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Automatic Irrigation System Using Arduino for Accurate Irrigation with Cross Checking Mechanism

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Abstract*— Irrigation is one of the most important aspects of agriculture. And it is very important to provide exact amount of water to crop because if the crop gets water more than needed then it may deplete. And if it gets less water then it may die. Also this is a very labour intensive and manual process. How would it be if a machine automatically irrigates the crop and farmer can operate it from any part of the globe without using internet. This is where our system comes in picture. In this system water will be irrigated after examining 9 factors. This will decrease the farmer's efforts and increase in productivity of crop and fertility of soil. Also farmer can operate it using his/her device which is connected with system from any part of world by just sending a SMS.

***Index Terms*— Arduino, Irrigation, Sensor, SMS**

I. INTRODUCTION

The Basic idea is to make a system using combination of many sensors and devices. In this system water will be given on basis of moisture of the soil, type of soil, temperature, water availability, age of crop, growth of crop, type of crop, in which part of day crop is irrigated and geographical location of farm , rainfall etc. using Arduino.

II. PROPOSED SYSTEM

There are 2 parts of the system software and Hardware.

A. Software-

The main part of software is coding. The coding for this system can be done in Arduino IDE in embedded C language. And an external Bluetooth application is required for receiving and sending data and a suitable application for sending and receiving SMS.

B. Hardware-

In hardware setup the main component is an Arduino Board. As mentioned earlier this system involves many sensors to evaluate water to be irrigated. The sensors are Moisture sensor, Rain drop sensor, Temperature and humidity sensor, Water depth sensor and water flow sensor etc. For communication this system has 2 ways one is Bluetooth communication which is possible for short distance and another is SMS for communicating which is possible for longer distance. For Bluetooth communication a Bluetooth module is present in the system and for SMS a GSM Module is used.

The reason behind using 2 ways of communication is that SMS Communication requires cellular Network is a requirement but on the other hand this type of communication is possible almost everywhere in the world. But to avoid any kind of communication break an alternative Bluetooth communication is used which is also cost effective and doesn't require any cellular network but is not possible from long distance.

This system can also be connected with internet by adding some more components but internet connectivity is not available in many areas and is also not cost effective.

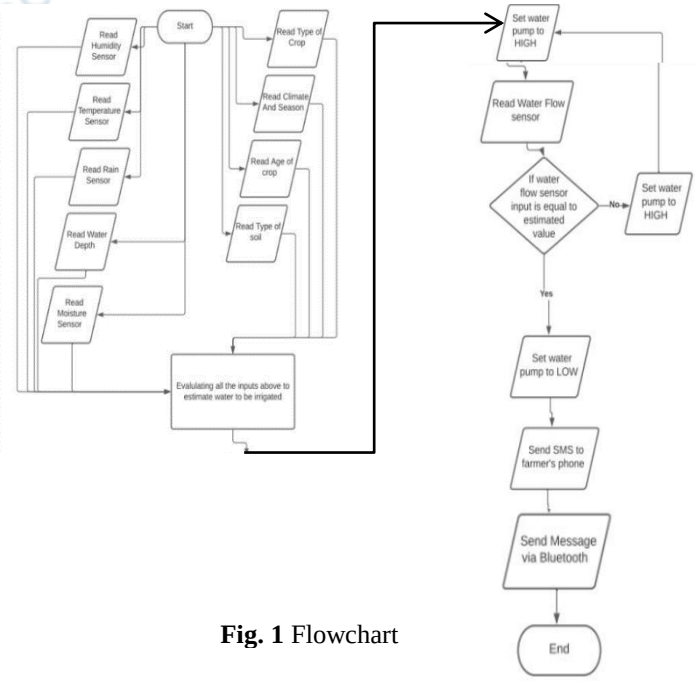

Fig. 1 Flowchart

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III. METHODOLOGY

This system will be a combination of many sensors. For example we will be using moisture sensors for measuring moisture content of soil and temperature sensor for measuring temperature, rain sensor to check rain, water sensor for checking water availability etc. and other data like type of soil and crop, age of crop, season, climate will be already feed in the arduino board. Depending upon this data, requirement of water will be calculated. Water pump will be configured with arduino board using a relay. So that arduino will send this data to water pump and exact amount of water will be pumped out and irrigated to crop. All this data will be sent via SMS/Bluetooth to farmer and after receiving confirmation from farmer the water will be irrigated. Working of whole system is shown in Fig 1 and Fig. 2.

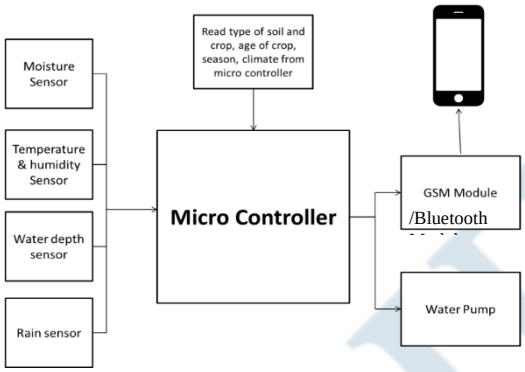

Fig 2. Block Diagram

IV. WORKING

- All sensors can be classified into 2 types – System sensors and on-ground sensors .
- In this system there will be a central unit which will have Arduino board , communication devices and some sensors like temperature sensor, Moisture sensor main unit and probes of moisture sensor will be placed all over field with long wires.
- In the same way Probe of rain sensor will be placed in field for accurate values. Water depth sensor will placed in the water source to measure the water availability in the water source. And one of the most important semsor in the sensor is water flow sensor which wil tell us how much water is irrigated, so that accurate water is irrigated and water is not wasted.
- Other important device in the system is relay which will connect pump with whole system will be present in central unit.
- Based on function sensors will be connected to either digital or analog pin with arduino board. For example. Moisture sensors, Water flow sensor, temperature sensor will be connected to analog pins and water depth and rain sensor will be connected to digital pins.
- In the same way water pump will be connected to relay and relay will be connected to a digital pin because the estimated water level and inputs from water flow sensor will be compared and a decision of keeping water pump on or off will be taken by system automatically.

V. ACCURACY

- For Accuracy in water estimation many factors are taken in consideration.
- After estimating the water to be irrigated, with help of water flow sensor it is cross checked if more or less water is irrigated through pump.
- Also the moisture content is not same in every part of field. So, a network of many moisture sensors spread all over the field give inputs and after calculating the average moisture content of soil water is irrigated.
- Also irrigation depends on climate, type of soil and crop. So, all this data is already feed in system while installation.
- All the inputs by sensors are accessible to farmers for cross checking .
- Farmer can change the given data very easily to avoid any kind of problem in irrigation.

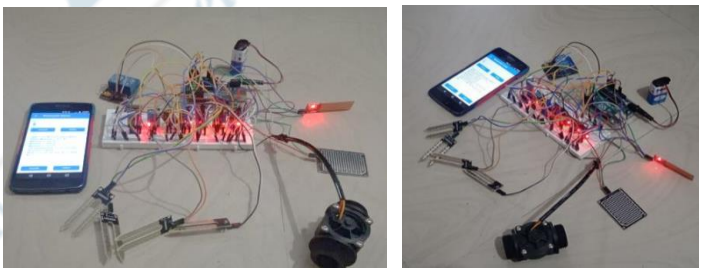

Fig.3 Prototype

VI. PROTOTYPE

- We have developed a small scale testing prototype (Fig. 6) which gives us accurate information and also value of how much water should be irrigated.
- This prototype can be connected to pump to irrigate the estimated value.
- If the moisture levels are less than 500 and all other factors are good then there is no need of irrigation
- If moisture content is more than 500 and other factors are disturbed the crop needs to be irrigated with farmers permission (Fig.5 & 6).
- Other factors include in which part of day crop is irrigated and geographical location of farm, rainfall, temperature, water availability etc.
- These are all supporting factors and help us give more accurate estimate of water to be irrigated.

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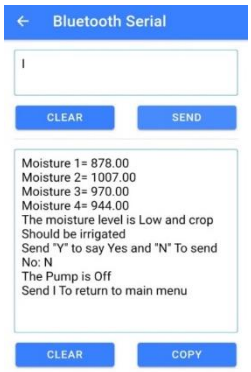
Fig.4 testing with ideal



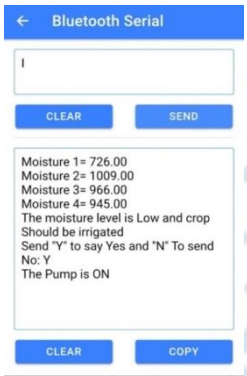


Fig.5 and Fig.6 testing in dry soil

VII. Advantages

- This system will help us to control use of water and preserve soil.so, that we can preserve natural resources.
- Farmer's income will increase and efforts will decrease. And if their efforts will decrease then farmers can opt for a side business.
- Probability of Failure of Crop will decrease.
- Quality Control Of crop is possible as right amount of irrigation will led to Increase in quality of Crop.
- Small Farmers will get an access to good quality technical equipment for farming [1].
- Easy to handle and cost-effective system.
- customizable according to land size and number of crops
- Analyzing more than 10 types of inputs to estimate water to be irrigated
- Accurate results in Harsh working conditions
- Fully trained system with water depth measuring mechanism.
- Easy Installation
- Very Mobile system
- Can be connected with any size pump.
- Can be operated by any phone powered by any OS having SMS or Bluetooth facility.

VIII. Future Scope

- Configuration with other Agro-tech devices.
- Real Time Crop Health Analysis
- AI Based recommendation and suggestions for better plant health.
- Adding More Sensors for more accurate output
- Connecting this system with Internet.
- Plant disease detection.
- Fertilizer evaluating mechanism

IX. Distinguishing Features

- The most unique feature is cross checking mechanism. Available Irrigation systems check the irrigated water by calculating speed of pump. But in this system the pump is left HIGH until the input from water flow sensor match evaluated value [2].
- Second distinguishing feature is that it does not require android or IOS on farmers phone to operate it can be operated by small phones also.
- Where most of systems use a standard way of evaluation. Our system takes factors like type of soil and crop.

X. Conclusion

- We are able to build an automatic irrigation system.
- We are able to develop a mobile and easy to operate system.
- We are able to get accurate results from the system.
- We are able to use the cross checking Mechanism using water flow sensor in our system

Acknowledgement

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