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Smart Agriculture System to Control the Water Resources Using Arduino UNO AND IoT

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Abstract: Agriculture is the foremost basic essential and important way to produce food & it plays a major role in the economic growth runs each nation by contributing to GDP. There are many crucial issues in agriculture associated with manual method such as wastage of water for the purpose of irrigation in the field, need for non-renewable source like time, money, human resource (Labour) etc. By using IOT technology and different field sensors, it is possible to do the automation techniques in agriculture. The main purpose of automating the irrigation system is to provide adequate water for the crops, when it is required. The smart irrigation system uses an Arduino based micro controller which takes the data related with the contents of moisture percentages in the soil by using sensors. In addition, servo motor is used to control the flow of water from the water resources. A decision controller algorithm is used to turn on the motor or to turn off the motor, which supplies the water to the agriculture field. The soil content information such as moisture, humidity, temperature is sent to the controller unit and then all these data were sent to the server database for the future analysis using wireless mode of transmission.

In this smart system, the option is given to control the decision making by user(farmer) by using a smart sensor with Arduino UNO microcontroller. The advantage of this system is to switching of the motor can be controlled from the remote place, so that the time energy and money can be saved. This smart irrigation system with smart sensors is very useful in those areas where there is lack of water or insufficient water and systematic approach is required to achieve very good growth in the field of agriculture.

Keywords: Smart irrigation system, Internet of Things (IoT), Soil Moisture Sensor, Temperature, Humidity.

I. INTRODUCTION

India is especially an agriculture-based country. Agriculture is recorded as most significant occupation or job for many of the Indian families. Contribution of agriculture in India recorded about sixteen percentage (16%) of total country's GDP and one-tenth (10%) of total exports. There is decrease on ground water level, day by day. Water shortage has become one of the big problems all over a world. The wastage of water can be controlled by using terraced irrigation, ditch irrigation, drip irrigation system. The worldwide irrigation scheme is categorized by increased & high demand for high quality agricultural productivity, unsatisfactory performance and deficiency of water for the purpose of agriculture. These problems are often roughly rectified and can be controlled if we use automated and smart irrigation system.

In this paper, we mainly focused on irrigation system by proposing an automatic and smart irrigation system which save money, power and time to the farmer and it avoids man made errors.

The old & Traditional irrigation techniques require manual intervention. With this automated real-time technology of irrigating the farm-land, the human interposing can be reduced or fully removed based on the conditions. By using this system, will automatically pump water based on the moisture in the soil, humidity and temperature required to different plant based on their growth condition. Internet of Things (IOT) is the thing that connects the device to the web and to other devices. In-built sensors are connected to a web platform, which processes the data from the various devices and applies analytics to share the foremost valuable information with applications built to handle specific needs. In this smart irrigation system, IOT is used to send the different soil parameters to the farmers from the sensors, which are placed in the field.

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II. LITERATURE SURVEY

Integrating real-time monitoring and controlling smart irrigation system the system proceeds actions such as turn on and off the motor on based on some parameter value. Where the system offers a user-friendly environment with a help of mobile based application that provides access to the users to operate this system [1]. Depending upon Drip Irrigation system watering directly to the roots of the plants. Various types of sensors were utilized to controlling and monitoring the water level. Also provided web page to control the water level [2]. The result of this study proposes innovative and simple semantic solutions to facilitate irrigation system for users and farmers to measure humidity in air, rainfall, speed of the wind, temperature and solar radiation in real-time controlled through mobile application [3]. Here Wi-Fi node is used for connection. fuzzy logic was implemented as a controller in this system.

III. PROBLEM STATEMENT

In present world, there was an emergence of global water abundance. Managing water inefficiently has become a crucial issue. This can be seen in many countries, which have insufficient of water resources and economic decline. This created serious problem in agricultural fields. Here, we proposed a Smart Irrigation System that is designed based on a PROTEUS tool and programmed using Arduino UNO microcontroller in Arduino IDE that automatically operates with the help of soil sensors. The moisture sensor senses the moisture content of the soil and automatically turn ON or OFF the water pump without interference of farmer which results in save water for the future use.

IV. MATERIALS AND METHODOLOGY

A Smart automated Irrigation System has numerous essential components which used in this project are listed as follows:

- Arduino UNO
- Soil Moisture Sensor
- DTH11 Temperature and Humidity Sensor
- Wi-Fi Module, LCD Display
- Relay, Water pump, DC mini–Servo Motor
- Bread board, Connecting wire

Software such as PROTEUS, Arduino IDE, c programming for Arduino is used to build the prototype pf smart irrigation system.

1.Arduino UNO

The Arduino Uno is an open-source microcontroller board which support ATmega328P. It consists of 14 pins (digital) input and output pins amongst which 6 pins are used as PWM outputs, 6 pins as analog inputs, it has inbuilt quartz oscillator and USB connection, an influence jack, an and push button. It has everything which are needed to support the microcontroller; The system is can be connected to Computer or Desktop via USB cable.

2.Soil Moisture Sensor

Sensor which senses soil moisture is one kind of device which used to gauge the volumetric content of water with in the soil. It measures the high-accuracy of water in the soil and generate the moisture level as output. The module can produce output based on both digital and analog and potentiometer is used to adjust the threshold value.

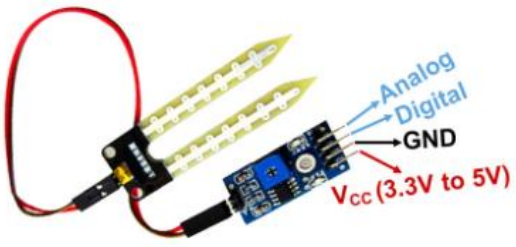

Figure1: Soil Moisture Sensor

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3.DHT11 Humidity & Temperature

DHT11 is a Humidity & Temperature. Humidity & Temperature sensor (DHT11) is a low-cost sensor, which produces digital output. It also uses a capacitance in Humidity sensor and a thermistor in temperature sensor to measure the values in the air and produces the digital signal as the output through data pin.

4.Servo Motor

Servo motor is an actuator (linear or rotary) which allows for an explicit control of position (linear or angular), acceleration and velocity. It consists of a motor which is connected to the sensor which provides position feedback. It also needs a controller which is relatively sophisticated, often a dedicated module designed specifically for use with servo motors.

5. Water Pump

It is a switch which is connected to the pump which controls the flow of water and Genuino 101. The relay will control the flow of water from the pump based on actions given to Genuino 101. The water pump will be inside the water pump connected with a pipe. When the pump is turned on it will supply water from the pot through the connected pipe.

6.WI-FI Module

The ESP826 is Wi-Fi module that contains SOC with the integrated TCP/IP protocol stack which will help microcontroller to access the Wi-Fi network. This device has an enough and powerful on-board processing unit and storage capacity that allows the device to integrate with the sensors and other devices with specific application software through its GPIO ports with minimum up-front and minimal loading runtime. It has a very high degree of an on-chip integration that allows for a minimum external circuitry, including a front-end module, is designed to occupy minimum PCBs.

V. PROPOSED METHODOLOGY

The proposed system model diagram is shown figure below. It will provide an outline of the entire process of the proposed system. Two sensors of different types are being used to measure three parameters at the same time. The incoming information from sensors are sent to the microcontroller. An LCD display is also connected to get the output on the display. Then microcontroller sends the data or information to the Wi-Fi module. Then this information can be sent to the mobile user. The operation can be performed by the user using the manual tasks or can be chosen for automatic operation as Arduino UNO will be performing the commands needed, if the values of the parameter reach below the threshold or desired value. After a particular time, interval, the motor is turned ON to provide the required amount of water and then it turns off automatically.

Soil moisture sensor is a module that is used in this proposed smart system which will measure the moisture content present in soil which is essential for growth of the plant. Sensor that senses soil moisture will collect all the data and are provided to the Arduino microcontroller. Microcontroller will process based on the control algorithm. Sensor will produce output in analog form between the range 0-5V. Microcontroller will then convert analog data in to digital form. When the amount of moisture or moisture value present in the soil is dry, then the motor will be turned ON and the water starts to flow from a tank through a pipe. When the amount of moisture in the soil is high, then the motor will automatically turn OFF. Along with soil moisture sensor, humidity and temperature sensor is also installed in this system. DHT11 sensor used to get accurate value of temperature and humidity level of that particular area. The system can be operated by manual mode also. For example, if the temperature exceeds more than the normal temperature for the plants, then the information will be notified to the farmer so he can turn on the motor to cool down the temperature. It will also display the humidity in the air for the growth of the plant.

The Irrigation System is programmed by considering the requirements of farmer and the type of soil efficient design mode. This system offers remote control to field conditions and real-time monitoring & control of the variable-rate irrigation controller. The main aim of the proposed system is to monitor and maintain the crop field in wireless manner.

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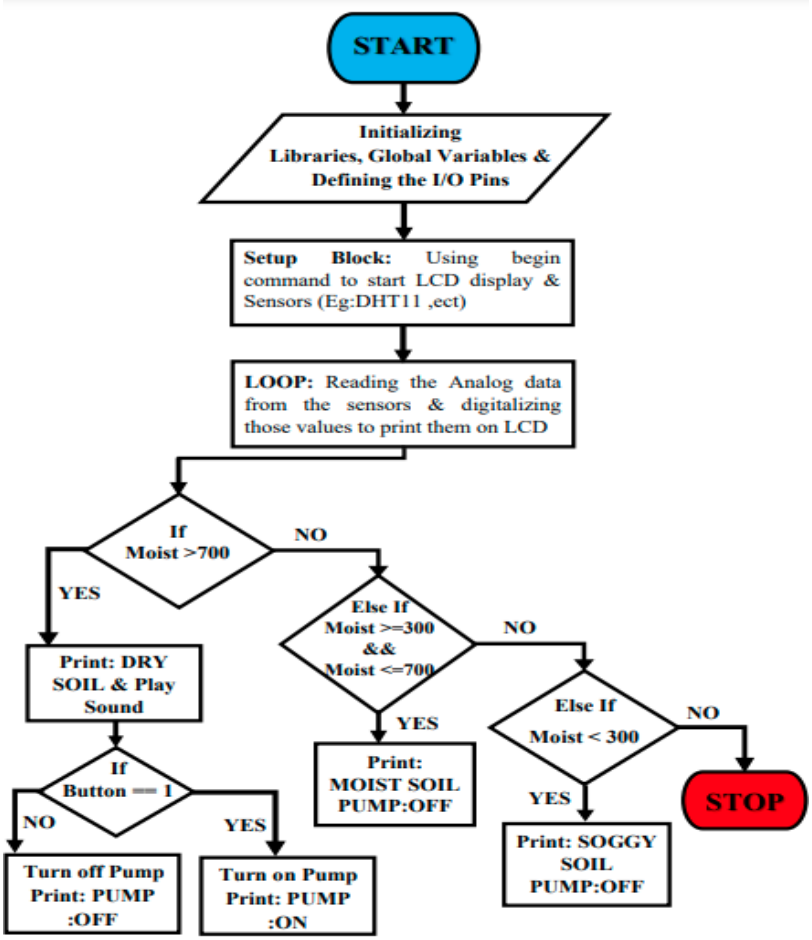

Figure 2: Flow chart

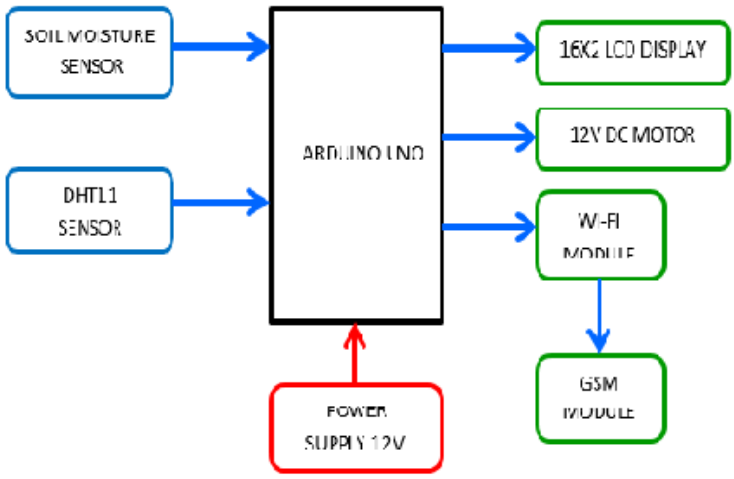

Figure 3: Block diagram

VI. SIMULATION AND IMPLEMENTATION

The following will give brief idea about parts where the software results have been analyzed. The circuit for basic smart irrigation system is simulated using Proteus 8.11 software and Arduino IDE. At the first stage, all the libraries

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including DHT 11, soil moisture sensor, I/O pins are included. Different parts of the system are connected as shown in the below diagram.

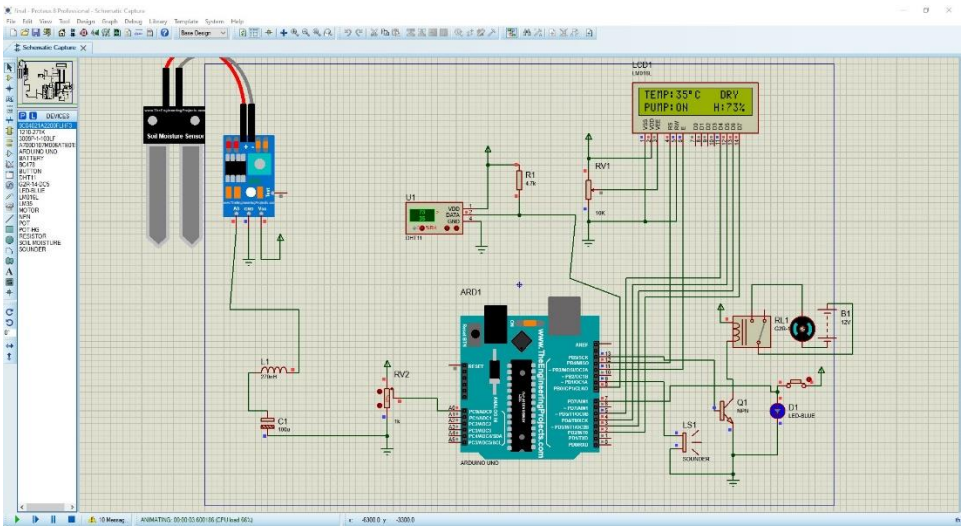

Figure 4: Schematic layout of the System

After dumping the code into Arduino Uno, soil moisture sensor checks the water contents in soil and will be displayed on the screen. It displays the moisture content in the soil, temperature, humidity and status of pump (ON or OFF). In simulation, three types of soil are checked. i.e., the soggy soil, (higher amount of moisture content in the soil), moisture soil and dry soil. When the moisture content in the soil is more than the assigned threshold level (m <=300), then the motor will be remains in OFF mode. If the moisture content is less than the threshold value, (m>=700), then the motor will automatically turn ON. Because of this, wastage of water is greatly reduced, which saves the farmer's energy, time and money. By using GSM, the smart system, sends the temperature, humidity, moisture details to farmers mobile and the famer / user can take other appropriate actions if required. By taking the readings/graph from the field, it is possible to control the motor and other manually also.

The prototype of Smart Irrigation System (circuit) is implemented and the real time value of moisture, temperature, humidity is sensed by the sensor and different places or by various different soil, and the values are displayed on the 16x2 LCD display. Motor is also connected to the Arduino UNO to pump the water. This information is sent to the farmers mobile for further action.

VII. RESULT ANALYSIS

The below figure/Table shows the moisture sensor result at different soil conditions.

Table 1: Moisture Sensor Result

Soil Type	Moisture level	Temperature	Humidity
Red soil	26%	30 C	70%
Black soil	38%	30 C	70%

VIII. CONCLUSION

The outcome of this project is to design smart irrigation system using IOT technology.The main purpose of the proposed system is to apply the functionally integrate the architecture in agricultural field by means of Automatic Irrigation to provide less or limited use of water to generate a high quality and healthy crop production. This Irrigation system is designed or implemented here is feasible as well as easy to control and very cost effective to manage the water resources in an optimized way in the agricultural process. This project was carried out using microcontroller

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board, soil moisture sensor, temperature sensor and other sensors. The Arduino with moisture sensor reads moisture content in soil to perform specific actions based on its value and the code. The proposed irrigation system reduces the man power of farmers and intervention human like supplying water to plants based on its moisture content and controlling the motor to fill tank.

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