Automatic Grid Irrigation System Based on Soil Moisture

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Abstract— In this paper we address issue of unplanned use of water which inadvertently results in wastage of water. In AUTOMATIC GRID IRRIGATION SYSTEM, the most significant advantage is that flow of water is cut when moisture in soil goes above a pre-set threshold value. This saves us a lot of water. By installing this system, the user will also be indicated through a SMS to his mobile whenever the soil is too wet or adequate water is used. Usually, when there are plants in the house, people water their plants whenever necessary by themselves. This process consumes a lot of time and sometimes more than required water is supplied to the plants. Because of this extra usage of water for gardening, there is a wastage of water.

Key words: Automatic, Irrigation, Sensor, Moisture, Grid

I. INTRODUCTION

Soil resistance is the main factor that is used in this system to control the automatic watering of plants. This work presents a simple circuit for watering of plants without human interference. The conventional method of watering plants is disadvantageous it takes a lot of time to actually inspect where the soil is really dried up and where it needs to be watered. This might be easy for small gardens or potted plants, but when huge agricultural fields are taken in account it becomes a laborious task if water is to be saved [1].

II. DESCRIPTION

Following are the main points our paper addresses to minimize the manual intervention in an irrigation system.

1) As there is no unnecessary usage of water, a lot of water is saved.
2) The sensor decides when the pump is to be turned off, saves a lot of time as manual checking of each grid is not necessary.
3) The user will be indicated in prior through a SMS when the water pump connected to the motor should be turned off.

So we have designed a system which integrated all the three solutions into one sensor to simply the job of irrigating large areas by dividing them into grids and setting an independent sensor in each grid so that only those grids which are dry will be watered.

III. IMPLEMENTATION

We use the basic concept in this circuit i.e soil have high resistance when it is dry and has very low resistance when it is wet. By using this concept we will make the system work. We insert two probes in the soil in such a way that that they will conduct when the soil is wet and they will not conduct when the soil is dry.

One of the probes is connected to the Vcc, that is 9V and the other is connected to the negative terminal of the op-amp. The voltage at the positive terminal of the op-amp is 4.5V due to the voltage division between two 10K Ohm resistors and is considered as reference voltage (Vref) for the LM324 comparator. In this way, 'n' number of op-amps are connected as 'n' sensors considering each sensor is placed in their respective grid in an extensive land. One of the terminals of the 100k Ohm potentiometer is connected to the negative terminal of op-amp and the other one is ground. The resistance of the potentiometer is set to a threshold value to differ wet from dry condition.

When the soil is dry, the two probes placed in the soil do not conduct as the soil offers very high resistance of around 10k Ohm and the voltage developed at the negative terminal (V-) of each op-amp is less than the reference voltage (Vref). Hence the output will be +Vsat in analog and 1 in digital as the comparator is in inverting configuration. As the output of LM324 comparator is +Vsat, the LED connected at the output terminal of each op-amp glows, indicating that the soil is in dry condition.

When the soil is wet, the two probes placed in the soil conducts, as the soil offers low resistance of around 1k Ohm and the voltage developed at the negative terminal (V-) of each op-amp is greater than the reference voltage (Vref). Hence the output will be –Vsat in analog and 0 in digital as the comparator is in inverting configuration. As the output of LM324 comparator is –Vsat, the LED connected at the output terminal of each op-amp doesn't glow, indicating that the soil is in wet condition.

To summarize,

V- < Vref => +Vsat or 1
V- > Vref => -Vsat or 0

The output across the op-amp is given as analog inputs to the anolog pins of arduino board. The Tx, Rx and Ground pins of arduino board are connected to the Rx, Tx and Ground of the GSM module. According to the code burnt in the arduino board if the analog input satisfies the necessary criteria, the arduino board will interface with the GSM module and the user will get a text message indicating which grid's water pump is to be switched off [2] [3].

IV. BLOCK DIAGRAM

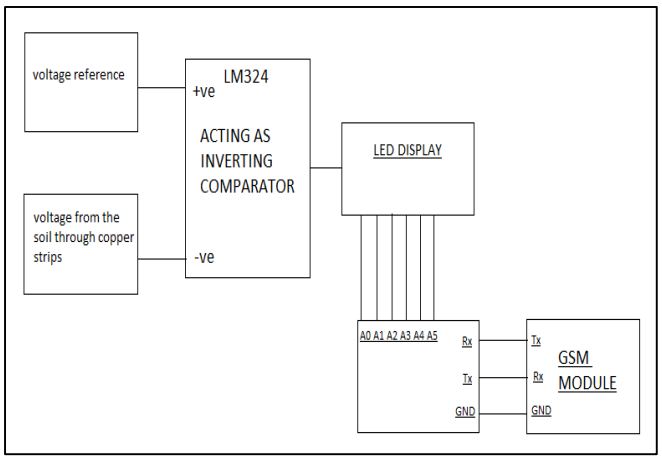

Fig. 1: Block diagram of automatic grid irrigation system

Fig. 1: shows the block diagram of automatic grid irrigation system which was described earlier. The system consists of LM324 IC which acts an inverting comparator which voltage from the soil through copper strips is provided as an input. The output of the comparator is fed to light emitting diodes to indicate which grid has wet soil in which the water pump has to be switched off. A GSM module is also interfaced to the system with arduino nano board in which is programmed to indicate the user through SMS to switch off the water pump in a specific grid [4].

V. SCHEMATIC CIRCUIT DIAGRAM

Fig.2 shows schematic circuit diagram with soil sensor circuit along with GSM module interface. As a prototype the soil sensor circuit depicted here consists of nine soil sensors which have to be placed in nine different grids. The outputs of each comparator is connected to light emitting diodes which in turn are connected to analog pins of arduino nano board. The user will be intimated with a SMS using GSM module connected to arduino nano board [5]. Note that only six analog pins of arduino nano board have been consisdered for prototype purpose. In practice, the number of inputs to the arduino board will be equal to the number of soil sensors placed in grids.

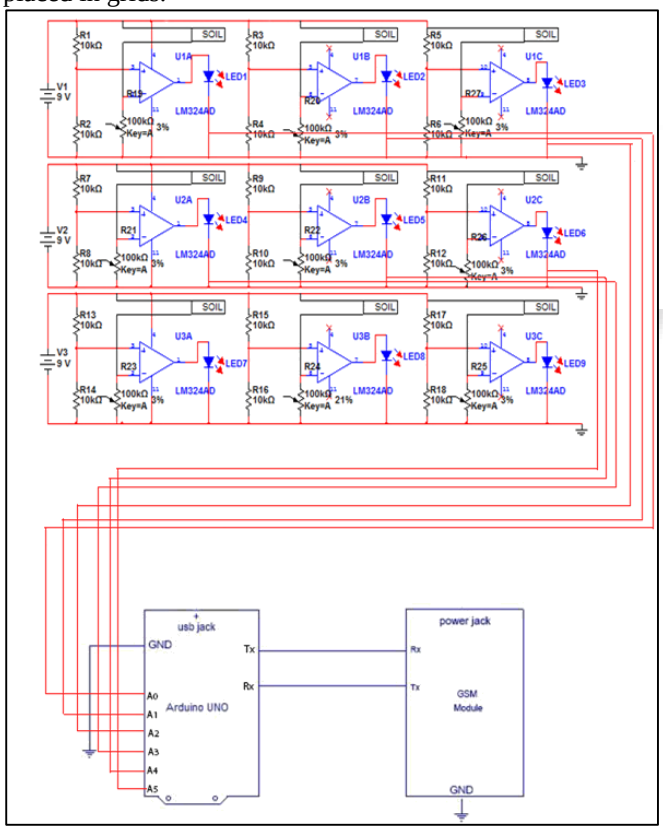

Fig. 2: Schematic circuit diagram of automatic grid irrigation system

VI. RESULTS

Fig. 3 shows the screen shot of the mobile screen by which the user will get to know in which grid the water pump has to be switched off.

Fig. 3: Screen shot of mobile screen

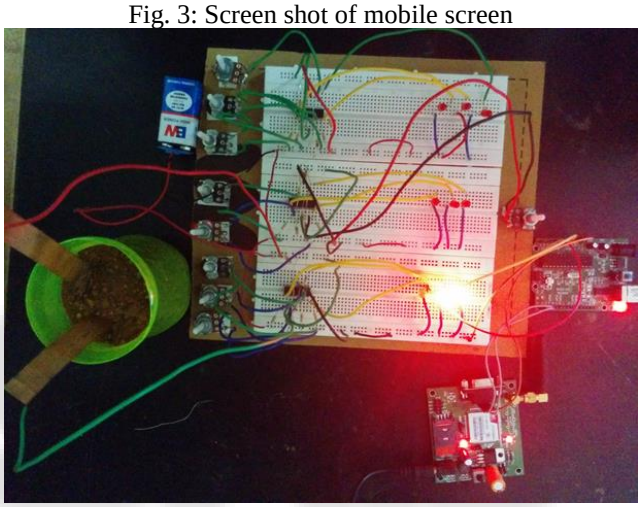

Fig. 4: Practical implementation of soil sensor circuit for automatic grid irrigation system

The practical implementation of soil sensor circuit based on soil moisture for automatic grid irrigation system is depicted in Fig. 4. The prototype consists of nine grids and results are verified by inserting copper strips of one of the grids in the wet soil. The user was intimated successfully through a message in his mobile handset which was depicted in Fig. 3.

VII. CONCLUSION

We can thus conclude that watering plants using an automatic grid irrigation system is advantageous and more efficient than manual alternative since the user will be indicated when the water pump should be switched off and in which particular grid to do so.

REFERENCES

[1] Samy Sadeky, Ayoub Al-Hamadiy, Bernd Michaelisy, Usama Sayedz," An Acoustic Method for Soil Moisture Measurement ", IEEE 2004

[2] R.Suresh, S.Gopinath, K.Govindaraju, T.Devika, N.Suthanthira Vanitha, "GSM based Automated Irrigation Control using Raingun Irrigation System", International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 2, February 2014.

[3] Pavithra D.S, M. S .Srinath, "GSM based Automatic Irrigation Control System for Efficient Use of Resources and Crop Planning by Using an Android Mobile", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Vol 11, Issue I, Jul-Aug 2014, pp 49-55
[4] S. R. Kumbhar, Arjun P. Ghatule, "Microcontroller based Controlled Irrigation System for Plantation", Proceedings of the International Multi Conference of Engineers and Computer Scientists 2013Volume II, March 2013
[5] Venkata Naga Rohit Gunturi, "Micro Controller Based Automatic Plant Irrigation System", International Journal of Advancements in Research & Technology, Volume 2, Issue4, April-2013.

