TABLE OF CONTENTS

1.COMPANY PROFILE

1.1 ABOUT COMPANY

- Pantech eLearning Private Limited is an unlisted private company incorporated on 17 February, 2021. It is classified as a private limited company and is located in Chennai, Tamil Nadu. It's authorized share capital is INR 15.00 lac and the total paid-up capital is INR 1.00 lac.
- The current status of Pantech eLearning Private Limited is - Active.
- Details of the last annual general meeting of Pantech elearning Private Limited are not available. The company is yet to submit its first full-year financial statements to the registrar.
- Pantech eLearning Private Limited has four directors - Senthilkumar Ramasamy Muniappa Gounder, Jeeva Mayandi Kalidass, and others.
- The Corporate Identification Number (CIN) of Pantech eLearning Private Limited is U80902TN2021PTC141464. The registered office of Pantech eLearning Private Limited is at No.11/A, Thanjavur Road, T. Nagar, Chennai, Chennai, Tamil Nadu.

1.2 RESEARCH ACTIVITY:

TECHNOLOGY EXPERTISE - CS:

- IOT Systems
- Cyber Security
- Cloud Computing and Virtualization
- Data Science & Analytics
- AI and Machine Learning
- Information Visualization
- Augmented Reality and Virtual Reality
- Natural Language Processing
- Big Data Analytics
- Deep Learning Techniques

TECHNOLOGY EXPERTISE - EC:

- Robotics
- Digital Image Processing
- 5G Wireless Communication
- Digital Signal Processing
- FPGA-Based Systems
- Cognitive Radio Communication
- Wireless Network
- Internet of Things
- Artificial Intelligence
- Deep Learning Technique

TECHNOLOGY EXPERTISE - EE:

- Renewable Energy Systems
- IOT and Embedded Systems
- Power System Stability
- Application of AI to Power System
- Control of Electrical Machines
- Wind energy power conversion
- MATLAB Tools
- Converter Designs
- Inverter Simulation Designs using MATLAB

TECHNOLOGY – NUTSHELL:

- IOT and Embedded Systems
- Power Electronics & Systems
- AI – Machine & Deep Learning
- Image Processing- MATLAB & Python
- Data Science & Analytics
- Android & Application Development

2.ABSTRACT

Weather Monitoring Station is an advanced solution for monitoring the weather conditions at a particular place and make the information visible anywhere in the world. The technology behind this is Internet of Things (IOT), which is an advanced and efficient solution for connecting the things to the internet and to connect the entire world of things in a network. Here things might be whatever like electronic gadgets, sensors and automotive electronic equipment. The system deals with monitoring and controlling the environmental conditions like temperature, relative humidity with sensors and sends the information to the web page and then plot the sensor data as graphical statistics. The data updated from the implemented system can be accessible in the internet from anywhere in the world.

3.INTRODUCTION

The internet of Things (IOT) is viewed as an innovation and financial wave in the worldwide data industry after the Internet. The IOT is a wise system which associates all things to the Internet with the end goal of trading data and conveying through the data detecting gadgets as per concurred conventions. It accomplishes the objective of keen recognizing, finding, following, observing, and overseeing thing.It is an augmentation and extension of Internet-based system, which grows the correspondence from human and human to human and things or things and things. It is a current correspondence paradigm that envisions a near future, in which the objects of regular day to day existence will be outfitted with microcontrollers, handsets for computerized correspondence, and reasonable convention stacks that will make them ready to speak with each other and with the clients, turning into a vital piece of the Internet.

The IOT idea, consequently, goes for making the Internet much more immersive and unavoidable. Moreover, by empowering simple get to and association with a wide assortment of gadgets, for example, for example, home apparatuses, reconnaissance cameras, checking sensors, actuators, showcases, vehicles, et cetera, the IOT will encourage the advancement of various applications that make utilization of the possibly gigantic sum and assortment of information created by such questions give new administrations to subjects, organizations, and open organizations. Present innovations in technology mainly focus on controlling and monitoring of different activities. These are increasingly emerging to reach the human needs. Most of this technology is focused on efficient monitoring and controlling different activities.

An efficient environmental monitoring system is required to monitor and assess the conditions in case of exceeding the prescribed level of parameters. When the objects like environment equipped with sensor devices, microcontroller and various software applications becomes a self-protecting and self- monitoring environment and it is also called as smart environment. The effects due to the environmental changes on animals, plants and human beings can be monitored and controlled by smart environmental monitoring system.

The by using embedded intelligence into the environment makes the environment interactive with other objectives, this is one of the application that smart environment targets. Human needs demands different types of monitoring systems these are depends on the type of data gathered by the sensor devices. Event Detection based and Spatial Process Estimation are the two categories to which applications are classified. Initially the sensor devices are deployed in environment to detect the parameters (e.g., Temperature, Humidity) while the data acquisition, computation and controlling action.

Sensor devices are placed at different locations to collect the data to predict the behaviour of a particular area of interest. The main aim of this project is to design and implement an efficient monitoring system through which the required parameters are monitored remotely using internet and the data gathered from the sensors are stored in the cloud and to project the estimated trend on the web browser. The temperature, humidity in the environment using wireless embedded computing system is the solution also provides an intelligent remote monitoring for a particular area of interest. In this project we also present a trending results of collected or sensed data with respect to the normal or specified ranges of particular parameters. The embedded system is an integration of sensor devices, wireless communication which enables the user to remotely access the various parameters and store the data in cloud.

4.TASK PERFORMED:

- The domain of the internship is “Internet of Things”.
- And the project developed during the internship is “Weather Monitoring Station”

4.1 OVERVIEWS:

- The Internship was completed at PANTECH E-LEARNING Technologies in October. My guide for the internship training was **Jishnu R** who was a well-versed teacher in the field of Internet of Things, Deep learning, Artificial intelligence, Augmented reality.
- The training took place in online mode and was carried out every day for 2 hours. They firstly gave a brief introduction to the IOT and Embedded C. There were assignments given on the basics of Interfacing Sensors. Later they explained the How to Sensor to cloud like Arduino Cloud , ThingSpeak and AWS , how it works, and its uses. Many small projects were taught like the Home automation using Google assistant.
- They taught us the **Raspberry Pi 3** in which we performed interfacing Sensor to Raspberry Pi , Home automation with AR & IOT using Raspberry Pi. It is easy to interfacing Arduino with cloud. The Data monitoring with Multiple widgets using ThingSpeak with Arduino is interesting concept to Make many for challenging Project. Overall it was a useful and a wrathful internship program that provided me with a lot of knowledge on **Internet of things**

4.2 PROBLEM STATEMENT

- The satellite weather report system gives condition of present which does not give the exact condition of the particular place.
- The Drawbacks is in conventional method are the devices are expensive and don’t have data visualization.
- In case of any abnormalities there is no such automatic device to give the alert signal hence it’s hard to control that abnormality. And also it is difficult in Remote area to view the weather parameters.

4.3 REQUIREMENTS:

4.3.1 HARDWARE REQUIREMENT

- Arduino Uno
- DHT 11 Sensor
- ESP8266
- LCD Display
- Jumper Wires

4.3.2 SOFTWARE REQUIREMENT

- Arduino IDE
- ThingSpeak

5. TECHNICAL ASPECTS:

- The Internet of Things (IOT) is aimed at enabling the interconnection and integration of the physical world and the cyber space. It represents the trend of future networking, and leads the third wave of the IT industry revolution.
- In this interconnected world, one of the most important technologies that have radically changed the lives of humans with the inducement of automation in all the routine tasks is IOT. Starting from Smart homes, Smart retail smart wearable, autonomous vehicles and many more.
- This technology has taken over the world like a storm. It is IOT technology that has changed the face of technology with smart driven automation tools and software. As the name suggests, it is an interconnection of things by the internet.
- The interconnected devices that connect different home appliances like solar panels, CCTV, laptops, security applications or any automobile object that has sensors and can collect and transmit data over the network.

How does IOT work:

IOT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments. IOT devices share the sensor data they collect by connecting to an IOT gateway or other edge device where data is either sent to the cloud to be analysed or analysed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices -- for instance, to set them up, give them instructions or access the data.

There are four major components of IOT:

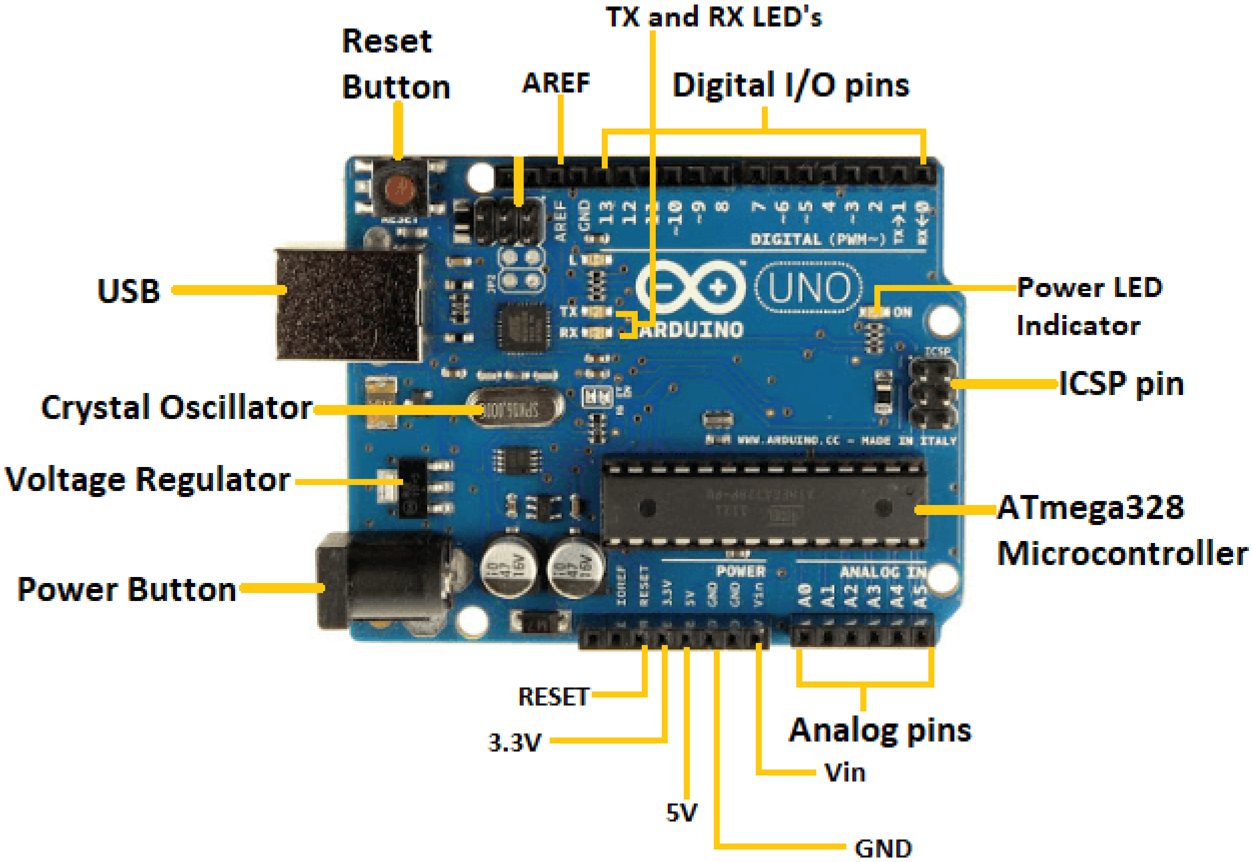
- **Sensors and actuators:** these components perceive information from and interact with the environment. Sensors collect data, while the actuators allow the system to perform specific actions. In the coffee machine example, the sensor monitors when the user wakes up, and an actuator starts making the coffee.
- **Connectivity:** the sensors and actuators are connected to a so-called gateway. The gateway is responsible for communicating with the nearby sensors and actuators, translating the messages into a common format which is then uploaded to a cloud service on the internet. The communication between

the gateway and the sensors and actuators is typically wireless, however wired connection is also possible. Cloud services are typically very cautious about privacy

- **Cloud:** the computer "cloud" – which is a network of computers on the internet – is responsible for storing and analysing the data in order to make smart decisions. The analysis might involve simple rules or complex artificial intelligence (AI) algorithms.
- **Human-Machine Interaction (HMI):** data and analysis are supervised by users either on dedicated user interfaces (UIs) or smartphones and tablets with specific applications. The goal of HMI in an IOT system is to inform the user and to let them override the automated decisions if needed.

5.1 TOOLS DESCRIPTION:

Arduino Uno



The Arduino UNO is a standard board of Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board. Arduino Uno is based on an AVR microcontroller called Atmega328. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

- **ATmega328 Microcontroller**- It is a single chip Microcontroller of the ATmega family. The processor code inside it is of 8-bit. It combines **Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.**
- **ICSP pin** - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.
- **Power LED Indicator**- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.
- **Digital I/O pins**- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.
- **TX and RX LED's**- The successful flow of data is represented by the lighting of these LED's.
- **AREF-** The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.
- **Reset button**- It is used to add a Reset button to the connection.
- **USB-** It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.
- **Crystal Oscillator**- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.
- **Voltage Regulator**- The voltage regulator converts the input voltage to 5V.
- **GND**- Ground pins. The ground pin acts as a pin with zero voltage.
- **Vin-** It is the input voltage.
- **Analog Pins**- The pins numbered from A0 to A5 are Analog pins. The function of Analog pins is to read the Analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

ESP8266

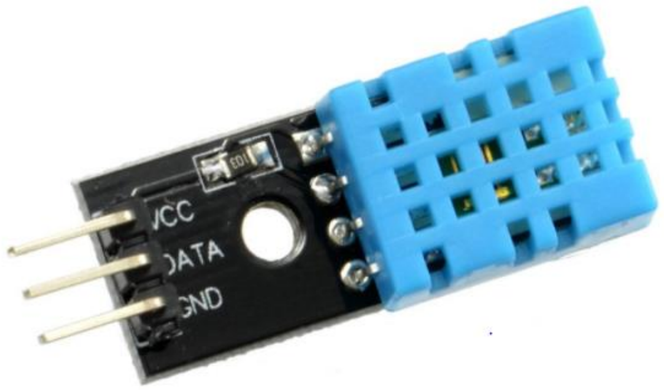
The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

The ESP8266 Wi-Fi module specifications or features :-

- It is a powerful Wi-Fi module available in a compact size at a very low price.
- It is based on the L106 RISC 32-bit microprocessor core and runs at 80 MHz
- It requires only 3.3 Volts power supply
- The maximum Input /Output (I/O) voltage is 3.6 Volts.
- Memory Size of instruction RAM – 32 KB
- The memory size of instruction cache RAM – 32 KB
- Size of User-data RAM- 80 KB
- Size of ETS systems-data RAM – 16 KB
- The current consumption is 100 m Amps
- The maximum Input /Output source current is 12 mA
- The frequency of built-in low power 32-bit MCU is 80 MHz
- The size of flash memory is 513 kb
- It is used as either an access point or station or both
- It supports serial communication to be compatible with several developmental platforms such as Arduino
- It is a 2.4 GHz Wi-Fi module and supports WPA/WPA2, WEP authentication, and open networks.
- It uses two serial communication protocols like I2C (Inter-Integrated Circuit) and SPI (Serial Peripheral Interface).
- It provides 10- bit Analog to digital conversion
- The type of modulation is PWM (Pulse Width Modulation)
- UART is enabled on dedicated pins and for only transmission, it can be enabled on GPIO2.
- It is an IEEE 802.11 b/g/n Wi-Fi module with LNA, power amplifier, balun, integrated TR switch, and matching networks.

DHT11 Sensor

DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc… to measure humidity and temperature instantaneously.

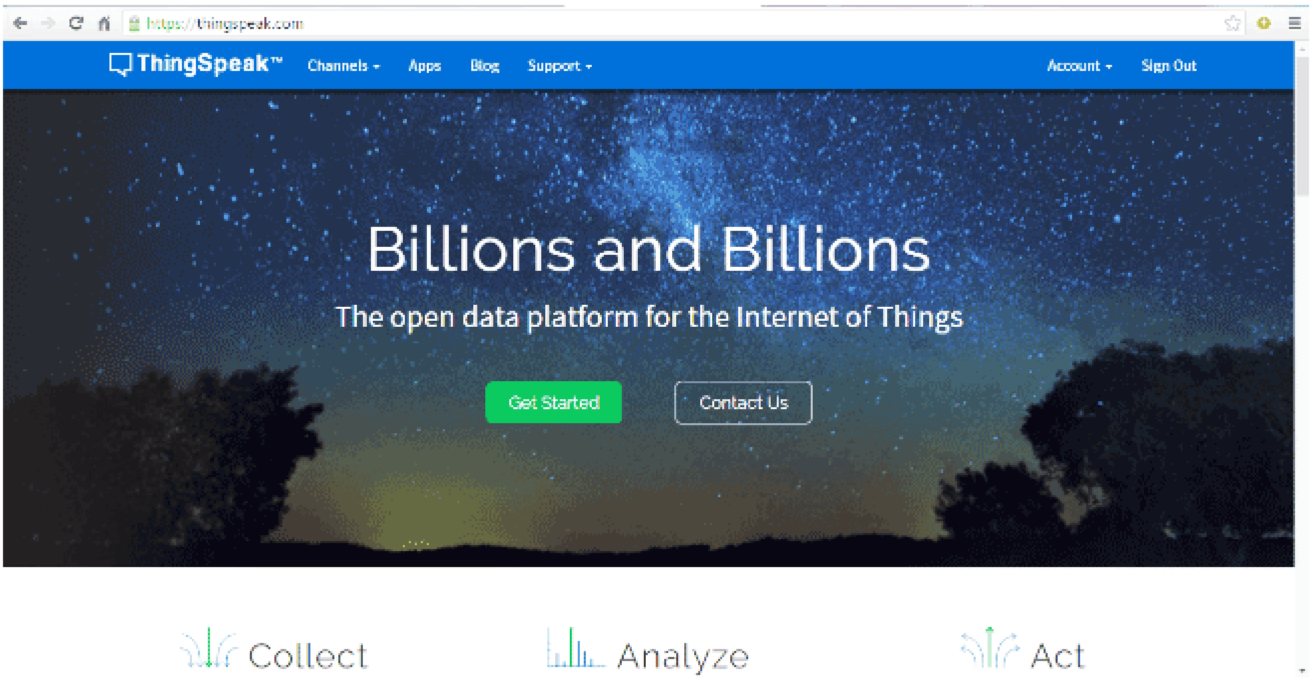


DHT11 humidity and temperature sensor is available as a sensor and as a module. The difference between this sensor and module is the pull-up resistor and a power-on LED. DHT11 is a relative humidity sensor. To measure the surrounding air this sensor uses a thermistor and a capacitive humidity sensor. DHT11 sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature.

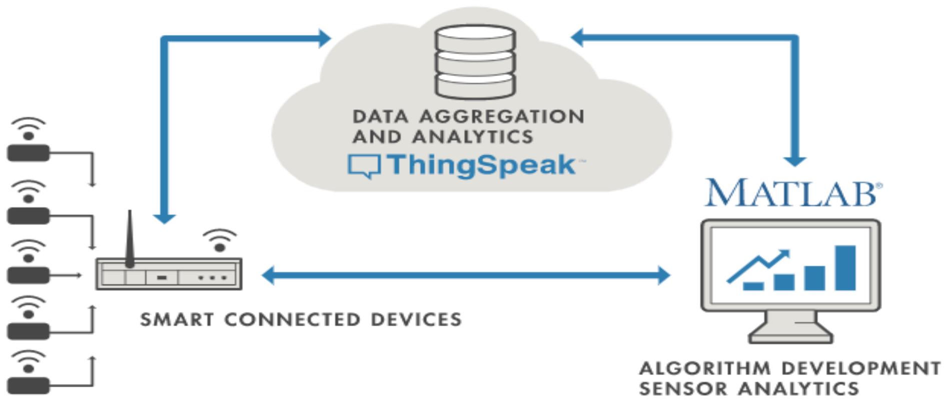
The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels. The IC measure, process this changed resistance values and change them into digital form. For measuring temperature this sensor uses a Negative Temperature coefficient thermistor, which causes a decrease in its resistance value with increase in temperature. To get larger resistance value even for the smallest change in temperature, this sensor is usually made up of semiconductor ceramics or polymers.

- The temperature range of DHT11 is from 0 to 50 degree Celsius with a 2-degree accuracy.
- Humidity range of this sensor is from 20 to 80% with 5% accuracy.
- The sampling rate of this sensor is 1Hz, it gives one reading for every second.
- DHT11 is small in size with operating voltage from 3 to 5 volts. The maximum current used while measuring is 2.5mA.
- DHT11 sensor has three pins- VCC, GND, Data Pin.

ThingSpeak



The Internet of Things(IOT) is a system of 'connected things'. The things generally comprise of an embedded operating system and an ability to communicate with the internet or with the neighbouring things. One of the key elements of a generic IOT system that bridges the various 'things' is an IOT service. An interesting implication from the 'things' comprising the IOT systems is that the things by themselves cannot do anything. At a bare minimum, they should have an ability to connect to other 'things'. But the real power of IOT is harnessed when the things connect to a 'service' either directly or via other 'things'. In such systems, the service plays the role of an invisible manager by providing capabilities ranging from simple data collection and monitoring to complex data analytics. The below diagram illustrates where an IOT service fits in an IOT ecosystem



ThingSpeak is a platform providing various services exclusively targeted for building IOT applications. It offers the capabilities of real-time data collection, visualizing the collected data in the form of charts, ability to create plugins and apps for collaborating with web services, social network and other APIs. We will consider each of these features in detail below. The core element of ThingSpeak is a ‘ThingSpeak Channel’. A channel stores the data that we send to ThingSpeak and comprises of the below elements:

- 8 fields for storing data of any type - These can be used to store the data from a sensor or from an embedded device.
- 3 location fields - Can be used to store the latitude, longitude and the elevation. These are very useful for tracking a moving device.
- 1 status field - A short message to describe the data stored in the channel.

To use ThingSpeak, we need to signup and create a channel. Once we have a channel, we can send the data, allow ThingSpeak to process it and also retrieve the same. Let us start exploring ThingSpeak by signing up and setting up a channel.

5. 2 IMPLEMENTATION

5.2.1 Code

```
#include"dht.h"
#include<LiquidCrystal.h>
LiquidCrystal lcd(14,15,16,17,18,19);
#include<Timer.h>
Timer t;
#include <SoftwareSerial.h>
SoftwareSerial Serial1(2, 3);
#define dht_dpin 12
#define heart 13
dht DHT;
```

```
char *api_key="SIWOYBX26OXQ1WMS";

static char postUrl[150];

int humi,tem;

void httpGet(String ip, String path, int port=80);

void setup()

        {

                lcd.begin(16, 2);

                lcd.clear();

                lcd.print("   Humidity   ");

                 lcd.setCursor(0,1);

                lcd.print("  Measurement ");

                delay(2000);

                lcd.clear();

                lcd.print("Circuit Digest ");

                lcd.setCursor(0,1);

                lcd.print("Welcomes You");

                delay(2000);

                Serial1.begin(9600);

                Serial.begin(9600);

                 lcd.clear();

                lcd.print("WIFI Connecting");

                 lcd.setCursor(0,1);

                 lcd.print("Please wait....");

                Serial.println("Connecting Wifi....");
```

```
        connect_wifi("AT",1000);
        connect_wifi("AT+CWMODE=1",1000);
        connect_wifi("AT+CWQAP",1000);
        connect_wifi("AT+RST",5000);
        connect_wifi("AT+CWJAP=\"1st floor\",\"muda1884\"",10000);
         Serial.println("Wifi Connected");
        lcd.clear();
         lcd.print("WIFI Connected.");
         pinMode(heart, OUTPUT);
        delay(2000);
        t.oscillate(heart, 1000, LOW);
        t.every(20000, send2server);
    }
void loop ()
    {
        DHT.read11(dht_dpin);
         lcd.setCursor(0,0);
         lcd.print("Humidity: ");
        humi=DHT.humidity;
        lcd.print(humi);
        lcd.print(" %    ");
        lcd.setCursor(0,1);
        lcd.print("Temperature:");
        tem=DHT.temperature;
```

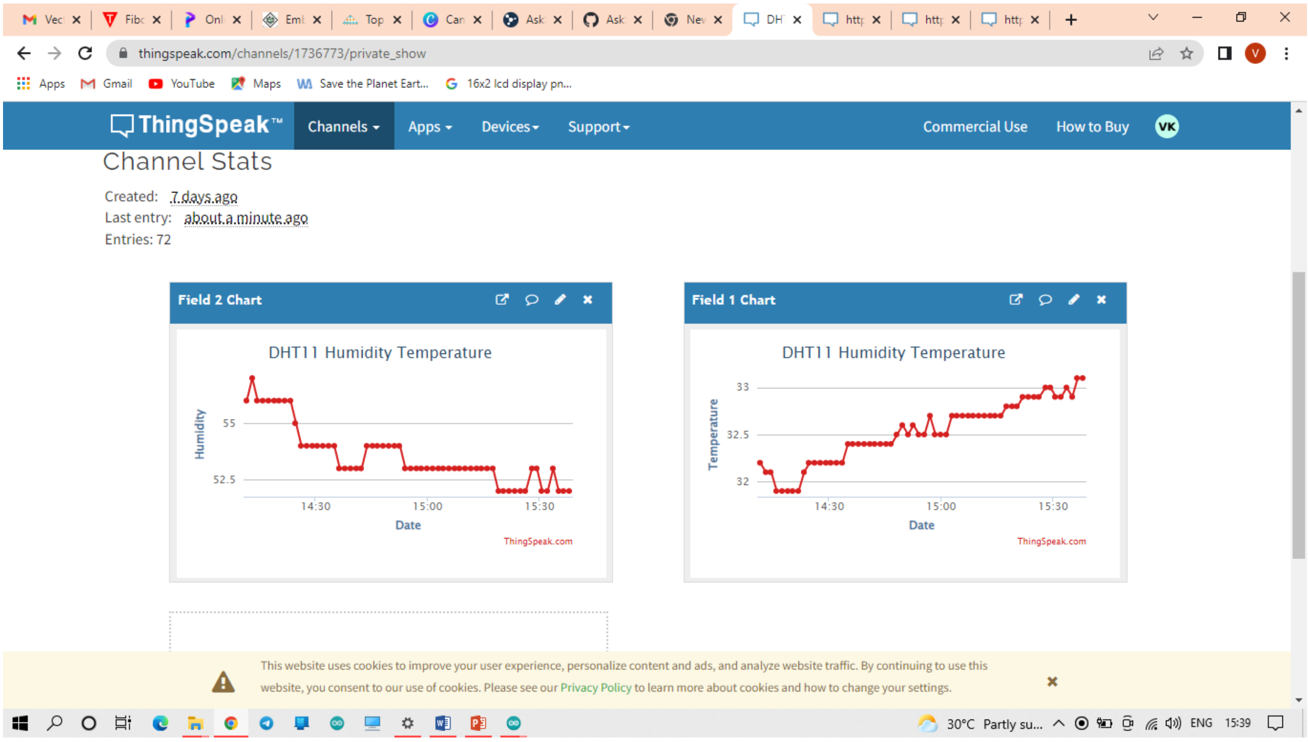
```
                lcd.print(tem);
                lcd.write(1);
                 lcd.print("C   ");
                delay(1000);
                 t.update();
        }
void send2server()
        {
                char tempStr[8];
                char humidStr[8];
                dtostrf(tem, 5, 3, tempStr);
                dtostrf(humi, 5, 3, humidStr);
                sprintf(postUrl,"update?api_key=%s&field1=%s&field2=%s",api_key,humidStr,tempStr);
                httpGet("api.thingspeak.com", postUrl, 80);
        }
        void httpGet(String ip, String path, int port)
        {
                int resp;
                String atHttpGetCmd = "GET /"+path+" HTTP/1.0\r\n\r\n";
                atTcpPortConnectCmd="AT+CIPSTART=\"TCP\",\""+ip+"\",  "+port+"";
                connect_wifi(atTcpPortConnectCmd,1000);
                 int len = atHttpGetCmd.length();
                String atSendCmd = "AT+CIPSEND=";
                atSendCmd+=len;
```

```
            connect_wifi(atSendCmd,1000);
            connect_wifi(atHttpGetCmd,1000);
      }
void connect wifi(String cmd, int t)
      {
             int temp=0,i=0;
            while(1)
              {
                  lcd.clear();
                  lcd.print(cmd);
                   Serial.println(cmd);
                  Serial1.println(cmd);
                   while(Serial1.available())
                        {
                              if(Serial1.find("OK"))
                               i=8;
                        }
             delay(t);
             if(i>5)
            break;
            i++;
       }
      if(i==8)
      {
```

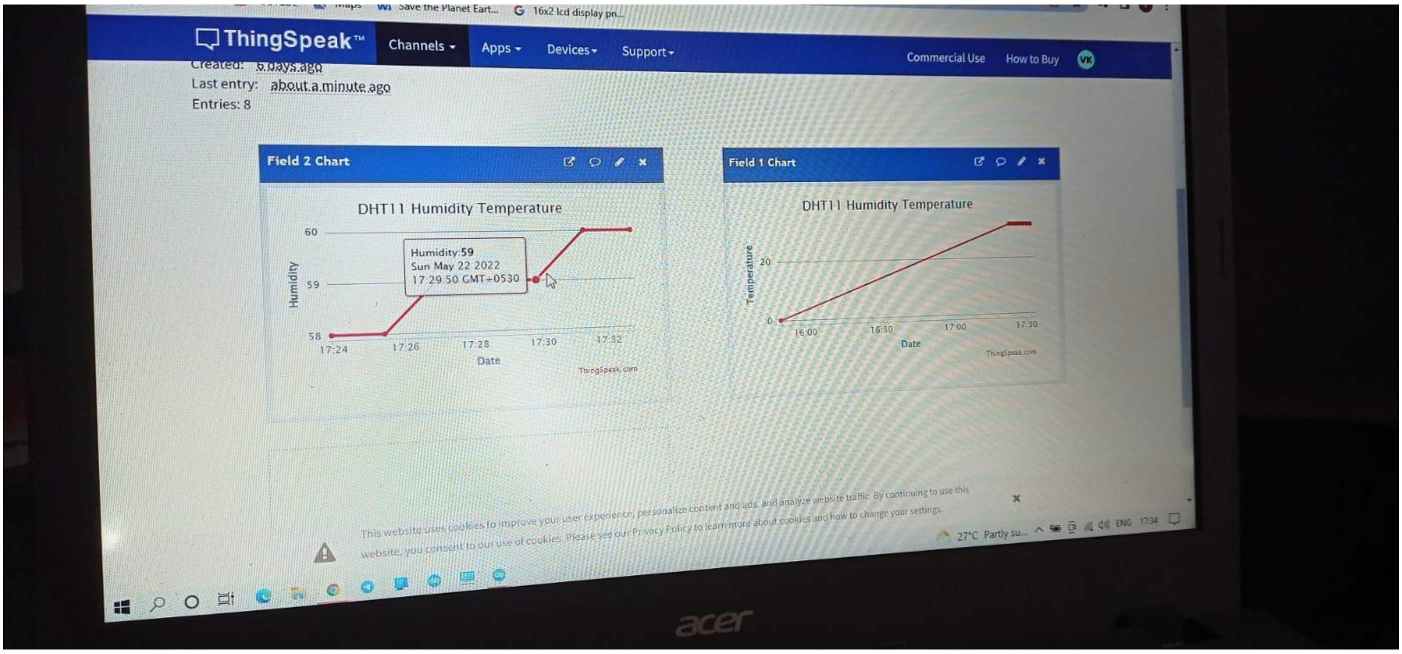
```
                Serial.println("OK");
                lcd.setCursor(0,1);
                lcd.print("OK");
        }
        else
        {
               Serial.println("Error");
               lcd.setCursor(0,1);
                lcd.print("Error");
        }
}
```

5.2.2 Results/Snapshots

Result in LCD Display



Result in ThingSpeak Cloud



Result in ThingSpeak Cloud

6.CONCLUSION

- The embedded devices in the environment for monitoring enables self-protection (i.e., smart environment) to the environment. To implement this need to deploy the sensor devices in the environment for collecting the data and analysis.
- By deploying sensor devices in the environment, we can bring the environment into real life i.e. it can interact with other objects through the network. Then the collected data and analysis results will be available to the end user through the Wi-Fi.
- The smart way to monitor environment and an efficient, low cost embedded system is presented with different models in this paper. In the proposed architecture functions of different modules were discussed. The temperature, humidity value can be monitored with Internet of Things (IOT) concept experimentally tested for monitoring three parameters.
- It also sent the sensor parameters to the cloud (Google Spread Sheets). This data will be helpful for future analysis and it can be easily shared to other end users. This model can be further expanded to monitor the developing cities and industrial zones for weather monitoring. To protect the public health from pollution, this model provides an efficient and low cost solution for continuous monitoring of environment.

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