SMART HOME BASED SYSTEM IOT WITH CLOUD COMPUTING

Minor Project Report

submitted in partial fulfillment of the requirement for the award of

Bachelor of Technology
in
Information Technology

By

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BONAFIDE CERTIFICATE

This is to certify that this Minor Project Report is the bonafide work of "SUMANT KUMAR (19UTIT0062), THAKUR VEDANSHU RAJ (19UTIT0065) and SAHIL SINHA(19UTIT0056)" who carried out the project entitled "SMART HOME BASED SYSTEM USING IOT WITH CLOUD COMPUTING" under our supervision from August 2022 to October 2022.

Internal Guide	**Head of the Department**
Dr. C MAHESH, M.E., Ph.D.	Dr. C. MAHESH, M.E., Ph.D.,

Submitted for Viva voice Examination held on _____

Internal Examiner	**External Examiner**

Submitted for the partial fulfillment for the award of the degree of Bachelor of Technology in Information technology from Vel Tech Rangarajan Dr. Sagunthala R D Institute of Science and Technology (Deemed to be University, u/s 3 of UGC Act,1956).

DECLARATION

We Sumant Kumar (19UTIT0062), Thakur Vedanshu Raj (19UTIT0065) and Sahil Sinha (19UTIT0056) hereby declare that the Major Project Report entitled "AUTOMATIC SMART HOME BASED SYSTEM USING IOT WITH CLOUD COMPUTING" done by me under the guidance of Dr. C MAHESH, B.E, M.E, Ph.D, at Vel Tech Rangarajan Dr.Sagunthala RD Institute of Science and Tech- nology , Chennai is submitted in partial fulfillment of the requirements for the award of Bachelor of Technology degree in Information Technology.

DATE: **SIGNATURE OF THE CANDIDATE**

PLACE: (Sumant Kumar)

(T. Vedanshu Raj)

(Sahil Sinha)

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We express our deepest gratitude to our respected **Founder Chancellor and President Col. Prof. Dr. R. RANGARAJAN B.E. (EEE), B.E. (MECH), M.S (AUTO). DSc., Foundress President Dr. R. SAGUNTHALA RANGARAJAN M.B.B.S.** Chairperson Managing Trustee and Vice President.

We are very much grateful to our beloved **Vice Chancellor Prof. S. SALIVAHANAN,** for provid- ing us with an environment to complete our project successfully.

We thankful to our esteemed Dean SoC, **Dr.V.SRINIVASA RAO,Ph.D.,** for providing us with an environment to complete our project successfully.

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ABSTRACT

Smart home systems achieved great popularity in the last decades as they increase the comfort and quality of life. Most smart home systems are controlled by smartphones and microcontrollers. smartphone application is used to control and monitor home functions using wireless communication techniques . Smart Home offers opportunities to save energy and reduce costs, improve the quality of life and increase security. Home and building automation provide comfort, security, energy savings, flexibility and adaptability to future development. The purpose of this paper is to make a prototype of a smart home. It will be equipped with several sensors and a NodeMcu. we present a composition of three components to build a robust approach of an advanced smart home concept and implementation.

Keywords:IOT Service, Cloud Computing

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

SM	Smart Home
IOT	Internet of things
Wi-Fi	Wireless Fidelity
MQTT	Message Queue Telemetry Transport
LDR	light dependant resistors
PIR	passive infra-red
LAN	local area network

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Chapter 1

INTRODUCTION

1.1 Introduction

smart home system, internet of things, cloud computing and rule-based event processing, are the building blocks of our proposed advanced smart home integrated compound. Each component contributes its core attributes and technologies to the proposed composition. IoT contributes the internet connection and remote management of mobile appliances, incorporated with a variety of sensors. Sensors may be attached to home related appliances, such as air-conditioning, lights and other environmental devices. And so, it embeds computer intelligence into home devices to provide ways to measure home conditions and monitor home appliances' functionality. IoT has exaggerated considerably within the previous few years since it's additional a brand new dimension to the globe of knowledge and communication technologies. For digitalizing home appliances corresponding to lighting, heating, security, audio, video etc. An IoT in home automation is that the best business resolution of late.

1. Smart Home promises the potentials for the user to measure home conditions (. e.g., humidity, temperature, luminosity, etc.),manipulate home (heating, ventilation and air conditioning) appliances and control their status with minimum user's intervention . Researchers and practitioners have made a great deal of efforts in facilitating the concept.

2. The aforementioned research efforts focus on the Smart home features of context-awareness,

energy efficiency, natural interaction, and user activity recognition.

1.2 Aim of the project

The main objective of the functions is to improve the quality of life and convenience in the home.Other goals are greater security and more efficient use of energy thanks to connected, remote-controllable devices.

1.3 Scope of the Project

The scope of the project is to control the home security and digitalized home.

1.4 Methodology

The proposed system uses the ESP8266MOD Wi-Fi module which is connected to the sensors and the electronic devices. It uses a Wi-Fi network to connect it from the cloud. The Wi-Fi module sends the Humidity and Temperature data to the cloud which allows the user to monitor the readings. The user can change the speed of the fan and switch ON or OFF the light. Machine Learning Algorithm is used to adjust the electronic devices according to the user behavior. Data from the sensors is stored in a CSV file using python. Using this data, the dataset is being made to make the appliances learn according to the user's behavior. The DHT11 sensor is connected to the ESP8266 which provides the data in a room.

Chapter 2

LITERATURE REVIEW

Garg et al. presented [1] a home automation system for sensing and maintaining appropriate environmental home conditions and to provide security from theft or hazard using sensors and controlling home appliances. It uses a cloud database to retrieve commands that control the home over the Internet. The cloud database is also used to store time-based parameters from various sensors in the home.Pujari et al. [2] developed an Android application with a Firebase database to transmit sensor data, receive commands and automatically control devices in the home. Automatic control of lights in their system is based on feedback from the passive infra-red (PIR) and light dependant resistors (LDR) sensors in the home. The work also incorporates detection of motion, gas leakage, and environmental conditions. Gladence et al. [3] proposed a client-server-based mechanism for smart home automation. The proposed system uses machine learning algorithms and NLP concepts to establish interaction between the systems and humans. The user issues command to carry out specific tasks such as controlling home appliances and doors and monitoring voice bed movement. The authors also designed a module to assist persons with disabilities through NLP and artificial intelligence techniques. Jabbar et al. [4]. The system controls electrical appliances and monitors environmental conditions, motion, and gas levels in the home, both locally and remotely, via a mobile application or laptop application. The authors developed a prototype for the system, called IoT@HoMe, for which a NodeMCU was used as a Wi-Fi-based gateway to connect different sensors in the home. Data generated by the sensors are uploaded to a cloud server (Adafruit IO) and accessed via If This Then That (IFTTT) on the user's smartphones or laptops.Salhi et al. [5]. The approach presented by the authors

uses a data flow model and data acquisition through sensors in the home for analytics and prediction. In conjunction with the sensed information, the data mining method was used to detect abnormalities in the air. Their approach was aimed at enhancing the safety and protection of property in smart homes. An Arduino Uno board was used to aggregate data generated by sensors, and a Raspberry Pi was used as a machine gateway to receive the sensed information.Mehmood et al. [6] developed an object detection mechanism for the control of smart home appliances, in which the automation system was based on an object detection algorithm, model view controller architecture, and cloud of things. The IoT devices communicated with home appliances through the message queuing telemetry transport (MQTT) mode. This work showed that object detection algorithms combined with deep learning algorithms enhance object detection in a smart home environment.

Chapter 3

PROJECT DESCRIPTION

3.1 Existing System

Zigbee ZigBee is AN IEEE 802.15 customary employed in home automation technology and the same as LAN and Bluetooth tech-nology [5,6]. This technology uses frequency (RF) for sign and management. Zigbee may be a mesh protocol, wherever devices will act as repeaters [5]. This technology offers advantage of in-crease within the property of devices inside the house. Zigbee technology is wireless therefore it helps to beat the intrusive in-stallation downside. The Zigbee customary provides 250kbps rate.

3.2 Proposed System

As of late, remote frameworks like Wi-Fi have clothed to be more and more basic in home systems administration. Likewise in home and building automation frameworks, the employment of remote advancements offers some points of interest that could not be accomplished utilizing a wired system [1] Reduced institution costs: and principal, institution prices are altogether bated since no cabling is significant. Wired arrangements need cabling, wherever material and conjointly the professional egg laying of links (e.g. into dividers) is expensive. [2] System skillful-ness and straightforward augmentation: Deploying an overseas system is especially worthy once, owing to new or modified con-ditions, growth of the system is significant. instead of wired institutions.

Advantages

- Home security:With IoT home automation you are less worried about home security. We can control the security of our home with our phone. If anything goes wrong, we may receive notifications on our phone and we may probably operate our lights or locks through our phone.
- Energy efficiency and savings:We can increase the energy efficiency by controlling our electrical fixtures through IoT. If we are unsure whether our child has left lights on before leaving, we can check and control it through our phone.
- Convenience: This can be considered as one of the main advantages of home automation using IoT. We have the control of all our devices connected through IoT. It makes it very convenient for we have to all the devices adjusted just through our phone. For example, if we forgot to adjust our thermostat in the morning before we left our house, we can adjust it from our office.

Disadvantages

- Smart home systems are complex for common people. It requires training for people having little knowledge on smart home technologies and product.
- Security from hackers is a big concern in a smart home system. This is because if hackers are able to infiltrate a smart device, they can turn off lights, turn off alarms, unlock the doors, copy secret personal and official data .
- Smart home devices should be interoperable regardless of their respective manufacturers in order to make effective smart home system.

3.3 Feasibility Study

3.3.1 Economic Feasibility

This project does not require any high cost equipment. It requires a smartphone or any personal devices or laptops or pc which are affordable by everyone.

S.N	Component Name	Cost (INR)	Quantity	Total Cost
1	Wi-Fi Module (ESP8266)	500	1	500
2	Sensor (DHT11)	200	1	200
3	Nano Arduino	400	1	400
4	Relay Board	200	1	200
5	Wires	40	1	40
6	PCB Board	150	1	150
7	Cloud Hosting	1000	1	1000
		Total Cost		2490

3.3.2 Technical Feasibility

This project is based on wireless technology and smart devices which are in phase with currently used technology.The ESP8266 uses between 2.5V and 3.6V. But the recommended maximum for the input voltage is 3.3V. Most of the sensors run on 3.3V as well but in case we use 5V sensors, we will then need to add a voltage regulator.The ESP8266 uses standard Wi-Fi capabilities with security capabilities of WPA/WPA2 and encryption capabilities . The ESP uses AT commands in order to be communicated to or from using serial.

3.3.3 Social Feasibility

The aspect of the study was to see the extent of acceptance of the system by the user. This project can easily accepted by the users as a necessity for data collection and analysis. They did not feel threatened by the system. This project easily accepted aerial images from the users and does the semantic segmentation based on their requirement and this helped them for data collection and analysis for various purposes in various fields.

3.4 System Specification

3.4.1 Hardware Specification

- System: Pentium IV2.4GHz.
- Hard Disk: 250GB

3.4.2 Software Specification

- adaio.fruit
- OS:Windows
- Language: Python
- Arduino
- Server: io.fruit

Chapter 4

MODULE DESCRIPTION

4.1 General Architecture

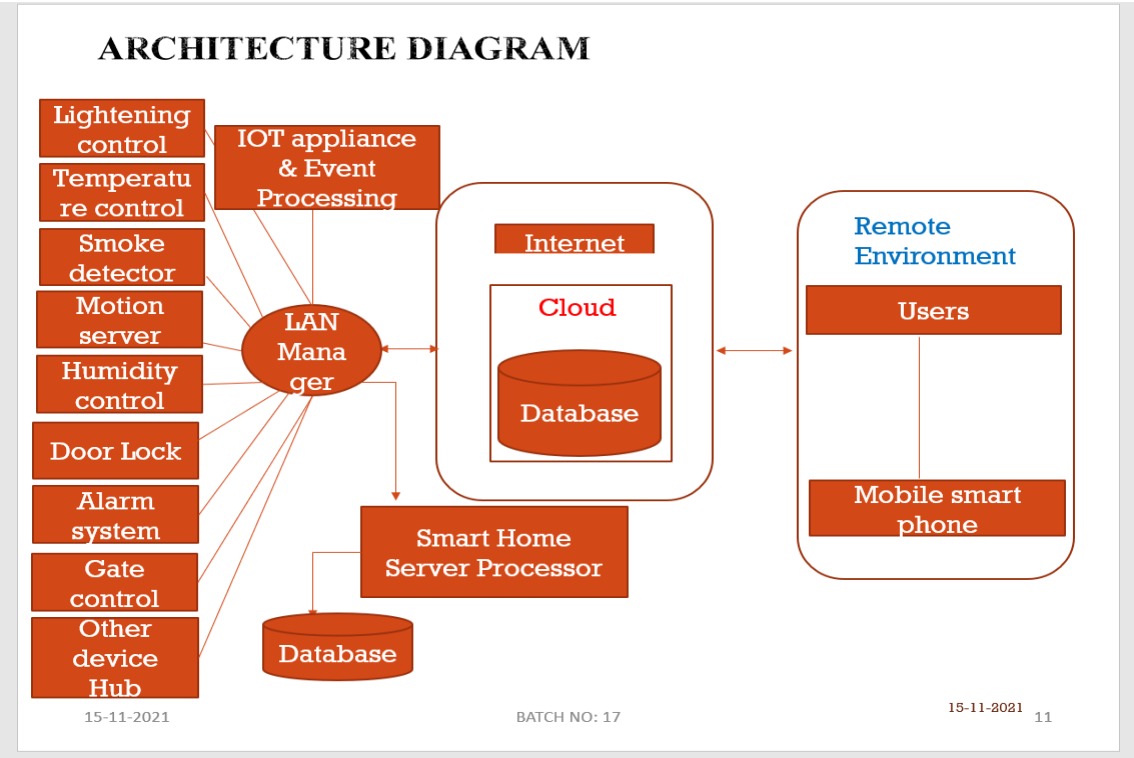

Figure 4.1: **Architecture Diagram**

Description: Current lifestyles and technologies have inspired new ways to manage home appliances free of restrictions previously imposed by distance and time. So-called home automation technologies allow users to control and schedule common home tasks, often without human intervention. Several types of home automation systems have been proposed and classified show in figure[4.1].smart-home main components and their inter-connectivity. On the left block, the smart home environment, we can see the typical devices connected to a local area network [LAN]. This enables the communication among the devices and outside of it. Connected to the

LAN is a server and its database. The server controls the devices, logs its activities, provides reports, answers queries and executes the appropriate commands. For more comprehensive or common tasks, the smart home server, transfers data to the cloud and remotely activate tasks in it using APIs, application programming interface processes. In addition, IoT home appliances are connected to the internet and to the LAN, and so expands smart home to include IoT. The connection to the internet allows the end user, resident, to communicate with the smart home to get current information and remotely activate tasks.

4.2 Design Phase

4.2.1 Data Flow Diagram

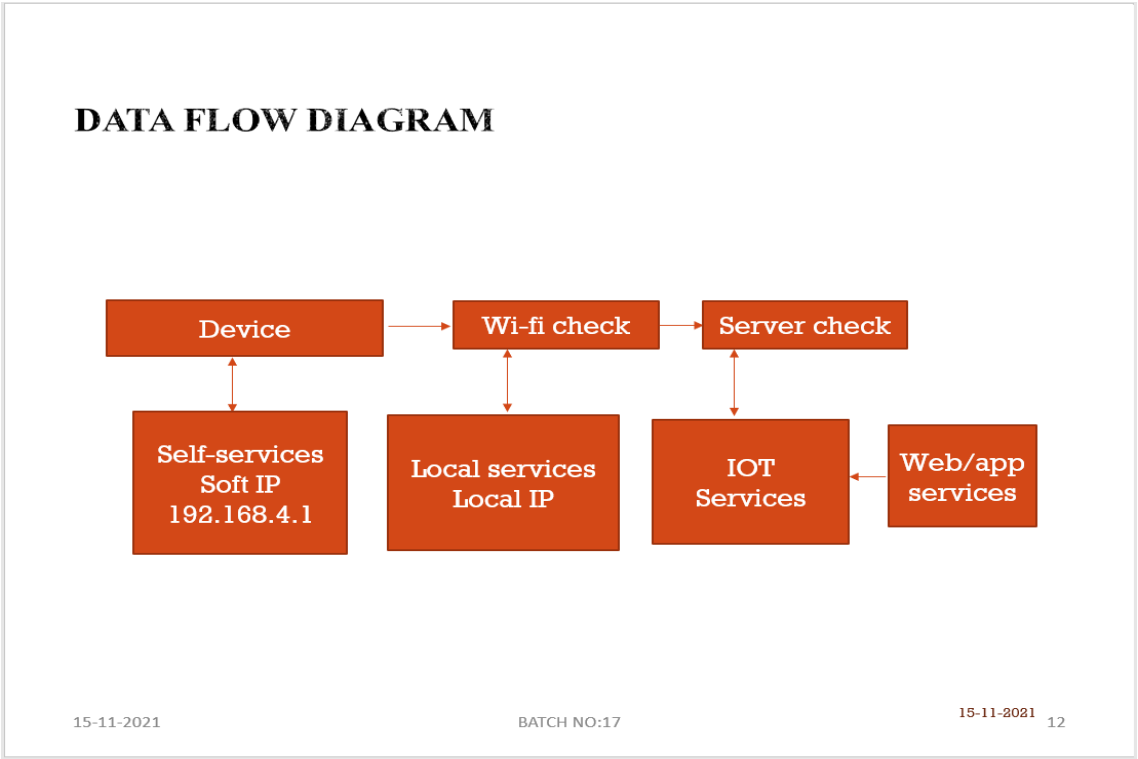

Figure 4.2: **Data Flow Diagram**

Description: A Data Flow Diagram (DFD) is a traditional way to visualize the information flows within a system. A neat and clear DFD can depict a good amount of the system requirements graphically show in figure[4.2]. It can be manual, automated, or a combination of both.It shows

how information enters and leaves the system, what changes the information and where information is stored. The purpose of a DFD is to show the scope and boundaries of a system as a whole. It may be used as a communications tool between a systems analyst and any person who plays a part in the system that acts as the starting point for redesigning a system.

4.2.2 Use Case Diagram

Figure 4.3: **Use Case Diagram**

Description: This is one of the primary use cases of our project. It describes the action which the user performs to get the readings of home conditions, e.g., temperature and humidity.The use case indicates that the user is able to manipulate various household appliances, such as lights, doors, fans and air conditioners.This use case indicates that the user can use UI to gain access to a home and have their activity logged. This would allow tracking the user's presence in a home.

4.2.3 Class Diagram

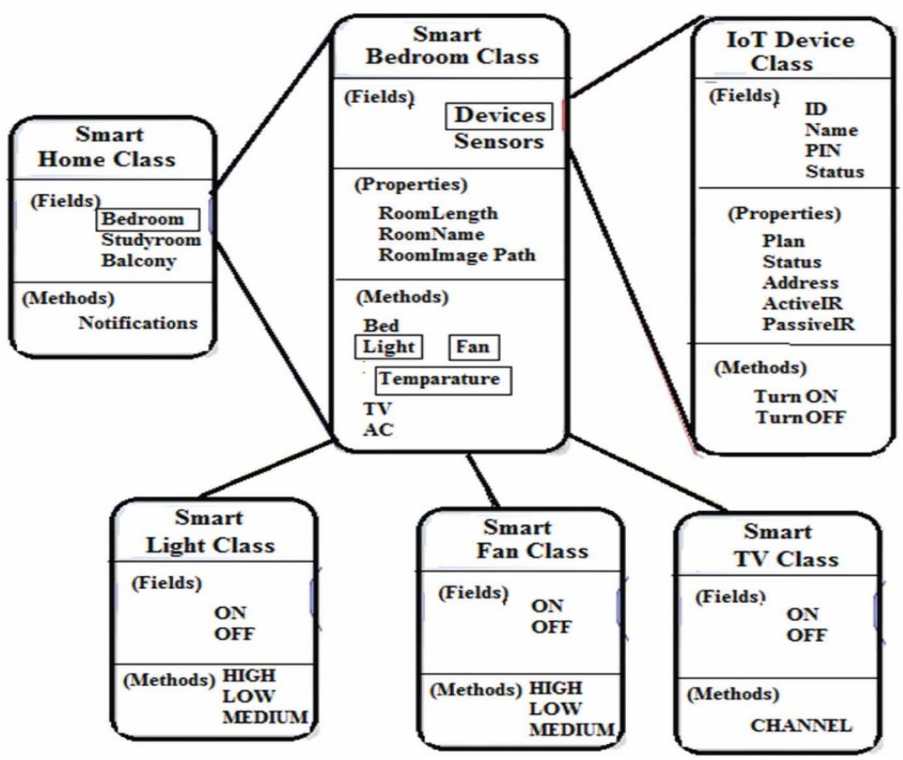

Figure 4.4: **Class Diagram**

Description: The class diagram is a model for creating the classes, their attributes, and functions.The system can detect the device automatically whenever the user is connected to the device.User can manage the basic functionalities of home applications such as ON/OFF, change the light intensity, speed of the fan, etc.User can postpone some of the functionalities of the existing events, and it can put in those events as a reminder for the future.All sensor communication information stored in the database module.

4.2.4 Sequence Diagram

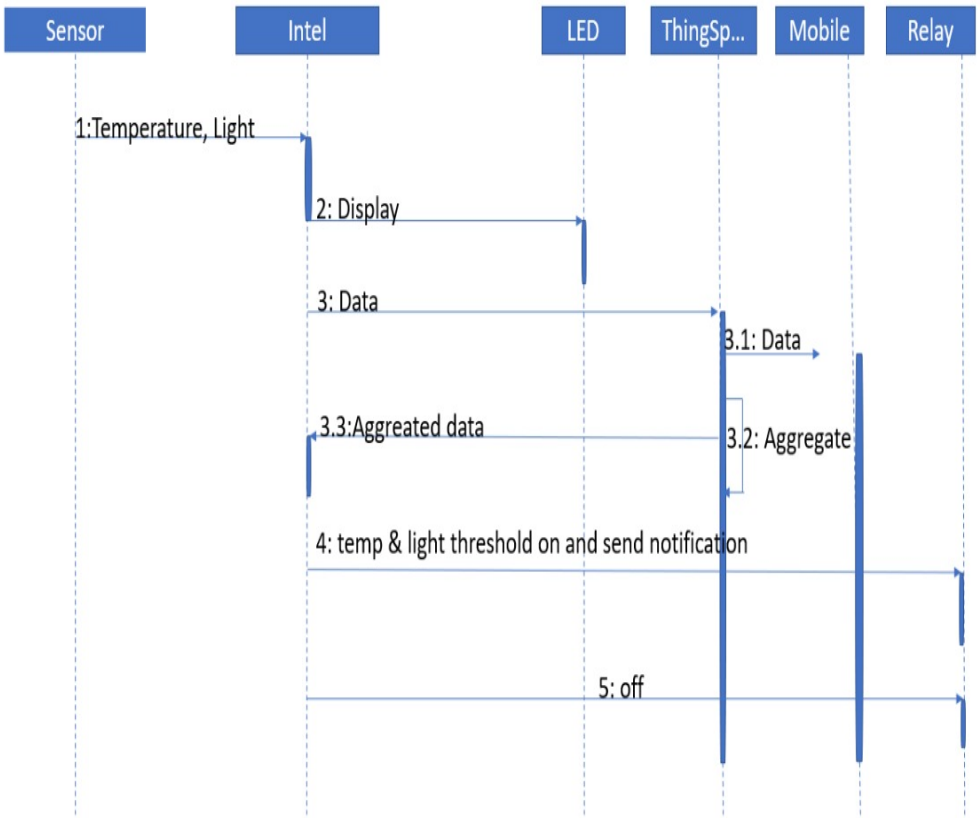

Figure 4.5: **Sequence Diagram**

Description: Sequence diagram showing communication flow in the smart home described. Every two seconds, a new report is sent by the meter to the main server. When a report makes certain HEMS condition to be met, the management of other smart home devices is triggered.

4.3 Module Description

- Humidity sensor: These sensors bring the capability of sensing humidity/RH levels in air for smart homes. The accuracy and sensing precision depends a lot on multiple factors including the overall sensor design and placement.

- Security: Systems like lock or TP-Link camera for household security are the usual part of a connected home kit. Enhanced security is a smart home benefit early adopters favor the most. However, smart locks and surveillance cameras are not the only tools to improve the security of households.

- Temperature sensor: The temperature devices measure temperature readings through electrical signals. The sensor is made up of two metals, which generate electrical voltage or resistance once it notices a change in temperature.The temperature sensor plays a critical role in maintaining a specific temperature within any equipment.

Chapter 5

IMPLEMENTATION AND TESTING

5.1 Input and Output

5.1.1 Input Design

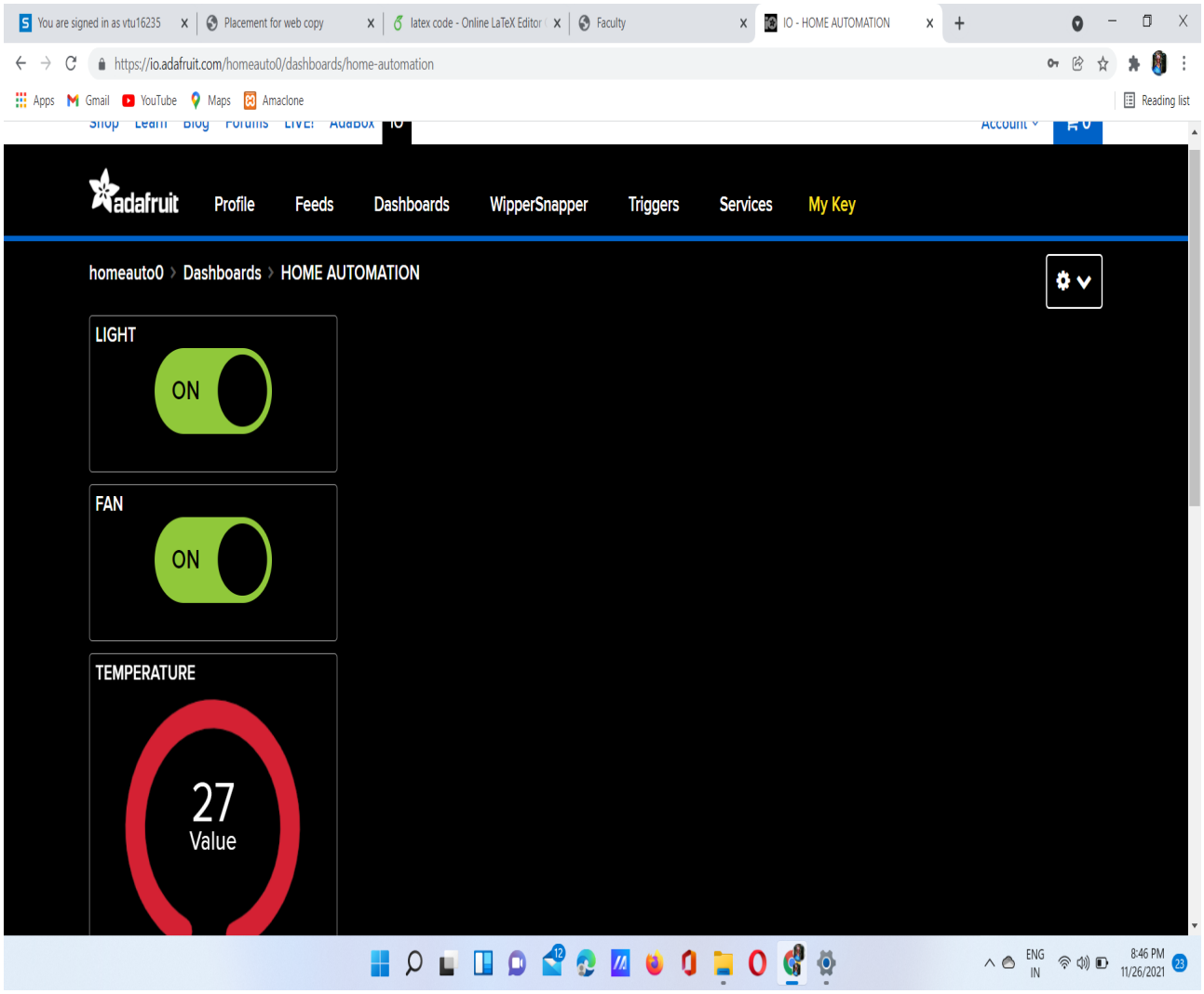

Figure 5.1: **Sensors data stored in the cloud**

5.1.2 Output Design

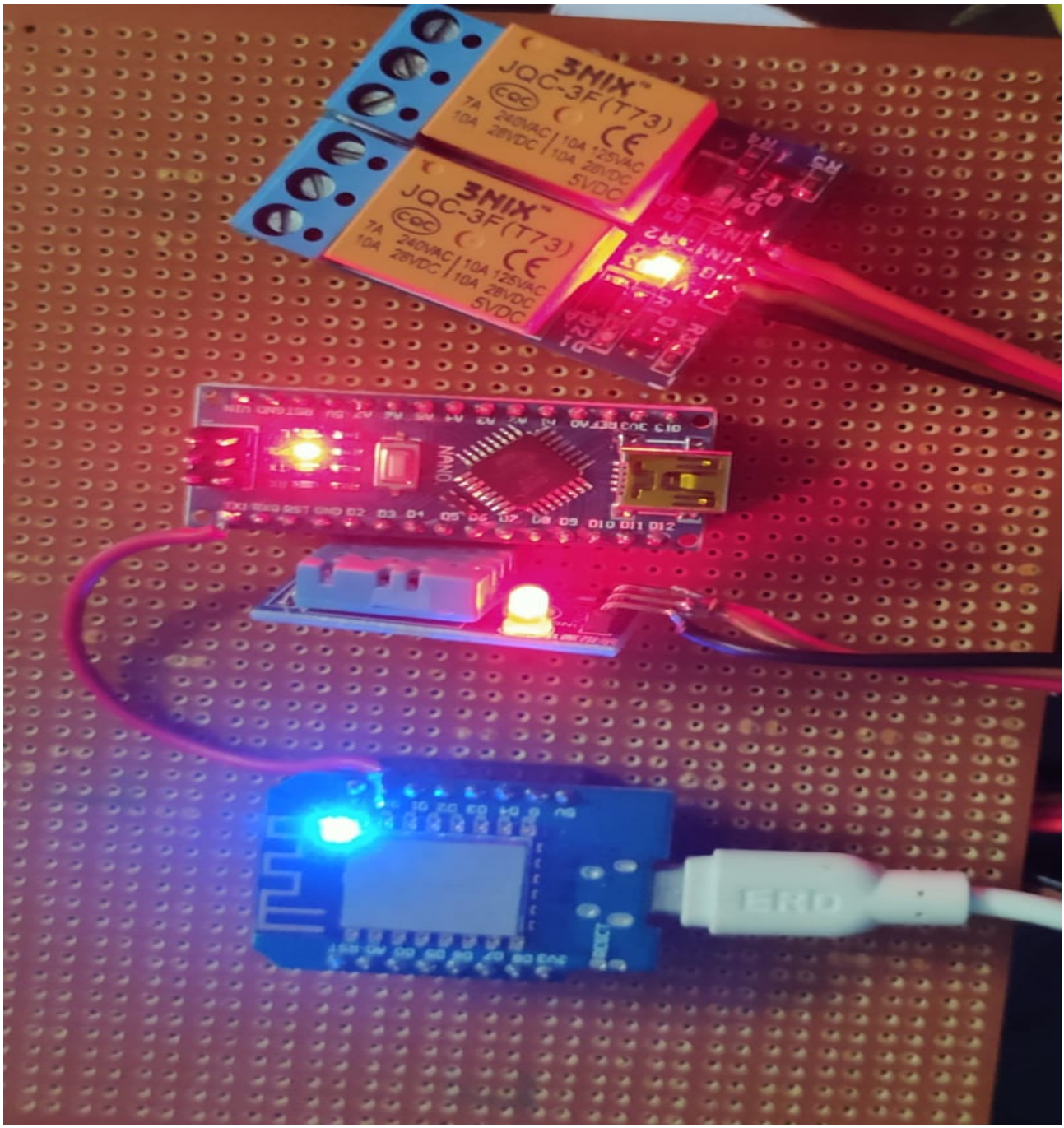

Figure 5.2: **Project output**

5.2 Testing

5.3 Types of Testing

5.3.1 Unit testing

Unit testing components should be tested separately should be done for testing software which is used for access to house system through devices (mobile phones,PC, etc).for components of average level: work of adafruit for components of lower level.

5.3.2 Integration testing

Integration testing should be separately executed interaction testing of high level components; interaction testing of average level components and interaction testing of the hardware level.

5.3.3 Functional testing

A smart home device is submitted to the usual product tests. We test products such as temperature sensors and humidity sensor for their mechanical and electrical safety and for their functionality.

5.3.4 Test Result

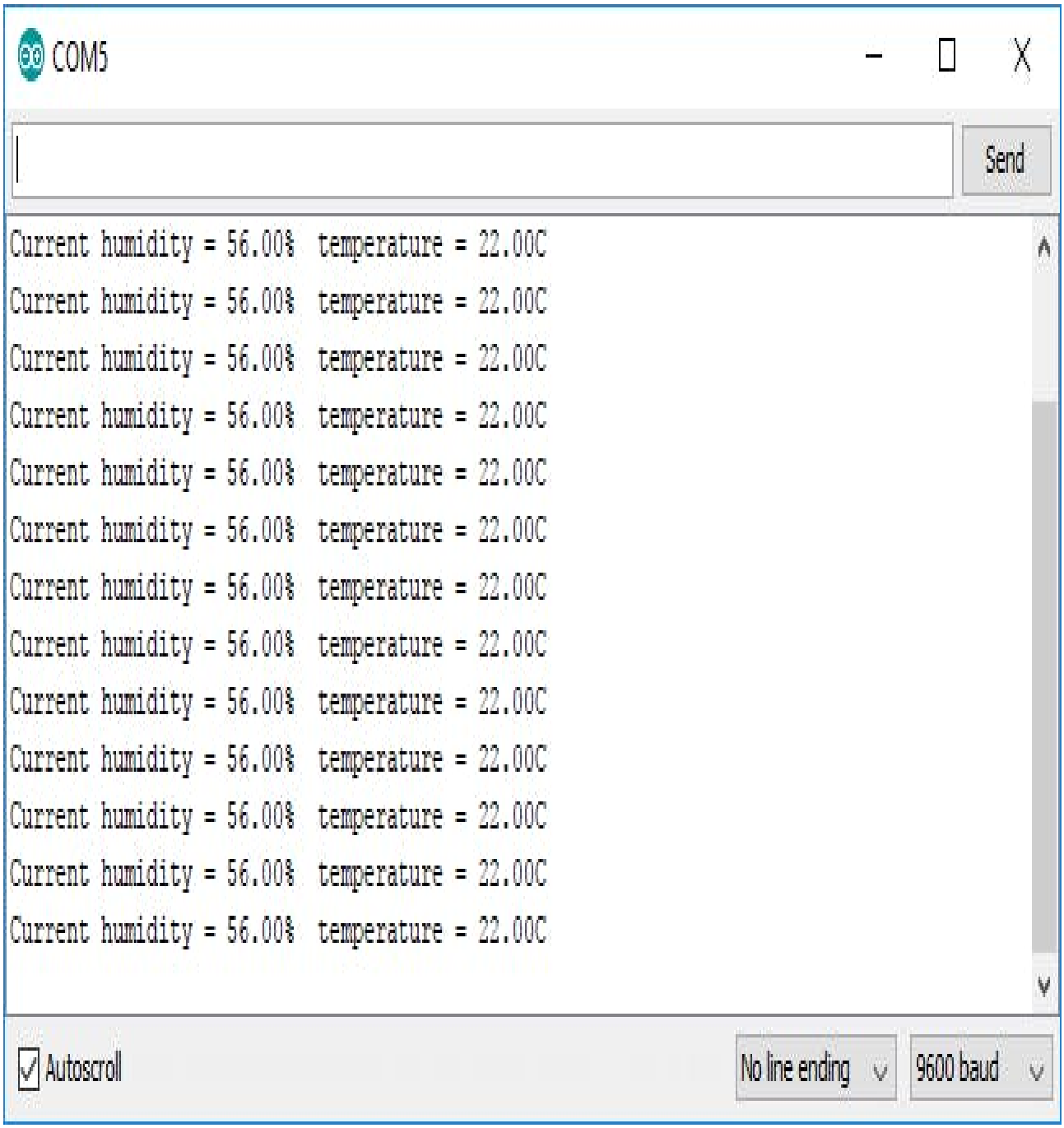

Figure 5.3: **Humidity and Temperature output**

Chapter 6

RESULTS AND DISCUSSIONS

6.1 Advantages of the Proposed System

- Easier to Lock and Unlock the Doors: The security of your home is the most important aspect of any house.
- Energy saving is probably the primary concern for every house owner. With convenient appliances and so many electronic gadgets, the amount of energy consumption is greatly increased.
- Know About Maintenance and Service: When your devices and appliances need servicing for maintaining its performance, must be known in advance. However, monitoring this is not always easy.

6.2 Sample Code

```
#include <Adafruit_Sensor.h>
#include <LiquidCrystal.h> //Load Liquid Crystal Library
LiquidCrystal LCD(2,3,4,5,6,7);  //Create Liquid Crystal Object called LCD
#include <DHT.h>
#include <DHT_U.h>
#define DHTPIN            8         // Pin which is connected to the DHT sensor.
#define DHTTYPE           DHT11     // DHT 11
DHT_Unified dht(DHTPIN, DHTTYPE);
uint32_t delayMS;
String response;
unsigned long time_prev=0;
unsigned long time_now;
bool change_update=false;
bool showespcom=true;
int a1=0;
int a2=0;

void setup()
{
 Serial.begin(9600);

 pinMode(9, OUTPUT);
```

```
 pinMode(10, OUTPUT);
 digitalWrite(9, LOW);
 digitalWrite(10, LOW);
}

void count_time(void)
{
  time_now=millis();
  if(time_now-time_prev >=6000)
  {
  time_prev=time_now;
  change_update=true;
  }
 }


  void loop()
{
 count_time();
 char c;
 sensors_event_t event;
   if(change_update)
    {
    dht.temperature().getEvent(&event);
    a1=event.temperature;
    dht.humidity().getEvent(&event);
    a2=event.relative_humidity;
    Serial.print("*");
    Serial.print(a1);
    Serial.print(",");
    Serial.print(a2);
    Serial.println("#");
    change_update=false;
LCD.setCursor(5,0);  //Set LCD cursor to upper left corner, column 0, row 0
LCD.print(a2);  //Print Message on First Row
LCD.setCursor(5,1);  //Set LCD cursor to upper left corner, column 0, row 0
LCD.print(a1);  //Print Message on First Row
 }

   }
```

Output

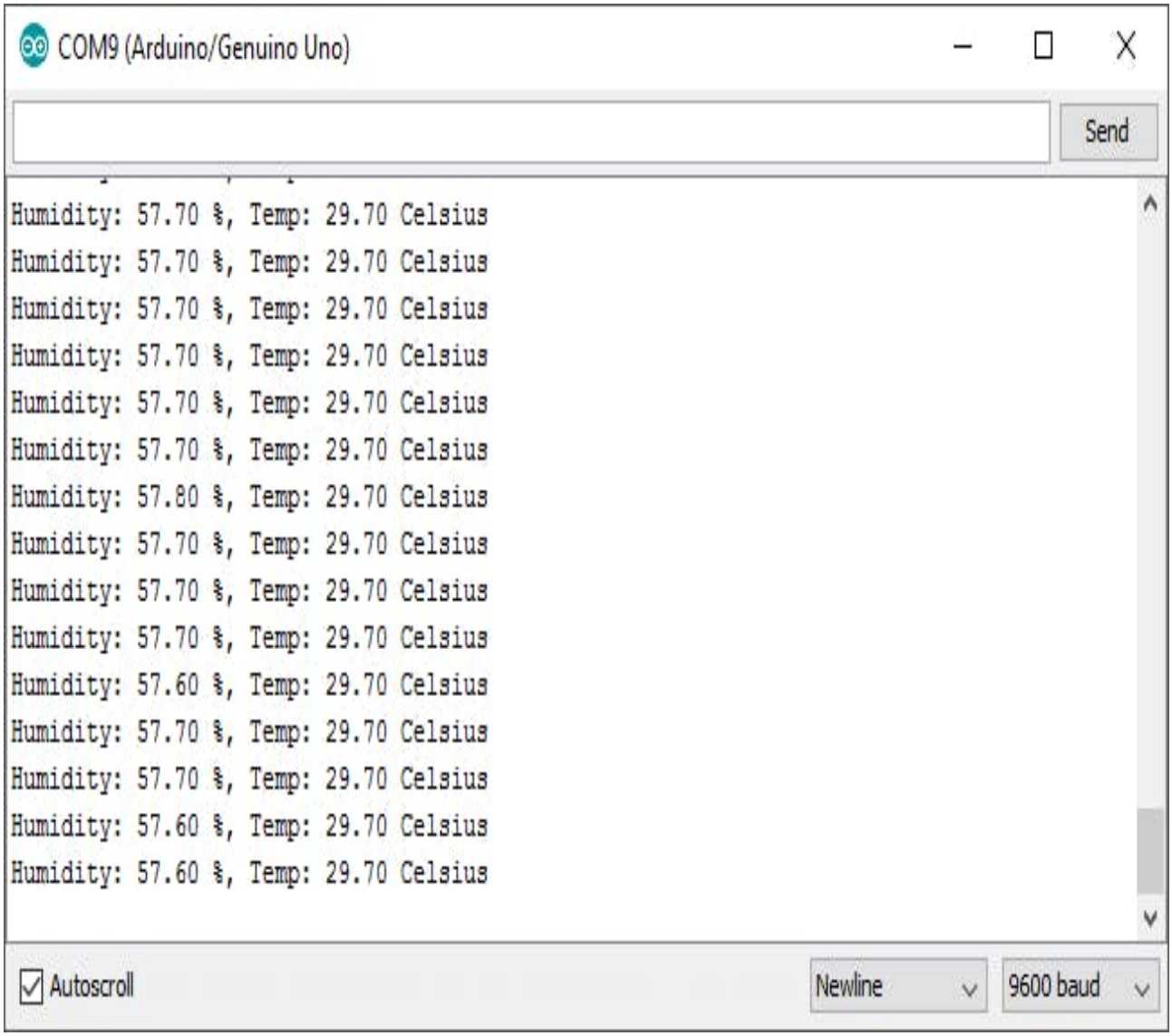

Figure 6.1: **Humidity and Temperature Output 1**

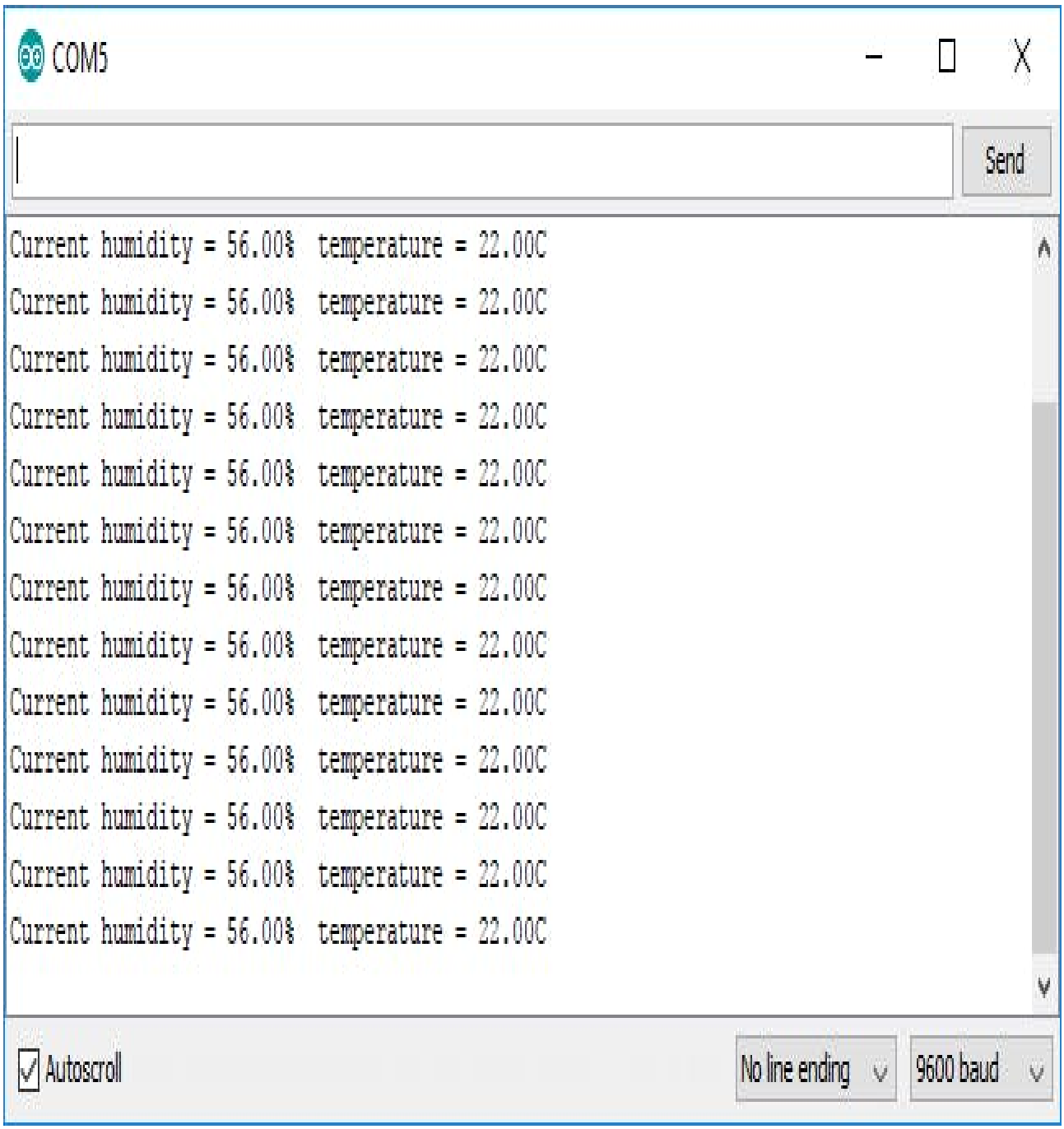

Figure 6.2: **Humidity and Temperature Output 2**

Chapter 7

CONCLUSION AND FUTURE ENHANCEMENTS

7.1 Conclusion

The different smart home based system with IOT systems services and their Features, Challenges and Security aspects are discussed. Internet (Wifi) based home system with IOT system is a flexible and low cost, such system can only work in the wireless network. Such systems are noise sensitive and their accuracy can be affected by signal to noise ratio. These data are uploaded from the gateway to the web server through the LAN. Data acquisition and transmission are coded in parallel processes. That is when data acquisition is operating, data transmission is not interrupted and is executed in the background. The approach was successfully used for demonstrating services for measuring home conditions, monitoring home appliances, and controlling home access. The infrastructure can be adopted for or adapted to other applications.

7.2 Future Enhancements

- There are a lot of other sensors that can be used to increase the security and control of the home like pressure sensor that can be put outside the home to detect that someone will enter the home.
- Changing the way of the automated notifications by using the GSM module to make this system more professional.
- The project demonstrates a way of using Web services and Cloud computing to build an IoT system for a smart home on a real-time basis. Through this approach, users can have access to the system from anywhere in the world.

Chapter 8

PLAGIARISM REPORT

8.1 plagiarism report

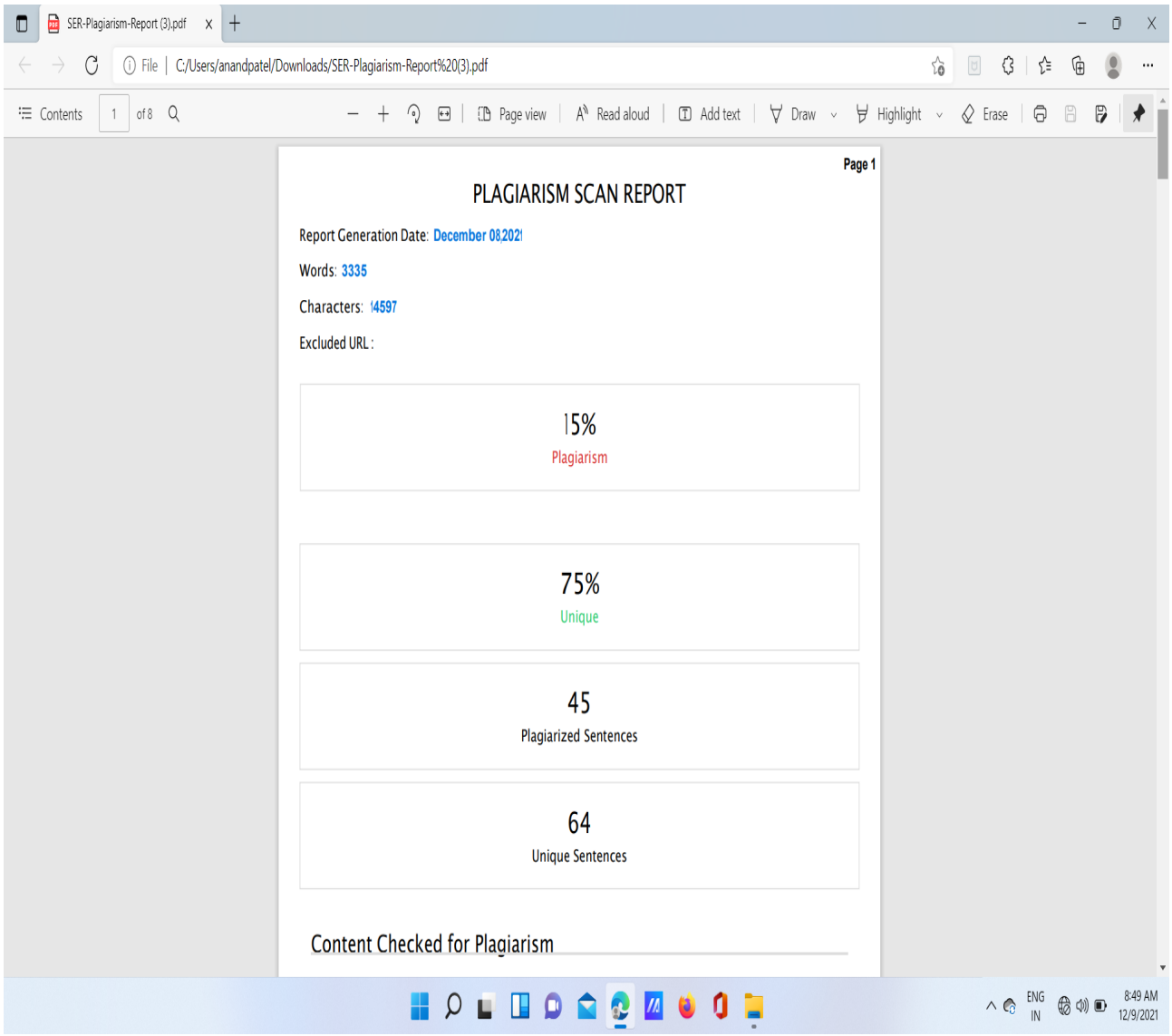

Figure 8.1: **plagiarism report**

Chapter 9

SOURCE CODE & POSTER PRESENTATION

9.1 Source code

```
#include <Adafruit_Sensor.h>
#include <LiquidCrystal.h> //Load Liquid Crystal Library
LiquidCrystal LCD(2,3,4,5,6,7);  //Create Liquid Crystal Object called LCD
#include <DHT.h>
#include <DHT_U.h>
#define DHTPIN            8         // Pin which is connected to the DHT sensor.
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DHT_Unified dht(DHTPIN, DHTTYPE);
uint32_t delayMS;
String response;
unsigned long time_prev=0;
unsigned long time_now;
bool change_update=false;
bool showespcom=true;
int a1=0;
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void setup()
{
 Serial.begin(9600);

 pinMode(9, OUTPUT);
 pinMode(10, OUTPUT);
 digitalWrite(9, LOW);
 digitalWrite(10, LOW);
}

void count_time(void)
{
  time_now=millis();
  if(time_now-time_prev >=6000)
  {
  time_prev=time_now;
  change_update=true;
```

```
  }
 }


  void loop()
{
 count_time();
 char c;
 sensors_event_t event;
   if(change_update)
    {
    dht.temperature().getEvent(&event);
    a1=event.temperature;
    dht.humidity().getEvent(&event);
    a2=event.relative_humidity;
    Serial.print("*");
    Serial.print(a1);
    Serial.print(",");
    Serial.print(a2);
    Serial.println("#");
    change_update=false;
LCD.setCursor(5,0);  //Set LCD cursor to upper left corner, column 0, row 0
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LCD.setCursor(5,1);  //Set LCD cursor to upper left corner, column 0, row 0
LCD.print(a1);  //Print Message on First Row
 }

   }
```

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