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IoT based automatic irrigation system on greenhouse

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ABSTRACT

This project is to provide an automatic irrigation system thereby saving time, money & power of the farmer. The traditional farm-land irrigation techniques require manual intervention. With the automated technology of irrigation, the human intervention can be minimized. Here a framework is proposed to screen crop-field utilizing sensors for soil dampness, stickiness and temperature. By observing these parameters our irrigation system can be mechanized if soil dampness is low. We also have notification of field status via E-mail or SMS. In drip Irrigation water drop by drop at the position of the roots. It is the best technology for watering fruit plants, gardens and trees. Water flow through a main pipe and divided into sub pipes. Specially prepared nozzles are attached to these sub pipes. In this system waste of water is very less and no worker need for irrigating. Our system knows the status of the farm field then ON/OFF the gate valve according to the moisture level in the field

Keywords— *Internet of Things (IoT), Automatic Irrigation System, Drip Irrigation, Sensors*

1. INRODUCTION

In present days, in the field of agriculture farmers are facing major problems in watering their crops. This is because they don't have proper idea about the availability of power. Even if it is available, they need to pump water and wait until the field is properly watered, which compels them to stop doing other activities. An automation of irrigation is the best solution which has several positive effects, the water distribution on fields or small gardens is easier and does not have to be permanently controlled by an operator. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial, and institutional improvements. Manual irrigation systems do not promote water conservation that results higher amount of water or low amount of water leads to poor plant growth. Automated irrigation systems are capable of determining and maintaining the right amount of the water.

2. PROPOSED SYSTEM

The project uses an ESP8266 microcontroller which is programmed to receive the input signal of varying moisture condition of the soil through the sensing arrangement. The sensor data are stored in database. The web application is designed in such a way to analyze the data received and to check with the threshold values of moisture, humidity and temperature. The decision making is done at server to automate irrigation. If soil moisture is less than the threshold value the motor is switched ON and if the soil moisture exceeds the threshold value the motor is switched off.

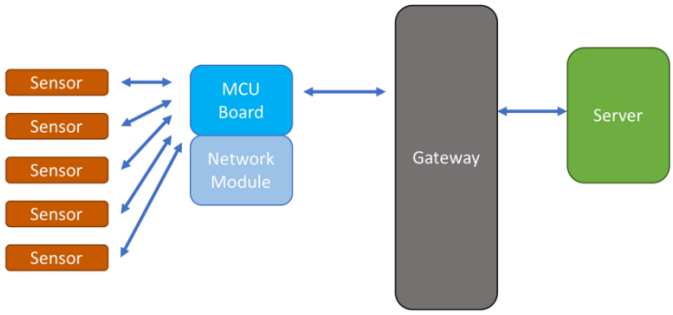

Fig. 1: Flow diagram of the proposed system

2.1 Sensors

Corresponding to our case, we need sensor devices to measure the garden's environment and condition. Capturing physical objects to digital form enables us to perform computing and processing.

2.2 MCU Board with Network Module

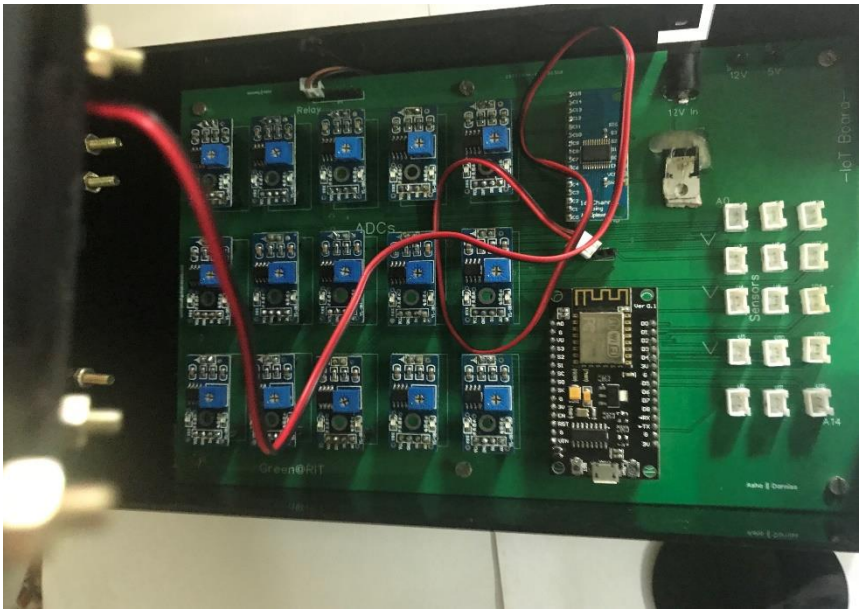

Fig. 2: Working Model

The goal of MCU is to process all data that is acquired from sensors. Most MCU boards have limited computation, so we need to send sensor data to a server for further computation. To enable us to send data, the MCU board should be attached to a network module, wireless router.

2.3 Gateway

The MCU boards can communicate with a server directly without modifying the protocol format. If a network module has the capability to deliver data over a primitive protocol, the functioning of gateway is necessary because a gateway can translate one protocol format to another protocol format.

2.4 Server

This is a center computation. This architecture is an ideal condition. In a real project, we integrate an MCU board and server in one box.

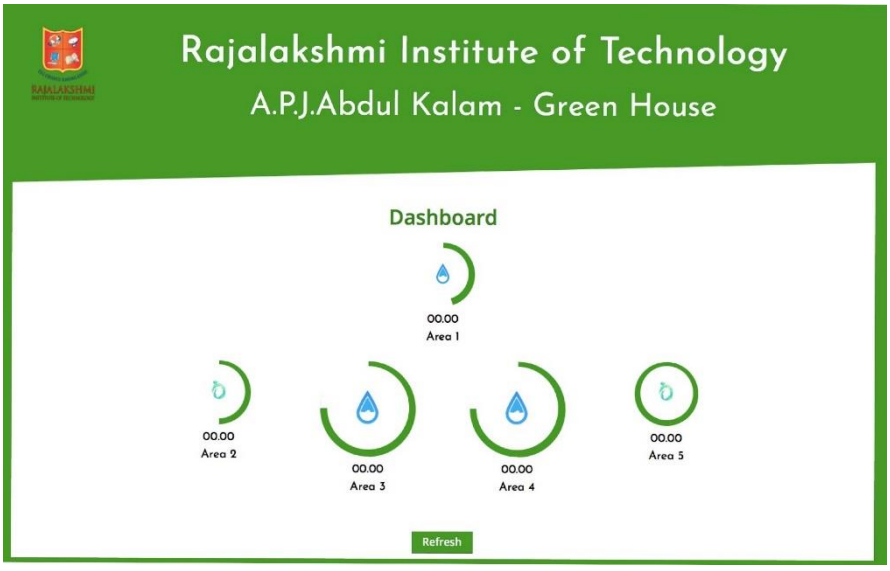

Fig. 3: IoT Dashboard

3. EXISTING SYSTEM

Considering the characteristic of irrigation in the rural area, this paper brings forward new devices based on wireless network, that are GSM (Global System Mobile) network and radio communication. Three levels are included in the system: the PC control platform or common cell phone for surveillance, the controller and the action unit. Simple GSM modules are available in the PC control platform and the controller. Orders can be sent from the PC control platform or cell phone to the controller and the information such as temperature, soil moisture and air humidity sampled by the controller can also be sent to the PC platform or cell phone by GSM message. Emitter and receiver of short-wave radio are embedded in the controller and the action unit respectively.

Radio communication works between the controller and the action units. Database of spot information sampled can be analysed and browsed by friendly interface in PC. The merit of this technology is that the solar batters supply power to the controllers and the action units, so additional power sources and wires are taken off. The demerit of this system is the speed of the network is slow and also problems occur such as misact of relay [1].

This project on "Automatic Irrigation System on Sensing Soil Moisture Content" is intended to create an automated irrigation mechanism which turns the pumping motor ON and OFF on detecting the moisture content of the earth. In the domain of farming, utilization of appropriate means of irrigation is significant. The benefit of employing these techniques is to decrease human interference and still make certain appropriate irrigation. This automated irrigation project brings into play an Arduino board ATmega328 micro-controller, is programmed to collect the input signal of changeable moisture circumstances of the earth via moisture detecting system. In agricultural lands with severe shortage of rainfall, this model can be successfully applied to achieve great results with most types of soil. The demerit of this technology is it covers only small amount of area. For covering large amount area many systems should be built [2].

India is an agricultural country with an abundance of fertile lands. It is thereby highly crucial, that as engineers it is necessary to contribute to the growth of this primary sector. Agriculture is the heart of our vibrant culture, and this should, without doubt, flourish in our nation. There is an exponential rise in population which induces a need to use our resources judiciously. As the demand for food grains increases so does the demand for water. This thought was the foundation for this project and the objective of this paper, is to automate the irrigation system. The proposed methodology uses Arduino for moisture sensing and controlling water supply and Node Microcontroller Unit (MCU) for notifying the status of the designed irrigation system to the farmers through mobile communication. The merit of this technology is that it ensures soil and fertilizers do not get washed away due to overwatering. Furthermore man power requirement reduces drastically. The demerit of this technology is that ARDUINO has only one Analog pin, so only one sensor can be used and it covers only small area [3].

The ongoing IOT research activities are directed towards the definition and design of standards and open architectures which is still have the issues requiring a global consensus before the final deployment. This paper gives over view about IOT technologies and applications related to agriculture with comparison of other survey papers and proposed a novel irrigation management system. The main objective of this work is to for Farming where various new technologies to yield higher growth of the crops and their water supply. Automated control features with latest electronic technology using microcontroller which turns the pumping motor ON and OFF on detecting the dampness content of the earth and GSM phone line is proposed after measuring the temperature, humidity, and soil moisture. The merit of this system is that the architecture uses micro-controller which promises an increase in system life by reducing power consumption. The demerit of this technology is that it uses GSM technology hence its working is not much accurate and it covers only small area [4].

With advancement in technology we can establish a system that automates the irrigation process such that there is efficient usage of water and create an ease of work load for the farmers. With embedded technology and Internet of Things, in this work, employing designed IoT based automated irrigation system for the Indian scenario. The system is able to deliver optimal water to the plants based on moisture, light and temperature levels which are obtained through sensors. The farmer will be able to monitor the parameters through the mobile app which is integrated with cloud storage. By analysing and comparing previous year's data and using current data we can able to efficiently find a way to save water. The merit of this technology is that the irrigation system on automation uses optimal resources to improve the efficiency of the irrigation. This system can be implemented in places that face water shortage to improve agricultural sustainability. The demerit of this system is it's depends on GSM technology and hence if signal is not properly obtained it may lead to collection of incorrect data [5].

4. IMPLEMENTATION

Hardware and software requirements for the proposed system are listed in Table 1.

Table 1: Hardware and Software used for experiments

S. No	Component	Description
Hardware Components		
1	Node MCU	ESP8266 is a low-cost, Wi-Fi Module chip that can be configured to connect to the IoT.
2	16 Channel MUX	This is a single-pole 16-throw Analog switch. The switch features four digital select inputs (S0, S1, S2 and S3), sixteen independent inputs/outputs (YN), a common input/output (Z) and a digital enable input (E). When E is HIGH, the switches are turned off.
3	Soil Moisture Sensor	Soil moisture sensors measure the volumetric water content in soil
4	Relay	Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit.
5	Solenoid Valve	It is a control unit which, when electrically energized or de-energized, either shut off or allow fluid flow. The actuator takes the form of an electromagnet. It requires 220V AC Supply
6	Drip Irrigation Kit	Drip irrigation is a type of micro-irrigation system that has the potential to save water and nutrients by allowing water to drip slowly to the roots of plants, either from above the soil surface or buried below the surface

Software Components		
7	IDE	The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures.
8	Online Server	000webhost provides free hosting that comes with an impressive set of features, like myphp admin, 1GB of storage Access etc

5. CONCLUSION AND FUTURE SCOPE

5.1 Conclusion

Fig. 4: Implementation on Green House

The automated irrigation system has been designed and implemented in this paper. The system developed is beneficial and works in cost effective manner. It reduces the water consumption to a greater extent. It needs minimal maintenance. The power consumption has been reduced very much. The system can be used in green houses. The System is very useful in areas where water scarcity is major problem. The crop productivity increases and the wastage of crops is very much reduced using this irrigation system. The developed system is more helpful and gives more feasible results.

5.2 Future Scope

This proposed system can be enhanced by adding up machine learning algorithms, which are capable to study and recognize the necessities of the crop, this would aid the agriculture field to be an automatic system. The inspections and outcomes tell us that this result can be executed for a lessening of water loss and decrease the manpower necessary for a field.

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