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IRRIGATION USING THE INTERNET OF THINGS

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Abstract

Agriculture plays an important role in the Gross Domestic Product (GDP) of every nation and likewise in the economy of the India also. It has been reported that 85% of India's population relies for their income on agriculture. There are a number of problems related to the agriculture like knowing the moisture content of the soil and the attributes/aspects of soil in the field The IOT helps farmers to overcome the majority of agricultural problems. The smart irrigation system based on IOT has been built to resolve the extra/additional flow of water into the field of agricultural land. For many purposes, such as water management and parameters of the soil like moisture content of the soil, soil's pH value and last one humidity are measured and crop nutrition, weather forecasting observed values are collected by microprocessor and further sent to the mobile user, an IOT-based smart irrigation system for performance. GSM module has been utilized to create a communication link between the farmer and the agricultural field. By SMS, the current field status will be sent to the farmer. This whole system will work towards in providing the information of the red, black and the laterite soil's moisture content for the Thus the farmer can access the field condition server anytime, anywhere, thus reducing the workforce and time which will save time and the money. This system can also be used to ensure the proper amount of water for the irrigation of the crops. This research will also be helpful in determining the proportionate quantity of the chemical fertilizers and the pesticides for a particular crop based on the output of the sensors thus minimizing the toxicity of the crops

Key words: Arduino, IOT, Irrigation, Microcontroller, Motor, Mobile, Sensor.

Introduction

Agriculture contributes to the GDP of the India because it contributes to Indian economy a lot. It has been reported that 85% of India's population relies for their income on agriculture. The IOT helps farmers overcome the majority of agricultural issues. Being India ranking second among the populated countries, the production rate of agriculture must be increased to meet the food consumption rate of the population. The Government of India has already taken several steps to encourage agriculture[1].

The smart irrigation system based on IOT has been built to resolve the excess flow of water into the field of agricultural land. Via the use of a temperature sensor, temperature readings are permanently observed and sent to wireless mobile communication systems via the GSM module. The picture of the crop on agricultural land was taken using a web camera. Then the original crop picture was compared to a healthy leaf with the aid of a digital imaging process and the nutrient value of the plant was found and data was collected. Via assigned IP addresses; Android applications continuously collect data from databases to which they are connected. If the temperature values surpass the specific value, the relay that is connected to the Arduino to regulate the DC motor is then exceeded. With 4 options, including motor status, temperature values, the android program. The motor status shows the present status of the water pump and pesticide pump[2].

The Internet of Things is a technology that uses a wireless mobile computer to keep an eye on a system's functionality. The Internet of Things is about the linkage of internal artefacts mounted at various locations far from one another. The Internet of Things concerns The Internet of Things is a type of network technology that collects data from different sensors and allows everything connected to information on Internet transfer [3].

It can be used to increase the status of the system. The Arduino microcontroller unit is also connected to communication devices for capturing data from sensors and for transmission to the user's wireless computer.

Using an advanced networking system such as a Wi-Fi module can do this. The data that the Arduino microcontroller gathers is translated into purposeful data and transmitted to the user. With the assistance of a wireless device such as an android tablet or cell phone, the user can observe the data.

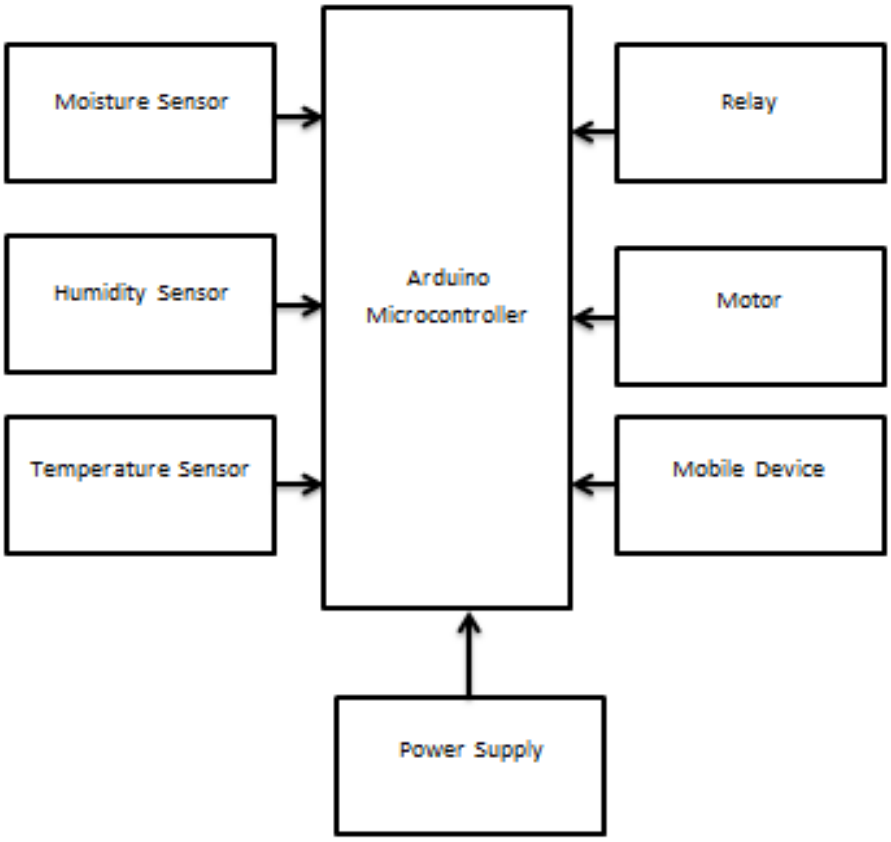

Figure 1: Shows the Smart Irrigation system's Block diagram with the connection of the microcontroller with the various sensors and the components.

The block schema of a clever irrigation system consisting of Moisture sensor for field detections, Moisture sensor for the detection of field humidity, the temperature sensor for the field measurement. Figure 1 shows the block diagram. IOT based smart irrigation system provides Nutrient value of the crop with help of oil nutrient sensor, it also provides weather forecasting information, soil moisture information, surrounding temperature information with the help of electronic devices and sensors used in the Smart irrigation system[4].

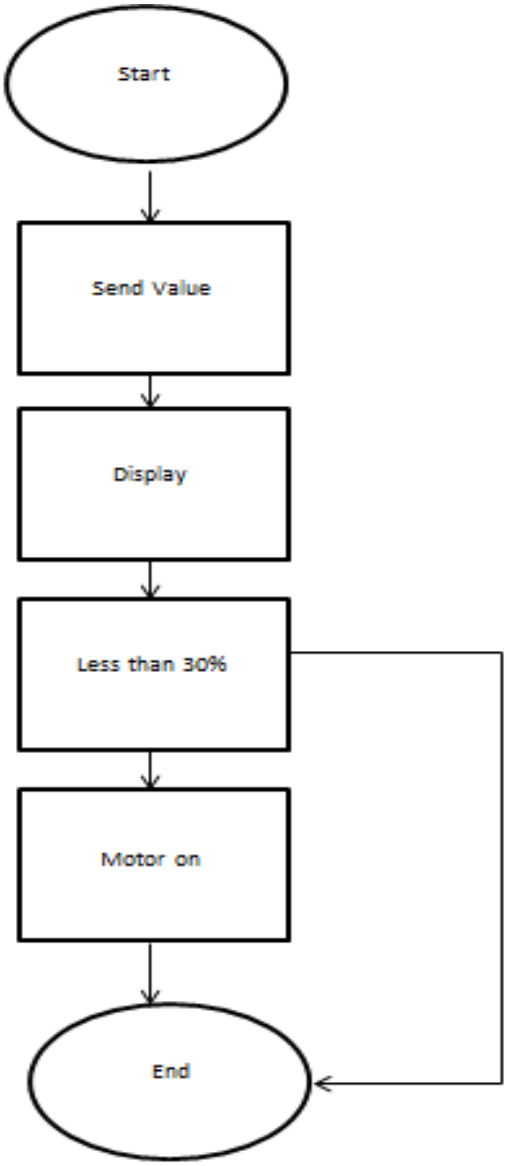

Figure 2: Shows the Smart Irrigation System's Flow chart of showing the starting of the motor at certain value

Fig. 2 shows the Steps that system follows for water irrigation system are:

Step 1: Moisture level of soil is observed with the help of soil moisture sensor.

Step 2: If, Value of moisture> fixed value, DC motor will not start.

Step 3: If, Level of Moisture<fixed value, DC motor starts automatically.

Step 4: Now if, level of moisture=fixed value, Returns to the initial position[1].

There are many advantages of IOT based smart irrigation system

1. No human power required: As the irrigation systems fully relies on the IoT system so the need of the manpower rules out automatically.

2. Helps in conservation of the water – As there is fixed supply of the water; so there are no chances of the overflow of the water into the fields. Hence implementing this system can help in water conservation.

3. Flexible- Being a flexible system it can be applied for the irrigation of the different varieties of the soils and crops. The value of the suitable for the particular crop and the soil can be adjusted as per the requirement.

4. Affordable- It requires minimal maintenance at affordable cost. It's based on the open source technology. It can be removed without any additional costs from the previous irrigation system.

5. Power consumption- Whole of the system runs at 5V. It can also be operated with the use of the solar energy which is easily available everywhere. It can be operated easily with the use of the DC batteries or the AC power supply.

6. Low maintenance- So every day checks are not required for smooth operation as the system is fully automated.

7. Remote Operation- The system can be operated remotely from anywhere via wireless android smartphone and data can be collected via the internet. [5].

Literature Review

R.Nandhini et. al. in their research paper propsed a system for the measurement of the soil's attributes like the moisture content, humidity and the pH value of the soil[6]. In their research paper they also proposed for the detection and the repelling of the birds intruding into the fields using the PIR sensor. There is use of the GSM module to provide a communication channel between the farmer and the fields.

Ashwini B V in his research paper proposed a remote based irrigation system in which the irrigation of the fields can be controlled from a remote location with the automatic sensing of the soil conditions by the sensors installed in the fields[3]. This system is based on the IoT. There is a online reference or the database to which all of these values are compared and accordingly the decision is taken by the system. Aashu Bedrae R. K et al. in their research paper developed an irrigation system for the fields for the proper utilization of the irrigation water and thus minimizing the waste of the water[7]. It is necessary because around 85% of the population depends on the agriculture and the wastage of water is a serious concern. This system will not just help in the minimization of the wastage but will also help in yielding the good quantity of the fruits and the vegetables because every plant requires some definite proportion of the water and providing less or more quantity can destroy the crops.

Bobby Singla et. al. in their research paper proposed for a smart rrigation system based on the IoT in which there is use of the sensor for the measurement of moisture content of the soil and the DHT-11 temperature sensor[8]. Using these sensors a system has been built which will provide the information for the timing of the irrigation of the fields and this information will be sent on the commucation channel and finally on the mobile of the farmer through some application based technique.

All the above proposed systems are helpful in knowing the condition of the soil but the system proposed in this research paper helps in the determining the nature of the soil and its attributes in real time.

Methodology

Design

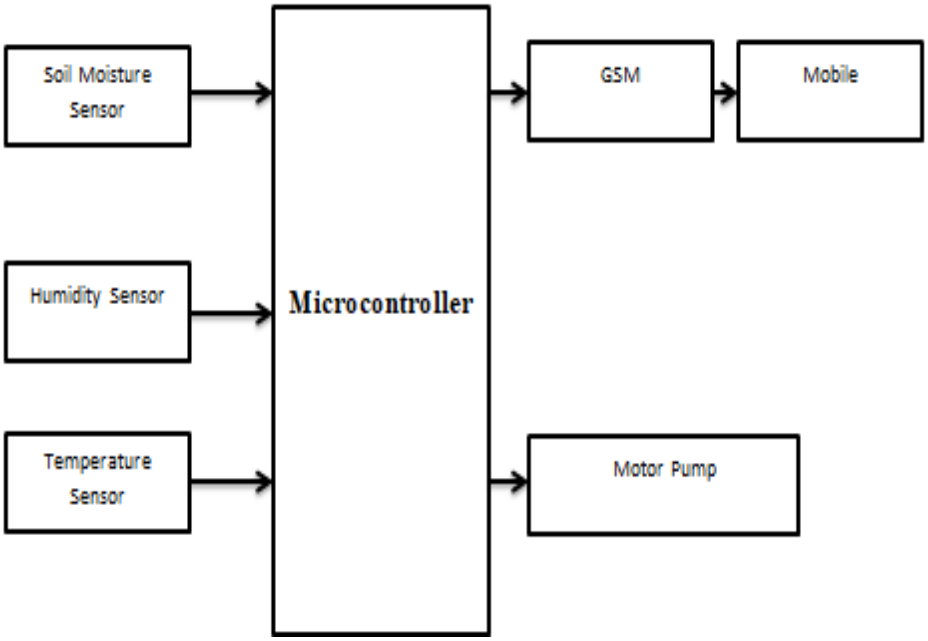

Figure 3: Block diagram of Existing System showing various sensors and the communication links established between the microcontroller, sensors and the actuators.

The current system for IOT-based smart irrigation systems using GSM technology is shown in Figure 3. The sensors used in the current system include temperature sensors, humidity sensors and soil moisture sensors. All these sensors monitor the parameters of the crops and send all the data to the microcontroller. All of this data is contrasted with the standard data for plant growth. The motor pump will automatically start and pour the water into the agricultural field when the data is above the threshold level. The soil moisture value, humidity value and temperature. In order to transfer the collected data to a wireless cell phone, the GSM module is used. All this useful data will be conveyed via message on the user's wireless smartphone. GSM calls are based on information or voice, but the component costs are too high, and this system often requires manpower to regulate the excess flow of water. Values are shown by the wireless cell phone module.

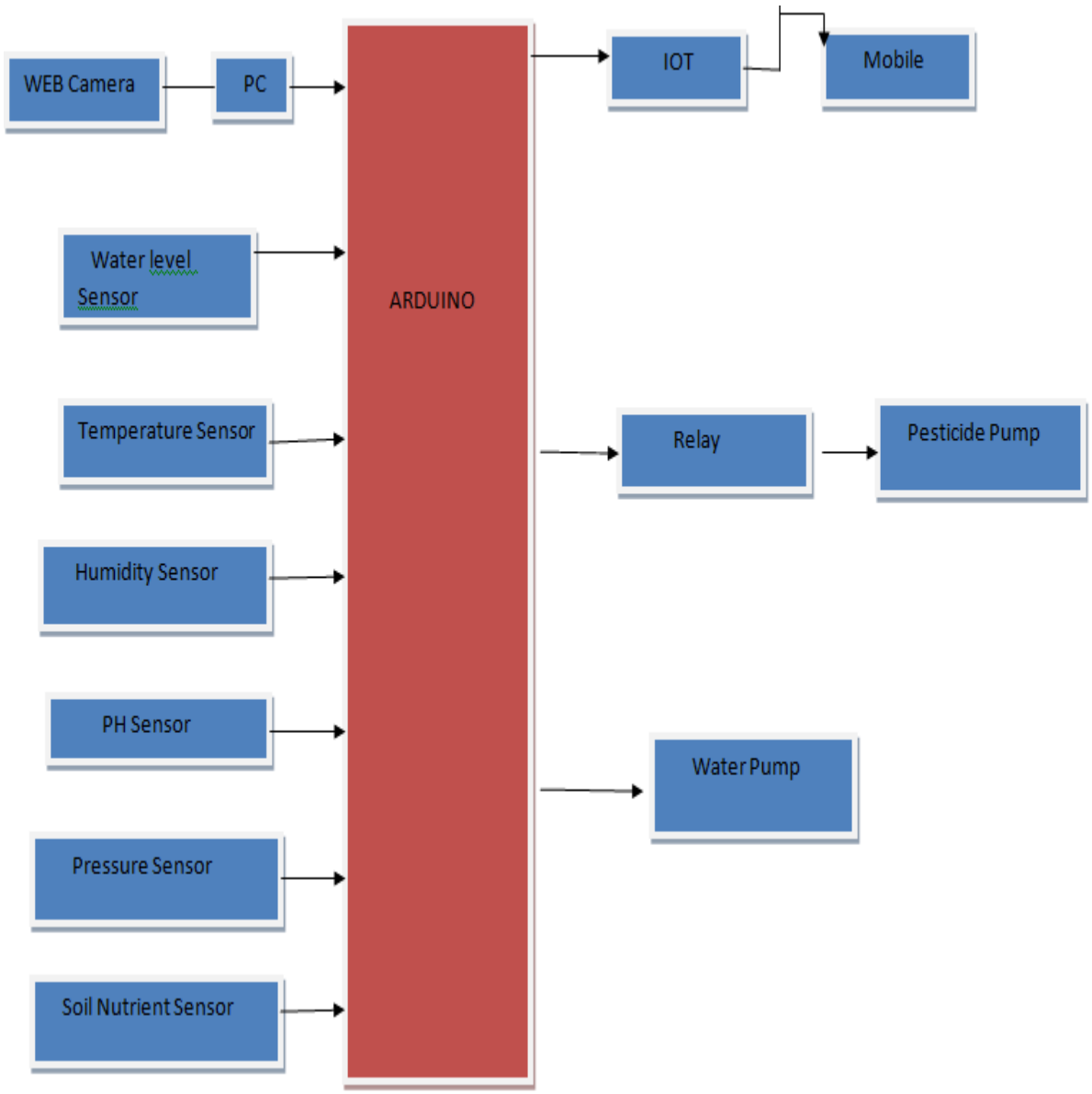

Figure 4: Diagram of Proposed System with the sensors attached to the microcontroller Arduino.

The block diagram of an Arduino based smart watering system has been shown in figure 3. The work proposed involves the Internet of Things for automatic irrigation control as shown in figure 4. The Internet of Things is a technology used to keep an eye on the functions of the device using an Android mobile device. It is a sort of network technology that collects data from different sensors, like a temperature sensor for the measurement of the agricultural soil temperatures, a water level sensor, a humidity sensor in the area around the agricultural soil, and offers users information via the Internet to measure atmospheric moisture.

IoT is more advanced than the GSM modules can be applied to gather data from existing scenarios. The current status of the crop can thus be observed and the health of the crop can be verified. This method is not only for maintaining the water level in the agricultural sector, it will also identify the plant pesticides and spray the medicine to extract the insect from the crop leaf, and with the aid of soil nutrient sensor, the device provides the crop's nutrient value. It thus decreases the energy spent by the man and also helps in weather forecasting.[2].

Instruments

1. Arduino UNO

The Arduino Unit is an open source electronic platform to read input light from the sensor and decoded by microcontroller and provides information to the user wireless communication system to which IP address they assigned.

2. Sensor

A. Soil moisture sensor

The soil humidity sensor is used to measure the soil's humidity. If the soil humidity value of the sensor is higher than the threshold value, the digital output level (0V) is low and the digital output is higher (5V). The digital pin reads the current moisture value of the soil directly to see whether or not it is above the threshold. With a potentiometer the threshold voltage can be adjusted.

B. pH sensor

pH shall be used to measure the water alkalinity or acidity determined by the relative number of hydrogen or hydroxyl ions present in the solution for water. The pH value is called acidic less than 7 and basic above 7. With change in temperature, the pH value of a solution changes. *Water level sensor*

Water level sensor is used to measure the level of water in the agricultural field. When water level is less than the particular value then it provides the information to the Microcontroller and microcontroller makes the DC motor switch ON.

C. Humidity sensor

Humidity sensor is used to measure the humidity of the environment.

D. Temperature sensor

The LM35 sensor for temperature measurement in Celsius. There are no additional or external calculations necessary to use the temperature sensor LM35 [9].

Result

The test for laterite, red and black ground was conducted in three tests and the results can be found in Table 1-3 below.

Table 1: Shows the Red Soil sample data and moisture content measurement.

Trial	W1 in gm	W2 in gm	Moisture in %
1	25	100	30
2	25	110	22.46
3	25	100	30.63

Table 2: Shows the Black soil sample data and moisture content measurement.

Trial	W1 in gm	W2 in gm	Moisture in %
1	25	98	25.32
2	25	95	29.27
3	25	90	23.80
		Average	26.13

Table 3: Shows the Laterite soil sample data and moisture content measurement.

Trial	W1 in gm	W2 in gm	Moisture in %
1	25	100	38.6
2	25	110	32.74
3	25	110	40.2
		Average	37.18

It was designed with three major soils, Laterite, Red and Black. The design has been tested. To ensure the proper functioning of the design, the sensor measurements were compared to the soil moisture test results. At the same time the sensor was put in the soil to obtain the correct results for the soil moisture test. As the sensor works in real time, quick results have been achieved. The shown results have been noted. The pump provided the water for these three soils with preferred values.

The Internet of Things is a technology used for keeping an eye on a device by using android mobile devices. The NTM collects data from various sensors, such as a temperature sensor, to measure the temperature of the farmland, water level sensor to measure water level in agricultural land, humidity sensor to measure the humidity of the environment near agricultural land and it will also identify the pesticides in the plant and spray the medicine to remove the insect from the leaf of the crop and also the system provides Nutrient value of the crop with help of soil nutrient sensor. So, it reduces man power and it also helps in weather forecasting and provides the information of data to users with the help of the Internet of Things.

Conclusion

With the aid of variety of sensors like pH sensor, humidity, temperature sensor, soil based nutrient sensor, pressure sensor, this research paper overcomes various drawbacks such as finding crop nutrition, weather forecasting and humidity of the atmosphere and also discussed the role of the Internet of things, how the data collected by the sensor and decoded by the microprocessor and sent information to the wireless mobile user or tablet to which an IP address has been assigned so that they can get the information. The data collected was for the different kind of soils means this system will provide information in the real time irrespective of the kind of the soil. This system will not only be helpful in knowing the soil parameters like pH value, moisture of the soil, contents of the soil but can also be helpful in knowing the irrigation status and the quantity of water required for the irrigation for the different types of crops in the same soil for the real time measurement of the moisture content of the soil. Current research can also be helpful in knowing the required amount of pesticides and the chemical fertilizers in the proportionate quantity for the particular crop and the soil that also depends upon the retaining of the soil.

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