



IoT INTERFACES FROM HARDWARE TO SOFTWARE  
AND WIRELESS COMMUNICATION

REPORT ON

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**Fire Warning System**

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# 1 Introduction

Welcome to our project on IoT interfaces from hardware to software and wireless communications. In this project, we design a small IoT system to track the humidity and temperature in user's house and give warning if suspicious and abnormal condition happens such as fire.

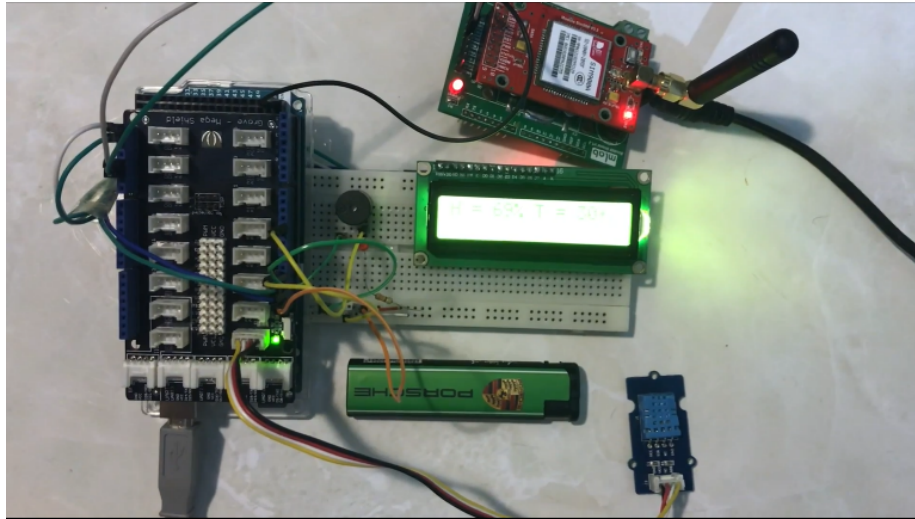
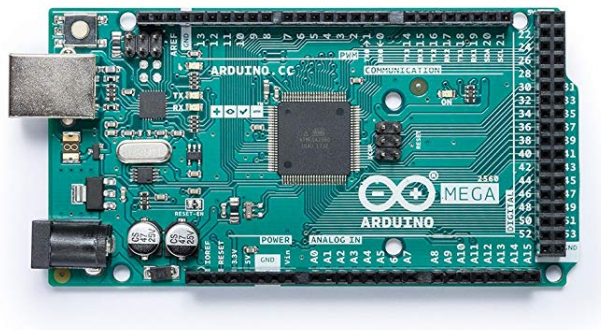


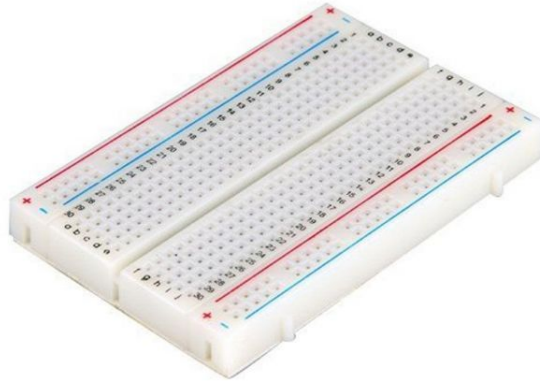
Figure 1: Overview of Fire Warning System

## 2 Components

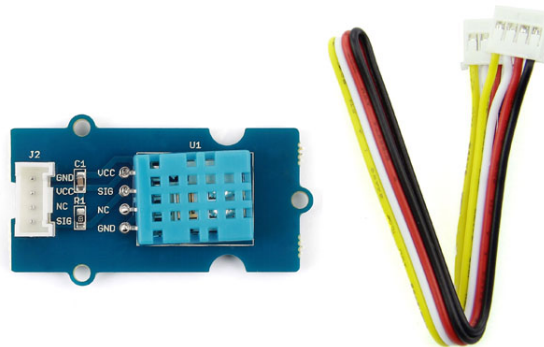
### 2.1 Arduino MEGA 2560



## 2.2 Breadboard



## 2.3 Temperature and Humidity sensor v1.2



## 2.4 Resistor



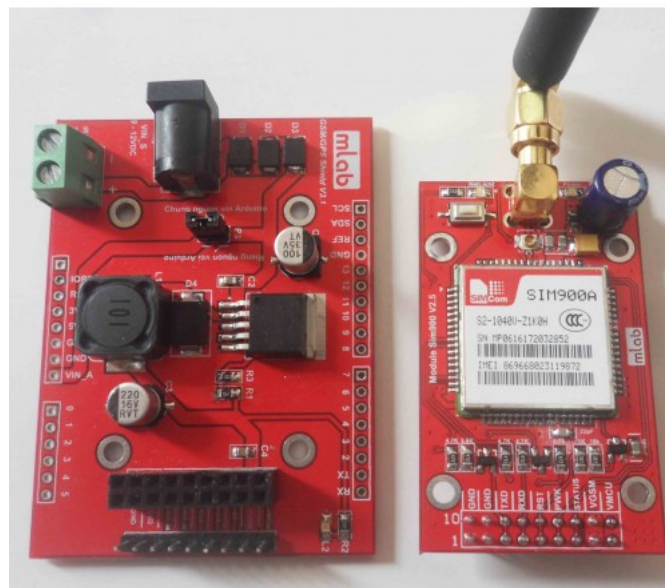
## 2.5 Buzzer



## 2.6 Led



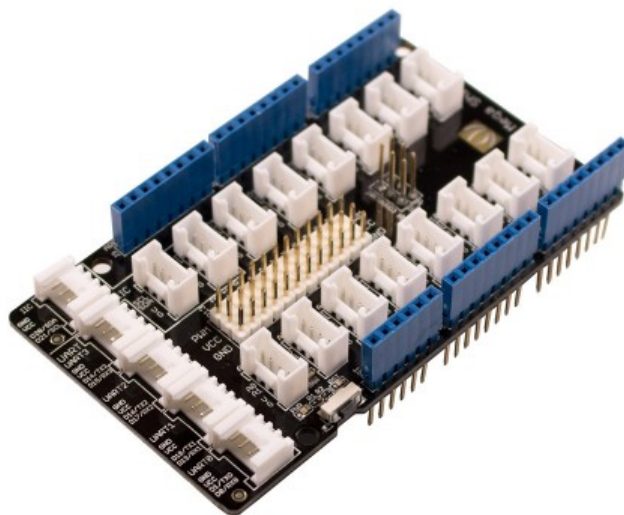
## 2.7 GSM Module Sim900A



## 2.8 LCD Display



## 2.9 Grove Mega Shield



### 3 Architecture

The computer connects to the Arduino using an USB cable to supply the power. The Arduino also connects to the GSM Module and the breadboard where others devices are plugged in.

The buzzer, led, resistor and LCD display are all connected to the circuit on the breadboard.

For the temperature and humidity sensor, we connect the all the plug pins to the A0-A1 in ANALOG of the Grove Mega Shield. For the GSM Module, the GND, TXD, RXD, PWK pins join sequently to the GND, TX2, RX2 and PIN 9 in DIGITAL.

The output pin for LED and the Buzzer are connecting to ANALOG A3, while the other pin for the LED links with GND power.

### 4 Details

In normal condition, the temperature and humidity sensor will measure and display the 2 values on the LCD screen, the led and the buzzer are off.

```
1  int h = int(dht.readHumidity());
   int t = int(dht.readTemperature());
3  // check if returns are valid, if they are NaN (not a number)
   then something went wrong!
   if (isnan(t) || isnan(h))
5  {
       Serial.println("Failed to read from DHT");
7  }
   else
9  {
       Serial.print("Humidity: ");
11      Serial.print(h);
       Serial.print(" %\t");
13      Serial.print("Temperature: ");
       Serial.print(t);
15      Serial.println(" *C");
       //Print the result to LCD
17      lcd.clear();//Clean the screen
       lcd.setCursor(0,0);
19      lcd.print("H = ");
       lcd.print(h);
21      lcd.print("% ");
       lcd.print("T = ");
23      lcd.print(t);
       lcd.print(" *C");
25      digitalWrite(led_buzzer,HIGH);
       delay(1000);
```

To read the temperature values recorded by the temperature and humidity sensor, we use provided DHT library (<https://github.com/adafruit/DHT-sensor-library>).

With the help of provided functions from the library, we can review our circuit and receive signals from the sensor.

In our experiment, we use a lighter and light it close to the system to test it. We also set the temperature value to 50°C for the system to give the warning.

```
2   if (t>51) {  
3       lcd.setCursor(0,1);  
4       lcd.print("Heat Warning!");  
5       digitalWrite(led_buzzer,LOW);  
6       delay(1000);  
7       Gsm.MakeSMS();  
8       delay(20000);  
9   }
```

After we increase the temperature value higher than the standard, the led will turn on and the buzzer will make the noise to warn that there is a fire. And in case that nobody is at home, we design the GSM Module to send a message to the register's mobilephone after a few second, therefore that person can get the warning wherever he is.

```
void Gsm_MakeSMS()  
2 {  
3     Serial2.println("AT+CMGS=\"\" + myphone + \"\");  
4     delay(5000);  
5     Serial2.print("Fire Warning!");  
6     Serial2.print("The temperature is over: ");  
7     Serial2.print(t);  
8     Serial2.print(" *C!");  
9     Serial2.print("Please check your house");  
10    Serial2.print((char)26);  
11    delay(5000);  
12 }
```

## 5 Source code

```
// Example testing sketch for various DHT humidity/temperature sensors
// Written by ladyada, public domain

#include "DHT.h"
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

//i2c pins
LiquidCrystal_I2C lcd(0x27, 20, 4);

#define DHTPIN A0    // connect to pin A0
#define DHTTYPE DHT11 // DHT 11

DHT dht(DHTPIN, DHTTYPE);

const String myphone = "+8489350025"; // Replace your number here
const int PWR_KEY = 9; // PIN 9 controll turn on/off Module Sim900A

void Gsm_Power_On(); // Function turn on module Sim 900A
void Gsm_Init(); // Function configure Module Sim 900A
void Gsm_MakeSMS(); // Function to send sms

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

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

int led_buzzer = A3; // Output pin for LED and Buzzer

void setup()
{
  Serial.begin(9600);
  Serial2.begin(9600);
  dht.begin();
  //We define our LCD 16 columns and 2 rows
  lcd.init();
  lcd.backlight(); //Power on the back light
  pinMode(led_buzzer, OUTPUT);
  digitalWrite(led_buzzer, HIGH);
  Gsm_Power_On();
  Gsm_Init();
}
```



```

void loop()
{
    // Reading temperature or humidity takes about 250 milliseconds!
    // Sensor readings may also be up to 2 seconds 'old' (its a very slow sensor)
    int h = int(dht.readHumidity());
    int t = int(dht.readTemperature());

    // check if returns are valid, if they are NaN (not a number)
    // then something went wrong!
    if (isnan(t) || isnan(h))
    {
        Serial.println("Failed to read from DHT");
    }
    else
    {
        Serial.print("Humidity: ");
        Serial.print(h);
        Serial.print(" %\t");
        Serial.print("Temperature: ");
        Serial.print(t);
        Serial.println(" *C");
        //Print the result to LCD
        lcd.clear();//Clean the screen
        lcd.setCursor(0,0);
        lcd.print("H = ");
        lcd.print(h);
        lcd.print("% ");
        lcd.print("T = ");
        lcd.print(t);
        lcd.print("*C");
        digitalWrite(led_buzzer,HIGH);
        delay(1000);

        if (t>50) {
            lcd.setCursor(0,1);
            lcd.print("Heat Warning!");
            digitalWrite(led_buzzer,LOW);
            delay(1000);
            Gsm_MakeSMS();
            delay(20000);
        }
        delay(2000);
    }
}

```

```

void Gsm_Power_On()
{
    digitalWrite(PWR_KEY, HIGH);
    delay(1500);
    digitalWrite(PWR_KEY, LOW);
    delay(10000);
}

void Gsm_Init()
{
    Serial2.println("ATE0");
    delay(2000);
    Serial2.println("AT+IPR=9600");
    delay(2000);
    Serial2.println("AT+CMGF=1");           // Select TEXT Mode
    delay(2000);
    Serial2.println("AT+CLIP=1");          // Show the caller's information
    delay(2000);
    Serial2.println("AT+CNMI=2,2");        // Show the sms
    delay(2000);
}

void Gsm_MakeSMS()
{
    Serial2.println("AT+CMGS=\"" + myphone + "\"");
    delay(5000);
    Serial2.print("Fire Warning!")
    Serial2.print("The temperature is over: ");
    Serial2.print(t);
    Serial2.print(" *C!");
    Serial2.print("Please check your house");
    Serial2.print((char)26);
    delay(5000);
}

```

## 6 Experiment

The link video of our experiment: <https://youtu.be/0Tr-kz3Y4ws>  
 WARNING: lower the volume in case the buzzer sound is too loud!