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# Automated Irrigation System Based Upon Crops

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*Abstract*— **One of the most important problems faced by the farmers in their farming activities is the constant need to watch over the irrigation. Many times, the farmers will not able to watch the irrigation regularly due to their works or long distances. Many times, the farmer must travel several kilometres to reach their field to irrigate the crops. So, mostly the farmers cannot able to maintain the irrigation regularly. And also, a huge amount of time and effort is expended daily in a farmer's life to irrigate the field. Through this paper, a project is proposed where a system is created to remotely control the process of irrigation such that zero intervention of human is required. The aim to setup a mobile Application with various crop type which is connected with the wireless sensor network in the field which will collect data about the moisture in the soil and send the information to start the water pump if the level goes below the threshold. The irrigation process will be controlled by the proposed Automatic system throughout the cultivation with a single click in the Application by the farmer.**

***Keywords***—Automation; sensors; crops; irrigation; Agriculture

## I. INTRODUCTION

Irrigation is a very important process in agriculture all over the world and there is no doubt that the farmer is well accustomed to the amount of water and suitable interval of time that will be required for irrigating a particular crop in a particular soil type. But, many times, the farmer may not able to irrigate the crop within the interval of time due to their works and long distances. In this modern world, farmers also have many works and they cannot able to irrigate the field with the proper interval of time. In such conditions, the improper watering to the crop may destroy the crop which will be irreversible. On the other hand, in monsoon or winter season, irrigation in consecutive days will not be necessary and on these days, the farmer have to travel to the field to just inspect the crop field.

The farmer loses a lot of time to travel to the field for inspection of moisture of soil or to just turn on the pump. This time could be used by the farmer to learn new agricultural techniques or spend that time caring for livestock and poultry. Also, in much larger crops, the conditions of the field across the area are uneven. The improper inspection of the crop and the understanding of the amount of water necessary to each part may result in disadvantageous crop yield with unequal production from these different parts.

This paper aims to present a system which can relieve the farmer from continuous and constant inspection of the field, that is to say, zero intervention of human in irrigation. It would not only help the farmer by easing his job of irrigating the field but will also ensure good quality yield. Due to the precise sensing of the sensors, wastage of water will be prevented, which is a growing concern all over the world especially in India.

Through the proposed system, the farmer will not have to monitor the field as irrigation happens automatically as and when required. A wireless sensor network will be used to set up the network and do the job. The sensors that have been placed in the various region s of the field will collect the moisture level and send the data to the circuit that the decision is made to on or off the motor pump according to the crop selected by the farmer in the mobile application.

Section II of this paper constitutes a methodology where the two parts of the proposed project will be defined. Section III includes basic block diagrams to visualize the system design. Section IV explains the process of implementation of the proposed project. Some basic connections between the various components will be a part of this section. Section V will include the various components that were used in the making of the system along with each of the component's short descriptions. Section VI will give the result of the project. Section VII will list some applications of the project. Finally, Section VIII will give a conclusion to this paper on our project followed by Acknowledgements and References that have been used in the paper.

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## II. METHODOLOGY

The proposed system is to set up a smart network with the mobile application over the entire field including the source of water and the pumping. The system will ensure two situations, one when the moisture content of the field is below a threshold it will command the motor pump to turn on the pump to water the field. Second, when the required moisture is reached, another command will be sent to turn off the pump and hence cutting the water source to the field. The system will have the following functionalities:

- The mobile Application which has been connected with the irrigation system.
- The mobile Application will have two modes.

I)Manual mode

ii)Automatic Mode

- Manual Mode: It consists of two options ON and OFF mode. It will control the motor pump. By this option the farmer can ON and OFF the motor pump when he needs to irrigate the field.
- Automatic Mode: This option contains list of crops. Each crop will have their different interval of irrigation period (delaying time which is previously programmed based on the crop type). The farmer just has to click the crop icon which the crop is planted in the field. By just clicking the button of the respective crop, the automatic irrigation system will be activated in the field.
- The soil sensors which are placed in the field will check the moisture level, when the moisture level goes below to the threshold, it will send the acknowledgement to the Arduino (which is programmed to control the motor pump) and it switches on the pump.
- While the water is being supplied, the sensor will wait for a certain duration of time, then continues to check the moisture level again as cross-check before moving onto next.
- When the desired level of moisture is achieved in the field, another acknowledgement to the Arduino to stop the water supply.

SOIL SENSOR:

These are the primary nodes. They are spread across the field strategically to retrieve the optimum readings to on and off the pump which irrigates the field. The only job of a soil sensor is to measure the moisture content/level of the soil. From time and period (delay process programmed based on the crop), the Arduino gets the information from sensor. When this data matches with the required lower value to start the pump, the water pump kicks on.

## III. BLOCK DIAGRAM

Figure 1 is a basic block diagram that shows how the information flow will happen in the field. For simplicity, it has been shown with a single crop in the mobile application. From the field, the sensor node will collect information. If it is decided by the system that water is to be supplied to the field, then the necessary information is transferred wirelessly to the system. This system starts the water pump and water is supplied.

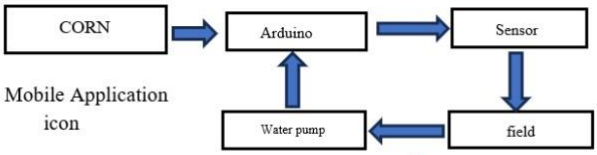


Figure 1: Layout of the field in the Block Diagram

Figure 1 is a basic block diagram that shows the placement of moisture sensors in the field where it was connected to the Arduino which decides to irrigate the field.

B. Supplying water to the field

The Arduino (shown in Fig. 2) does a simple yes or no operation on the information that it has obtained from the moisture sensors to decide whether the water pump is to be ON or OF. If the final answer renders to be ‘no’, the control exits and goes to the next condition.

If it is ‘true’, the Arduino and relay gets powered by the external power supply and the Arduino kicks on the motor pump to irrigate the field. After the soil moisture attains the certain level, the soil sensor sends the acknowledgement to the control system and it send the signal to the Relay to break the circuit to off the motor pump. Then the control system waits certain interval of time (based on the crop type) before checking the moisture level again. After this delaying period, the loop again starts and soil sensor again checks the moisture in the soil. In this manner, in a single click in the mobile application, the irrigation process is done automatically.

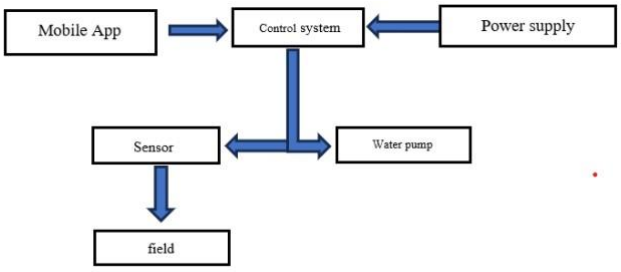


Fig. 2- Sending water to the field

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## IV. IMPLEMENTATION

AUTOMATIC MODE:

When the farmer selects the Automatic mode and, in this mode, he selects the particular crop icon that he was planted in the field. From the mobile application, the acknowledgement was sent to the control system in the field. The Arduino and Relay in the control system will get the power supply from the external source.

The soil sensor which was placed in the field is turned on and it measures the moisture content, the value which was measured by the soil sensor will send to the control system, the Arduino will compare the value from the soil sensor to the threshold value which was previously programmed according to the crop type (pre-defined moisture level: which will be decided according to the reviews gotten from the farmers at different places).

When the value from the soil sensor is goes below to the threshold value, the control system will kick on the motor pump. When the sensor value reaches to the threshold value, the control system will send the signal to the Relay to break the circuit and off the motor pump.

Then the soil sensor waits for the certain interval of time which is predefined according to the crop. After this delaying time, again will continues soil sensor checks the moisture level throughout the cultivation.

in case the moisture level is satisfactory when compared to the threshold value, after the delaying period due to rainfall or seasonal changes, the motor pump will not be on. then the soil sensor waits for certain period of time to check the moisture level and the loop will continue.

manual mode:

if the farmer wants to irrigate the field as per their convenience means they can select the manual mode to on and off the motor by remotely.

### v. components used & description

every component works under the commands of the microprocessor which is the arduino to get the desired results. every component that has been used in the system has been described in the following:

a. arduino uno

arduino stands for node microcontroller unit. it is inexpensive and an open-source iot platform. it consists of an analogy pin, digital pins, and serial communication protocols which allows an easy hardware development environment with system-on-a-chip (soc). arduino is the backbone of the project that is being defined in the paper, and all the components' commands and controls start from this.

b. relay

a power relay module is an electrical switch that is operated by an electromagnet. the electromagnet is activated by a separate low power signal from a microcontroller. it acts as a circuit breaker. it breaks the circuit, when the moisture is detected by the soil sensor which is equivalent to the threshold.

c. esp01 wi-fi module:

the esp8266 esp-01 is a wi-fi module that allows the microcontroller to access the wi-fi network. it is used to connect the arduino with the mobile application to communicate wirelessly

D. soil sensor:

the soil moisture sensor (sms) is a sensor connected to the irrigation system controller that measure soil moisture content in the soil. the soil moisture sensor uses capacitance to measure dielectric permittivity of the surrounding medium. in soil, dielectric permittivity is a function of water content. the sensor creates a voltage propositional to the dielectric primitivity, and therefore the water content of the soil. when it measures the low moisture content in the soil, it sends the signal to the controller to turn on the motor pump.

E. motor pump:

a motor pump is a mechanical device, used to move the liquids from one place to another by using a-mechanical action. it is used to irrigate the field.

## VI. RESULT

The prototype with the mobile application manages to start the moment with less to zero intervention the moment power is supplied. When the system starts, the moisture sensor lights up which indicates that, through the combinational logic circuit, power has been supplied to the moisture sensor and it is in measuring mode. In this manner, the soil sensor which is placed in the field, gets the moisture level and sends it to the Arduino microcontroller the power is with them. While testing the prototype, this was observed on the computer screen. And thereafter, as per the value of moisture in the field and the threshold is decided which is preprogrammed on the control system, the field was watered if the respective value is below the threshold. After the moisture level attains the threshold level, the circuit was broken and the motor pump was switched off.

## VII. APPLICATIONS

Some of the applications of the project are listed below:

- It can be used to measure the loss of moisture in the soil over time due to evaporation and intake.
- On one click in the mobile application, the irrigation throughout the cultivation will be automated.
- Zero intervention of human for irrigation throughout the cultivation.
- Cost efficient and reduces the wages and man power.
- Minimizes water waste and improves plant growth and the circuit is designed to work automatically and hence, there is no need for very less human intervention.

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- The same system or in general the same idea can be used along with sensors of temperature (DHT11 or LM35), solar exposure, pH value and mineral content of the soil in the field for example in fertilizer spraying for plants: the use of sensors which measure the number of different minerals in the soils will indicate which are deficient in the soil such as magnesium.
- It can be implemented in the process of spraying of pesticides.

## VIII. CONCLUSION

Using an app automated irrigation system will leads to zero intervention of human for irrigation which is the major part of the practice of farming and optimises the usage of water by reducing the wastage of water. Different crops require different moisture level with different interval of time. The mobile app will have crops with their predefined moisture level and predefined interval of time. By the single click of icon in the mobile app with respect to the crop in the field will be automated the irrigation process throughout the cultivation. It is user friendly and fast response. The accurate measurement and watering improve yield obtained because of the accuracy of nutrients provided (through water) to field. It will decrease the crop destruction due to high or low moisture level. This can be an industrial revolution.

## IX. ACKNOWLEDGEMENT

We wish to give our deep sense of gratitude and heartfelt thanks to our project mentor and, Professor Santhanalakshmi K and N.M.K. Ramalingam Sakthivelan for being the constant source of encouragement from a selection of the topic to implementation and further. We would also like to extend our thankfulness to the staff of our Computer Science and Engineering department for providing all the lab facilities.

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