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A Report on Garments Fire Alarm and Gas Leak Detector System

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A Report on Fire Alarm and Gas Leak Detector System

by

Md. Tajwar Ali (19202103183),

Tasmia Binte Munir Maisha (19202103195),

Parvas Hossain Piash (19202103200),

Sadman Sakib (19202103167).

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Abstract

The main cause of fire occurrences at Bangladeshi garment manufacturers is that insufficient safety measures were taken when constructing the factories. This IoT project presents a Fire Alarm Gas Leakage Detector system that can be utilized not only in garments industries but also in homes and offices, where fire and gas hazards are a potential risk. The major goal of the project is to improve environmental safety and security by creating a sustainable and affordable system that can identify potential risks in real-time. The NodeMcu (ESP8266) and Arduino microcontroller boards that make up the system allow it to carry out a variety of functions, including collecting data, processing, and communication. To identify any potential fire or gas leak dangers, the system includes a flame sensor and a gas sensor and microcontroller boards receive the environmental data that the sensors collect and process it. Lastly, data is sent to Firebase, a real-time database, where it can be monitored.

Approval

A report on garments fire alarm and gas leak detector system is submitted by

Md. Tajwar Ali Rumman (ID-19202103183)

Tasmia Binte Munir Maisha(ID-19202103195)

Sadman Sakib (ID-19202103167)

Parvas Hossain Piash(ID:19202103200)

under the department of Computer Science and Engineering of Bangladesh University of Business and Technology is accepted in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Engineering

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_____

Supervisor
Sudipto Chaki
Assistant Professor
Department of Computer Science and Engineering
Bangladesh University of Business and Technology

Acronyms List

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Chapter 1

Introduction

1.1 Introduction

The garment manufacturing industry which is an essential sector of any country's economy, but that process involves various hazards, including potential fire and gas leakage risks, which pose a threat to the safety of workers and the environment. The need for safety and security has led to the development of various safety systems, including fire alarms and gas leakage detectors. All though there are previous many existing systems but our project "Garments Fire Alarm Gas Leakage Detector" aims to develop a system that can detect fire and gas leakages to improve safety standards in the garment environment. One of the major purposes of this project is to create a dependable and efficient system for detecting potential fire hazards in the garment production environment. In Bangladesh, despite of being world's second largest garment exporter safety and security for garment worker is a burning issue. Major fire incidents at garment factories in Bangladesh has one simple reason that is factories are made without proper safety measures. Moreover, even if there are some safety protocols, they are not that much efficient and that's why accidents keep happening frequently.

So, The development of this IoT-based safety system is essential to improve safety standards in the garment industry of our country. The system will enable the user to detect potential hazards in real-time, and take quick action to prevent accidents and damages. The system's low cost and ease of installation will enable small and medium-sized garment factories

to adopt the system and improve safety standards within their facilities. Our system's main components are Arduino,NodeMcu(ESP8266), which is an affordable and widely available microcontroller board that can be used to develop IoT projects. NodeMcu(ESP8266) has a built-in Wi-Fi module, which enables it to connect to the internet and send notifications to the user in real-time. The use of NodeMcu(ESP8266) in this project will reduce the cost of the system and enable small and medium-sized garment factories to adopt the system. Mainly the system consists of NodeMcu(ESP8266) and other sensors that can detect any abnormal increase in temperature, smoke or gas leakage in the environment. The system will send an alert to the user in real-time when a potential hazard is detected. This real-time detection will enable the user to take quick action to prevent any accidents or damages. Hence, it's a cost-effective and scalable solution that can be easily implemented in existing garment factories and will improve overall safety and security measures in garment factories. Also, we are going to use Firebase or blynk application depending on the project requirements.

Furthermore, the project may able to provide data analytics to help identify potential areas for improvement in the garments manufacturing environment by collecting and analyzing data from the sensors, the system can provide insights into the environmental conditions that can lead to these potential hazards. This data can then be used to develop strategies to further improve safety standards and prevent accidents.

The Garments Fire Alarm Gas Leakage Detector system is an essential safety system designed to detect potential fire hazards and gas leakage in the garment manufacturing environment and will provide real-time monitoring and alerts to concerned authorities for prompt response. The use of NodeMcu(ESP8266) and other sensors like Flame sensor, MQ2 gas sensor, Ultra sonic sensor etc will reduce the system's cost, improve ease of installation, and enable small and medium-sized garment factories to adopt the system.

Chapter 2

Literature Review

Application of Internet of Things in a Kitchen Fire Prevention System proposed by Wei-Ling Hsu et. al developed a smart kitchen fire prevention system and can effectively reduce the loss that results from a kitchen fire. This study built a kitchen fire prevention system that, when it detects a gas leak, flame, or high temperature in the kitchen, may immediately activate an alarm device to send warnings to the occupants and turn off the gas supply. Also, Line messages are sent to alert the emergency services and community management staff, and the residence's main entrance door automatically unlocks to let rescue workers enter and put out the fire. In this study, three control panels, Arduino, Webduino and D1 Mini, were used. Despite the encouraging feedback from those who have visited their lab, future research directions can be linked with carbon monoxide poisoning prevention to successfully protect the home and the safety of the people.[1]

Internet of Things (IOT) Based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor was invented by Rohan Chandra Pandey et al. Their main goal was to design a dangerous gas detection and alerting system based on microcontrollers. Hazardous gases including propane and LPG were detected, shown, and alerted every single second on the LCD display. When the typical level of these gas is exceeded, an alarm is immediately created, and an alert message (Email) is also sent to the appropriate person via the Internet and an ARM development board. Along with Gas sensor and LPG sensor, Raspberry pi 3 has been used as a single-board computer with wireless LAN and Bluetooth. With the aid of this technology,

the decision to use real-time gas leakage monitoring and measuring gas output levels has been plainly seen.[2]

Microcontroller Based Monitoring and Controlling of LPG Leaks Using Internet of Things was offered by P Anuradha et al and this study attempts to continuously track LPG gas leakage at home or in enterprise. This information will be updated via IoT communication to the web browser in the case of a gas leak and to take corrective measures by that,IoT enables the user to continuously monitor the data.[3]

A Low Cost Home Automation System Using Wi-Fi Based Wireless Sensor Network Incorporating Internet of Things(IoT) was provided by Vikram.Net al. This paper illustrates a methodology to provide a low cost Home Automation System (HAS) including Gas Leakage warning system that is detected by the MQ2 gas sensor which is sensitive to a certain inflammable gases using Wireless Fidelity (Wi-Fi). The user can exercise seamless control over the devices in a smart home via the Android application based Graphical User Interface (GUI) on a smartphone. The use of the Arduino container controller also makes the system cheaper and easy access and easy management make the system highly efficient.[4]

Gas Leakage Detection System using IoT with integrated notifications using Pushbullet-A Review was provided by M Athish Subramanian et al. The fundamental goal of this study is to use IoT-based gas detection systems to assure people's and animals' safety surroundings. The MQ5 gas sensor and Arduino Uno controller are combined with a cloud storage for data collecting and storage and analysis. When gas leaks from the surroundings, the user receives a physical alert in the form of a buzzer and an LED to take preventive action before harming the surrounds. Also, notifying the user via thingtweet, an app that connects a user's twitter account to the thingspeak database, and notifications of petrol leaks are sent as an alert in the user's twitter handle. For ease of reading, the paper covers a wide range of software, including XAMPP and Python. Hence This research presented a simple yet effective solution to the problem of gas detection.[5]

Home and Industrial Safety IoT on LPG Gas Leakage Detection and Alert System was offered by Zainal H. C. Soh et al. The primary goal of this study is to detect and monitor gas levels with a gas sensor and report gas levels to Ubidots via the Internet of Things (IoT). This project measures the gas level in a residence or industrial factory and updates throughout the day and week and maintains a safe gas level and data recorded in Ubidots' dashboard. MQ2 gas sensor is connected to Intel Edison to collect the all data and send telegram to owner in case of gas leakage occurs. As a result, it is challenging to put in many sensors since their initial values may differ, making it difficult to synchronise the readings and outcomes.[6]

Development of wireless sensor network system for LPG gas leakage detection system was studied by T.H.Mujawar et al. The implementation of a wireless sensor network for the detection of LPG gas leaks is discussed in this paper, and the system design features an Arduino Nano microcontroller, a gas sensor, and an XBee. The system was installed within a room containing a gas cylinder, and as leaks were noticed, the response could be collected, sent to mobile devices stored in the Arduino GSM shield, and displayed via the monitoring system. The value of concentration and amount of explosiveness is then displayed in LabVIEW using a five-star rating after reading the output voltage from the gas sensor.[7]

An IoT based Fire Alarming and Authentication System for Workhouse using Raspberry Pi 3 was proposed by Ahmed Imteaj et al. In this work, they suggested a system that can locate an area impacted by a fire and detect it and the Raspberry Pi 3 has been used to operate several Arduino which are equipped with a camera and several sensors. An intelligent algorithm is employed to determine when to sound the fire alarm. In addition, the system will turn off the gas and power when it detects a fire and activate the fire suppressant, which includes turning on the water valves that put out fires. The system will alert the closest fire service station about the occurrence at the same time by sending an SMS using a GSM module. Also, the system will use a GPS module to notify the administrator of the fire's position. There will be a variety of sensors involved, including temperature sensors, gas sensors, smoke sensors, flame sensors, etc. After careful examination, we discovered that the smoke sensor produces a value of 030ppm in normal operation and a number ranging from

500ppm to 20000ppm in an alarming condition. According to the results of the experiment, the level for the smoke sensor was 500ppm, while the threshold for the light ambient sensor was 200. Although this The system may eventually become more efficient and feasible with advances in sensor technology.[8]

Automatic smoke detection system with favoriot platform using internet of things (IoT) was suggested by Mohd Alif bin Suparman et al. The suggested system can warn the user and the Fire and Rescue Department when a specified quantity of smoke is detected by a gas sensor via the Favoriot platform in addition to monitoring the smoke situation of a room. This program uses an Arduino Uno to operate all of the devices, and a WiFi shield connects them to the network so that the data from the smoke sensor can be read in the Favoriot platform. In this study, the state of the room is examined while various burning items are present, and the smoke levels are measured. As a result, 80 ppm is the ideal threshold level for an automatic smoke detection system. Yet, in the future, the automatic smoke detector with Favoriot platform can be improved by incorporating future technologies such as a remote control sensor, allowing the user to monitor easily without access to the Favoriot platform.[9]

An IoT based efficient fire supervision monitoring and alerting system was proposed by Ms B Prabha. This research project introduces an innovative fire detection and warning system. The Raspberry Pi 3 has been used to monitor the integrated devices with many sensors and cameras. The sensors continuously sense and broadcast values over a Wi-Fi association to the online digital server. When a fire is detected, the camera begins to record the image and the device begins to deliver the message with the afflicted spot images. When the fire transmitter detects an explosion, it activates the smoke alarm and a sprinkler motor. Also, The database for sensor data can be configured by the administrator and accessed from anywhere. Hence, the system's future work can be improved by adding more sensors and identifying the invader using face recognition and image processing. Moreover, an Android application can be created to provide confirmation on the decision to be made in the event of a fire outbreak.[10]

Chapter 3

Methodology

3.1 Introduction

The project on a fire alarm and gas leak detection system for garments is really beneficial and could stop some potentially harmful situations. To construct our project, we adhered to various necessary components and steps. Our proposed model's features were combined to provide a genuine output, and the outcomes were astounding. The sections below outline this project's methodology.

3.2 Requirement Analysis

In order to avoid the consequences, we simultaneously created a gas leak detection and a fire alarm for this project. This project may be used both online and offline, so if it detects fire or smoke, it will activate the buzzer and alert the local cloud data set, which is displayed on the (16*2)LCD Display. The Firebase online cloud will also be notified by the notification. The Firebase will receive the information of fires and gas leaks. So, even if a person is far from a danger area, they can still receive fire alarm notifications through their Firebase server.

3.2.1 Hardware Requirements

- Arduino uno.
- nodemcu esp8266.

- flame sensor.
- Mq3 gas sensor.
- 5v buzzer.
- 10k(Ohm) potentiometer.
- LCD Diplay.
- breadboard.
- jumper cables.

3.2.2 Software Requirements

- Firebase (for real-time data set)
- Arduino

3.3 System Design

In two stages, we construct our system. First, a local cloud system was created, which was then used to create a memory system. The data is sent to the local cloud whenever the sensors detect fire or smoke, and the data is subsequently shown on the LCD screen. Second, we have linked the system to Firebase so that when it senses fire or smoke, it will alert the Firebase app, and the information will be displayed here.

3.3.1 Circuit Diagram

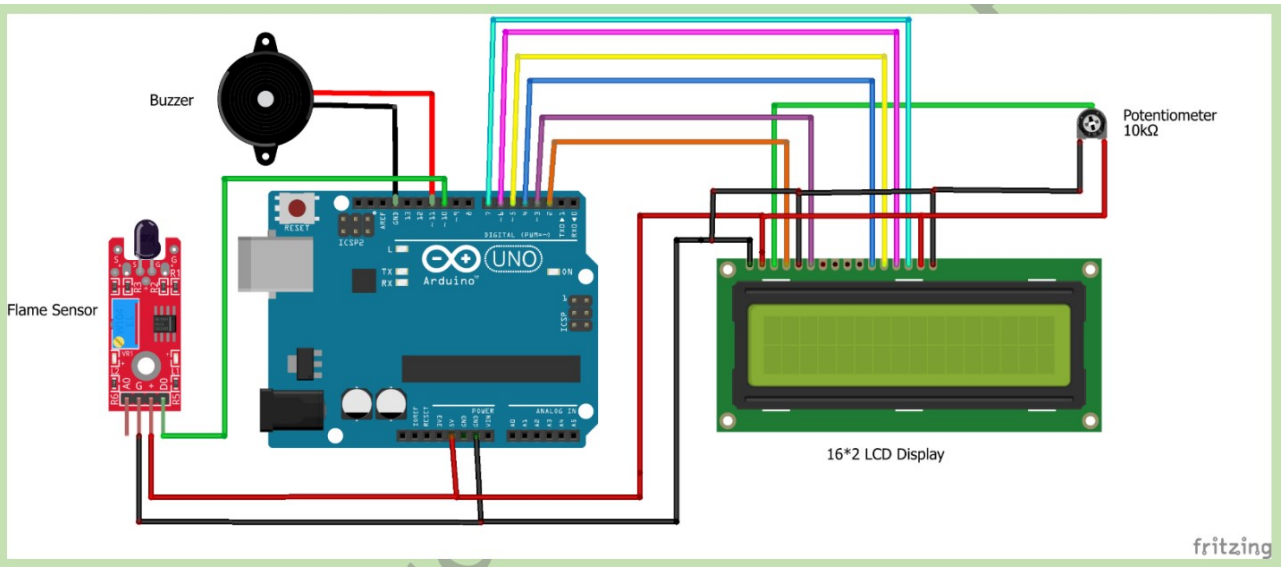


Figure 3.1: Setup with arduino uno for the local cloud part.

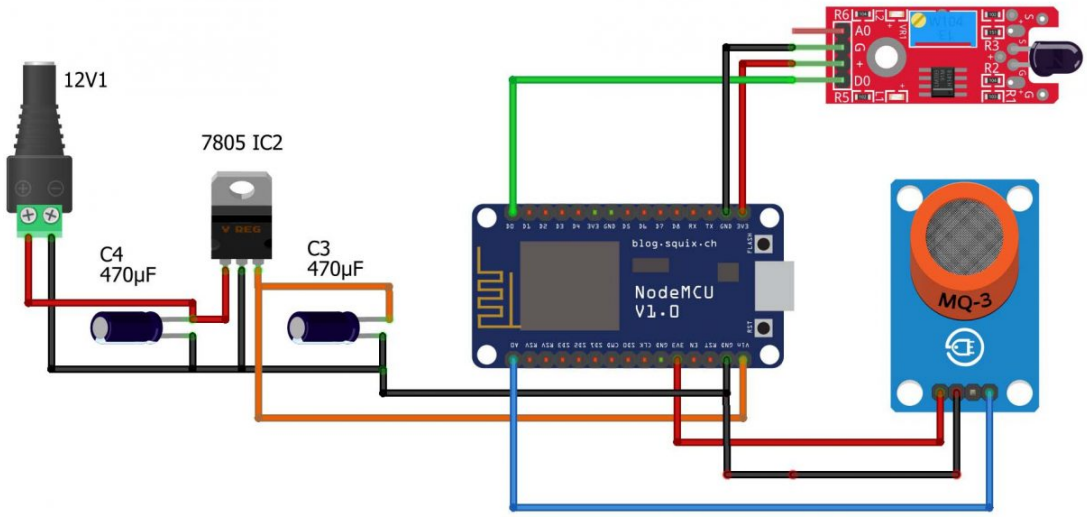


Figure 3.2: Setup with Nodemcu for connection with the Firebase.

3.3.2 Implementation

- We have used Arduino uno as local cloud host. We constructed this system after uploading the code in the arduino uno.
- We used Nodemcu for sending the alaram data in the online cloud which is real-time database in Firebase.
- After connecting the Nodemcu with Firebase, we took the API code from the Firebase and set it in the system code.

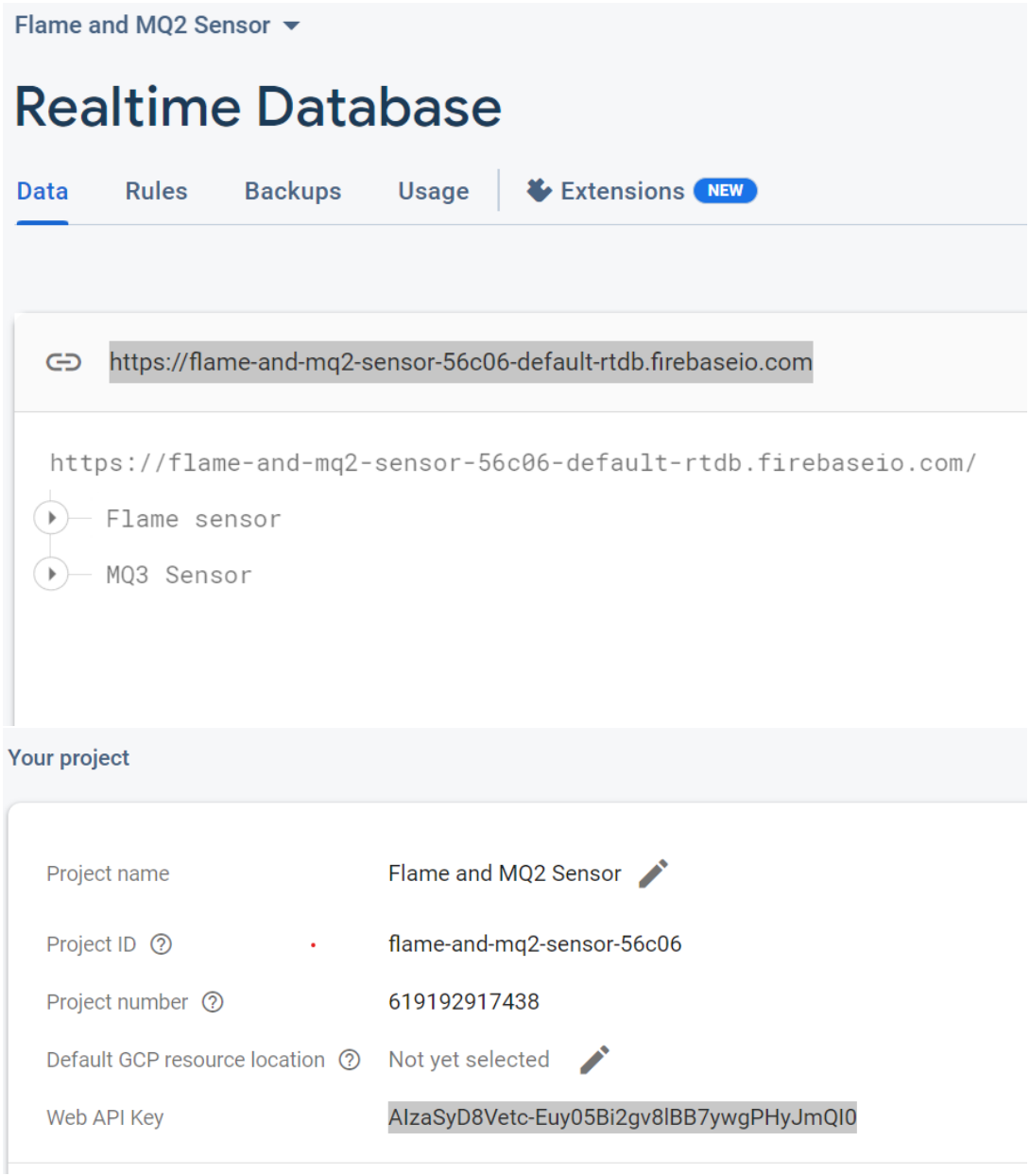


Figure 3.3: Connection setup with the Firebase.

- In the system's code, we have also included a link to a page that will display data related to alert warnings.

- Implementing the Firebase API and URL in the system's code.

Flame_And_MQ2

```
#include <Arduino.h>
#if defined(ESP32)
  #include <WiFi.h>
#elif defined(ESP8266)
  #include <ESP8266WiFi.h>
#endif
#include <Firebase_ESP_Client.h>

//Provide the token generation process info.
#include "addons/TokenHelper.h"
//Provide the RTDB payload printing info and other helper functions.
#include "addons/RTDBHelper.h"

// Insert your network credentials
#define WIFI_SSID "Hi Guys"
#define WIFI_PASSWORD "idontknow"

// Insert Firebase project API Key
#define API_KEY "AIzaSyD8Vetc-Euy05Bi2gv8lBB7ywgPHyJmQI0"

// Insert RTDB URLefine the RTDB URL */
#define DATABASE_URL "https://flame-and-mq2-sensor-56c06-default-rtdb.firebaseio.com"

//Define Firebase Data object
FirebaseData fbdo;

FirebaseAuth auth;
FirebaseConfig config;

unsigned long sendDataPrevMillis = 0;
bool signupOK = false;
int fsensor=D0;
int mq3sensor=A0;
int sensorvalue;
String firestatus="";
void setup(){
  Serial.begin(115200);
  pinMode(fsensor, INPUT);//define F_Sensor input pin
  pinMode(mq3sensor, INPUT);//MQ3 sensor

  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
  Serial.print("Connecting to Wi-Fi");
  while (WiFi.status() != WL_CONNECTED){
    Serial.print(".");
    delay(300);
  }
```

Figure 3.4: Implementing API and URL.

- As the connection of Nodemuc depends on a network, we connected it with a wifi network and after doing this we could send data to the real-time data in the Firebase.

Flame_And_MQ2

```
#include <Arduino.h>
#if defined(ESP32)
  #include <WiFi.h>
#elif defined(ESP8266)
  #include <ESP8266WiFi.h>
#endif
#include <Firebase_ESP_Client.h>

//Provide the token generation process info.
#include "addons/TokenHelper.h"
//Provide the RTDB payload printing info and other helper functions.
#include "addons/RTDBHelper.h"

// Insert your network credentials
#define WIFI_SSID "Hi Guys"
#define WIFI_PASSWORD "idontknow"

// Insert Firebase project API Key
#define API_KEY "AIzaSyD8Vetc-Euy05Bi2gv81BB7ywgPHyJmQI0"

// Insert RTDB URLefine the RTDB URL */
#define DATABASE_URL "https://flame-and-mq2-sensor-56c06-default-rtdb.firebaseio.com"

//Define Firebase Data object
FirebaseData fbdo;

FirebaseAuth auth;
FirebaseConfig config;
```

Figure 3.5: Wifi connection

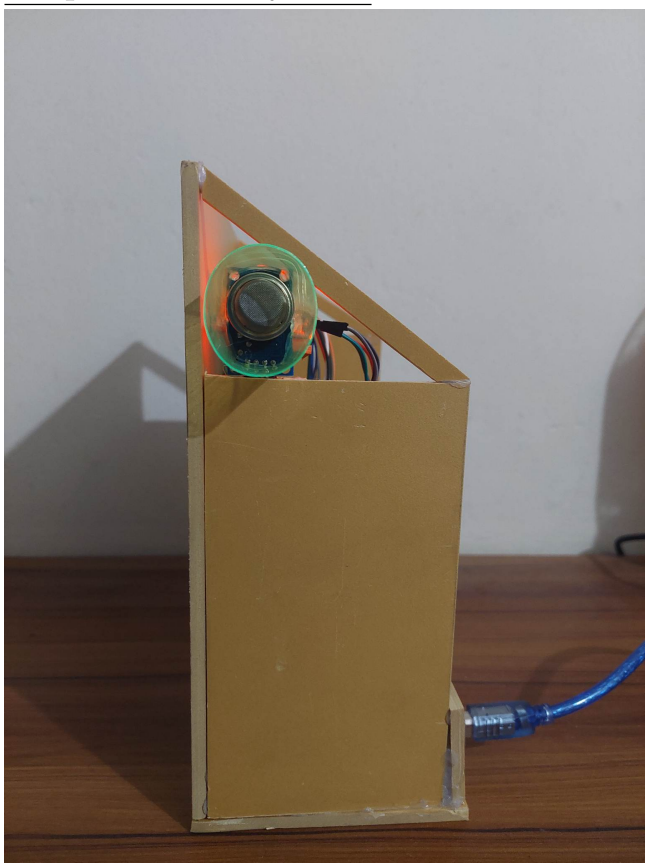
- **Note:** In order to implement the code we have used the Arduino software.

Chapter 4

Experimental Results

After we had done setting up the structure of our system and implementing the source code to the Arduino uno and Nodemcu, we got some outstanding performance and results. All the functionalities were working appropriately. The outputs are shown below.

Outputs of the System:



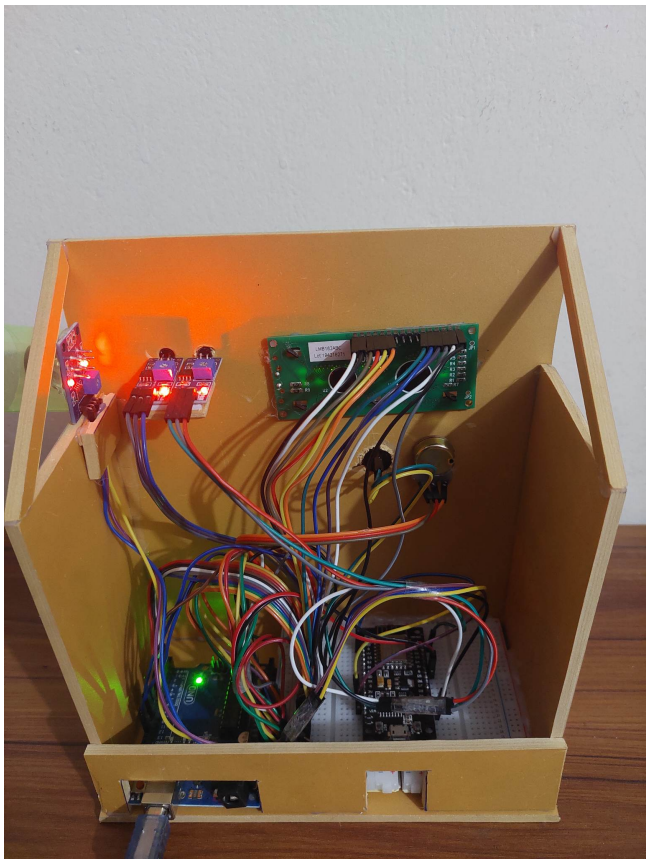


Figure 4.1: Fire alarm and gas detector system setup.

Figure 4.2: Status of the fire detection.

4.1 Result Analysis

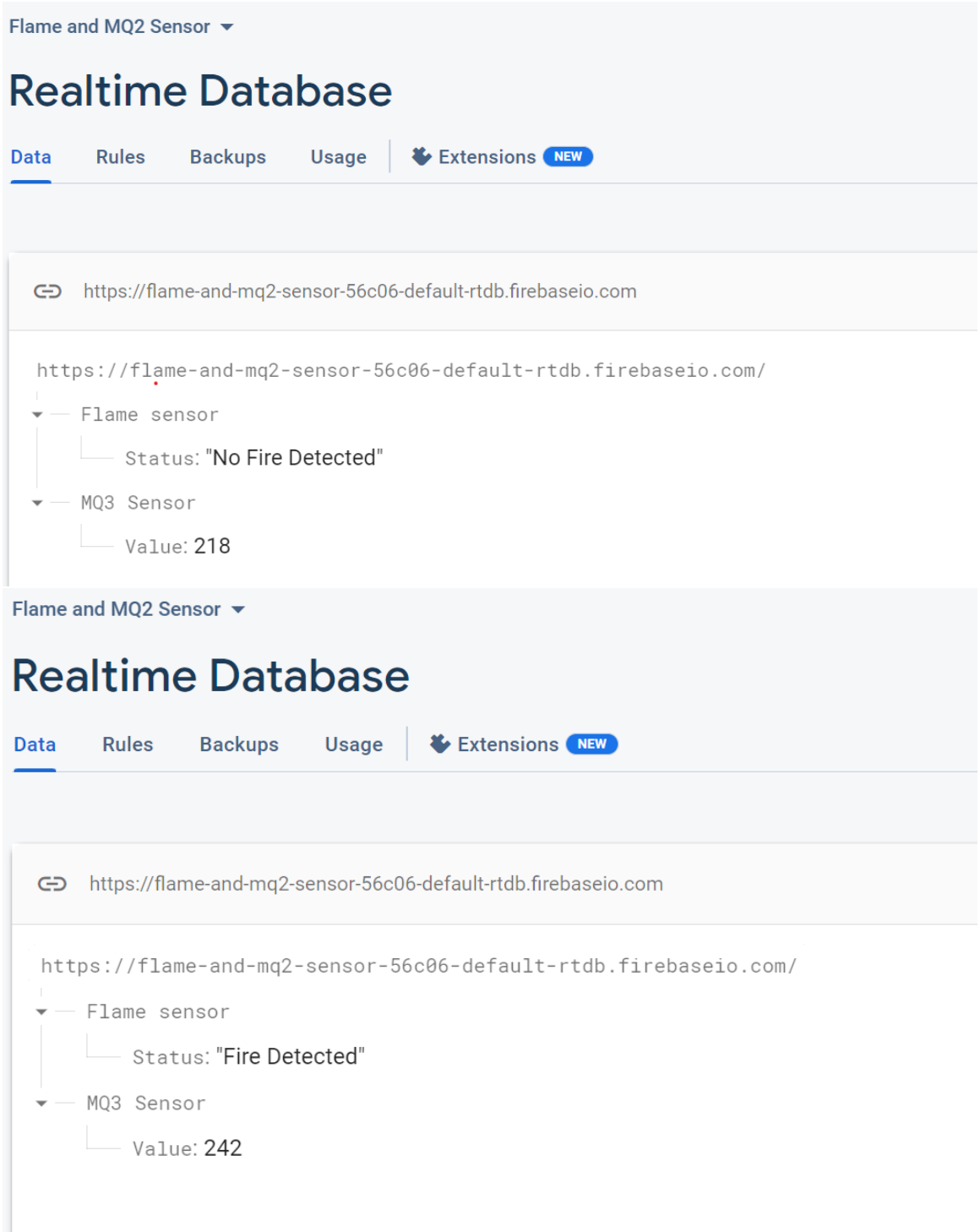


Figure 4.3: Status of the systems fire detection in the Firebase.

Observation:

- When there was no fire around the flame sensor, the sensor showed "No Fire Detected" in the Firebase Realtime dataset.
- If fire is near the system, it shows that "Fire is detected" in the Firebase Realtime dataset.

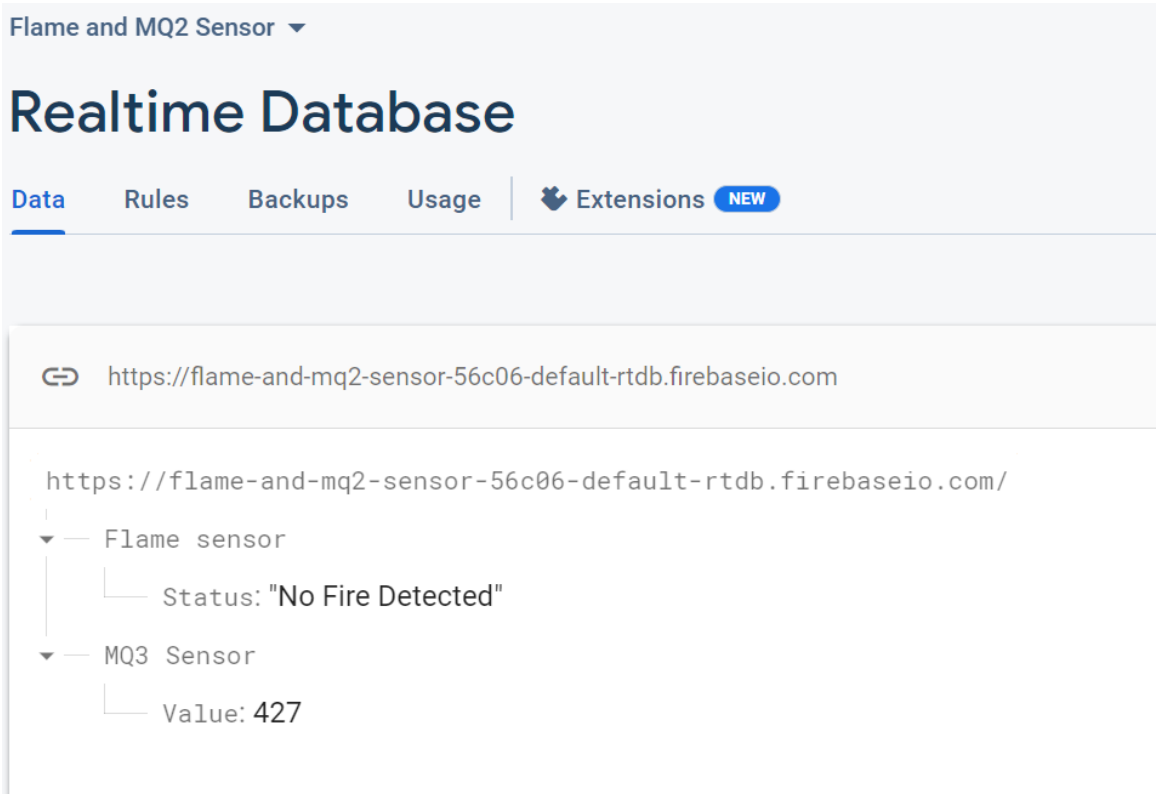


Figure 4.4: Mq3 sensor(smoke sensor) value rise.

Observation:

- The normal gas level range is around 200-300. If it rises up then the smoke sensor with send notification to the Firebase Realtime dataset.
- The gas value rose up to 427, which concludes the presence of gas leak around the system.

Chapter 5

Conclusion

5.1 Conclusions

In conclude, the Garments Fire Alarm Gas Leakage Detector project is a practical and dependable answer that may raise safety standards in the garment industry. The execution of this project will allow for the assurance of worker and environmental safety, reducing harm and accidents. Through the combination of NodeMcu(ESP8266), Arduino, flame sensor, and gas sensor, the system can effectively detect any abnormal increases in temperature, smoke, or gas leakage, which could indicate a potential fire hazard. The system also provides real-time monitoring through firebase. Additionally, the system is designed to be easy to install and operate, making it accessible to small and medium-sized garment factories. The use of readily available and affordable components ensures the system is cost-effective and easy to maintain.

5.2 Future Work

In future, we will work on the system to provide data analytics that can be used to develop strategies to improve more safety standards and prevent accidents. By collecting and analyzing data from the sensors, the system will provide insights into the environmental conditions that can lead to potential hazards, which can be used to develop preventative measures and improve safety. Moreover, we can work on system sending alerts to the user in real-time through a mobile application or SMS service.

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