SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU-572103

(An Autonomous Institute under Visvesvaraya Technological University, Belagavi)

Project Report on

"Safe Office Cab"

submitted in partial fulfillment of the requirement for the completion of V semester of

BACHELOR OF ENGINEERING

in

ELECTRONICS & COMMUNICATION ENGINEERING

Submitted by

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

2025-26

SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU-572103

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

CERTIFICATE

Certified that the mini project work entitled "SAFE OFFICE CAB" is a bonafide work carried out by Akash Prakash Honnamore (1SI23EC001), Diksha (1SI23EC039), Pruthviraj S Yali (1SI23EC086) and Sanjana Madhav Naik (1SI23EC099) in partial fulfillment for the completion of V Semester of Bachelor of Engineering in Electronics & Communication Engineering from Siddaganga Institute of Technology, an autonomous institute under Visvesvaraya Technological University, Belagavi during the academic year 2025-26. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the department library. The Mini project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the Bachelor of Engineering degree.

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Course Outcomes

CO1: To identify a problem through literature survey and knowledge of contemporary engineering technology.

CO2: To consolidate the literature search to identify issues/gaps and formulate the engineering problem.

CO3:To prepare project schedule for the identified design methodology and engage in budget analysis, and share responsibility for every member in the team.

CO4: To provide sustainable engineering solution considering health, safety, legal, cultural issues and also demonstrate concern for environment.

CO5: To identify and apply the mathematical concepts, science concepts, engineering and management concepts necessary to implement the identified engineering problem.

CO6: To select the engineering tools/components required to implement the proposed solution for the identified engineering problem.

CO7: To analyze, design, and implement optimal design solution, interpret results of experiments and draw valid conclusion.

CO8: To demonstrate effective written communication through the project report, the one-page poster presentation, and preparation of the video about the project and the four page IEEE/Springer/ paper format of the work.

CO9: To engage in effective oral communication through power point presentation and demonstration of the project work.

CO10:To demonstrate compliance to the prescribed standards/ safety norms and abide by the norms of professional ethics.

CO11: To perform in the team, contribute to the team and mentor/lead the team.

Attainment level: - 1: Slight (low) 2: Moderate (medium) 3: Substantial (high)

POs: PO1: Engineering Knowledge, PO2: Problem analysis, PO3:Design/Development of solutions, PO4: Conduct investigations of complex problems, PO5: Modern tool usage, PO6: Engineer and world, PO7: Ethics, PO8: Individual and collaborative team work, PO9: Communication, PO10: Project management and finance, PO11: Lifelong learning

PSO1: Problem analysis and design, PS02: Problem identification and formulation,

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO-1											3		3
CO-2		3										3	
CO-3											3		3
CO-4						3	3						3
CO-5	3	3										3	
CO-6					3								3
CO-7			3	3								3	
CO-8										3			3
CO-9										3			3
CO-10								3					3
CO-11									3				3
Average	3	3	3	3	3	3	3	3	3	3	3	3	3

Abstract

Employee safety during travelling in office transportation has become a major concern for organizations, especially during early morning or late night working hours. Ensuring real-time monitoring and immediate response during such travel is essential to prevent risks and enhance employees confidence.

Growing safety concerns in office transportation highlight the need for a dependable solution. Implementing the Safe Office Cab system offers an effective way to address these challenges. With continuous monitoring and timely alerts, the system enhances employee safety and ensures a safer and more reliable commuting experience. The main goal of the system is to monitor safety inside the cab of the employees, track its movement in real time and provide emergency support whenever it's required.

The system uses a smoke and alcohol sensor to continuously monitor the conditions inside the cab. If any harmful or unsafe conditions are detected inside the cab for the employees while in the journey, the buzzer immediately alerts and an alert message is sent to the monitoring team through the Blynk cloud and Telegram alert bot. In addition, a GPS module interfaced to Raspberry Pi 3B updates the cab's live location to the Blynk cloud, allowing authorities to track the cab throughout the journey. To handle emergency situations such as harassment or threats of an employees, a panic button is provided for the passenger. When the panic button is pressed, the camera starts recording the situation going on inside the cab, a loud buzzer is activated for attention and an emergency alert message through Blynk cloud and Telegram alert bot is instantly sent to the authorities for immediate action.

Overall, the system offers a cost-effective and reliable IoT solution for improving employee safety during office transportation. It detects unsafe conditions in real time and enables quick alerts and emergency response to ensure secure travel.

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Chapter 1

Introduction

Employee transportation has become an essential service for many organisations, especially with extended working hours during early mornings and late evenings. In this context, the safety of employees particularly women has emerged as a critical concern. Incidents such as unsafe driving, route deviations and lack of immediate assistance highlight the limitations of many existing cab services, which often do not provide real time monitoring or effective emergency support.

To address these concerns, the *Safe Office Cab* system is proposed as a technology driven solution focused on enhancing women and employee safety during office travel. By integrating the Raspberry Pi 3B with GPS tracking, alcohol and smoke detection, a camera module, and a panic button, the system enables continuous monitoring and rapid emergency response. This approach improves driver accountability, ensures timely assistance, and helps organisations provide a safer and more reliable transportation environment for their employees.

1.1 Motivation

Employee transportation has become an essential service for many organisations, especially as work schedules extend into early mornings and late evenings. However, the safety of employees, particularly women during office travel hours, remains a major concern. Many existing cab services lack real time monitoring, route tracking, and emergency support, which can result in unsafe driving practices, route deviations, or delayed responses during critical situations inside the cab.

To address these challenges a secure, reliable and technology driven transportation solutionis needed. By integrating a microprocessor such as the Raspberry Pi 3B with GPS tracking, alcohol detection, smoke detection, a camera module and a panic button, the system enables continuous monitoring and immediate action during emergencies. This approach enhances driver accountability, improves employee safety, and assists organisations in managing their transportation operations more efficiently.

1.2 Objective of the project

The main objectives of the *Safe Office Cab* are:

- To design a system that can be implemented in an office cab to ensure employee safety through real-time GPS tracking, monitoring and emergency support.

- To customize and integrate the existing Blynk App and Blynk Cloud platform for real-time location tracking, alert message notifications, and secure communication between the office cab system and the monitoring authorities during emergency situations.

1.3 Organisation of the report

The report is organized into seven chapters. The objectives and motivation of the project are outlined in Chapter 1. Literature Survey that presents a through overview of previous research on similar projects in Chapter 2. The project's system overview and block diagram of the project is discussed in Chapter 3. System hardware that includes all hardware components is discussed in Chapter 4. The software implementation of the system is included in Chapter 5. The results and findings are discussed in Chapter 6. Conclusions of the project along with possible future developments is included in Chapter 7.

Chapter 2

Literature Survey

"CAB SAFETY: A comprehensive analysis of implementation gaps and strategic recommendations" highlights several shortcomings in existing corporate cab safety systems, such as delayed alert responses, lack of continuous monitoring and weak integration of IoT technologies. The study emphasizes the need for real-time communication, automated alerting and more reliable safety mechanisms to protect employees during office travel [1]. These insights guide the *Safe Office Cab* project by stressing the importance of timely notifications, cloud-based monitoring, and smart sensing technologies to improve passenger safety.

"Smart cab security system design with IoT" provides valuable guidance on incorporating IoT enabled sensors and cloud platforms to detect unsafe conditions inside a vehicle. The study demonstrates how gas detection, alcohol monitoring, and automated warning systems can significantly enhance passenger security [2]. It also highlights the role of mobile based IoT dashboards for remote supervision, which directly influences the design of the *Safe Office Cab* system by supporting real-time updates and instant alert generation.

"IoT-based smart transportation system implementation and security challenges" examines the vulnerabilities present in connected transportation networks, especially in the areas of data security and reliable communication. The authors emphasize the importance of encrypted communication and robust location tracking to ensure passenger safety [3]. These findings reinforce the need for secure GPS tracking and reliable data transmission within the*Safe Office Cab* system.

"IoT based smart vehicle security and safety system" demonstrates how GPS tracking, sensor-based alerts, and automated notifications can enhance onboard security for both passengers and vehicles. The study shows that continuous monitoring and real-time alerting play a vital role in preventing incidents and ensuring timely interventions [4]. This directly supports the inclusion of GPS modules, buzzer alerts, and cloud-based alert systems in the proposed cab safety solution.

"Smart taxi security system design with Internet of Things" explores how IoT communication can reduce emergency response time and improve vehicle tracking accuracy. The study emphasizes cloud connectivity, sensor driven decision making, and automated data logging elements that align closely with the design goals of the *Safe Office Cab* system [5]. These insights reinforce the importance of quick alerts and reliable monitoring in ensuring passenger safety during cab travel.

"Women employee security in corporate cabs" focuses on the rising safety concerns faced by female employees while using corporate transportation. The study highlights the need for panic buttons, automatic alerts, and continuous monitoring to ensure a safe environment during travel [6]. This research strongly supports the implementation of an emergency push button, real-time communication, and camera-based evidence capture in the *Safe Office Cab* project.

"IoT based vehicle monitoring and driver assistance system framework" discusses continuous monitoring of driver behavior and vehicle conditions using IoT sensors. The study emphasizes the role of real-time data in improving road safety and managing large scale transport fleets [7]. These insights contribute to the project by underscoring the need for automated sensing (alcohol, smoke), instant alerts, and consistent monitoring of cab conditions.

"A solution for employee security in corporate cabs" proposes an emergency alert system to enable employees to send rapid notifications during unsafe situations. The study shows the effectiveness of integrating panic mechanisms and reliable communication technologies in office transportation systems [8]. This work forms a foundational reference for incorporating an emergency button, buzzer activation, and camera recording features in the *Safe Office Cab* system.

2.1 Summary Literature Survey

The reviewed studies collectively highlight the growing importance of implementing reliable, real-time safety mechanisms in corporate transportation systems. Several researchers have emphasized the role of IoT based monitoring, cloud connectivity and sensor driven alert systems in addressing safety challenges faced by employees, especially during late hour travel. The literature also identifies major gaps in existing cab safety solutions, such as delayed emergency responses, lack of automated detection features and limited integration of communication technologies.

Research focused on GPS tracking, alcohol detection, gas sensing and automated notification systems underline the need for continuous environment monitoring inside the cab. Studies addressing the safety of women employees further highlight the necessity of live tracking and instant communication with authorities. Additionally, research on smart transportation and vehicle monitoring systems highlights the necessity of secure data transmission, real-time location updates and driver behavior assessment.

Chapter 3

System Overview

Employee safety during travel is a growing concern, especially when cabs operate during late hours. To address this challenge, the *Safe Office Cab* system has been developed using Raspberry Pi 3B and Internet of Things (IoT) technologies to provide continuous monitoring and real-time tracking.

3.1 System Block Diagram

Figure 3.1 shows the block diagram of *Safe Office Cab* system, that integrates several key components to efficiently manage its operations.

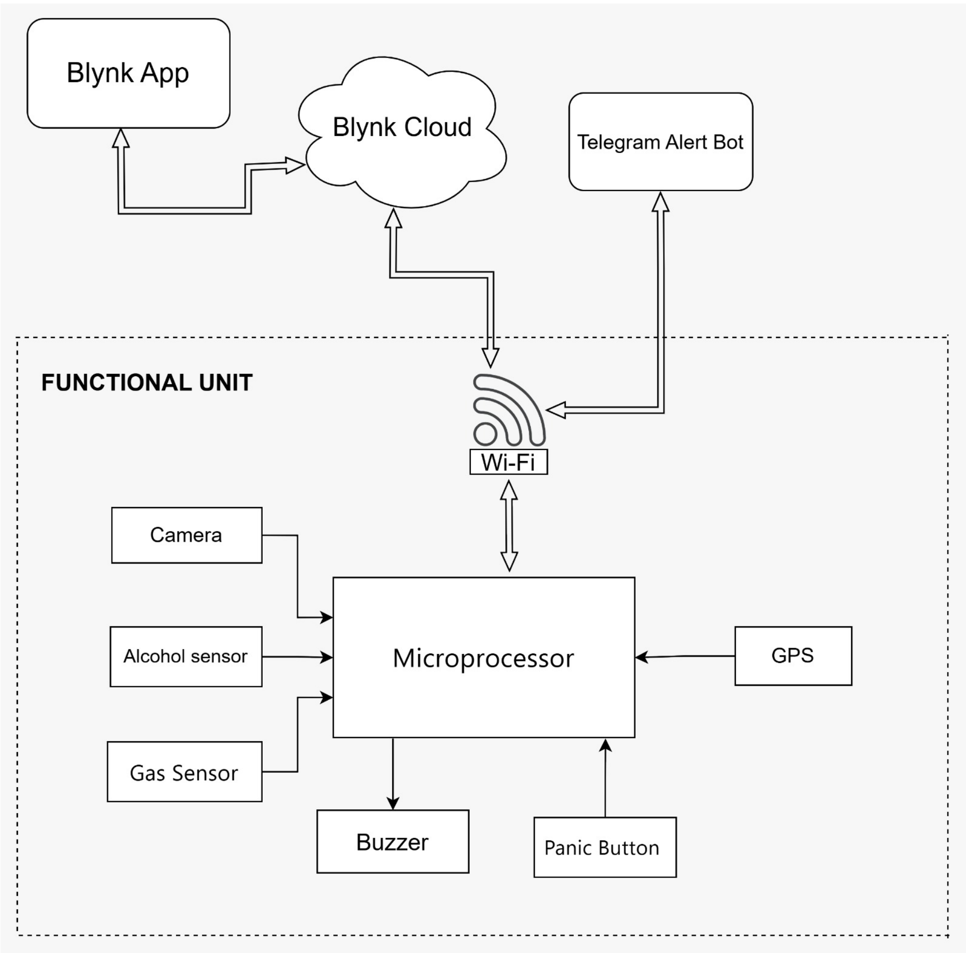

Figure 3.1: Block diagram of the system

The block diagram represents the overall working of the *Safe Office Cab* system, where multiple safety components are connected to a central microprocessor. This microprocessor acts as the brain of the system, collecting data from all sensors and making decisions in real time. Each component is designed to ensure continuous monitoring of the cab and enhance passenger safety.

The camera module provides visual information that can be used for monitoring the driver and surroundings. Along with this, the alcohol sensor and gas sensor continuously check for unsafe conditions such as alcohol consumption or harmful gas leakage. These sensors send instant signals to the microprocessor whenever an abnormal condition is detected.

A panic button is provided for passengers, allowing them to trigger an immediate alert during emergencies. When panic button pressed, the microprocessor activate the buzzer to warn nearby people and simultaneously sending alerts to the monitoring system. The GPS module updates the cab's location, helping track the vehicle at all times.

The microprocessor communicates over Wi-Fi to transfer live data to the Blynk Cloud. This enables real-time monitoring through the Blynk cloud, where the company or user can view status updates, sensor readings and the cab's current location. Any unusual activity is instantly reflected on the app.

In addition, the system also sends emergency notifications to a telegram alert bot. This ensures that alerts reach responsible authorities or family members without delay. Together, these interconnected units create a reliable and smart safety system for office transportation.

Chapter 4

System Hardware

This chapter gives the detailed description of hardware components used in the project. Figure 4.1 shows the direct GPIO pin connection circuit diagram of the Safe Office Cab system designed using a Raspberry Pi 3B. The MQ-3 gas sensor and MQ-5 alcohol sensor are directly interfaced with the Raspberry Pi 3B through digital GPIO pins to continuously detect smoke and alcohol presence inside the cab. A panic button is provided for passengers to manually raise an emergency alert whenever required. Two buzzers are connected to the Raspberry Pi 3B to generate immediate audible warnings during unsafe conditions and system interactions. The Neo-6M GPS module is interfaced through the UART pins of the Raspberry Pi 3B to enable real-time tracking of the cab's location. All components operate using a common power supply and ground, ensuring smooth communication and reliable performance of the overall safety system.

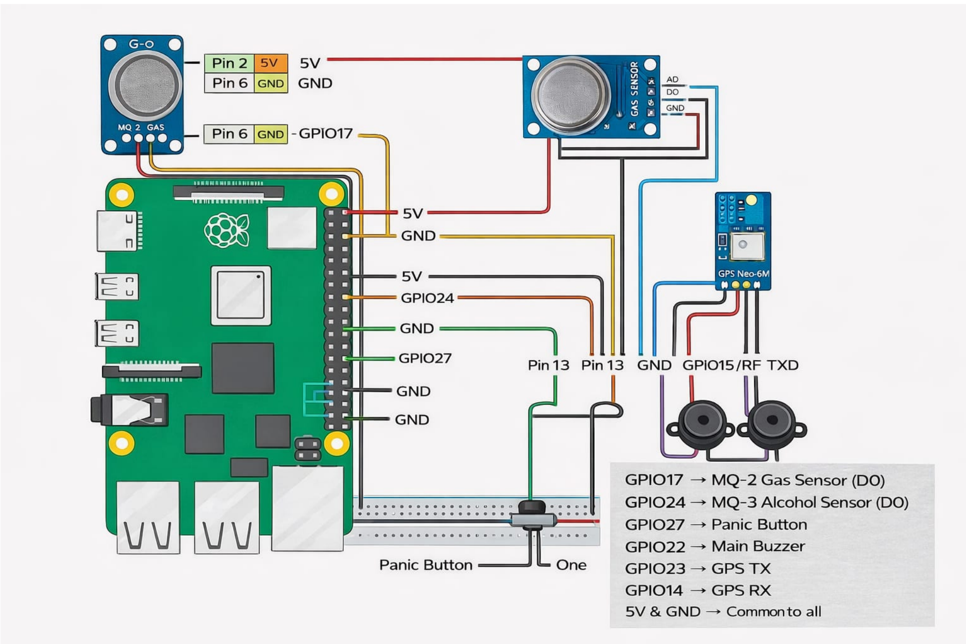

Figure 4.1: Circuit diagram of the system

4.1 Raspberry Pi 3B

As shown in Figure 4.2, the Raspberry Pi 3B serves as the central controller of the system because it efficiently processes sensor data, executes Python-based programs, manages the camera and transmits information to both the Blynk cloud and Telegram alert bot using its built in Wi-Fi. Its GPIO pins allow easy integration of sensors, GPS module, and the buzzer, making it well suited for a real-time safety monitoring system.

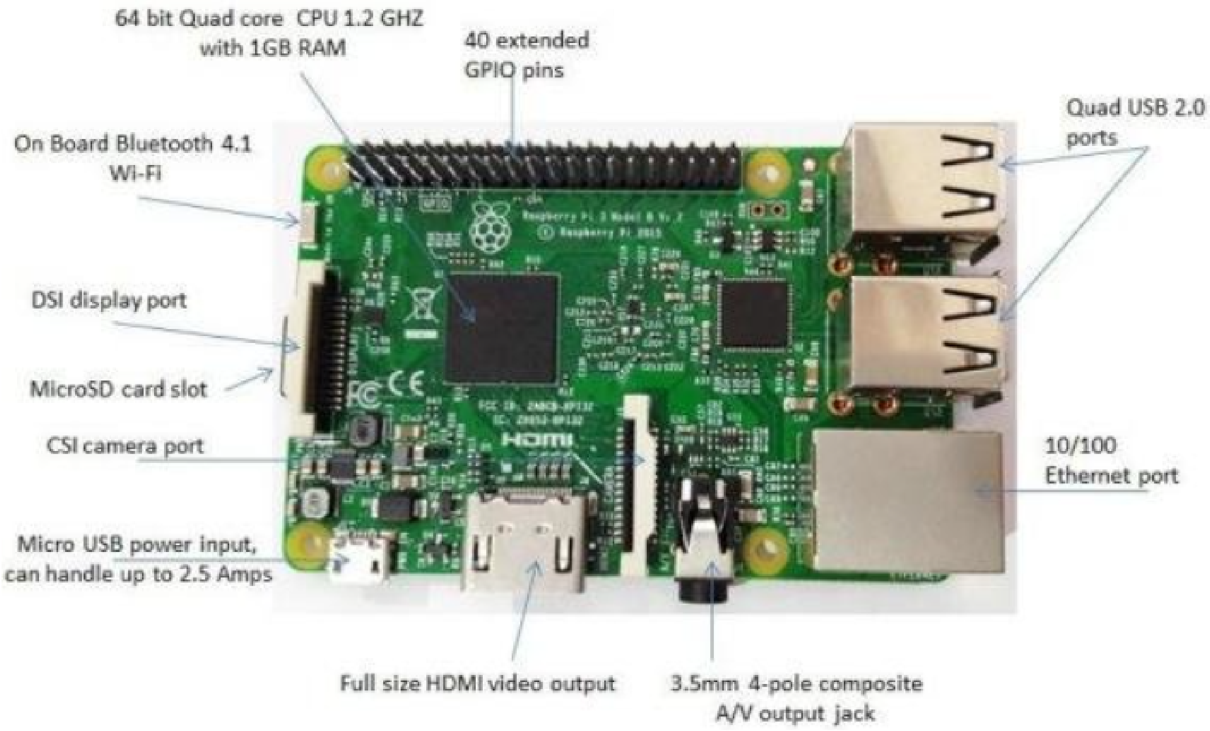

Figure 4.2: Microprocessor Raspberry Pi 3B [9]

- Specifications of Raspberry Pi 3B:

  - Processor: 64-bit Quad-Core processor.
  - Internet: Built-in Wi-Fi and Bluetooth 4.1
  - Storage: MicroSD Card Slot.
  - Dimensions: 85mm x 56mm x 17mm.
  - Antenna: onboard PCB antenna. Power Supply 5V/3A.

The Raspberry Pi 3B acts as the central control unit of the system, coordinating all hardware components and managing system operations. It processes real-time data from sensors, communicates alerts and live location through Wi-Fi to the cloud and Telegram, and interfaces with devices such as the GPS module, camera and buzzer to ensure timely monitoring and emergency response for employee safety.

4.2 Camera Module

As illustrated in Figure 4.3, the Raspberry Pi Camera Module is employed to capture images or video during emergency situations. It connects directly to the Raspberry Pi 3B and offers clear visual monitoring inside the cab. This feature supports evidence recording and enhances by providing a visual account of events when an alert is triggered.

- Features of Camera module:
  - Interface: Uses CSI (Camera Serial Interface) connector.
  - Lens: Fixed-focus lens for general-purpose imaging.
  - Compatibility: Fully supported by Raspberry Pi 3B.
  - Power: Low power consumption during operation.
  - Video: Supports 1080p Full HD recording at 30fps.

In the system, the camera module is activated only when the emergency button is pressed. During that particular period, it captures images or video for safety and evidence purposes, helping authorities verify the situation and take appropriate action without compromising privacy.

Figure 4.3: Raspberry Pi 3B Camera Module [10]

4.3 MQ-3 Alcohol Sensor

As shown in Figure 4.4, the MQ-3 sensor is used to sense the presence of alcohol vapour inside the vehicle. In digital mode, it provides a HIGH or LOW signal to the Raspberry Pi 3B, indicating whether the alcohol level is within or beyond the set limit. When the threshold is exceeded, the output switches to LOW, enabling the system to alert the driver and send notifications immediately, thereby helping prevent drunk-driving incidents.

- Features of MQ-3 Alcohol Sensor:
  - Detection: Senses ethanol level in driver's breath.
  - Voltage: 5V power supply.
  - Sensitivity: High sensitivity to alcohol.
  - Output: Gives analog output based on alcohol level.

The MQ-3 alcohol sensor is used in the system to detect the presence of alcohol vapors from the driver's breath. When the alcohol level exceeds a safe threshold, the sensor sends data to the Raspberry Pi, which triggers alerts and notifications, helping ensure driver sobriety and enhancing overall passenger safety during travel.

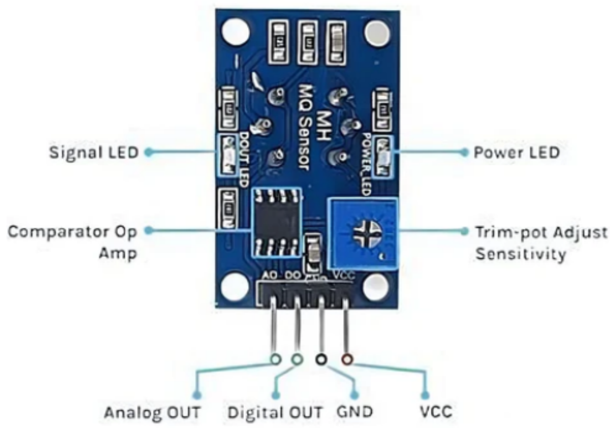

Figure 4.4: MQ-3 Alcohol Sensor [11]

4.4 MQ-5 Smoke Sensor

As depicted in Figure 4.5, the MQ-5 sensor is used to detect harmful gases such as LPG, methane and smoke. It provides a digital HIGH or LOW output, allowing quick and straightforward identification of unsafe gas levels. When the concentration of harmful gases increases, the sensor outputs a LOW signal to the Raspberry Pi 3B, which then activates alarms and sends safety alerts to ensure passenger protection.

- Feature of MQ-5 Smoke Sensor:
  - Detection: Senses smoke, methane and other harmful gases.
  - Voltage: 5V supply.

- Sensitivity: High sensitivity to smoke.

- Output: Provides both digital as well as analog outputs.

The MQ-5 smoke sensor is used in the system to detect the presence of smoke or harmful gases inside the cab. When unsafe levels are detected, it sends data to the Raspberry Pi, which triggers immediate alerts through the Blynk cloud or Telegram, enabling quick response and ensuring a safer travel environment.

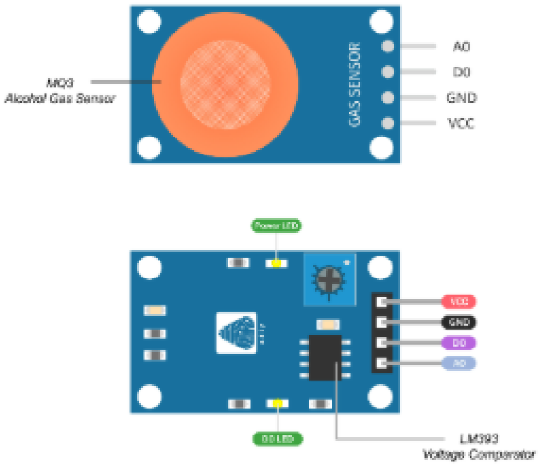

Figure 4.5: MQ-5 Smoke Sensor [12]

4.5 Buzzer

The buzzer provides an audible alert whenever an emergency is detected. It is triggered by the Raspberry Pi 3B in response to alcohol detection, gas leakage or activation of the panic button. This immediate sound warning helps both the driver and passengers quickly become aware of potential danger.

- Features of Buzzer:

  - Type: Electronic sound-producing component.

  - Operation: Generates beeps sound or alerts signals.

  - Voltage: 3.3V–5V.

  - Signal: Digital output from a Raspberry Pi 3B.

  - Usage: Used for notifications and safety alerts.

The buzzer is used in the system to provide immediate audible alerts when unsafe conditions such as alcohol detection, smoke presence, or emergency events are identified. It works in coordination with the Raspberry Pi 3B to quickly warn occupants inside the cab, enabling prompt attention and response during critical situations.

4.6 Neo-6M GPS Module

As presented in Figure 4.6, the NEO-6M GPS module provides the cab's real-time geographical position by continuously receiving satellite signals and generating accurate latitude and longitude coordinates. These coordinates are transmitted to the Raspberry Pi 3B through serial communication, where they are processed and sent to the Blynk IoT dashboard. This enables live vehicle tracking by coordinates and assists authorities or concerned personnel in quickly locating the cab during emergency situations.

- Specification of Neo-6M GPS Module:

  - Accuracy: Shows latitude and longitude readings.

  - Voltage: 3.3V–5V power supply.

  - Usage: Suitable for navigation, tracking cab.

  - Output: Sends data through serial communication (UART) appears in Blynk cloud.

The Neo-6M GPS module is used in the system to obtain the real-time location of the office cab by providing accurate latitude and longitude coordinates. During normal operation or emergency situations, this location data is sent to the Raspberry Pi and shared through the Blynk cloud or Telegram alerts, enabling live tracking and faster response for employee safety.

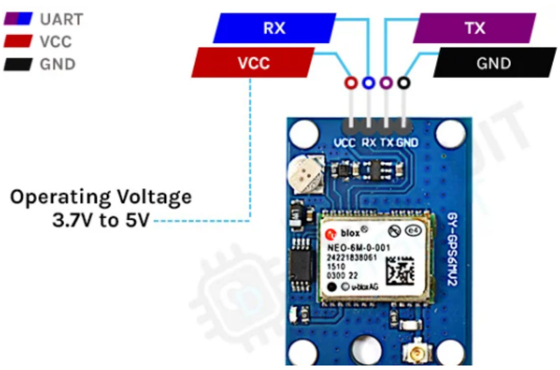

Figure 4.6: Neo-6M GPS module [14]

4.7 Push Button

Buzzer and Alert Functionality: The panic button allows passengers to instantly signal an emergency situation. When panic button pressed, it sends a direct input to the Raspberry Pi 3B, prompting the system to trigger alerts, activate the buzzer and notify the Blynk dashboard and emergency contacts. This ensures immediate attention and quick assistance during critical moments.

The push button is used as an emergency trigger in the project, allowing passengers to manually raise an alert during critical situations. When pressed, it immediately notifies the Raspberry Pi, which activates safety actions such as sending alerts message through telegram , sharing location details, and enabling evidence recording to ensure quick assistance and response.

- Details of the Push Button:
  - Pins: 4 pins.
  - Voltage: 3.3V - 5V.
  - Mounting: Can be easily place on breadboard.

Chapter 5

System Software

In this chapter, explains how the *Safe Office Cab* system software enables communication with the Blynk IoT platform. Through this connection, users can view and control the safety features of the system directly from their smartphones in real time. The software functions as an interface that links the Raspberry Pi 3B hardware with the Blynk cloud server, allowing seamless data exchange and continuous system monitoring.

5.1 Software for Blynk

The system software for blynk, user can see how Raspberry Pi 3B integrates with the Blynk cloud and enables all Internet of Things (IoT) functions that it provides. These functions include but are not limited to sending notifications of alerts remotely through a buzzer, view and monitor sensor data, control actuators, log all recorded information. This software layer provides:

1. A live updating of real-time information on the Blynk dashboard.
2. A means to remotely activate and deactivate buzzer alerts, as well as to use them for safety reminders.
3. A way to receive notifications through notification if there is an emergency event.
4. Encrypted communication between the Raspberry Pi 3B and the Blynk cloud.
5. Synchronizing events that occur on the hardware with the mobile dashboard.

5.2 System Flowchart

The flow chart illustrated in Figure 5.1 explains the sequential operation of the *Safe Office Cab* system. When the device is powered on, the program continuously gathers data from the connected sensors. If any unsafe condition is detected, the system immediately generates an alert otherwise, it keeps monitoring the cab environment. This simple and continuous flow ensures smooth operation and enhances safety throughout the entire journey.

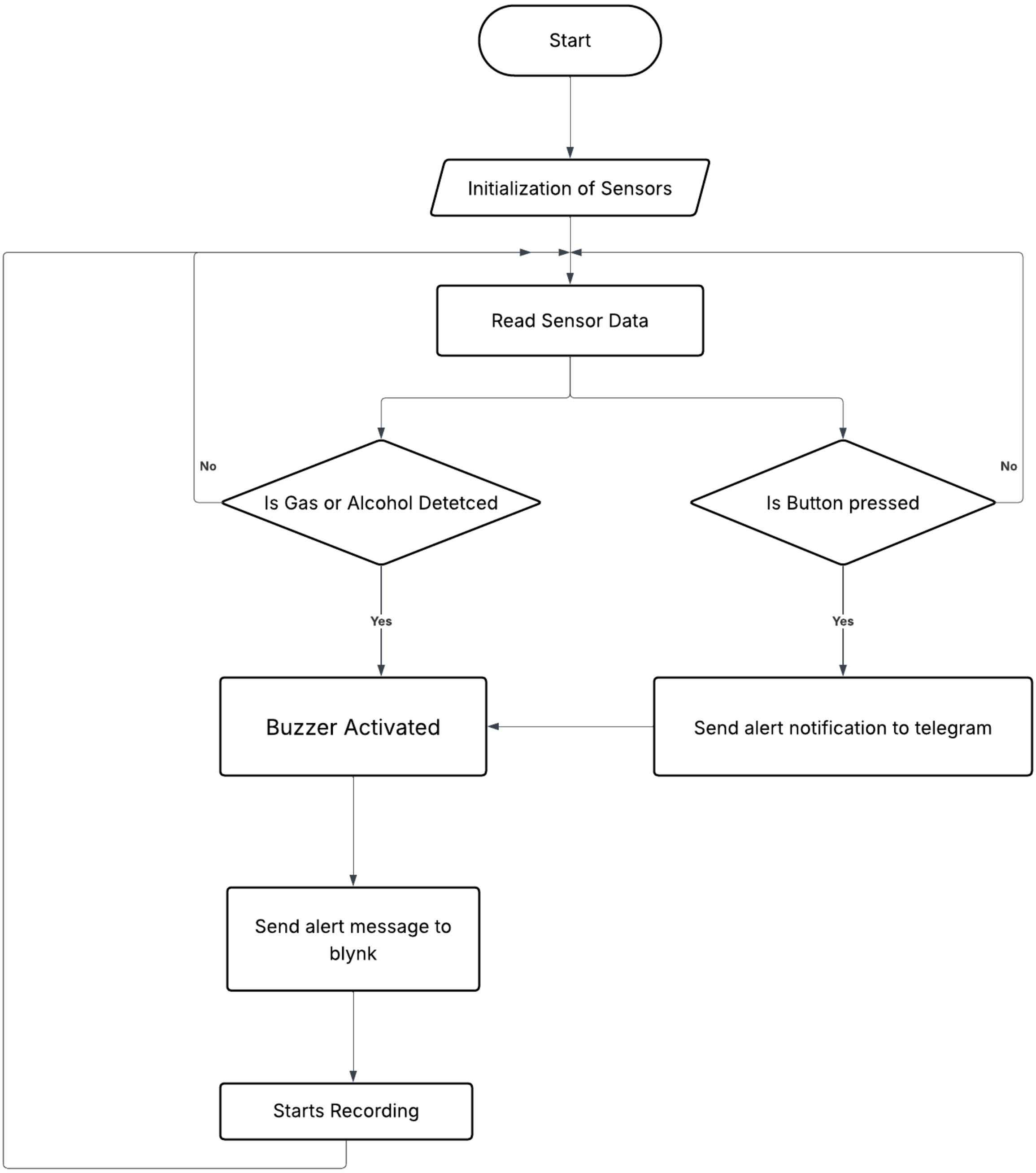

Figure 5.1: Flowchart of the system

Chapter 6

Results

Figure 6.1 and Figure 6.2 shows the hardware prototype of the proposed Safe Office Cab monitoring system. The setup is built around a Raspberry Pi 3B, which acts as the central processing unit and interfaces with various sensors through a breadboard and jumper wires. As seen in the figure, the system integrates sensing modules for monitoring unsafe conditions inside the cab, along with a GPS module used to track the real-time location of the vehicle. All components are powered and interconnected to enable continuous data acquisition and processing. This compact prototype arrangement demonstrates how multiple hardware modules are combined to ensure real-time monitoring, improved employee safety, and reliable system operation during office transportation.

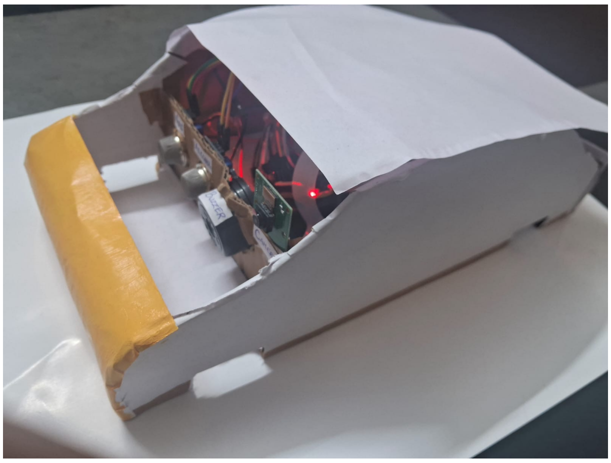

Figure 6.1: Prototype of the system- Top View

As shown in Figure 6.3, the results of the *Safe Office Cab* project confirm that the entire monitoring system was successfully implemented using the Raspberry Pi 3B as the microprocessor. All integrated hardware components including the smoke sensor, alcohol sensor, GPS module, the panic button, buzzer, camera module and blynk cloud connectivity performed reliably during testing.

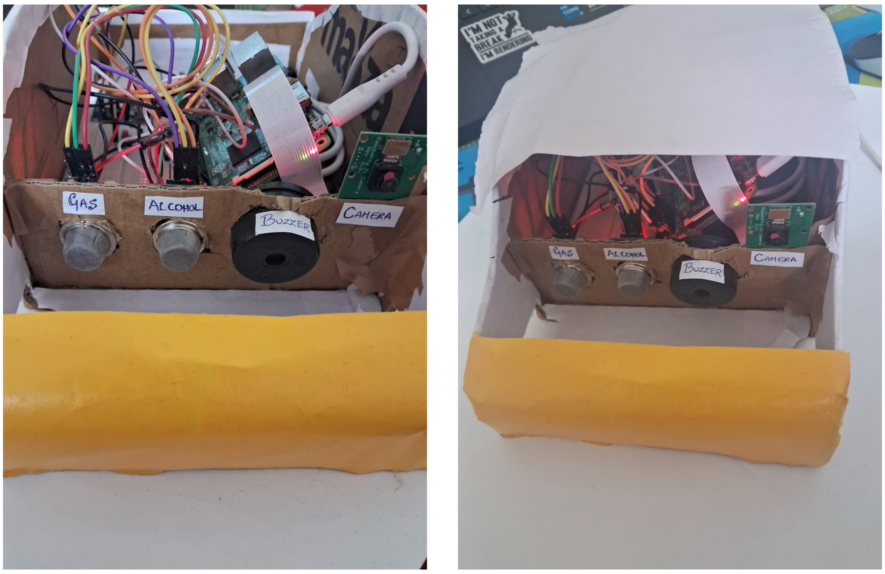

Figure 6.2: Prototype of the system

The system accurately detected unsafe smoke or alcohol levels, instantly activated the buzzer and sent alert notifications to both the Blynk cloud and the Telegram alert bot. The GPS module consistently provided precise real-time tracking on the Blynk dashboard and the panic button functioned correctly by triggering emergency alerts, sounding the buzzer and starting the camera recording. Overall, the results demonstrate that the system meets the intended safety requirements and operates effectively in real-time conditions.

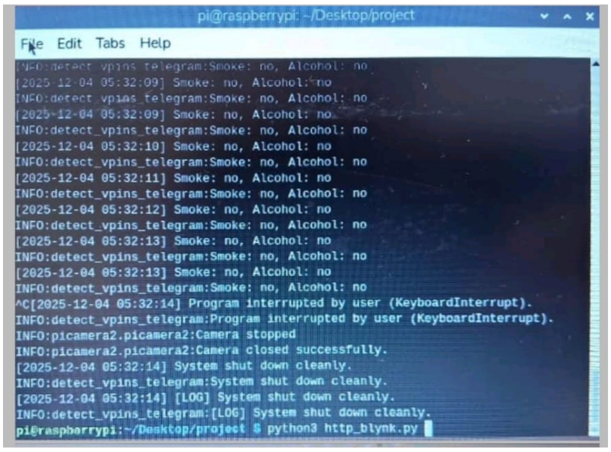

Figure 6.3: Terminal window of Raspberry Pi

The Raspberry Pi 3B connected easily to all the different components and during extended time testing. The monitoring interface through the blynk cloud was determined to be quite easy for users to navigate and understand as they can see the current status of working devices, the alert notifications system and the exact location of working devices all displayed clearly.

6.1 Snapshots

Figure 6.4 shows the complete hardware implementation of the *Safe Office Cab* project. The Raspberry Pi 3B acts as the central controller, interfacing with the alcohol sensor and smoke sensor to continuously monitor unsafe conditions inside the cab. A panic button is provided for emergency situations, which triggers immediate alerts, while the buzzer gives audible warnings. The GPS module enables real-time location tracking and the camera module records visual evidence during emergencies. All components are interconnected using a breadboard, forming a compact and integrated safety monitoring system suitable for office transportation.

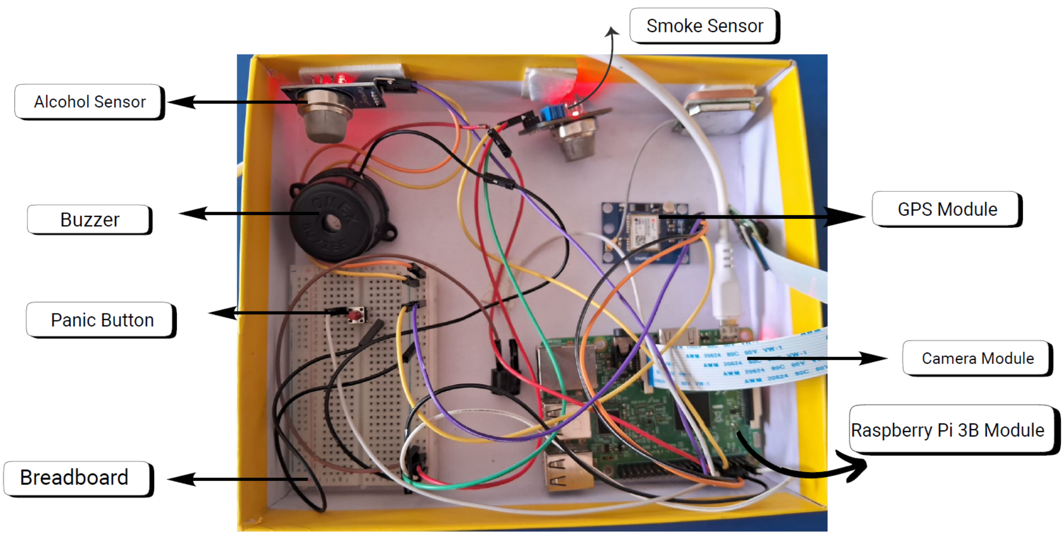

Figure 6.4: System setup of Safe Office Cab

Figure 6.5, illustrates the Blynk cloud dashboard used in the *Safe Office Cab* project to monitor alcohol detection in real time. When the alcohol sensor detects the presence of alcohol, the status on the dashboard is immediately updated and a notification indicating that recording has started is displayed. The alcohol indicator changes its state, confirming detection, while system logs are shown in the terminal section for verification. This cloud based interface enables remote monitoring, quick response, and effective supervision of cab safety conditions.

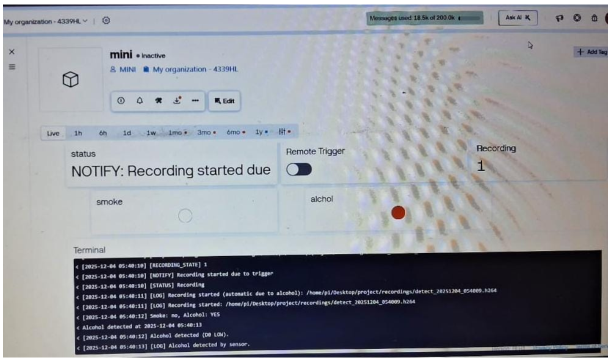

Figure 6.5: Dashboard of Blynk cloud indicating Alcohol detection

Figure 6.6 shows the Blynk cloud dashboard used in the *Safe Office Cab* system to monitor smoke detection in real time. When the smoke sensor detects the presence of smoke inside the cab, the system status is updated as smoke detected, and the smoke indicator turns active on the dashboard. The current GPS location of the cab is also displayed, enabling authorities to identify the exact position during an emergency. This cloud based monitoring ensures quick awareness and timely response to unsafe conditions inside the cab.

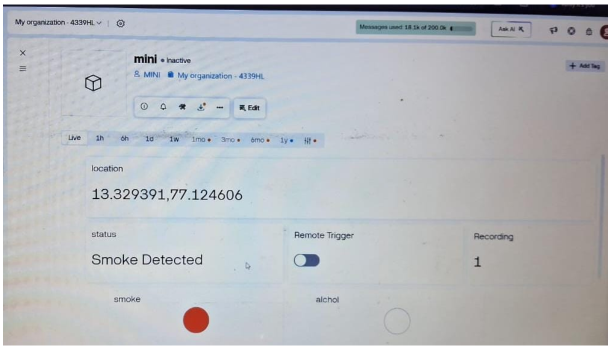

Figure 6.6: Dashboard of Blynk cloud indicating Smoke detection

Figure 6.7 illustrates the remote trigger button feature in the Blynk cloud dashboard of the *Safe Office Cab* system. The trigger button allows authorized personnel to remotely initiate actions such as starting the camera recording during critical situations. Once activated, the system updates the status message as recording started and reflects the change on the dashboard. This feature provides remote control capability and enhances the overall responsiveness and safety management of the office cab system.

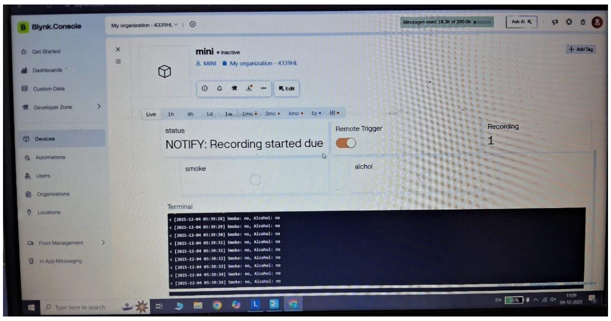

Figure 6.7: Dashboard of Blynk cloud indicating Remote trigger

Chapter 7

Conclusion

The *Safe Office Cab* system demonstrates an effective integration of IoT, sensing technologies and real-time communication to enhance passenger safety during office transportation. Through continuous monitoring using alcohol and smoke sensors, live GPS tracking and automated alert mechanisms through Blynk cloud and Telegram alert bot, the system reliably identifies unsafe conditions and provides immediate notifications to authorized personnel. The inclusion of a panic button and camera recording further strengthens emergency response.

The conclusion validates that the proposed system operates with consistency and accuracy, offering practical and cost efficient solution for improving employee security during their travel. By providing real-time visibility, alerts and reliable monitoring features, the system contributes to safer cab operations and supports organizations in establishing a more secure transportation framework.

7.1 Scope for future work

The Safe Office Cab system has strong potential for future enhancement, allowing it to become even smarter and more secure. Features such as detecting harsh braking, over speeding and irregular cab movements can be added to improve early warning and reduce accident risks. RFID and GSM modules can be upgraded for safer driver authentication, faster emergency communication and live tracking.

Additional improvements such as high resolution camera monitoring, detailed data logging, and driver display messages can strengthen system reliability and transparency. With options like mobile dashboards and backup power, the system can offer continuous monitoring and greater user convenience, making it a more advanced and dependable safety solution.

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Appendices

Appendix A

Sustainable Development Goals

Sl.	**SDG**	**Level**
1	Good Health and Well-being	3
2	Gender Quality	3
3	Decent work and Economic Growth	3
4	Industry, Innovation and Infrastructure	2
5	Sustainable cities and Communities	2
6	Peace, Justice and Strong Institutions	2

Levels: Poor:1, Good :2, Excellent:3

Appendix B

Self-Assesment of the Project

Sl.	**PO and PSO**	**Contribution from the Project**	**Level**
1	Engineering Knowledge	Applied core electronics and IoT concepts.	3
2	Problem Analysis	Identified key safety issues in cab transportation.	2
3	Design/development of solutions	Developed a safe cab monitoring model.	2
4	Investigations of complex problems	Tested sensors and verified system performance.	3
5	Modern tool usage	Used Raspberry pi 3B, GPS, Sensors and Blynk Application.	3
6	The Engineer and the world	Addressed real-world employee safety needs.	3
7	Ethics	Ensured ethical data use and safety compliance.	2
8	Individual and Team Work	Worked collaboratively to build the system.	3
9	Communication	Documented and presented project effectively.	3
10	Project Management and Finance	Managed components, cost and timelines.	2
11	Life-long Learning	Learned new technologies and practical skills.	2
12	PSO1	Problem analysis and design.	2
13	PSO2	Probelm identification and formulation.	2

PSO1: The ability to analyze and design systems in the areas related to microelectronics, Communication, Signal Processing and embedded systems for solving real world problems (Professional Skills). PSO2: The ability to identify problems in the areas of communication and embedded systems and provide efficient solutions using modern tools/algorithm individually or working in a team (Problem solving Skills).

Levels: Poor:1, Good :2, Excellent:3

Appendix C

Data Sheet of Raspberry Pi 3B model

Table C.1: Technical specifications of Raspberry Pi 3B model

Parameter	**Description**
Processor	64-bit Quad-Core ARM Cortex-A53 processor operating at 1.2 GHz, capable of handling multitasking and real-time data processing efficiently.
Memory	1 GB LPDDR2 SDRAM shared between CPU and GPU for smooth execution of applications.
Ethernet	10/100 Mbps Ethernet port for reliable wired network connectivity.
USB Interfaces	Four USB 2.0 ports for connecting peripherals such as keyboard, mouse, camera, sensors and storage devices.
GPIO Pins	40-pin GPIO header supporting digital input/output, UART, SPI, I^2C, and PWM interfaces for sensor and module integration.
Camera Interface	CSI (Camera Serial Interface) port for direct connection of Raspberry Pi camera modules.
Storage	MicroSD card slot used for operating system installation and data storage.
Power Supply	5 V DC input via Micro-USB port with recommended current rating of 2.5–3 A.
Physical Dimensions	Compact board size of approximately 85 mm $\times$ 56 mm, suitable for embedded applications.

Appendix D

Datasheet of MQ-3 Gas Sensor

Table D.1: Technical specifications of MQ-3 Alcohol Sensor

Parameter	**Description**
Sensor Type	Semiconductor gas sensor designed to detect alcohol vapors using a tin dioxide (SnO_2) sensitive layer.
Primary Detection Gas	Highly sensitive to ethanol vapors and commonly used for breath alcohol detection applications.
Operating Principle	Alcohol vapors reduce the sensor resistance when exposed, producing a corresponding change in output voltage proportional to concentration.
Heater Voltage	Operates with a 5 V heater supply to maintain the sensing element at an optimal temperature.
Heater Power Consumption	Low power heater suitable for continuous operation in embedded systems.
Output Signal Type	Provides an analog voltage output that varies with alcohol concentration and can be interfaced using an ADC.
Sensitivity Range	Capable of detecting alcohol concentration in the range typically found in human breath.
Response Time	Quick response to alcohol vapor exposure, enabling real-time monitoring.
Applications	Used in breath analyzers, drunk driving detection systems and safety monitoring applications.

Appendix E

Datasheet of MQ-5 Alcohol Sensor

Table E.1: Technical specifications of MQ-5 Gas Sensor

Parameter	**Description**
Sensor Type	Semiconductor sensor using SnO_2 for combustible gas detection.
Target Gases	Detects LPG, methane, propane and harmful gas.
Operating Principle	Gas presence changes sensor resistance, producing voltage variation.
Operating Voltage	Requires a 5 V DC supply for operation.
Output Signal	Provides analog output proportional to gas concentration.
Warm-Up Time	Needs initial preheating for stable readings.
Detection Range	Covers a wide range of combustible gas levels.
Response Time	Responds quickly to detected gases.
Operating Temperature	Suitable for common ambient temperature conditions.
Operating Humidity	Operates reliably under varying humidity.
Applications	Used in gas leakage and safety monitoring systems.

Appendix F

Datasheet of Neo-6M GPS Module

Table F.1: Technical specifications of NEO-6M GPS Module

Parameter	**Description**
Module Type	Standalone GPS receiver module designed for reliable satellite-based positioning and navigation.
Positioning System	Supports the Global Positioning System (GPS) for accurate location and timing information.
Power Consumption	Designed for low power operation while maintaining continuous tracking performance.
Position Accuracy	Provides accurate latitude and longitude information suitable for real-time vehicle tracking.
Communication Interface	Uses UART serial communication for data transfer to microcontrollers and single-board computers.
Receiver Architecture	High-sensitivity receiver capable of tracking multiple satellites simultaneously for stable position fixes.
Data Output Format	Outputs standard NMEA sentences containing location, speed, and timing information.
Operating Voltage	Operates from a low-voltage DC supply, making it suitable for embedded systems.
Communication Interface	UART serial communication for data transfer.
Applications	Used in vehicle tracking and navigation systems.