Automatic Irrigation System Using Multi-Point Soil Moisture Measurements

R.Nishalini[1], M.Ramalingam[2], S.Robert Samuel[3], S.Srudhi[4], C.Shanmugam[5]
[1, 2, 3, 4, 5] Dept of Electronics and Communication Engineering
[1, 2, 3, 4, 5] Jansons Institute of Technology, Coimbatore, Tamil Nadu, India

Abstract- *This paper proposes automatic irrigation system using multi-point soil moisture measurements using Arduino microcontroller, which was automatically programmed for on and off the motor and solenoid valve when the soil moisture content below the threshold value. Since our proposed system is an automatic, human involvement is reduced for irrigation purpose. The complete system was programmed using Arduino simulator IDE setup and fused into Arduino microcontroller. This proposed frame work was tested for moisture level of varied places on the field.*

Keywords- Arduino microcontroller, Motor, Soil moisture, Solenoid valve, Threshold value.

I. INTRODUCTION

In our country now-a-days water scarcity is increasing day-by-day in many aspects. Improper farming also leads water to wastage. To conserve the water, we have come up with this project. Whenever we venture out of town for few days, we always accustomed worry about our plants as they have water on regular basis. So here we are making Automatic Plant Irrigation System using Arduino, which automatically provides required water to the plants, and also help to stop the effect of excess water and dryness of the sector respectively

II. LITERATURE SURVEY

In definitely true nursery vegetable quick improvement in the food creative invention of new things, consistent development of food requesting demands control [1]. For a nation like India, where the process of people making, selling, and buying things is commonly possibly going to water systems, it is an absolutely perfect, definite method during a time. It also helps in capability, expelling human and identical in all direction conditions, everything mistake in changing degrees of soil stickiness, and we are not setting up to use valuable things. Expand their net advantages. The way of thinking behind this is the non-participation of storms, and the land Water system is the fake use of water to water in the dirt store [2]. The by and large dependable extraction of water to aid in produce yields. In producing age earth reduces the water level[3] because of which some part of

the earth is usually used in dry zones and during (rain, snow, etc) that keeps on happening in unimmersed zones. Another shortage, yet secures plants against ice [4]. Critical purpose behind this is the immediate result of the use of Water system Water Types, because of which a ton of water enters into the waste surface water structure. The most gigantic Trickle Water system advantage is that water is determined by nearness to the root zone of the sprinkler water outline. So, plants spill by the stream, sparing a huge measure of water. Now, ranchers have been the standard water structures methods, for example, overhead using Indian water structure procedures through manual control sprinklers [5], going ahead with flood type. In which ranchers dive the land into the typical breaks is wet. Lower plant leaves and stem. The whole soil spends more water or surface throughout this approach is soaked and usually remains wet long after the water outline throughout the water arrives at a late taking into account they make which harvests. Such a condition makes sicknesses be dried by the leaf. Water shortcoming can be clumsy to plants structure living things. What might be ordinary, the spill or stream water structure is before visible shrinking and dying happens. Blocked rate, lighter a present-day water structure that bit by bit applies weight trademark thing looks for after short water [6]. These issues limited amounts of water to part of the root zone of the plant. Water can be brilliantly added to the end if we use changed little scope reliably to keep up a positive soil controller-based structure [7] in which the state of suddenness, and the pressure of sponginess in the plant water system happens exactly when it is very unusual with valid use of water valuable things.

III. PROPOSED SYSTEM

The endeavor is planned to develop an automatic irrigation system that switches the siphon motor ON/OFF on sensing the moisture content of the soil. Using proper water framework procedures in agriculture is fundamental. This method is to reduce farmer works and still assurance proper water framework.

The endeavor uses a PIC(16F887) micro controller which is used to get the data of moisture condition of the soil through the soil moisture sensor. This is done by

using an op-amp as a comparator between the soil moisture sensor and the micro controller as an interface.

When the controller gets a data is below the threshold value, then drives the water to the respective field through the siphon motor. An LCD is interfaced with the micro controller to show the status of the moisture content of the field. The sensing of moisture content on the field is done by using two firm metallic shafts installed into the field at a division. Relationships from the metallic shafts are interfaced with the comparator.

The endeavor uses PIC (16F887) micro controller, Op - Amp, Relay, Water Siphon motor, Diodes, Voltage Regulator and LCD are the required parts. Power supply required for the irrigation system is 12V dc voltage. The direct AC supply is applied on step down transformer that ventures down to 12V ac voltage. This AC is changed to DC by using a rectifier, at that point it is directed to 5V using a voltage regulator that is used for motor activity.This irrigation system the PIC (16F887) micro controller is programmed by the embedded C language by using MPLAB software. This C program is inserted into the micro controller by using PIC micro controller kit. The sensor placed on the field and it senses the moisture content of the field, then the comparator compare the value from the sensor, it sends the data to the micro controller. The micro controller check the moisture content with threshold value. When the moisture content is below the threshold value, then it drives, the water is supplied to the respective field from a tank by using siphon motor. The moisture content is displayed LCD.

In this system soil sensors are placedon the different places on the field. It checks the moisture level of the soil and if the moisture level of the soil is below the threshold value then the Arduino sends the signal to the relay to supply the water from the tank that is pumped using water pump and also send the signal to the relay driver to control the solenoid valve.The water is supplied to the field through the solenoid valves. This system is totally automatic, thus it reduces the work of the farmers.
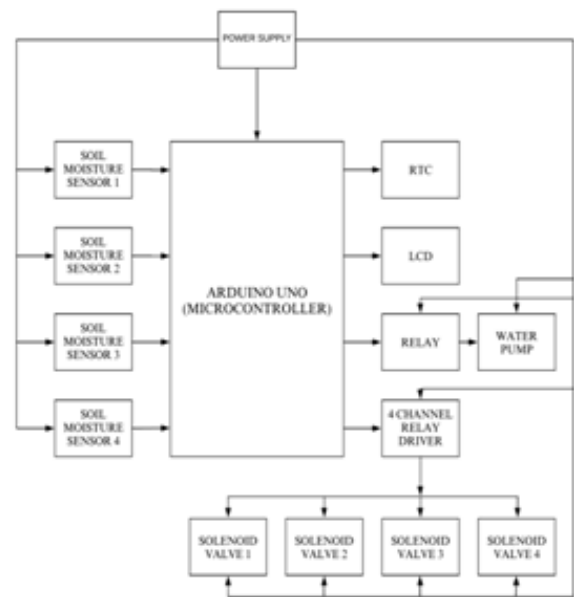
BLOCK DIAGRAM

Figure No 1

Figure No 1 shows the block diagram, In this block diagram the power supply block, is connected to the Arduino microcontroller, Soil moisture sensor, Solenoid valve, water motor, Relay, and Relay driver blocks.The soil moisture sensors, Solenoid valves, Liquid Crystal Display (LCD), water motor, Relay and Relay driver and Real-Time Clock (RTC) blocks are connected to the arduino microcontroller.

IV. EXPERIMENTAL SETUP OF THE PROPOSED SYSTEM

A. LCD

A 16x2 Liquid Crystal Display (LCD) is operating at a voltage of 5V. it is interfaced with digital pins of Arduino microcontroller. This is used to show the output of the irrigation system. Thefollowing figureshown in Figure no 2
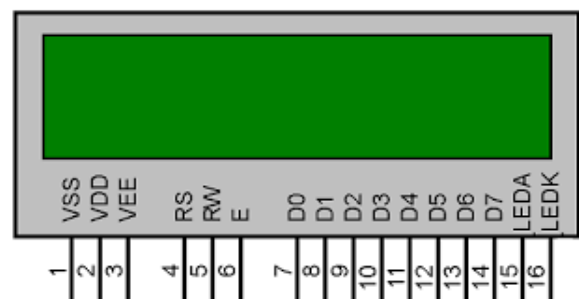

Figure No 2

B. SOIL MOISTURE SENSOR

The Soil Moisture Sensor comprise two probes. This probes uses capacitance to measure dielectric permittivity of the soil. The sensor operating at the

Figure No 3

voltage of 5V which is proportional to the dielectric permittivity, it will identify the changes in the voltage so the moisture content of the soil to be measured. Thefollowing figureshown in Figure No 3.

C. SOLENOID VALVE

A solenoid valve acts like a device which converts the voltage into energy. It operating at a voltage of 12V. This is controlled by a microcontroller, when the signal from microcontroller, It will opening and closing when the field needs water, It will allow flow through the valves. The following figure shown in Figure No 4.
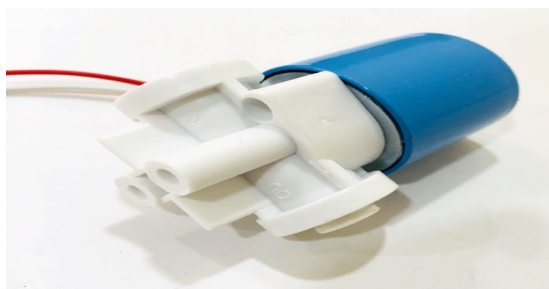

Figure No 4

D. COMPARATOR

LM293 is a microcircuit (IC). It could be a dual independent accurate voltage comparator. LM-293 features a capability to perform its operation from one supply source additionally as from splitting power supply. The aim to style LM-293 is to allow a typical mode range to the bottom level, and it performs this operation with the single power supply source. The following figure shown in Figure No 5.

Figure No 5

E. RTC

A real-time clock (RTC) is an IC that keeps an updated track of this time. This information may be read by a microprocessor, usually over a serial interface to facilitate the software performing functions that are time dependent.

F. RELAY DRIVER

The Relay Driver Module consist of 4external relays. These modules operating at 5V dc or 600 mA. It acts as a switch which is used to ON/OFF the solenoid valve and water motor.

G. AC TO DC CONVERTER

This module is an isolated-type industrial level module which is prepared to be utilized in AC-DC power converting. When the situations of over voltage, over current and short appear, this module will help to shield whole device by locking up

V. FLOW CHART

Figure No 6

VI. RESULT

The moisture level of soil tested by using soil moisture sensor is observed through LCD as shown in Figure No 7 The different moisture level on different field condition was as shown in Figure No 8-11.When the moisture level is below the threshold value, the system supply the water to the field.
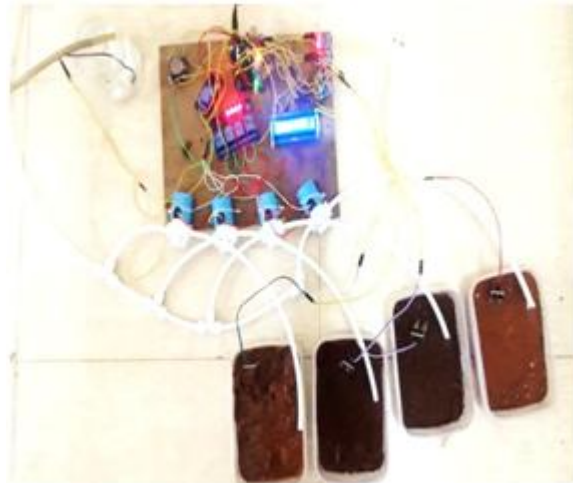

Figure No 7

Figure No 8

Figure No 9

Figure No 10

Figure No 11

OUTPUT TABLE

Table No 1

SOIL SENSORS	MOISTURE LEVEL (%)	FIELD CONDITION
Field 1	1%	Dry
Field 2	51%	Wet
Field 3	68%	Wet
Field 4	81%	Wet

VII. CONCLUSION

This whole paper mainly focuses on two things. The First thing is sensing moisture level of field. The second reason, it keeps the proper moisture content on field and this system will be improved the crop growing. Thus, the "ARDUINO BASED AUTOMATIC IRRIGATION SYSTEM" has been designed and tested Successfully. It has been developed by features of all the hardware parts used. The presence of every module has been reasoned out and placed carefully, this way giving to the best working of the unit. So, the Arduino Based Automatic Irrigation System has been designed and tested successfully. The system has been tested to function Automatically. The moisture sensors measure the moisture level (water content) of the field at different places. If the moisture level is found to be below the threshold value, the moisture sensor sends the signal to the Arduino board

which triggers the Water Pump to turn ON and supply the water to plant using the solenoid valve. When the threshold value is reached, the system halts on its own and the Water Pump and solenoid valve is turned OFF. So, the ability to do things of the whole system has been tested completely and It is designed with low cost and low power yielding, high accuracy and also saving water.

REFERENCES

[1] Klute. A. (ed.), (1986): "Methods of Soil Analysis, Part 1: Physical and Mineralogical Methods". American Society of Agronomy, Madison, Wisconsin, United States, 1188 pp.

[2] Knight, J.H., (1992): "Sensitivity of time domain reflectometry measurements to lateral variations in soil water content". Water Resources Research, 28, pp. 2345–2352.

[3] Bircher, S., Skou, N., Jensen, K.H., Walker, J.P., & Rasmussen, L. (2011). "A soil moisture and temperature network for SMOS validation in Western Denmark". Hydrol. Earth Syst. Sci. Discuss., 8, 9961-10006.

[4] Sheetal Mohite, Mr. Mrityunjay Ojha International Journal of Advance Technology in Engineering and Science Vol. No 3, Issue 10, October(2015) "Microcontroller Based Plant Irrigation"

[5] Mritunjay Ojha, Sheetal Mohite, Shraddha Kathole& Diksha Tarware Vol. 5, Issue 3, Apr - May (2016); 25-36 (IJCSE) ISSN(P): 2278-9960; ISSN(E): 2278-9979 International Journal of Computer Science and Engineering Research in "Microcontroller Based Automatic Plant Watering System"

[6] Muzammil Hussain, Prof. S. P. Gawate, Prof. Dr. P. S. Prasad, Prof. P. A. Kamble Volume 5, Issue 1, January (2015) ISSN: 2277 128X International Journal of "Advanced Research in Computer Science and Software Engineering".

[7] M. D. Dukes, Transactions of the ASABE Vol. 55(2): 563-569 © (2012) "American Society of Agricultural and Biological Engineers" ISSN 2151-0032