M.KUMARASAMY
COLLEGE OF ENGINEERING
NAAC Accredited Autonomous Institution
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ISO 9001:2015 Certified Institution
Thalavapalayam, Karur – 639 113.

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A Minor Project Report

On

IOT BASED FIRE DEPARTMENT ALERTING SYSTEM

Submitted by

JEEVANANDHAM R (927622BEE045)

KAMALI R V (927622BEE050)

KEERTHIVASAN S (927622BEE057)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

M.KUMARASAMY COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to Anna University, Chennai)

THALAVAPALAYAM, KARUR-639113.

MAY 2023

M.KUMARASAMY COLLEGE OF ENGINEERING

(Autonomous Institution, Affiliated to Anna University, Chennai)

BONAFIDE CERTIFICATE

Certified that this Report titled **"IOT BASED FIRE DEPARTMENT ALERTING SYSTEM"** is the Bonafide work of **JEEVANANDHAM R (927622BEE045), KAMALI R V (927622BEE050), KEERTHIVASAN S(927622BEE057)** who carried out the work during the academic year (2023-2024) under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other project report.

SIGNATURE
SUPERVISOR
Mr.PL.Somasundaram M.E.,
Assistant Professor
Department of Electrical and
Electronics Engineering
M.Kumarasamy College
of Engineering, Karur

SIGNATURE
HEAD OF THE DEPARTMENT
Dr. J. Uma M.E., Ph.D.,
Professor & Head
Department of Electrical and
Electronics Engineering
M.Kumarasamy College of
Engineering, Karur

Submitted for Minor Project II (18EEP202L) viva-voce Examination held at M. Kumarasamy College of Engineering, Karur-639113 on ……..

DECLARATION

We affirm that the Minor Project - II report titled "**IOT BASED FIRE DEPARTMENT ALERTING SYSTEM"** being submitted in partial fulfillment for the award of **Bachelor of Engineering in Electrical and Electronics Engineering** is the original work carried out by us.

REG.NO	STUDENT NAME	SIGNATURE
927622BEE045	**JEEVANANDHAM R**	----------
927622BEE050	**KAMALI R V**	----------
927622BEE057	**KEERTHIVASAN S**	----------

VISION AND MISSION OF THE INSTITUTION

VISION

- ✓ To emerge as a leader among the top institutions in the field of technical education

MISSION

- ✓ Produce smart technocrats with empirical knowledge who can surmount the global Challenges.
- ✓ Create a diverse, fully-engaged, learner - centric campus environment to provide Quality education to the students.
- ✓ Maintain mutually beneficial partnerships with our alumni, industry, and Professional associations.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To produce smart and dynamic professionals with profound theoretical and practical knowledge comparable with the best in the field.

MISSION

- ✓ Produce hi-tech professionals in the field of Electrical and Electronics Engineering by inculcating core knowledge.
- ✓ Produce highly competent professionals with thrust on research.
- ✓ Provide personalized training to the students for enriching their skills.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs)

- ✓ **PEO1:** Graduates will have flourishing career in the core areas of Electrical Engineering and also allied disciplines.
- ✓ **PEO2:** Graduates will pursue higher studies and succeed in academic/research careers
- ✓ **PEO3:** Graduates will be a successful entrepreneur in creating jobs related to Electrical and Electronics Engineering /allied disciplines.
- ✓ **PEO4:** Graduates will practice ethics and have habit of continuous learning for their success in the chosen career.

PROGRAMME OUTCOMES(POs)

After the successful completion of the B.E. Electrical and Electronics Engineering degree program, the students will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of solutions:

Design solutions for Complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety,and the cultural, societal and environmental considerations.

PO4: Conduct Investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning in formed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member orleader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs)

The following are the Program Specific Outcomes of Engineering Students:

- **PSO1:** Apply the basic concepts of mathematics and science to analyse and design circuits, controls, Electrical machines and drives to solve complex problems.
- **PSO2:** Apply relevant models, resources and emerging tools and techniques to provide solutions to power and energy related issues & challenges.
- **PSO3:** Design, Develop and implement methods and concepts to facilitate solutions for electrical and electronics engineering related real-world problems.

Abstract (Key Words)	Mapping of POs and PSOs
IOT- Arduino- Sensors-fire-temperature-Wi-Fi module-LCD Display-Alert-Fire Department.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12. PSO1, PSO2, PSO3.

ACKNOWLEDGEMENT

Our sincere thanks to **Thiru.M. Kumarasamy, Founder and Dr.K. Ramakrishnan B. E,Chairman** of **M. Kumarasamy College of Engineering** for providing extra ordinary infrastructure, which helped us to complete the Minor project in time.

It is a great privilege for us to express our gratitude to our esteemed **Principal Dr.B.S. Murugan M.Tech., Ph.D.,** for providing us right ambiance for carrying out the project work.

We would like to thank our **Head of the Department Dr.J. Uma M.E., Ph.D., Department of Electrical and Electronics Engineering,** for her unwavering moral support throughout the evolution of the project.

We would like to express my deep gratitude to our Minor Project Guide **Mr.PL.Somasundaram M.E., Assistant Professor, Department of Electrical and Electronics Engineering,** for his constant encouragement, kind co-operation, valuable suggestions and support rendered in making our project a success.

We offer our wholehearted thanks to our Minor project coordinator **Mr.P. Maniraj M.E., Assistant Professor, Department of Electrical and Electronics Engineering,** for his constant encouragement, kind co-operation and valuable suggestions for making our project a success.

We are glad to thank all the **Faculty Members** of **Department of Electrical and Electronics Engineering** for extending a warm helping hand and valuable suggestions throughout the project.

Words are boundless to thank **Our Parents and Friends** for their constant encouragement to complete this Minor project successfully.

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ABSTRACT

The IoT-based Fire Department Alerting System revolutionizes emergency response. Leveraging interconnected sensors and data analysis, it detects fire outbreaks swiftly, transmitting real-time alerts to the fire department. Through efficient communication protocols, it pinpoints the exact location, enabling rapid deployment of firefighting resources. This system ensures prompt action, minimizing property damage and enhancing public safety. It integrates a network of sensors strategically placed in buildings or areas susceptible to fires. These sensors continuously monitor environmental changes such as temperature, smoke, and other indicators of fire. When a potential fire is detected, these sensors immediately transmit signals to a central control unit or a cloud-based platform. This platform processes the data and triggers real-time alerts to the fire department or emergency services. These alerts contain crucial information including the precise location of the fire, enabling rapid and targeted response, thus significantly reducing the response time and mitigating potential damages. The system aims to revolutionize traditional fire alert systems by leveraging IoT technology for quicker, more efficient, and precise firefighting responses.

Department of Electrical and Electronics Engineering

18EEP202L – Minor Project II

Problem Identification – Survey Form

1. **Name and Address of the community**:

2. **Age Group**
   - **a) Less than 10 Years**
   - **b) 10 years to 20 Years**
   - **c) 21 years to 35 Years**
   - **d) 36 Years to 50 Years**
   - **e) More than 50 Years**
3. **Discussion:**
   - **a) What**? (Define the Problem)

   - **b). Why?** (Reason for the Problem occurrence)

   - **c). When?** (When the problem began or first noticed)

   - **d) Where?** (Place of the problem's first occurrence or sighting)

   - **e) Who?** (The person or thing that the problem affects)

f) How? (The sequence of events that resulted in the problem)

Signature of the respondent

g) Which? (People have attempted to solve the issue)

h) Does the problem appear to have only one possible solution?

4) Work Plan of the project

5) Final Solution

Signature of the surveyor

CHAPTER 1
SURVEY FORM ANALYSIS

1.1 NAME AND ADDRESS OF THE COMMUNITY

Name: Mrs. P. Bagawathi, Pasupathi Nagar, Pugalur, Karur-639113

Name: Mr. Ramasamy, Petrol Bunk Worker, HP Petrol Bunk, Velayuthampalayam-639117.

Name: Mrs. S. Lakshmi, Head Mistress, Panchayat Union Elementary School – 639008.

Name: Mr. Ravi, Electricity Board Officer, Palapatti, Namakkal-637001.

Name: Mr. Raja, Apartment resident , Karupattipalayam Road, Namakkal-637003.

Name: Mr. V. Sekar, TNPL (Mechanic), Mohanur-637015.

1.2 PROBLEM IDENTIFICATION

By analyzing the survey, the problem identified is that, it is difficult to locate the root source and place of smoke and temperature. Difficulty in tackling reliability lapses in device connectivity and functionality, potential delays in fire detection triggering alerts, scalability challenges in managing simultaneous incidents, security vulnerabilities exposing data to breaches, interoperability complications and the persistent risk of false alarms. Understanding these key problems is crucial to ensure a responsive, secure, and efficient system capable of timely fire detection, streamlined alert dissemination, and effective coordination among emergency responders, while adhering to regulatory standards and optimizing cost-effectiveness.

1.3 SOLUTION

As a solution for the above mentioned problem we have designed an IOT based fire department alerting system which will be used in real time. The IoT-based fire alerting system consists of interconnected sensors that detect the high temperature, fire and human movement in the restricted areas. These sensors are strategically placed in high-risk areas and communicate wirelessly with a central control unit. Upon detecting signs of a fire, the sensors send real-time alerts to the control unit, which then automatically notifies the nearest fire department via an optimized communication network. Additionally, the system can provide real-time updates and situational data to first responders, aiding in their preparedness and response strategies.

CHAPTER 2
LITERATURE REVIEW

Paper 1:

Title: IoT Based Fire Alerting Smart System

Author: Ibtehal Mahfoodh Mohammed Al Hasani, Syed Imran Ali Kazmi, Reehan Ali Shah, Raza Hasan, Saqib Hussain

Year: 2022

Inference: The research paper proposes the "IOT based Fire Alerting Smart System" in smart buildings by merging IoT devices, such as fire alarm systems (smoke and high-temperature sensors), sensors, and other auxiliary equipment. The study article suggests integrating IOT devices, such as sensors, other auxiliary equipment, and fire alarm systems (smoke burn with high-temperature sensors), to create an "IOT based Fire Alerting Smart System" for smart buildings.

Paper 2:

Title: FireNot - An IoT Based Fire Alerting System: Design and Implementation.

Author: Bahman A. Sassani, Noreen Jamil, M. G. Abbas Malik & S.S Tirumala

Year: 2020

Inference: FireNot is a cloud-based system that uses sensors (hardware) to detect fire and alert the user through internet and is maintained and monitored using a simple Android app. The FireNot system uses Raspberry Pi programmed through Python language and utilizes Google API for location detection. This paper practically demonstrates the FireNot system through extensive testing on various operations and the FireNot system is proven to be efficient.

Paper 3:

Title: IoT Based Automatic Fire Alarm System

Author: Jeevanandham A.T, Sivamurugan P

Year: 2020

Inference: A mishap in the business is defined as an unplanned, spontaneous event in which damage to one's home is caused by an item, substance, person, or radiation. A few accidents happen as a result of fire. Fire and smoke detectors are used to detect fires or smoke early on, which can save lives. As of right now, an Internet of Things alarm system with a temperature and smoke sensor is planned. Not only will it indicate the presence of fire for a designated period of time, but it will also transmit relevant information to a portable device via IOT. Temperature and smoke sensors, as well as a basic to sophisticated converter, are used to transform the basic signals received at the sensor's end into computerized and subsequent.

Paper 4:

Title: IoT-Based Fire Alarm System

Author: Asma Mahgoub, Nourhan Tarrad, Rana Eisherif, Abdulla Al-Ali, Loay Ismsail.

Year: 2019

Inference: Fire alarm systems are essential in alerting people before fire engulfs their homes. However, fire alarm systems, today, require a lot of wiring and labor to be installed. This discourages users from installing them in their homes. Therefore, we are proposing an IoT based wireless fire alarm system that is easy to install. The proposed system is an ad-hoc network that consists of several nodes distributed over the house. Each of these nodes consists of a microcontroller (ESP8266 nodeMCU) connected to smoke, temperature, humidity, flame, Methane and Carbon Monoxide (CO) sensors that continuously sense the surrounding environment to detect the presence of fire. The nodes create their own Wi-Fi network. These nodes communicate with a centralized node implemented with a Raspberry Pi microcontroller integrated with a 4G module. Once fire is detected by a node, it sends a signal to a centralized node that is triggered to send an SMS to the fire department and the user, call the user and alert the house by producing a local alarm. The user can also get information about the status of his home via sending an SMS to the system. The sensing nodes create a mesh network and they are linked to the central node via a

bridge node. Communication between the bridge node and the sensing node is through Message Queuing Telemetry Transport (MQTT) protocol. A prototype was developed for the proposed system and it carried out the desired functionalities successfully with an average delay of less than 30 seconds.

Paper 5:

Title: Innovative Fire Detection and Alarm System for Sustainable City Development

Author: Amevi Acakpovi, Douglas Tetteh Ayitey, Edward Nagai Adjaloko

Year: 2021

Inference: This paper proposes an innovative method of efficiently and effectively detecting early fire at a relatively low cost. This study adopted an experimental approach in designing and constructing a low-cost artifact that made use of an Arduino board and a set of sensors, LCD display, and a buzzer. The device was programmed in C using the Arduino development environment. The proposed system was able to detect the early presence of smoke, trigger an alarm, and displayed constantly the status of the system on an LCD display. The mass production of this device will help mediate the constant occurrence of fire in buildings, especially in developing countries. However, the availability of raw materials for quick and effective products is also a challenge. The merit of paper relies on the intelligence programmed in the microcontroller coupled with the operation of the sensor that permitted early detection of fire at a relatively lower cost.

CHAPTER 3

PROPOSED METHODOLOGY

3.1 BLOCK DIAGRAM

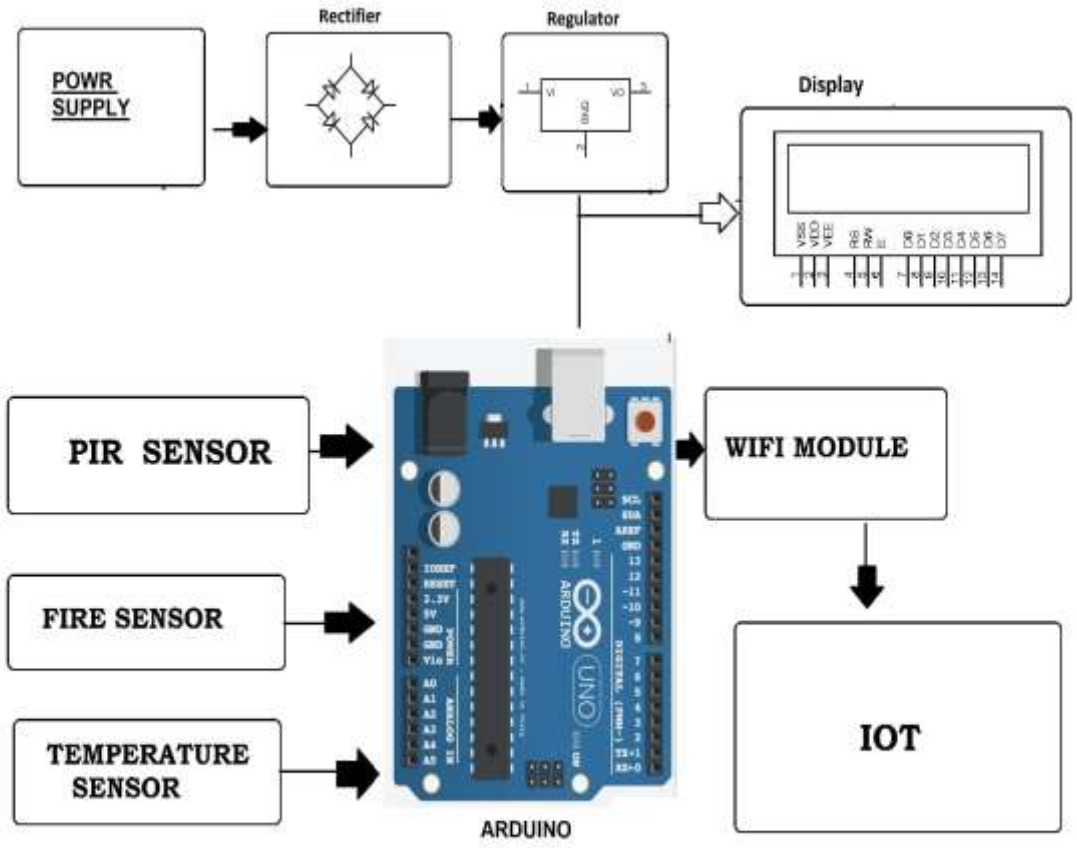

Fig 3.1 BLOCK DIAGRAM

3.2 DESCRIPTION

A fire department alerting system is a comprehensive network designed to swiftly notify and mobilize firefighters in case of emergencies. These systems ensure rapid and efficient responses to fires, accidents, or other emergencies by the fire department. A fire department alerting system comprises hardware and software components integrated to promptly and effectively notify firefighters during emergencies. It includes alarm triggers, communication networks, dispatch consoles, and automated messaging systems. These systems are designed to swiftly mobilize the necessary response teams, ensuring a rapid and coordinated reaction to fires or other critical situations.

3.3 PROJECT - TOTAL COST

S.NO	COMPONENTS	QUANTITY	COST
1.	Arduino UNO	1	550
2.	Power Supply	1	450
3.	Fire Sensor	1	100
4.	Temperature Sensor	1	100
5.	PIR Sensor	1	500
6.	Wi-Fi Module	1	150
7.	LCD Display	1	150
8.	Connecting Wires	Few	100
9.	GPS Module	1	400
		TOTAL	**2500**

Table 3.1 Project – Total Cost

CHAPTER 4
RESULT AND DISCUSSION

4.1 HARDWARE COMPONENT DESCRIPTION

ARDUINO UNO BOARD:

The Arduino Uno is a popular microcontroller board based on the ATmega328P, designed for beginners and hobbyists to create electronic projects. It features 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, and a USB connection for programming and power. Its open-source platform and extensive community support make it an ideal choice for learning and prototyping in electronics and programming.

Fig: 4.1 ARDUINO UNO

FIRE SENSOR:

A fire sensor, commonly referred to as a flame detector or smoke detector, is a device designed to detect the presence of fire or smoke. These sensors utilize various detection methods, such as infrared, ultraviolet, or ionization, to identify the heat, light, or particles produced by a fire. They are crucial for early warning systems in residential, commercial, and industrial settings to

Fig: 4.2 FIRE SENSOR

ensure timely alerts and enhance safety.

TEMPERATURE SENSOR:

A temperature sensor is a device that measures and converts the thermal energy of an object or environment into a readable temperature value. Common types include thermocouples, resistance temperature detectors (RTDs), and thermistors, each suited for different accuracy and range requirements. These sensors are widely used in various applications, such as climate control, industrial processes, and consumer electronics, to ensure proper temperature monitoring and regulation.

Fig: 4.3 TEMPERATURE SENSOR

PIR SENSOR:

A Passive Infrared (PIR) sensor detects motion by measuring the infrared radiation emitted from objects in its field of view. It consists of a pyroelectric sensor that generates an electrical signal when it senses a change in infrared levels, typically caused by the movement of a warm body, such as a human or animal. PIR sensors are commonly used in security systems, automatic lighting controls, and other applications requiring motion detection.

Fig: 4.4 PIR SENSOR

WI-FI MODULE:

A Wi-Fi module is a hardware component that enables devices to connect to wireless networks, facilitating communication and data transfer over Wi-Fi. These modules, such as the popular ESP8266 and ESP32, integrate microcontrollers and radio transceivers, allowing for seamless integration into various IoT and embedded systems. They are widely used in applications ranging from home automation and wearable technology to industrial monitoring and smart city infrastructure.

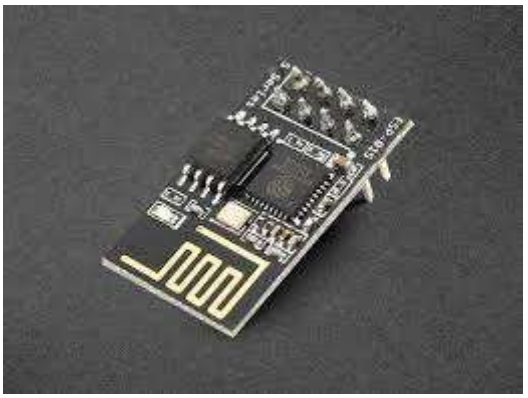

Fig: 4.5 WI-FI MODULE

GPS MODULE:

A GPS module is a device that receives signals from satellites to determine its precise location on Earth. It typically consists of a GPS receiver, antenna, and processing unit to interpret the received signals and calculate latitude, longitude, and altitude coordinates. GPS modules are commonly used in navigation systems, vehicle tracking devices, and outdoor recreational gadgets to provide accurate positioning information.

Fig: 4.6 GPS MODULE

LCD DISPLAY:

An LCD (Liquid Crystal Display) is a flat panel display technology that uses liquid crystals to produce images. LCD displays consist of multiple layers including a backlight, liquid crystal layer, and polarizing filters to control the passage of light and generate images. They are widely used in electronic devices such as TVs, computer monitors, smartphones, and digital watches for their thin profile, low power consumption, and ability to display high-quality images.

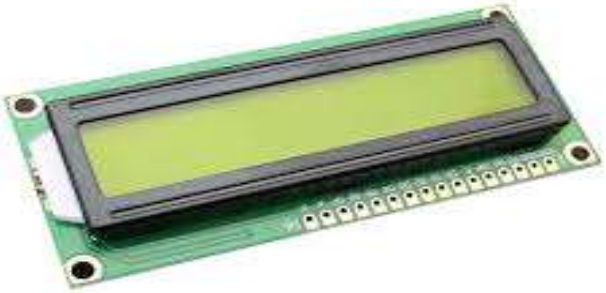

Fig: 4.7 LCD DISPLAY

STEP DOWN TRANSFORMER:

A step-down transformer is an electrical device that reduces the voltage level from its input to its output. It achieves this reduction by having more turns in its primary coil than in its secondary coil. In a project, a step-down transformer can be used to convert high voltage AC power from the mains supply to a lower voltage suitable for powering electronic circuits or devices safely.

Fig: 4.1.8 STEP DOWN TRANSFORMER

BUZZER :

A buzzer is an electronic device that produces a buzzing or beeping sound when an electrical signal is applied to it. It typically consists of a coil of wire and a diaphragm that vibrates to create sound waves when current passes through the coil.

Fig: 4.9 BUZZER

4.2 HARDWARE KIT

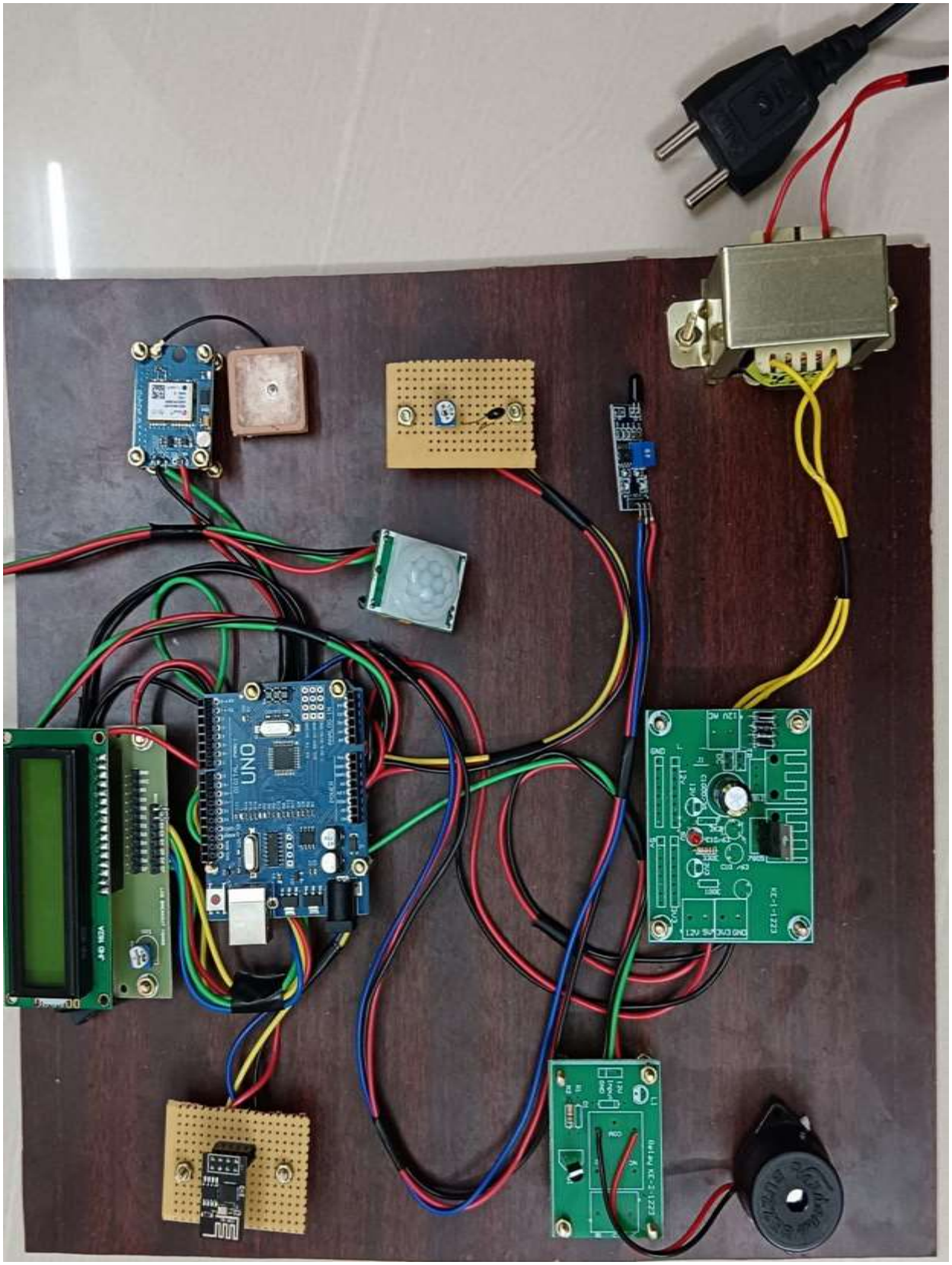

Fig 4.10 HARDWARE KIT IMAGE

4.3 WORKING PRINCIPLE

An IoT-based fire department alerting system revolutionizes fire detection and response by leveraging interconnected devices to provide swift and effective emergency notifications. At its core, the system consists of several key components working in harmony to detect fires, transmit alerts, and coordinate responses.

The system utilizes IoT-enabled fire sensors strategically placed in locations prone to fire hazards. These sensors employ various detection methods such as Temperature,
Fire and PIR sensors to identify potential fire incidents. Upon detecting abnormal conditions indicative of a fire, the sensors immediately send signals to a central control unit.

The system uses a Fire sensor, Temperature sensor along PIR sensor to efficiently detect fires and alert the fire departments over IoT. We use an Arduino Uno in order to check if a sensor is triggered. Then it reconfirms if it really is a fire outbreak using temperature sensors in order to confirm the fire outbreak. The system now uses a Wi-Fi connection to access the IoT server and transmit data about this incident over the internet.

As soon as the system receives the sensor data it checks the device id-data was sent from and displays device id (which will be named after area/flat id). At the same time, Arduino sends the data to the Wi-Fi module ESP8266. ESP8266 will then send the following data to the IoT website. The system now displays the fire incident with an alarm buzzer in the fire department over the internet where authorized people can take appropriate measures in order to curb the fire.

CHAPTER- 5

CONCLUSION

In conclusion, the proposed system could meet the primary goal, which was to create an effective IoT-based fire alarm system capable of detecting fire, humidity, temperature, smoke, and flame. It's also capable of sending and receiving SMS and messages, as well as obtaining precise sensor data. The paper discussed and the proposed system is based on the Internet of Things technology. Technology has taken over the globe and people's lives, and we use it in all aspects of our everyday life; it is continuously evolving and giving significant benefits to society. Homes, buildings, and forests can all benefit from the sophisticated fire detection system. This study specifically focuses on universities or government buildings in the Middle East. This system has numerous advantages, including the capacity to reduce the time required for building evacuations, rapid interaction with those engaged in the evacuations, as well as the ability to ensure people's safety by guiding people who are at risk to the nearest exit, this emphasizes the significance of a sophisticated fire detection system.

POST IMPLEMENTATION SURVEY FORM

Department of Electrical and Electronics Engineering

18EEP202L – Minor Project II

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   d) 36 Years to 50 Years

   e) More than 50 Years

3. **Discussion:**

   a) What? (Define the Problem)

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Signature of the respondent

g) Which? (People have attempted to solve the issue)

h) Does the problem appear to have only one possible solution?

4) Work Plan of the project

5) Final Solution

Signature of the surveyor

5.1 PROJECT IMPLEMENTATION -GEOTAG PHOTO

Fig: 5.1 PROJECT IMPLEMENTATION PHOTO

5.2 PROJECT DEMONSTRATION VIDEO LINK:

https://drive.google.com/file/d/1gcPdJiDFB3FLz9BICD54V8mcU_g2L2yu/view?usp=drive_link

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