Chapter-1

Introduction

The airbag notification system is an essential component of vehicle safety, as it helps alert the occupants and emergency responders in the event of an airbag deployment. Traditional airbag systems provide internal notifications within the vehicle, but there is a need to extend the notification capabilities to external devices, such as mobile phones, to ensure timely assistance.

In this mini-project, we propose the implementation of an airbag notification system using IoT cloud technology and an ESP8266 controller. The system incorporates various components, including a flex sensor for airbag deployment detection, a GPS module for live location detection, a servo motor for automatic unlocking of car doors, an ultrasonic sensor for front barrier detection and distance calculation, an LCD display for visual feedback, and an emergency switch for manual emergency indication.

The system leverages the flexibility and connectivity offered by the ESP8266 controller, which serves as the main control unit. It connects to the Blynk IoT platform, enabling communication with registered mobile numbers for notification purposes. The live location data obtained from the GPS module is attached to the notifications, providing precise information about the vehicle's whereabouts during the airbag deployment event.

Furthermore, the system includes the automatic unlocking of car doors using a servo motor. This feature ensures quick access for both occupants and emergency responders, facilitating timely assistance during critical situations. The ultrasonic sensor detects the presence of front barriers and calculates the distance to them, which is displayed on the LCD display, providing the driver with essential information for safe navigation.

To prevent false notifications, an emergency switch is incorporated, allowing the driver to manually indicate if there is no emergency. In such cases, a message is sent to the Blynk IoT platform, and the IoT dashboard reflects the absence of an emergency situation.

The proposed airbag notification system aims to enhance vehicle safety by utilizing IoT cloud connectivity, sensor integration, and real-time communication. By providing notifications to registered mobile numbers with live location attachments, automatically unlocking car doors, and incorporating features for front barrier detection and emergency indication, the system ensures a comprehensive approach to airbag deployment detection and emergency response.

1.1 Overview

The mini project focuses on developing an airbag notification system using IoT cloud technology and an ESP8266 controller. The system aims to enhance vehicle safety by detecting airbag deployment and sending notifications to a registered mobile number through the Blynk IoT

platform. It also includes additional features such as live location detection, automatic unlocking of car doors, front barrier detection, distance calculation, and emergency status indication.

The system utilizes a flex sensor to detect airbag deployment, which triggers the notification process. The ESP8266 controller acts as the central control unit, coordinating the functionalities of various components. A GPS module is employed for live location detection, providing real-time coordinates of the vehicle to be included in the notification. The servo motor is used to automatically unlock the car doors once the airbag is deployed, ensuring quick access for occupants and emergency responders.

To detect the presence of front barriers and calculate the distance, an ultrasonic sensor is integrated into the system. The calculated distance is displayed on an LCD display, providing visual feedback to the driver. Additionally, an emergency switch is incorporated to allow the driver to indicate if there is no emergency, preventing false notifications. In such cases, a message is sent to the Blynk IoT platform, and the IoT dashboard displays the absence of an emergency.

The proposed system aims to improve vehicle safety by utilizing IoT cloud connectivity, sensor integration, and real-time communication to provide timely notifications, location information, and door unlocking functionality. The mini-project demonstrates the application of these technologies to enhance the overall safety and security features of vehicles during emergency situations.

1.2 Literature survey

In the field of automotive safety, several studies have been conducted on airbag deployment detection systems and IoT-based solutions. These works have contributed to improving the prompt notification of airbag deployments and enhancing the overall safety of vehicle occupants. In this literature survey, we will discuss some of the relevant works done by previous authors, their advantages, disadvantages, and how our system addresses the identified challenges.

- "Smart Car Safety System using IoT" by S. Alam et al. presents a comprehensive study on the integration of IoT technology into car safety systems. Here is a brief summary of the paper:

The authors begin by highlighting the increasing need for advanced safety systems in vehicles and the potential of IoT to address this demand. They emphasize the importance of real-time monitoring and intelligent decision-making to enhance vehicle safety.

The proposed smart car safety system incorporates various IoT components and sensors to monitor and respond to different safety aspects. It focuses on detecting potential accidents, deploying airbags, and notifying relevant parties in emergency situations.

The system utilizes a combination of sensors such as accelerometers, gyroscopes, and proximity sensors to gather data about the vehicle's motion, orientation, and proximity to obstacles. These sensors continuously monitor the vehicle's environment and detect any potential collision or

hazardous situation. In addition to collision detection, the system also integrates GPS modules to track the vehicle's location and enable real-time monitoring. The GPS data can be used to provide accurate information about the vehicle's position in case of emergencies or accidents.

Cloud connectivity is a crucial aspect of the proposed system, enabling seamless data transmission and remote monitoring. The authors emphasize the role of cloud platforms in storing and analyzing the collected sensor data, as well as facilitating communication between the vehicle and relevant stakeholders. The system's architecture includes an intelligent decision-making module that processes the sensor data and determines if there is a need for airbag deployment. This module employs algorithms and rule-based logic to assess the severity of the detected situation and trigger the airbag deployment mechanism accordingly. Furthermore, the paper discusses the implementation of communication mechanisms, such as GSM or internet connectivity, to notify emergency services, the vehicle owner, or predefined contacts in case of accidents or airbag deployment. Overall, the paper provides insights into the design and implementation of a smart car safety system using IoT. It emphasizes the significance of real-time monitoring, intelligent decision-making, and cloud connectivity in enhancing vehicle safety. The proposed system aims to detect accidents, deploy airbags when necessary, and notify relevant parties promptly, contributing to improved emergency response and overall road safety.

- S. M. Kanhere et al., "IoT-Based Vehicle Safety System," 2017 International Conference on Advances in Computing, Communications, and Informatics (ICACCI), 2017.

In this paper, the authors propose an IoT-based vehicle safety system that aims to enhance vehicle safety and provide real-time alerts in emergency situations. The system utilizes various components, including GPS, accelerometer, and GSM modules, to monitor vehicle parameters and detect potential risks. The key features of the system are:

Sensor Integration: The system incorporates an accelerometer to detect sudden changes in vehicle motion, such as collisions or accidents. The GPS module is used to track the vehicle's location in real-time.

Alert Generation: When the accelerometer detects an impact or sudden change in motion, it triggers an alert. The system uses the GSM module to send immediate notifications to the relevant stakeholders, such as the vehicle owner or emergency services.

Emergency Assistance: In case of an emergency, the system can automatically contact emergency services and provide them with the vehicle's location information obtained from the GPS module. This allows for quick response and assistance.

Remote Monitoring: The system enables remote monitoring of the vehicle's status and location through cloud connectivity. This allows users to track their vehicles and receive notifications even when they are not physically present with the vehicle.

The paper discusses the architecture and implementation details of the IoT-based vehicle safety system. It also highlights the importance of such systems in improving road safety and reducing response time during critical situations. The authors evaluate the system's performance and demonstrate its effectiveness in detecting accidents and sending timely alerts.

Overall, this paper provides insights into the design and implementation of an IoT-based vehicle safety system, showcasing the integration of sensors, cloud connectivity, and communication modules to enhance vehicle safety and emergency response.

- "Development of IoT-Based Vehicle Safety System using Arduino and Raspberry Pi" (S. V. Kulkarni et al.)

The paper titled "Development of IoT-Based Vehicle Safety System using Arduino and Raspberry Pi" presents a study on the design and implementation of an IoT-based vehicle safety system. The authors utilize the Arduino and Raspberry Pi platforms to integrate various sensors and provide real-time monitoring and alerting capabilities for vehicle safety. The following key points summarize the paper:

1. Objective: The paper aims to develop an IoT-based vehicle safety system that enhances the safety of vehicles by detecting and notifying potential risks and emergencies.
2. System Architecture: The proposed system employs the Arduino and Raspberry Pi platforms for sensor integration and data processing. It includes various sensors such as ultrasonic sensors, temperature sensors, gas sensors, and an accelerometer.
3. Sensor Integration: The authors describe the integration of different sensors to monitor and detect potential hazards. Ultrasonic sensors are used to measure the distance between the vehicle and obstacles, while temperature and gas sensors are utilized to detect fire or hazardous conditions. An accelerometer is employed to monitor sudden changes in velocity or collisions.
4. Data Processing and Decision Making: The sensor data collected by the system is processed and analyzed using the Arduino and Raspberry Pi platforms. The authors outline the algorithms and decision-making mechanisms used to determine the severity of a situation and trigger appropriate alerts or actions.
5. Alerting Mechanism: The system incorporates various alerting mechanisms to notify the driver or relevant authorities in case of emergencies. It can generate audio alarms, visual alerts, and send notifications to a connected mobile device or remote monitoring system.
6. Cloud Connectivity: The authors discuss the integration of cloud platforms to store and analyze the sensor data collected by the system. This enables remote monitoring, data logging, and historical analysis of vehicle safety parameters.
7. Experimental Evaluation: The authors conducted experiments to evaluate the performance and effectiveness of the proposed system. They provide details on the experimental setup, data

collection, and analysis, highlighting the system's ability to detect potential risks and respond with timely alerts.

8. Conclusion: The paper concludes that the IoT-based vehicle safety system utilizing Arduino and Raspberry Pi platforms can effectively enhance vehicle safety by providing real-time monitoring, risk detection, and alerting capabilities.
9. Overall, the paper "Development of IoT-Based Vehicle Safety System using Arduino and Raspberry Pi" provides insights into the design and implementation of an IoT-based vehicle safety system. It highlights the integration of sensors, data processing mechanisms, alerting mechanisms, and cloud connectivity to enhance vehicle safety and emergency response.

1.3 Objectives / Scope / Aim of the mini-project work

The main objectives of the mini-project on airbag notification through IoT cloud using an ESP8266 controller are as follows:

- Develop a system that can accurately detect airbag deployment using a flex sensor.
- Integrate the ESP8266 controller as the main control unit to coordinate the functionalities of various components.
- Establish communication with the Blynk IoT platform to send notifications to a registered mobile number and also to Gmail once airbag deployment is detected.
- Include live location detection using a GPS module to provide real-time coordinates of the vehicle.
- Automatically unlock the car doors using a servo motor upon airbag deployment to facilitate quick access for occupants and emergency responders.
- Utilize an ultrasonic sensor to detect the presence of front barriers and calculate the distance to them for enhanced safety.
- Display the calculated distance to the front barrier on an LCD display for the driver's visual feedback.
- Incorporate an emergency switch that allows the driver to manually indicate if there is no emergency situation, preventing false notifications.
- Display the emergency status on an IoT dashboard through the Blynk platform for monitoring purposes.

The aim of this mini-project is to develop a comprehensive system that enhances vehicle safety by providing timely airbag deployment detection, notification to a registered mobile number with live location attachment, automatic unlocking of car doors, front barrier detection, and emergency status

indication. The project aims to demonstrate the integration of IoT, cloud connectivity, and various sensors to improve the safety and security features of vehicles in emergency situations.

1.4 Motivation & Problem Statement

Motivation:

The motivation behind the development of the airbag notification system through an IoT cloud using an ESP8266 controller is to enhance the safety and security features of vehicles. Airbags play a crucial role in protecting occupants during accidents, and timely notification of airbag deployment can help alert emergency services and provide assistance to those involved in the incident. By integrating IoT technology and cloud connectivity, the system aims to improve the effectiveness of airbag deployment detection and notification, as well as enable additional functionalities like live location detection and automatic unlocking of car doors.

Problem Statement:

The problem addressed by this project is the lack of immediate and comprehensive notification systems for airbag deployment in vehicles. In traditional vehicles, airbag deployment may go unnoticed by the driver or passengers, delaying the response from emergency services and reducing the chances of timely assistance. Additionally, there may be situations where the driver is unable to manually call for help due to injury or disorientation.

The project aims to solve these problems by utilizing a flex sensor to accurately detect airbag deployment. Once the airbag is deployed, a notification is sent through the Blynk IoT platform to the registered mobile number and also for Gmail , providing instant awareness to the driver and passengers. The system also incorporates live location detection using a GPS module, allowing emergency services to quickly locate the vehicle. The automatic unlocking of car doors using a servo motor further enhances safety and facilitates easier access to occupants during emergency situations.

The inclusion of an ultrasonic sensor to detect front barriers and calculate their distance provides an additional layer of safety, while the emergency switch enables the driver to indicate if there is no emergency, preventing false notifications. The integration of these components into a cohesive system ensures efficient airbag deployment detection, timely notification, and improved emergency response, ultimately enhancing the safety and security of vehicle occupants.

1.5 Existing & Proposed module.

Existing System:

The existing system lacks a comprehensive and integrated solution for airbag deployment detection, mobile notification, live location sharing, front barrier detection, and emergency response. Typically, airbag deployment detection systems are standalone and do not incorporate IoT cloud technology for immediate notification and location sharing. Additionally, they may not include features such as front barrier detection and distance calculation, or an emergency switch to stop notifications in non-emergency situations.

Proposed System:

The proposed developed mini-project module builds upon the existing module with enhancements and improvements. The main changes include the addition of automatic car door unlocking using a servo motor upon airbag deployment and further refinement of the system's functionality and user interface.

In the developed module, once the airbag is deployed, the flex sensor detects it and sends a notification through the Blynk IoT platform to the registered mobile number. The notification includes an attachment of the live location, which is detected by the GPS module. The ESP8266 controller coordinates the entire system and receives data from the ultrasonic sensor to calculate the distance to the front barrier. This distance is then displayed on the LCD display for the driver's visual feedback.

Additionally, an emergency switch is incorporated to allow the car driver to manually indicate if there is no emergency situation. When activated, the emergency switch sends a message to the Blynk IoT platform and updates the IoT dashboard, indicating that there is no emergency. Furthermore, upon airbag deployment, the servo motor is automatically activated to unlock the car doors, providing an additional safety feature.

Overall, the proposed developed mini-project module expands upon the existing system by adding automatic door unlocking, refining the user interface, and improving the overall functionality and safety aspects of the airbag notification system.

Chapter 2 Block diagram,

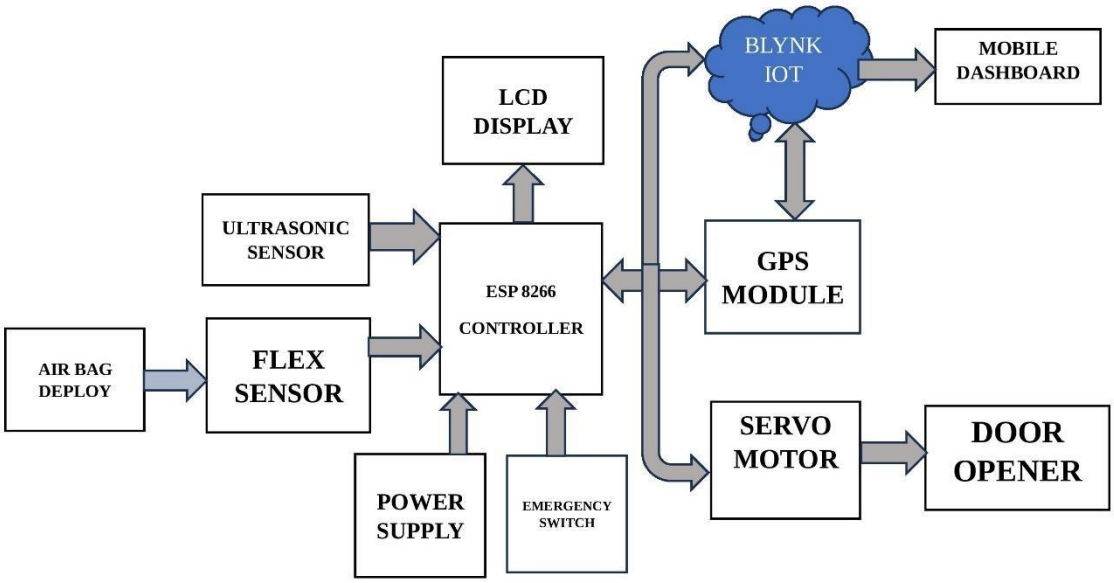


Fig. 2.1 : Block-diagram of the proposed methodology

The airbag notification system incorporates several components that work together to ensure effective operation. The Flex Sensor plays a crucial role by detecting the deployment of the airbag and transmitting the corresponding signal to the ESP8266 Controller. Acting as the central control unit, the ESP8266 Controller coordinates the functionalities of all other components. It receives the signal from the Flex Sensor and processes it accordingly.

To determine the live location of the vehicle, the system utilizes a GPS Module. This module receives location data from GPS satellites and relays real-time coordinates to the ESP8266 Controller. The Ultrasonic Sensor is employed to detect the presence of a front barrier and measure the distance to it. The data collected by the Ultrasonic Sensor is then transmitted to the ESP8266 Controller for further analysis.

For providing visual feedback to the driver, an LCD Display is incorporated. It displays the calculated distance to the front barrier, enabling the driver to be aware of potential obstacles. Additionally, an Emergency Switch is included, allowing the driver to manually indicate the absence of an emergency. Once activated, the Emergency Switch sends a signal to the ESP8266 Controller, which adjusts the system accordingly.

In the event of airbag deployment, the Servo Motor automatically activates to unlock the car doors, facilitating quick and safe exit for the occupants. The Blynk IoT platform plays a vital role in connecting the ESP8266 Controller to the internet and enabling communication with other devices.

It allows the system to send notifications, including the live location attachment, to the registered mobile number.

The Registered Mobile Number represents the user's mobile number that is registered within the system. When an airbag deployment is detected, the system sends a notification containing the live location attachment to this mobile number and also to Gmail, ensuring timely and crucial information reaches the concerned individuals.

The block diagram visually represents the interconnections between the various components of the system, highlighting how they collaborate to achieve the desired functionality of the airbag notification system.

2.1 Algorithm:

Here is an algorithm outlining the steps involved in the airbag notification system using an ESP8266 controller:

1. Initialize the system and set up the necessary components, including the ESP8266 controller, flex sensor, GPS module, servo motor, ultrasonic sensor, LCD display, emergency switch, and Blynk IoT platform.
2. Continuously monitor the status of the flex sensor.
3. If the flex sensor detects airbag deployment:
    a. Activate the GPS module to obtain the live location data.
    b. Send a notification through the Blynk IoT platform to the registered mobile number, including the live location attachment.
    c. Activate the servo motor to unlock the car doors.
4. Continuously monitor the ultrasonic sensor to detect the presence of a front barrier.
5. Calculate the distance to the front barrier using the ultrasonic sensor.
6. Display the calculated distance on the LCD display.
7. Continuously monitor the status of the emergency switch.
8. If the emergency switch is activated:
    a. Stop sending notifications through the Blynk IoT platform.
    b. Display a "No Emergency" message on the IoT dashboard.
9. Repeat the above steps to continuously monitor the system and respond to airbag deployment events, barrier detection, and emergency switch status.

2.2 Flow chart

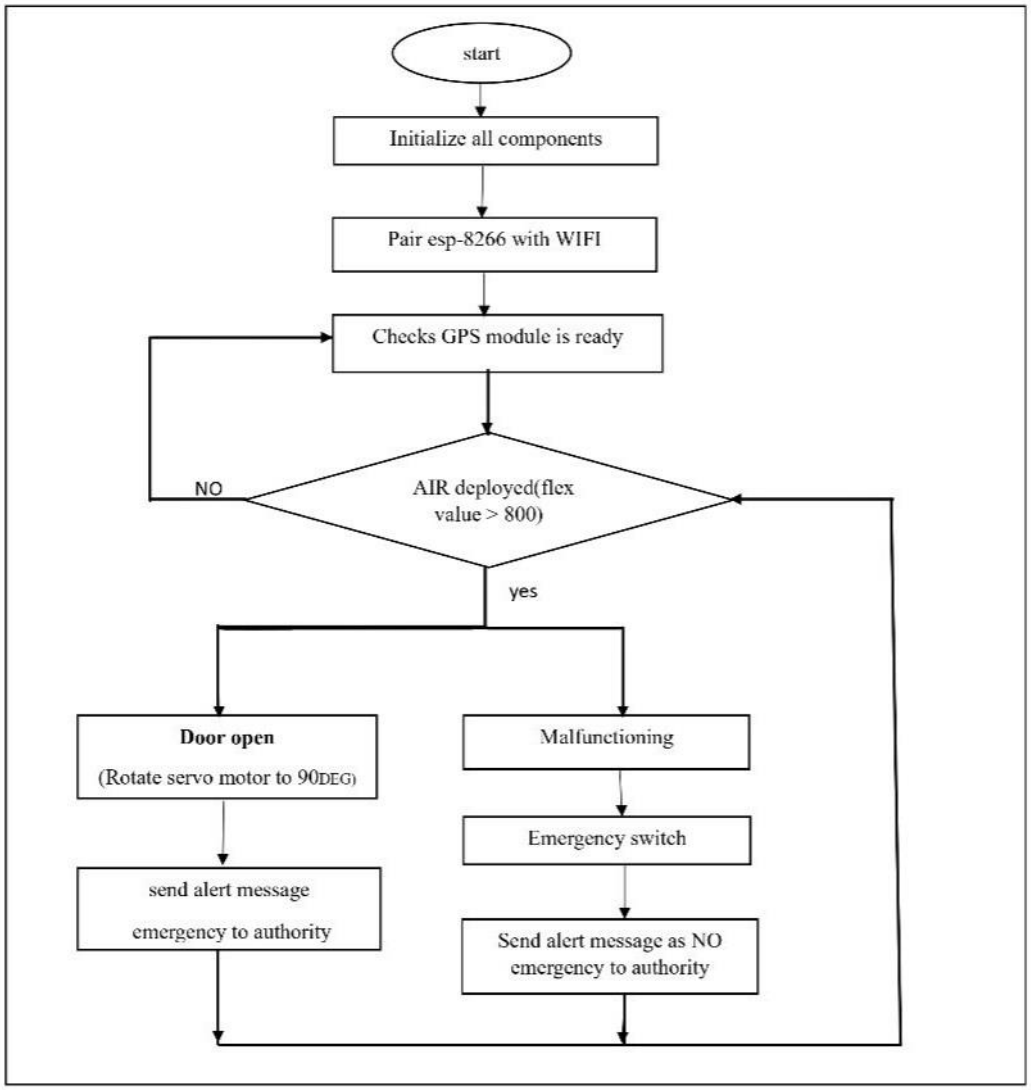


Fig. 2.2 : Flow-chart

Chapter-3 3.1 Hardware tools

3.1.1 ESP 8266 controller

Fig.3.1: ESP8266 controller

When it comes to the ESP8266 controller in the context of your topic on airbag notification through IoT cloud, it plays a crucial role in enabling the connectivity and communication between the various components of the system. Here's an explanation of the ESP8266 controller and its significance:

The ESP8266 is a highly integrated Wi-Fi microchip with a built-in TCP/IP protocol stack, designed for embedded applications. It offers a cost-effective and efficient solution for connecting devices to the internet and forming an IoT network. In your airbag notification system, the ESP8266 serves as the central control unit responsible for coordinating the functionalities of the different components. The ESP8266 controller performs the following tasks in your system:

- Communication with Flex Sensor: The ESP8266 receives signals from the flex sensor, which detects the deployment of the airbag. It processes the sensor data to determine if the airbag has been deployed.
- Blynk IoT Integration: Once the airbag deployment is detected, the ESP8266 utilizes the Blynk IoT platform to send a notification to the registered mobile number. It establishes a connection to the Blynk server and transmits the necessary information, including the live location attachment.
- GPS Module Integration: To enable live location detection, the ESP8266 interacts with the GPS module. It receives location data from GPS satellites and extracts the coordinates, which are then used to attach the live location information to the notification sent via Blynk.

- Servo Motor Control: Upon airbag deployment, the ESP8266 triggers the servo motor to automatically unlock the car doors. This action ensures quick and easy exit for the occupants after the airbag has been deployed.
- Ultrasonic Sensor Integration: The ESP8266 communicates with the ultrasonic sensor to detect the presence of a front barrier and calculate its distance. The calculated distance is then displayed on the LCD display for the driver's reference.
- Emergency Switch Handling: The ESP8266 monitors the emergency switch status. If the switch is activated, indicating that there is no emergency situation, the ESP8266 can halt the notification process and update the IoT dashboard accordingly.

The ESP8266 controller's role is crucial in ensuring the smooth operation of the entire system. It acts as the bridge between the various sensors, actuators, and the IoT cloud platform, enabling seamless communication and control.

3.1.2 Flex sensor

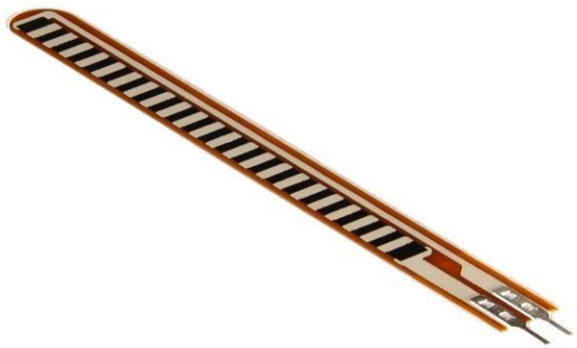


Fig.3.2: Flex sensor

A flex sensor, also known as a bend sensor or flex force sensor, is a type of sensor that measures the amount of bend or deflection applied to it. It consists of a thin strip of flexible material, such as a polymer or conductive ink, that changes its resistance when subjected to physical deformation. Functionality: In the airbag notification system, the flex sensor performs the following functions:

1. Airbag Deployment Detection: The flex sensor is strategically placed in a position where it can detect the deployment of the airbag. When the airbag inflates upon impact or in an emergency

situation, it causes a change in the shape or flexion of the surrounding area. This change in shape is detected by the flex sensor, which in turn triggers the notification process.

2. Notification Trigger: Once the flex sensor detects the deployment of the airbag, it sends a signal to the ESP8266 controller. This signal serves as a trigger for the system to initiate the notification process.

Working Principle:

The flex sensor works on the principle of resistive bending. It contains a resistive material that changes its resistance when it is bent or flexed. The resistance of the flex sensor is directly proportional to the degree of bending or flexing applied to it.

When the airbag is deployed, it causes a change in the shape of the surrounding area, leading to the bending or flexing of the flex sensor. This flexing action alters the resistance of the sensor, which is then measured by the ESP8266 controller. The ESP8266 controller is programmed to monitor the resistance of the flex sensor continuously. When it detects a significant change in resistance, indicating the deployment of the airbag, it initiates the notification process through the Blynk IoT platform.

Advantages:

1. The flex sensor offers several advantages within the airbag notification system:
2. Sensitivity: The flex sensor is highly sensitive and can detect even minor changes in bending or flexing, making it suitable for detecting airbag deployment accurately.
3. Compact Size: Flex sensors are thin and lightweight, allowing for easy integration into various components of the system.
4. Durability: Flex sensors are designed to withstand repeated bending and flexing, ensuring their reliability and longevity in automotive applications.
5. Low Power Consumption: Flex sensors consume minimal power, making them energy-efficient and suitable for use in battery-powered systems.
6. Cost-Effective: Flex sensors are relatively inexpensive compared to other types of sensors, making them a cost-effective choice for airbag deployment detection.

In summary, the flex sensor plays a critical role in the airbag notification system by detecting the deployment of the airbag. Its sensitivity to changes in bending or flexing allows for accurate detection of airbag deployment. Once the flex sensor detects the deployment, it triggers the notification process, enabling the system to send alerts through the Blynk IoT platform to the registered mobile number. The flex sensor enhances the overall safety and effectiveness of the system by providing timely and reliable detection of airbag deployment.

3.1.3 GPS module

Fig 3.3 : GPS module

A GPS (Global Positioning System) module is a device that receives signals from multiple GPS satellites to determine precise location coordinates (latitude, longitude, and altitude). It utilizes the data from these satellites to calculate the device's position accurately.

Functionality: In the airbag notification system, the GPS module performs the following functions:

1. Live Location Detection: The GPS module receives signals from GPS satellites and calculates the real-time coordinates of the vehicle's location. It provides accurate latitude and longitude information, which is essential for determining the vehicle's position.
2. Attachment of Live Location: Once the airbag is deployed, indicating an emergency situation, the GPS module provides the current coordinates to the ESP8266 controller. This live location data is then attached to the notification sent through the Blynk IoT platform to the registered mobile number. The attachment of live location enables the recipient to know the exact location of the vehicle in case of an emergency.

Working Principle:

The GPS module works based on the principle of trilateration. It receives signals from multiple GPS satellites orbiting the Earth. Each satellite broadcasts a signal containing its precise location and the current time.

The GPS module receives these signals and measures the time it takes for each signal to reach the module. By comparing the time delays from multiple satellites, the module can determine the distance between itself and each satellite.

Using the distance measurements from at least four satellites, the GPS module performs complex calculations to determine the module's precise location on Earth. It provides latitude, longitude, and altitude coordinates with a high level of accuracy.

Advantages:

1. The GPS module offers several advantages within the airbag notification system:
2. Accurate Location Tracking: The GPS module provides accurate and precise location coordinates, enabling accurate tracking of the vehicle's position.
3. Real-time Updates: The module continuously receives signals from GPS satellites, allowing for real-time updates of the vehicle's location.
4. Wide Coverage: GPS signals are available globally, making the GPS module suitable for use in various locations and environments.
5. Reliable Performance: GPS technology is well-established and widely used, ensuring reliable performance in determining location coordinates.
6. Integration with ESP8266 Controller: The GPS module can be easily integrated with the ESP8266 controller to provide location data for airbag notification and other functionalities. In summary, the GPS module plays a crucial role in the airbag notification system by providing accurate live location detection. It allows for the attachment of the vehicle's real-time coordinates to the notification sent through the Blynk IoT platform, ensuring that emergency responders or registered individuals have access to the precise location information. The GPS module enhances the overall effectiveness and safety of the system by enabling prompt and accurate response in emergency situations.

3.1.4 Servo motor

Fig.3.4: Servo motor

The servo motor is an important component in the airbag notification system, serving multiple functions such as unlocking car doors upon airbag deployment. Here is a detailed explanation of the servo motor and its role in the system:

Overview: A servo motor is a type of rotary actuator that allows for precise control of angular position. It consists of a motor, a control circuit, and a feedback system. Servo motors are widely used in various applications where accurate positioning and control are required.

Functionality: In the airbag notification system, the servo motor performs the following functions:

1. Car Door Unlocking: Once the airbag is deployed, indicating a potential emergency situation, the servo motor is activated to automatically unlock the car doors. This action allows for quick and easy access to the vehicle, aiding in the safe evacuation of passengers.
2. Control and Positioning: The servo motor can be used for controlling and positioning components within the system. For example, it can be utilized to control the movement of the LCD display or any other mechanical components that require precise positioning.
3. Working Principle: The servo motor operates based on the principle of feedback control. It receives a control signal from the ESP8266 controller, which specifies the desired position or angle. The control circuitry inside the servo motor compares the desired position with the current position obtained from the internal feedback mechanism.

The servo motor's internal feedback system typically uses a potentiometer or an optical encoder to provide position feedback. This feedback allows the control circuit to adjust the motor's rotation until the desired position is achieved. By continuously monitoring the position and making adjustments, the servo motor maintains accurate positioning.

Advantages:

1. The servo motor offers several advantages within the airbag notification system:
2. Precise Control: Servo motors provide precise control over angular positioning, allowing for accurate and repeatable movements.
3. Compact Size: Servo motors are available in compact sizes, making them suitable for integration into space-constrained environments, such as vehicles.
4. Feedback Mechanism: The built-in feedback system ensures accurate positioning by continuously monitoring and adjusting the motor's position.
5. Easy Integration: Servo motors are relatively easy to integrate into the system, as they typically require a control signal and power supply.
6. Versatility: Servo motors can be used for various applications within the system, offering flexibility in controlling mechanical components.

In summary, the servo motor plays a crucial role in the airbag notification system by automatically unlocking the car doors upon airbag deployment. With its precise control and positioning

capabilities, the servo motor enhances the safety and efficiency of the system. By integrating servo motors into the system, the airbag notification system can ensure quick access to the vehicle in emergency situations, facilitating the evacuation of passengers.

3.1.5 Ultrasonic sensor :

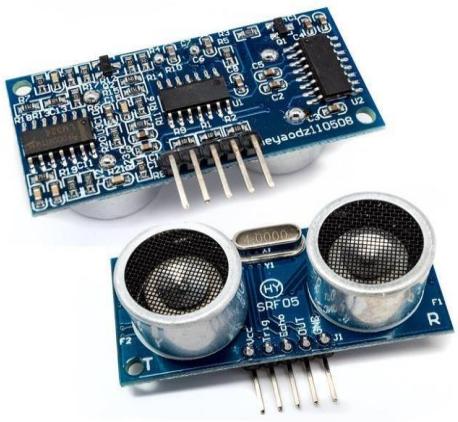


Fig.3.5: Ultrasonic sensor

The HC-SR05 or HY-SRF05 Precision Ultrasonic Sensor is a key component in the airbag notification system, utilized for front barrier detection and distance calculation. Here is a detailed explanation of the ultrasonic sensor and its role in the system:

Overview:

The HC-SR05 or HY-SRF05 Precision Ultrasonic Sensor is a non-contact distance measurement device that uses ultrasonic waves to determine the distance between the sensor and an object. It consists of a transmitter and a receiver, working in tandem to measure the time taken for the ultrasonic wave to travel to the object and back. This time measurement is then used to calculate the distance.

Functionality: The ultrasonic sensor serves an essential purpose in the airbag notification system:

1. Front Barrier Detection: The sensor is positioned in the vehicle to detect the presence of a front barrier, such as a vehicle or obstacle. It emits ultrasonic waves and measures the time it takes for the waves to bounce back after hitting the barrier. By analyzing the time taken, the sensor can determine the distance to the front barrier.
2. Distance Calculation: Using the measured time, the ESP8266 controller calculates the distance to the front barrier using a mathematical formula. The calculated distance value is then used for

various purposes within the system, such as displaying it on the LCD display and making decisions based on the proximity of the barrier.

Advantages:

1. The HC-SR05 or HY-SRF05 Precision Ultrasonic Sensor offers several advantages for the airbag notification system:
2. Accurate Distance Measurement: The sensor provides accurate distance measurements, allowing for precise detection of the front barrier's proximity.
3. Non-Contact Operation: The ultrasonic sensor operates without physical contact with the front barrier, eliminating the risk of damage or interference caused by direct contact.
4. Wide Detection Range: The sensor has a wide detection range, making it suitable for various applications, including detecting both near and far objects.
5. Easy Integration: The HC-SR05 or HY-SRF05 sensor can be easily integrated into the system, as it requires minimal external components and follows a straightforward interface protocol.
6. Compact Size: The sensor is compact and lightweight, making it suitable for installation in vehicles and other space-constrained environments.

In summary, the HC-SR05 or HY-SRF05 Precision Ultrasonic Sensor plays a vital role in the airbag notification system. It detects the presence of a front barrier and calculates the distance to the barrier using ultrasonic waves. The measured distance is used for displaying information on the LCD display and making decisions regarding airbag deployment. With its accurate distance measurement capabilities and non-contact operation, the ultrasonic sensor enhances the safety and effectiveness of the airbag notification system, ensuring timely notifications and accurate detection of potential hazards.

3.1.6 Lcd display

Fig.3.6: LCD display

The 16x2 LCD display is an integral component of the airbag notification system, working in conjunction with the ESP8266 controller to provide visual feedback to the car driver. Here is a detailed explanation of the LCD 16x2 display and its role in the system:

Overview: The LCD 16x2 display is a type of alphanumeric display module that consists of 16 columns and 2 rows, allowing for the display of up to 32 characters at a time. It utilizes liquid crystal technology to generate characters and graphics, providing a clear and easily readable interface for conveying information.

Functionality: The LCD display serves multiple purposes in the airbag notification system:

1. Distance Display: The ultrasonic sensor measures the distance to the front barrier, and this distance value is sent to the ESP8266 controller. The controller, in turn, processes the data and sends it to the LCD display. The LCD displays the calculated distance, providing the car driver with real-time information about the proximity of the front barrier.
2. Emergency Status Display: The emergency switch is connected to the ESP8266 controller. When the switch is pressed, indicating there is no emergency, the controller can update the LCD display to show the status as "No Emergency." This visual feedback assures the driver that the system has acknowledged the absence of an emergency situation.
3. System Status and Messages: The LCD display can also be used to provide additional system status information or display relevant messages. For example, during the airbag deployment detection process, the system can display messages such as "Checking Airbag Status" or "Sending Notification" to indicate the ongoing processes.

   Advantages:

1. The LCD 16x2 display offers several advantages for the airbag notification system:
2. Clear Visibility: The display utilizes a backlight that enhances visibility, making it easy for the car driver to read the displayed information even in low-light conditions.
3. Real-time Updates: The display can provide real-time updates, ensuring that the driver receives up-to-date information regarding the distance to the front barrier and the emergency status.
4. User-Friendly Interface: The 16x2 format allows for concise information display, presenting the data in a straightforward and easy-to-understand manner.
5. Integration with ESP8266 Controller: The display can be easily connected to the ESP8266 controller through appropriate interfacing techniques, enabling seamless communication between the controller and the display.
6. Compact and Space-Saving: The 16x2 LCD display is compact in size, making it suitable for installations where space is limited.

In summary, the LCD 16x2 display plays a crucial role in the airbag notification system by providing visual feedback to the car driver. It displays the calculated distance to the front barrier, indicating

the proximity of potential obstacles. Additionally, it shows the emergency status as "No Emergency" when the emergency switch is pressed. The display enhances the system's user interface, providing clear and real-time information, thus contributing to the overall effectiveness and safety of the airbag notification system.

3.1.7 Electric switch

Fig 3.7: Electric switch

A Single-Pole, Single-Throw (SPST) 16 Amp Rocker Switch is a type of electrical switch that is commonly used in various applications, including the airbag notification system you described. This switch is designed to control the flow of electric current by either connecting or disconnecting the circuit.

In the context of the airbag notification system, the SPST 16 Amp Rocker Switch is utilized as an emergency switch. Its purpose is to allow the car driver to manually indicate if there is no emergency situation and to stop sending messages to the Blynk IoT platform. Here is a detailed explanation of the SPST 16 Amp Rocker Switch:

Functionality:

1. SPST Configuration: The switch has a single-pole, meaning it controls the connection of one electrical circuit, and a single-throw, meaning it has only two positions - ON and OFF. When the switch is in the ON position, the circuit is closed, allowing current to flow. When it is in the OFF position, the circuit is open, interrupting the current flow.
2. 16 Amp Rating: The switch is rated for a maximum current of 16 Amps. This indicates the maximum amount of current the switch can safely handle without causing damage or overheating.
3. Rocker Design: The switch features a rocker-style actuator that can be easily pressed or toggled between the ON and OFF positions. This design provides a convenient and user-friendly interface for the car driver to control the system.

4. Emergency Switch Function: In the airbag notification system, the SPST 16 Amp Rocker Switch serves as an emergency switch. If there is no emergency situation, the car driver can press or toggle the switch to the OFF position. This action sends a signal to the ESP8266 controller, indicating that no emergency is present.

5. Stopping Message Sending: Once the emergency switch is pressed and the signal is received by the ESP8266 controller, it can stop sending messages to the Blynk IoT platform. This prevents unnecessary notifications from being sent to the registered mobile number and allows the driver to indicate that no emergency assistance is required.

Displaying "No Emergency" on IoT Dashboard: Additionally, the ESP8266 controller can update the IoT dashboard, provided by the Blynk platform, to display the status as "No Emergency." This visual representation on the dashboard assures the user that the system has acknowledged the absence of an emergency.

Advantages:

1. Manual Control: The SPST 16 Amp Rocker Switch provides a simple and reliable method for the car driver to manually control the system's emergency status, ensuring that notifications are sent only when necessary.
2. Easy Integration: The switch can be easily integrated into the system's circuitry and connected to the ESP8266 controller, allowing for seamless interaction and control.
3. Robust and Durable: Designed to handle high current loads, the switch is built to withstand the demands of automotive applications and provide long-lasting performance.
4. Visual Feedback: The rocker design of the switch allows for clear visual feedback, indicating the current status (ON or OFF) of the emergency switch.

In summary, the SPST 16 Amp Rocker Switch serves as an essential component in the airbag notification system, allowing the car driver to manually indicate the absence of an emergency. By toggling the switch to the OFF position, the system can stop sending messages to the Blynk IoT platform and update the IoT dashboard to reflect the "No Emergency" status. This switch provides a reliable and user-friendly interface for controlling the system's emergency notifications and enhances the overall functionality and safety of the airbag notification system .

3.2 Software tools

3.2.1 Blynk IOT

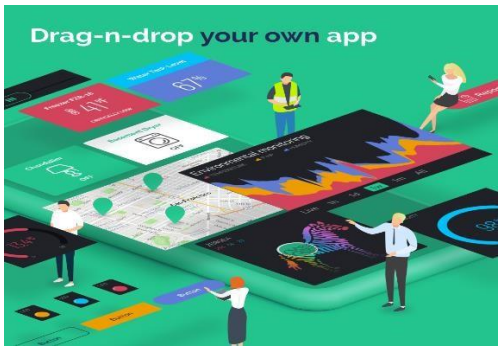


Fig 3.8: Bynk IOT cloud

Blynk IoT platform is a versatile and user-friendly Internet of Things (IoT) platform that enables the ESP8266 controller to connect to the internet and interact with various devices and services. In the context of the airbag notification system you described, Blynk plays a crucial role in facilitating communication between the ESP8266 controller and the registered mobile number, allowing for real-time notifications and control.

Features and Functionality:

1. Cloud Connectivity: Blynk provides cloud connectivity, allowing the ESP8266 controller to connect to Blynk's servers via Wi-Fi or cellular network. This enables remote access and control of the airbag notification system from anywhere in the world.
2. Mobile Application: Blynk offers a mobile application available for both iOS and Android platforms. The mobile app serves as a user interface, allowing users to monitor and control the system using their smartphones or tablets.
3. User Interface (UI) Widgets: Blynk provides a wide range of customizable UI widgets that can be easily added to the mobile app's interface. These widgets include buttons, sliders, graphs, gauges, and more. They can be used to display real-time data, receive user inputs, and trigger actions within the system.
4. Event-driven Actions: With Blynk, you can define specific events or conditions that trigger actions within the airbag notification system. For example, when the flex sensor detects airbag deployment, the ESP8266 controller can send a notification through Blynk to the registered mobile number.
5. Notification Service: Blynk's notification service allows you to send push notifications directly to the mobile app on the registered device. In the airbag notification system, Blynk can send

notifications to the registered mobile number, informing them about the airbag deployment. These notifications can also include attachments such as the live location obtained from the GPS module.

6. Data Logging and Visualization: Blynk enables the logging and visualization of data collected by the system. It can store historical data and generate graphs or charts to display trends and patterns over time. This can be useful for analyzing the performance and behavior of the airbag notification system.
7. Integration with Third-Party Services: Blynk supports integration with various third-party services and platforms, allowing for extended functionality. For example, you can integrate Blynk with cloud storage services or other IoT platforms to enhance data storage, analysis, or integration with other smart devices.

Advantages:

1. User-Friendly: Blynk offers a simple and intuitive user interface, making it accessible to users with minimal programming or IoT experience.
2. Rapid Prototyping: Blynk provides a quick and easy way to prototype IoT projects, allowing you to focus on system functionality rather than complex infrastructure development.
3. Remote Control: With Blynk, you can remotely monitor and control the airbag notification system using a mobile device, providing convenience and flexibility.
4. Customization: Blynk's UI widgets can be customized to match the specific requirements and preferences of the system, enhancing the user experience.
5. Active Community: Blynk has a large and active community of users and developers who share knowledge, projects, and libraries, providing support and inspiration for IoT projects.

In summary, Blynk IoT platform empowers the airbag notification system to connect to the internet, communicate with the registered mobile number, and provide real-time notifications and control. It offers a user-friendly interface, mobile app integration, event-driven actions, data logging, and integration with third-party services. By leveraging the capabilities of Blynk, the system becomes more versatile, accessible, and interactive, enhancing the overall functionality and user experience of the airbag notification system

3.2.2 Arduino IDE

Fig 3.9: Arduino IDE

Arduino IDE (Integrated Development Environment) is a software platform used for writing, compiling, and uploading code to Arduino boards, including the ESP8266 controller used in the airbag notification system.

The Arduino IDE provides an intuitive and user-friendly interface for programming microcontrollers. It supports a simplified version of the C++ programming language, making it accessible even to beginners in the field of embedded systems and IoT.
With the Arduino IDE, developers can create and edit sketches (programs) for the ESP8266 controller. The IDE offers features such as syntax highlighting, code completion, and error checking, which aid in writing clean and error-free code.

To program the ESP8266 controller, the Arduino IDE utilizes a set of libraries and functions specifically designed for the Arduino platform. These libraries provide pre-written code for various tasks, such as interacting with sensors, communicating with external devices, and connecting to the internet.

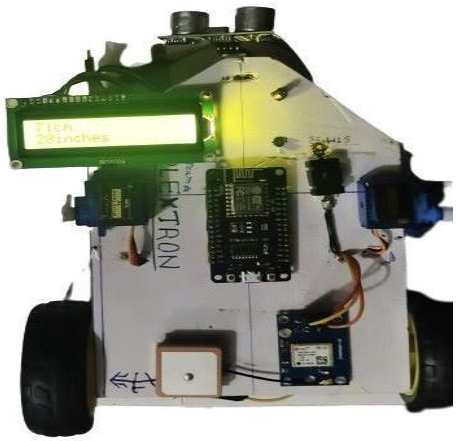
In the context of the airbag notification system, the Arduino IDE would be used to write the code that integrates the flex sensor, GPS module, ultrasonic sensor, LCD display, servo motor, and emergency switch functionalities. The code would include logic for detecting airbag deployment, sending notifications through Blynk IoT to register mobile numbers, retrieving live location data from the GPS module, unlocking car doors using the servo motor, calculating and displaying front barrier distance on the LCD display, and handling emergency switch inputs.

Once the code is written, the Arduino IDE allows for the compilation of the code, which checks for any syntax errors or issues. After successful compilation, the code can be uploaded to the ESP8266 controller, which is connected to the computer via USB. The IDE handles the communication and programming process, enabling the code to run on the controll

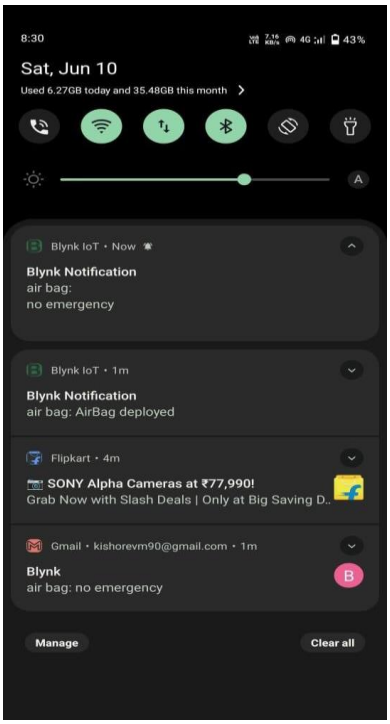
Chapter-4

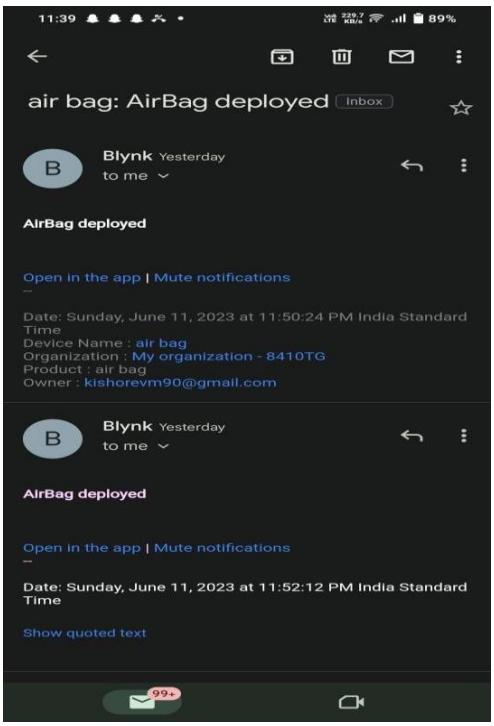
4.1 Results

4.1.1 Barrier detection output

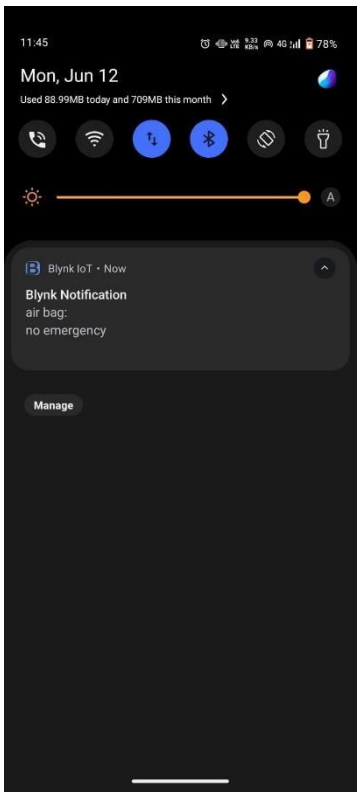


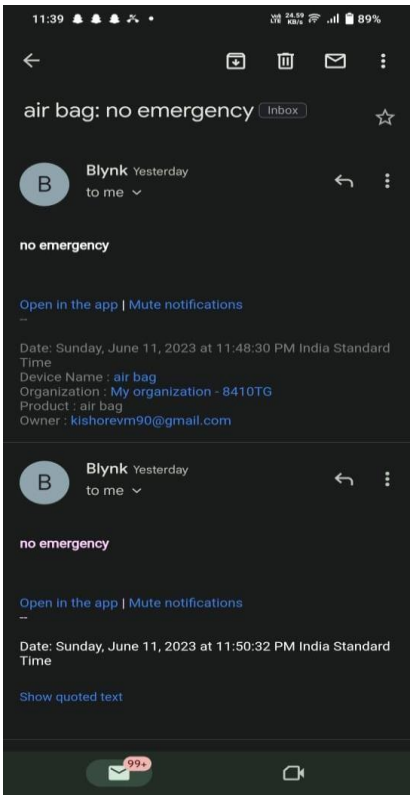
4.1.2 air bag notification once air bag deployed





4.1.2 when driver turns on the switch





4.2 Discussions:

Accuracy and Reliability: Evaluate the accuracy and reliability of the flex sensor in detecting airbag deployment and the overall performance of the system in detecting and responding to emergencies.

Notification System Effectiveness: Assess the effectiveness of the notification system in promptly alerting registered mobile numbers and providing live location attachments.

Location Accuracy: Evaluate the accuracy of the GPS module in providing real-time location data and its impact on the overall system functionality.

Car Door Unlocking Mechanism: Discuss the reliability and security of the servo motorbased car door unlocking mechanism and any potential challenges or limitations.

Barrier Detection and Distance Calculation: Analyze the performance of the ultrasonic sensor in detecting front barriers and the accuracy of distance calculation displayed on the LCD.

User Feedback: Gather feedback from users (car drivers) regarding the usability, convenience, and effectiveness of the emergency switch and the overall system's functionality.

System Integration and Communication: Discuss the integration of all the components and their seamless communication through the ESP8266 controller and the Blynk IoT platform.

Chapter-5

5.1 Applications:

1. Automotive Safety: The airbag notification system enhances automotive safety by detecting airbag deployment and notifying registered users in real-time.
2. Emergency Response: The system provides immediate notification to registered mobile numbers with live location attachments, enabling faster emergency response in case of airbag deployment.
3. Barrier Detection: The ultrasonic sensor's capability to detect front barriers and calculate their distance can assist drivers in avoiding collisions and accidents.

5.2 Advantages:

1. Enhanced Safety: The system promptly alerts registered users, allowing them to seek immediate help or assistance in emergency situations.
2. Real-time Location Tracking: The live location attachment provides accurate real-time location information, enabling emergency responders to locate the vehicle quickly.
3. Automatic Door Unlocking: The automatic unlocking of car doors can facilitate quicker access for emergency responders or passengers.
4. Barrier Detection and Distance Calculation: The ability to detect front barriers and calculate their distance helps drivers maintain a safe distance and avoid collisions.

5.3 Limitations:

4. Sensor Accuracy: The accuracy and reliability of the flex sensor, ultrasonic sensor, and GPS module can impact the system's performance.
5. Connectivity Issues: The system relies on a stable internet connection for communication with the Blynk IoT platform, which can be affected by network coverage or signal strength.
6. False Alarms: Inaccurate detection or sensitivity of the flex sensor may lead to false alarms, causing inconvenience to users.
7. System Integration: Integration of multiple components and ensuring seamless communication between them may present technical challenges.
8. User Dependency: The effectiveness of the system relies on users registering their mobile numbers and maintaining an active internet connection.

Chapter-6

6.1 Conclusions and Future Work

The development of the airbag notification system using IoT cloud and ESP8266 controller has shown promising results in enhancing automotive safety and emergency response. The system successfully detects airbag deployment using the flex sensor and promptly sends notifications through the Blynk IoT platform to registered mobile numbers. The inclusion of live location detection using the GPS module provides critical information for emergency responders. Additionally, the automatic unlocking of car doors using the servo motor and the barrier detection and distance calculation capabilities of the ultrasonic sensor contribute to overall user safety.

The system has the potential to improve emergency response time and mitigate the consequences of accidents. By alerting registered users and providing them with real-time location information, emergency services can be notified promptly and reach the scene more efficiently. The automatic unlocking of car doors facilitates quick access to the vehicle in emergency situations, while the barrier detection feature helps drivers avoid collisions and maintain safe driving distances.

6.2 Future Work

There are several areas of improvement and expansion for future work on this airbag notification system:

- Fine-tuning Sensor Accuracy: Further calibration and refinement of the flex sensor, ultrasonic sensor, and GPS module can improve the accuracy and reliability of the system.
- Advanced Data Analysis: Analyzing the collected data, such as airbag deployment patterns or barrier detection statistics, can provide valuable insights for further enhancing vehicle safety.
- Integration with Advanced Safety Systems: Integrating the airbag notification system with other advanced safety systems, such as collision detection or automatic braking, can create a comprehensive safety solution.
- Machine Learning and AI Integration: Implementing machine learning algorithms and artificial intelligence techniques can enhance the system's ability to predict and prevent accidents based on historical data and sensor inputs.
- User Interface and Customization: Developing a user-friendly interface and allowing users to customize system settings can improve user experience and satisfaction.

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Photographs