Automatic Irrigation System

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Abstract- An automated irrigation system have been developed using sensors technology with Arduino to efficiently utilize water for irrigation purpose. The system has soil moisture sensor inserted into the soil of the plants and a water level sensor placed in a water container from where water will be pumped to plants for irrigation. An algorithm has been build out with threshold values of soil moisture sensor to control the water quantity in soil and also a water level sensor has been implemented to measure the water level in tank. This project requires Arduino board having inbuilt ATMega328 microcontroller. This project is need of the hour to convert manual irrigation into an automated irrigation which with the help of soil moisture sensor will detect dankness content of soil leading to turn ON/OFF of pumping motor.This is project brings into play a micro-controller which is of 8051 family, this programmable micro-controller collects the input signals converted into values of moisture in the soil via soil moisture sensors. As the microcontroller starts obtaining the signals, it creates an output that forces a relay for running the water pumping motor. An LCD screen is also linked to the micro-controller to show moisture conditions of the soil and water pump. The water level sensor is used to detect the level of tank so that tank contains efficient water to transfer into crops.

Keywords- Arduino UNO,Soil Moisture Sensor (with LM393 Driver),LM 35 Temperature Sensor,16x2 LCD Display,Water level Switch,5V Relay,BC547 or similar NPN Transistors,Resistors (Refer Circuit Diagram),Potentiometer (10Kohm),5mm,1N4007 Diode,Terminal Strips and Screw Terminals,PCB

I. INTRODUCTION

In the world of advance electronics, life of human beings should be simpler. Hence to make life simpler and convenient, we have made "AUTOMATIC IRRIGATION SYSTEM". A model of controlling irrigation facilities to help millions of people. This model uses sensing arrangement technology with microcontroller to make a smart switching device. The main reason is the lack of rains & scarcity of land reservoir water. Irrigation has always been an ancient practice which has evolved through so many stages over the years. Our ancestral farmers in a bid to irrigate their farm sought for various methodologies. Manual irrigation using buckets and watering cans, flood irrigation, drip irrigation, sprinkler irrigation were and are still being used today. The existing system has several limitations; leaching off of soil nutrients, erosion due to flooding, loss of water from plant surfaces through evaporation, water wastage which can result to water scarcity in drought areas and production of unhealthy crops. This problem can be rectified if we use microcontroller based automated irrigation system in which the irrigation will take place only when there will be acute requirement of water.

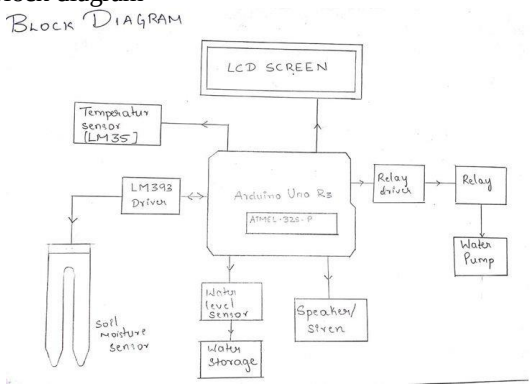
II. LITERATURE SURVEY

A. Review Stage - A total of two reviews have been conducted in the completion of project. Each review was a discussion of the progress of the project. The discussion took place in presence of the project group members, the guide and an examiner. The first review consisted of a discussion on whether to apply AC voltage or DC voltage. The second review consisted of a discussion on the Arduino based implemented circuit on the breadboard.

B. Final Stage - The final stage in the completion of the project will consist of a detailed review in the presence of external examiners (field experts). A viva directed for each individual member would be conducted.

III. EXPERIMENTAL SETUP

A. Block diagram



B. Components

- Arduino UNO
- Soil Moisture Sensor (with LM393 Driver)
- 16x2 LCD Display
- Water level Switch
- 5V Relay
- BC547 or similar NPN Transistors
- Resistors (Refer Circuit Diagram)
- Potentiometer (10Kohm)
- Terminal Strips and Screw Terminals
- PCB
- The **soil moisture sensor module** used here have two output pins (Digital output and Analog output). The output from the probe of the moisture sensor is compared with a reference value using a lm393 comparator. The reference value can be changed by turning the potentiometer in the module. The digital pin gives an active low output when the soil is wet. Here we are using

the analog output from the module by connecting it to one of the analog pins of Arduino. While using the analog output the wet detection value can be set/adjusted within the program itself.

- As shown in the circuit diagram, a float switch is connected to one of the analog pins of Arduino and a 1K Ohm resistor is used to pulled up the line. Analog pins of Arduino can also be used as digital inputs. The status of the tank is identified by checking the output of the float switch. Arduino reads the voltage dropped across the pull up resistor for sensing the level of water in the tank. Â Two LEDs are connected to the 2nd and 3rd pin of Arduino to show the moisture status and tank status respectively. And the 4th pin links to the base of a BC547 transistor which in turn drives the 12 V DC motor.
- A 16×2 LCD is connected with Arduino in 4-bit mode. JHD162A is the LCD module used here. JHD162A is a 16Ã—2 LCD module based on the HD44780 driver from Hitachi. The JHD162A has 16 pins and can be operated in 4-bit mode (using only 4 data lines) or 8-bit mode (using all 8 data lines). Here we are using the LCD module in 4-bit mode. Control pin RS, RW and En are directly connected to arduino pin 13, GND and 12. And data pin D4-D7 is connected to 11, 10, 9 and 8 of arduino.

IV. WORKING

In the programming part, to facilitate communication between Arduino and LCD module, we make use of a built in library in Arduino <LiquidCrystal.h>“ which is written for LCD modules making use of the Hitachi HD44780 chipset (or a compatible chipset). This library can handle both 4 bit mode and 8 bit mode wiring of LCD. In 4 bit mode, data is sent using 4 data pins and 3 control pins. In our project, R/W pin is always grounded so we require only 6 pins in 4 bit mode, thus saving no of pins. During interfacingÂ the library is first initialized and then define pins using the command LiquidCrystal lcd(RS, E, D4, D5, D6, D7), pins are assigned in this order. In program we can see this command as LiquidCrystal lcd(13,12, 11, 10, 9, 8), here RS pin to 13, Enable pin to 12, D4 pin to 11, D5 pin to 10, D6 pin to 9 and D7 pin to 8 respectively.

The Arduino reads the sensor output through the analog input pins using analogRead function. For example â€œanalogRead(moisture_sensorPin);â€• converts the voltage (in the range 0 to 5V) at theÂ A0 pin into a number (in the range 0 to 1023) This way the voltage at A0 is compared to a fixed number (avg_moisture) for identifying the current status of the soil .=

The status of the float switch is compared to identify the current water level and according to these both sensor status the controller will switch the motor to ON or OFF condition. IfÂ values from the float switches is high and if the reading from the moisture sensor is low, then controller will shows a full level tank status and a low level moisture status on LCD andÂ switches the motor to ON condition. This is done by giving a signal to the base of the BC547 transistor which is connected to the 4th pin of the arduino UNO. The controller will also switch the moisture status LED and the tank status LED OFF by writing a digital 0 to the 2nd and 3rd pin of arduino.Â The motor will be in ON conditionÂ until the moisture content goes above reference value or if the float switch status become low.

V. ADVANTAGES

Larger yards take a lot of time to water by hand, especially if you grow fruits and vegetables. Depending on the plants you grow, they may need watering twice a week during the summer. Installing an irrigation system may seem like a costly endeavor, including the labor involved, but sprinkler or drip configurations have several advantages.

Prevents Disease and Weeds

Specialized drip irrigation systems direct water specifically to each plant's rootball, rather than sprinkling the entire garden like a typical rainstorm. As a result, surrounding weed seeds cannot germinate, so you'll have less weeding to do. Water at the roots also prevents leaf diseases caused by standing droplets on the foliage. Because the water does not strike the leaves or flowers, blight diseases have no chance of proliferating.

Conserves Water and Time

Hand watering with a hose or watering can takes substantial time and early morning and evening watering rituals take away from family and work. Both drip and sprinkler irrigation systems have timers that can be preset for daily or weekly watering so you do not need to monitor the watering because the timer shuts the water off when it has finished. Your water bill should be lower if the irrigation system is effective.

Preserves Soil Structure and Nutrients

Watering with a wide open garden hose may allow too much water to seep into the soil. As a result, nutrients leach out with the water runoff, leaving the plants with fewer nutrients available. The soil may also become compacted when you water with a hose. Plants may show signs of withering or root disease with suffocating, compacted soil. Using either drip or sprinkler irrigation produces smaller droplets, helping to preserve nutrients and reducing soil compaction.

Gardening Flexibility

If you have a busy schedule, you'll appreciate being able to work in the garden at the same time as the plants are being watered. While one garden section is being watered, you can plant and prune in another area.

VI. APPLICATIONS

- It can be used for creating artificial environment.
- It can be used for automatic room temperature control.
- It is useful to handicapped and aged people as it does not require any work.

VII. RESULT

The system provides several benefits and it can operate with less manpower. The system supplies water only when the humidity in the soil goes below the reference. Due to the direct transfer of water to the roots water conservation takes place and also helps to maintain the moisture to soil ratio at

the root zone constant to some extent. Thus the system is efficient and compatible to changing environment. The concept in future can be enhanced by adopting DTMF technology. This project is basically dependent on the output of the sensing arrangement. Whenever there is need of excess water in the desired field then it will not be possible by using sensing arrangement technology. For this we will have to adopt the DTMF technology. By using this we will be able to irrigate the desired field in desired amount.

VIII. ACKNOWLEDGEMENT

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