Microcontroller Based Irrigation Using Sensor
[A Smart Way for Irrigation]

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Abstract

The main objective of this project is to solve the irrigation problem of the farmers. In this project we have the predefined water requirements for 6 crops and for their different stages. Depending upon the crop selected by the user, the controller selects the water level required for the field. Then, it sends a signal to the sensor, which in turn gives the water level in the field. If the water level present is less than the required, depending upon the difference we irrigate the land to meet the required water level. With this project we achieve three things; firstly we try to make efficient use of the available water. Secondly we try to reduce the workload of the farmer. Finally we try to increase the yield of the crop.

Keywords: Agricultural problems, Irrigation, Microcontroller, Crops, Sensor.

1. Introduction

Agriculture provides the primary source of livelihood for more than one third of the world's total workforce, who produce the food needed to sustain the population of our planet. Indian society is an agrarian society. Agriculture has been the main stay of its economy as 65% of its population still lives by agriculture. Even though 65% of the population is into this field from many centuries most of them face a problem. The problem is that they do not know the water requirement of the crop they grow, so they either over irrigate or do not provide sufficient water, which leads to retarded growth.

With this project we achieve three things; firstly we try to make efficient use of the available water. Secondly we try to reduce the workload of the farmer. Finally we try to increase the yield of the crop. At present, agriculture accounts up to 27.4% of the national income, if we have good means to increase the yield, not only the farmer is benefited the national income also increases.

The basic block diagram of the microcontroller based irrigation using sensor is as shown in Fig. 1. In this project we will be using a soil moisture sensor VH400 which will be giving the moisture content of the soil to the microcontroller. In turn the microcontroller will control the water pump for what duration it will be turned on, in order to meet the required water level and displaying the required messages on the LCD. Initially the microcontroller will be programmed for the required crop by the user using the keypad interface and in turn the required water level will be displayed on the LCD. Later the microcontroller sends a signal to the sensor through ADC to measure the actual water level content and then displays it on the LCD.

If the actual water level is greater than required, then no action is taken, else the water pump will be turned on through the relay to supply the water level difference.
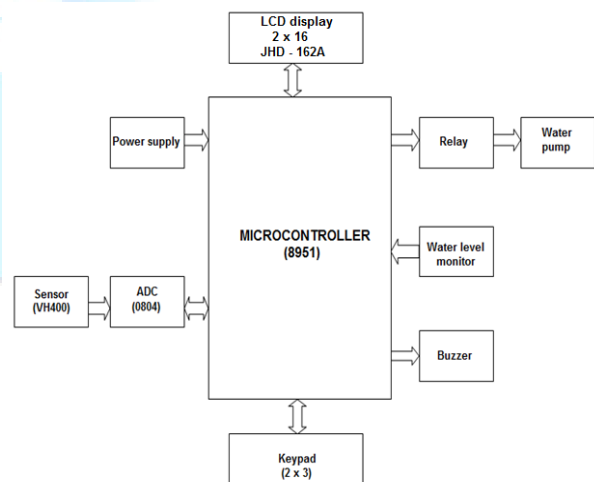

Fig. 1: Block diagram of the microcontroller based irrigation using sensor.

While the water pump is powered and if in case there is no water, then the water level monitor sends a signal to the microcontroller which in turn reacts to it by switching off the relay and turning on the buzzer to alert the operator and displays the required message on the LCD.

2. Working Principle

The main features of this project are,

1. Allowing the user to select his crop using the keypad which makes the module portable for any kind of crop.
2. Displaying messages on LCD which in turn makes the operator aware of the process involved during the entire operation.
3. Making use of a sensor which can measure the moisture content with a very big precision and accuracy.
4. While supplying the water, if in case there is insufficient water, then cutting off the supply to the water pump and sounding the buzzer to make the operator aware of insufficient water.

The entire working of the project is explained as follows,

Initially when the user switches on the supply to the module he is made to interact with the controller through the keypad to program it for his required crop. As this module is programmed for two kinds of soil and six different crops, the user needs to select his soil and crop of interest. So, at the beginning he is asked to enter the kind of soil he wants by displaying a message on the LCD.

2.1. Displaying

To display these messages on LCD we have used LCD JHD-162A which is 16 x 2 LCD. We have controlled the LCD by the control pins RS and EN with R/W permanently connected to ground. By sending the message to be displayed on the data lines and by properly controlling the control pins, we are able to display the required message. Since we have many messages to be displayed, the entire process of sending commands and text message to LCD is written as a function and called whenever required.

So, once the initial message is displayed on LCD, the user is given two options of either selecting a black or red soil. For this to be done we send a logic 0 to row 1 and the microcontroller scans the column, depending on the key

pressed the controller branches to the soil selected. Again the user is asked to select the crop, for this a message is displayed and rows are again excited, depending on key press, controller further branches to the selected crop.

If in case the selected crop has any type or stage, the process of displaying messages, scanning columns continues till the final user input is accepted. Once this user interaction is completed we display the required water level for selected crop on LCD and in turn the controller is programmed for the crop.

The next process includes checking the actual water level in the soil, for this soil moisture VH400 is used which has three pins, one connected to Vcc, another to ground and the black wire of the sensor gives the measured water level.

2.2. Communication and Computation

Since the output of the sensor is an analog voltage and the controller cannot read analog values so an analog to digital converter ADC 0804 is used. ADC 0804 is a single channel ADC with control and data lines. The control lines are CS, RD, WR and INTR. For this module CS and RD are permanently grounded.

Once user inputs the selected crop, microcontroller sends the control signal WR to ADC, which indicates the ADC to read the sensor value and start converting the analog value to its equivalent digital value. As the processing speed of ADC and microcontroller are the same, controller has to wait till the conversion is completed by ADC. This is indicated by the control line INTR of the ADC, which is an input to the controller. The controller waits till INTR pin of ADC goes to zero. i.e., INTR=0. Once the pin goes low then the equivalent digital value is available on the data lines of ADC.

The digital value is received by the microcontroller from ADC and depending on the received value, it displays the actual water level content on the LCD.

Now, the controller has both the actual and required water levels with it. With this data, if the actual water level is greater than the required water level, then a message is displayed on LCD stating that required water level is met and no further action is taken.

In case, the actual water level is less than required water level, the difference is computed and depending on the

difference, we compute how much more water should be supplied, so that the crop gets its required water. Once the amount of water to be supplied is computed, the same is displayed on LCD and then we trigger the relay which in turn powers the water pump.

A relay is basically a mechanical switch where one pin switches between two points depending on the input from the microcontroller. The two points between which it switches are named as NO and NC. When the input is low the pin is connected to NC and when high, connected to NO. Once it switches to NO, it can turn on the water pump.

The water pump used is a submergible water pump which is placed inside the water. Depending on the controller, if it requires to turn on the water pump, the pin connected to relay is exited, which switches the solenoid to NO and hence a 230V supply is given to water pump and water is supplied to the field through the sprinkler which has nozzle through which the water flows out in form of rotary deflector. This process will be interrupted in two situations, firstly if the amount of water to be supplied is completed, then irrigation completed message is displayed on LCD and the relay off through microcontroller.

The second situation is, while the field is being supplied with the required water, if in case the water available is insufficient then the water pump is turned off and a message stating no water is displayed on LCD.

In order to know whether sufficient amount of water is available we use a water level monitor circuit. The main component is a transistor whose base is placed in the water supplying source along with a +5V wire also with it. The emitter output is connected as an input to the controller. If water is present than the 5V is conducted by the water and the base gets its knee voltage, hence the transistor conducts and the controller gets a   logic 1 at the pin connected to the controller.

If no water is present, then no voltage is applied to the base. Now the transistor turns off and logic 0 is given the controller which indicates the controller that sufficient water is not present. This is informed to the operator by sounding the buzzer and turning off the water pump.

Buzzer has two pins, one marked as '+' and other as '-'. The '+' pin is connected to controller and '-' is grounded. Whenever insufficient water is detected, the buzzer pin connected to controller is excited which sounds the buzzer and alerts the operator.

3. Conclusion

The entire idea of helping the farmer in irrigating the field, in order to meet the crops required water level has been implemented using the soil moisture sensor VH400 and other components. Each of the hardware module and logic used in this project has been explained in detail in the report.

The outputs obtained, which displaying messages on LCD during the entire process and irrigating the field using water pump and sprinkler and sounding the buzzer whenever insufficient water is present is achieved.
This idea is experimented on two plots, one containing red soil and other black soil. In the plot rice and ragi is grown and the module is experimented on the plots and result is found to be successful.

References

[1] Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. Mckinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Pearson Education, New Delhi, Second Edition (2011).

[2] Abhinay Rajpal, Sumit Jain, Nistha Khare and Anil Kumar Shukla, "Microcontroller Based Automatic Irrigation System With Moisture Sensors", Proc. of the International Conference on Science and Engineering (2011).

[3] Colorado State University http:// www.e xt.colostate .ed u/pubs/crops /04700.html.

[4] Vegetronix, http://w ww.vegetroni x.com/Products/VH 400 /.

[5] University of Agricultural Sciences, http://www.u as b an galore .edu.in/.

[6] The Touch of Electronics Technology, http:// my tu to rial cafe.com/.

[7] United Nations Framework Convention on Climate Change, "Challenges and Opportunities for Mitigation in the Agricultural Sector", 21 November 2008.