ECE 2010: CONTROL SYSTEMS

PROJECT REPORT

SMART IRRIGATION SYSTEM

SUBMITTED TO :

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Declaration

We hereby declare that the project “Smart Agriculture System" submitted by us, for the course project of ECE2010-Control Systems is a record of bonafide work carried out by us under the supervision of Prof. Rajesh R.

We further declare that the work reported in this report has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma or course project in this institute or any other institute or university.

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Abstract

With the amount of natural resources like land and water dwindling rapidly, it is imperative that we make use of these resources as efficiently as possible. In this project, we've implemented a "Smart Agriculture System". Additionally, we've included an alarm system that will warn the farmers in case of a fire. The system consists of an Arduino to which a soil moisture sensor, a flame sensor, a water pump and a buzzer are attached. The soil moisture sensor tells us the moisture level of the soil and lets us know when the soil needs water, while the flame sensor is involved in warning in case of a fire.

The continuous extraction of water can lower the water level. The advantage with this system is that water will be used only when required and be directly aimed at the root so as to minimize loss. In addition to this, the farmer can be assured about the safety of his field.

Objective

The objective of this project is to simplify and automate the agriculture process, in particular irrigation, so that water can be used efficiently. In a country where there are limited renewable resources and an ever growing population, we need to be as careful and efficient as possible. For this purpose, we will be making use of closed loop control system to automate the irrigation process. Data will be collected from the soil moisture sensor and will be used to water the field as needed. When the moisture content is high, the motor pump is turned off and the water stops pumping.

INTRODUCTION:

India has a massive agriculture industry and agriculture requires a lot of water. Water, however, is not available in an endless quantity and a major part of the country is going through water crisis. This crisis is worse during the hotter months and we often see droughts in many parts of the country. This unpredictability in the weather makes life hard for the farmers. To add to this, there can be many accidents, such as accidental fires, that can further ruin their crops. We have proposed a method to help them combat this problem and to automate the entire process.

Automation in this sector is essential as it allows for sustainable use of resources in the exact quantity that they're needed and at the exact time that they are needed. Our proposed solution allows the farmer to use the correct amount of water as and when it is required. It is essential that the crops aren't watered at wrong times or perhaps when it has already rained and there is sufficient amount of moisture available. Using an Arduino, or any other similar microcontroller can help with this problem, as they are cheap, easy to use and readily available. They can very efficiently manage to pump water when it is necessary. An added benefit is the fire alarm system with the help of flame sensor, which can warn of any fires.

The main motivation behind our proposed method is to introduce farmers to new technology that is cheap and accessible to everyone. Majority of Indian farmers still rely on traditional agricultural practices, either out of lack of money or because of lack of awareness. This simple improvement can help boost our biggest industry.

LITERATURE SURVEY:

- A RESEARCH PAPER ON SMART AGRICULTURE USING IOT

Ritika Srivastava, Vandana Sharm, Vishal Jaiswal, Sumit Raj

Link: https://www.irjet.net/archives/V7/i7/IRJET-V7I7479.pdf

- "Smart Agriculture System using IoT Technology" International Journal of Advance Research in Science and Engineering

Adithya Vadapalli , Swapna Peravalli , Venkatarao Dadi

Link:

https://www.researchgate.net/publication/347563621_Smart_Agriculture_System_using_IoT_Technology_International_Journal_of_Advance_Research_in_Science_and_Engineering_2319-8354

- IoT based Smart Agriculture:

Nikesh Gondchawar, Prof. Dr. R. S. Kawitkar

Link: http://www.kresttechnology.com/krest-academic-projects/krest-major

- A Survey on Smart Agricultural System using IoT

S Vasanti Venkateshwar Mohammad Mohiddin

https://www.ijert.org/a-survey-on-smart-agricultural-system-using-iot.

SYSTEM MODEL:

SENSORS:

SOIL MOISTURE SENSOR:

The moisture sensor consists of 2 probes that are buried in the ground at required depth. The working of the moisture sensor is simple and straightforward. The moisture sensor just senses the moisture of the soil. The change in moisture is proportional to the amount of current flowing through the soil.

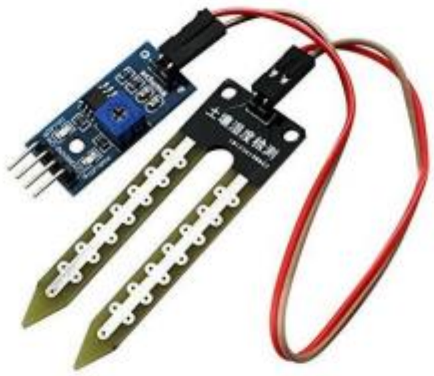


Fig. 1

ULTRASONIC SENSOR:

The ultrasonic sensor measures distance from an object using ultrasonic waves. This sensor is mainly used in our project to determine the water level in the tank. Its placed at the top of the water tank. When the distance from the water is the highest i.e., the water level is low, a water pump is switchedon to fill the tank.

Fig. 2

FLAME SENSOR:

This module is sensitive to the flame and radiation. It can also detect ordinary light source in the range of a wavelength 760nm-1100 nm. The detection distance is up to 100 cm. When a fire is detected, it switches a buzzer on.

Fig. 3

BUZZER:

A buzzer generates a monotone sound using a piezoelectric vibration plate when powered on. If the flame sensor detects fire, It is switched on to inform the user that a fire has been detected.

Fig. 4

Arduino Uno:

Arduino Uno is a microcontroller board based on the ATmega328P chip. The board provides a power supply input and support for usb connection. It has about 16 digital io pins and 6 analog input pins. These pins are used to communicate with sensors and actuators, and can be used to read an input or output value or signal. The logic is programmed into the chip using a usb interface.

Fig. 6

Water pump:

This is used to water the soil. It has a low operating current and can directly be powered by the 5V Arduino output.

METHODOLOGY:

HARDWARE IMPLEMENTATION

To automate irrigation, we proposed a closed loop control system. It comprises of two components: a soil moisture sensor and a water pump, both of which are connected to the Arduino.A water pump is installed within a water tank. When the moisture content is low, the Arduino is programmed to activate the pump. The water pump is turned off when a sufficient moisture level is reached, and the cycle resumes.

To begin, the soil moisture sensor is inserted in dry soil. This activates the water pump, which immediately begins pumping water from the water tank to the soil. The water pump stops pumping water as soon as the earth becomes moist. Similarly, there is no water pumping when we set our soil moisture sensor in already wet soil. The water pump starts pumping water from the tank again as the earth dries out and the moisture level drops. The soil moisture content is also displayed in real time by the Arduino in the serial monitor. This cycle continues, and the irrigation operation is thus automated.

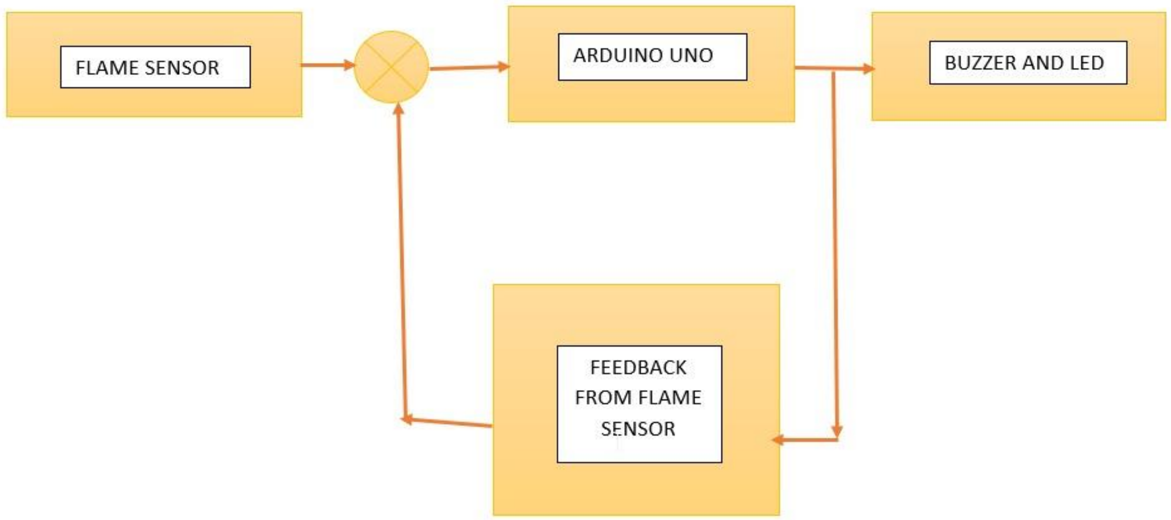
On top of that, we have a flame sensor and a buzzer connected to the Arduino. The buzzer starts buzzing when a lit matchstick is brought close to the flame sensor and stops after the fire is extinguished. This serves as a fire alarm system, alerting the farmer if something goes wrong and a fire breaks out in the field.

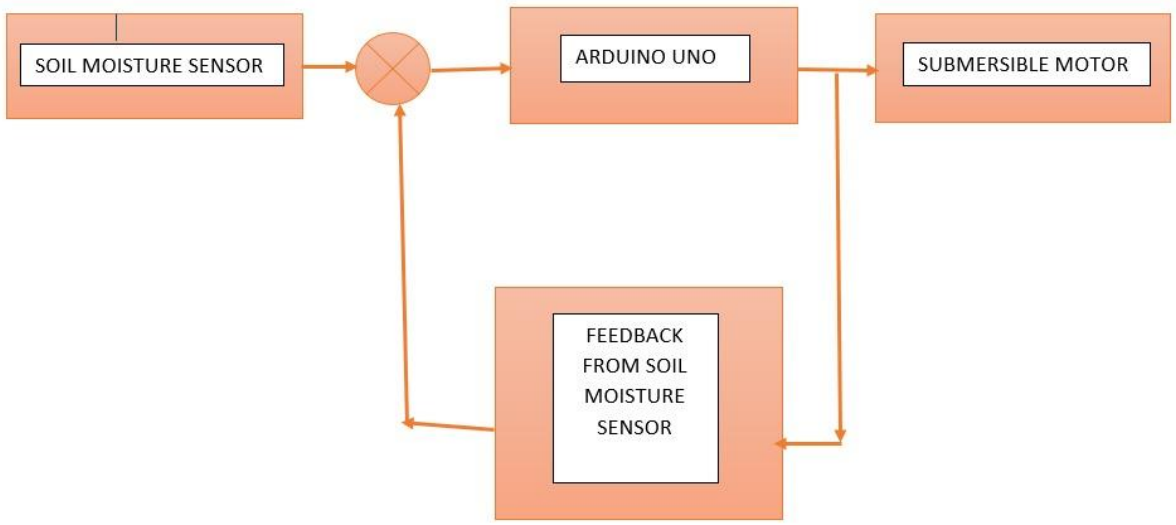
CODE FOR SOIL SENSOR:

```
int sensor_pin = A0; // Soil Sensor input at Analog PIN A0
int output_value ;
void setup() {
  // put your setup code here, to run once:
  pinMode(4,OUTPUT);
     Serial.begin(9600);
   Serial.println("Reading From the Sensor ...");
   delay(2000);
}


  // put your main code here, to run repeatedly:

  void loop() {
   output_value= analogRead(sensor_pin);
 output_value = map(output_value,550,10,0,100);
   Serial.print("Mositure : ");
   Serial.print(output_value);
   Serial.println("%");
   if(output_value<0){
      digitalWrite(4,HIGH);
     }
     else{
             digitalWrite(4,LOW);
     }
   delay(1000);
}
```

CODE FOR FLAME SENSOR:

```
const int ledpin=13; // ledpin,flamepin and buzpin are not changed throughout the process
const int flamepin=A2;
const int buzpin=11;
const int threshold=200;// sets threshold value for flame sensor
int flamesensvalue=0; // initialize flamesensor reading
void setup() {
Serial.begin(9600);
pinMode(ledpin,OUTPUT);
pinMode(flamepin,INPUT);
pinMode(buzpin,OUTPUT);
}
void loop() {
flamesensvalue=analogRead(flamepin); // reads analog data from flame sensor
if (flamesensvalue<=threshold) { // compares reading from flame sensor with the threshold value
digitalWrite(ledpin,HIGH); //turns on led and buzzer
tone(buzpin,100);
delay(1000); //stops program for 1 second
}
else{
digitalWrite(ledpin,LOW); //turns led off led and buzzer
noTone(buzpin);
}
}
```


FLAME SENSOR
ARDUINO UNO
BUZZER AND LED
FEEDBACK FROM FLAME SENSOR


SOIL MOISTURE SENSOR
ARDUINO UNO
SUBMERSIBLE MOTOR
FEEDBACK FROM SOIL MOISTURE SENSOR

PROCEDURE:

Step 1: Read data from the sensors.

Step 2: While using hardware, display the data on the serial monitor

Step 3 – Determine whether the moisture level is less than or greater than the predetermined amount.

Step 4 – Turn on the water pump if it is less than the needed value.

Step 5 – Turn off the water pump after the moisture level has been reached.

Step 6 – Check the flame sensor for a high signal at the same time.

Step 7 – If the signal is too high, activate the buzzer. Otherwise, the buzzer will remain turned off.

Step 8 – When a low signal is received, turn off the buzzer.

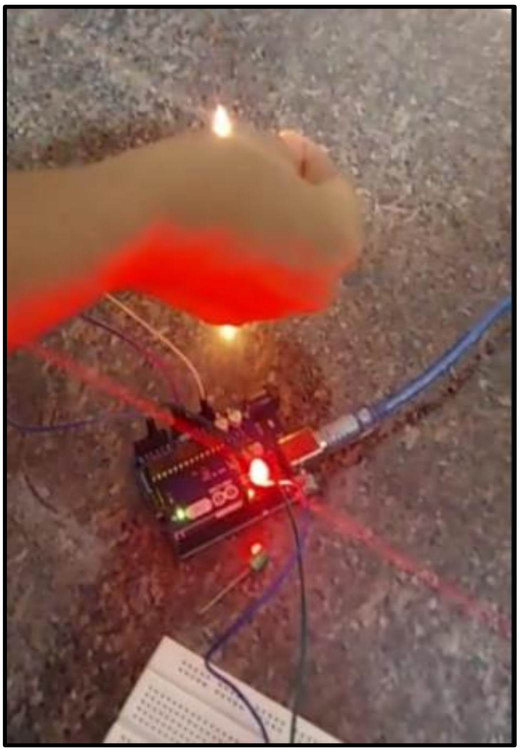
PERFORMANCE ANALYSIS:

The proposed system performs efficiently in regards to the watering the soil when the moisture level is low. It immediately stops when the moisture level reaches the threshold. There is no wastage of water or any other discrepancies. This is at par with the other systems and projects reviewed by us.

RESULTS AND DISCUSSIONS

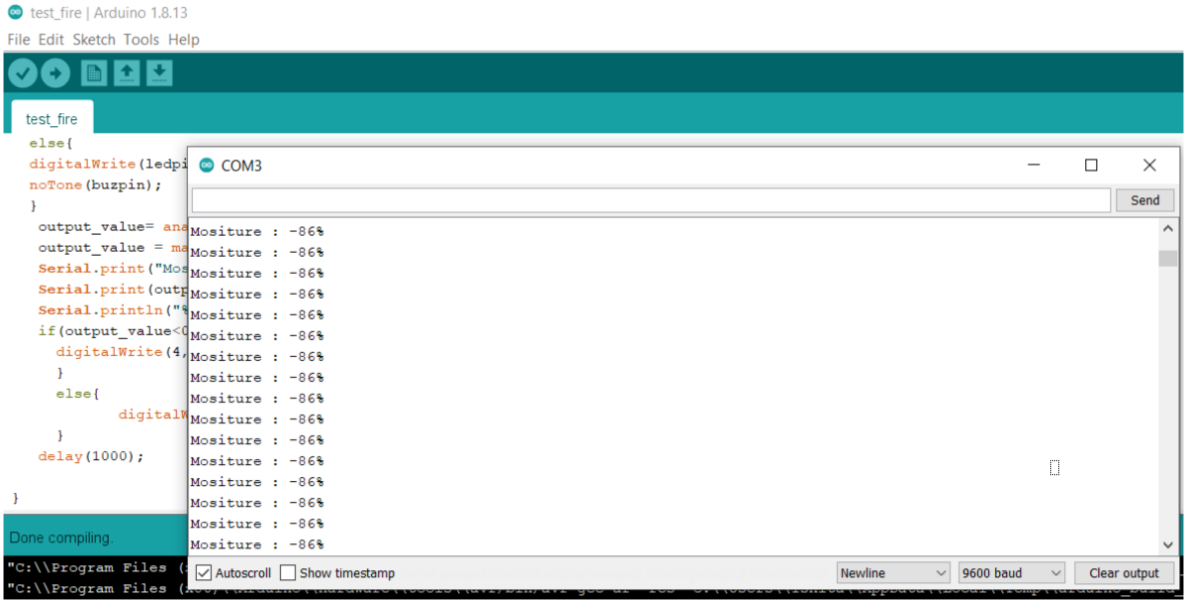
FLAME SENSOR:

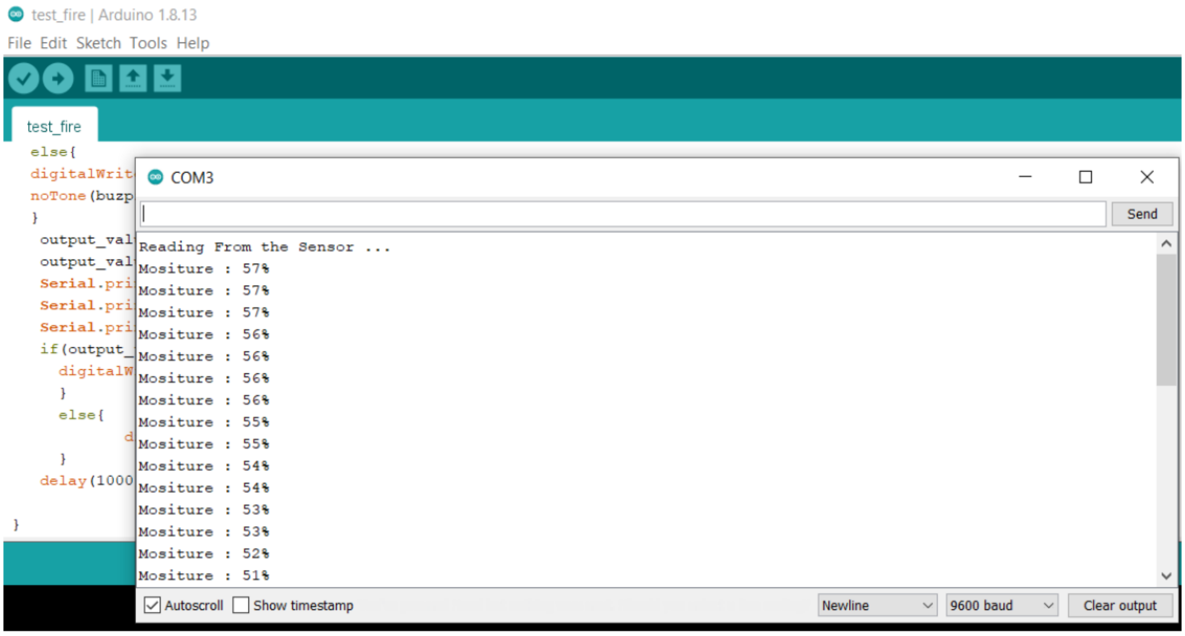
When there a flame near the sensor the sensor buzzes and the LED turns on alarming the user



SOIL SENSOR:

When the sensor is placed in dry soil the soil moisture, the serial monitor will display negative moisture content and the pump will turn on and irrigate the soil. If the soil is wet the moisture content will be shown as positive and the pump will remain off


test_fire | Arduino 1.8.13
File Edit Sketch Tools Help
test_fire
COM3
Send
Mositure : -86%
Autoscroll
Show timestamp
Newline
9600 baud
Clear output
Done compiling.


test_fire | Arduino 1.8.13
File Edit Sketch Tools Help
test_fire
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Autoscroll
Show timestamp
Newline
9600 baud
Clear output

What is the significance of threshold value?

Threshold value basically means that within that particular value, if a flame is detected, the flame sensor will sound the alarm. The value is kept not too high to prevent any unnecessary buzzing. So we have set an arbitrary value of 200. So the buzzer will get triggered if the flame lies within the threshold range. This is the significance of threshold value in the code

How is the soil moisture getting calculated and displayed?

The soil moisture sensor that we used was an resistive one. these sensors to possess two exposed probes that are inserted directly into the soil sample.A electrical current is sent from one probe to the other, which allows the sensor to measure the resistance of the soil between them.

When the water content in the soil is high, it has a higher electrical conductivity (water is a good conductor of electricity!). Hence, a lower resistance reading is obtained which indicates high soil moisture.

When the water content in the soil is low, it has poorer electrical conductivity. Hence, a higher resistance reading is obtained, which indicates low soil moisture.By pairing the sensor with a timer circuit, we obtain an analog voltage that can be read with an Arduino board. This sensor qualitatively measures the humidity of the soil. When the humidity of the soil rises, the value of the output decreases; conversely, when the humidity decreases, the output value becomes higher.

Sometimes we will see the value also comes negative. This is an indication that the soil is extremely dry and the water pump must be turned on and it automtically irrigates the soil

CONCLUSION:

Through this project we plan to create a prototype to automate the irrigation process depending on soil moisture levels, effectively reducing water waste from superfluous irrigation. We also plan to install a fire alarm to alert the farmer in the event of a fire. The fundamental benefit of this technology will be that it minimises human interaction, making the process easier for farmers.

FUTURE WORKS:

The project's future goals include merging it with IoT and moving it further. Data from the sensors can be collected and saved in a database. Machine learning algorithms can be used to forecast when soil moisture levels are likely to drop and turn on the pump automatically based on that information. It can be used to forecast user behaviour, weather patterns, harvest seasons, and other variables. This will further eliminate human participation and make the process much more efficient, resulting in higher crop yields.

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4. microcontrollerslab.com
5. www.instructables.com
6. www.c-sharpcorner.com
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9. http://www.kresttechnology.com/krest-academic-projects/krest-major