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Monitoring and Crop Watering System through Smartphones

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Abstract: The Monitoring and Crop Watering Systems on small and medium scale industries generally are done manually by haul a bucket to watered plants. Therefore, to overcome this weaknesses and disadvantages, in this study, a system was designed to combine the process of crop watering, and monitoring soil condition in one device. Hence, in present project, the system used Arduino to control the water pump by monitoring the soil moisture level. This new designed system is suitable to be used domestically. The hardware system is only monitor by using smartphones and is convenient to carry at anywhere. In this project, the design of the monitoring and crop watering systems has soil moisture sensor to detect the soil moisture condition simultaneously. Furthermore, Arduino Uno is use as the main microcontroller to control all the device. Beside designing, analysis is made to determine its capability to operate in desired condition. The result shows this low cost system also reduces the watering time by 80% when compared to manual watering. Critical aspects of this system are the ergonomic consideration and cost whereas this system was built with low initial value and more practically with only monitoring using smartphone to prevent musculoskeletal disorders (MSD). As the result of this study, an improved monitoring and crop watering system which perform the whole operation of watering system were develop. This is a Mobile Integrated and smart irrigation system using IOT based on application controlled monitoring system.

Keywords: Arduino, Soil Moisture, Moisture and Temperature Sensor

1. Introduction

As known, water is very important because everything needs water to live such as humans, plants, animals and others. Plants must have enough water to live, grow, and reproduce. Some farmers did not know the exact value for their plants need and it will cause their plants growth stunted. The rate of absorption of water by the roots, the value of absorption at the stomata of the leaves and the types of soil used are exaggerated by the surrounding temperature and humidity.This project is inspired from the motivation of the farmers who rely entirely on the agricultural sector as a source of income. Malaysia

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is a country experiencing a climate of equator that causes uncertain weather. Sometimes the weather in our country enjoys a tropical monsoon climate which can be rainy and sunny over the year. As we know, weather really can give a big effect or impact to the moisture of the soil. Mostly farmers who work in the fields rely only on the rain and bore wells for their irrigation of their lands. Soil moisture and temperature are the most important factor for a successful plant. Hence, with this helpful systems, it will ensure the soil of the plants are in the best conditions.

The project aims to ensure that the crop land is constantly hydrated with suitable moisture to farmers based on the objectives which is to design a smart monitoring and watering system by creating an Arduino coding for plant monitoring and watering system and to design a software and hardware that able to monitor and water plant from smartphones. The aim of this Monitoring and Crop Watering Systems Through Smartphones project is to develop an upgraded version of water sprinkler or haul buckets for watering plants where the system developed can reduce the time taken for the watering processed. The scope of this project is focused on modern farmers and small-scale workers in our project implementation. Therefore, the project must not be overlocked from its purpose and function which are the area coverage for the moisture and temperature sensor must be at most $1m^2$, the area coverage for the sprinkler to water the plant must be at most $1m^2$ and this system can be monitor from the smartphone by Wi-Fi.

In the early 18^{th} century, farmers used haul bucket to water their crops. In the metal era, an innovation had been made for the watering crop system which is use automatic water sprinkler to water their plants. Nowadays, IoT has been introduces as a new technology system which is more convenient. The system had given an implemented to crop monitoring system that gives advantages to agriculture. Hence, these monitoring and watering crop system through a smartphone is a new innovation product that use IoT technology. It can help us as the system use the notification services to connect with user. Smartphone can connect to system that user can monitor their farm. From that, a system that can monitoring and watering crops automatically have been build.

In Bo Sun, Jonanth Jao, Kui Wu (2013) the author designed a system that can be controlled its performances using short text message (SMS) from the cell phone[1]. Meaning that the motors performances depend on turning ON/OFF remotely using mobile phone from any brand and its performance is sent by sending it through message. This Project has been implemented in India and different weather condition was test for it suitability. The motors will turn off as soon as the farmers get an alarm about the single phasing. They used a GSM with a digital mobile telephone system and then it will compress the data receive and then sends it down channels with two others stream user's data.

According to Louis D. Albright, Robert W. Langhans (2015), the author used sensor devices coupled with wireless technologies to monitor the temperature, humidity and moisture[3]. The details of their ideas are having a wireless sensor that connects through a Wi-Fi to a Central Monitoring Station through General Packet Radio Station. In addition to that it also connects with Global Positioning System (GPS) to send massage to the central monitoring station. They also had an external sensor such as soil moisture, pH and leaf wetness. They will then set a threshold from the sensors such as soil moisture to trigger the water Sprinklers on or off. Also, if there is a value from the pH sensor, it will be sent from the base station to inform the farmers using GSM modem and then Farmer can take his action from that point. Using GSM gives wide range of communication. The performance can be monitored as long it connected to Wi-Fi networks.

Based on Kim, R. Evans, W. Iversen (2008), Distributed WSN network is use for sensing the data as well as to control the irrigation system. Field conditions are site-specifically monitored by five in-field sensor stations distributed across the field based on a soil property map[2]. The data is sampled and then wirelessly transmitted to a base station. A watering machine is controlled by a programming logic controller updates georeferenced location of sprinklers from a differential global positioning system (GPS) and wirelessly communicates with a computer at the base station. Signal from sensor network and watering controller are interfaces with a Bluetooth to the base. Graphic user interface-based software developed offers stable remote access to field conditions and real-time control and monitoring of the watering controller. This GPS system provides large scale of agriculture monitor to track the assets.

Based on these three system, they are using the wireless system as their main component to conduct the system. All of the system used long range controllable mechanism that can be control by farmer in longer distance. Besides, sensor is the most important component to detect the conditions of the plants. For agriculture, humidity and temperature is the most important aspects for plant to grow up perfectly.

Apart from that, in this project the Arduino Uno R3 used as a microcontroller for the system. This component will make this project easier to handle because it can be programmable through USB port. The power supply used is rechargeable battery that makes this project easier to carry to another places. After that, the water pump also used as a medium for watering plants. The NodeMCU ESP8266 and Raspberry Pi 3 Model B is used to connect the system to telegram apps. It will send the information of the system in telegram notifications. This system consists of Arduino Uno, temperature sensor, soil moisture sensor, water pump, NodeMCU ESP8266 and Raspberry Pi 3 Model B.

2. Materials and Methods

When the system start, the sensor will start operate according to its function. Soil moisture sensor was used to read the moisture of the soil. According to our research, the most suitable moisture sensor is more than 20% moisture percentage value. For this system, the soil moisture sensor had been set to 410 for its minimum value of soil moisture. Thus, this sensor also connected to water pump that were used to supply water to plants. So, if the reading of the soil moisture is higher than 410 the water pump will turn on and vice versa. After that, the water will be supplied to plant through plastic tube. For temperature, LM35 sensor is used to read the temperature of the surrounding. It will do calculation that's has been coded in our microcontroller. Thus, it will display the temperature of surrounding after finish calculation. After every sensor had did their operations, the data that it gets from the system will connect to NodeMCU ESP8266. This component is the link between the system and user as it is the medium for wireless connection. NodeMCU ESP8266 will send data to user in form of Telegram notification. Next, it will display the soil moisture level and the work of water pump (See Figure 1).

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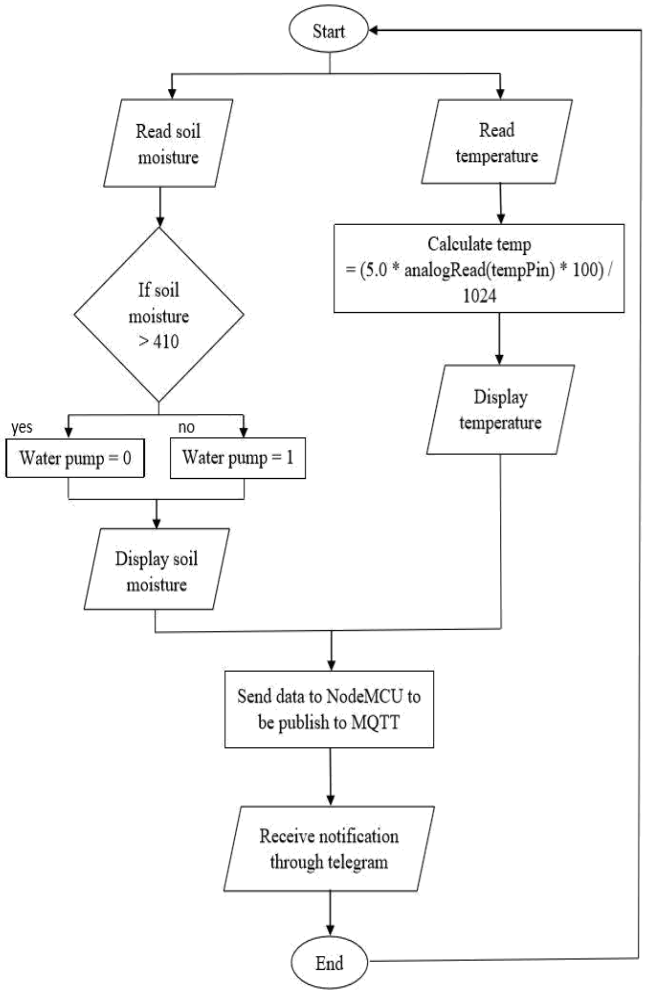

Figure 1 : Flowchart of Monitoring and Watering Crop System Through Smartphones

3. Results and Discussion

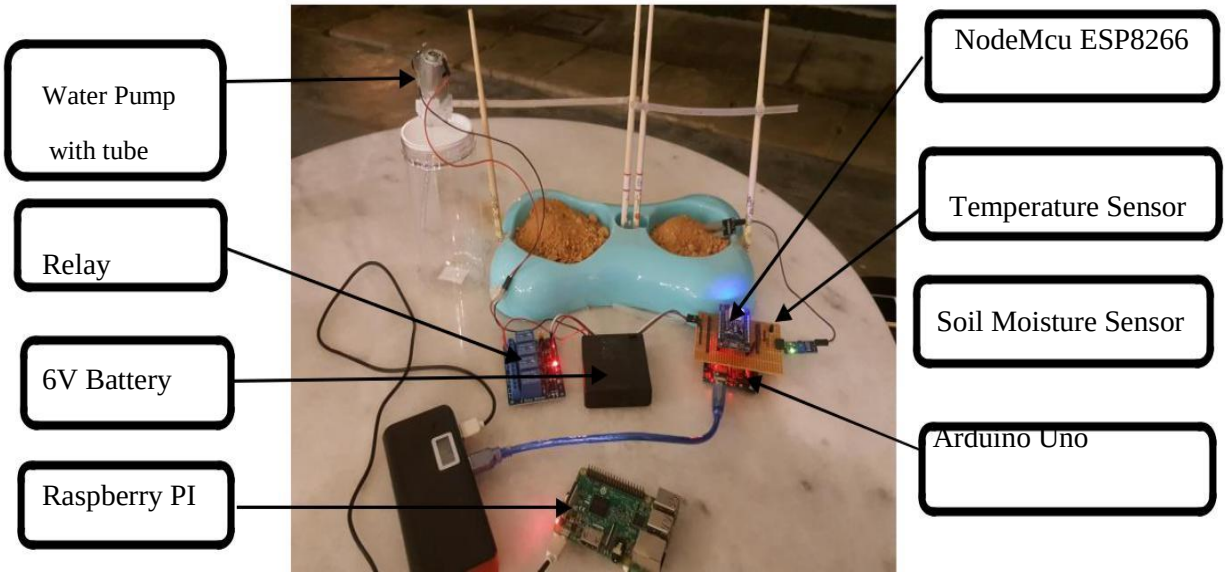

Figure 2 : Project Prototype with components

This project use Arduino UNO as the controller, soil moisture sensor and temperature sensor as the detectors, DC water pump as output before IOT the systems, Raspberry PI 3 Model B and NodeMCU ESP8266 as medium for IOT. Arduino UNO use to control all electronic component (See Figure 2). Soil moisture sensor is to detect soil moisture level while temperature sensor is to detect surrounding temperature (See Figure 3). DC water pump is to pump the water after the soil moisture sensor detect that the soil moisture level is at dry condition. Raspberry Pi and NodeMCU is use to transmit and receive data from Arduino before send notification through Telegram. When the sensor detects the moisture level, the water pump will trigger and it will allow the water to flow to watered the crop (See Table 1). Then, user will get a notification from the telegram.

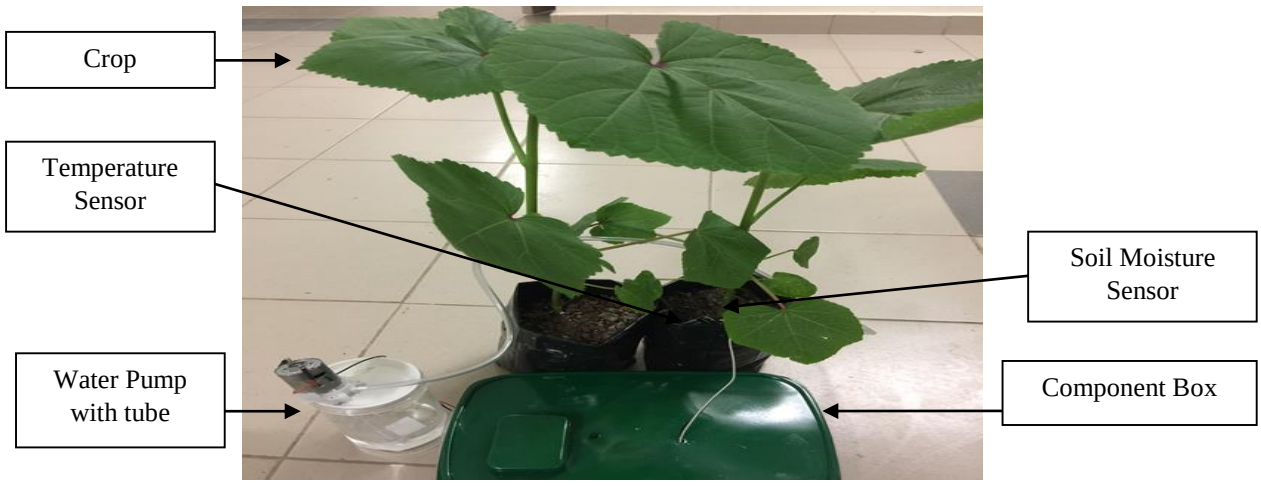

Figure 3 : Actual Project Prototype

Table 1: Average soil moisture level in their best condition

Moisture level			Soil condition
Value of soil moisture sensor	**Percentage(%)**	**Level**	
0 – 200	1 – 20	Low	Dry soil
201 – 409	20 – 39	Medium	Well drained soil
410 – 819	40– 80	High	Moist soil
820 - 1024	81 – 100	Very High	Wet soil

4. Conclusion

It can be concluded that this machine as well as the modification can give a benefit to the industry and mostly to the small and medium scale of industry. In Household still use the traditional watering method, by using watering can, water hose or even carrying water bucket to water the plant. The watering plants chores is not easy and a difficult task to some people that love gardening but always busy with works to water the plant frequently. Due to that, after one day or someday not watering the plant can get wilted. Other than that, some people find it is a hustle to refill the watering can or any water bucket to water their crops or plants. It is because they will hurt their back and this method is not suitable for someone with a weak back. Industrial, household and small business equipment are of high cost for its safety, functionality and other facilities provided. A cost effective device with respect to performance which should reaches to customer place. The need identified here is the requirement of a monitoring and watering plants device for small business to water their plants easily with less effort. Furthermore, the improvement should be made in line with the current technology which maybe wide range control monitoring and watering plants system, can be widely used in our country, especially small and medium scale.

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References

[1] Bo Sun, Jonathn Jao, Kui Wu, "Wirless Sensor Based Crop Montoring System for Agriculture Using Wi-Fi Network Dissertation", IEEE Computer Science, pp. 280-285, 2013

[2] Y. Kim, R. Evans, W. Iversen, "Remote Sensing and Control of an Irrigation System using Distributed Wireless Sensor Network", IEEE transaction on Instrumentation and Measurement, pp. 1379-1384, 2008.

[3] Louis D. Albright, Robert W. Langhans, "Controlled Environment Agriculture –Scoping study", Web, September 2015.

[4] B.Johnson,"HowtheRaspberrypiworks", *Internet*,[online]Available computer.howstuffworks. com/raspberry-pil.html [Accessed 18 Oct 2018]