ELC ACTIVITY

Cyber security and Internet Security

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ELC Activity

- This activity deals with the design and implementation of an IoT-based Smart Remote Monitoring System.
- During this activity, the students have to work with the sensors and modules and they need to do its interfacing with the Arduino.
- This hands-on session would be a fun and engaging way to learn with your fellow friends and mentors.

Applications can be…

- Design a Smart Home Security System.
- Design a security system to protect the lockers in banks.
- Design an automatic door bell system to ring the bell when a human is detected.
- Design a system which can be used in museums to protect valuable things
- Design a system which can detect some unpleasant event, for example, flame or gas leakage in industrial buildings.
- Design a theft detection system for shopping malls.
- Design an alert system to identify unusual activities in banks, offices etc.

These are indicative activities only; you are free to explore to go to the next level.

Come up with innovative ideas of utilizing the available hardware in the best possible way for a particular application of your choice.

Assessment

- Submit short video of 4-5 minutes in which all the team members have to participate and Report in pdf which comprised of title of project, team member details, objectives, need analysis, working methodology (maximum 2 pages)
- Submission will be via link (provided on LMS)
- Group members can submit the same video and report through their individual accounts on LMS portal but evaluation will be group wise.

Equipments

- You all will be provided with the sensors and other required hardware.
- Each group representative needs to collect them.
- Hands on using them and develop a real time applications.

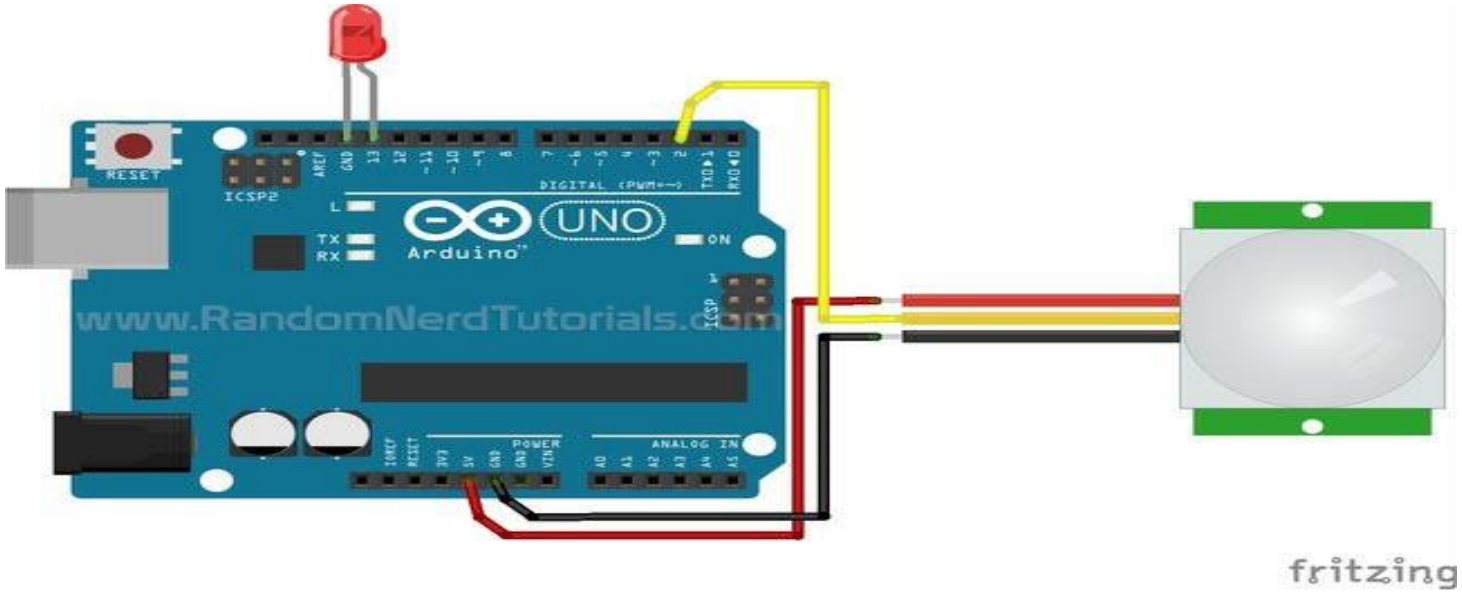
List of Hardware

Major	Minor
PIR Sensor (Motion Sensor) IR Sensor Ultrasonic Sensor Flame Sensor Gas Sensor RFID Sensor EM-18 RFID Reader Module ESP8266 I2C LCD LCD Display	Mega Arduino Board Multimeter Resistors Jumper wires Breadboard Switches

PIR Sensor with Arduino

PIR sensor has three terminals: V_{cc}, OUT, and GND. Connect the sensor as follows:

- Connect the $+V_{cc}$ to +5v on Arduino board.
- Connect OUT to digital pin 3 on Arduino board.
- Connect GND with GND on Arduino.
- Connect LED in between the Pin no. 13 and GND.
- Circuit Magic.com



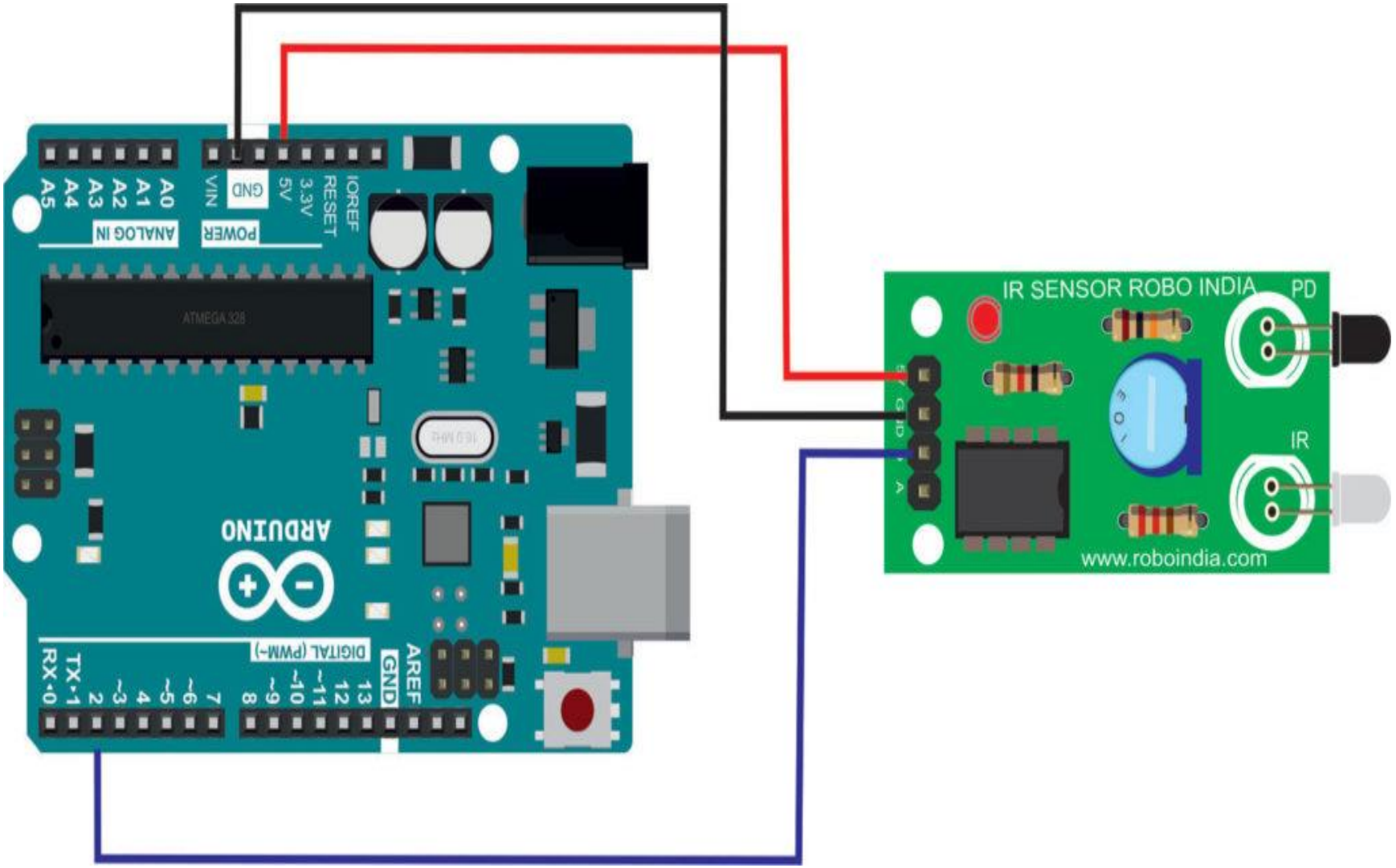
PIR SENSOR

```
//the time we give the sensor to calibrate (10-60 secs according to the datasheet)
int calibrationTime = 30;

//the time when the sensor outputs a low impulse
long unsigned int lowIn;

//the amount of milliseconds the sensor has to be low
//before we assume all motion has stopped
long unsigned int pause = 5000;

boolean lockLow = true;
boolean takeLowTime;

int pirPin = 3;    //the digital pin connected to the PIR sensor's output
int ledPin = 13;


////////////////////////////
//SETUP
void setup(){
  Serial.begin(9600);
  pinMode(pirPin, INPUT);
  pinMode(ledPin, OUTPUT);
  digitalWrite(pirPin, LOW);

  //give the sensor some time to calibrate
  Serial.print("calibrating sensor ");
    for(int i = 0; i < calibrationTime; i++){
      Serial.print(".");
      delay(1000);
      }
    Serial.println(" done");
    Serial.println("SENSOR ACTIVE");
    delay(50);
  }
```

PIR SENSOR (contd..)

```
////////////////////////////
//LOOP
void loop(){

     if(digitalRead(pirPin) == HIGH){
       digitalWrite(ledPin, HIGH);   //the led visualizes the sensors output pin state
       if(lockLow){
         //makes sure we wait for a transition to LOW before any further output is made:
         lockLow = false;
         Serial.println("---");
         Serial.print("motion detected at ");
         Serial.print(millis()/1000);
         Serial.println(" sec");
         delay(50);
         }
         takeLowTime = true;
       }

     if(digitalRead(pirPin) == LOW){
       digitalWrite(ledPin, LOW);  //the led visualizes the sensors output pin state

       if(takeLowTime){
        lowIn = millis();          //save the time of the transition from high to LOW
        takeLowTime = false;       //make sure this is only done at the start of a LOW pl
        }
       //if the sensor is low for more than the given pause,
       //we assume that no more motion is going to happen
       if(!lockLow && millis() - lowIn > pause){
           //makes sure this block of code is only executed again after
           //a new motion sequence has been detected
           lockLow = true;
           Serial.print("motion ended at ");      //output
           Serial.print((millis() - pause)/1000);
           Serial.println(" sec");
           delay(50);
           }
       }
  }
```

IR Sensor


IR SENSOR ROBO INDIA
PD
IR
www.roboindia.com
ARDUINO
POWER
ANALOG IN
DIGITAL (PWM~)

IR Sensor

https://www.youtube.com/watch?v=nF8z7RcEulk

https://www.youtube.com/watch?v=SKJGARYRGwQ&fbclid=IwAR2o8wrfZBCrg2SJAfmaGjhpLxU_vToE1yjZVdIVQoWOEQgVCULtuPvmxzQ

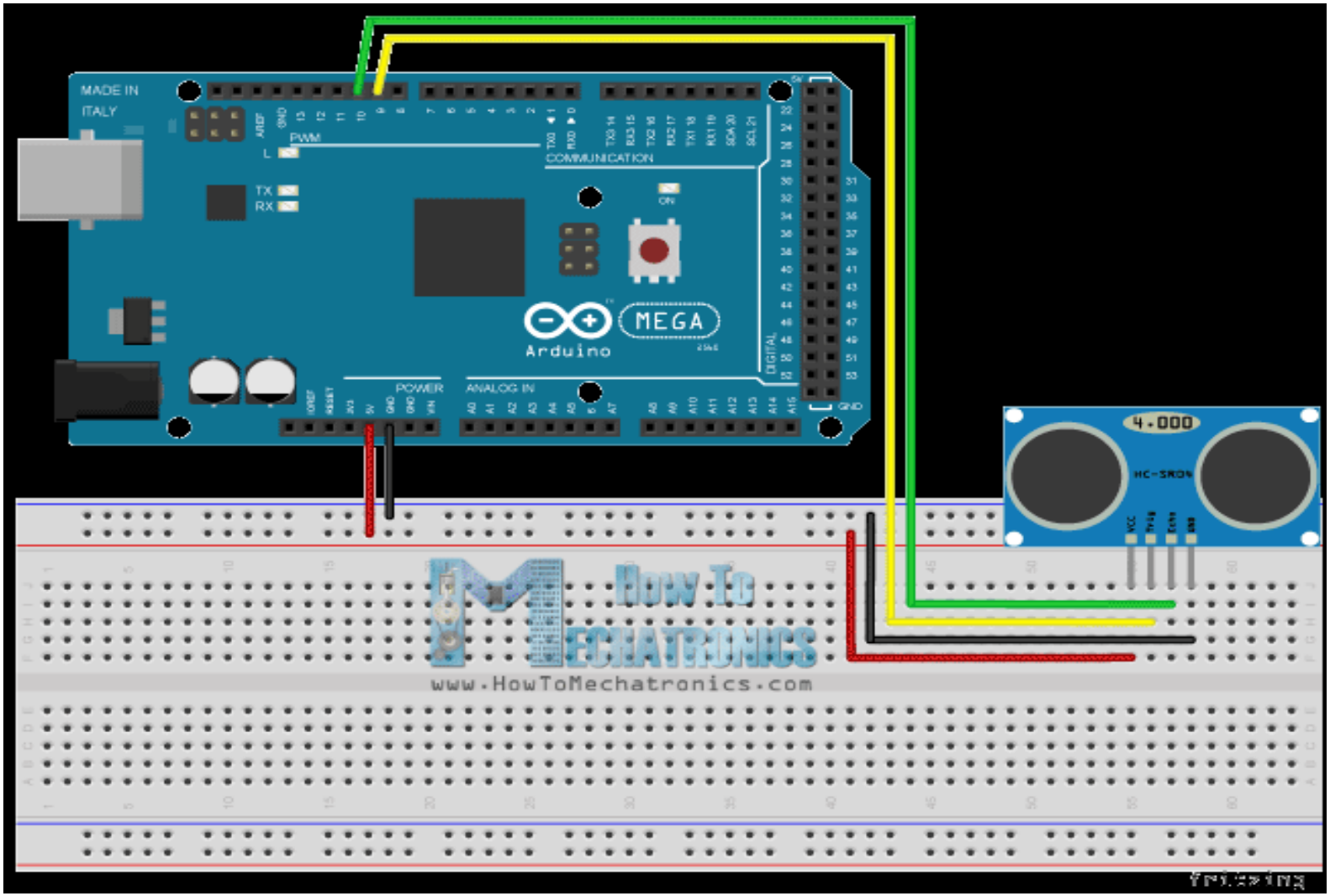
```
void setup()  {
   pinMode(7,INPUT);
   Serial.begin(9600);
   pinMode(13,OUTPUT);
}

void loop()  {

Serial.print("IRSensorip   ");
Serial.println(digitalRead(7));

if(digitalRead(7)==0)
{
   digitalWrite(13,HIGH);
   }
 else{
      digitalWrite(13,LOW);
      }

}
```

Ultrasonic Sensor

- The transmitter transmits ultrasonic pulses & they are reflected back & gets sensed by the receiver if any obstacle lies between the path.
  The range of this ultrasonic is about 4 metres. There is a chance of error of +-3cm in measuring the distance.
  It measures the time interval between sending & receiving the pulse & then by a formula – gives us the distance.
- It has got 4 pins :-
  VCC – connect it to 5V supply.
  GND – connect it to ground.
  echopin, trigpin – connect it to any digital pin (as of here, we've connected them to 9, 10).
- & the positive terminal of the LED is connected to pin number 7 on Arduino .

http://mechstuff.com/connection-interfacing-programming-of-ultrasonic-sensor-hc-sr04/

Ultrasonic Sensor

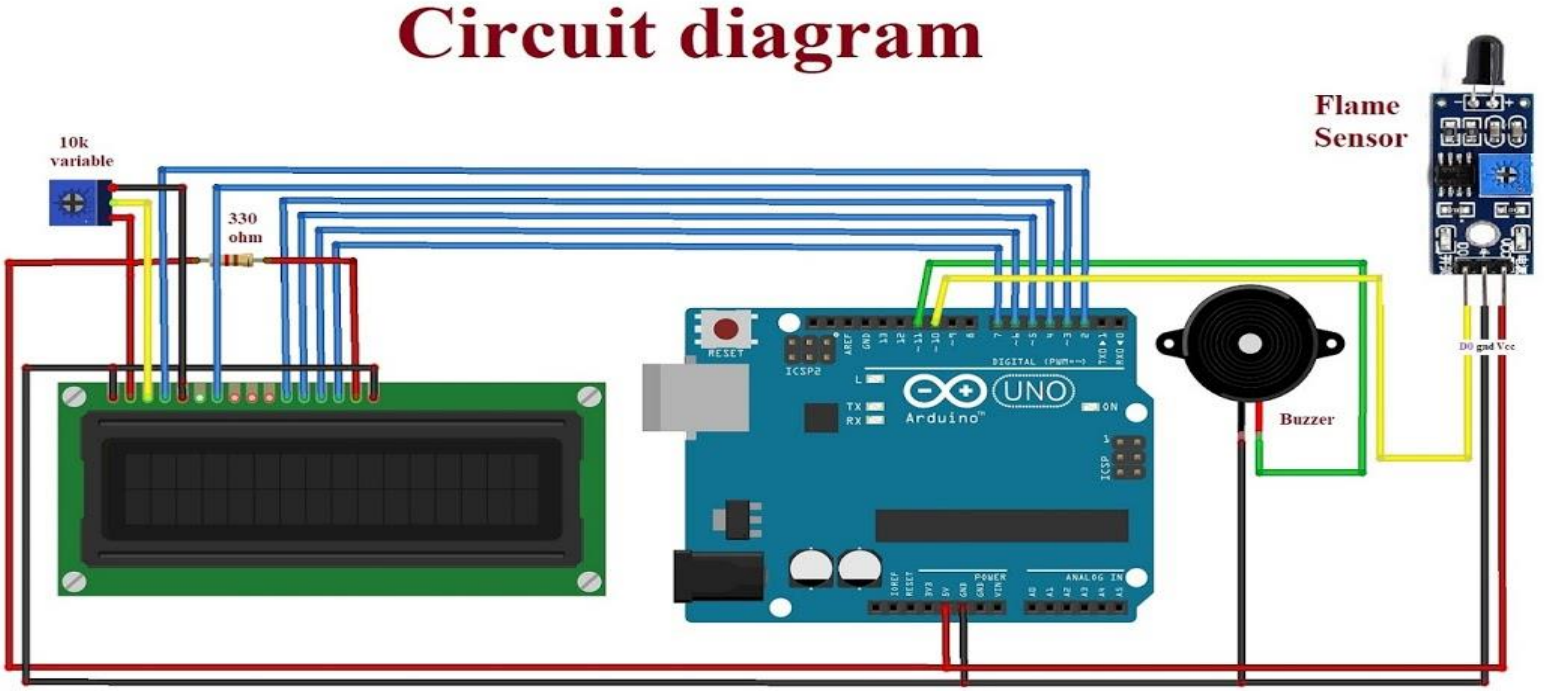


Ultrasonic sensor code

```
int trigPin = 9;
int echoPin = 10;
int led = 7;


void setup() {
   Serial.begin(9600);
    pinMode(led, OUTPUT);
    pinMode(trigPin, OUTPUT);
   pinMode(echoPin, INPUT);
   // put your setup code here, to run once:

}

void loop() {
   long duration, distance;
   digitalWrite(trigPin,HIGH);
   delayMicroseconds(1000);
   digitalWrite(trigPin, LOW);
   duration=pulseIn(echoPin, HIGH);
   distance =(duration/2)/29.1;
   Serial.print(distance);
   Serial.println("CM");
   delay(10);

 if((distance<=10))
   {
     digitalWrite(led, HIGH);
}
    else if(distance>10)
 {
      digitalWrite(led, LOW);
    }
```

Flame Sensor

- https://www.youtube.com/watch?v=OgIhextacLk



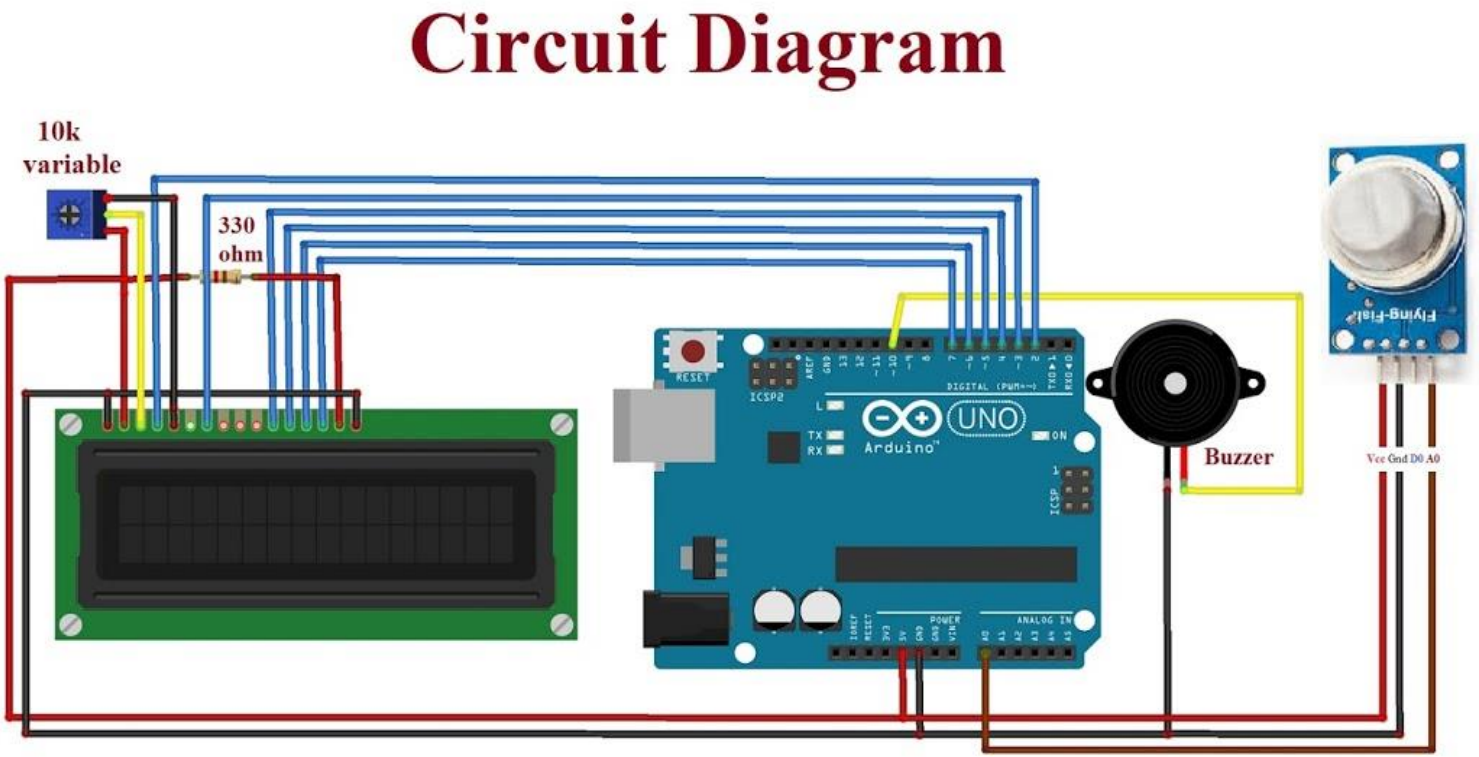
Flame Sensor

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);

#define flamePin 10
#define buzzerPin 11


void setup() {
 Serial.begin(9600);
 lcd.begin(16, 2);

 pinMode(buzzerPin,OUTPUT);
 pinMode(flamePin,INPUT);

  lcd.setCursor(0, 0);
  lcd.print("Calibrating");
    for(int i = 0; i <15; i++){
      if (i==4)
      {
         lcd.setCursor(0, 1);
         lcd.print(".");
        }
       else  lcd.print(".");
      delay(500);
      }
    lcd.setCursor(11, 1);
    lcd.print("Done");
    delay(1000);
    lcd.clear();
    lcd.setCursor(1, 0);
    lcd.print("Sensor Active");
    delay(1500);
    lcd.clear();

}

void loop() {
```

```
void loop() {

int Flame = digitalRead(flamePin);

  if (Flame == LOW)
  {
     digitalWrite(buzzerPin,HIGH);
     lcd.setCursor(0, 0);
     lcd.print(" Flame : ");
     lcd.print("Flame");
     lcd.setCursor(0, 1);
     lcd.print("  is Detected");
     Serial.print(Flame);
     Serial.print("\t");
     Serial.print("Flame is Detected");
  }
  else if (Flame == HIGH)
  {
     digitalWrite(buzzerPin,LOW);
     lcd.setCursor(0, 0);
     lcd.print("Flame : ");
     lcd.print("No Flame");
     Serial.print(Flame);
     Serial.print("\t");
     Serial.println("No Flame");
  }

  delay(300);
  lcd.clear();
}
```

Gas Sensor

https://www.youtube.com/watch?v=pCECQEZ147E



Gas Sensor

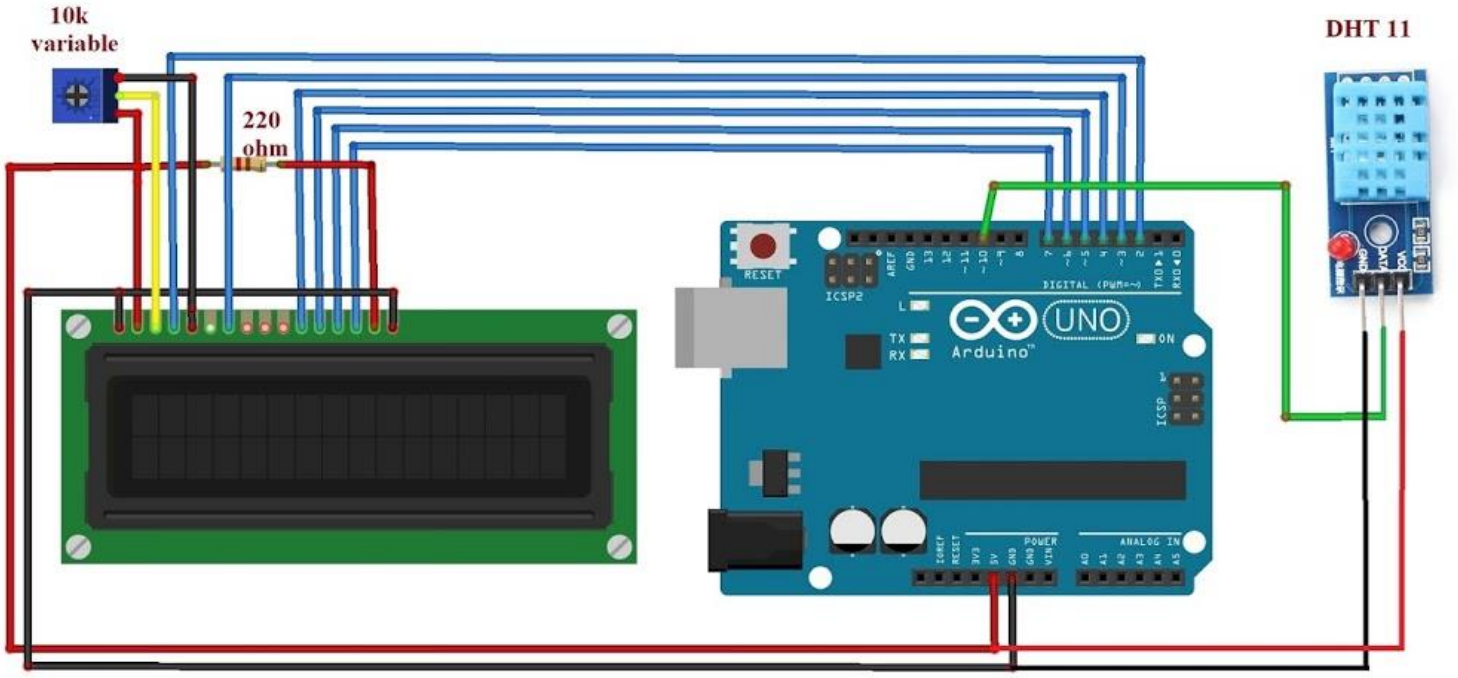
```
#include <LiquidCrystal.h>
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);
#define buzzerPin 10
#define gasPin A0

void setup() {
 Serial.begin(9600);
 lcd.begin(16, 2);

 pinMode(buzzerPin,OUTPUT);

 lcd.setCursor(0, 0);
  lcd.print("Calibrating");
    for(int i = 0; i <10; i++){
      if (i==4)
      {
         lcd.setCursor(0, 1);
         lcd.print(".");
        }
       else  lcd.print(".");
      delay(500);
      }
    lcd.setCursor(5, 1);
    lcd.print("done");
    delay(1000);
    lcd.clear();
    lcd.setCursor(1, 0);
    lcd.print("SENSOR ACTIVE");
    delay(1500);
    lcd.clear();

}
```

```
void loop() {

int gasSensor = analogRead(gasPin);

  if (gasSensor > 350)
  {
     digitalWrite(buzzerPin,HIGH);
     lcd.setCursor(0, 0);
     lcd.print("Value : ");
     lcd.print(gasSensor);
     Serial.print(gasSensor);
     Serial.print("\t");
     lcd.setCursor(0, 1);
     Serial.println("Gas is Detected");
     lcd.print("Gas is Detected");
     delay(300);
     lcd.clear();
  }
  else if (gasSensor < 350)
  {
     digitalWrite(buzzerPin,LOW);
     lcd.setCursor(0, 0);
     lcd.print("Value : ");
     lcd.print(gasSensor);
     Serial.print(gasSensor);
     Serial.print("\t");
     lcd.setCursor(0, 1);
     Serial.println("No Gas");
     lcd.print("No Gas");
     delay(300);
  }

}
```

Temperature and Humidity Sensor (DHT11)

https://www.youtube.com/watch?v=GVyabySFkFI

Circuit Diagram



Temperature and Humidity Sensor (DHT11)

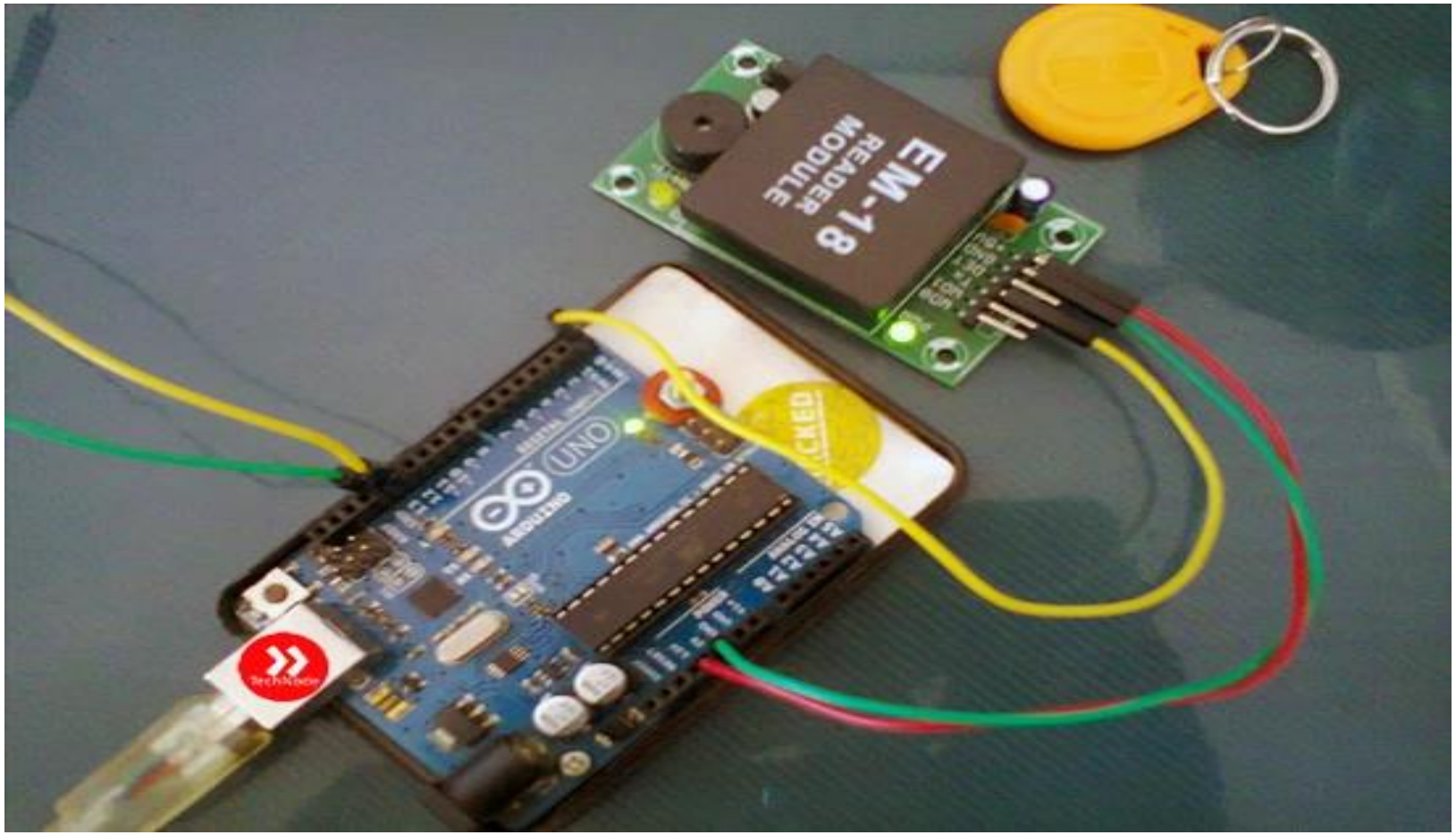
```
#include <Adafruit_Sensor.h>
#include <DHT.h>
#include <DHT_U.h>
#include <LiquidCrystal.h>
const int rs = 2, en = 3, d4 = 4, d5 = 5, d6 = 6, d7 = 7;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

#define DHTPIN            10          // Pin which is connected to the DHT sensor.

#define DHTTYPE           DHT11     // DHT 11

DHT_Unified dht(DHTPIN, DHTTYPE);

uint32_t delayMS;

void setup() {
  Serial.begin(9600);
  lcd.begin(16, 2);
  // Initialize device.
  dht.begin();
  Serial.println("DHTxx Unified Sensor Example");
  // Print temperature sensor details.
  sensor_t sensor;
  dht.temperature().getSensor(&sensor);

  dht.humidity().getSensor(&sensor);

  delayMS = sensor.min_delay / 1000;

  lcd.setCursor(0, 0);
  lcd.print("Calibrating");
    for(int i = 0; i <10; i++){
      if (i==4)
      {
         lcd.setCursor(0, 1);
         lcd.print(".");
        }
       else  lcd.print(".");
      delay(500);
      }
lcd.setCursor(5, 1);
lcd.print("done");
delay(1000);
lcd.clear();
lcd.setCursor(1, 0);
lcd.print("SENSOR ACTIVE");
delay(1500);

}
```

Temperature and Humidity Sensor (DHT11)

```
void loop() {
  // Delay between measurements.
  delay(delayMS);
  lcd.clear();
  // Get temperature event and print its value.
  sensors_event_t event;
  dht.temperature().getEvent(&event);
  if (isnan(event.temperature)) {
    Serial.println("Error reading temperature!");
  }
  else {
    lcd.setCursor(0, 0);
    lcd.print("Temp : ");
    Serial.print("Temperature: ");
    Serial.print(event.temperature);
    lcd.print(event.temperature);
    Serial.println(" *C");
    lcd.write(0xdf);       // for dgree sign
    lcd.print("C ");
  }
  // Get humidity event and print its value.
  dht.humidity().getEvent(&event);
  if (isnan(event.relative_humidity)) {
    Serial.println("Error reading humidity!");
  }
  else {
    lcd.setCursor(0, 1);
    lcd.print("Humidity: ");
    Serial.print("Humidity: ");
    Serial.print(event.relative_humidity);
    lcd.print(event.relative_humidity);
    lcd.print("%");
    Serial.println("%");
  }
```

EM-18 RFID Reader Module

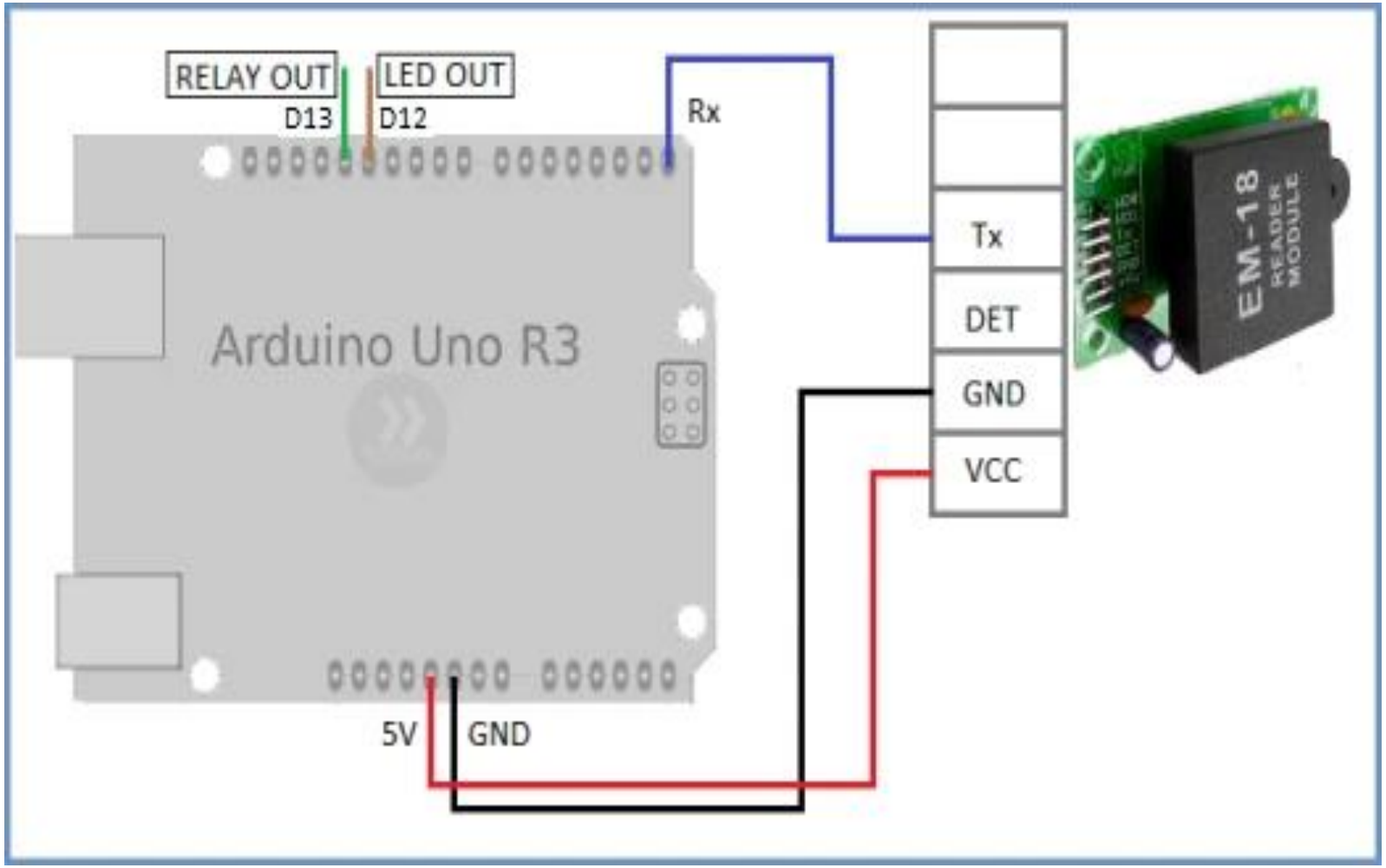
https://www.electroschematics.com/arduino-rfid-access-control-em-18/



EM-18 RFID Reader Module

```
int count = 0;
void setup()
{
        Serial.begin(9600);
}
void loop()
{
        if(Serial.available())
        {
                count = 0; // Reset count to zero// Keep reading Byte by Byte from the Buffer till the
                {
                        char input = Serial.read();
                        Serial.print(input);
                        count++; //
                        delay(5); //
                }
                Serial.println();
                Serial.print("Tag Length : ");
                Serial.print(count);
                Serial.println(" Bytes");
        }
}
```

EM-18 RFID Reader Module (Access Control)



EM-18 RFID Reader Module (Access Control)

```
/* Arduino Simple RFID Access Control
Using EM-18 RFID Reader Module
Prefatory Code For Novices
An inspired design. Thanks to Internet!
T.K.Hareendran
Project designed & tested at TechNode on 17.02.2014
https://www.electroschematics.com */
#define RELAYPIN 13
#define WARNLEDPIN 12
char tag[] ="51005F46642C"; // 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
boolean flag = 0;                        // A variable to store the Tag match status
void setup()
{
        Serial.begin(9600);              // Initialise Serial Communication with the Serial Monitor
        pinMode(RELAYPIN,OUTPUT);        // RELAY OUTPUT
        pinMode(WARNLEDPIN,OUTPUT); //WRONG TAG INDICATOR
}
void loop()
{
        if(Serial.available())// Check if there is incoming data in the RFID Reader Serial Buffer.
        {
                count = 0; // Reset the counter to zero
                /* Keep reading Byte by Byte from the Buffer till the RFID Reader Buffer is     empty
                   or till 12 Bytes (the ID size of our Tag) is read */
                while(Serial.available() && count < 12)
                {
                        input[count] = Serial.read(); // Read 1 Byte of data and store it in the input[
                        count++; // increment counter
                        delay(5);
                }
```

EM-18 RFID Reader Module (Access Control)

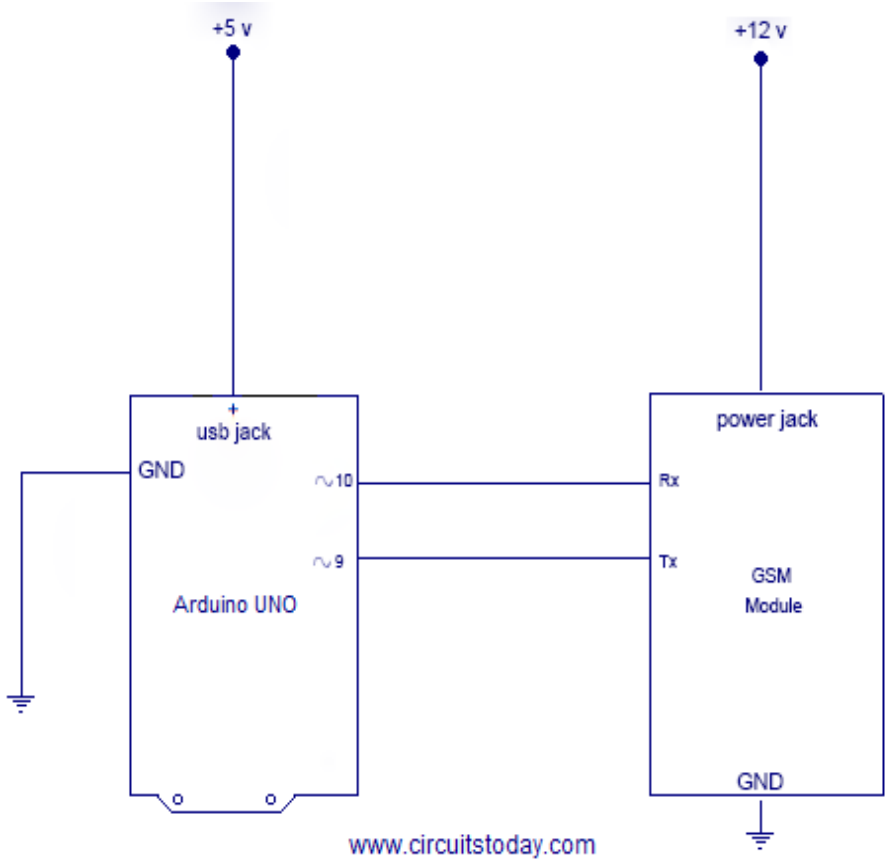
```
if(count == 12) //
{
        count =0; // reset counter varibale to 0
        flag = 1;
        /* Iterate through each value and compare till either the 12 values are
           all matching or till the first mistmatch occurs */
        while(count<12 && flag !=0)
        {
                if(input[count]==tag[count])
                flag = 1; // everytime the values match, we set the flag variable to 1
                else
                flag= 0;
               /* if the ID values don't match, set flag variable to 0 and
                  stop comparing by exiting the while loop */
                count++; // increment i
        }
}
if(flag == 1) // If flag variable is 1, then it means the tags match
{
        Serial.println("Access Allowed!");
        digitalWrite(RELAYPIN,HIGH);
        delay (5000);
        digitalWrite (RELAYPIN,LOW);
}
else
{
        Serial.println("Access Denied"); // Incorrect Tag Message
        digitalWrite(WARNLEDPIN,HIGH);
        delay(5000);
        digitalWrite(WARNLEDPIN,LOW);
}
/* Fill the input variable array with a fixed value 'F' to overwrite
all values getting it   empty for the next read cycle */
for(count=0; count<12; count++)
{
```

EM-18 RFID Reader Module (Access Control)

```
                for(count=0; count<12; count++)
                {
                        input[count]= 'F';
                }
                count = 0; // Reset counter variable
        }
}
```

GSM800A with Arduino

https://www.youtube.com/watch?v=sZxCpPYpkyY



GSM800A with Arduino

https://www.youtube.com/watch?v=sZxCpPYpkyY

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(9, 10);
char msg;
char call;

void setup()
{
  mySerial.begin(9600);   // Setting the baud rate of GSM Module
  Serial.begin(9600);    // Setting the baud rate of Serial Monitor (Arduino)
  Serial.println("GSM SIM800A BEGIN");
  Serial.println("Enter character for control option:");
  Serial.println("h : to disconnect a call");
  Serial.println("i : to receive a call");
  Serial.println("s : to send message");
  Serial.println("r : to receive message");
  Serial.println("c : to make a call");
  Serial.println("e : to redial");
  Serial.println();
  delay(100);
}
```

GSM800A with Arduino

```
void loop()
{
  if (Serial.available()>0)
   switch(Serial.read())
  {
    case 's':
      SendMessage();
      break;
    case 'c':
      MakeCall();
      break;
    case 'h':
      HangupCall();
      break;
    case 'e':
      RedialCall();
      break;
    case 'i':
      ReceiveCall();
      break;
    case 'r':
      ReceiveMessage();
      break;

  }
 if (mySerial.available()>0)
 Serial.write(mySerial.read());
}

void SendMessage()
{
  mySerial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
  delay(1000);  // Delay of 1000 milli seconds or 1 second
  mySerial.println("AT+CMGS=\"+YYxxxxxxxxxx\"\r"); // Replace x with mobile number
  delay(1000);
  mySerial.println("sim800a sms");// The SMS text you want to send
  delay(100);
   mySerial.println((char)26);// ASCII code of CTRL+Z
  delay(1000);
}

void ReceiveMessage()
{
  mySerial.println("AT+CNMI=2,2,0,0,0"); // AT Command to recieve a live SMS
  delay(1000);
  if (mySerial.available()>0)
  {
    msg=mySerial.read();
    Serial.print(msg);
  }
}
```

GSM800A with Arduino

```
void MakeCall()
{
  mySerial.println("ATD+YYxxxxxxxxxx0;"); // ATDxxxxxxxxxx; -- watch out here for semicolon at the end!!
  Serial.println("Calling  "); // print response over serial port
  delay(1000);
}
void HangupCall()
{
  mySerial.println("ATH");
  Serial.println("Hangup Call");
  delay(1000);
}

void ReceiveCall()
{
  mySerial.println("ATA");
  delay(1000);
  {
    call=mySerial.read();
    Serial.print(call);
  }
}
void RedialCall()
{
  mySerial.println("ATDL");
  Serial.println("Redialing");
  delay(1000);
}
```

I2C LCD

Now, with only 3 pins from microcontroller, you can display message on this LCD. Compared to parallel LCD which required at least 6 pins of I/O, this LCD offer more cost effective solution. The LCD display is four lines by 20 characters and provides basic text wrapping so that your text looks right on the display.

https://www.instructables.com/id/How-to-Use-I2C-Serial-LCD-20X4-Yellow-Backlight/

I2C Library

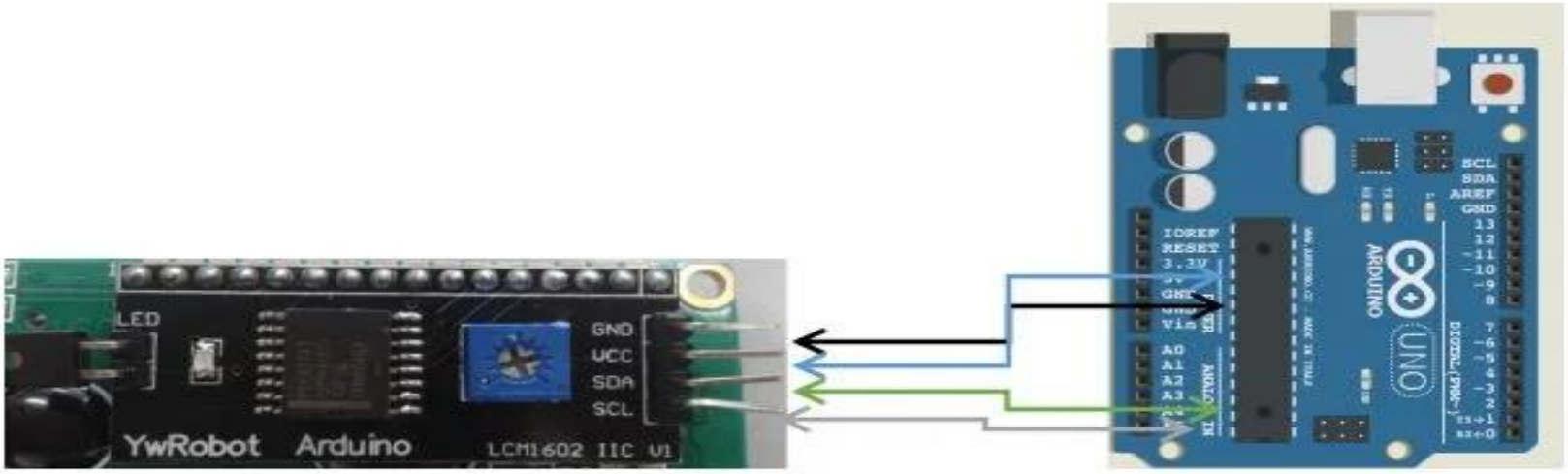
For this tutorial,it is necessary to download and install the "LiquidCrystal_I2C" library.LiquidCrystal_I2C is a library of Arduino which enables serial LCD 20x4 connect with Arduino.To be able to interface the serial LCD with arduino, you will have to download this library and save it into your Arduino's libraries.

Download the LiquidCrystal_I2C file below >Go to document >Save the file into your Arduino Uno Library folder. Refer the image above for your references.

Download (https://cdn.instructables.com/ORIG/FHO/9LI0/J2UPIBMD/FHO9LI0J2UPIBMD.rar)

I2C LCD (Contd…)

VCC -5V
GND - GND
SDA-A4
SCL-A5

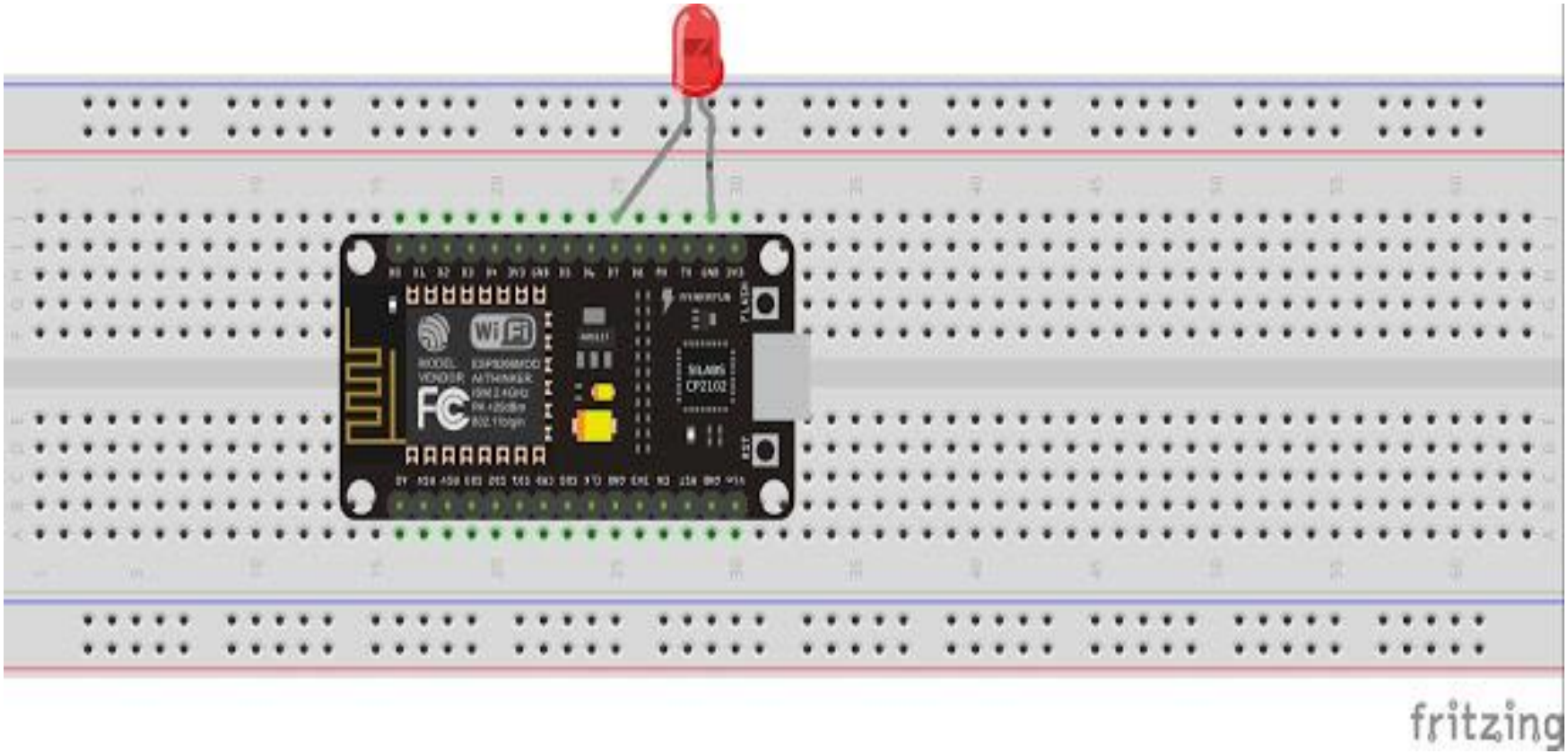


I2C LCD (Contd…)

```
#include "Wire.h" // For I2C
#include "LCD.h" // For LCD
#include "LiquidCrystal_I2C.h" // Added library*
//Set the pins on the I2C chip used for LCD connections
//ADDR,EN,R/W,RS,D4,D5,D6,D7
LiquidCrystal_I2C lcd(0x27,2,1,0,4,5,6,7); // 0x27 is the default I2C bus address of the backpack-see article
void setup()
{
   // Set off LCD module
   lcd.begin (16,2); // 16 x 2 LCD module
   lcd.setBacklightPin(3,POSITIVE); // BL, BL_POL
   lcd.setBacklight(HIGH);
   lcd.print("Hello, World!");
   lcd.setCursor(0,1);
   lcd.print("Good Day");
}
void loop()
{
}
```

Node MCU or ESP8266

https://www.instructables.com/id/Quick-Start-to-Nodemcu-ESP8266-on-Arduino-IDE/



Node MCU or ESP8266

For Program go to the mentioned link:

https://www.youtube.com/watch?v=3gOKrMAz7WE

https://github.com/amphancm/ESP8266WiFiControl

https://www.youtube.com/watch?v=-6Nb5kL43GY

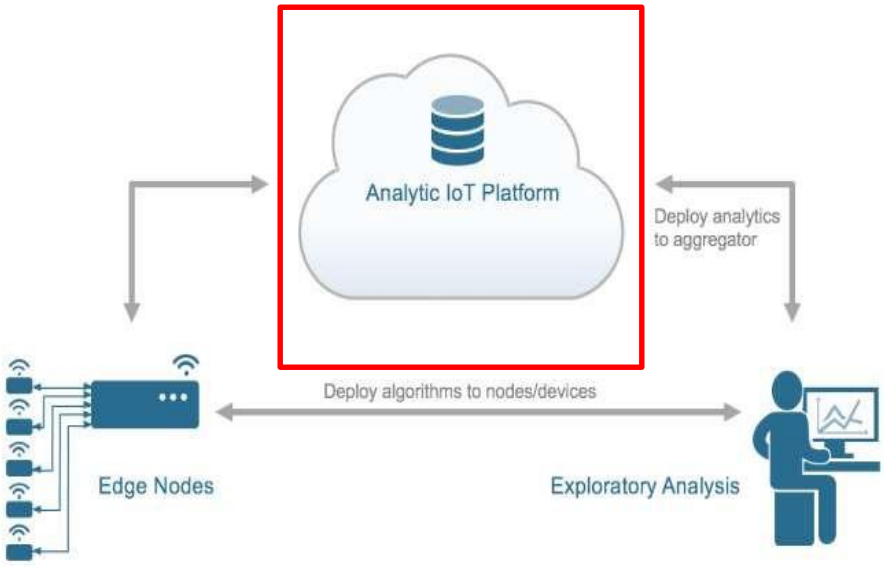
https://www.youtube.com/watch?v=BZOfiPUyZqc

https://www.youtube.com/watch?v=5SvRolROPxA

ThingSpeak

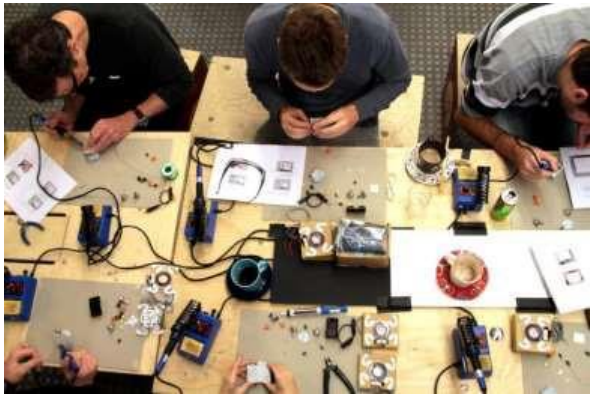
What is ThingSpeak?

- Analytic IoT platform
  - Collect data from sensors, “things”
  - Visualize data instantly
  - Has more than 60,000 users
- Analyze data
  - MATLAB integration allows users to run scheduled code on data coming into ThingSpeak
- Act on data
  - E.g. send a tweet when the temperature in your backyard reaches 32 degrees



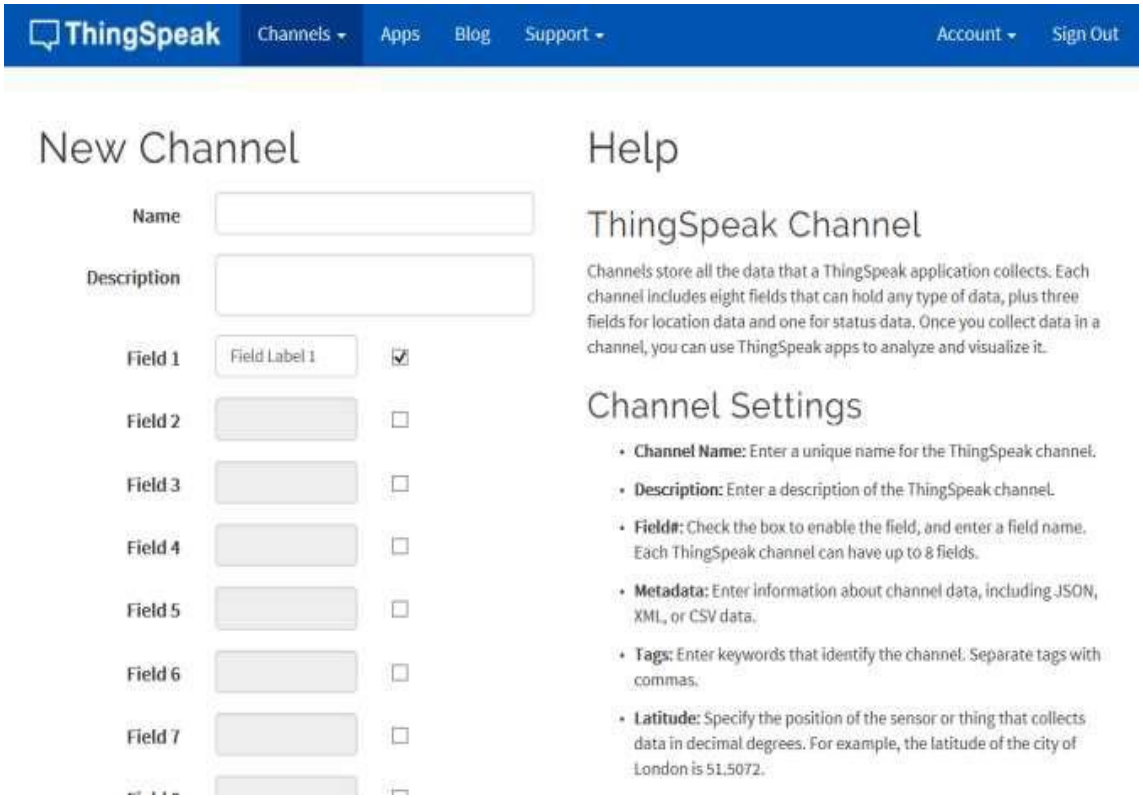
Who is ThingSpeak for?

- Makers
- Academics
- Engineers and scientists



https://thingspeak.com/

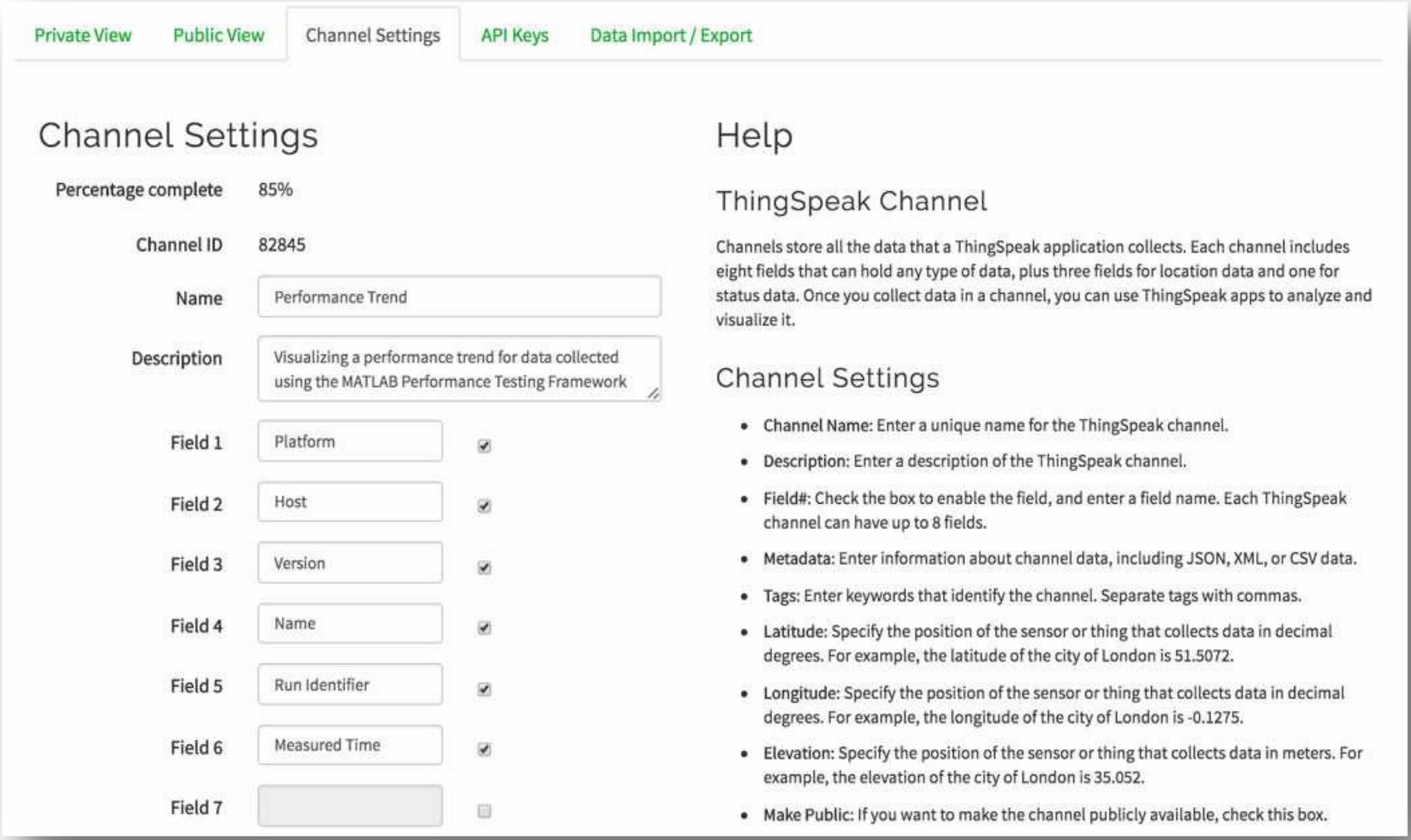
ThingSpeak: Collecting Data using Channels



- For any new data, first login and create a channel in ThingSpeak
- Channels have read and write API keys and can be public or private
- A channel is made up of 8 fields and can store 8 streams of data (Temp, Humidity, etc.)
- Channels can be updated at a maximum rate of once every 15 seconds

ts.pdf (iitd.ac.in)

Set up ThingSpeak channel



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Post performance data to our ThingSpeak channel

ThingSpeak™ Channels Apps Blog Support Account Sign Out

Performance Trend

Channel ID: 82845
Author: anoush
Access: Public

Visualizing a performance trend for data collected using the MATLAB Performance Testing Framework
: Performance, Trend, MATLABUnit

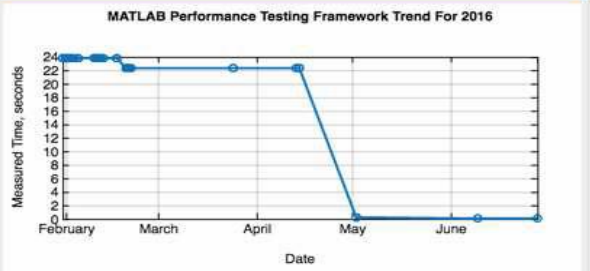
Private View | Public View | Channel Settings | API Keys | Data Import / Export

Add Visualizations | Data Export | More Information | MATLAB Analysis | MATLAB Visualization

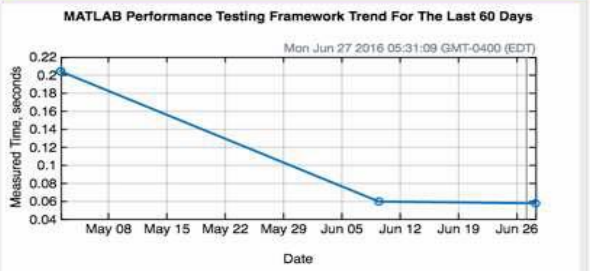
Channel Stats

Created 5 months ago
Updated about 3 hours ago
Last Entry about 3 hours ago
649 Entries

Performance Trend For 2016



Performance Trend For The Last 60 Days



Pre-Session Survey Form

Post-Session Survev Form

THANK YOU