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AUTOMATIC PLANT WATERING SYSTEM

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ABSTRACT

Irrigation is the art of applying water to the plants/ fields to grow and to increase the quantity as well as quality of the fruits, food grains etc., Automatic irrigation system is a modern method of irrigating the vegetable, fruit fields, farms, gardens and land scraping areas as against the conventional method, which uses large number of men- hours and uncontrolled water quantity. This modern irrigation method using soil sensors (copper electrodes) has the advantage of precisely applying water for irrigation in both location and point, thus offering the potential of increased profit due to reduced water.

This project work describes about "Automatic Plant Watering System" designed with Arduino microcontroller. The main purpose of the project work is to apply water to the plants automatically, by sensing the soil condition. For sensing the soil condition, weather it is dry or wet, two copper electrodes are used as soil sensors for two fields and output of these sensors are fed to the microcontroller. The output of microcontroller is used to drive the relay to operate or control the pumping motor to the field whose soil is dry. This is electrically controlled equipment, when the soil is found to be dry; automatically the controller moves the pumping motor to that particular field and energizes the relay to activate the water pumping motor and supply water to the field or plants.

And when the motor is switched ON the soil condition becomes wet. By sensing the wet condition of the soil, automatically the pumping motor will be switched OFF by the microcontroller. Thus, saves precious water and electricity as well. A small proto type module is constructed for practical demonstration of the concept. The demo module is constructed with two fields and these are identified through magnetic and limit switches arranged at the fields. The DC water pumping motor is arranged over the sliding channel mechanism moves horizontally between the fields.

INTRODUCTION

In India agriculture is the most important occupation of the people. More than 60% of our total population depends for their subsistence on agriculture. After independence due to various development projects introduced in the field of agriculture, production of food grains has been continuously increasing. The entire Indian economy is depending on agriculture. Any fluctuation in agriculture income will directly affect the India's national income. In this regard, a thought is given to develop an Automatic Plant irrigation System designed with micro-controller.

Irrigation engineering comprises of a full knowledge of sources of irrigation water, their proper preservation and application of this water to the land after conveying it from the source through an irrigation system, consisting of canal and connected works. It also includes a working knowledge of different types of soils and the water requirements of various crops sown in them.

In this project work lot of importance is given for the drip irrigation, such that by sensing the soil moisture, water supply can be controlled automatically. For this purpose, relay is used, to energizing the pumping motor to supply water to the plants. The relay is energized automatically when the soil is dry, similarly the relay can be closed automatically when the soil is in wet condition. For sensing the soil condition copper electrodes are used.

The current technology, which involves the subject of mechatronics can restrict the motion of pumping motor, it will be positioned where required depending on the soil condition. For this purpose, magnetic switch and limit switches are used and they are supposed to be installed near the fields. The pumping motor arranged over the sliding channel mechanism will be moved horizontally within a specified span. This moving mechanism also carries the permanent magnet; this magnet can be positioned below the pumping motor at certain distance, thereby it moves along with pumping motor. Whenever the magnet passes over the magnetic switch, it will be activated automatically and generates active low signal for the controller, based on this information generated by the magnetic switch, microcontroller can understand the position of pumping motor. The same way at the extreme end positions of the pumping motor moving mechanism, limit switches are placed, one at the home position and the other at the second field. Magnetic switch is present at the first field. This controller unit is programmed to position the pumping motor and supply water depending up on the soil sensor information.

Irrigation is usually required when the yearly rainfall is either insufficient or ill distributed or ill timed. Yield is much better where irrigation is practiced and fields are watered at the proper time. In countries like India and Egypt, Irrigation provides employment for large sections of people. It raises the standard of living and prosperity. Irrigation projects are successful only when sufficient quantities of water are available and the land is suitable to grow remunerative crops. No irrigation is normally required if the total annual rainfall is 100cms. Or more and takes place at correct times. When it is proposed to grow valuation and better types of crops like Rice, Sugar cane, Vegetables, Cotton etc., irrigation is very essential.

For this purpose, the control circuit is designed with Arduino micro-controller unit with the advancement of technology in the electronics. Particularly in the Hybrid electronics and Microelectronics, the electronics has entered in to each and every field, whether it is a communication electronics or control electronics or computer electronics. To make more innovative and more comfortable for modern irrigation, it is decided to develop a project in plant irrigation automation.

In this project work, micro-controller chip is playing a major role, the controller used in this project is ATMEGA 328 Arduino controller. Nowadays with the advancement of technology in the field of micro-controllers, all the activities in our day-to-day living have become part of information technology and we find micro-controllers in each and every application. Thus, the trend is directing towards controller-based project works. However, in this project work, the basic signal processing of information gathering from the soil condition, is done with analog circuit, for this purpose copper electrodes are used for sensing the field soil condition.

Continuous monitoring of the soil condition manually is quite difficult task, there by this system is designed which monitors the soil sensitivity continuously, and energizes the water pumping motor automatically. Similarly, the system de-energizes pumping motor automatically, when the soil condition becomes wet.

By implementing this kind of monitoring and control systems for the agriculture purpose, each and every field can be automated. However, in this project work micro-controller is used just as a controller in controlling the relay. In this project relay is used and is connected at the output of the controller, which energizes or de-energizes automatically according to the received information from the copper electrodes. Before we go into concept of field automation first, we have to define automation.

The term Automation refers to means of control of electrical and mechanical operations without human interference. Definition of automation can be extended to field Automation which states “monitoring and control of various electrical equipment’s used for modern drip irrigation to their predetermined levels without human interference”. In real time application with one micro-controller, we can process large number of micro-controller or other IC device to be tailored to implement a specific function. The application program executed by a micro-controller drives the system hardware in order to implement the desired system function for a given micro-controller; different application programs allow different systems function to be implemented within a range limited by the available system hardware. As the technology advances, changing lifestyles patterns and willingness to spend in crop improvement, fulfill the desire for intelligent, fully automated field. In a typical automated field various equipment’s can be used for various methods of irrigation. The detailed description of a micro-controller is provided in the further chapters.

HARDWARE DETAILS

The IC's and other important components used in this project work, procured from the Hyderabad Electronics Market. The details or data sheets of the IC's are down loaded from the Internet. The following are the web sites that can be browsed for collecting the data sheets.

1. www. Texas Instruments.com
2. www. National semiconductors.com
3. www. Fairchild semiconductors.com

The following are the IC's and other important components used in this project work

1. Arduino uno Atmega 328 Micro-controller board
2. L293D H – Bridge IC
3. Voltage regulator
4. Relay
5. BC 547 Transistor
6. DC Motor

The required PCB'S (Printed Circuit boards) for the project work fabricated by SUN RISE CIRCUITS, Kushaiguda Industrial Estate, Hyderabad. Kushaiguda Industrial Estate is very famous for fabricating the PCB's.

CONCLUSION

The project work "**Automatic Plant Irrigation System**" is successfully designed tested and a demo unit is fabricated. Since it is a demonstration unit, facility is provided only for two fields only, but for real application number of electrodes may be used depending upon the area of the field.

In this project work the required power supply for the entire circuitry is derived from the main source, since the circuitry to be installed at fields, and availability of conventional energy at fields may be difficult, therefore this supply can be generated using solar energy. For this purpose, suitable solar panel can be utilized for charging the battery and the stored energy from the battery can be utilized to generate required power supply for the circuitry.

REFERENCES:

In order to select a suitable topic for the project, lots of references are made. A part from selection, while designing circuits, lot of study material is referred. The list is as follows:

Text Books:

1) Digital Electronics by JOSEPH J. CARR
2) Digital and Analog Communication System By: K. Sam Shanmugam
3) Electronic Circuit guide book – Sensors by JOSEPH J. CARR
4) The 8051 Micro-controller Architecture, programming & Applications By: Kenneth J. Ayala
5) Programming and customizing the 8051 Micro-controllers by: Myke Predko
6) The concepts and Features of Micro-controllers by: Raj Kamal
7) Irrigation Engineering By: B.R. Gupta

Manuals:

(1) CMOS / TTL IC Data Manuals
(2) Electronics for you: Monthly Magazine
(3) Practical Electronics
(4) Elector India