# SAFETY HELMET FOR MINING WORKERS

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# DEPARTMENT VISION

To be a glorious center for providing exemplary Electronics and Communication Engineering education with virtues for the upliftment of the society.

# DEPARTMENT MISSION

To impart sufficient knowledge in the discipline of Electronics and allied areas with a focus on developing the required technical skills and virtues to meet the relevant and timely needs of the society.

# CONTENTS

# MOTIVATION

- Coal mining hazards like gas explosions and spontaneous combustion demand real-time monitoring and immediate response to ensure miner safety.
- Revolutionize mine safety by providing real-time alerts on dangerous conditions, protecting miners from common hazards.
- Leverage IoT and machine learning technologies to mitigate risks and reduce fatalities in the mining industry.
- Prioritize miner safety and wellbeing.

# OBJECTIVE



- **OBJECTIVE 1**

Develop a safety helmet for mining workers that uses IoT technology and ARM Cortex-M to enhance safety and real-time monitoring in hazardous environments.

- **OBJECTIVE 2**

Implement various sensors to monitor environmental conditions(e.g.,toxicgases, temperature,humidity) , worker health and gesture detection using image sensing transmitting data to a control center for immediate response.

# INTRODUCTION



- Coal mining is one of the most dangerous industries worldwide, with a significant number of workplace accidents and fatalities reported each year.
- In 2023, coal mining accidents resulted in 42 fatalities, reflecting an increase from 32 the previous year.
- This project proposes a smart helmet equipped with IoT sensors and gesture detection using image sensing to monitor environmental and health parameters, offering a real-time safety mechanism for miners.

# LITERATURE REVIEW



| SI.NO | AUTHOR | NAME OF THE PAPER | FINDINGS |
|---|---|---|---|
| 1. | Lalitha K., Ramya G.,and Shunmugathammal M. (2023) | "AI based Safety Helmet for Mining Workers using IoT Technology and ARM Cortex-M" | The authors propose a smart helmet that integrates IoT sensors to track environmental factors and miner health in real time. This helmet uses gas, temperature, and heart rate sensors, while a gesture recognition system helps miners communicate with the control center using STM32 microcontroller technology. |
| 2. | N. Singh, V. K. Gunjan, G. Chaudhary, R. Kaluri, N. Victor, and K. Lakshmanna(2022) | "IoT Enabled Helmet to Safeguard the Health of Mine Workers" | This paper discusses an IoT-based helmet designed to enhance miner safety by continuously measuring harmful gases and worker vitals. The helmet sends real-time data to control units, aiming to mitigate risks and ensure immediate action in emergencies. |

# BLOCK DIAGRAM

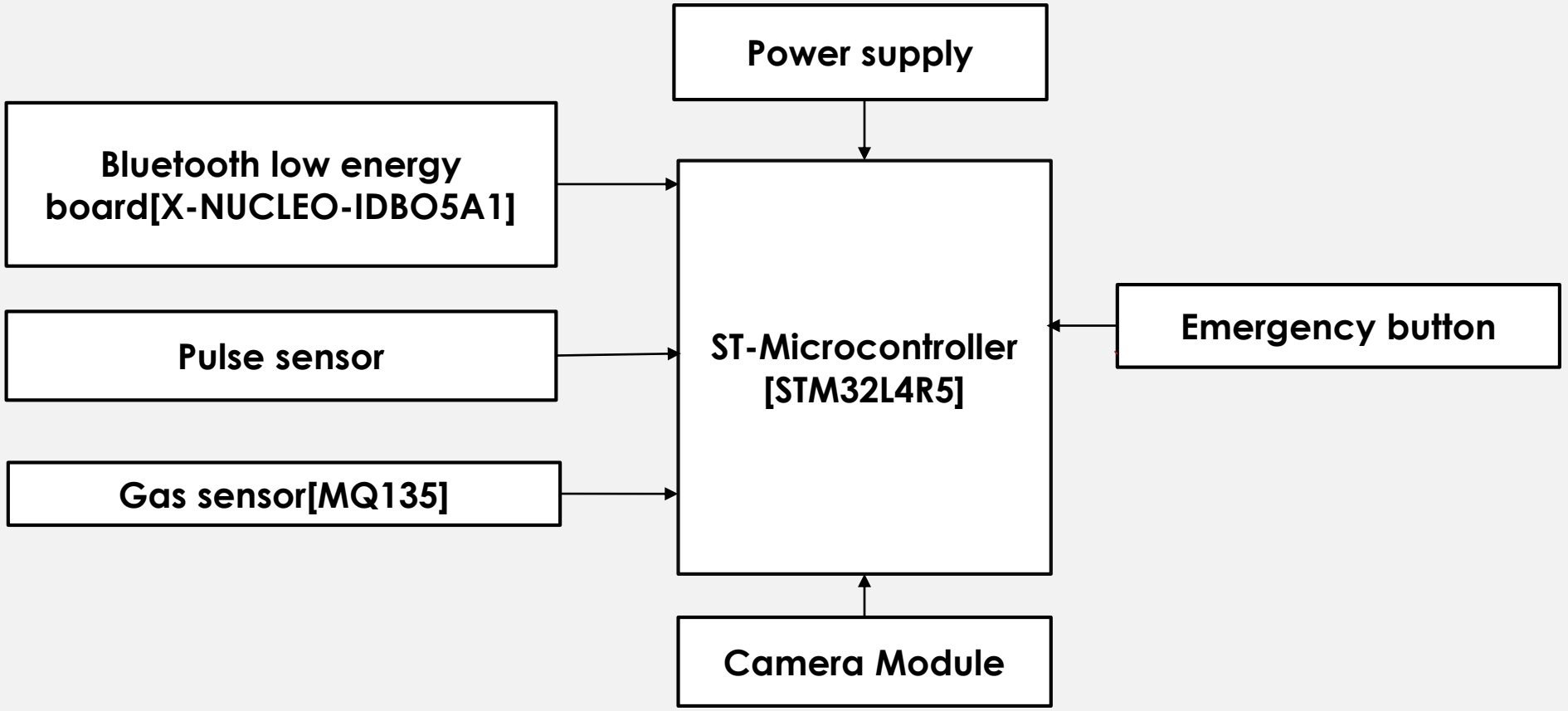



**Fig . 1.**Proposed framework for helmet unit

## ➢ ST-Microcontroller [STM32L4R5]

STM32 microcontroller serves as the central processing unit, integrating and processing data from various sensors.

## ➢ Pulse sensor

A pulse sensor is a non-invasive device that measures heart rate, detecting changes in blood flow through the forehead. It converts pulsatile signals into electrical pulses.

- **Gas sensor[MQ135]**

The MQ-135 is a gas sensor used to detect gases like ammonia, nitrogen oxide, smoke, and CO2. It's commonly used for air quality monitoring due to its ability to sense a wide range of harmful gases.

- **Camera Module**

Camera modules enable gesture detection.
GestureDetection: Recognize hand gestures for control.

- **Emergency button**

An emergency button provides a quick and simple way for miners to alert authorities in critical situations.

- **Bluetooth low energy board[X-NUCLEO-IDBO5A1]**

Bluetooth Low Energy (BLE) board enables wireless communication between the helmet and control room/emergency services

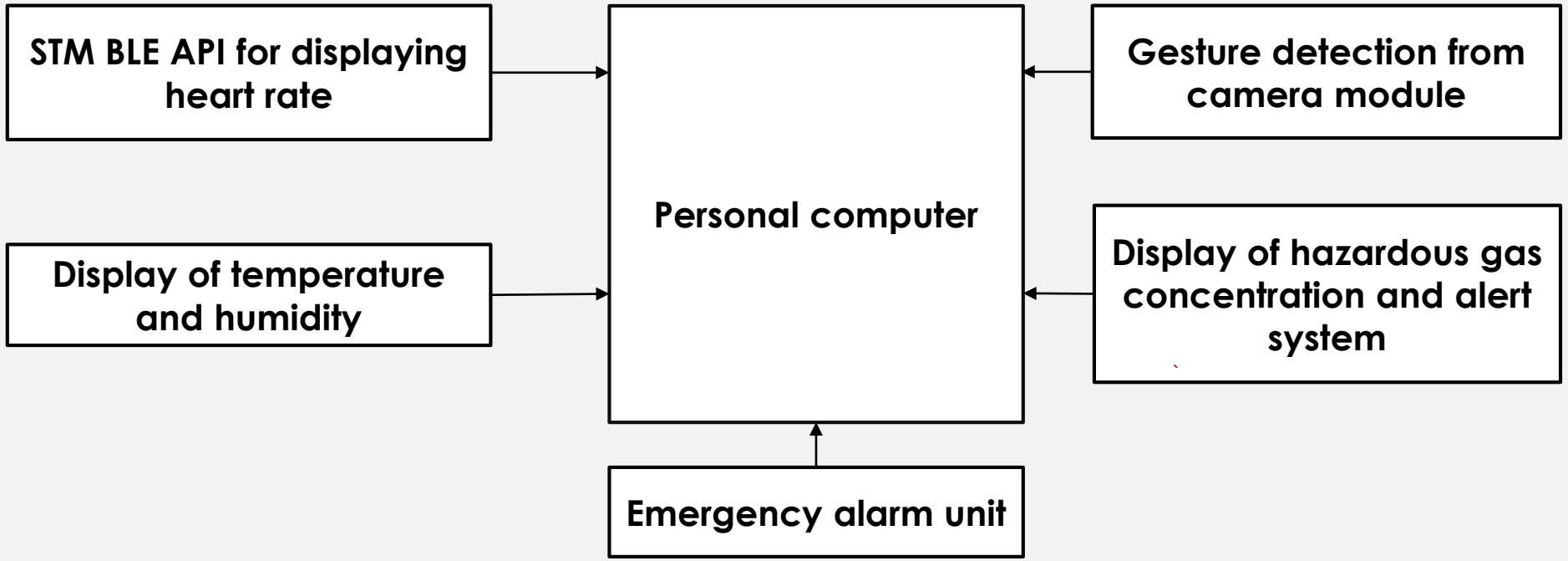
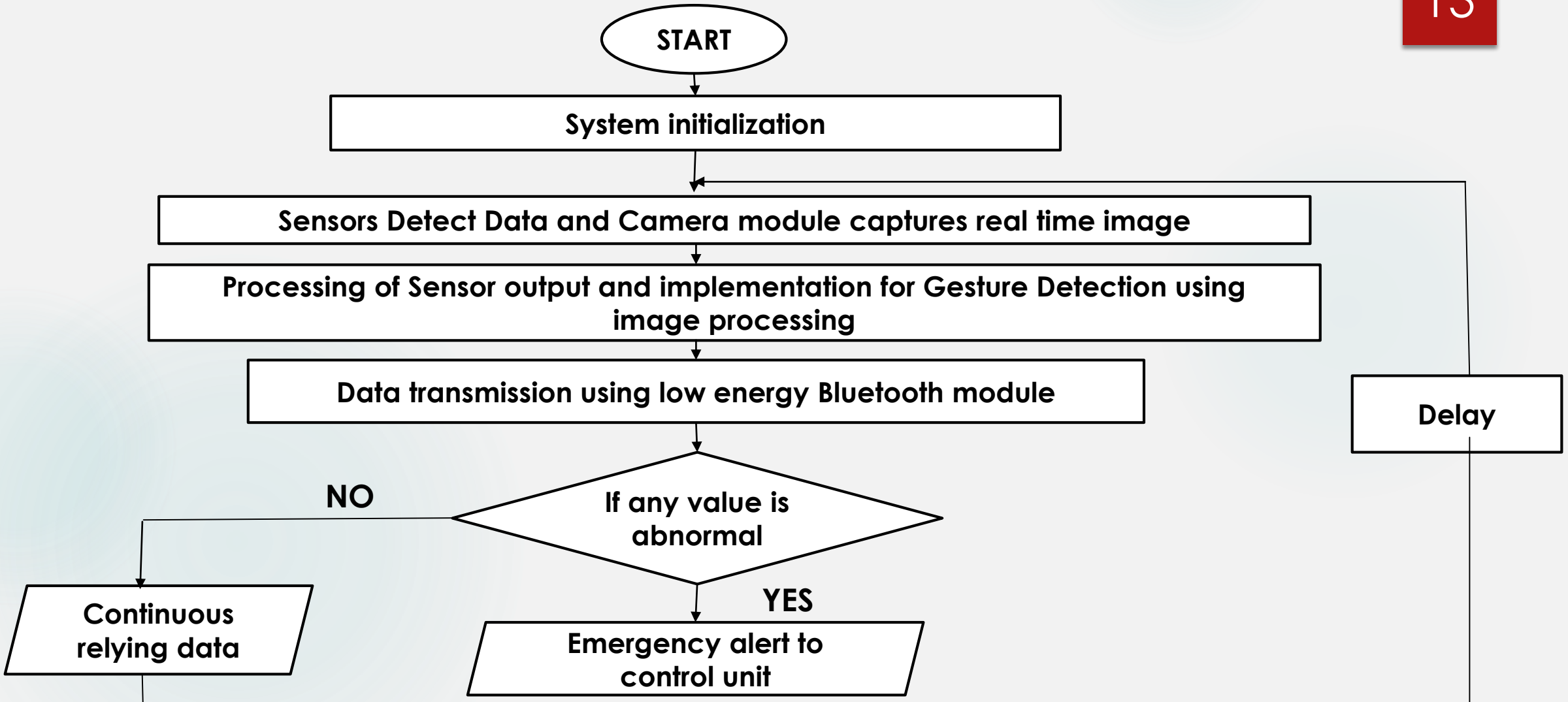



**Fig . 2.**Proposed framework for control module

# FLOW CHART




START
System initialization
Sensors Detect Data and Camera module captures real time image
Processing of Sensor output and implementation for Gesture Detection using image processing
Data transmission using low energy Bluetooth module
Delay
If any value is abnormal
NO
YES
Continuous relying data
Emergency alert to control unit

# DATABASE PLANNING TO USE



| SI NO | IMAGE | GESTURE | COUNT |
|---|---|---|---|
| 1 |  | Good | 500 |
| 2 |  | Not good | 500 |
| 3 |  | Immediate evacuation | 500 |
| 4 |  | Stop | 500 |
| 5 | None of above | | 500 |

# TYPE OF GESTURES AND ITS DESCRIPTION

| Sl.NO | Gesture | Description |
|---|---|---|
| 1 | GOOD | The worker is safe |
| 2 | NOT GOOD | There are some unusual situations |
| 3 | IMMEDIATE EVACUATION | Emergency |
| 4 | STOP | Terminate the current job |

# WORK PLAN



| MONTH AND YEAR | WEEK | PLANNED ACTIVITY |
|---|---|---|
| AUGUST 2024 | 1st | Discussion regarding topics |
| AUGUST 2024 | 2nd | Selection of topic |
| AUGUST 2024 | 3rd | Study on the topic and discussion with guide |
| AUGUST 2024 | 4th | Literature survey(requirement analysis and research) |
| SEPTEMBER 2024 | 1st and 2nd | Components selection |
| SEPTEMBER 2024 | 3rd and 4th | Design |
| OCTOBER 2024 | 1,2,3,4 | Coding and training for gesture recognition |
| NOVEMBER 2024 | 1ST | Initial prototype |

# REFERENCE

[1] L. K, R. G, and S. M, “AI-Based safety helmet for mining workers using IoT technology and ARM Cortex-M,” IEEE Sensors Journal, vol. 23, no. 18, pp. 21355–21362, Sep. 2023.

[2] N. Singh, V. K. Gunjan, G. Chaudhary, R. Kaluri, N. Victor, and K. Lakshmanna, “IoT enabled HELMET to safeguard the health of mine workers,” Computer Communications, vol. 193, pp. 1–9, Jun. 2022,

# THANK YOU