Ahsanullah University of Science and Technology

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

PROJECT OF MEASUREMENT AND INSTRUMENTATION

PROJECT NAME : **HOME AUTOMATION SYSTEM**

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Submitted by :

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Abstract:

With the rising power of technology, we are able to accomplish things at a much quicker rate. We have at the touch of a button access to large amounts of information due to the capability of computers and the Internet. Not only has technology given us more information, but it also has given us the ability to communicate, organize, and manage our time.

Objective :

In our project we have tried to combine some useful sensor to make our life much easier and save our energy and time. Our destination is to lessen the wastage of electrical energy.

We worked on four basic part :

1. **Power**
2. **Security**
3. **Automation**
4. **Safety**

An overview of project:

In power section: **1. Solar tracking solar charger**

In security section: **1. Laser security**

2. RFID door lock

In Automation section: **1. Bluetooth controlled light & fan**

2. Temperature controlled fan speed

3. Motion sensing light

4. Water level depending pump

5. Night flood light

6. Rain alarm

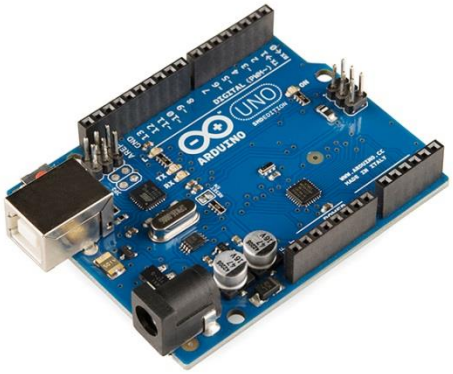
7. Automatic sprinkler for garden

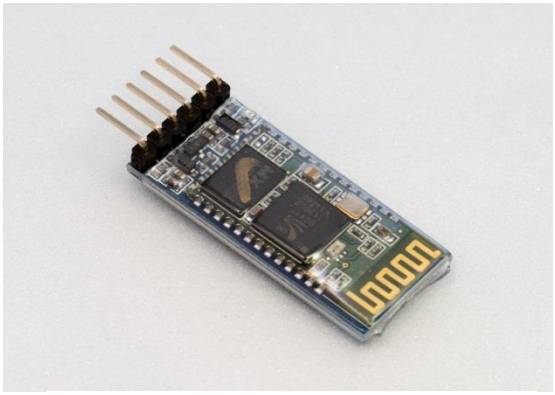
In Safety section: **1. Smoke detecting alarm**

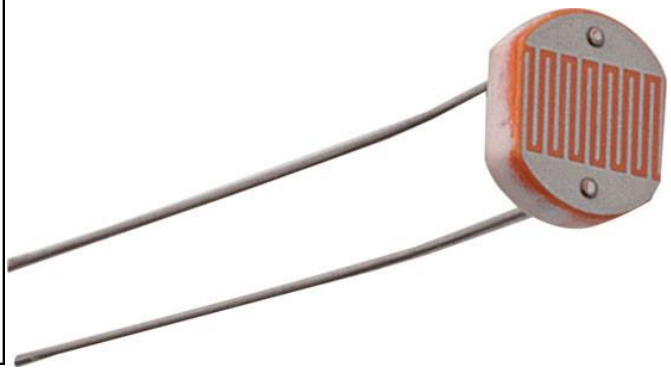
Components :

1. Arduino UNO
2. Arduino Mega
3. RFID RC522
4. Crystal display
5. RFID card
6. Servo motor
7. Laser light
8. LDR (Light Depending Resistance)
9. Bluetooth module (HC-05)
10. LED
11. Temperature sensor (LM-35)
12. 5v DC motor with blade
13. Potentiometer
14. Motor driver (L293d)
15. PIR motion sensor
16. Moisture sensor
17. Rain sensor
18. Smoke detecting sensor
19. Plywood
20. Glue
21. Connecting wire

Overview of the components :

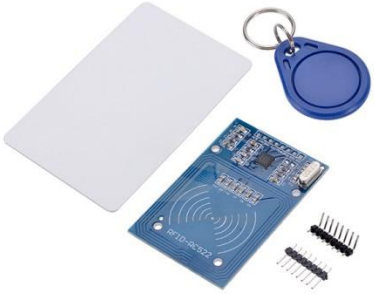




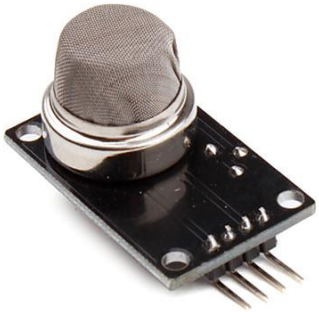



N42AF
LM35
DZ


Moisture Sensor
V1.0




Brushless Motor



Project description :

Solar tracker :

Rfid doorlock :

MF RC522 is used in highly integrated 13.56MHz contactless communication card chip to read and write, of NXP for “three” and the application launched a low voltage, low cost, small size, non-contact card chip to read and write, intelligent instruments and portable handheld devices developed better.

So for a valid card the door will open . But for a invalid card it will show access denied . The door can open or close from inside by a push button but it can only closed from outside by another push button.

Laser security :

A laser beam is created by a laser pointer. Then there created a laser circle all around the home by mirrors attaching at a right angle. Then finally it is focused on a LDR. So whenever anyone enter from any side of the house premises the laser is blocked and getting signal from LDR a buzzer is being powered.

Bluetooth control light and fan :

It’s an app based project, where one can control the electronic appliances in home by an android application. By using this application, we can control the electronic appliance in 3 rooms where each room has a capability of having 4 electronic appliances (One analog and Three digital electronics). Here we use the free software BLUETERM.

Temperature control fan speed :

Through the project we try to automatically control the speed of a DC fan according to the temperature read by a LM35 sensor. We show the temp and fan speed on the display and set the temperature for which we want which speed. And after switching the speed will automatically control by temperature. By lm 35 temperature sensor we sense the temperature. Then under 20 *C the fan remains off. Then if we increase the temperature then the speed of the fan increases. After 33*c the fan rotates at high speed.

Motion sensing light :

A motion detector is a device that detects moving objects, particularly people. It is integrated as a component of a system that automatically performs a task or alerts a user of motion in an area. Motion detectors form a vital component of security, automated lighting control, home control, energy efficiency, and other useful systems.

An electronic motion detector contains an optical, microwave, or acoustic sensor, and in many cases a transmitter for illumination. However, a *passive* sensor only senses a signal emitted by the moving object itself. Changes in the optical, microwave, or acoustic field in the device's proximity are interpreted by the electronics based on one of the technologies listed below. Most inexpensive motion detectors can detect up to distances of at least 15 feet (5 meters).Here we use PIR motion sensor.

Passive infrared (PIR)

Passive infrared sensors are sensitive to a person's skin temperature through emitted black body radiation at mid-infrared wavelengths, in contrast to background objects at room temperature. No energy is emitted from the sensor, thus the name "passive infrared" (PIR). This distinguishes it from the electric eye for instance in which the crossing of a person or vehicle interrupts a visible or infrared beam.

Water level depending pump

To measure the level of water we use the sonar sensor HC SR04. The HR-SR04 has four pins namely Vcc, Trigger, Echo, GND and they are explained in detail below.

1) VCC : 5V DC supply voltage is connected to this pin.

2) Trigger: The trigger signal for starting the transmission is given to this pin. The trigger signal must be a pulse with 10uS high time. When the module receives a valid trigger signal it issues 8 pulses of 40KHz ultrasonic sound from the transmitter. The echo of this sound is picked by the receiver.

3) Echo: At this pin, the module outputs a waveform with high time proportional to the distance.

4) GND: Ground is connected to this pin.

the 40KHz pulse train is transmitted just after the 10uS triggering pulse and the echo output is obtained after some more time. The next triggering pulse can be given only after the echo is faded away and this time period is called cycle period. The cycle period for HC-SR04 must not be below 50mS. According to datasheet, the distance can be calculated from the echo pulse width using the following equations.

Distance in cm = echo pulse width in uS/58

Distance in inch = echo pulse width in uS/148

So when the level of water is a little bit higher then half of the full tank then it would power up the pump.

Night flood light :

It is just an LDR depending light. When it gets dark the potential difference across LDR changes. We get input signal from it and power up the flood light.

Rain alarm :

It is a conducting plate. When water falls upon it gets conducted. More current flows through it and then it send a signal. We power up a buzzer after getting the signal.

Automatic sprinkler for garden :

When the soil is dry, the impedance will be high and the LM-393 will show a high value on the output.
When the soil is wet, it will show a low value in the output.
The module has one digital output and an analog output. If the soil moisture is below a threshold; drives a water pump for one minute. It is possible to set the soil moisture threshold by a set point potentiometer.

Smoke detecting alarm :

For detecting smoke we use an ionization sensor. Ionization sensor technology contains a small amount of radioactive material encapsulated in a metal chamber. Ionization technology is faster at reacting to fast flaming fires that give off little smoke.

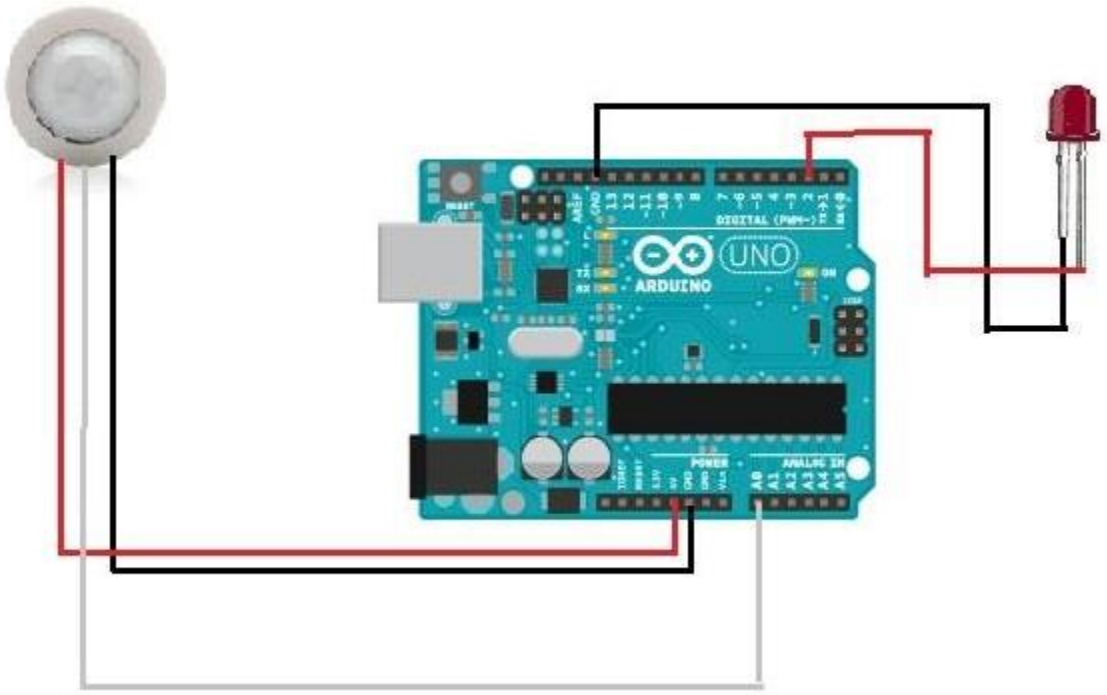
Ionizing sensors contain a small amount of americium-241, a radioactive material. It is housed in an ionization chamber, which is basically two metal plates a small distance apart. One of the plates carries a positive charge, the other a negative charge. Between the two plates, the alpha particles emitted by the americium-241. The alpha particles collide with the air in the ionization chamber to produce charged particles. The positively charged metal plate attracts the negatively charged ions (electrons) and the negatively charged plate attracts the positively charged ions (mostly oxygen and nitrogen). The steady flow of ions creates a small but steady current.

The current is disrupted when smoke enters the ionization chamber. Smoke particles attach to the charged ions and restore them to a neutral electrical

state. This reduces the flow of electricity between the two plates in the ionization chamber, and when the electric current drops below a certain threshold, the alarm is triggered. Hot air entering the chamber changes the rate of ionization and therefore, the electric current level, which triggers an alarm.

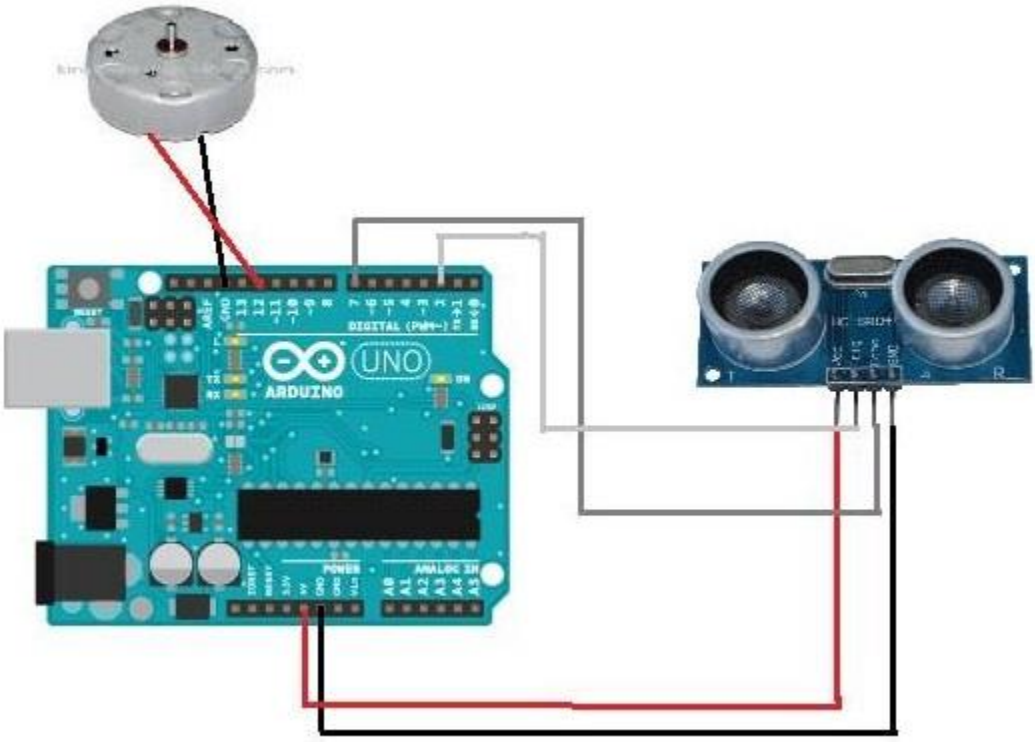
Circuit Diagram :

Motion sensor

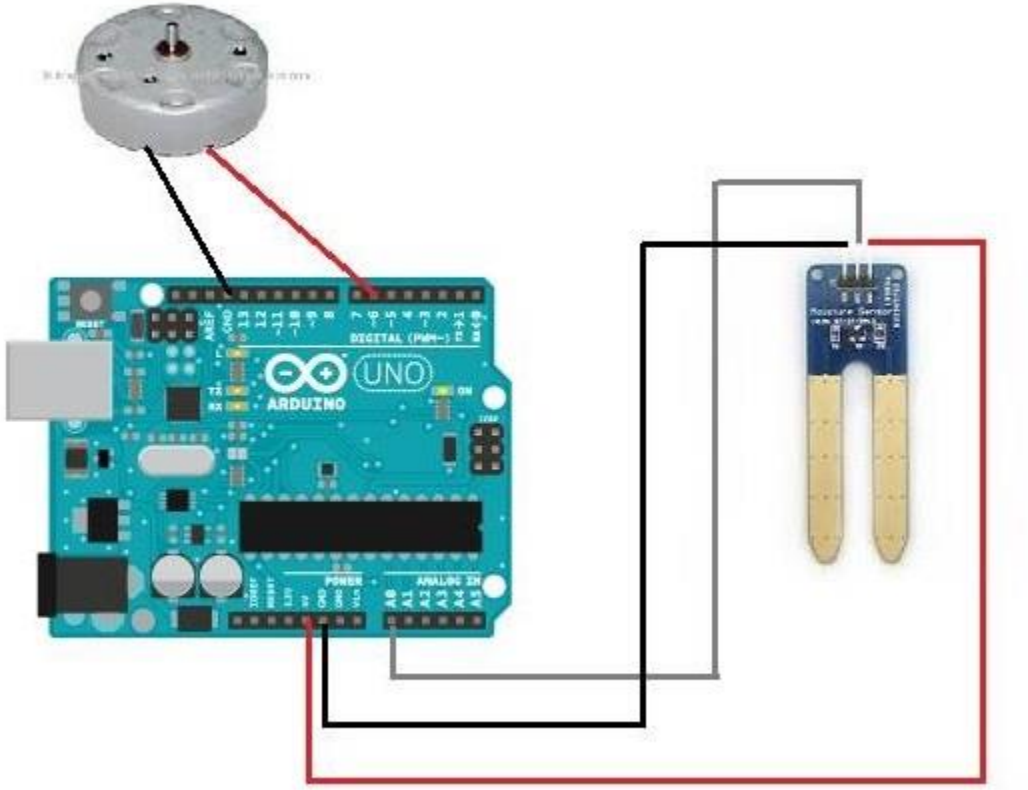


Smoke detector :

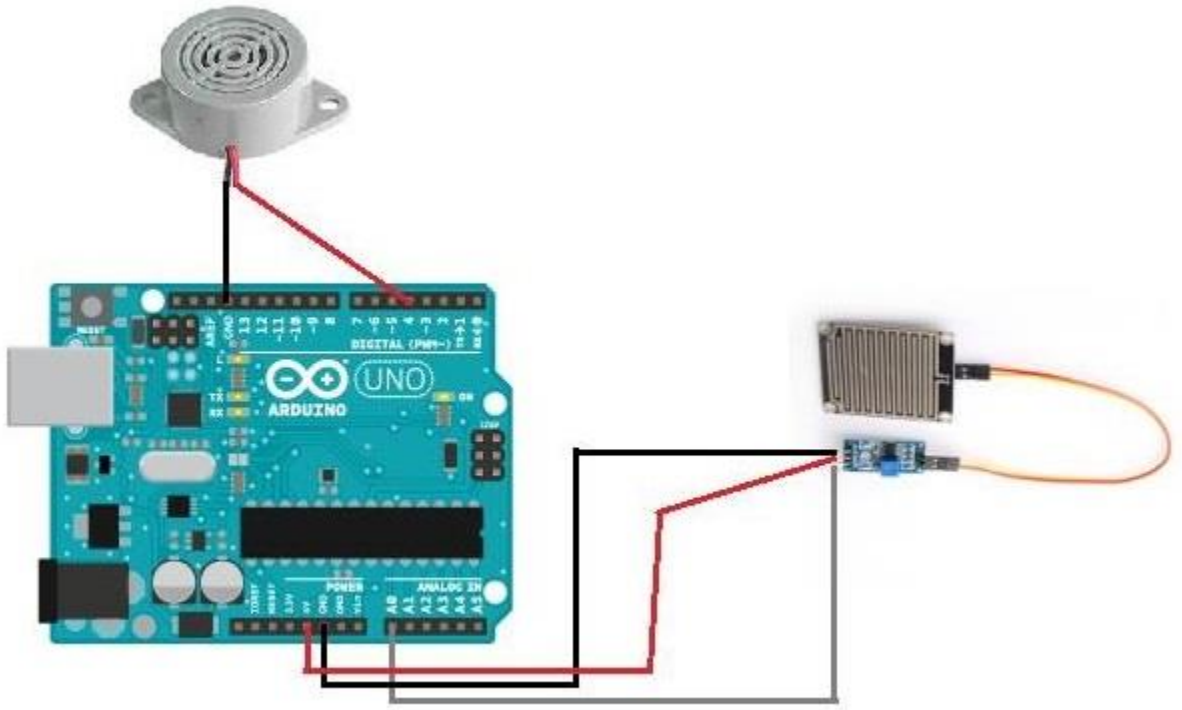
Water level detecting :



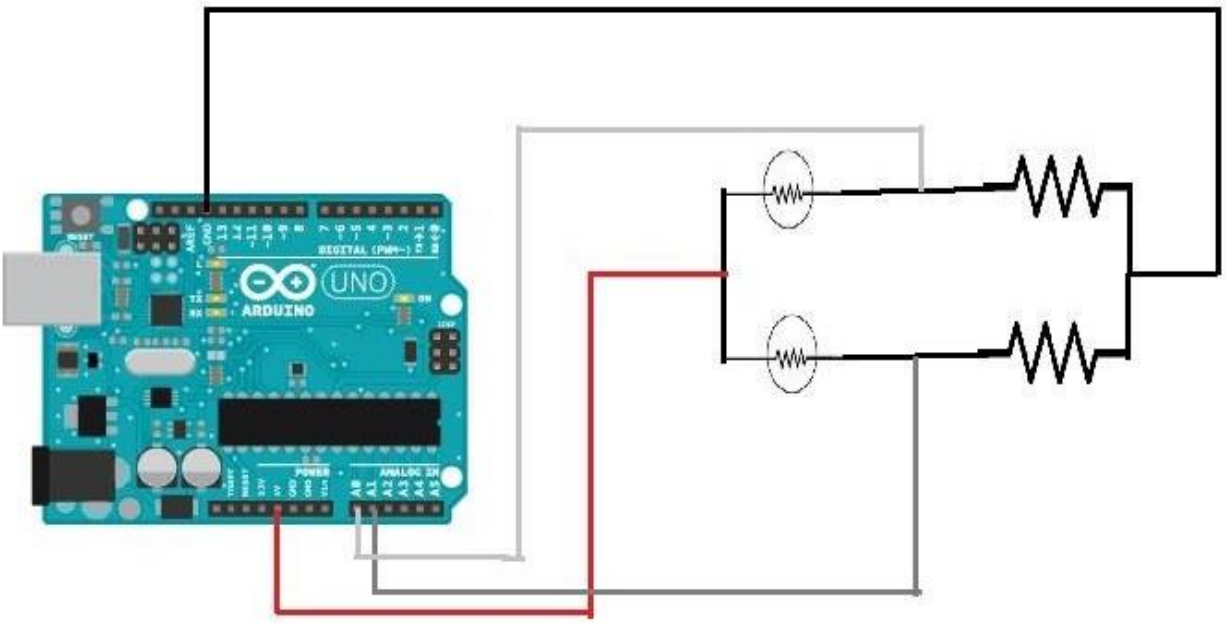
Moisture detecting pump :



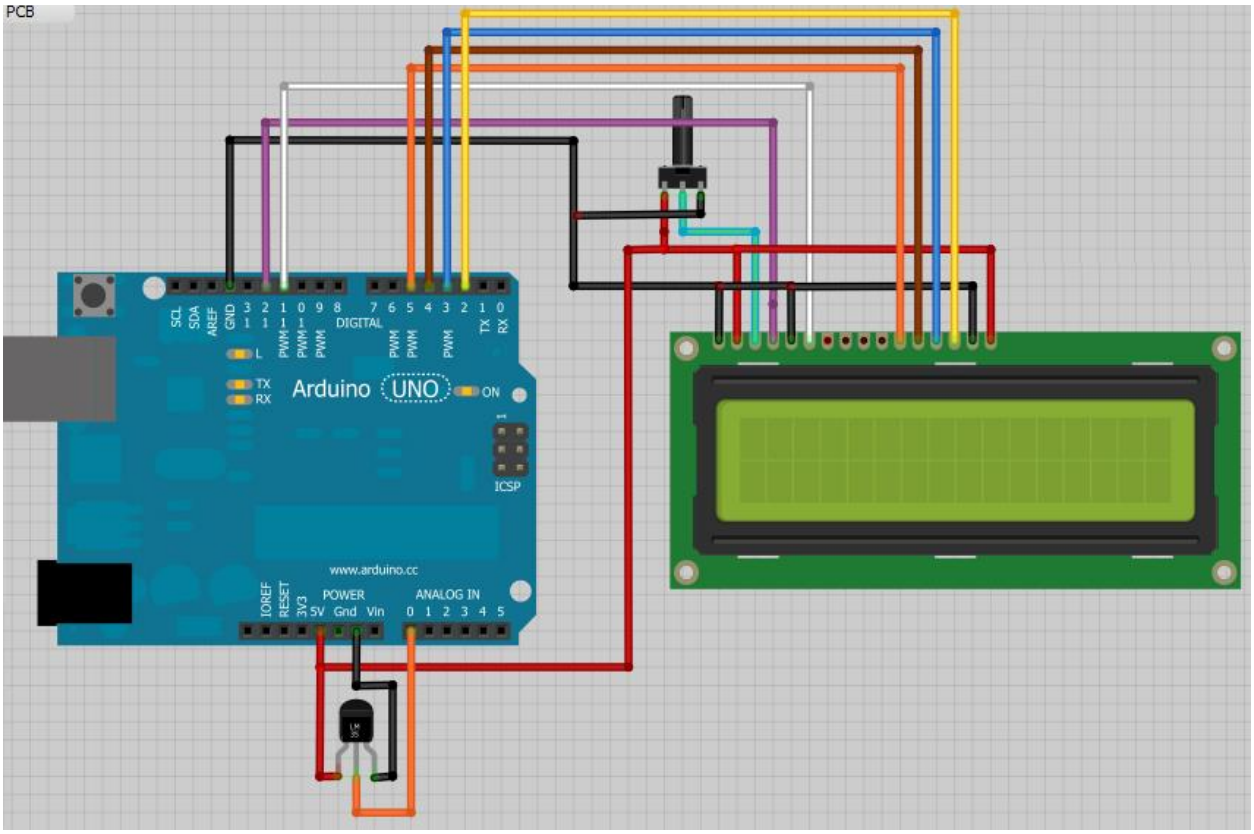
Rain Alarm :



Solar Tracker :



Temperature Control Fan :



Code:

```
//**********RFID******************
#include <Servo.h>
#include <SPI.h>
#include <MFRC522.h>
```

```
#include <LiquidCrystal.h>


LiquidCrystal lcd(A0,A1,A2,A3,A4,A5);



#define switch_pin 3
#define switch_pin_2 4


#define closse 180
#define open 90

byte readCard[4];


#define SS_PIN 10
#define RST_PIN 9


MFRC522 mfrc522(SS_PIN, RST_PIN);

byte permitted_card[4]={0xD2 , 0x01 , 0x6F , 0xB8};
//D2016FB8
```

```
int arrived=0;
Servo gate;


void setup()
{
  lcd.begin(16,2);

  Serial.begin(9600);
  Serial.println(" Start...");
  gate.attach(5);
  SPI.begin();
  mfrc522.PCD_Init();
  mfrc522.PCD_SetAntennaGain(mfrc522.RxGain_max);

 pinMode (switch_pin,INPUT);

  gate.write(180);
  delay(15);

  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print(" Welcome ");
  lcd.setCursor(0,1);
  lcd.print("Show your ID ");
```

```
}


void loop()
{

  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print(" Welcome ");
  lcd.setCursor(0,1);
  lcd.print("Show your ID ");


  if( digitalRead(switch_pin)==1)
  {
    Serial.println("Gate opened ");
    gate.write(open);
    delay(15);

    while(digitalRead(switch_pin_2) != 1);

    Serial.println("Gate closed ");
    gate.write(closse);
```

```
  delay(15);

  delay(200);


}



  if ( read_id()==1 )
  {
    //if(memcmp(readCard , permitted_card ,4 )== 0)
    if(check())
    {
      Serial.println("Password matched .");

      lcd.clear();
      lcd.setCursor(0, 0);
      lcd.print("Password matched");
      lcd.setCursor(0, 1);
      lcd.print("Please enter  ");

      gate.write(open);
      delay(15);
```

```
  while(digitalRead(switch_pin) != 1);

  delay(200);

  gate.write(closse);
  delay(15);




}
else
{
  Serial.println(" Password didn't  match .");



  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Access Denied");
  lcd.setCursor(0, 1);
  lcd.print("****************");

  delay(2000);
```

```
      }


   }


  delay(200);


}
```

```
int read_id()
{
   if ( ! mfrc522.PICC_IsNewCardPresent()) {
    return 0;
  }
  if ( ! mfrc522.PICC_ReadCardSerial()) {
    return 0;
  }

  Serial.println("Scanned PICC's UID:");
```

```
  for (int i = 0; i < 4; i++) {
    readCard[i] = mfrc522.uid.uidByte[i];
    Serial.print(readCard[i], HEX);
  }
  Serial.println("");
  mfrc522.PICC_HaltA();  return 1;
}

int check()
{
  int yy=0;

   for( int m=0; m<4 ; m++)
   {
      if(permitted_card[m]==readCard[m])
      yy=1;
      else
      yy=0;


    }
    return yy;
}
//******************Solar*****************
#include <Servo.h>
Servo myservo;
```

```
int pos = 90;
int tolerance = 2;

void setup() {
  myservo.attach(9);
  pinMode(A0,INPUT);
  pinMode(A1,INPUT);
  myservo.write(pos);
  delay(50);

}

void loop() {
  int val1 = analogRead(A0);
  int val2 = analogRead(A1);
  if((abs(val1 - val2) <= tolerance) || (abs(val2 - val1) <= tolerance)) {
   // DO NOTHING
 }else {
  if(val1 > val2)
    {
      pos = --pos;
    }
  if(val1 < val2)
    {
      pos = ++pos;
    }
```

```
 }
  if(pos > 180) { pos = 180; }
  if(pos < 0) { pos = 0; }

  myservo.write(pos);
  delay(50);

  }

int sensorValue0;
float inputVoltage0;

void setup() {
  pinMode(A0 ,INPUT);
  pinMode(4,OUTPUT);

  Serial.begin(9600);
}

void loop() {

  sensorValue0 = analogRead(A0);
   inputVoltage0 = sensorValue0 * 0.0049;

  Serial.println(inputVoltage0);
  delay(500);
```

```
 if(inputVoltage0>4.95)
 {
  digitalWrite(4,HIGH);

 }

 if(inputVoltage0<4.95)
 {
  digitalWrite(4,LOW);

 }


}
#include <LiquidCrystal.h>
LiquidCrystal lcd(7,10,5,4,6,2);
int tempPin = A1;
int fan = 11;
int led = 8;
int temp;
int tempMin = 30;
int tempMax = 70;
int fanSpeed;
int fanLCD;
```

```
void setup() {
  pinMode(fan, OUTPUT);
  pinMode(led, OUTPUT);
  pinMode(tempPin, INPUT);
  lcd.begin(16,2);
}

void loop() {
   temp = readTemp();
   if(temp < tempMin) {
      fanSpeed = 0;
      digitalWrite(fan, LOW);
   }
   if((temp >= tempMin) && (temp <= tempMax)) {
      fanSpeed = map(temp, tempMin, tempMax, 32, 255);
      fanLCD = map(temp, tempMin, tempMax, 0, 100);
      analogWrite(fan, fanSpeed);  // spin the fan at the fanSpeed speed
   }

   if(temp > tempMax) {       // if temp is higher than tempMax
     digitalWrite(led, HIGH);  // turn on led
   } else {                   // else turn of led
     digitalWrite(led, LOW);
   }

   lcd.print("TEMP: ");
```

```
  lcd.print(temp);      // display the temperature
  lcd.print("C ");
  lcd.setCursor(0,1);   // move cursor to next line
  lcd.print("FANS: ");
  lcd.print(fanLCD);    // display the fan speed
  lcd.print("%");
  delay(200);
  lcd.clear();
}

int readTemp() {
  temp = analogRead(tempPin);
  return temp * 0.48828125;
}
int sensorValue0;
float inputVoltage0;

void setup() {
  pinMode(A0 ,INPUT);
  pinMode(4 ,OUTPUT);
  Serial.begin(9600);
}

void loop() {
sensorValue0 = analogRead(A0);
inputVoltage0 = sensorValue0 * 0.0049;
```

```
 Serial.println(inputVoltage0);
 delay(500);

  if(inputVoltage0>3)
  {
    digitalWrite(4,HIGH);
    delay(5000);
  }

  if(inputVoltage0<3)
  {
    digitalWrite(4,LOW);

  }

}
#include <SoftwareSerial.h>
int sensorValue0,sensorValue1,sensorValue2,sensorValue3,sensorValue4,sensorValue5;
float inputVoltage0,inputVoltage1,inputVoltage2,inputVoltage3,inputVoltage4,inputVoltage5;
long duration, distance;

SoftwareSerial Genotronex(10, 11); // RX, TX

int ledpin=33; // led on D13 will show blink on / off
```

```
int BluetoothData; // the data given from Computer


void setup() {
  pinMode(A0 ,INPUT);  //FAN LM35 Input
  pinMode(A1 ,INPUT);  //LDR INPUT
  pinMode(A2 ,INPUT);  //SMOKE DETECTOR INPUT
  pinMode(A3 ,INPUT);  //MOTION SENSOR INPUT
  pinMode(A4 ,INPUT);  //RAIN SENSOR???
  pinMode(A5 ,INPUT);  //IRRIGATION SENSOR
 pinMode(21 ,INPUT);    //Echo pin     WLI
 pinMode(22 ,OUTPUT);   //Trigger pin WLI
 pinMode(23 ,OUTPUT);   //MOTOR       WLI
 pinMode(24 ,OUTPUT);   //MOTOR LED1  WLI
 pinMode(25 ,OUTPUT);   //MOTOR LED2  WLI
 pinMode(26 ,OUTPUT);   //MOTOR LED3  WLI
 pinMode(3 ,OUTPUT);   //FAN OUTPUT
 pinMode(27,OUTPUT);   //LDR OUTPUT
 pinMode(28,OUTPUT);    //SMOKE OUTPUT
 pinMode(29,OUTPUT);   //MOTION OUTPUT
 pinMode(30,OUTPUT);   //RAIN ALARM
 pinMode(31,OUTPUT);   //IRRIGATION SYSTEM

  Genotronex.begin(9600);
  Genotronex.println("Bluetooth On please press 1 or 0 blink LED ..");
  pinMode(ledpin,OUTPUT);
```

```
 Serial.begin(9600);
}

void loop() {

  sensorValue0 = analogRead(A0);
  inputVoltage0 = sensorValue0 * 0.0049*100;
  sensorValue1 = analogRead(A1);
  inputVoltage1 = sensorValue1 * 0.0049;
  sensorValue2 = analogRead(A2);
  inputVoltage2 = sensorValue2 * 0.0049;
  sensorValue3 = analogRead(A3);
  inputVoltage3 = sensorValue3 * 0.0049;
  sensorValue4 = analogRead(A4);
  inputVoltage4 = sensorValue4 * 0.0049;
  sensorValue5 = analogRead(A5);
  inputVoltage5 = sensorValue5 * 0.0049;
   ///////////////

  //Serial.println(sensorValue0);
  //Serial.println(sensorValue1);
  Serial.println(sensorValue2);
  //Serial.println(sensorValue3);
  //Serial.println(sensorValue4);
  //Serial.println(sensorValue5);
  //Serial.println("\n\n");
```

```
 delay(1500);




//************* TEMPERATURE CONTROLL FAN *************//


 if(inputVoltage0>33.0){
   analogWrite(3,255);
 }
 else if(inputVoltage0>30.0){
   analogWrite(3,210);
 }
 else if(inputVoltage0>27.0){
   analogWrite(3,165);
 }
  else if(inputVoltage0>24.0){
   analogWrite(3,145);
 }
  else if(inputVoltage0>21.0){
   analogWrite(3,100);
 }
  else{
   analogWrite(3,LOW);
```

```
 }


//********************** LDR ********************//

if(inputVoltage1>130) {
   digitalWrite(27,HIGH);
  }
 if(inputVoltage1<130) {
   digitalWrite(27,LOW);
    }




//**************** WATER LEVEL INDICATOR ***************//

 digitalWrite(22, LOW);
 delayMicroseconds(2);

 digitalWrite(22, HIGH);
 delayMicroseconds(10);

 digitalWrite(22, LOW);
 duration = pulseIn(21, HIGH);
```

```
//Calculate the distance (in cm) based on the speed of sound.
 distance = duration/58.2;

 Serial.println(distance);
 delay(500);
 if(distance>30){
   digitalWrite(23,HIGH);
   digitalWrite(24,LOW);
   digitalWrite(25,LOW);
   digitalWrite(26,LOW);
}
 if(distance>20 && distance<30){
   digitalWrite(23,HIGH);
   digitalWrite(24,HIGH);
   digitalWrite(25,LOW);
   digitalWrite(26,LOW);
}
  if(distance>10 && distance<20){
   digitalWrite(4,HIGH);
   digitalWrite(6,HIGH);
   digitalWrite(5,LOW);
   digitalWrite(2,LOW);

}
  if(distance>5 && distance<10){
```

```
  digitalWrite(23,HIGH);
  digitalWrite(24,HIGH);
  digitalWrite(25,LOW);
  digitalWrite(26,LOW);

}
if(distance<5 ){
  digitalWrite(23,LOW);
  digitalWrite(24,LOW);
  digitalWrite(25,LOW);
  digitalWrite(26,HIGH);
}



//********************* SMOKE DETECTOR ***************//

if(sensorValue2<200){
digitalWrite(28,LOW);
}
if(sensorValue2>200){
digitalWrite(28,HIGH);
}
```

```
//********************** MOTION SENSOR ******************//

 if(inputVoltage3>3)
 {
   digitalWrite(29,HIGH);
 }

 if(inputVoltage3<3)
 {
   digitalWrite(29,LOW);
    }


//************************ RAIN SENSOR ******************//

  if( sensorValue0<300)
  digitalWrite(30,HIGH);
  if( sensorValue0>300)
  digitalWrite(30,LOW);


  //******************* IRRIGATION SYSTEM **************//
```

```
 if( sensorValue0>500)
 digitalWrite(31,HIGH);
 if( sensorValue0<500)
 digitalWrite(31,LOW);



 //****************** BLUETOOTH SWITCH ****************//

   if (Genotronex.available()){
BluetoothData=Genotronex.read();
  if(BluetoothData=='1'){   // if number 1 pressed ....
  digitalWrite(ledpin,HIGH);
  Genotronex.println("LED  On D13 ON ! ");
  }
 if (BluetoothData=='0'){// if number 0 pressed ....
 digitalWrite(ledpin,LOW);
  Genotronex.println("LED  On D13 Off ! ");
 }
}

}
```

Problems / Drawback:

1. **We can't upload code connecting TX and RX pin.**
2. **Solar construction and control is much difficult.**
3. **Laser position is displacing.**
4. **Motion sensor works on high range of area.**
5. **Smoke and motor takes high current, so we can't connect directly to the arduino.**
6. **In door lock system, we face difficulties to set the gate position, led position, RFID position.**
7. **The home should be more stable**

Improvement :

We will add GSM so that if anyone presses any invalid card at door the owner will get a message. If there is fire alarm another message will be sent.

We will add ETHERNET shield so that owner can access all the switches through internet from any corner of the world.

Discussion :

By this project we can know about different sensor and how they work. We also known that how those sensor can be implement on our daily life makes our home digitalize.