Sanitary Pad Disposal System

An Internship Report

submitted by

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in partial fulfilment of requirements

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BACHELOR OF TECHNOLOGY

Department of Computer Science and Engineering

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, DESIGN AND MANUFACTURING, KANCHEEPURAM

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I, **Revanth Janjanam**, with Roll No: **COE19B004** hereby declare that the material presented in the Project Report titled **Sanitary Pad Disposal System** represents original work carried out by me in the **Department of Computer Science and Engineering** at the Indian Institute of Information Technology, Design and Manufacturing, Kancheepuram.

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Revanth Janjanam

Place: Chennai

Date: 05.10.2023

CERTIFICATE

This is to certify that the report titled **Sanitary Pad Disposal System**, submitted by **Revanth Janjanam (COE19B004)**, to the Indian Institute of Information Technology, Design and Manufacturing Kancheepuram, in partial fulfilment of requirements for the award of the degree of **BACHELOR OF TECHNOLOGY** is a bonafide record of the work done by him/her under my supervision. The contents of this report, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

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ABSTRACT

The safe and sustainable disposal of sanitary waste, particularly sanitary pads, is a critical concern encompassing environmental, health, and social dimensions. This project aims to address these challenges by developing a smart sanitary disposal system with incineration capabilities. The system incorporates NodeMCU for connectivity, temperature sensors for precise control, and Nichrome wire as the heating element.a relay as a crucial switching component, allowing for precise control over the incineration process. The relay serves as the interface between the NodeMCU and the Nichrome wire, enabling the system to activate and deactivate the heating element as needed It ensures safe disposal by continuously monitoring incineration temperatures, preventing environmental pollution, and minimizing health risks.

KEYWORDS: Incineration, NodeMCU, Temperature Sensors, Nichrome Wire, Relay Switching, Waste management.

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NOTATION

Ω	Ohm
V	volts
$^\circ$**C**	degree centigrade

CHAPTER 1

Introduction

1.1 Scope

The scope of the project includes designing and building a sanitary disposal system using **NodeMCU (ESP8266)**, a 5V relay module, Nichrome wire, and a DS18B20 temperature sensor for the safe disposal of sanitary pads. The system completely burns the sanitary pads at high temperatures. Incineration breaks down material into ash which helps to eliminate any potential pathogens or bacteria present in the pad ensuring proper hygiene. In this process, the temperature is constantly monitored using a DS18B20 temperature sensor such that to avoid hazards or any failures. The temperature sensor will provide input data that enables the relay module to effectively control the heating element and automatically turn it off after completion of incineration.

1.2 Background and Motivation

Women's well-being and hygiene have consistently remained a global focal point. In rural areas, there is a notable absence of awareness regarding menstrual hygiene and the utilization of sanitary napkins. Inadequate menstrual hygiene practices can lead to fungal infections, recurring infections in the reproductive tract, a heightened risk of cervical cancer, and increased vulnerability to infertility. It's worth noting that comprehensive education on reproductive hygiene and sexual health is not currently integrated into the Indian educational system[1].Menstruation affects around 1.6 million girls and women of reproductive age each month. A quarter of school-going girls miss school days due to menstruation. More than half of adolescent girls experience their first menstruation without prior knowledge. Over half of adolescents rely on their mothers for information about menstruation, while 70 percent of mothers view it as unclean. Approximately 57.6 percent of young women aged 15-24 use safe and hygienic menstrual products. Each month, around 60,000 pads are disposed of, and most of them are not biodegradable. The use of unclean cloth is associated with a 2.5 times higher risk of developing cervical abnormalities (CIN III) and malignancy compared to using clean cloth or sanitary napkins. About 63 percent of girls do not change their menstrual absorbents while at school.

Figure 1.1: Different types of napkin

the improper disposal of sanitary pads is one of the major concerns in India. In addition to the environmental and wildlife impacts, the improper disposal of sanitary napkins can also strain sanitation infrastructure in urban and rural areas. Blocked sewage systems and overflowing septic tanks are not uncommon consequences of flushing non-disposable materials. This not only incurs significant costs for municipalities but also poses health risks to sanitation workers.[1] As articulated by Anisha Bhatia in her article dated April 24, 2017, on the SwatchIndia.ndtv website, it's noteworthy that a solitary woman has the potential to generate approximately 125 kilograms of non-biodegradable waste over her menstruating years[2]. This revelation underscores the environmental consequences associated with the 355 million women globally who are collectively responsible for producing a substantial amount of plastic waste. This waste, as Bhatia points out, can endure in the environment for an extended period, ranging from 500 to 800 years before it decomposes. Recommended options for disposal of different sanitary wastes (as per MHM Guidelines 2015)[1]

Figure 1.2: Sanitary Waste

Table 1.1: Waste Management Options

Sanitary Waste	**Disposal into toilet**	**Deep burial**	**Composting**	**Pit burning**	**Incinerator**
Used tissues, paper, cloth, cotton	Good Practice	Good Practice	Good Practice	Less recommended	Low cost or Electric
Cotton napkins	Less recommended	Good Practice	Good Practice	Less recommended	Electric
Commercial napkins with plastic and liners	Less recommended	Good Practice	Not possible	Less recommended	Bio-Medical Waste Incinerator

Stree Sanman said that providing sanitary napkins to women during the mensuration cycle is not a choice but a necessity. incinerators safely dispose of the sanitary napkin preventing harm to both land and human health. incinerators efficient in reducing smoke emissions significantly .[3]

The sanitation disposal system, equipped with an incinerator, is designed to serve a wide range of settings, including educational institutions such as schools and colleges, as well as transportation hubs like train compartments and railway stations. Additionally, it can be deployed in public toilets, contributing to the improvement of public sanitation and benefiting society at large

1.3 Objectives

- Develop a sanitary disposal system using NodeMCU, a temperature sensor, a relay module, and Nichrome wire for safe and efficient sanitary pad incineration.
- Monitor incineration temperatures to ensure safe and controlled disposal, preventing environmental pollution and health risks.
- Promote environmentally responsible waste management by reducing the impact of improper sanitary waste disposal.
- Enhance public health by minimizing the risk of infections and diseases related to inadequate sanitary waste management.
- Create a user-friendly system suitable for deployment in educational institutions, public facilities, and other diverse settings, advancing both technological innovation and societal well-being

CHAPTER 2

Methodology

2.1 Key Related work

In their study titled "Design of Sanitary Napkin Disposal System at Thrissur Municipality," Megha M V, M A Chinnamma, and Anitha K Subash aimed to develop an innovative sanitary napkin disposal system.[4] Their objectives included improving sanitary waste disposal, reducing infection risks from unhygienic disposal practices, minimizing environmental pollution caused by non-biodegradable napkins, and preventing drainage system clogs due to absorbent napkins. Their work underscores the importance of efficient sanitary waste management for public health and environmental sustainability.[5]

Dr.V. M. Pimpalkar along with his team created a system operates via a microcontroller activated by 5V DC voltage.[6] A 12V DC supply heats the burner coil, and the preset 5-minute timer initiates napkin disposal. After completion, an LED signals the end, turning off the heater and relay. The timer adjusts for additional napkins, increasing by 5 minutes for each, handling up to 5 napkins simultaneously.

Shreeshayana R's study, "Sanitary Napkin Vending Machine with Incinerator for Menstrual Hygiene," aimed to design an Electric Incinerator for the proper disposal of used sanitary napkins.[7] Incinerators are essential for reducing waste volume by eliminating flammable matter, and this research contributes to innovations in menstrual hygiene and waste management

Study titled "Solar-Based Sanitary Waste Dispenser," Dr. S. R. Kalambe and his team aimed to develop a solar-powered sanitary waste disposal machine. This innovative approach leverages solar panels to enhance sustainable waste management practices. Their work explores the integration of renewable energy to address sanitation and environmental concerns.[8]

2.2 Method:

In this project, the hardware components include the NodeMCU (ESP8266) microcontroller for core functions, a DS18B20 temperature sensor for safe burning control, a 5V relay to manage the power supply, and a nichrome wire as the heating element. The software used is the Arduino IDE, which programs the NodeMCU to control hardware and automate sanitary napkin disposal, fostering efficiency and hygiene.

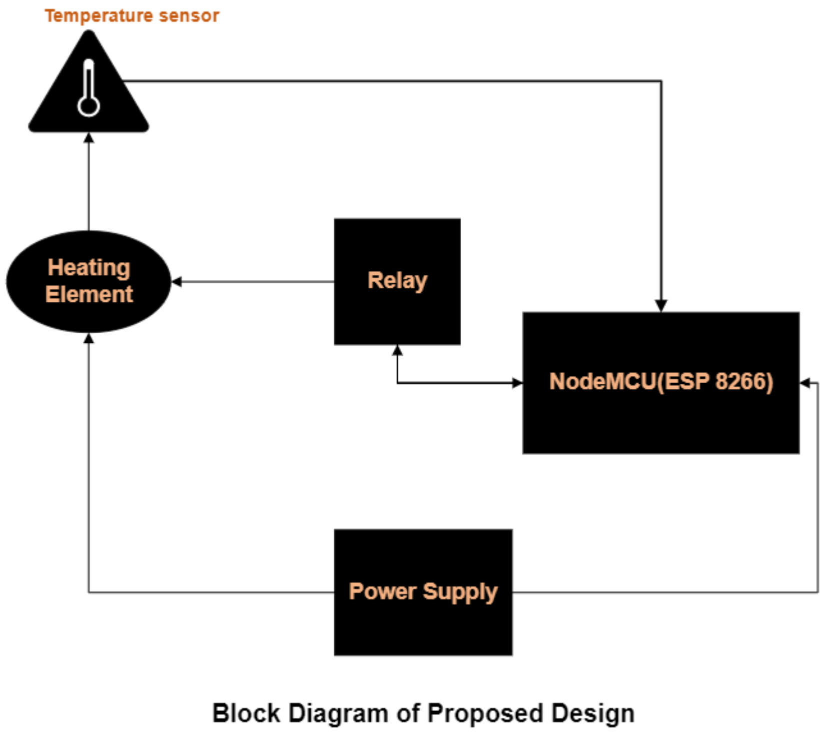

Figure 2.1: Block diagram of Proposed Design

2.2.1 Software requirements

Arduino Software (IDE)

The Arduino Integrated Development Environment, often referred to as Arduino IDE, plays a crucial role as a software tool for programming and creating applications for Arduino microcontrollers. It facilitates the uploading of code into the open-source

NodeMCU platform, displaying real-time output through the serial monitor, and even allows user inputs to trigger specific processes.

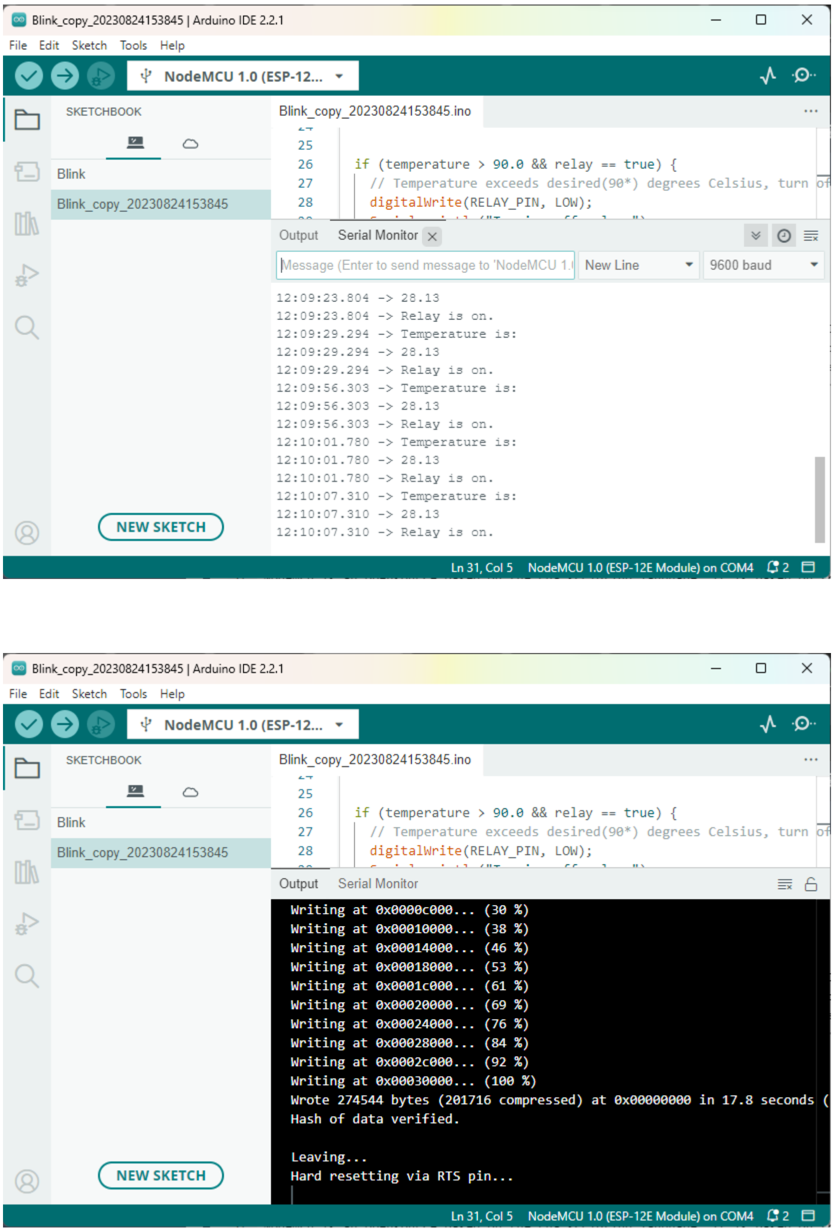

Figure 2.2: Inputs and Outputs of Arduion IDE

With a rich repository of libraries designed to control NodeMCU, temperature sensors, and other peripherals, Arduino IDE proves highly versatile and indispensable for a wide range of IoT applications.

2.2.2 Hardware requirements

Nodemcu

Nodemcu is an opensource based on the Lua scripting language. It is based on the esp8266 WiFi module. It is widely used in the development of projects because of its low cost, small size, and built-in WiFi module.

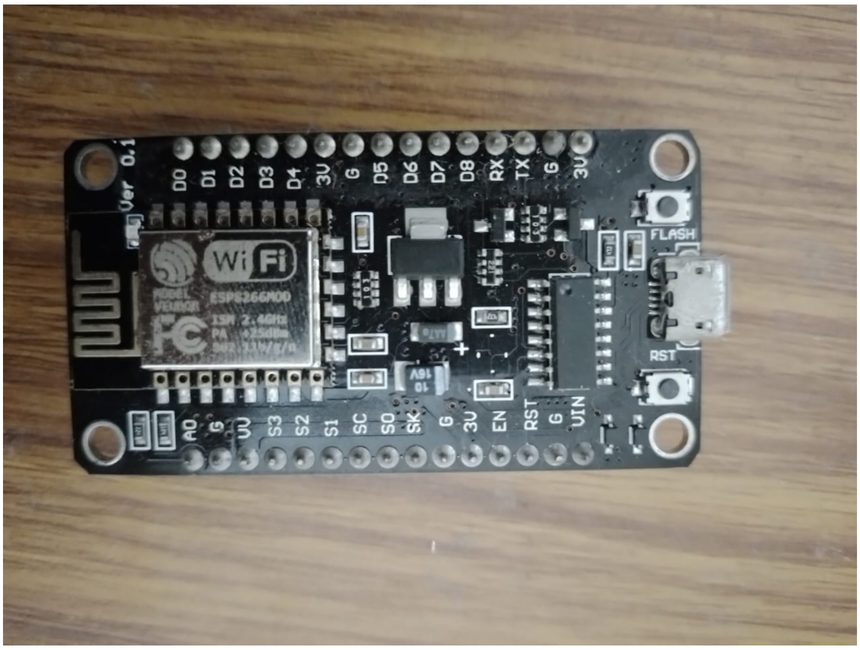

Figure 2.3: NodeMCU

Key attributes of Nodemcu:

- It is built around an esp8266-core microcontroller, which has a 32-bit processor and built-in wifi, enabling it to connect to the internet and other devices.
- It has support for Arduino IDE, allowing us to use familiar Arduino libraries and functions.
- It has multiple GPIO pins, enabling us to connect to various sensors and other components for different applications.

Purpose in our system:

The NodeMCU (ESP8266) serves as the central control unit, overseeing all operations. It interacts with a temperature sensor (DS18B20) to regulate incineration temperatures, ensuring safety. The NodeMCU triggers the 5V relay, which controls the power supply to the burning element (usually nichrome wire) for sanitary napkin disposal.

Relay

A relay is an electromechanical switch that regulates an electrical circuit by opening or closing its contacts in response to an electrical signal. Relays are frequently employed in many different applications, such as the isolation of one portion of an electrical circuit from another or the control of high-voltage circuits with low-voltage signals.

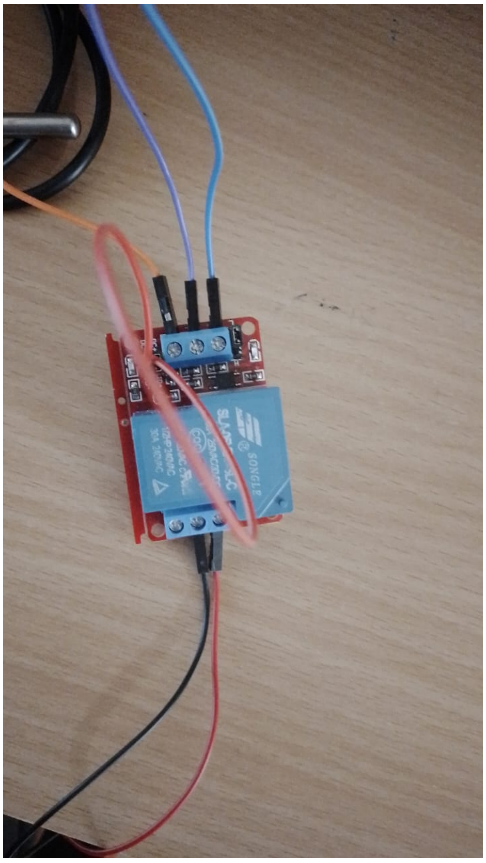

Figure 2.4: 5V Relay

The 5V relay is used to control the power supply to the burning element, which is made of nichrome wire. The relay then acts as a switch, allowing or interrupting the flow of electrical current to the nichrome wire.

Temperature sensor

The DS18B20 is a well-known one-wire communication protocol that enables straightforward wiring and simple microcontroller interaction. It is a very accurate digital temperature sensor. Since its usual temperature range is between -55°C and +125°C, it is appropriate for a variety of applications. Additionally, its popularity in applications ranging from weather stations and HVAC systems to industrial automation and home automation is attributed to its capacity to connect multiple sensors simultaneously, low power consumption, and compatibility with a variety of microcontroller platforms like Arduino and Raspberry Pi.

Figure 2.5: Temperature Sensor

The DS18B20 temperature sensor is used to monitor and regulate the temperature within the incinerator. It provides precise temperature monitoring, ensuring the effective and safe burning of sanitary napkins. The NodeMCU (ESP8266), which interprets the data and manages the burning process, receives data from the sensor and communicates with it to improve the safety and efficacy of sanitary napkin disposal.

Burning element

Nichrome wire, composed of nickel and chromium, is prized for its high electrical resistance and temperature stability, making it an excellent choice for controlled heating applications It warms up quickly, disperses heat evenly, and can resist extreme temperatures without corroding or degrading. Nichrome wire provides stable and precise heating for a variety of applications, including incineration as well as home appliances, industrial furnaces, and electrical resistors.

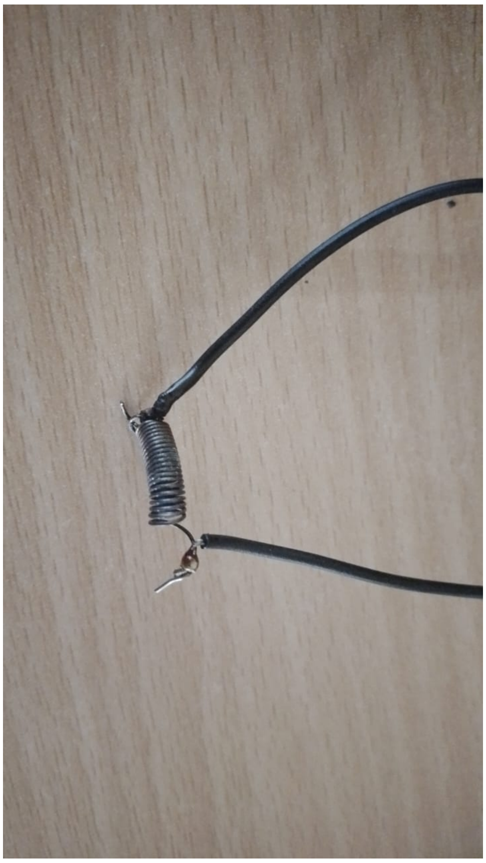

Figure 2.6: Nichrome wire

Nichrome wire serves as the heating element responsible for incinerating sanitary napkins. Its high electrical resistance and temperature stability enable efficient and controlled heating, ensuring the safe disposal of napkins. When activated by the system's control unit, typically a NodeMCU (ESP8266), the nichrome wire quickly heats up to facilitate the incineration process, contributing to improved hygiene and waste management.

Other components

- **Jumper wires:**
  Jumper wires establish electrical connections between components in the system, enabling signal and power transmission.

Figure 2.7: Female-Female Jumper

Figure 2.8: Female-Male Jumper

Figure 2.9: Male-Male Jumper

- **Resistors:**
  Resistors regulate voltage and current within the circuit, safeguarding components from overvoltage and ensuring safe operation.

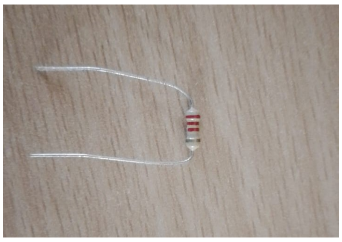

Figure 2.10: Resistor

- **Reverse Bias Diodes:**
  Reverse bias diodes protect against voltage spikes, particularly in inductive loads like relays, by providing a safe discharge path for reverse currents, preserving component integrity.

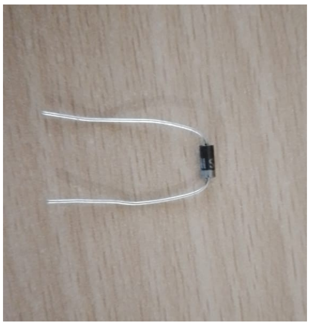

Figure 2.11: Diode

- **Micro USB**
  a USB cable provides power and data connectivity between the microcontroller (NodeMCU) and a computer.

Figure 2.12: Micro USB

CHAPTER 3

Work Done

3.1 Connecting NodeMcu with Arduino-IDE

3.1.1 Physical connection

Nodemcu has a female micro USB port so we can connect to a laptop using a micro USB cable

3.1.2 Software installations

- Install CP210x Universal Windows Driver to host communications with the board.
- Install the latest version of Arduino Ide software
- In the ardunio ide download ESP8266 board package

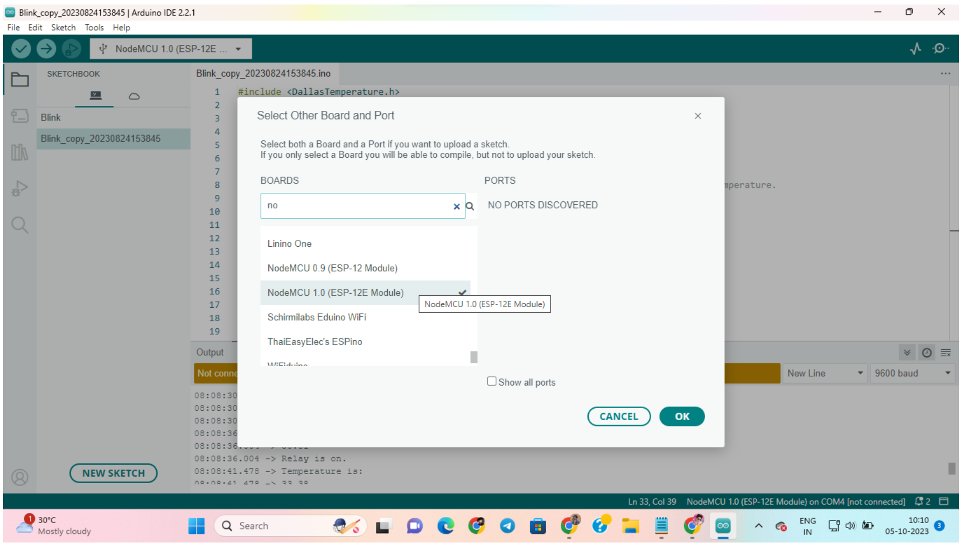

Figure 3.1: NodeMCU module

3.1.3 Setup

In the arduino Ide

- select the board as Nodemcu

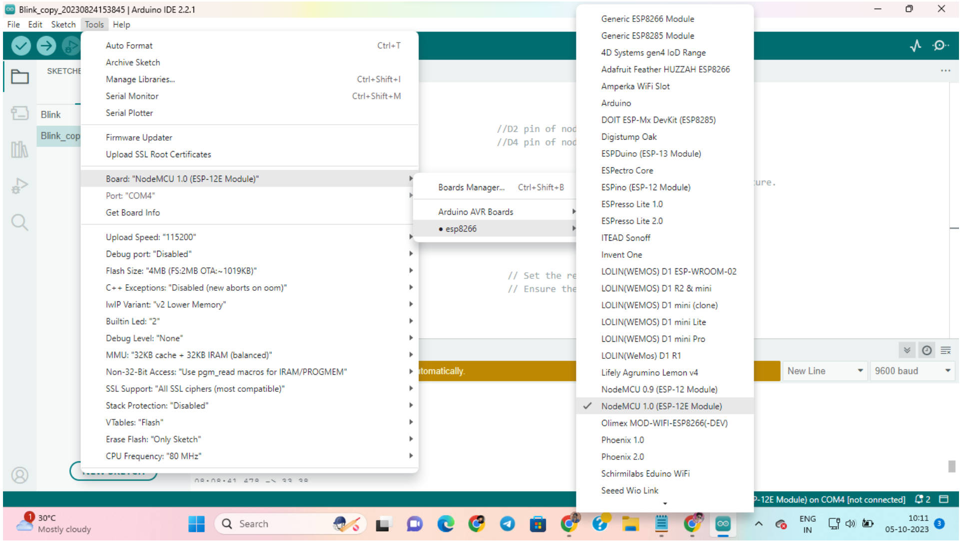

Figure 3.2: Selection of ESP8266 Board

- select the port "COM4"(in my case) to which USB is connected

3.2 Connecting NodeMcu with temperature sensor

3.2.1 Physical connections

- Components used: Jumper wires, resistors(combination of two 2.4ohm in series), DS18B20 temperature sensor, NodeMcu
- Power supply: Connect the DS18B20's VCC (power supply(red wire)) to the NodeMCU's 3.3V output pin. To provide a common ground reference, connect the DS18B20's GND (Black wire) pin to the NodeMCU's ground (GND).
- Data connection: Connect the data pin (Yellow wire) of the DS18B20 to a GPIO pin(D2 pin) on the NodeMCU
- Pullup resistor: Add the resistor of 4.7ohm in between vcc and data pin

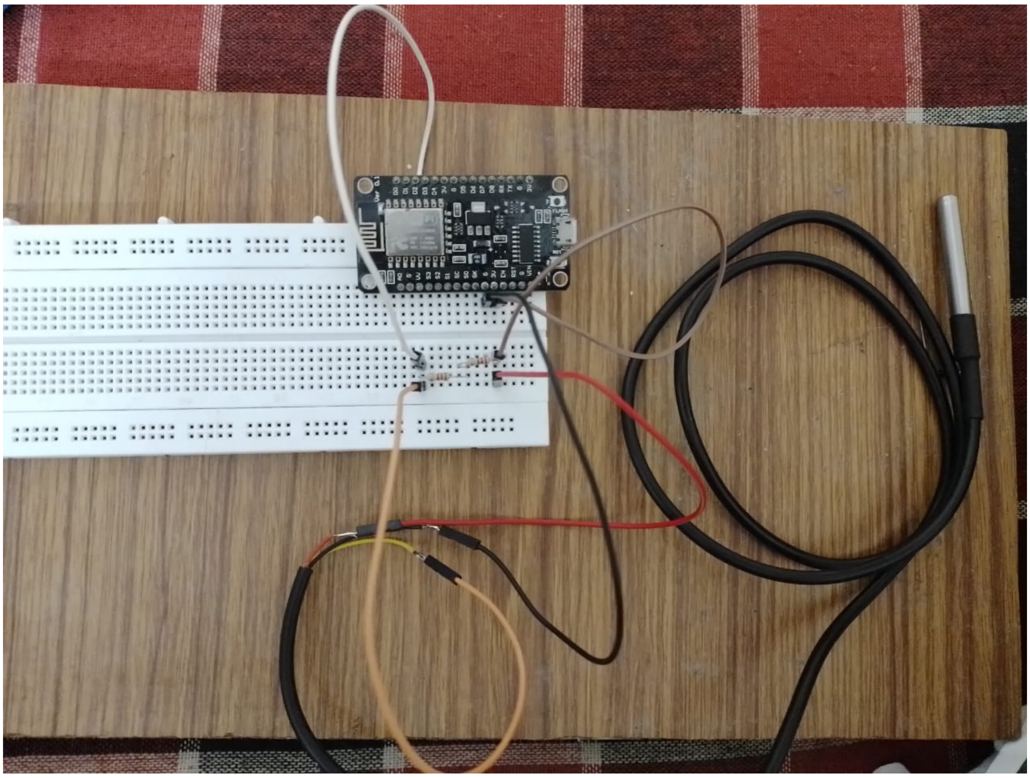

Figure 3.3: Nodemcu interfacing with temperature sensor

3.2.2 Software setup

- Install DallasTemperature and onewire libraries in the ardunio ide
- Add the libraries to the code

```
#include <DallasTemperature.h>
#include <OneWire.h>
```

Figure 3.4: Required Libraries

- As we connected the data wire to D2 pin to use inputs
- Pass the one wire reference to dallasTemperaturesensor

```
OneWire oneWire(ONE_WIRE_BUS);
DallasTemperature sensors(&oneWire);
```

Figure 3.5: Onewire

- in void setup begin the sensor
- send command to get temperatures

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

Figure 3.6: void setup

```
void loop(void)
{
  sensors.requestTemperatures();                /
  float temperature = sensors.getTempCByIndex(0);
```

Figure 3.7: Void loop

3.3 Connecting Relay with NodeMcu

3.3.1 Physical connections

- used compounds: NodeMcu,5v Relay, Jumperwires
- Connect the control pin (usually labeled "IN" or "Signal") of the relay module to one of the GPIO pins on the NodeMCU (D4 pin in our case). This GPIO pin will be used to control the relay.

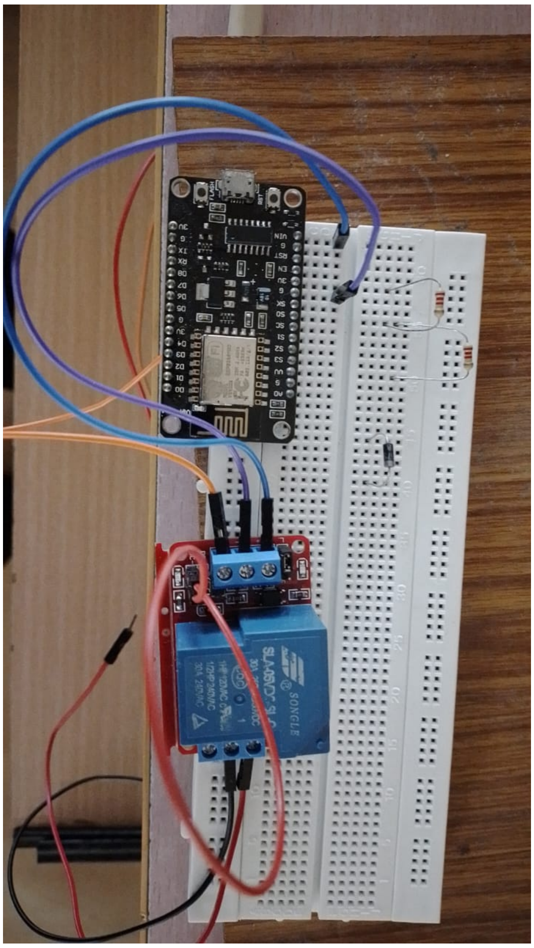

Figure 3.8: Nodemcu interfacing with Relay

- Connect the VCC (DC+) and GND(DC-) pins of the relay module to the 5V and GND pins on the NodeMCU, respectively.

3.3.2 Software setup

- As we connected Data pin of relay module to D4 pin of NodeMcu
- Set the relay pin as output and set turn on the relay.

3.4 Connecting the relay module to heating element

- compounds required:5v Relay module, nichrome coil,5v output adaptor(power source), connecting wires, reverse bias diode.
- connect the +ve terminal of the adaptor to the heating element and the -ve terminal to the relay's common ground.

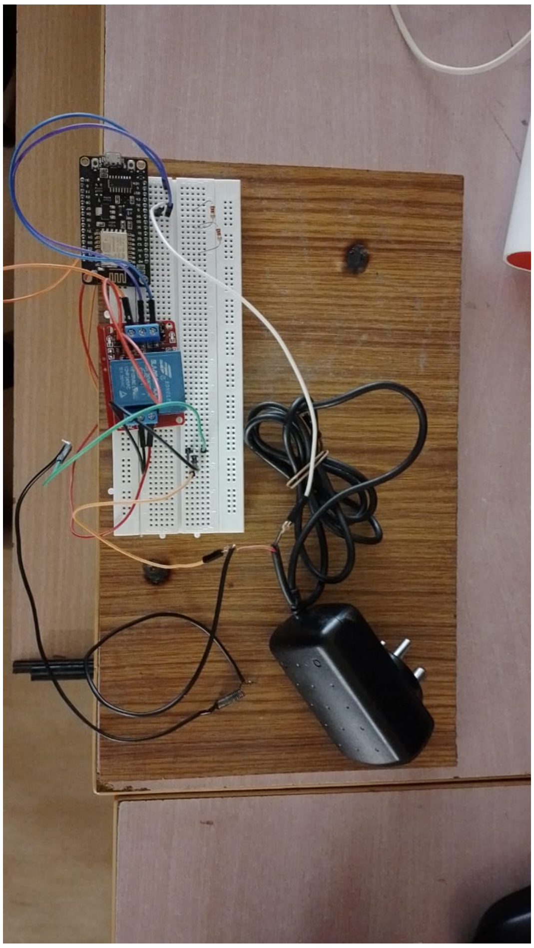

Figure 3.9: Relay to the heating element

- connect the other end of the nichrome wire to the com port of the relay.

- connect the diode parellel to the nichrome coil positive terminal to the power supply.

3.5 Final setup

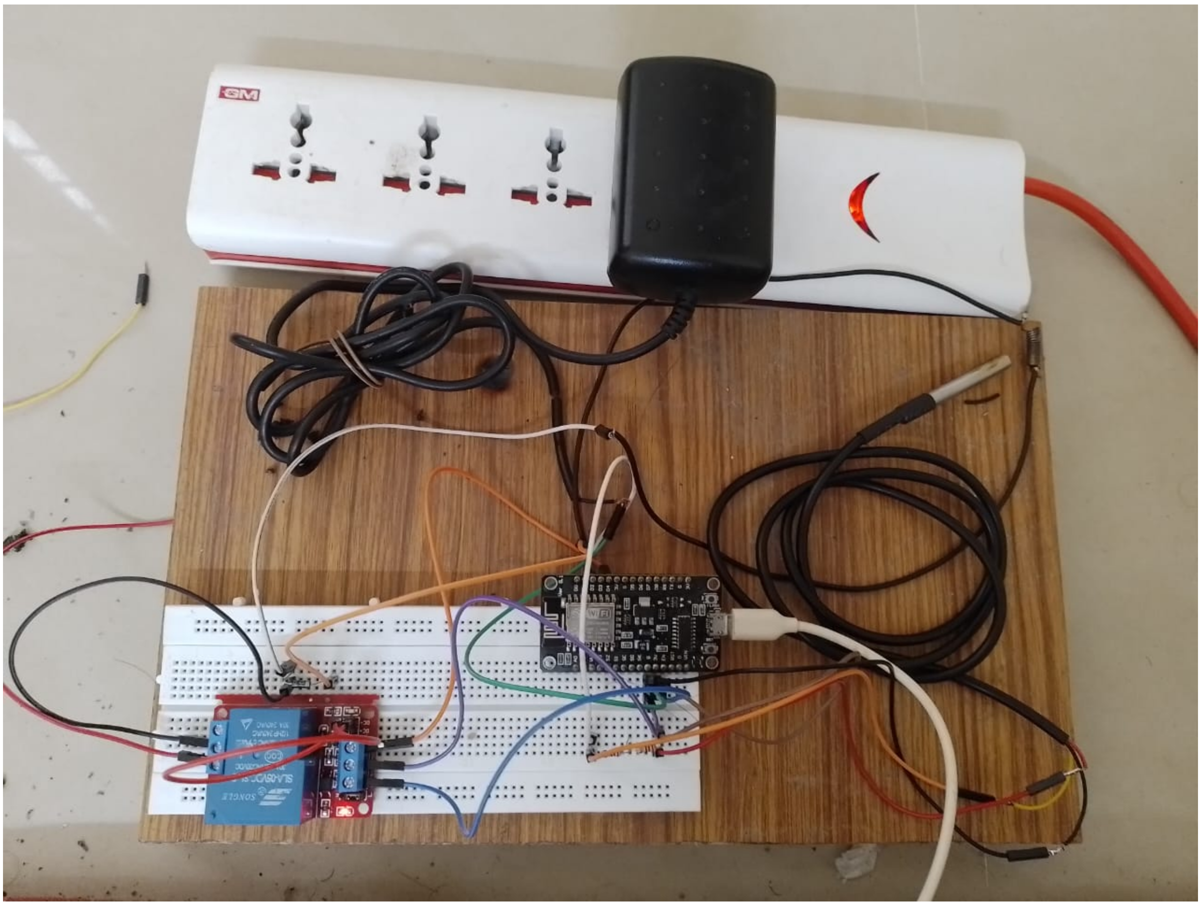

Figure 3.10: Circuit Diagram of the Proposed Design

3.6 Algorithm

- The temperature sensor gets the temperature readings in a continuous loop.
- If the temperature is less than the desired temperature keep the relay module on to keep burning the coil
- If the temperature reaches the desired turn off the relay module to stop the incineration
- Take the input from the user to restart the burning.

Figure 3.11: Arduino IDE code for the setup

CHAPTER 4

Results and Discussion

By starting the system and running the code the relay will be on and the temperature sensor takes the readings and display them on the serial monitor.

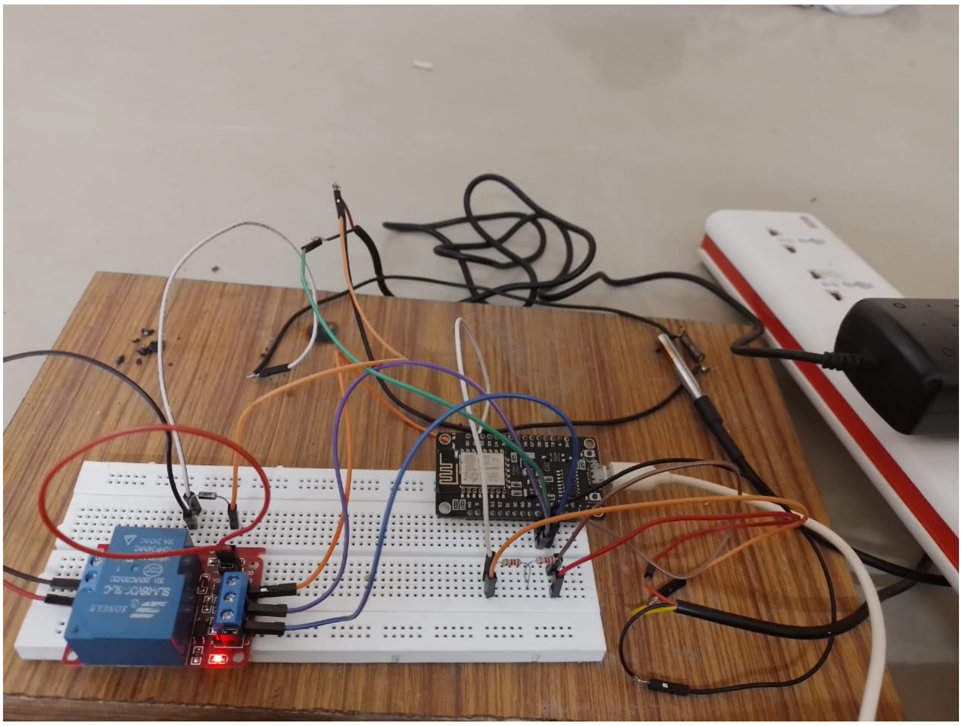

Figure 4.1: Setup of the Design

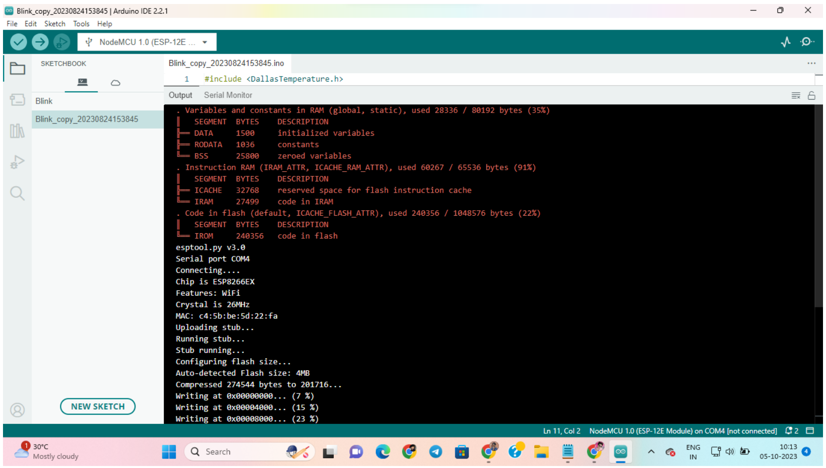

Figure 4.2: Code Simulation on Arduino IDE

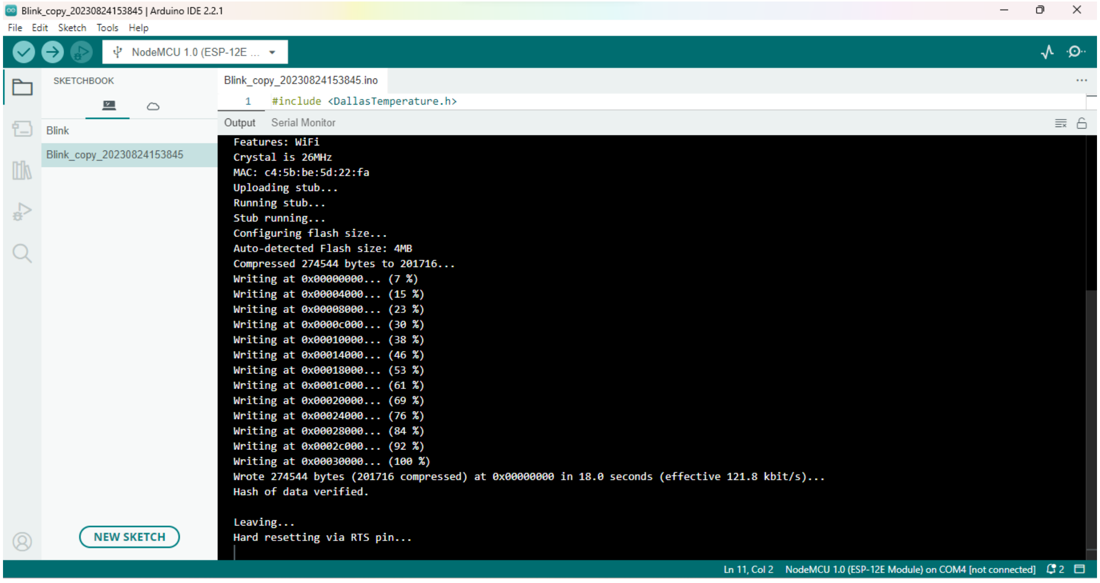

Figure 4.3: Code Simulation

4.1 Burning the tissue paper

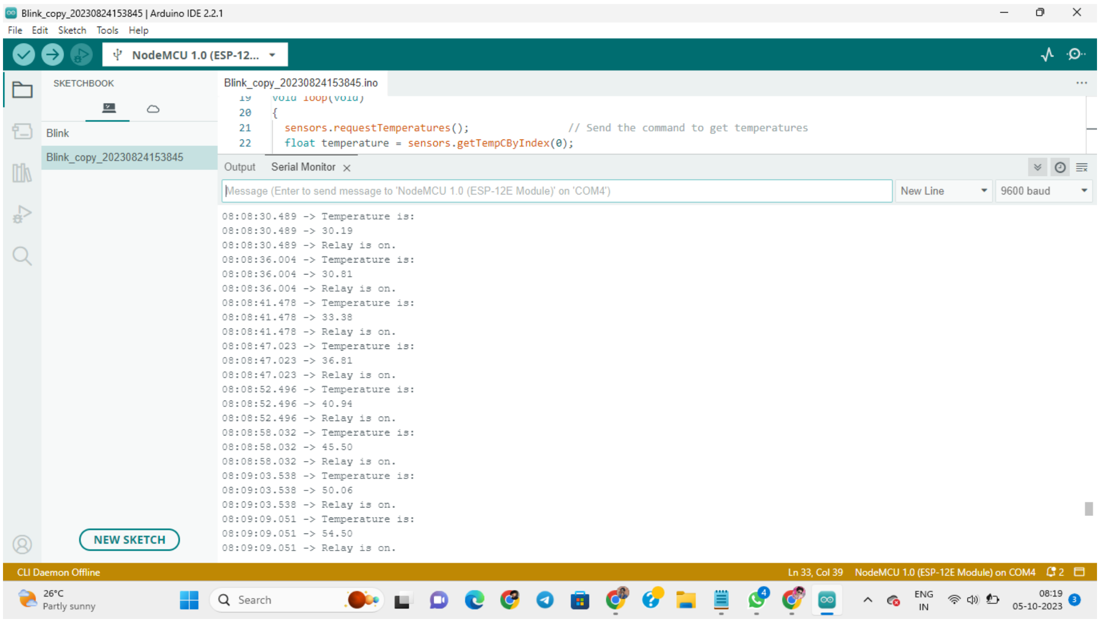

Figure 4.4: Temperature sensor and Relay readings

The tissue started burning at 70°C and in the process of incineration it went upto 100°C.

Figure 4.5: Burning of Tissue

So for the safe burning i kept the turnoff temperature as 90°C.

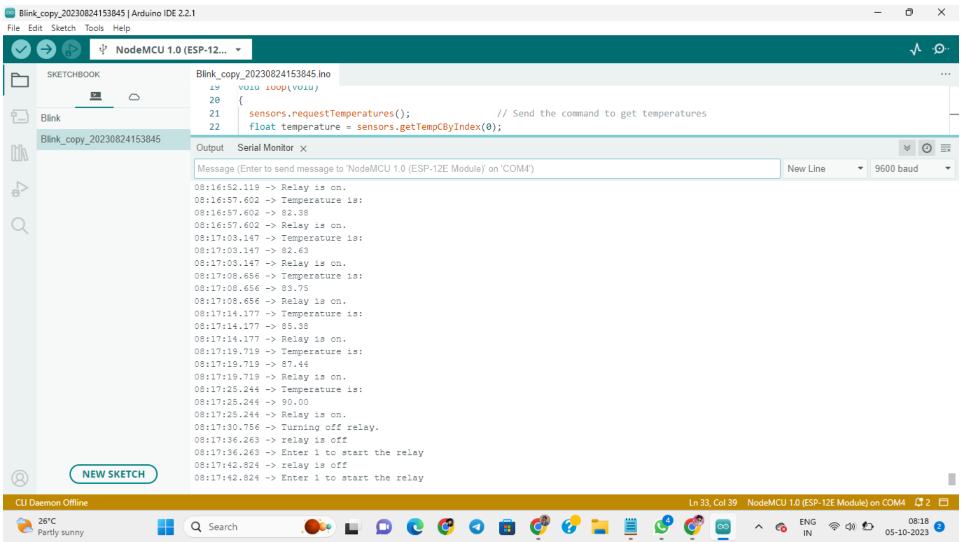

Figure 4.6: Relay output in Serial Monitor

The relay stops the current flow when the temperature is more than 90°C.

Figure 4.7: Complete burnt of tissue

Setup when the process got completed and relay is in off state.

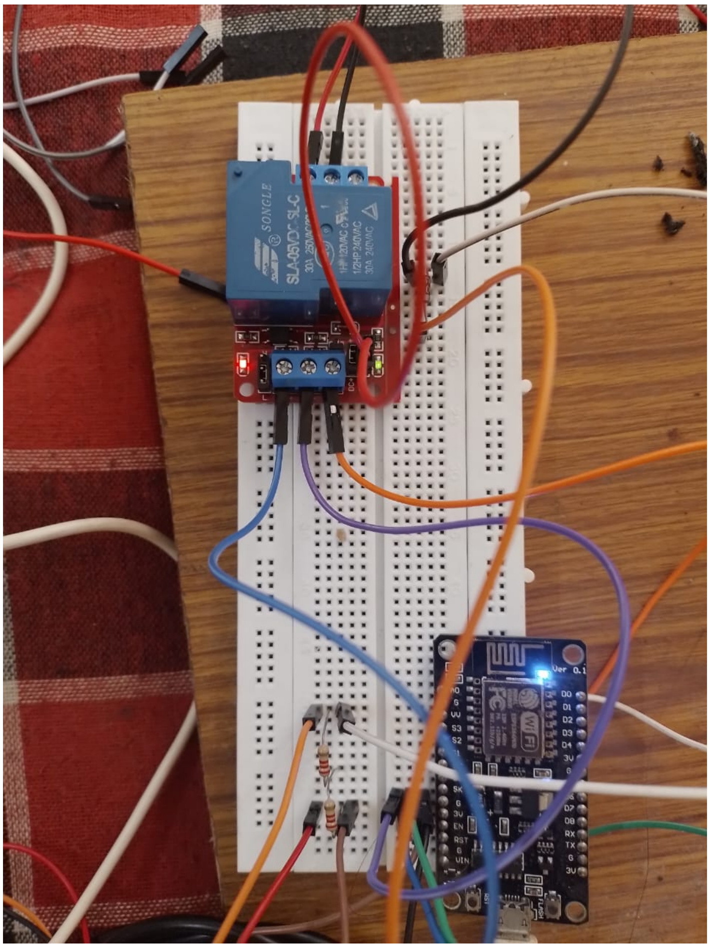

Figure 4.8: Process Termination

Figure 4.9: Burnt Ash

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5.1 Conclusion

In conclusion, the project to design and build a sanitary disposal system with the integration of NodeMCU, temperature sensors, relay modules, and Nichrome wire for sanitary pad incineration holds immense promise in addressing pressing challenges related to waste disposal, environmental impact, and public health. The objectives set for the project encompass the development of a technologically advanced, safe, and user-friendly system that promotes responsible waste management

5.2 Future Scope

Enhanced Automation with Object Detection: Incorporating sensors like ultrasonic sensors can enhance the automation of the system. These sensors can detect the presence of objects, such as sanitary pads, and automatically activate or deactivate the incineration process. This adds efficiency and reduces human intervention.

Mobile/Web Application Integration: The project can expand to develop a user-friendly mobile or web application that allows remote control and monitoring of the NodeMCU-based sanitary disposal system. This provides convenience and real-time status updates to users.

QR Code System for Commercial Use: Implementing a QR code system for sanitary disposal units could open up commercial opportunities. Users could access the system through QR codes, allowing for payment-based access in public spaces or commercial facilities.

IoT Connectivity: Consider expanding the project to include Internet of Things (IoT) connectivity. This would enable data collection, remote monitoring, and advanced analytics for system optimization and maintenance.

Environmental Impact and Education: Conduct a comprehensive environmental impact assessment to quantify the project's contribution to reducing pollution and promoting sustainable waste management. Develop educational modules and awareness campaigns to educate users and the community about responsible waste disposal, hygiene, and sanitation.

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