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COURSE TITLE: STRUCTURED COMPUTER PROGRAMMING

SOIL MONITORING SOFTWARE APPLICATION

The proposed application is a real-time soil monitoring software for the agricultural farmlands to provide optimal and integrated data collections. Real-time monitoring provides reliable and timely information of crop and soil status which plays an important role in the decision making of the crop production improvement. Agriculture depends on many parameters such as inter and intra variabilities of plants to give better yields. Here the system is designed to collect the data set for major parameters like temperature, humidity, soil pH, soil moisture, light intensity, carbon-dioxide of the fields and timely interval for the water system. The system consists of an ATmega 328 microcontroller, DHT11 Sensor, soil hygrometer, light intensity sensor, soil pH sensor, MQ-135 sensor and DC motor. Data sets collected is used for the analysis of selection of crops and their vulnerabilities for regulating the irrigation parameters which will be of help in the agricultural practices, it will make it easier for farmers to take decision on planting crops, watering and fertilizing them and preventing irrigation. The automated watering helps the crops to get flow of water to fields based on the parameters, which is controlled by the DC motor.

Hardware and Software features

The proposed system is capable of determining the temperature of the soil, moisture content, time interval for the water system, an alarm trigger and password protection for the system. It would be designed to automatically measure the soil moisture, environmental temperature, humidity, light intensity, soil PH and carbon dioxide level for photosynthesis. The motor is fixed to trigger an alarm for the automatic water pumping if the water level in the soil decreases below the threshold level. By collecting or measuring these parameters one can also select the suitable crop to be grown in the particular region or in the particular soil manually. In the heart of the system is an ATmega328 microcontroller. It is an easily available chip and Boasts of high performance at low power consumption, 1Kb of EEPROM, 2Kb of RAM, 6 channels of 10 bit analog to digital converters, and 14 digital pins which are sufficient to interface maximum of 18 sensors.

The below figure represents the basic design approach of the software application with its relevant hardware interfaced with a microcontroller. In this project, the ATMEGA328 microcontroller which belongs to the family of mega AVR series would be utilized. It requires 5V for its operation from the main power supply. The 5V power supply is given to all the sensors, LCD display and microcontroller except the PH sensor. The PH sensor and the DC motor require dual power supply of +12V and -12V. Here the DHT11 temperature and humidity sensor is used to measure the atmospheric temperature and humidity. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness. Soil hygrometer sensor is used to measure the volumetric water content indirectly by using some other property of soil such as electrical resistance, dielectric constant or interaction with neurons as a proxy for the moisture content. Measuring soil moisture is important for agricultural application to help farmers to manage their irrigation system more efficiently and to know the exact soil moisture conditions on their fields. Light intensity sensor is used to measure the intensity of light, which converts light energy in to electrical energy.

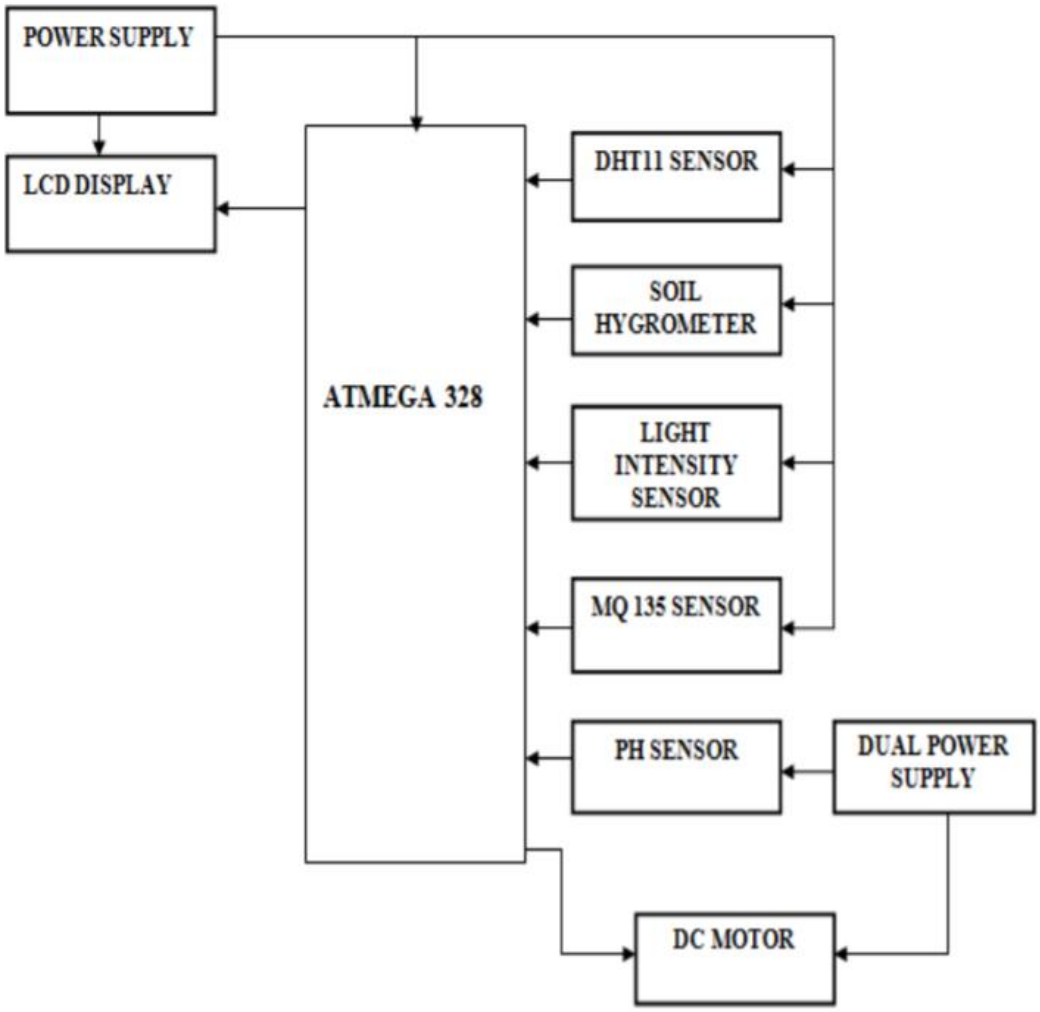


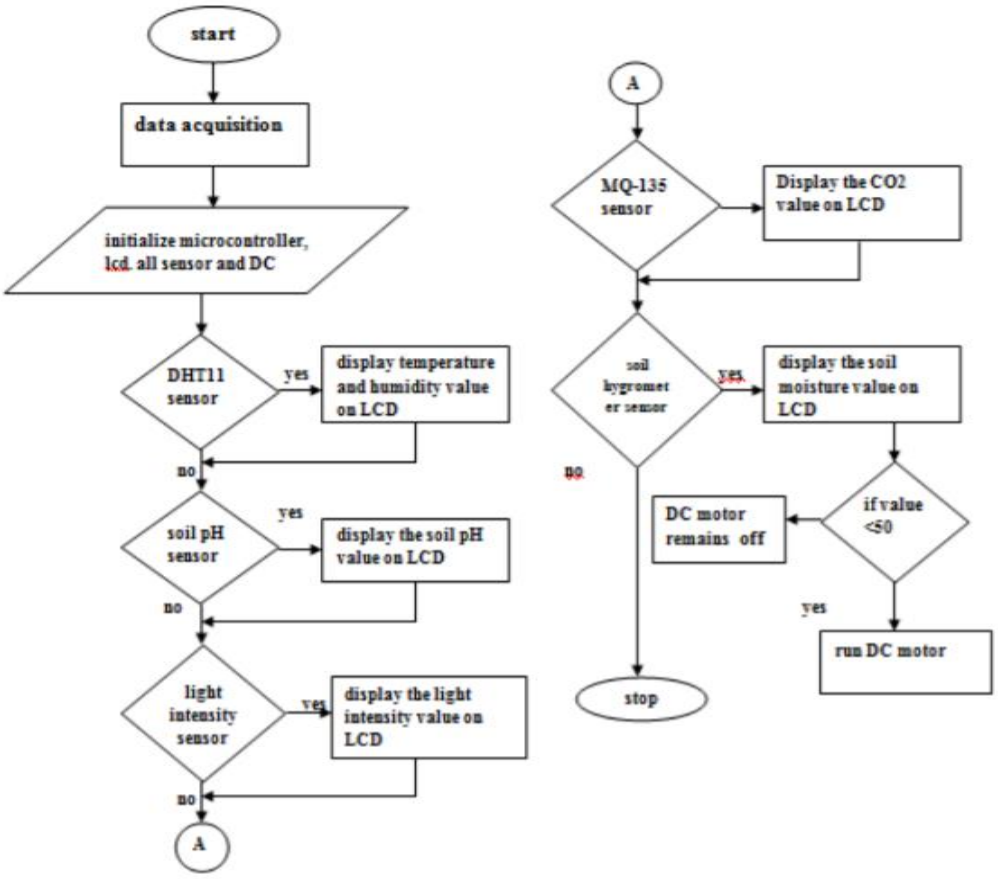
Fig. 1 Top-down design approach of the application

The MQ-135 gas sensor applies SnO2 which has a lower conductivity in the clear air as a gas-sensing material. In an atmosphere where there may be polluting gas, the conductivity of the gas sensor raises as the concentration of the polluting gas increases. MQ-135 performs a good detection to smoke and other harmful gas, especially sensitive to ammonia, sulfide and benzene steam. Its ability to detect various harmful gas and lower cost make MQ-135 an ideal choice of different applications of gas detection. Hydrogen ion concentration of any solution can be measured by its pH value. The range of pH varies from 0 to 14, if any solution has a pH value close to 0 it is treated as highly acidic, when its value is close to 14 it is considered as highly alkaline. A special selective hydrogen ion electrode (pH rods) is also immersed in the solution for electrically measurement of the pH value. This electrode gives an output voltage that changes its value according to the concentration ratio of Hydrogen ions inside the electrode as comparison to those which are outside the electrode. The output of the reference electrode does not depend on the concentration of ion ratio. After measuring the voltage between these 2 electrodes i.e. between

reference and a special electrode, the pH of the solution can be determined. The data obtained from all these sensors is fed to the microcontroller; the microcontroller converts analog data into digital by using A/D convertor and then sends the values to the 16x2 LCD display for displaying of the sensed values. This project implements a DC motor to simulate the working of a water pump. If the soil moisture content is below a specified value the alarm is triggered and the motor turns on to indicate that the water is pumped on to a particular patch of land.

Flow chart

The Flow chart below shows the working process of the designed module for collecting the data sets of Soil moisture, temperature, humidity, pH, light intensity, alarm trigger, password protection and carbon dioxide by LCD display. Watering to the fields is based on the set threshold value by DC motor.



Algorithm

Step 1: Start

Step 2: Set Input/output ports

Step 3: while (true)

If true go to step 4

: ENDIF

Step 4: Enter code

If code is correct go to step 5

: ELSE

If the code is wrong send a message and sound the alarm

: ENDIF

Step 5: Check moisture level

If moisture level is normal go to step 6

: ELSE

If moisture level is low Open water Valve (irrigation tank)

: ENDIF

Step 6: Check Temperature level

If temperature is high open water Valve (irrigation tank)

: ELSE

If temperature is normal close Water Valve (irrigation tank)

Step 7: check water level

If water level is low send a message and trigger the alarm

: ENDIF

Step 8: END

Conclusion

The proposed system can improve the efficiency of scientific and agricultural practices. Irrigation, loss and degradation of crops can be minimized and efficiency increased. It can be used to automatically trigger an alarm and irrigate the fields once the soil moisture goes down below the threshold value.