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CHE1007 - Safety and Hazard Analysis

IoT based fire mitigation system

Review 3

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CERTIFICATE

This is to certify that the project work entitled “IoT based fire mitigation system” that is being submitted by the above mentioned team members for Safety and Hazard Analysis (CHE1007) is a record of bonafide work done under my supervision. The content of this project work, in full or in parts, have neither been taken from any other source nor have been submitted for any other CAL course.

Place: Vellore

Signature of faculty

Date: 31st October, 2019

Prof. Dr. Mahesh Ganesapillai

ACKNOWLEDGEMENT

We would like to express our special thanks of gratitude to our teacher, Prof. Dr. Mahesh Ganesapillai, who gave us the golden opportunity to do this wonderful project on a fire mitigation system. It helped us in doing a lot of research and we came to know about so many creations, methods, came up with some new innovative ideas, used a whole lot of websites and databases. Secondly, we would also like to thank our friends and groupmates who helped us a lot in finalizing this project within the limited time frame.

GOAL:

The *main goal* of developing such a system is **to protect the precious human lives and no property damage.**

PROBLEMS FACED BY THE SOCIETY:

- According to the National Crime Records Bureau (NCRB), on an average, in India, about 25,000 people die annually because of fire accidents and connected causes.
- Fire safety regulations are poorly enforced in India. One of the speculation of this statement is the Surat fire on 24 May 2019, where 22 students died and others were injured in an academic coaching centre located on a building's terrace.

India has the scope to strengthen its institutional capacity, financial resources and infrastructure to mitigate the adverse effects of natural hazards. Since India has a sound technical base, we can make use of technology for fire mitigation.

*In this article, we've put forward a system which is capable to **detect fire, send a SOS with location and notify the user with relevant details** of the affected region. We have also created a software application (app) to facilitate the same.*

UNIQUENESS OF THE PROJECT:

- ✚ The system will immediately send a SOS along with a Google Map link of the affected spot.
- ✚ An admin can confirm or deny the impeachment and if the admin confirms the situation as a breaking out of fire through the app, then a fire brigade can be called right away with the click of a button.
- ✚ For notifying about the incident: SOS alert message + App notification alert + additional beep sound on registered mobile phones.
- ✚ The MQ2 sensor which are using as a smoke sensor can also detect H2, LPG, CH4, CO, Alcohol, and Propane. So, we can **not only detect just smoke** but too many things as well. Due to its high sensitivity and fast response time, corrective measures can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer.

INTRODUCTION:

When it comes to a workplace, **fire accident is a crucial issue** to investors and employees. At present, many factories, hospitals and other places which are contributing to our lives the most, lack proper fire mitigation system. Either they don't find it useful and neglect the protection system the workplace needs or many are unaware of the fact that IoT has come up with a very innovative solution towards safety of people as well as the property through an effective and efficient fire detection and alarming system. In context with the buildings or houses, there is no such effective use of smoke detectors lying on the ceiling.

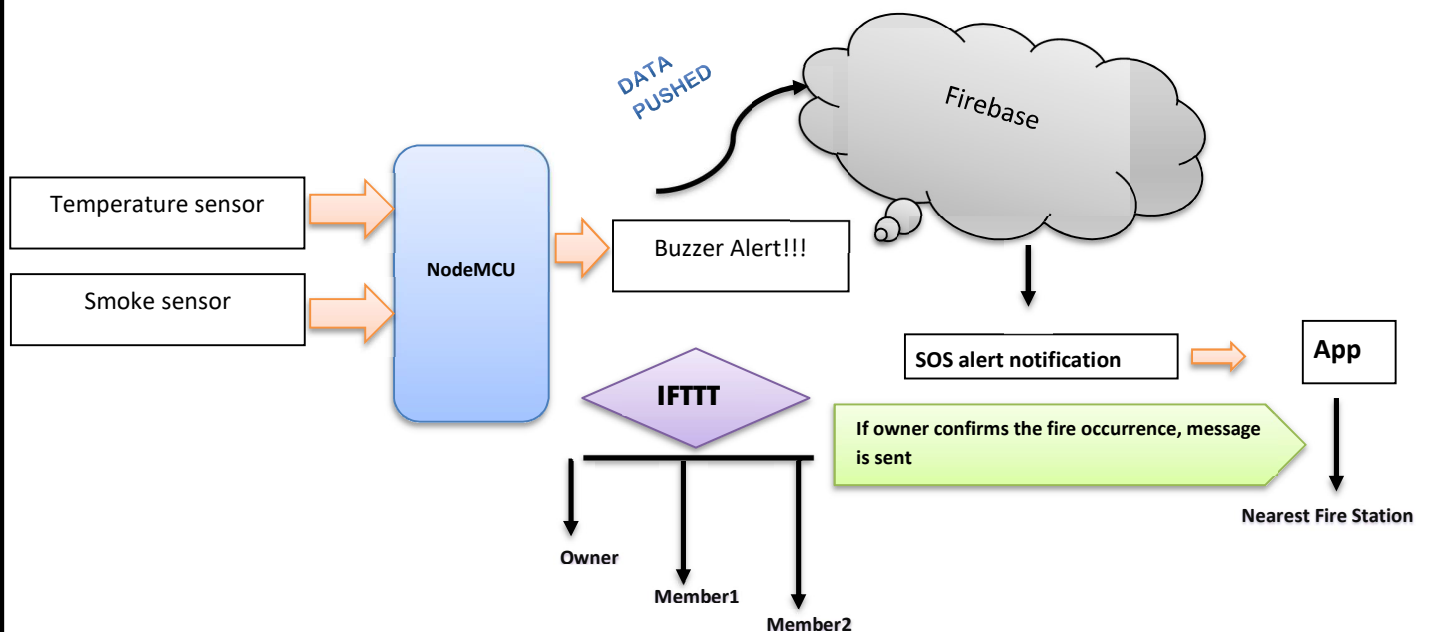
This project -

- ❖ Builds faith between investors and companies so that investors won't hesitate in fields of safety to invest.
- ❖ Ensures safety towards the lives of people.
- ❖ Notifies the owner, nearest fire station and relatives or the neighbours.

- ❖ After surveying our target places, we will be able to decide the best positioning of the sensors, which will again be a success to avoid false alarms.

BLOCK DIAGRAM:

The block diagram of this project is quite simple on paper; it has a few basic components but it is quite efficient in producing the result as required.



Hardware components used:

1. NodeMCU
2. DHT11 Temperature Sensor
3. MQ2 Gas Sensor
4. Buzzer
5. Jumpers

Software used:

1. Arduino IDE
2. Firebase console

WORKING PRINCIPLE:

In this autonomous system, the process occurs in THREE parts. First is **NodeMCU** (a micro controller with a ESP8266 Wi-Fi module) which reads the data including temperature, humidity and smoke from the respective sensors; second is **IFTTT (IF This Then That) site**, in which phone numbers are mentioned to whom the message will be sent when the fire occurs, and the other part is **Firestore console** which receives the data taken by the NodeMCU and pushes live data to the app made by us where if owner (owning the app) confirms the fire, the message is sent to the nearest Fire station.

The NodeMCU, IFTTT, Firestore console are **linked with Arduino IDE**, where they are interfaced and can work hand in hand as the code commands it to.

The code written to control NodeMCU would contain a specific IP address for each sensor node for identification so that we can locate the place of fire. Each NodeMCU acting as server takes the readings from the sensors compares them to the threshold value. If the sensor value reading reaches threshold, the NodeMCU performs necessary actions.

If the sensor reading values are above the threshold value, the fire alarm gets ON. If either temperature gets above the threshold value or the smoke is detected (smoke ppl level greater than threshold), the buzzer gets ON and alerts people around it. All these information gets updated on the Firestore console which sends SOS alert notification to owner & if owner as the admin ensures that there is a fire breakdown, the fire station is notified.

App Features:

- ✓ **Display live data of temperature, humidity level, smoke level.**
- ✓ **Google map link of the affected location.**
- ✓ **Notification alert when the fire occurs.**

IMPLEMENTATION:

1. Connect the sensors to the NodeMCU accordingly.
2. Configure the programmable device (NodeMCU).
3. Write an Arduino code on the Arduino IDE to link the NodeMCU and Firebase.
4. Burn the code in the sketch and do the required settings on firebase console.
5. Powering up all the devices using a power source.
6. Interfacing each and every activity with the app to make it work as required.

EXPERIMENTED RESULT:

After assembling our system, the reading of the sensors has been checked. The main program (Arduino sketch) is executed in the Arduino IDE. The program begins to execute each statement in the code and reads the signals from sensors and produces the outputs depending upon the conditions provided in the code. The output is the readings shown on the **Serial Monitor** of Arduino IDE and data which is pushed on to the firebase for cloud storage is shown on the **Firebase Console**. If the values reach above the threshold value, the **buzzer will turn ON** as alarm.

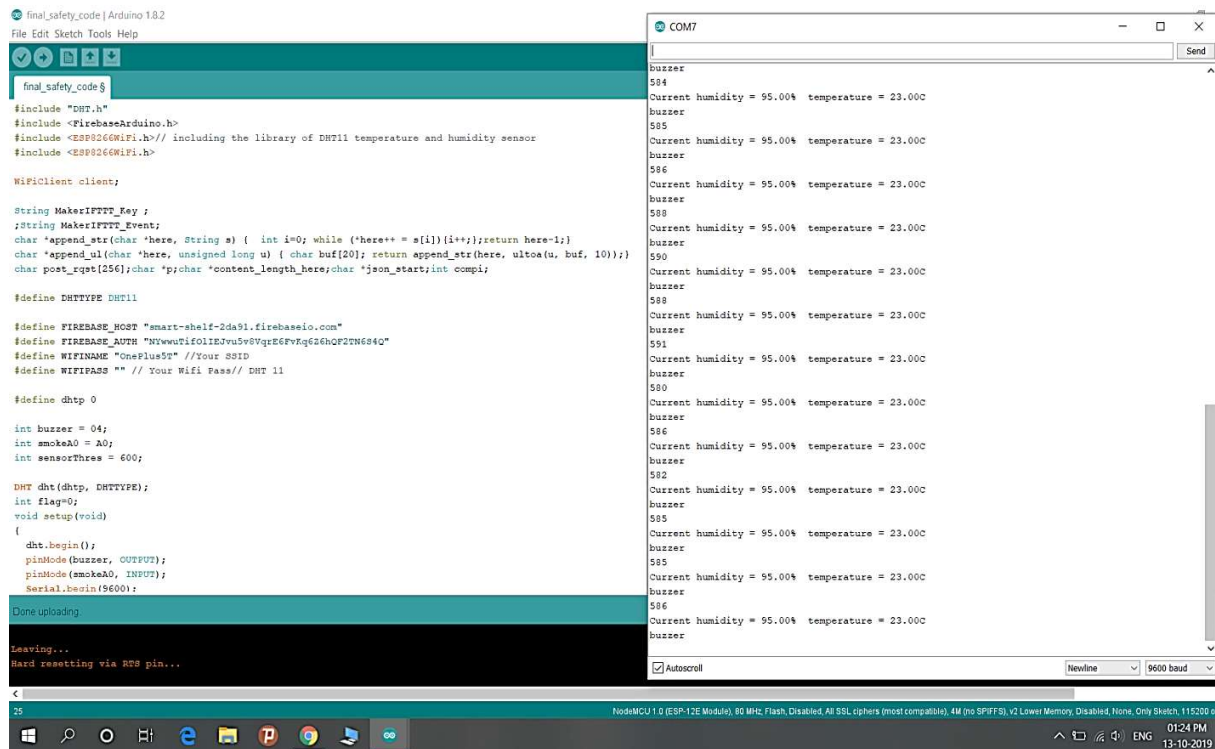


Figure 1: Serial Monitor after execution of code

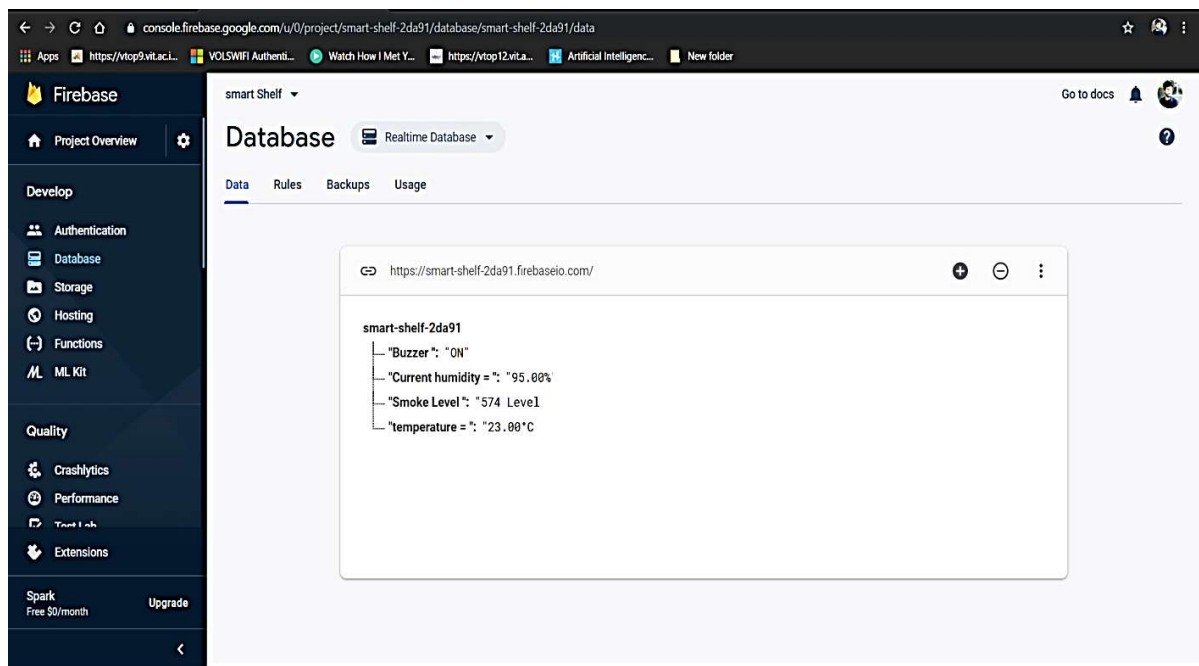


Figure 2: Firebase console showing data

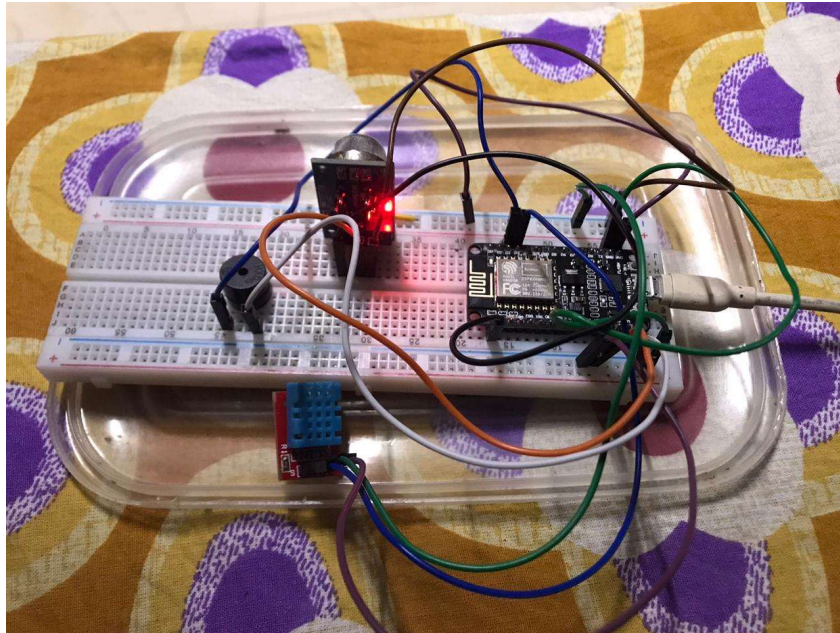
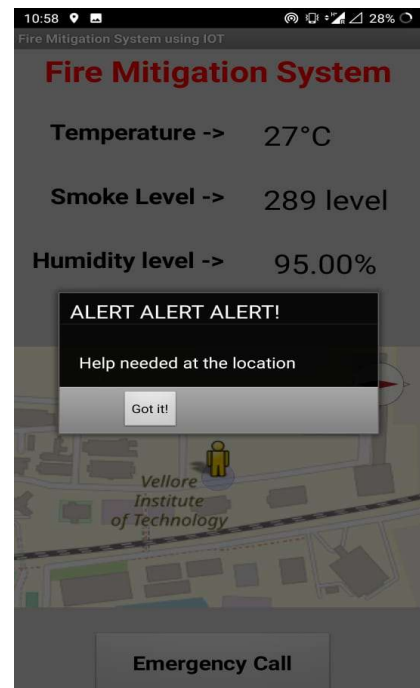
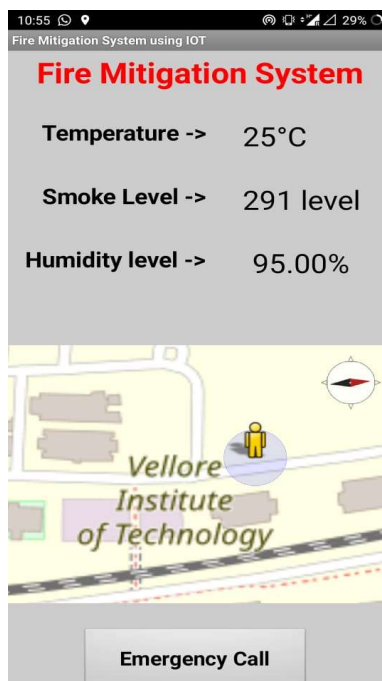
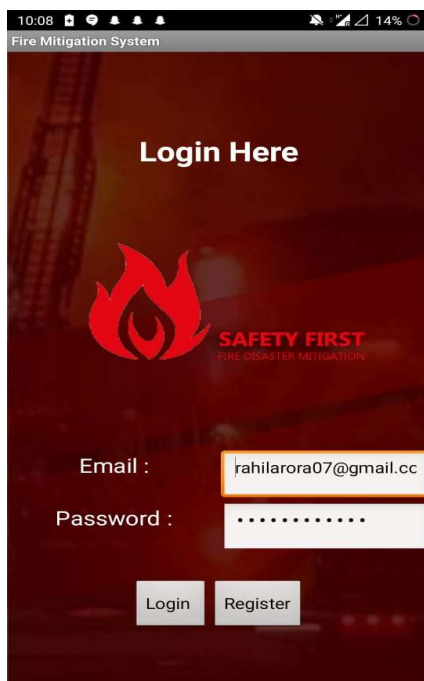


Figure 3: Circuit with NodeMCU and sensors



CONCLUSION:

In this project, we have discussed the latest technology that can help reduce catastrophic accidents caused by fire. We designed the whole system and evaluated its effectiveness as well as scalability. With the improvement of sensor technology, the system will become more efficient and useful. If this system can be successfully integrated in every workplaces and residential areas, it is estimated that the loss of life and property due to fire accidents will reduce remarkably and the country's economy will not be stumbled by such tragic accidents. We can further extend this project by adding some more features like extinguishing fire after the immediate detection (if the fire occurred is controllable without any external help like fire brigade) which can make it more efficient and security oriented. A camcorder can also be used to track all the activities of the unknown person or intruders and show the cam recordings on the mobile app remotely.