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A Secure intelligent Drip Irrigation System – Using IoT, Cloud and Mobile Application

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Abstract – *Water is the major base for the agriculture. Due to lack of rainfall and draining of water resources, we need to save the water for future. This paper mainly stresses on intelligence in water saving using soil moisture sensor, securing crop by using camera and PIR sensor and the system is made to operate using solar power supply as well as AC power (AC to DC adapter) supply to send data continuously even on power cut. Internet of Thing is the concept used to effectively communicate with crop by understanding the requirements of the crops. Measuring and monitoring the soil moisture will help us to save the water and plants get required amount of water for the proper growth. By using this system farmer can keep track of the soil moisture through a Smartphone. Farmer is able to control the water flow through the mobile application, monitor the growth of the crop by taking a picture using camera and system helps the farmer to prevent the intruder (humans and animals) by using PIR sensor provided with speaker and invoke the camera to capture the picture of intruder and send to the user.*

Key Words: Camera, PIR sensor, Raspberry-Pi, Soil moisture sensor.

1. INTRODUCTION

Indian economy is majorly based on agriculture. More than 70% of the Indian population livelihood depends on the agriculture. Agriculture in India requires 83% of the total available water from different resources. As the water levels in the resources are running out day by day, a necessary action must be taken to develop a system to prevent the wastage of water in agriculture. By adopting an effective method to use the water in agriculture by integrating it with the smart technologies, we can utilize the water resources properly.

Agriculture in our country depends mainly on monsoons rainfall. Agriculture yield is controlled by rainfall, so the agriculture is said to be "the gaming of the monsoon" as the monsoon rainfall is uncertain and uneven. More than 75% of the total annual rainfall occurs in four months, i.e. between June and October. So it is very much necessary to save rain water for the rest of the eight months along with other water resources. A Proper planning must be done for the usage of water resources to avoid the wastage of water in the farm land.

2. LITERATURE REVIEW

Drip irrigation is made automation by controlling it by mobile application. The serial data collected from the sensors are send to cloud and database server for data mining, it is done to examine large pre-existing data in order produce the new information[1]. The number of wireless sensors is placed randomly over 2-D plane. Each sensor is integrated with a networking device and data is received by the ARDUINO-UNO. The data sending and system control is done by using Raspberry Pi[2]. Through the sensor networks, agriculture can be connected to the microcontroller, which allows creating connection between farmer and crop. The main objectives are reliability and longevity, sensor networks must be remotely manageable and low cost[3]. The Arduino Uno board is used for the controlling and receiving data from moisture sensors (YL69).The data is sent to thing speak cloud server to analyze and provide graph. The system is operated using web application[4].

The water tank is used for the drip and flow control is done by micro controller based on the soil moisture and temperature. It is controlled using the android application[5]. The drip is controlled by sending the SMS. The system use ATMEGA8 micro controlled to integrate all the modules. DTMF(Dual tone multi-frequency) signally in designed for telephony signaling over voice quality telephone lines[6]. The sensor nodes are placed in the paddy field and data is collected from each node by a base node (or) sink node and send to the mobile through internet and controlling the water flow is done through the mobile application[7]. The volumetric density of the water in the soil (soil moisture) is maintained by using Cloud, IoT and Android system (Blynk application)[8].

The existing system is not providing security to the crop and also to the system from intruders. We are not able to monitor the crop growth. It is not possible to get the soil moisture level during power cut. To overcome these drawbacks we included the PIR sensors for detecting and preventing the intruders by giving warning through speaker. Camera is installed to capture the growth of the crop and intruders. The system is operated using the solar and electric power supply which is beneficiary to get data during power cut also.

3. PROPOSED SYSTEM

Drip irrigation system is automated by providing full controlling capability to the farmer through mobile application. Farmer can control the system from anywhere through mobile application.

The main features of the proposed system are

1. Farmers are able to ON/OFF the drip using mobile application, based on the level of soil moisture level.
2. Monitor the growth of the crop by taking picture as and when needed.
3. Intruder are detected and prevented by using PIR sensors provided with the speaker and inturn invoke the camera capture intruders.
4. The system is operated both in AC power supply (AC to DC adapter) and in solar power supply. So that it will continuously sends the data with on power cut also.

In this system the soil moisture sensors will sends the real time values at regular intervals. The Raspberry Pi microcomputer collects the values from the sensors through serials communication. GSM GPRS module will send the data to the ThingSpeak and database. Once the data stored in the database, analysis of the data is done and the result is send to the mobile application and web application. Along with it data received at ThingSpeak cloud server will analyze and provides the graph to mobile and web application to take decision. Farmer will take decision of ON/OFF the water flow based on the soil moisture level; using solenoid value (electromagnetic value) for the water flow control. if the value is below the lower threshold value then drip must be ON to keep the moisture level, if the value is above the upper threshold value then drip must be OFF to save the water.

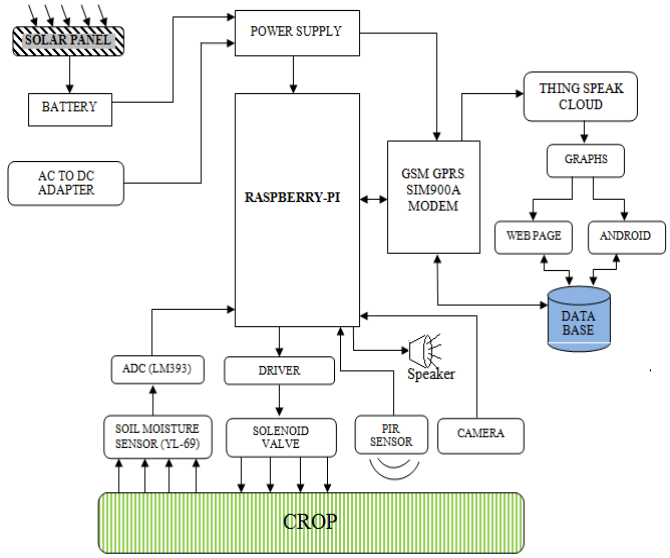

Figure-1: Architecture Diagram

The system is operated by dual power supply by both AC power supply and solar power supply to send the data regularly during the power cut also.

The Solar power supply is provided to system with,

1. A solar cell: 6.8W, 6V/530mA
2. Eight hours of sun on the cells at 70% of max
3. Delivery of current to the Raspberry Pi with the GSM GPRS SIM900A Modem at 85% efficiency
4. Raspberry Pi running 14 hours per day
5. 6,600mAh LiPo battery

Figure-2: Solar Panel

The camera is provided to monitor grow of the crop by taking picture at regular intervals.

Figure-3: Camera attached to Raspberry Pi

The PIR sensor is used to alert the farmer about the intruders (humans or animals) and give warning to intruders through speaker. This will also invoke the camera to capture the picture of the intruders and sends to the farmer.

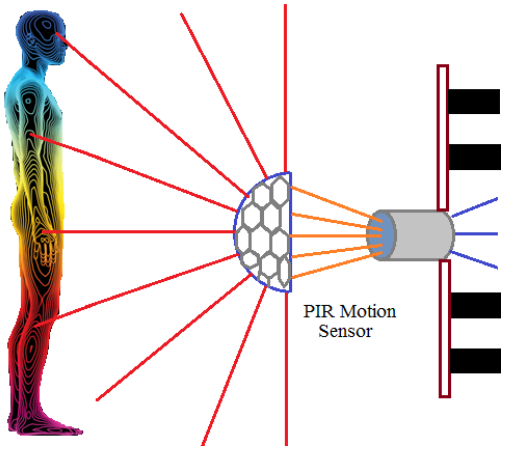

Figure-4: PIR motion sensor

3.1 Algorithm

Algorithm: Measuring and Monitoring Soil Moisture

Step 1: Initialize all modules by providing power is supply.

Step 2: Read the soil moisture level.

Step 3: Check the moisture level (less than or more than threshold value).

Step 4: If moisture level is more than an upper threshold value, stop drip flow.

Step 5: If moisture level is less than a lower threshold value, start drip flow.

Step 5: Go to Step 3.

3.2 Flow diagram

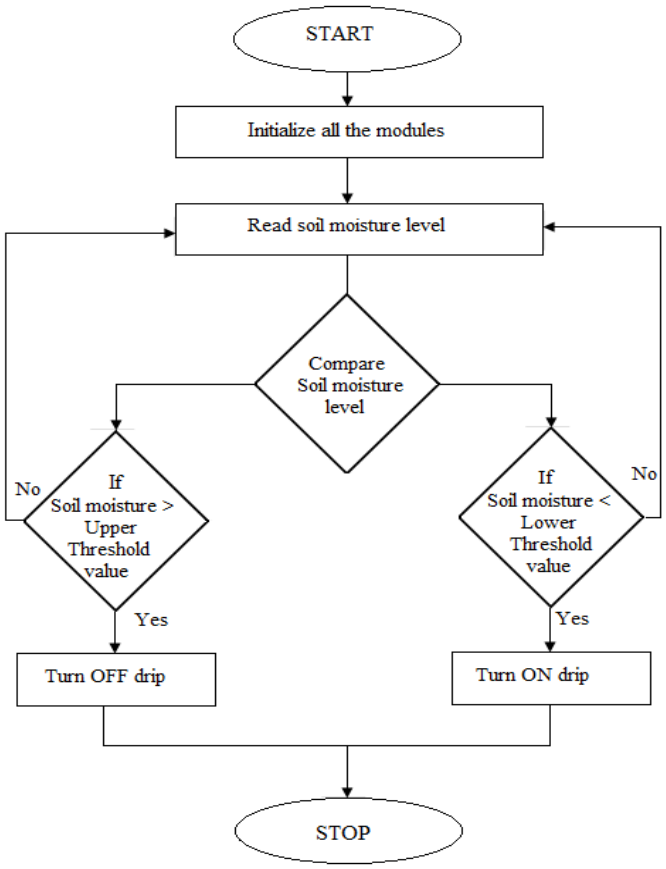

Figure-5: Flow chart

4. CONCLUSION

Automated drip irrigation is the most beneficial approach for the farmers. This system reduces the extra manpower to the farmer for his farm work like supplying water to plants, safeguard the crop from intruders. PIR sensor alert the farmer and gives warning to intruders like animals (came for destroying the crop) and humans (to steal to device). PIR sensor will invoke the camera to take picture of the intruder and sends to the farmer. The camera can also been used to take pictures to monitor the crop growth. According to the soil moisture sensor data, the farmer can control drip using the mobile application provide with internet connectivity. The solar power supply to the system made it send the sensor data even on the regular power cut. This system remove drawback of previous systems like electricity problem, monitoring crop development problem and intruder problems. This approach is very beneficial for the farmer for increasing crop production with secure system.

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