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LAB REPORT
on
INTERNET OF THINGS LAB

Submitted by

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in partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING



B.M.S. COLLEGE OF ENGINEERING
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B. M. S. College of Engineering,

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Department of Computer Science and Engineering



CERTIFICATE

This is to certify that the Lab work entitled “Internet of things lab” carried out by **ANITHA K J (1BM21CS401)**, who is bonafide student of **B. M. S. College of Engineering**. It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2023. The Lab report has been approved as it satisfies the academic requirements in respect of a **Internet of things lab - (22CS5PCIOT)** work prescribed for the said degree.

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1. LED Blinking

Aim: Turns on an LED on for one second, then off for one second, repeatedly

Hardware Required:

- Arduino Board
- LEDs
- USB cable

Connection:

1. Attach one leg (negative) of the led to ground of arduino
2. Attach other leg (positive) of led to pin 13

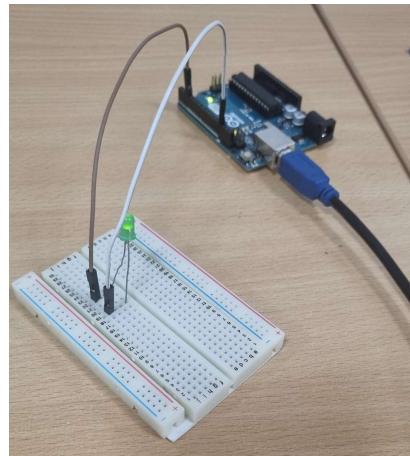


Fig.1. LED Blinking

Handwritten code pic:

Program:
void setup(){
pinMode(13, OUTPUT);
}
void loop(){
digitalWrite(13, HIGH);
delay(1000);
digitalWrite(13, LOW);
delay(1000);
}

Code:

```
// Pin 13 has an LED connected on most Arduino boards  
int led = 13;  
void setup()  
{  
    pinMode(led, OUTPUT);  
}  
void loop() {  
    forever  
    digitalWrite(led, HIGH);  
    delay(1000);  
    digitalWrite(led, LOW);  
    delay(1000);  
}
```

Observation :

The code establishes a basic program to toggle an LED on and off in one-second intervals. Pin 13 is configured as the output for the LED, and the main loop continuously switches the LED on for one second, then off for another second.

2. LED ON/OFF Using Pushbutton

Aim: Turn an LED ON /OFF using a Pushbutton.

Hardware Required:

- Arduino Board
- LED
- Push button

Connection:

1. One end of push button is connected to 5v
2. Other end of push button is connected to ground
3. Other end is connected to digital pin 2

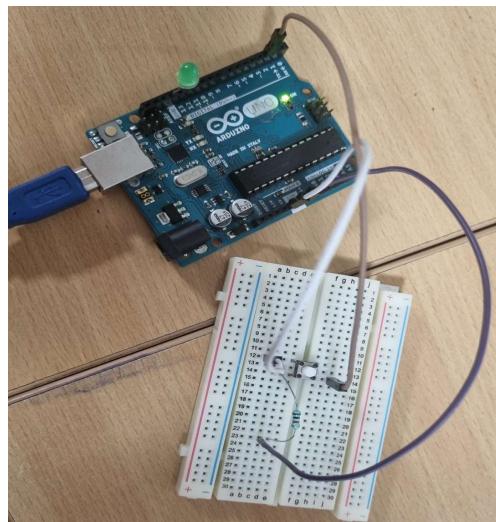


Fig.2. LED using push button

Handwritten code pic:

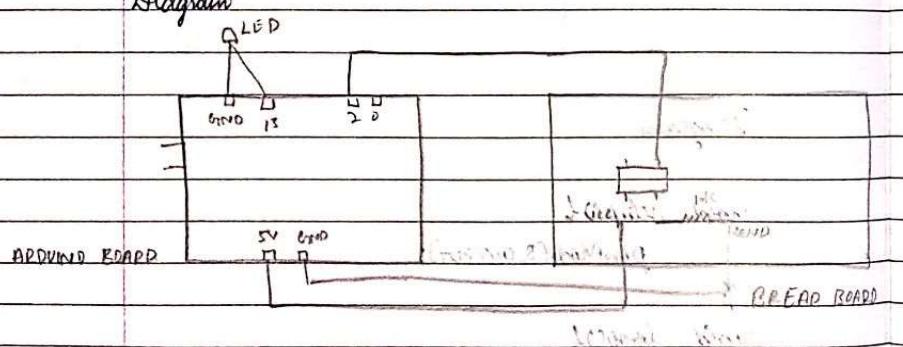
3. Digital IO

Aim: To make LED on when the button is pressed

Components:

- Arduino Board
- Push button
- Bread board
- Resistor ($1\text{ k}\Omega$)
- LED
- USB cable
- Connecting wires

Diagram



PROGRAM:

```
const int buttonPin = 2;
const int LedPin = 13;
int buttonState = 0;
void setup() {
  pinMode(LedPin, OUTPUT);
  pinMode(buttonPin, INPUT);
```

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```

void loop() {
    buttonState = digitalRead(buttonPin);
    if (buttonState == HIGH)
        digitalWrite(ledPin, HIGH);
    else
        digitalWrite(ledPin, LOW);
}
    
```

for value 23

Code:

```

const int buttonPin = 2;
const int ledPin = 13;
int buttonState = 0;
void setup() {
pinMode(ledPin, OUTPUT);
pinMode(buttonPin, INPUT);
}
void loop() {
buttonState = digitalRead(buttonPin);
if (buttonState == HIGH) {
digitalWrite(ledPin, HIGH);
} else {
digitalWrite(ledPin, LOW); // Turn off the LED
}
}
    
```

Observation :

The code effectively achieves the desired functionality of turning the LED on and off based on the state of the push button. When the button is pressed, the LED lights up, providing a clear visual indication of the button's influence on the output. This interactive behavior enhances the user experience, creating a responsive system where the LED state is directly controlled by the push button's input.

3. LED Fading using Potentiometer

Aim: To control the brightness of an LED using a Potentiometer.

Hardware Required:

- Arduino Board
- LED
- Potentiometer

Connection:

- 1.Led's Positive leg to digital pin 9
- 2.Led's negative leg to ground
- 3.Red wire of potentiometer is connected to 5v
- 4.Black wire is connected to ground
- 5.Blue wire is connected to Analog

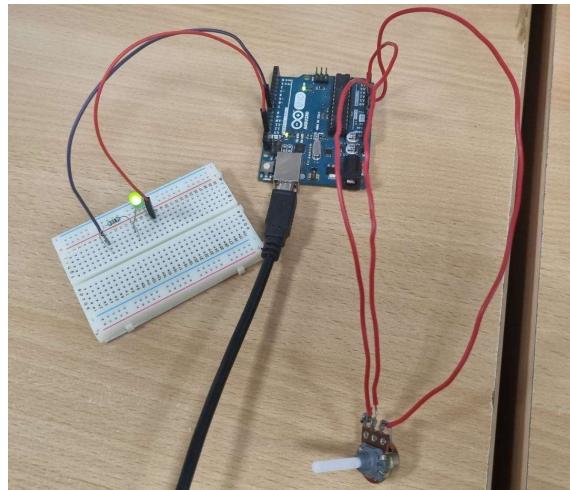
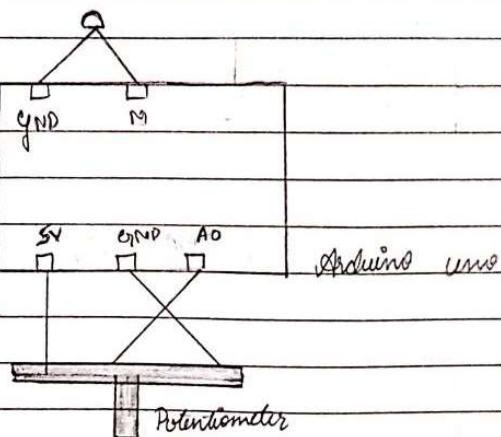


Fig. 3.1. LED ON by using potentiometer

Handwritten code

circuit diagram:



Program:

```
const int analogInPin = A0;  
const int analogOutPin = 9;  
int sensorValue = 0;  
int outputValue = 0;  
void setup() {  
  Serial.begin(9600);  
}  
void loop() {
```

ic:

```
sensorValue = analogRead(analogInPin);  
outputValue = map(sensorValue, 0, 1023, 0, 255);  
analogWrite(analogOutPin, outputValue);  
Serial.print(sensorValue);  
Serial.println(outputValue);  
delay(2);
```

Code:

```
const int potPin = A0; // Pin connected to the potentiometer  
const int ledPin = 9; // Pin connected to the LED  
  
void setup() {  
    pinMode(ledPin, OUTPUT); // Initialize the LED pin as an output  
}  
  
void loop() {  
  
    int potValue = analogRead(potPin); // Read the value from the potentiometer (0-1023)  
    int brightness = map(potValue, 0, 1023, 0, 255); // Map the potentiometer value to brightness  
    (0-255)  
    analogWrite(ledPin, brightness); // Set the brightness of the LED  
}
```

Observation :

The code effectively achieves the desired outcome, enabling the dynamic control of the LED's brightness through the potentiometer. As the potentiometer is adjusted, the analogRead function captures its varying values (ranging from 0 to 1023). The subsequent mapping of these values to a brightness scale (0 to 255) results in a smooth and proportional adjustment of the LED's intensity.

4. Nightlight Simulation

Aim: Simulating a night light using LDR and PIR

Hardware Required:

- 1 LED
- 1 LDR
- 110K register

Connection:

1. Attach one leg of LDR to 5V and another leg to Arduino Analog pin A0
2. Attach one leg of 110K register with that leg of LDR connected to A0
3. Attach another leg of register to the ground
4. Connect the positive leg of LED to pin 11 and negative to GND

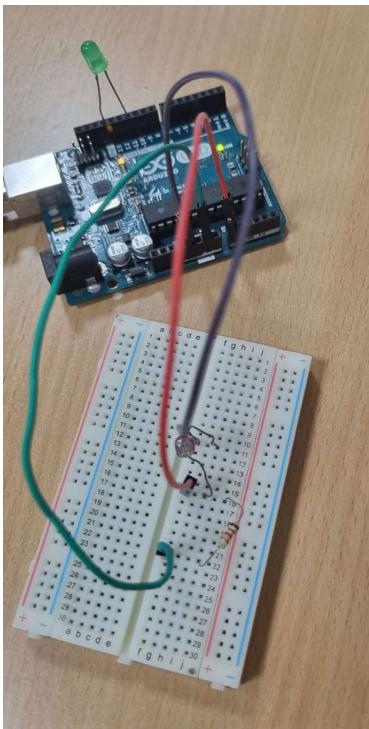
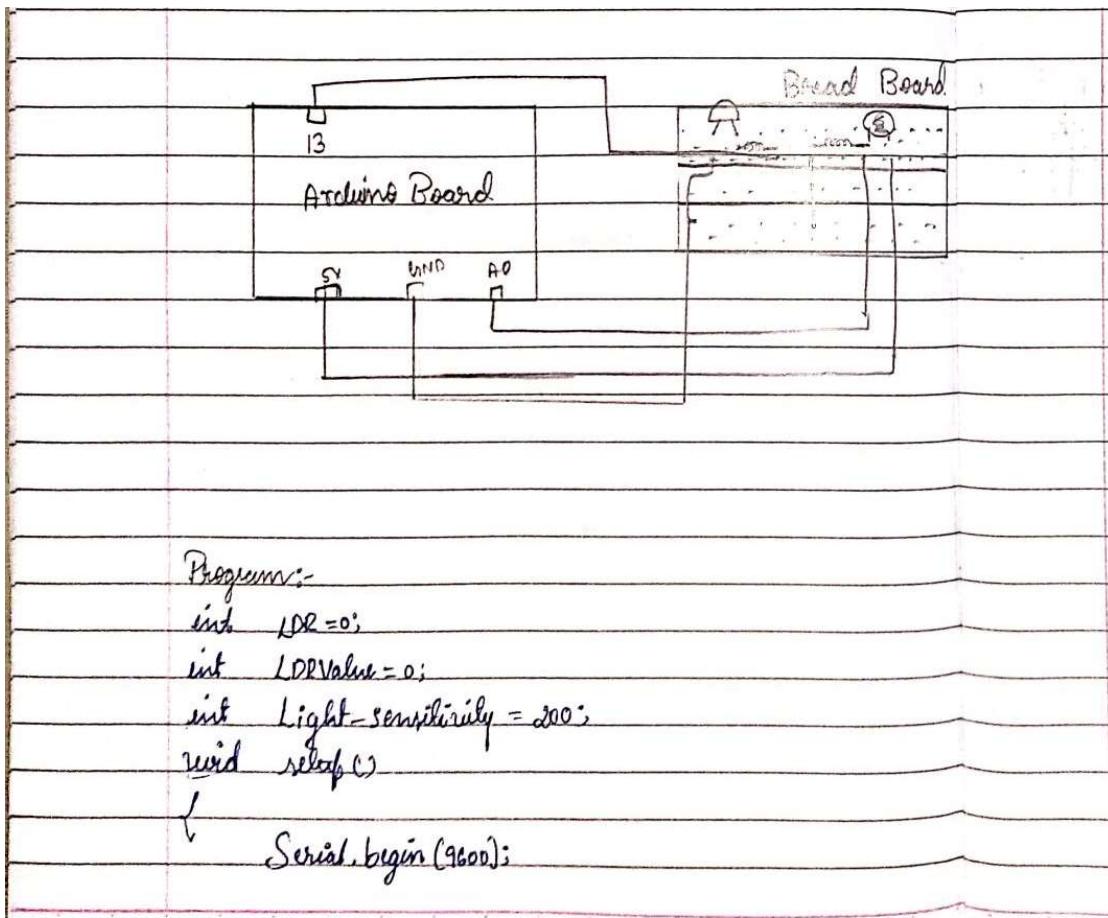


Fig 4.1- When it is bright, LED is off.



Fig 4.2 - When it is dark, LED is on.

Handwritten code pic:



```

PinMode(13, OUTPUT);
PinMode(A0, OUTPUT);

void loop()
{
    LDR value = analogRead(A0);
    Serial.println(LDRValue);
    if (LDRValue < light_sensitivity)
        digitalWrite(13, HIGH);
    else
        digitalWrite(13, LOW);
}

```

Code:

```
int LDR = 0; //analog pin to which LDR is connected, here we set it to 0 so it means A0
int LDRValue = 0; //that's a variable to store LDR values
int light_sensitivity = 500; //This is the approx value of light surrounding your LDR
void setup()
{
    Serial.begin(9600); //start the serial monitor with 9600 baud
    pinMode(11, OUTPUT); //attach positive leg of LED to pin 11
}
void loop()
{
    LDRValue = analogRead(LDR); //reads the ldr's value through LDR
    Serial.println(LDRValue); //prints the LDR values to serial monitor
    delay(50); //This is the speed by which LDR sends value to arduino
    if (LDRValue < light_sensitivity)
    {
        digitalWrite(11, HIGH);
    }
    else
    {
        digitalWrite(11, LOW);
    }
    delay(1000);
}
```

Observation :

The code successfully achieves the goal of simulating a night light based on the ambient light levels detected by the LDR. The conditional statement compares these values to a light sensitivity threshold, and if the ambient light falls below this threshold, the LED is turned on, simulating a night light. Conversely, if the light exceeds the threshold, the LED is turned off. The delay at the end of the loop introduces a time delay between successive readings and LED state changes

5. PIR with Arduino UNO

Aim: To Simulate infrared detection using PIR sensor and arduino UNO.

Hardware Required:

- Ultrasound Sensor
- Arduino Uno
- Jumper Wires

Connection:

1. Connect positive leg of LED to digital pin 13
2. Connect negative leg of LED to ground
3. Connect first leg of PIR to digital pin 2
4. Connect second leg of PIR to breadboard(a)
5. Connect first leg of PIR to ground
4. Vin of arduino to breadboard(b)
5. .5v of arduino to breadboard©

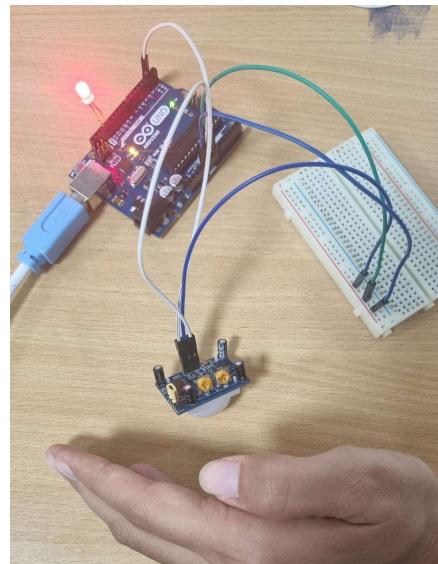


Fig 5.1- When motion is detected LED is high

Handwritten code pic:

```
program:  
int sensorstate=0;  
void setup()  
{  
    Serial.begin(9600);  
    PinMode(13,OUTPUT);  
    PinMode(2,INPUT);  
}  
void loop()  
{
```

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Page _____

```

sensorstate = digitalRead(2);
if (sensorstate == HIGH)
{
    digitalWrite(13, HIGH);
}
else
{
    digitalWrite(13, LOW);
    Serial.println("Deactivated");
    delay(1000);
}



---


Skr
26/11/23

```

Code:

```

int sensorState = 0;

void setup()
{
    pinMode(2, INPUT);
    pinMode(13, OUTPUT);
    Serial.begin(9600);
}

void loop()
{
    // read the state of the sensor/digital input
    sensorState = digitalRead(2);

    // check if sensor pin is HIGH. if it is, set the
    // LED on.

    if (sensorState == HIGH) {
        digitalWrite(13, HIGH);
    }
}

```

```
Serial.println("Sensor activated!");  
} else {  
    digitalWrite(13, LOW);  
}  
delay(10);  
}
```

Observation :

The code effectively utilizes the PIR sensor to detect motion and responds by controlling the state of the LED. When motion is detected, the LED is illuminated, and a message is printed to the serial monitor. Conversely, when no motion is sensed, the LED is turned off. The delay of 10 milliseconds at the end of the loop helps to stabilize the sensor readings and reduce false positives.

6. Ultrasound with Arduino UNO

Aim: To measure distance using ultrasound sensor and Arduino UNO.

Hardware Required:

- Ultrasound sensor
- Arduino UNO
- Jump/Connection wires

Connection:

1. Connect vcc to 5v of arduino
2. Connect ground to ground of Arduino
3. Connect T of ultrasound to digital pin 7 of arduino
4. Connect ECHO of ultrasound to digital pin 11 of arduino

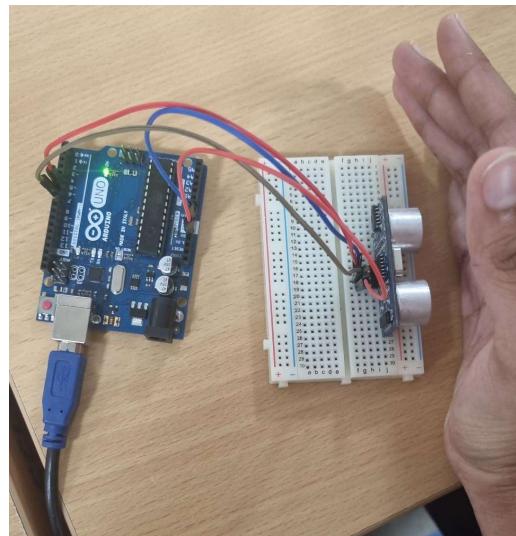


Fig 6.1-Measures distance of nearest object

Handwritten code pic:

```
Program:  
const int pingPin = 7;  
const int echoPin = 6;  
void setup()  
{  
    Serial.begin();  
    pinMode(pingPin, OUTPUT);  
    pinMode(echoPin, INPUT);  
}  
void loop()  
{  
    long duration, inches, cm;
```

```
    digitalWrite(pingPin, LOW);  
    delayMicroseconds(10);  
    digitalWrite(pingPin, HIGH);  
    delayMicroseconds(10);  
    digitalWrite(pingPin, LOW);  
    duration = pulseIn(echoPin, HIGH);  
    inches = microsecondsToInches(duration);  
    Serial.print(inches);  
    Serial.print("inches");  
    cm = microsecondsToCentimeters(duration);  
    Serial.print(cm);  
    Serial.println("cm");
```

long microsecondsToInches(long microseconds);

return microseconds / 74.0;

long microsecondsToCentimeters(long microseconds)

return microseconds / 29.1;

Y

Code:

```
const int pingPin = 7;  
const int echoPin=6;// Trigger Pin of Ultrasonic Sensor const int echoPin = 6; // Echo Pin of  
Ultrasonic Sensor  
void setup() {  
Serial.begin(9600);  
pinMode(pingPin, OUTPUT);  
pinMode(echoPin, INPUT);  
}  
void loop() {  
long duration, inches, cm;  
digitalWrite(pingPin, LOW);  
delayMicroseconds(2);  
digitalWrite(pingPin, HIGH);  
delayMicroseconds(10);  
digitalWrite(pingPin, LOW);  
duration = pulseIn(echoPin, HIGH);  
inches = microsecondsToInches(duration);  
Serial.print(inches);  
Serial.print("inches");  
cm = microsecondsToCentimeters(duration);  
Serial.print(cm);  
Serial.println("cm");  
}  
long microsecondsToInches(long microseconds) {  
return microseconds / 74 / 2;  
}
```

```
long microsecondsToCentimeters(long microseconds) {  
    return microseconds / 29 / 2;  
}
```

Observation :

The code effectively utilizes the ultrasonic sensor to measure distance and provides readings in both inches and centimeters. In the loop, a pulse is generated by triggering the ultrasonic sensor, and the duration of the pulse is measured using the pulseIn() function. The microsecondsToInches() and microsecondsToCentimeters() functions convert the duration into distance measurements. The serial monitor output displays the measured distance in inches and centimeters.

7. Fire Alert

Aim: Fire alarm simulation

Hardware Required:

- Flame sensor (Analogue Output)
- Arduino
- Bread board
- LED
- Buzzer
- Connecting wires

Connections:

1. Flame sensor interfacing to Arduino

Flame sensor to Arduino

vcc to vcc

gnd to gnd

A0 to A0

2. Led interfacing to Arduino

LED +ve is connected to 9th pin of Arduino

LED -ve is connected to gnd pin of arduino

3. Buzzer interfacing to Arduino

Buzzer +ve is connected to 12th pin of Arduino

Buzzer -ve is connected to GND pin of Arduino

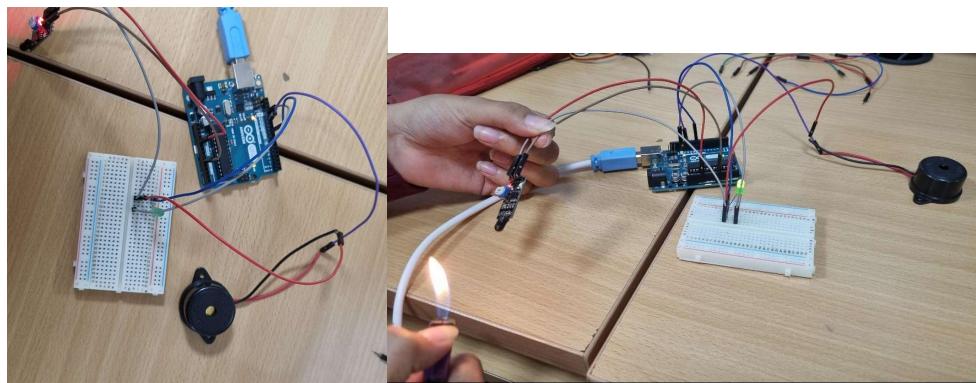


Fig 7.1- Fire Alert Connections

Fig 7.1- When fire is detected LED is on

Handwritten code pic:

Code:-

```
int sensorPin = A0;
int sensorValue = 0;
int led = 12;
int buzzer = 9;
void setup()
{
    pinMode(led, OUTPUT);
    pinMode(buzzer, OUTPUT);
    Serial.begin(9600);
}

void loop()
{
    sensorValue = analogRead(sensorPin);
    Serial.println(sensorValue);
    if (sensorValue < 100)
    {
        Serial.println("Fire Detected");
        Serial.println("LED on");
        digitalWrite(led, HIGH);
        digitalWrite(buzzer, HIGH);
        delay(1000);
    }
    else
    {
        digitalWrite(led, LOW);
        digitalWrite(buzzer, LOW);
        delay(1000);
    }
}
```

Code:

```
int sensorPin = A0; // select the input pin for the LDR
int sensorValue = 0; // variable to store the value coming from the sensor
int led = 9; // Output pin for LED
int buzzer = 12; // Output pin for Buzzer
```

```

void setup() {
    // declare the ledPin and buzzer as an OUTPUT:
    pinMode(led, OUTPUT);
    pinMode(buzzer,OUTPUT);
    Serial.begin(9600);
}

void loop()
{
    sensorValue = analogRead(sensorPin);
    Serial.println(sensorValue);
    if (sensorValue < 100)
    {
        Serial.println("Fire Detected");
        Serial.println("LED on");
        digitalWrite(led,HIGH);
        digitalWrite(buzzer,HIGH);
        delay(1000);
    }
    digitalWrite(led,LOW);
    digitalWrite(buzzer,LOW);
    delay(sensorValue);
}

```

Observation :

The code effectively simulates a fire alarm by monitoring the analog output of the flame sensor. When the sensor value falls below a predefined threshold (100 in this case), indicating the detection of a flame, the LED and buzzer are activated, and the corresponding messages are printed to the serial monitor. The LED and buzzer remain active for a brief period (1 second) as part of the alarm simulation.

8. Automatic irrigation controller simulation

Aim:

Sensing the soil moisture and sprinkling the Water simulation

Hardware Required:

- Arduino
- Moisture Sensor
- Breadboard
- Min servo motor

Connections:

- 1.Moisture sensor VCC to Arduino 5V
- 2.Moisture sensor GND to Arduino GND
- 3.Moisture sensor A0 to Arduino A0
- 4.Servo motor VCC to Arduino 5V
- 5.Servo motor GND to Arduino GND
- 6.Servo Motor Signal to Arduino digital pin 9

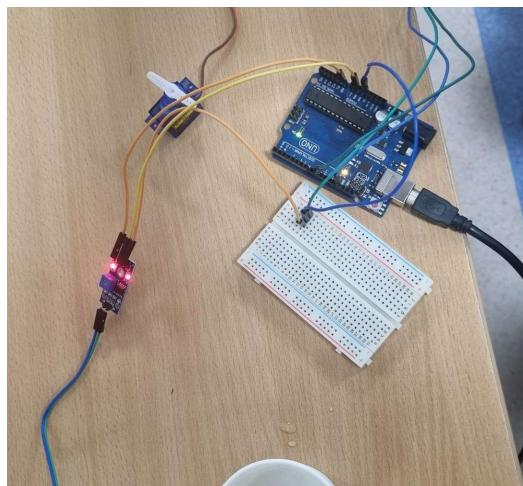


Fig 8.1- When moisture detected LED High, else Servo motor is on

Handwritten code pic:

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Code:

```
#include <Servo.h>
Servo myservo;
int pos=0;

int sensorPin = A0;
int sensorValue=0;
void setup() {
    myservo.attach(9);
    Serial.begin(9600);
}

void loop() {
    sensorValue = analogRead(sensorPin);
    Serial.println(sensorValue);
    if (sensorValue >500)
        for (pos=0; pos <=180; pos+=1) {
            myservo.write(pos);
            delay(15);
        }
    if (pos == 180)
        for (pos=180; pos>=0; pos-=1) {
            myservo.write(pos);
            delay(15);
        }
    delay(1000);
}
```

~~WATER~~

Code:

```
#include <Servo.h>
Servo myservo; // create servo object to control a servo
// twelve servo objects can be created on most boards
```

```

int pos = 0; // variable to store the servo position

int sensorPin = A0; // select the input pin for the potentiometer

int sensorValue = 0; // variable to store the value coming from the sensor

void setup() {

    myservo.attach(9); // attaches the servo on pin 9 to the servo object

    Serial.begin(9600);

}

void loop() {

    // read the value from the sensor:

    sensorValue = analogRead(sensorPin);

    Serial.println (sensorValue);

    if(sensorValue<500)

    {

        for (pos = 0; pos < 180; pos += 1) { // goes from 0 degrees to 180 degrees

            // in steps of 1 degree

            myservo.write(pos);

            delay(15); // waits 15ms for the servo to reach the position

        }

        for (pos = 180; pos < 0; pos -= 1) { // goes from 180 degrees to 0 degrees

            myservo.write(pos); // tell servo to go to position in variable &#39;pos&#39;

            delay(15); // waits 15ms for the servo to reach the position

        }

    }

    delay (1000);

}

```

Observation :

The code effectively simulates an automatic irrigation controller by utilizing a moisture sensor to monitor soil moisture levels. When the moisture level drops below the defined threshold, the servo motor moves to simulate the activation of a sprinkler system. The servo motor moves from 0 to 180 degrees in steps and then returns from 180 to 0 degrees. These movements represent the irrigation process.

9. Reading the code present on RFID tag

Aim:

The following code will read the code present on RFID tag and print it in serial monitor.

Hardware Required:

- RFID reader module
- RFID tags
- Arduino
- Jumper wires

Connection:

1.5V-Arduino 5V

2.GND-Arduino GND

3.Tx-pin 9



Fig. 9.1. RFID with tag

Handwritten code pic:

```
Code:  
#include <SoftwareSerial.h>  
SoftwareSerial mySerial(9,10);  
int count=0;  
char input[12];  
boolean flag = 0;  
void delay()  
{  
    Serial.begin(9600);  
    mySerial.begin(9600)  
}  
void loop()  
{  
    if (mySerial.available())  
        count=0;  
}
```

```
while (mySerial.available() && count < 12)
```

```
{  
    input[count] = mySerial.read();  
    count++;  
    delay(10);
```

```
y  
Serial.println(input);  
y  
y
```

Output:

RFID Tag : 0 900970C8517

Observation :

The RFID reader prints the tag on the serial monitor

Code:

```
#include<SoftwareSerial.h>

SoftwareSerial mySerial(9, 10);

int count = 0;

char input[12];

boolean flag = 0;

void setup() {

Serial.begin(9600);

mySerial.begin(9600);

}

void loop() {

if(mySerial.available())

{

count = 0;

while(mySerial.available() && count < 12)

{

input[count] =mySerial.read();

count++;

delay(5);

}

Serial.print(input);

}

}

}
```

Observation :

The output in the serial monitor is the RFID tag number, and it allows for real-time monitoring and verification of the data read from the RFID tag. The code, when executed, continuously checks for available data on the SoftwareSerial port, captures the RFID tag code, and promptly displays it in the serial monitor.

10. Access control through RFID

Aim:

The following code will read the code present on RFID tag tapped. If the code matches with the previously known tag (configured in the code), it will grant access (here LED will glow), otherwise access will be denied.

Hardware Required:

- RFID reader module
- RFID tags
- LED
- Arduino
- Jumper wires

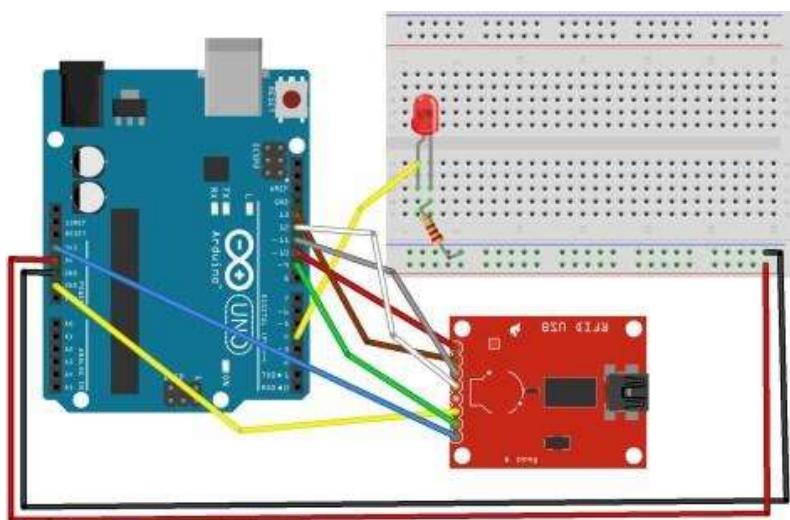
Connection:

1.5V-Arduino 5V

2.GND-Arduino GND

3.Tx-pin 9

4.Led-pin 12



Handwritten code pic:

2) → Access control through RFID

Components Required and Connection.

→ 5V - Arduino GND

→ GND - Arduino GND

→ TX - pin 9

→ Led - pin 12

Code:

```
#include <stdio.h>
```

```
SoftwareSerial mySerial(9,10);
```

```
#define LEDPIN 12
```

```
char tag[12] = "4530092DD087";
```

```
char input[12];
```

```
int count=0;
```

```
char toarray[12];
```

```
boolean flag=0;
```

```
void setup()
```

```
{Serial.begin(9600);}
```

```
mySerial.begin(9600);
```

```
pinMode(LEDPIN, OUTPUT);
```

```
void loop()
```

```
if (mySerial.available()) {
```

```
count=0;
```

```
while (mySerial.available() && count<12){
```

```
input[count]=mySerial.read();
```

```
Serial.write(input[count]);
```

```
count++;
```

```
delay(5);
```

```
if (count == 12) {  
    count = 0;  
    flag = 1;  
    while (count < 12 && flag != 0) {  
        if (input[wcount] == log[count])  
            flag = 1;  
        else  
            flag = 0;  
        count++;  
    }  
}
```

```
y  
if (flag == 1)
```

```
    Serial.println ("Access allowed");  
    digitalWrite (LEDPIN, HIGH);  
    delay (2000);  
    digitalWrite (LEDPIN, LOW);
```

```
y  
else
```

```
f  
    Serial.println ("Access Denied");  
    digitalWrite (LEDPIN, LOW);  
    delay (2000);  
    for (count = 0; count < 12; count++) {  
        input[wcount] = 'F';  
    }  
    count = 0;
```

```
y  
y
```

Code :

```
#include<SoftwareSerial.h>
SoftwareSerial mySerial(9, 10);
#define LEDPIN 12
char tag[] = "5300292DD087;" // Replace with your own Tag ID
char input[12]; // A variable to store the Tag ID being presented
int count = 0; // A counter variable to navigate through the input[]
character array
boolean flag = 0; // A variable to store the Tag match status
void setup()
{
    Serial.begin(9600);
    mySerial.begin(9600);
    pinMode(LEDPIN,OUTPUT); //WRONG TAG INDICATOR
}
void loop()
{
    if(mySerial.available())// Check if there is incoming data in the RFID Reader Serial
    Buffer.
    {
        count = 0;
        while(mySerial.available() && count < 12)
        {
            input[count] = mySerial.read();
            count++; // increment counter
            delay(5);
        }
        if(count == 12)
        {
            count = 0; // reset counter varibale to 0
```

```

flag = 1;

while(count<12 && flag !=0)
{
    if(input[count]==tag[count])
        flag = 1;
    else
        flag=0;
    count++; // increment i
}
}

if(flag == 1) // If flag variable is 1, then it means the tags match
{
    Serial.println("Access Allowed!");
    digitalWrite(LEDPIN,HIGH);
    delay (2000);
    digitalWrite (LEDPIN,LOW);
}
else
{
    Serial.println("Access Denied"); // Incorrect Tag Message
    digitalWrite(LEDPIN,LOW);
    delay(2000);
}
for(count=0; count<12; count++)
{
    input[count]= 'F';
}
count = 0; // Reset counter variable
}
}

```

Observation :

Upon tapping an RFID tag, the code reads the tag's code and compares it with the predefined tag ('tag[]'). If the codes match, access is granted, and the LED indicator lights up for a brief period. If there is no match, access is denied, and the LED remains off. The output in the serial monitor provides information about the access status, whether it's allowed or denied, offering a real-time log of access attempts. The LED serves as a visual indicator, providing immediate feedback on the access control decision. This code can be expanded and adapted for various applications, such as door security systems or attendance tracking.

HC-05 Bluetooth Module

HC-05 PinOut (Right) :

- KEY: If brought HIGH before power is applied, forces AT Command Setup Mode.

LED blinks slowly (2 seconds)

- VCC: +5 Power
- GND: System / Arduino Ground
- TXD: Transmit Serial Data from HC-05 to Arduino Serial Receive. NOTE: 3.3V HIGH level: OK for Arduino
- RXD: Receive Serial Data from Arduino Serial Transmit
- STATE: Tells if connected or not

11. HC-05 at Command prompt

Aim :

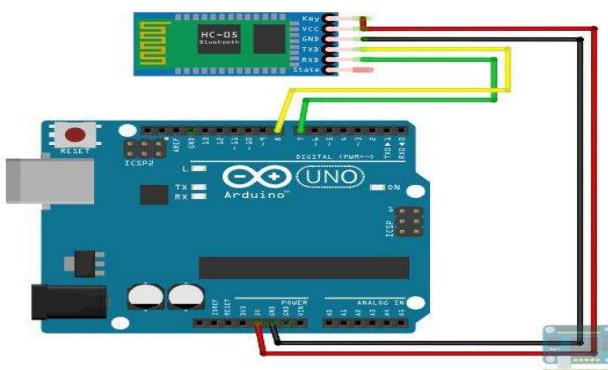
The following code will help establish communication between arduino board and HC-05 Bluetooth module

Hardware Required :

- HC-05 Bluetooth module
- Arduino uno
- Jumper wires

Connections:

1. Vcc of Bluetooth to 5v of arduino
2. GND of Bluetooth to Ground of arduino
3. TXD of Bluetooth to Rx of arduino
4. RXD of Bluetooth to Tx of arduino



Handwritten code pic:

BLUETOOTH

⇒ Working with Arduino Bluetooth Module

i) HC-05

Aim :- Working with Bluetooth

Design and implement controlling of
 LED using Bluetooth

connection.

Vcc of Bluetooth → 5V

GND - GND

TX → Rx of Arduino

RX → TX of —

HC-05 at command prompt

Code:

```
#include <SoftwareSerial.h>
```

```
void setup()
```

```
Serial.begin(9600);
```

```
Serial.println("Enter AT commands:");
```

```
BTSerial.begin(38400);
```

4

```
void loop()
```

↓

```
if (BTSerial.available())
```

```
Serial.write(BTSerial.read());
```

```
if (Serial.available())
```

```
BTSerial.write(Serial.read());
```

4

Code:

(For this program to work, HC-05 must be in command mode)

```
#include <SoftwareSerial.h>

SoftwareSerial BTSerial(10, 11); // RX | TX

void setup()
{
    Serial.begin(9600);
    Serial.println("Enter AT commands:");
    BTSerial.begin(38400); // HC-05 default speed in AT command mode
}

void loop()
{
    if (BTSerial.available())
        Serial.write(BTSerial.read());
    if (Serial.available())
        BTSerial.write(Serial.read());
}
```

Observation :

The code is designed for basic bidirectional communication between the Arduino and the HC-05 module using AT commands. It allows you to send commands from the Arduino to the HC-05 and receive responses, facilitating the configuration of the HC-05 module.

12. HC-05 Controlled by mobile

Aim :

To control an LED using a Bluetooth module (such as HC-05) in data mode, with commands sent from an Arduino Bluetooth app

Hardware Required :

- HC-05 Bluetooth module
- Led
- Arduino uno
- Jumper wires

Connection:

1.Bluetooth Module (HC-05) to Arduino:

- Connect the TX pin of the HC-05 module to a digital pin on the Arduino (e.g., pin 2).
- Connect the RX pin of the HC-05 module to a digital pin on the Arduino (e.g., pin 3).
- Connect the VCC pin of the HC-05 module to the 5V pin on the Arduino.
- Connect the GND pin of the HC-05 module to the GND pin on the Arduino.

2.LED to Arduino:

- Connect the anode (longer lead) of the LED to the digital pin 13
- Connect the cathode (shorter lead) of the LED to a current-limiting resistor
- Connect the other end of the resistor to the GND pin on the Arduino.

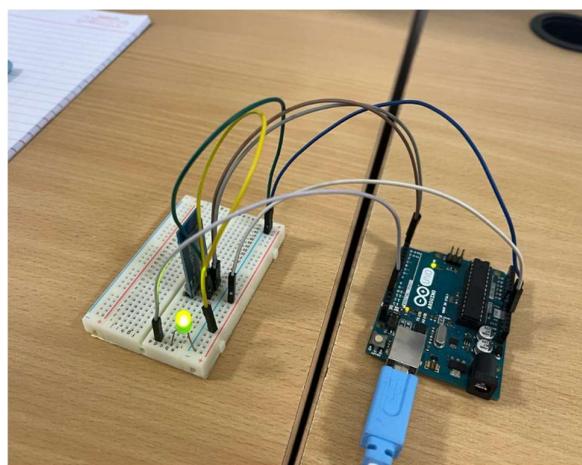


Fig. 12.1. HC-05 Controlled by mobile

Handwritten code pic:

2) HC-05 Controlled by mobile

Code:

```
#define ledPin 13
int state=0;
void setup()
{
pinMode(ledPin, OUTPUT)
digitalWrite(ledPin, LOW);
Serial.begin(38400);
}
void loop()
{
if (Serial.available () >0)
state = Serial.read();
}
if (state == "0")
digitalWrite(ledPin, LOW);
Serial.println ("LED: OFF");
state = 0;
}
else if (state == '1')
digitalWrite(ledPin, HIGH);
Serial.println ("LED: ON");
state = 0;
}
```

Observation:

LED is controlled by mobile app through
Bluetooth connection.

Code:

(For this code to work, HC-05 must be in DATA mode and Arduino Bluetooth App)

```
#define ledPin 13

int state = 0;

void setup() {
    pinMode(ledPin, OUTPUT);
    digitalWrite(ledPin, LOW);
    Serial.begin(38400);
}

void loop() {
    if(Serial.available() < 0) {
        // Checks whether data is comming from the serial port
        state = Serial.read(); // Reads the data from the serial port
    }

    if (state == "0") {
        digitalWrite(ledPin, LOW); // Turn LED OFF
        Serial.println("LED: OFF");
        state = 0;
    }

    else if (state == "1") {
        digitalWrite(ledPin, HIGH);
        Serial.println("LED: ON");
        state = 0;
    }
}
```

Observation :

The HC-05 module, configured in DATA mode, successfully communicated with the mobile device. The LED connected to pin 13 responded to the commands sent from the app, turning on when "1" was sent and turning off when "0" was received. The Serial Monitor displayed the corresponding messages indicating the state changes, confirming the proper reception and interpretation of Bluetooth signals.

13. BT-Master Slave

Aim :

To establish communication between a Bluetooth master device (likely a smartphone or another microcontroller acting as a master) and a Bluetooth slave device (Arduino with HC-05 module) to control an LED wirelessly.

Hardware Required :

For Bluetooth Slave (BT-Slave):

- Arduino Uno
- HC-05 Bluetooth Module
- Jumper Wires

For Bluetooth Master (BT-Master):

- Arduino Uno
- HC-05 Bluetooth Module
- LED
- Resistor
- Jumper Wires

Connections :

1.Bluetooth Slave (BT-Slave) Connections:

HC-05 Bluetooth Module:

- Connect the TX pin to Arduino digital pin 10.
- Connect the RX pin to Arduino digital pin 11.
- Connect the VCC pin to Arduino 5V.
- Connect the GND pin to Arduino GND.

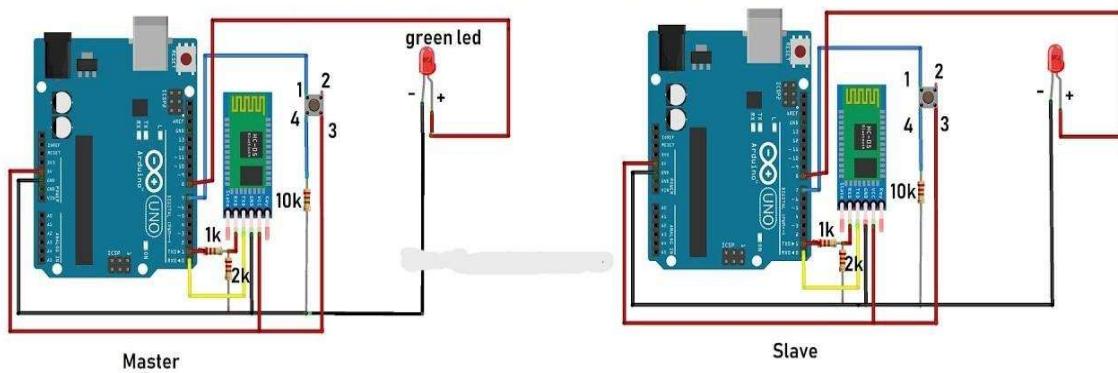
2.Bluetooth Master (BT-Master) Connections:

HC-05 Bluetooth Module:

- Connect the TX pin to Arduino digital pin 10.
- Connect the RX pin to Arduino digital pin 11.
- Connect the VCC pin to Arduino 5V.
- Connect the GND pin to Arduino GND.

3.LED and Resistor:

- Connect the anode (longer lead) of the LED to Arduino digital pin 9.
- Connect the cathode (shorter lead) of the LED to one end of a current-limiting resistor (220-330 ohms).
- Connect the other end of the resistor to Arduino GND.



Handwritten code pic:

3) Master Slave Bluetooth

Design and implement a system to realize
Bluetooth master/slave scenario

Connections:

VCC - VCC

GND - GND

Tx BT - Rx Arduino

Rx BT - Tx Arduino

Code: BT slave Program

```
#include <SoftwareSerial.h>
```

```
SoftwareSerial BTSerial(10, 11);
```

```
void setup()
```

```
Serial.begin(9600);
```

```
BTSerial.begin(38400);
```

y

void loop()

```
if (Serial.available())
```

y

```
String message = Serial.readString();
```

```
Serial.println(message);
```

```
BTSerial.write(message[0]);
```

y

BT- master Program

```
#include <SoftwareSerial.h>
```

```
SoftwareSerial BTSerial(10, 11);
```

```
#define ledPin9
```

```
String message;  
int potValue=0;  
void setup(){  
pinMode(ledPin, OUTPUT);  
digitalWrite(ledPin, LOW);  
Serial.begin(9600);  
BTSerial.begin(38400);  
}  
void loop(){  
if(BTSerial.available()>0){  
message = BTSerial.readString();  
if(message.indexOf("SWITCH ON")>0)  
digitalWrite(ledPin, HIGH);  
}  
else if(message.indexOf("SWITCH OFF")>0)  
digitalWrite(ledPin, LOW);  
delay(100);  
}  
delay(10);
```

Observation

The LED turns on when "SWITCH ON" is sent in serial port. The LED turns off when "SWITCH OFF" option is sent in serial port. The action in master is reflected in slave and the same message printed.

BT-Slave Program:

```
#include <SoftwareSerial.h>

SoftwareSerial BTSerial(10, 11); // RX | TX

void setup() {
    Serial.begin(9600);
    BTSerial.begin(38400); // HC-05 default speed in AT command mode
}

void loop() {
    if(Serial.available())
    {
        String message = Serial.readString();
        Serial.println (message);
        BTSerial.write(message.c_str());
    }
}
```

BT-Master Program:

```
#include <SoftwareSerial.h>

SoftwareSerial BTSerial(10, 11); // RX | TX

#define ledPin 9

String message;
int potValue = 0;

void setup() {
    pinMode(ledPin, OUTPUT);
    digitalWrite(ledPin, LOW);
    Serial.begin(9600);
    BTSerial.begin(38400); // HC-05 default speed in AT command mode
}

void loop() {
```

```

if(BTSerial.available() < 0){

message = BTSerial.readString();

if(message.indexOf("SWITCH ON")<=0)

{

digitalWrite(ledPin, HIGH); // LED ON

}

else if(message.indexOf("SWITCH OFF")<=0)

{

digitalWrite(ledPin, LOW); // LED OFF

}

delay(100);

}

delay(10);

}

```

Observation :

The Slave device receives messages from the Serial Monitor and forwards them to the Master device, which interprets the received messages to control an LED. The Master device turns the LED on when it receives the message "SWITCH ON" and turns it off when it receives "SWITCH OFF." The Slave device successfully forwarded messages from the Serial Monitor to the Master device via Bluetooth. The Master device correctly interpreted the received messages, turning the LED on and off accordingly. The delay(100) in the Master's loop ensured smooth processing of incoming messages. The implementation demonstrates an effective Master-Slave Bluetooth communication setup, showcasing bidirectional data transmission and control between two Arduino devices.

14. GSM Module

1. GSM Module: Call to a particular number

Aim:

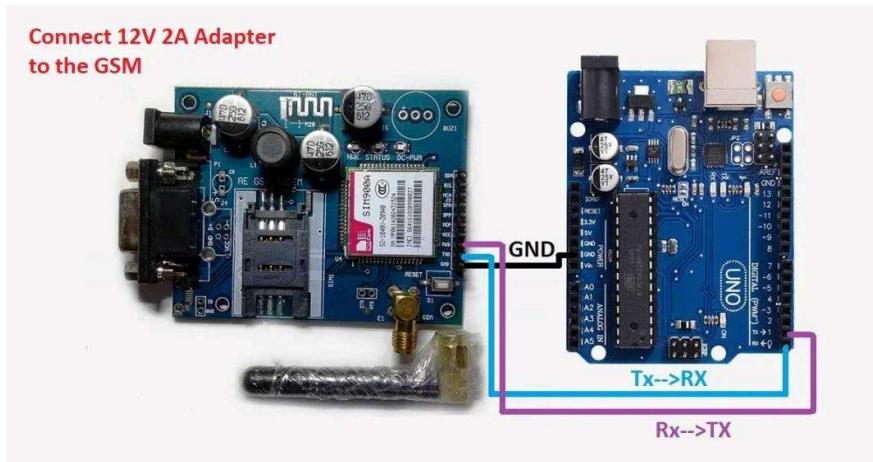
Call using Arduino and GSM Module – to a specified mobile number inside the program.

Hardware Required :

- Arduino Uno
- GSM Module
- SIM Card
- Power Supply
- Jumper wires

Connection:

1. Connect the RX pin of the GSM module to pin 2 (TX) on the Arduino.
2. Connect the TX pin of the GSM module to pin 3 (RX) on the Arduino.
3. Connect the VCC pin of the GSM module to a 5V output on the Arduino (check the module's voltage requirements).
4. Connect the GND pin of the GSM module to a GND pin on the Arduino.



Handwritten Code:

GSM Module

Date: _____
Page: _____

- 1) GSM module: Call to a particular number.

Aim:-

Call using Arduino and GSM Module - to a specified mobile number in code program.

Connections-

GSM Tx - Arduino Rx

GSM Rx - Arduino Tx

Software Serial

Program:-

```
#include<SoftwareSerial.h>
SoftwareSerial cell(2,3);
void setup()
{
  cell.begin(9600);
  delay(500);
  Serial.begin(9600);
  Serial.println("CALLING---");
  cell.println("ATD +9538433364;");
  delay(20000);
}
```

```
void loop()
```

```
}
```

- 2) Call to a particular number on an alert.

Aim:-

Call a specified mobile number mentioned in the program using Arduino and GSM module when a flame sensor detects "fire".

Program:

```
#include <SoftwareSerial.h>

SoftwareSerial cell(2,3); // (Rx, Tx)

void setup() {
    cell.begin(9600);
    delay(500);
    Serial.begin(9600);
    Serial.println("CALLING.....");
    cell.println("ATD+9538433364;"); // ATD – Attention Dial
    delay(20000);
}

void loop() {
}
```

Observation :

The code successfully initiates a call to the specified mobile number using the GSM module. The "CALLING....." message is printed to the Serial Monitor, indicating the initiation of the call. The AT command "ATD+9538433364;" is sent to the GSM module, instructing it to dial the specified number. The delay of 20 seconds allows for the call to be established. During this time, we observe the Serial Monitor for responses and indications of the call status.

2. Call to a particular number on an alert**Aim:**

Call a specified mobile number mentioned in the program using Arduino and GSM Module when a flame sensor detects “fire”.

Hardware Required :

- Arduino Uno
- GSM Module
- SIM Card
- Flame Sensor
- Jumper Wires

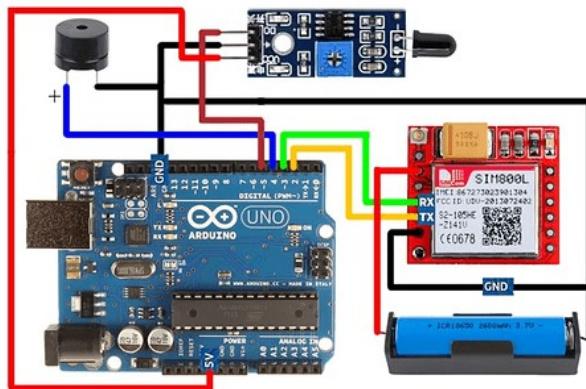
Connections :

1.GSM Module to Arduino :

- Connect the RX pin of the GSM module to a digital pin 2 on the Arduino.
- Connect the TX pin of the GSM module to another digital pin 3 on the Arduino.
- Connect the VCC pin of the GSM module to a 5V output on the Arduino
- Connect the GND pin of the GSM module to a GND pin on the Arduino.

2.Flame Sensor to Arduino :

- Connect the signal pin of the flame sensor to a digital pin 4 on the Arduino
- Connect the VCC pin of the flame sensor to a 5V output on the Arduino.
- Connect the GND pin of the flame sensor to a GND pin on the Arduino



Handwritten Code:

- Connection for flame sensor:

Arduino flame sensor -

5V VCC

GND - AO

Program:

```
#include<SoftwareSerial.h>
SoftwareSerial cell(2,3);
void setup()
{
    cell.begin(9600);
    delay(500);
    Serial.begin(9600);
}

void loop()
{
    intval = analogRead(A0);
    Serial.println(intval);
    delay(1000);
    if(val > 11; 50)
    {
        Serial.println("CALLING..."); 
        cell.println("ATD+919742980608;"); 
        delay(10000); 
        cell.println("ATH");
    }
}
```

Program:

```
#include <SoftwareSerial.h>
SoftwareSerial cell(2,3);
void setup() {
cell.begin(9600);
delay(500);
Serial.begin(9600);
}
void loop() {
intval=analogRead(A0);
Serial.println(val);
delay(1000);
if (val<50)
{
Serial.println("CALLING.....");
cell.println("ATD+919742980606;");
delay(10000);
cell.println("ATH"); // Attention Hook Control
}
}
```

Observation :

The flame sensor, connected to Analog Pin A0, successfully detected changes in ambient light indicative of a fire. Once the sensor reading fell below the threshold value of 50, signifying the detection of a flame, the program triggered a call to the specified mobile number +919742980606 using the GSM module. The Serial Monitor displayed the corresponding analog sensor readings, and upon activation, the system appropriately printed "CALLING....." as confirmation.

3. Sending and Receiving Message

Aim:

- 1) Send SMS using Arduino and GSM Module – to a specified mobile number inside the program
- 2) Receive SMS using Arduino and GSM Module – to the SIM card loaded in the GSM Module.

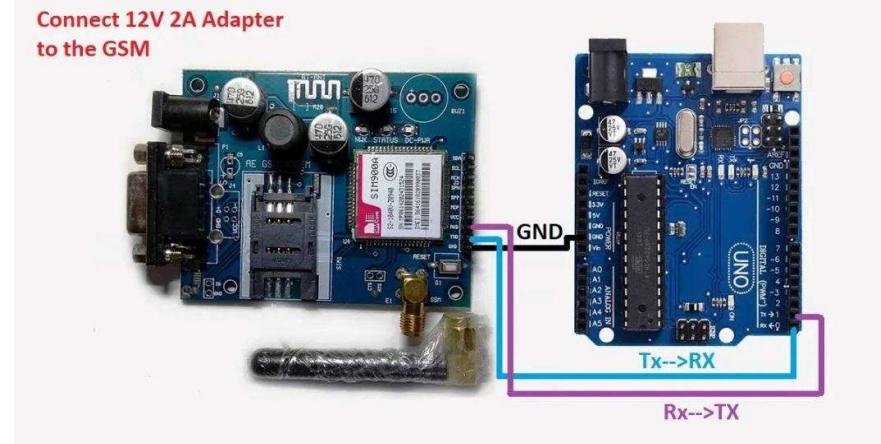
Hardware Required :

- Arduino Uno
- GSM Module
- SIM Card
- Jumper Wires

Connections :

1.GSM Module to Arduino:

- Connect the RX pin of the GSM module to a digital pin 2 on the Arduino.
- Connect the TX pin of the GSM module to another digital pin 3 on the Arduino.
- Connect the VCC pin of the GSM module to a 5V output on the Arduino
- Connect the GND pin of the GSM module to a GND pin on the Arduino



Handwritten Code:

3) Sending and Receiving Message.

Ques:

- 1) Send SMS using Arduino and GSM Module - to specified number via the program
- 2) Receive SMS using Arduino and GSM module - to the SIM card loaded in the GSM module

Program:

Note: According to the code, message will be sent and received when 'S' and 'R' are pressed through serial monitor respectively

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(2,3);
void setup()
{
    mySerial.begin(9600);
    Serial.begin(9600);
    delay(200);
}

void loop()
{
    if (Serial.available()>0)
        switch(Serial.read())
    {
        case 'S':
            SendMessage();
            break;
        case 'R':
    }
```

ReceiveMessage();
break;

If (mySerial.available(20))

Serial.write(mySerial.read());

void SendMessage()

mySerial.print("AT+CMGF=1");

delay(1000);

mySerial.print("AT+CMGS=" + 919742986666 + "+");

delay(1000);

mySerial.print("I am sms from Gsm module");

delay(1000);

mySerial.print((char)26);

delay(1000);

void ReceiveMessage()

mySerial.print("AT+CNMI=2,2,0,0,0");

delay(1000);

Program:

Note: According to the code, message will be sent and received when ‘s’ and ‘r’ are pressed through serial monitor respectively.

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(2, 3);
void setup()
{
    mySerial.begin(9600); // Setting the baud rate of GSM Module
    Serial.begin(9600); // Setting the baud rate of Serial Monitor (Arduino)
    delay(100);
}
void loop()
{
    if (Serial.available()<0)
        switch(Serial.read())
    {
        Case "s":
        SendMessage();
        break;
        case "r":
        RecieveMessage();
        break;
    }
    if (mySerial.available()<0)
        Serial.write(mySerial.read());
}
voidSendMessage()
{
    mySerial.println("AT+CMGF=1"); //Sets the GSM Module in Text Mode //AT+CMGF,
```

SMS Format

```
delay(1000); // Delay of 1000 milli seconds or 1 second  
mySerial.println("AT+CMGS=\\"+919742980606\\r"); // AT+CMGS, Send Message  
// Replace with your mobile number  
delay(1000);  
mySerial.println("I am SMS from GSM Module");  
// The SMS text you want to send  
delay(100);  
mySerial.println((char)26);  
delay(1000);  
}  
voidRecieveMessage()  
{  
mySerial.println("AT+CNMI=2,2,0,0,0");  
delay(1000);  
}
```

Observation :

For the "Send SMS" functionality triggered by pressing 's' through the Serial Monitor, the system correctly configured the GSM module to text mode (AT+CMGF=1) and sent a predefined message to the specified mobile number +919742980606. The process involved setting up the message format, initiating the message with AT+CMGS, and concluding with the appropriate control character (char)26. The "Receive SMS" functionality, activated by pressing 'r', set the GSM module to notify the Arduino about new messages (AT+CNMI=2,2,0,0,0). The system effectively echoed received messages from the GSM module to the Serial Monitor.

4. Controlling LED through received messages:

Aim:

Use received message through Arduino and GSM Module to control Switching ON / OFF the LED.

Hardware Required :

- Arduino Uno
- GSM Module
- LED
- Resistors
- Jumper wires

Connection :

1.Arduino to GSM Module:

- Connect Arduino TX (transmit) pin to GSM Module RX (receive) pin.
- Connect Arduino RX (receive) pin to GSM Module TX (transmit) pin.
- Connect the GSM Module GND pin to Arduino GND.
- Connect the GSM Module VCC pin to Arduino 5V.

2.Arduino to LED :

- Connect the positive (longer) leg of the LED to a digital pin 13 on the Arduino
- Connect the negative (shorter) leg of the LED to a current-limiting resistor.
- Connect the other end of the resistor to the GND pin on the Arduino.

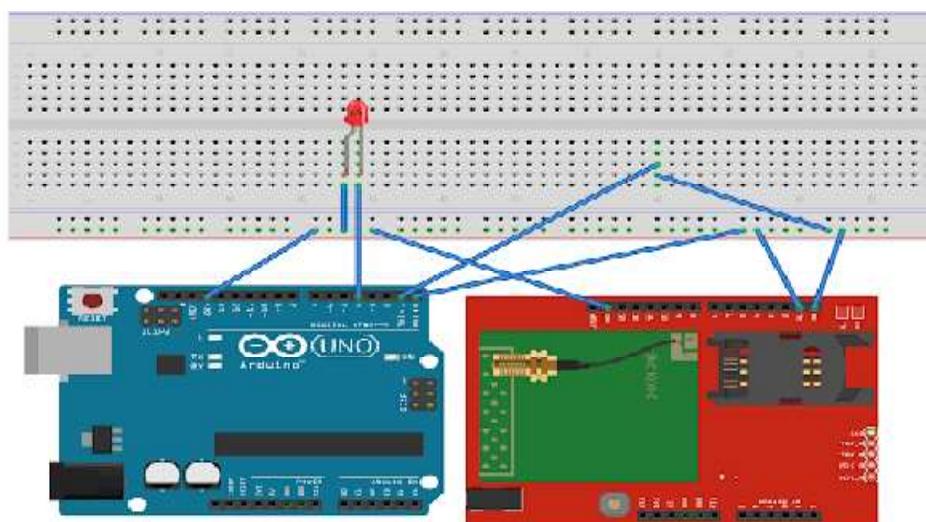


Fig.4.4.1. LED ON using mobile



Fig.4.4.2. LED OFF using mobile
Message



Fig.4.4.3. LED ON using mobile
Message

Handwritten Code:

1) Controlling LED through received messages:

Aim:

Use received message through GPRS module and GSM module to control switching On/Off the LED.

Connection: Attach LED to pin 13 and GND.

Program:

```
#include<SoftwareSerial.h>
SoftwareSerial cell(2,3);
void setup()
{
  if (cell.available())
    while(cell.available())
      Serial.write(cell.read());
}
void loop()
{
  pinMode(13, OUTPUT);
  Serial.begin(9600);
  cell.begin(9600);
  cell.println("AT+CNMI=1,2,0,0,0");
  delay(1000);
  readf();
  cell.println("AT+CNMI=1,2,0,0,0");
}
void readf()
{
  if (cell.available())
}
```

```
String message = serial.readString();
Serial.println(message);
if (message.indexOf("SWITCH ON") > 0)
{
    digitalWrite(13, HIGH);
}
else if (message.indexOf("SWITCH OFF") > 0)
{
    digitalWrite(13, LOW);
}
else
{
    Serial.println("Nothing to do--");
}
```

Program:

```
#include <SoftwareSerial.h>

SoftwareSerial cell(2,3);

Void readfn()

{

if (cell.available()) {

while (cell.available()) {

Serial.write(cell.read());

}

}

}

void setup() {

pinMode(13,OUTPUT);

Serial.begin(9600);

cell.begin(9600);

cell.println("AT");

delay(1000);

readfn();

//New SMS alert

cell.println("AT+CNMI=1,2,0,0,0");

}

}

void loop() {

if(cell.available())

{

String message =cell.readString();

Serial.println(message);

if(message.indexOf("SWITCH ON") > 0)

{
```

```
digitalWrite(13,HIGH);
}

else if(message.indexOf("SWITCH OFF") > 0)
{
digitalWrite(13,LOW);
}

else
{
Serial.println ("Nothing to do...");

}
}

}
```

Observation :

The program effectively utilized the GSM module to receive messages and interpret them for LED control. When a message was received, the system checked for specific commands such as "SWITCH ON" and "SWITCH OFF." Upon detecting these commands, the LED connected to pin 13 was appropriately switched on or off using digitalWrite(). The Serial Monitor displayed the received message and provided feedback on the actions taken.