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Synchronization of Smart Irrigation System with Minimal Wastage of Water

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Abstract - *Most of the population involved in farming agriculture are above fifty years old. So to check moisture of soil temperature & water level it is difficult to handle for someone single handedly, so to overcome this issue an agriculture IoT monitoring device based on Wi-Fi module, ESP8266, water moisture sensor, soil moisture sensor, wire temperature sensor (water proof) and servo motor interface with Arduino 2560R3 are used. This device is used for sensing moisture of soil, water level on area under reference, temperature of soil and servo-motor. These all three work in sync to maintain temperature of soil, condition of roots of plant and drainage supply of area under reference.*

Key Words: IoT, Automated Farming, Prediction System, Soil Moisture Detection.

1.INTRODUCTION

This project is basically designed for use in the farming sector. This model consists of mainly three sensors through which can detect moisture of soil, temperature and water level of soil. The three sensors are soil moisture sensor, wire temperature sensor and the last one is water level monitoring sensor. The main motto of this model is that we can control and monitor from our mobile phones as it is connected through Wi-Fi modules.

2. IDENTIFICATION, RESEARCH AND COLLECT IDEA

Here while taking into account the water crisis in most of the areas around the world blisteringly, considering some parts of India city states and some Middle East countries and also to those farmers who are living in drought prone regions. We have designed a system to reduce wastage of water as much as we can so our system here assures that the water loss which will take place in the area under reference will be only due to surface tension and this can be made by making a system which coincides with drip irrigation and sprinkler irrigation.

Ultimately the practice of modern farming is sustainable because of control on water content. So that practicing IoT in farming is economically feasible so it is rock bottom. We have come across waterproof moisture detection sensors like Wi-Fi module, wire temperature sensor & water level sensor.

3. LITERATURE REVIEW

Prakhar Srivastava, Mohit Bajaj and Ankur Singh Rana presented overview of ESP8266 Wi-Fi module based Smart Irrigation System using IoT. But there is no tool to check temperature of soil hence to enable this we have used temperature wire sensor. [1]

The paper proposed by R. Nandhini, S. Poovizhi, Priyanka Jose, R. Ranjitha and S. Anilacontains cover most of the required sensors but cannot be used in real time irrigation system so to overcome this we have interfaced DC water pump to provide water to soil. [2]

The paper by Swapnali Pawar, Priti Rajput and Asif Shaikh automate most of the things using raspberry pi 3. But it detects temperature of one particular area only not the whole field, so we have used temperature wire sensor which cover entire field. [3]

M. Munir , Imran Bajwa , Amna Ashraf , Waheed Anwar , and Rubina Rashid have used pressure sensor. To reduce cost and interference between two sensors we have implicitly programmed temperature wire sensor and water level indicator to replace pressure sensor. [4]

Bobby Singla, Satish Mishra, Abhishek Singh and Shashank Yadav studied smart irrigation system using IoT which having a user controlled interface. But we have automated the entire system using workflow. [5]

4. OBJECTIVES

The work is focused on the use of soil moisture sensor, temperature wire sensor, DC water pump and indication of water level. The main objectives of this work are:
1) Conventionally farmers get information through different types of sources. But the problem was never solved taking farmers' problems into account, a technique called modern farming was introduced.
2) With the help of modern farming techniques farmers can easily get information about water content, temperature & moisture content of soil.
3)With the help of Wi-Fi modules they can easily access and monitor their farm on their Wi-Fi enabled device.
4)Using Wi-Fi modules farmers can get information about their farms on mobile phones so it would be feasible for an individual farmer to access the irrigation system from the

individual's place of comfort. Hence it would be favorable for that individual to increase their yield and monitor their farm.
5) With the help of sensors we can detect the temperature and water level of soil, which can be helpful for farmers to irrigate their land.

5. SENSORS USED

5.1 ARDUINO 2560R3

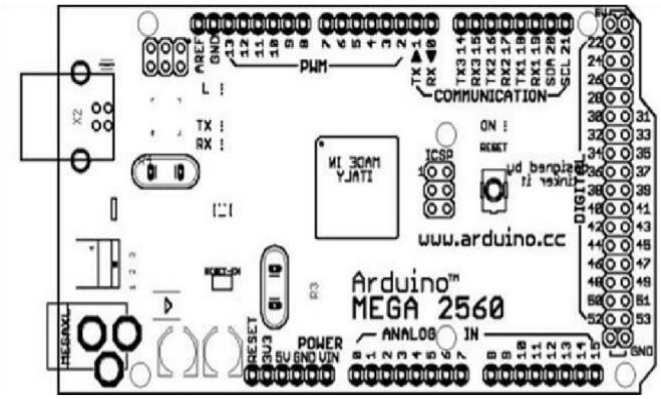

Fig -1: ARDUINO 2560R3

It is a microcontroller board basically works on ATmega2560 as shown in **Fig -1.** In this board 54 digital pins are available which are input and output pins. It usually consists of 16 analog input pins, and next 15 pins are PWM outputs, a USB connection, power jack ICSP header, and reset button. 256 KB flash memory for purpose of storing code 16 analog input pins provides lob its of resolution.

5.2 D518B20 1-WIRE TEMPERATURE SENSOR

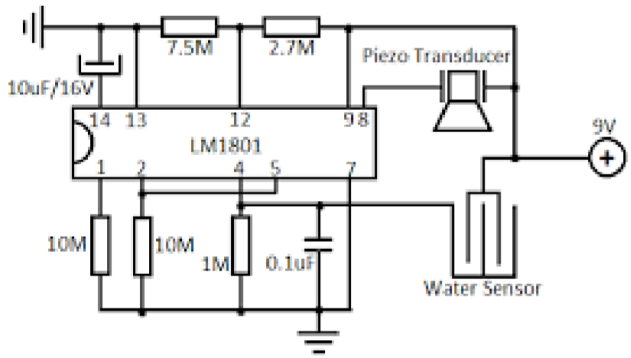

Fig -2: D518B20 1-WIRE TEMPERATURE SENSOR

In this sensor basically we come across two kind of form factors. This one is much more similar to an ordinary sensor. The main feature which makes it different from other sensor as shown in **Fig -2** is that this is waterproof so that it makes this sensor perfect to measure the temperature of soil while executing irrigation. It can measure temperatures from -55°C to +125°C with ±0.5°C accuracy. User can resolve the configuration to 9 to 12 bits, by default it is set to 12 bit.

5.3 SOIL DAMPNESS SENSOR

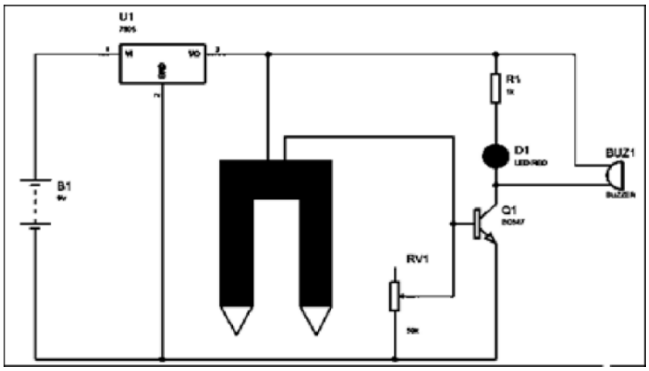

Fig -3: SOIL DAMPNESS SENSOR

This sensor thoroughly contributes to examine dampness of soil. It measures how much water content soil can hold and the impulse of water content indirectly by electrical resistance dielectrics constant soil moisture sensor having common application in agriculture. In agriculture it is important to measure soil moisture contents which helps farmers to manage their irrigation system which improve farming skills. **Fig -3** shows us the clear diagram of this sensor.

5.4 ESP8266 WI-FI MODULE

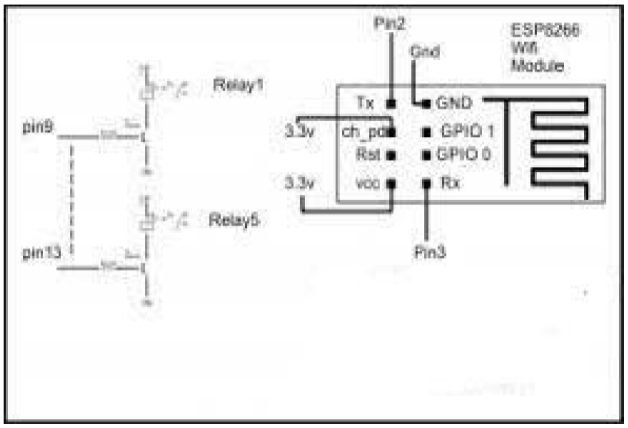

Fig -4: ESP8266 WI-FI MODULE

It is a low-cost microchip having microcontroller capability. Using this chip we can check temperature and moisture level through mobile application. It is a very low-cost module and very inexpensive in volume shown in **Fig -4**.

5.5 WATER LEVEL SENSOR

While working on any area under irrigation to reduce the wastage of water is the fundamental agenda of this product. As many times it is noticed in some area while irrigating in rainy season or due to leakage a puddle is formed so at that

time an impulse is sent to turn off the motor. This sensor tests the level of water in that specific area and if the water level comes in contact with the sensor it converts it into an analog impulse and following impulse is sent to the ardiuno to switch off the motor until the water level get back to normal level.

6. WORKING

1) First the soil moisture sensor senses the moisture of soil and respectively the impulse is sent to the arduino regarding the percentage of moisture present in the soil then the task displays in the way it is programmed.

If moisture in soil is more than 70% the output shown to the user is "Plant is happy". If the moisture of soil is less than 70% and more than 50% pulse send to the microcontroller to switch the relay at 3 in range of (1 to 5).

The moisture detected here in percentage value is the RMS value of moisture detected by all the sensors. Motor will stop when the RMS value of moisture from each sensor is greater than 90%. If moisture in any of the sensors is very much less than 50% it will display "area fault".

2) As we have previously mentioned about the temperature wire sensor, soil moisture sensor so let's have brief glance over how these two components are working so different here:

a) If the temperature detected by the instrument is greater than the required temperature for which our sensor is programmed, the motor will run for an interval of 20,5 & 20 seconds till the temperature is maintained to a constant temperature.
b) If the temperature is very much greater than required temperature and switch the relay module at its highest speed and settle the temperature to required temperature with approximation of ±0.5°C.
c) As soon as the temperature of soil gets warmer the motor will start and reduce the temperature to the required temperature.
d) But if the moisture content in the soil is more than 70% and the temperature is greater than required temperature then the switch will turn itself to a sprinkler to reduce the temperature.

3} Along with all these, the working of water level sensor is to reduce wastage of water. If the water level is traced high by the water level sensor it will turn off the temperature sensor and motor until the water level is traced back to normal again. Once the water level is reached to normal level our entire system will restart itself.

a) If level is traced in two of them is high:
If water level shown by any two sensors is high, it will turn off the entire system until the water level goes down again
b) If level is traced in any one of them is high:
If the water level shown by one of the sensors is high, it will call the Wi-Fi module to send the message of "area failure" and "area number" to the user.

This is how the whole working of the entire system takes place. The **Fig -5** shows the rough idea of our model of this project and **Fig -6** shows the final circuit diagram.

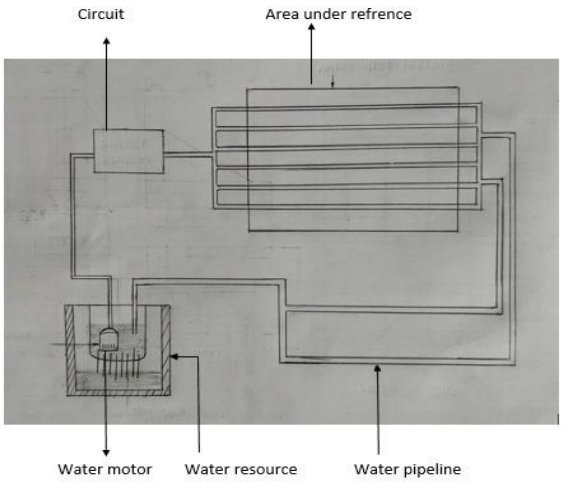

Fig -5: MINIMAL WATER WASTAGE MODEL

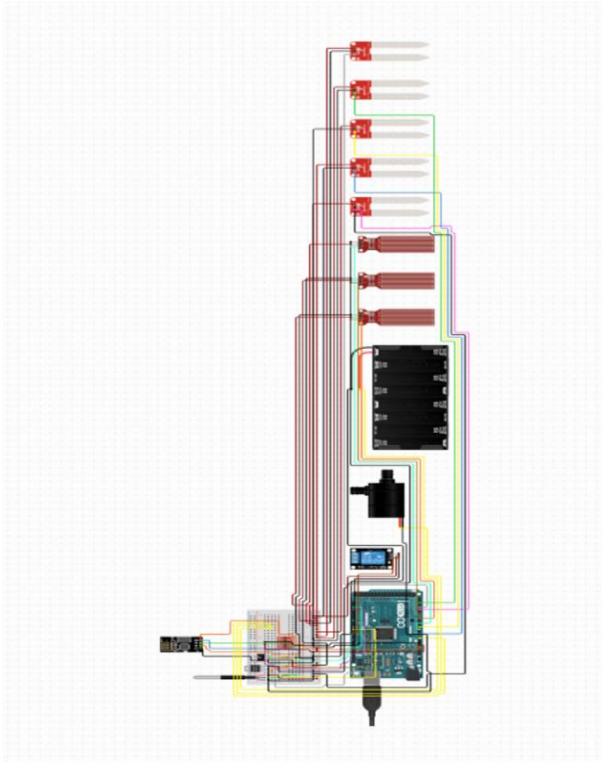

Fig -6: CIRCUIT DIAGRAM

7. CONCLUSION

Taking into consideration of moisture content of soil we have implemented multiple types of sensor in one model using IoT monitoring device based on Wi-Fi module to minimize water wastage in synchronous way.

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