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Monitoring Soil Moisture by Accessing Weather Information through Matlab

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Abstract

In this research paper, an intelligent soil moisture monitoring system is proposed comprising of three parts which are interfaced together using Arduino. The first part accesses weather information with the help of MATLAB from weather forecast websites such as Intellicast and Accuweather to get precipitation and other relevant data and the second part consist of a soil moisture sensor for reading soil moisture level whereas the third part consist of a LCD screen for displaying the forecasted weather information for user's need. Using the present soil moisture level and the information accessed from web, the system determines whether there is a need of supplying water to the soil or the forecasted rainfall would be sufficient to get the required soil moisture level of the soil and hence the motor supplying water to the soil is controlled. The proposed system helps in water and energy conservation as it tries to utilize natural source of water that is rain and helps in reducing operation time of the motor.

Keywords: MATLAB, soil moisture sensor, Arduino, LCD, GUI

1. Introduction

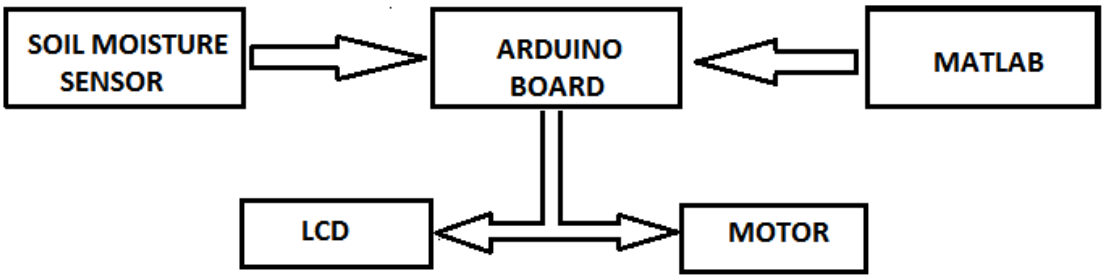
India is an agricultural land where vast varieties of crops are grown requiring different soil moisture level. Some crops such as wheat require lesser amount of water as compared to rice such that lesser or excessive amount of water can even ruin the crop.

In this project, a system is developed which sense the soil moisture level and access forecasted rainfall or precipitation. If there is a very high chance of rain than the motor is not operated whereas if there is minimal chance of rain than the motor is operated to get the required moisture level of the soil for the crop. This project prevents unnecessary operation of motor thus preserving both electric energy and water.

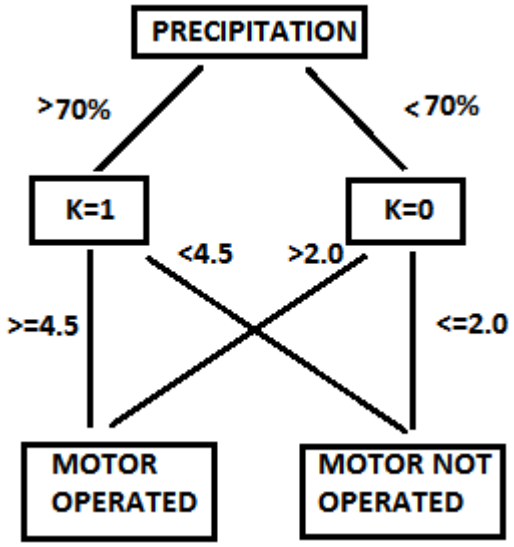
In the MATLAB, a GUI is created which consists of three parts which are interfaced together with the help of Arduino UNO. In the first part, the user accesses the weather information from web. In the second part, a soil moisture sensor is employed to measure moisture level of the soil whereas in the third part, the forecasted weather information is displayed on LCD.

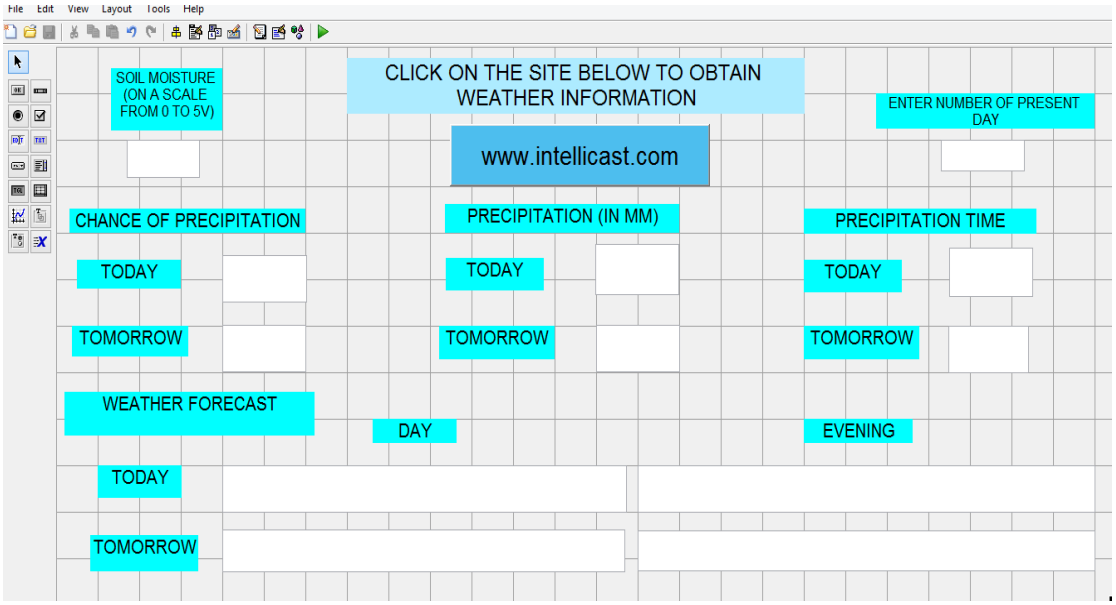
2. Project Description

Block Diagram of Implementation

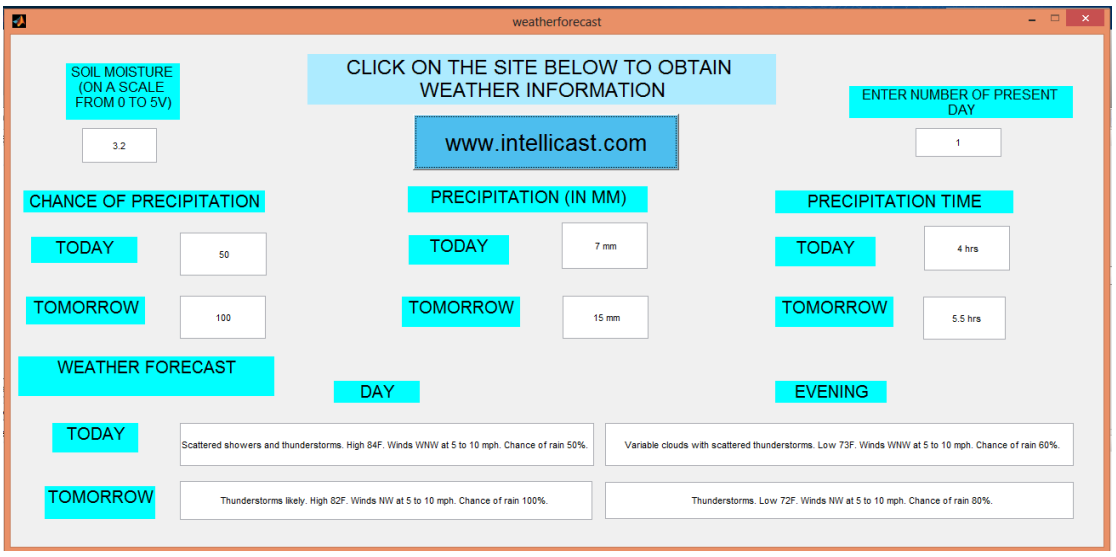


Flow Chart of Working





GUI for accessing weather information and displaying content.



3. MATLAB

The name MATLAB stands for matrix laboratory. It is a tool used for numerical computation and visualization and is widely used in academic and research institutions as well as industrial enterprises. In this project, a Graphical User Interface is created which allows the user to access weather forecast website. When the program is executed, it asks the user to input the number of the present day (Ex. for Monday, 1 should be entered) .The function urlread helps in extracting data from the html format of the webpage in the form of an array consisting of cells containing information which is accessed by specifying row and column number of the cell. The

information so obtained is weather forecast for present day and the following day including chance of precipitation in percentage, precipitation in mm and precipitation time in hours.

4. Soil Moisture Sensor

In this project, a SBT4447 soil moisture sensor is used with an operating voltage of 3.3V to 5V. The Vcc and GND of sensor are connected to Vcc and GND of the Arduino respectively. It consists of two pins D0 (for digital output) and A0 (for analog output) and a potentiometer for adjusting the sensitivity of sensor. Here, we will be connecting A0 of sensor to the analog pin A0 of Arduino for reading analog value obtained from the sensor. A threshold value is set (in this case 2V for the scale from 0V to 5V). If the value obtained from sensor is greater than the threshold, than this means that the soil moisture level is less else it is sufficient.

5. LCD

A HD44780 compatible LCD screen is primarily used for the purpose of displaying elaborate weather forecast for user's general information.

6. Arduino

It is a microcontroller board based on the ATmega328 having 14 digital input/output pins, 6 analog input, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. In this project, the Arduino takes input from soil moisture sensor in the form of voltage from 0 to 5V. If the voltage is greater than a threshold value, the motor is operated till the moisture reaches a requisite level. But if the information accessed from web indicates that the forecasted chance of precipitation is greater than 70%, than the motor is not operated. However, if the input voltage acquired from sensor is greater than 4.5V than the motor is operated irrespective of the forecasted rainfall.

7. Conclusion

The automatic soil moisture monitoring system so developed helps in improving irrigation efficiency while minimizing environmental impacts caused by use of excessive water and electric energy. The system integrates information obtained from weather forecast sites and soil moisture sensor to regulate system without requiring manual involvement of persons.

References

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