key words : About four key words or phrases in alphabetical order, separated by commas.

1. INTRODUCTION

Plants need watering system to ensure people easy in perform watering action while they are not at home. The prototype is needed in early stage development for plant watering system. Plant watering system can allow user to monitor their watering system using mobile phone. The water flow will start automatically when the system detects dry soil and water pump will stop after reaching exact value of soil moisture. User will be given authority to open water pump bypass even though the plants have reaching its maximum value of soil moisture. Light bulb will be added as extra specification for plant watering system to replace the sunlight for indoor plants.

The mobile apps for plant watering system act as a platform to deliver the message regarding water quantity inside water tank, soil moisture value and it allows user to open water flow bypass. Plant watering system will be applicable for indoor plants because its specification will be setup for indoor plants only. The user of the system can be anyone that have interests in indoor plantation at their home.

1.1 Problem Statement

The current issues facing for planting the indoor plants is lack of technological watering system. Apart from that, the knowledge of watering in correct method and correct quantity is not reach into the mindset of community. Different species of indoor plants have specific amount of water to be followed to ensure the plants keep growing and produce crop. It is also depending on the vase size and type of base used for planting the plants. The method for spreading water in whole area of plants is according to the age stage of the plants. For this project, seed germination will become the main focusing age stage for the plants and the method to spread water for seed germination is by using sprinkle head.

Soil moisture is important. Plants might be exposed to some diseases if humidity condition is not satisfied. Different species have specific value of soil moisture. For this project, seed germination for chili plant need at least 5.0 Ph value for soil moisture. However, there have no method to measure value of soil moisture manually. It is difficult to measure soil moisture manually, thus the use of advance technology in measuring soil moisture will greatly benefit the agricultural community.

1.2 Literature Review

A) Type of plants

Different plants have their own requirements for their maintenance. Chili plant is chosen as our case study. Chili plant have different categories in its size, colour, taste and shape. Minister of Agriculture and Agro-based Industry (Malaysia) have mentioned in their portal that chili plant is one of the top-ranking profitable vegetables.

The appropriate age for the chili plant is starting from first day until 30 days. In this age stage, it is being called as germination of chili seed and germination seed need peat moss-based to ensure the seed in warmth condition. Peat moss-based being created to enhance solid quality of plant growth, diminish occurrence of diseases and maintain a strategic space for the plant (Strerret, 2001). Thus, germination seed of chili plant by using peat moss-based will be selected as expected tester for project development.

B)Chili plants disease in defect area of plantation
Edema diseases- occur because the water consumption for chili plant is exceeding its limit.

Powdery Mildew diseases- is the disease occur when chili plant does not have enough spacing and ventilation.

Leaf Burn diseases - happen when perform watering chili plant by splashing onto leaf in hot weather

Blossom End Rot - disease occur because of Calcium deficiency. The calcium for chili plant will be difficult to absorb in the soil because the water flow does not reach suitable level of soil moisture.

Flower Drop diseases - is a common disease happen in chili plantation and it is cause by overwatering and underwatering technique in chili plant. The flowers easily drop because the soil is wet.

More profits gained, and good quality product will be the outcome for production plantation if the environment is monitored in suitable atmosphere during cultivation period (Prenger and Ling, 2007). Hence, several computerized systems have been proposed recently to help farmers to take care of their plants and monitor the growth more efficiently. Mandula K. et. al, 2015) proposed a system that sends sms messages alerting the farmers to water their plants. (Ibrahim A. and Jonathan T., 2016) simulated a garden center's sprinkler system with a microcontroller. (K. Krishna Kishore et.al, 2018) used Arduino interfaced camera and image processing to analyse health of plants to determine the appropriate amount of water for the plants. (C. M. Devika et. Al, 2017) used AtMega328 microcontroller to sense soil moisture level switch water pump on and off automatically as plant irrigation system. None of the system demonstrated how mobile application can be utilized.

2. PROPOSED MOBILE APPLICATION

The system is composed of software and hardware components as described in Table 1. BLYINK is used to develop the software as it has been designed for the IoT (Doshi et al. 2017).

Table 1: Software & Hardware Component

Tools	Names	Description
Software	BLYNK	Develop mobile apps that can connect with hardware components
	Arduino	Build instruction to instruct all hardware components and allow hardware components deliver information into mobile apps.
Hardware	Terminal Board	It is an integrated board that consist of power supply, Wi-Fi transmitter and logic converter. The purpose of this board to ease the wiring process on Arduino and to ensure whole system can receive same amount of voltage from primary power supply.
	Relay Board	Relay board act as 'middle man' to convey the switching instruction from microcontroller as microcontroller unable to provide high voltage more than 5V. Relay is essential to power up big device
	Sensors -Water level sensor -Soil moisture sensor	Water level sensor is to check quantity of water in water tank. Soil moisture sensor is to check the soil moisture
	Adapter	Power up the whole system
	Arduino power head	To ensure Arduino receive power supply
	Wi-Fi cables	To ensure the information can be transferred from Wi-Fi transmitter and delivered to mobile apps

The application interface is presented in Figure 1. It comprises soil moisture value, water volume and bypass terminal displays. The bypass terminal shows the progress when water pump has been turned on.

Figure 1: System Interface

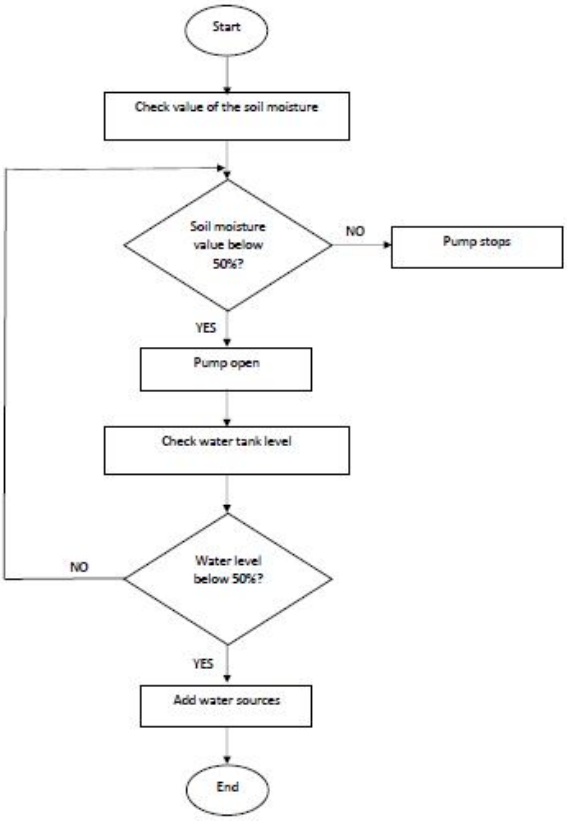

Figure 2: System Flowchart

Figure 2 presents the algorithm in flow chart form which describes how the plant watering is performed automatically. The system converts water level value by placing rating number from 1 to 10. If the number is 5, the water inside the tank have 50% quantity. However, if the system shows value more than 10, it is mean that the water inside the water tank is abundant. If soil moisture percentage is below than 50%, the system will open water pump and let the water flow until soil moisture reach 50% and above.

Figure 3 describes the connection between all hardware components. The component includes terminal board, relay board, Arduino Uno, solenoid valve, water pump, sensor circuit and adapter.

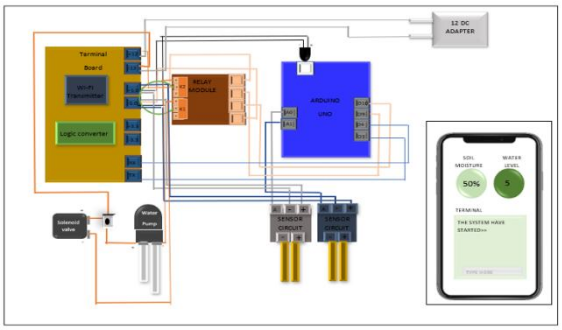

Figure 3: Connection and configuration diagram

Terminal board is an integrated board that consist of power supply, Wi-Fi transmitter and logic converter. The purpose of this board to ease the wiring process on Arduino and to ensure whole system can receive same amount of voltage from primary power supply.

Relay board acts as 'middle man' to convey the switching instruction from microcontroller as microcontroller is unable to provide high voltage more than 5V.

Arduino acts as a microcontroller. Arduino receive information from circuit sensor by using WI-FI transmitter and process the information to be sent in mobile apps using WI-FI transmitter. Relay module connected in D10 and D9 are to supply more power to Arduino. Arduino port is to turn on Arduino with power of 5 V.

Solenoid valve or known as solenoid motor acts as a starter for pump. It needs power supply 12 V from terminal board to start the pump. Water pump acts as a mechanism to ensure the water flows to perform watering activity.

Sensor circuit is used for soil moisture sensor and water level sensor. This circuit is necessary to capture data transmitted from soil moisture sensor and water level sensor.
The information in mobile application will be updated once Arduino controller has done with data processing from soil moisture sensor and water level sensor. The updated information will be sent by using WI-FI transmitter to the mobile apps

3. RESULTS AND DISCUSSION

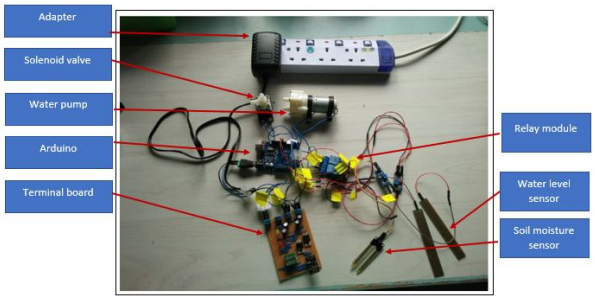

Figure 4: System's Prototype

The prototype of the system is shown in Figure 4 and some results have been achieved and discussed in this section. In the beginning, we faced some problems **with** unstable communication between terminal board and mobile application. This has been improved by upgrading the WiFi transmitter. The Wi-Fi transmitter is able to capture information from water level sensor and soil moisture sensor and send it to Arduino. Arduino processes the data and use wi-fi transmitter to send the information to mobile apps. Thus, information is updated in mobile application.

The system was demonstrated to a local farming and agriculture office, and home residential plant growers. About 82% of them like the system and 18% is undecided. Some feedbacks have also been collected to upgrade the system in the future.

4. CONCLUSION AND RECOMMENDATION

A mobile application has been developed to monitor the health of plants by performing the watering activities based on soil moisture level and plant requirements automatically. Several recommendations were suggested for improving the system in near future. First, add specification inside mobile apps for user to choose what kind of plants that they want to water. This specification can allow the system to be used for different plant species at the same time. The system will identify every selected plant inside mobile apps and water pump timing will open according to selected plants.

Another specification request is adding specification for insect's identification. The mobile apps need to analysis every insect capture by user and state whether the insects can bring harm to the plants or bring health to the plants. This specification can allow user to aware the harmful insects for their plants.

Furthermore, new specification inside mobile apps for system notification recommend by representative community. The system able to send notification when water pump open and water tank empty through WhatsApp apps. This specification can allow user aware regarding the current situation of their plants and the problems for watering their plants.

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