Improving the Performance of Agriculture Irrigation System using Arduino

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Abstract*: Irrigation process is nothing but a cultivation of agricultural crops during the inadequate rainfall. And also it is used to maintain the landscapes. Now a days, irrigation process to the crops are very difficult and the farmers facing lot of problems to get the good quality of crops because of providing the sufficient quantity of water with the precious time feed to the crops is most difficult task. This problem can be overcome by automatic irrigation system. In recent years, lot of researchers focusing towards the automatic irrigation for helping to reduce the burden of farmers and also they are focusing about to properly cultivate the crops with the proper time period. In this proposed work, by using the arduino uno, the automatic irrigation process is done in effectively. With the additional accessories and components along with the arduino such as moisture sensor, solenoid value, relay modules and adapter provides the effective irrigation system. This proposed system is focusing to feed the necessary water to the crops based on its natural character automatically by the arduino code of the system. Also it protects the farmers against the injury causes due to harmful insects in the agriculture land when working in night.

***Keywords*: Arduino uno, Moisture sensor, relay module, solenoid valve.**

I. INTRODUCTION

Today's world, whatever technology which are used in domestic, industries and agriculture systems, the automation technology is wide spreading for improving the performance of the system and reduce the manpower. In our India, 40% of people are mainly depending upon the agriculture and it is one of the most important mankind in our India [1]. farmers doesn't have the sufficient knowledge about their lands that it the fertility, cannot able to choose the right seeds for their agriculture lands [2].

Without the water, we never imagine the process of agriculture system. So, effective utilization of water for the irrigation is most important task in the agriculture system. Also some of the Such problems can be avoided by effective automatic agriculture irrigation system. This automatic system are very much essential now a days to the farmers for knowing their soil natural property as well as which type of seeds are much suitable for their land [3]. Also feeding the water to the crops with the sufficient quantity at precious time interval can be done. This system is widely suitable to the farmers those who are working in night hours because of avoiding injury by harmful insects and provides the safety / security to them.

In this automation system, the amount of moisture content in the land can be sensed by moisture sensor. This is very helpful to detect the wet / dry conditions of land and analyze to make a strategy for the required quantum of water flow to the particular area of the land [4-6]. In particular, this project proposal is essential to the less availability of water in rural areas for saving the water required to the agriculture land and also provide safety and security to the farmers [7-10].

This paper is organized by five chapters such as Chapter-I: Introduction deals the need of automation in agriculture process. Chapter-II deals the literature survey about the proposal. Chapter-III discusses the proposed methodology of the automation system. Chapter-IV deals the complete block diagram for the proposed methodology and Chapter-V discusses the results about the project.

II. LITERATURE SURVEY

Pavithra, et.al., discussed the GSM based Automatic Irrigation Control System for efficient use of resources by using mobile phones. By using GSM techniques, it gives the convenient feature to the farmers for their work and gets notified. Due to this process are well aware of the process of the system and are able to do their work without getting any problem. And are useful for the user to get notified even if he is out of the village for a short time he can monitor the work happening in the field and is able to stop and start the process whenever needed.

Venkata Naga Rohit Gunturi, "Micro Controller Based Automatic Plant Irrigation" discussed the entire system is controlled using microcontroller and it give the

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interrupt signal to the motor. Temperature and humidity sensors are used to sense the humidity and temperature of the soil.

DC Slaughter et.al., deals the development and application of computer hardware, software, electronic instrumentation and control systems for solving problems in agriculture and related industries.

Archana et.al., discussed the humidity and soil moisture of the root of the plant, by using moisture sensors. Microcontroller takes the readings of the root zone by sensors in the agriculture area. Based on the reading, the chances of error in the system is reduced thus the automation is done effectively.

Gunturi discussed the project in conservation of excess of water used in the field and also proposed the many techniques for controlling the wastage by using 3.5 microprocessor.

VR balaji et.al., published a project and it is not depending on electricity and power supply feed to the project using solar PV system. Also soil moisture sensors are used to find values of microcontroller which is used to control the motor.

Karan kansara developed automatic irrigation system using microcontroller. With the help of GSM module, the signal can generate, transmit and decode from cellular network and the work is easy and done in effective manner.

Joaquin Gutierrez published a project for the irrigation processing using photovoltaic panel. This project is more suitable for the summer season for helping to save the usage of water. Solar based plant irrigation in which the water is drawn by a submersible pump and sprinklers the water in the plants.

BR Shiraz Pasha, et.al., discussed to use the ATMEGA3 Microcontroller which is giving the interrupt signal to the motor and also provides the information about automatic irrigation.

N Wang proposed the computers and electronics in agriculture provides an international view in development of hardware, software and control system. This proposed method is based on automatic irrigation system by using advanced technology and hardware.

By using the above mentioned literature survey, the following proposed system is planned to improve the performance of automatic agriculture irrigation system. In this proposed system, arduino uno is used due to the cost factor and also the system can be easily controlled by the farmer at different locations.

III. PROPOSED METHODOLOGY

In this proposed system, arduino uno is the central hub of the automation process. Whatever the monitoring and control processes for the agriculture irrigation can be done by and through only arduino uno. Relay module, moisture sensors and solenoid valves are the other important components for the agriculture automation system. The process of work also includes the light emitting diode for monitoring the work done in the field. The total area of the land is separated into number of phases and those phases are monitored by separate moisture sensors.

At the entry and exit stages, the moisture sensors are attached for sensing the wet / dry conditions of land. If the land is dry, the water is fed to the respective land area by one end of moisture sensor at the respective phase. The other end of the moisture sensor senses the water flows through the field as moisture is indicated the flow of water is stopped. The same process is started to the next dry area for the irrigation. Such a process is done to several phases of the land and it avoids the water for overflowing.

In this proposed system, five relay modules are connected with the arduino uno for indicating which area is irrigated and it shuts off the respective light based on the moisture is detected by the respective sensor. The four solenoid valves which are connected with the arduino are controlling the water flows through the valve. If the digital signal through the arduino is indicated as “0”, the condition becomes low and if the system indicated as “1”, the condition becomes high. Arduino is coded to turn “OFF” the motor, if the condition is high, and if the condition is low, the motor is made to turn ON.

By this way, the system is working efficiently and fed the water only to the areas which is needed water and it is switched off if the water is not necessary to the particular phase of the land. Hence, it avoids the water wastage and also saves a huge quantum of water for avoiding over watering.

IV. BLOCK DIAGRAM FOR THE PROPOSED METHODOLOGY

The major components of the proposed work are arduino uno (***ATmega328p***), moisture sensor, relay module and solenoid and motor for pumping the water. The detailed descriptions about those components are:

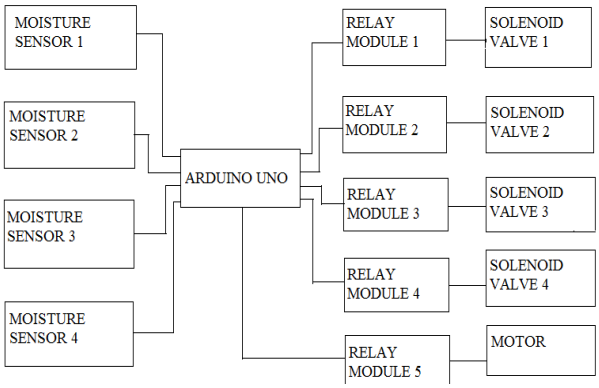

Fig. 1 Block diagram for automation irrigation system

Arduino Uno: It is a microcontroller board based on the ATmega328P. It is having 14 digital input/output, 6 analog inputs, 16 MHz quartz crystal with USB connection. The power supply is provided by AC to DC adapter. This arduino uno is connected with a computer through USB cable.

Fig. 2 Arduino Uno

"Uno" is the Italian word and it is marked to release the Arduino Software (IDE) 1.0. With the sets of digital and analog input / output pins, that is the possibility to interface the expansion of boards and circuits.

Moisture Sensor*:* Volumetric water content of the soil is measured by moisture sensors. Measurement of volumetric water content is used to indirectly measure the soil resistance, dielectric constants and property of soil.

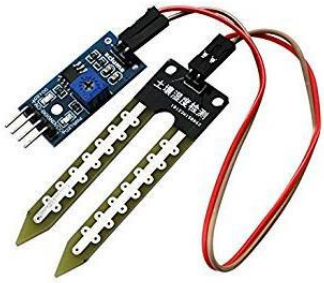

Fig. 3. Moisture Sensor

The moisture sensor is having two probes and used to measure the moisture value of the soil based on the resistance value of it. If more water available in the soil, it contacts more electricity due to less resistance of the soil. If less water, it conducts less electricity of more resistivity of soil.

Relay Module: In this proposed system, the single-channel simple relay module is used. It is having three terminals such as normally open, normally closed and common terminals. At "IN" pin, the low signal is applied for switch on the relay. This module doesn't have any holes for mounting.

Fig. 4. Relay Module

It is a separate hardware device used in the automatic agriculture system. It can be controlled by remote control device through the network or the internet. Based on the commands received from arduino uno, the device can be powered on and off remotely through the wide area network.

Solenoid Valve: It is a electro-mechanical device. Magnitude of current which is flowing through the solenoid induces the magnetic field and it regulates the opening of valve.

Fig. 5. Solenoid Valve

It is normally used as a control element for controlling the flow of fluids based on the electric current – magnetic field - mechanism. It is highly reliable fast acting and safe switches for agriculture irrigation system.

V. RESULTS AND DISCUSSION

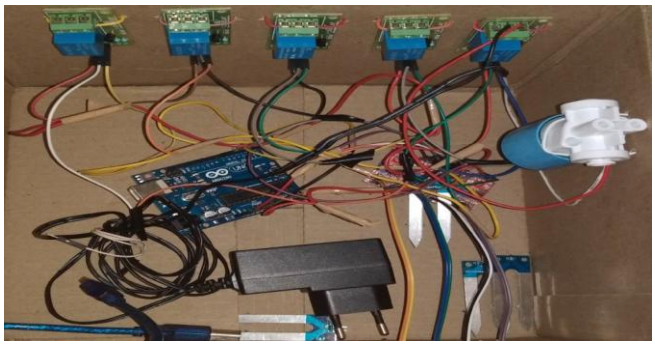

Fig. 6 Hardware Setup of Automation Irrigation System

Figure 6 shows the hardware arrangement of automation irrigation system using arduino uno. The moisture sensors are used to sense the moisture content of the soil by sending the current through the soil. If the soil is in dry condition, the resistive value of the soil is more. Otherwise the resistance is low at more moisture content of the soil.

Based on the resistive value of the soil, the sensor can sense and send the signal to the arduino uno for the availability of water in the area of agriculture land. Depends upon the requirement of water, the arduino uno gives the commands in the analog and digital formats to the respective relay module and its contacts are closed. If it is closed, the supply is given to the corresponding solenoid coil and the valve is opening depends upon the magnitude of magnetic field.

By this way, the amount of water flow to the agriculture land can be regulated and avoids the water wastage. In this hardware setup, 12 V DC motor is used for pumping the water to the land. The IDE software is used in arduino uno because of uploading the programme to arduino is very easy by using this software. The threshold values are set depends upon the DC motor supplies the water to the soil.

VI. CONCLUSION

The main objective of this automatic irrigation system is to make the process to save the water with precious time. The hardware of the irrigation system properly worked in various soils. Based on its performance, this system is effectively suitable for the irrigation compare with the natural irrigation process for the less amount of manpower and time. Also farmer can operate this unit with the long distance. One of the major achievements of the proposal is to reduce the quantum of water used and only required amount of water is supplied to the crop at the right time. So the growth of crop is better than the natural irrigation system. In future work, the temperature sensors will be included with this project; it can extend the large agriculture plant also.

APPENDIX

Arduino Uno (ATmega328P) specifications:

Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14

Moisture Sensor specifications:

Working Voltage	5V
Working Current	<20mA
Interface type	Analog
Working Temperature	10℃~30℃

Relay Module specifications:

Supply Voltage	3.75 to 6 V
Current with De-energized	2 mA
Current with Relay energized	70 to 72 mA
Input Control Signal	Active Low
Current Control Signal-Input	1.5 to 1.9 mA
Contact Voltage (Maximum)	250 VAC or 30 VDC
Contact Current (Maximum)	10 A

Solenoid valve specifications:

Supply Voltage	12V DC
Size	1/4"
Working pressure	0.02-0.8Mpa
Highest Working temperature	60℃
Rated power	4.8W

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