

Smart riders using Internet of Things-driven accident avoidance for two-wheeler safety systems

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Abstract

An Arduino-based control system and numerous sensor technologies are combined in the state-of-the-art smart vehicle management system to increase traffic safety and discourage auto theft. It has an IR-sensor-equipped helmet confirmation system, a MQ-3 sensor, and an alcohol section system based on an MPU-6050 accelerometer and gyroscope. In the case of an accident, the system automatically triggers a emergency alert and sends pre-programmed contacts to GPS coordinates. Additionally, an anti-theft device prevents unauthorized car movement by enabling distance via SMS and providing the owner with real-time information. By employing a verification method based on eyesight, A separate helmet detecting module based on Yolov 7 functions independently of the primary hardware functions. Traditional sensors in conjunction with modern imaging techniques By incorporating the safety measures, the system ensures reliability, safety, and enhanced operational integrity under a variety of circumstances. In this multi-layer approach, the underlying hardware solutions and the A-interest verification coexist and provide a comprehensive safety framework.

Keywords: Arduino, MQ-3 alcohol sensor ,MPU-6050 accelerometer ,GPS ,GSM and YOLOv7.

1.Introduction.

The growing amount of thefts, accidents, and traffic regulations worldwide make road safety and car safety crucial problems. Every year, thousands of incompatibilities have been caused by drunk driving, helmet failure, and unintended accidents. automobile theft has also been a major issue for both police and automobile owners. Smart vehicle technology can reduce these risks by automating security measure enforcement and integrating real-time monitoring and vigilance systems. The smart safety system addresses these problems by integrating distance vehicle SMS, accident prevention, and alcohol section helmet detection. The system provides a comprehensive security solution that is compatible with two-wheelers and ensures that riders follow basic safety regulations, such as donning helmets and abstaining from drunk driving. Additionally, the system provides the location of the accident and instantly alerts emergency contacts and authorities in the case of an accident, allowing for timely action. By allowing the owner to remotely control the bike's ignition and follow the bike using SMS instructions, stolen prevention capabilities improve the safety of the vehicle. The goal of this project is to create a smart, integrated system that can rapidly increase safety and vehicle safety by utilizing microcontroller technology and costly, easily accessible sensors. The increase in two-wheeler-related traffic accidents brought on by intoxicated and helmetless drivers served as a major impetus for the initiative. Furthermore, the high prevalence of auto theft made theft prevention measures imperative. It is now feasible to create a system that can automatically prevent accidents, identify theft, and instantly alert the appropriate parties thanks to the quick development of IoT and sensor technology. The current strategies for identifying accidents and prohibiting driving while wearing helmets mostly rely on manual enforcement or post-back reporting, which may be ineffective or implemented too late to save lives. By integrating these elements into a single system, the smart safety system provides an active answer to safety concerns in the automobile sector. Statement of the problem: There is an urgent need for systems that can increase vehicle security and rider safety, particularly given the surge in traffic accidents, particularly those involving two-wheelers. Things like drunk driving, failing to wear a helmet, and motorcycle theft pose a severe risk to motorcycle riders and their vehicles. Current enforcement tactics often rely on manual compliance, which might be ineffective.

Therefore, it is necessary to have a comprehensive Smart Safety System that can automatically:

1. Stop the automobile from starting if the rider's breath contains alcohol.
2. To guarantee helmet use compliance, make sure the rider is wearing a helmet before allowing ignition.
3. As soon as a fall or accident happens, immediately send out an emergency notice that includes the location of the occurrence.
4. Alert users if the vehicle is moved without being unlocked in order to prevent theft attempts.
5. Provide a secure method for the rider to use SMS to remotely unlock the vehicle.

2.The following are the Smart Safety System's primary goals.

1. Alcohol Detection and Ignition Locking: Measure the rider's blood alcohol concentration using a MQ-3 alcohol sensor, and if it finds alcohol, prevent the vehicle from starting. This feature promotes safe driving by prohibiting drunk driving.
2. Helmet Detection: An infrared sensor is used to detect if a rider is wearing a helmet. The bike won't start until the helmet is on in order to guarantee compliance with safety regulations.
3. Accident and Fall Detection: The MPU6050 accelerometer and gyroscope sensor detects any odd tilting or impact that can indicate an accident or fall. As soon as an accident is discovered, pre-designated contacts receive an emergency SMS with GPS coordinates, enabling prompt rescue efforts.
4. Theft Prevention and Detection: The system's theft detection feature sends the owner a warning SMS if the bike is moved without being unlocked. This prevents the vehicle from moving without authorization.
5. Remote Unlocking via SMS: The rider can remotely unlock the vehicle by sending a secret code via text. By facilitating secure remote access and vehicle operation, this raises the bar for ease and security even further.
6. Yolov7 helmet detection: Despite working in parallel, there is no contact. This module uses machine learning to interpret camera data and identify helmets, providing an experimental example of vision-based safety verification. Crucially, it doesn't affect ignition control, sensor readings, or any other hardware component, ensuring that the vital safety measures remain unaltered.

3.Literature Review.

By combining Internet of Things (IoT) technology with real-time monitoring and preventive features, the "Smart Helmet for Alcohol Detection and Accident Prevention Using IoT" project offers motorcycle riders cutting-edge safety features. A Breathalyzer sensor included inside the helmet tracks alcohol consumption; if the rider's blood alcohol content exceeds the permitted level, the motorbike will not start. Additionally,

by identifying sudden crashes or collisions, accelerometers and GPS mapping enable the detection of accidents and automatically transmit emergency messages with the rider's location in real time [1]. Due to population growth, traffic in India's megacities is growing daily. In order to determine which factors are more likely to cause accidents, we used the WEKA tool's Info Gain Attribute Evaluator function in this work. Additionally, we used the Apriori technique to perform association classification and found the optimum rule for the accident dataset[2]. Attempts to combat drowsiness while driving, such as using the vehicle radio or cold air, are simply temporary solutions. The only safe way to combat driver fatigue, especially when the driver reaches the stage of fighting sleep, is to stop driving and take a 30-minute break that includes either a quick (less than 15 minutes) nap or coffee (about 150 mg of caffeine), which works especially well when taken together. Exercise is not very beneficial. Employers and workers need to be better educated on how to plan trips, the risks of driving when fatigued, and when to drive[3]. Under boring driving circumstances, a significant percentage of car accidents are caused by drivers dozing off. Many of these incidents involve drivers of corporate cars, trucks, and other cargo vehicles. There are significant time of day (circadian) impacts, with drowsiness being most noticeable when working night shifts and driving home afterward. Although the length of the journey is the sole criteria included in the laws protecting professional drivers, circadian variables also have a significant role in determining how sleepy a driver is. In the middle of the day, older drivers are also susceptible to drowsiness. Although there is some discussion of potential pathological reasons of driver drowsiness, there isn't much proof that this issue significantly affects accident rates. Sleep doesn't happen on its own without warning [4]. In order to decrease drinking and driving in the state, it would also allow us to more effectively create educational and awareness campaigns aimed at particular demographic groups. Log-linear models, conditional probabilities, and basic descriptive statistics are used to examine the connection between driver variables and alcohol-related accident participation. According to the findings, the age range of 25 to 34 has the greatest proportion of accidents involving alcohol or drugs. As the drivers' ages grow, the rates decrease. The findings also showed a strong correlation between driving attributes and drug and/or alcohol use in collisions. Traffic accidents involving alcohol and drugs were also more common among male, Caucasian, and in-state drivers [5]. The drivers drove automobiles fitted with sensors to record driver psychophysiological information and car performance. Two sleepiness detection techniques are being evaluated in light of this study. The first is a video-based system that assesses percales, a sleepiness metric linked to sluggish eye closure that has scientific backing. The second detection technique is predicated on a model that uses vehicle performance data to predict percales. Measures related to lane maintaining, steering wheel motions, and the vehicle's lateral acceleration were utilized to estimate percales using a non-parametric (neural network) model [6]. Face orientation, eye closure time, blink and nod frequency, and fixed gaze. These factors are used to calculate the driver's level of inattention using a fuzzy classifier.

Combining many visual criteria, as opposed to depending just on one, yields a more accurate and dependable definition of inattention. Several sequences recorded with different users and in both daytime and evening driving conditions on a freeway have been used to evaluate the system. A few experimental results and conclusions on the operation of the system are presented [7]. Blinking, yawning, and several other face movements are examples of these facial behaviors. Additionally, an accelerometer and automated eye tracking were used to record head movements. These metrics were fed into learning-based classifiers like multinomial ridge regression and Adaboost. In a driving computer game, the system predicted sleep and accident events with 96% accuracy among individuals and over 90% accuracy across subjects. This is the greatest prediction rate for identifying actual sleepiness that has been documented to far. Additionally, the data provided fresh insights on how people behave when driving while sleepy [8]. In order to prevent traffic accidents, the main goal of the project is to create a smart vehicle management system. This smart vehicle management system prototype consists of three main components. First, there is a drowsiness detector that will detect the driver's level of tiredness while they are driving. Second, an alcohol detector will determine whether the motorist in question has any alcohol on their body. Last but not least, an overload detector will indicate whether or not the car is overloaded [9].

References

Gabor characteristics are classified using LDA in order to identify yawning. Three thousand photos from thirty participants with different lighting conditions, postures, and face accessories (glasses) are used to evaluate the suggested method. As a baseline, the ratio of mouth height to breadth may also be used to identify yawning. According to the findings of the experiment, the suggested method works well for detecting yawning in real time, Gabor characteristics are more effective than geometric features at representing yawning, and an average identification rate of 91.97% is attained—much higher than the baseline [10].

The system uses IoT-based communication to immediately alert emergency services and authorized contacts, shortening accident response times by a considerable margin. By preventing cases of drunk driving and optimizing emergency responses, the smart helmet acts as an active safety device to reduce road fatalities and enhance the overall safety of motorcycles. Development in the future can focus on improving sensor precision, integrating health monitoring features, and broadening applications to further enhance the safety of riders.

4. Methodology

The technique uses a methodical approach to create a safety system that is effective.

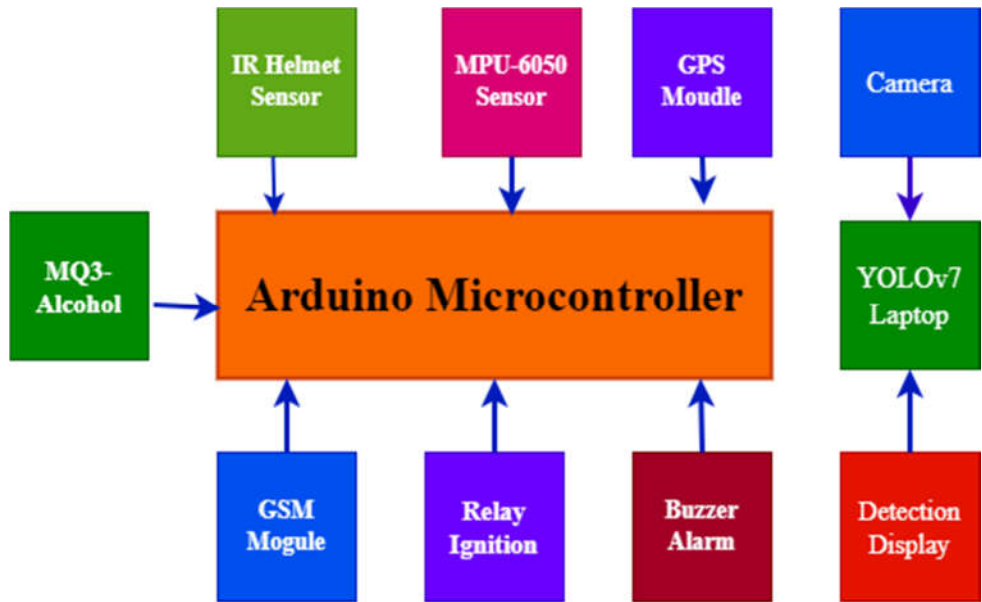


Fig 1: block diagram of Smart Safety System for Two Wheeler's.

The Smart Vehicle Safety System is powered by a multi-layered safety architecture that includes hardware sensors and a separate computer vision module.

The primary protections are:

- Alcohol Detection: A MQ-3 sensor cuts off ignition if it detects alcohol vapor.
- Hardware-Based Helmet Verification: An infrared proximity sensor verifies that the helmet is in place before turning on the vehicle.
- Accident Detection: An MPU-6050 motion sensor activates emergency alerts when it recognizes motion patterns that resemble collisions.
- Theft Prevention: GPS-tracked alarms, SMS-based remote unlocking, and unauthorized movement detection come next.

The physical components of the safety system support it. These include:

The ESP32 microcontroller acts as the main controller and is responsible for analyzing sensor data and managing the ignition system.

- Sensors: MQ-3 Alcohol Sensor (used for alcohol detection), IR Sensor (Helmet Detection), and MPU-6050 (accelerometer/gyroscope)

- GPS drones can use the SIM800L GSM Module and NEO-6M GPS Module to find their location in reference to a network of satellites in orbit.

- Actuation & Power: To ensure the system runs continuously, the Power Supply and Relay Module (Ignition Control) provide all necessary electrical power to all components.

- Laptop: The YOLO machine learning model is implemented using this laptop as the primary processing unit. It captures helmet photos and instantly categorizes them.

The hardware and software components must function perfectly together to deliver the desired functionality. Crucial elements include:

- Arduino IDE: Programs may be developed, built, and uploaded to an Arduino using this software. It is an open source software.

- Libraries: The Arduino IDE uses a number of libraries, including TinyGPS++, MPU6050_tockn, and Software Serial.

YOLOv7 Configuration (Separate): The model recognizes and categorizes helmets in real time when it is installed on the laptop. It can identify objects in images.

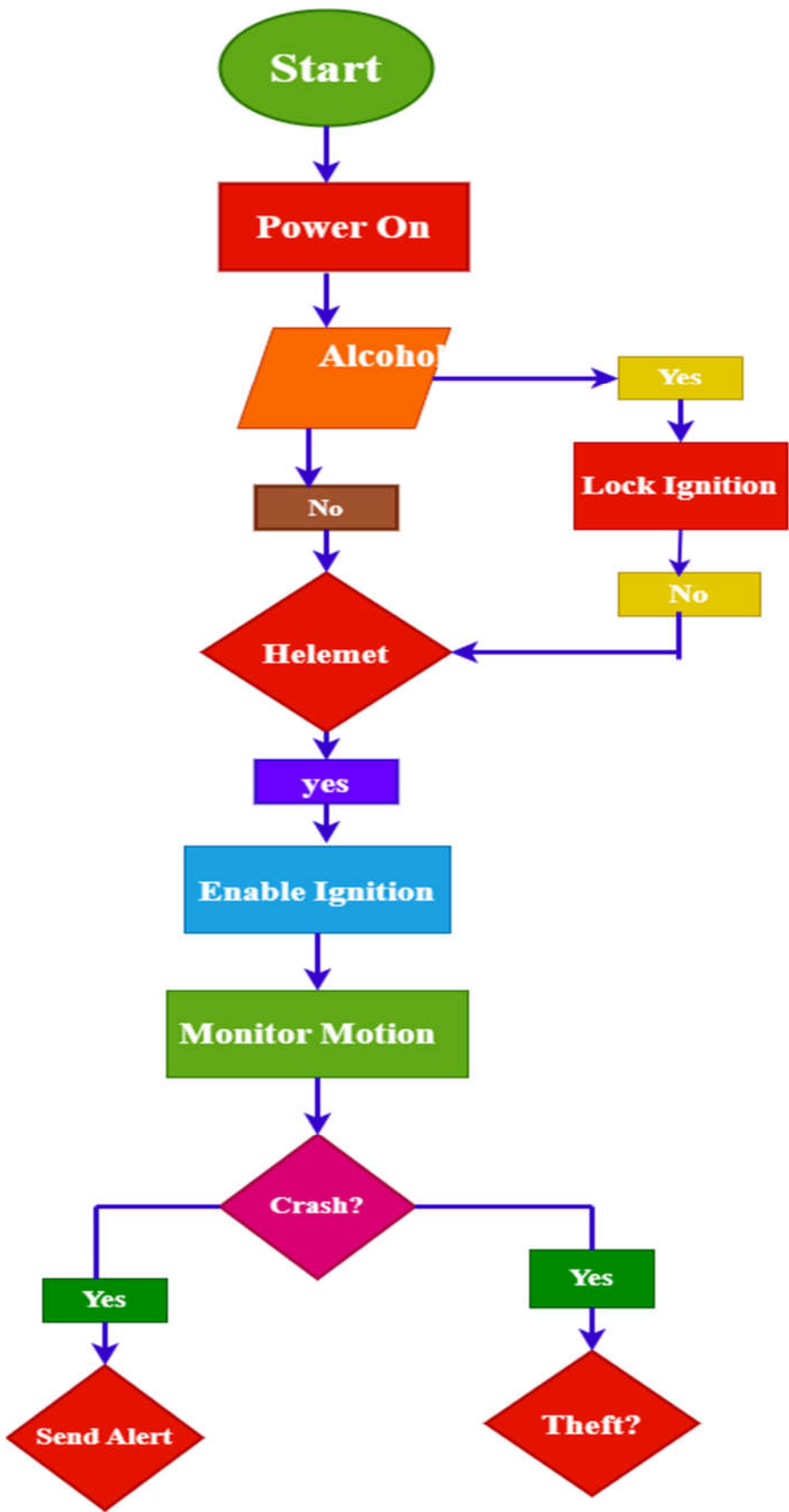


Fig 2: Flow diagram for the suggested methodology

This flow chart (fig. 2) shows the monitoring and igniting system of a smart automobile. Alcohol is ingested after the mechanism has been activated. The ignition turns off when alcohol is detected. If not, check the system to determine if the rider is wearing a helmet. If no helmet is detected, the ignition remains closed; if it is, ignition may occur. The technology monitors constant speeds and investigates accidents or theft attempts. If an accident is found, a notice is sent. If theft is found, appropriate measures can be implemented. Additionally, a camera is included into a YOLOv7 object identification model, which shows relevant data.

5. Proposed System

An IOT-based smart helmet prototype that safeguards the security and safety of bike riders is described in this study. In this instance, the system is responsible for the following: The technology will not allow the rider to start the car if they are not wearing a helmet. It recognizes when a rider has consumed alcohol and won't start the bike's engine. The technology alerts the rider when their speed exceeds the predetermined limit. Fingerprint authorization provides security and prevents vehicle theft. It detects accidents and alerts the registered contact, providing location and picture information.

6. System Design.

The admin and user modules are the two parts of this system. The user module includes an Android application that is used to notify guardians and local authorities. There are two sections in the admin module: Section for helmets Section for bikes

1.1 Helmet Section:

1.2 This section consists of push button, alcohol sensor, accelerometer, micro controller, RF transmitter.

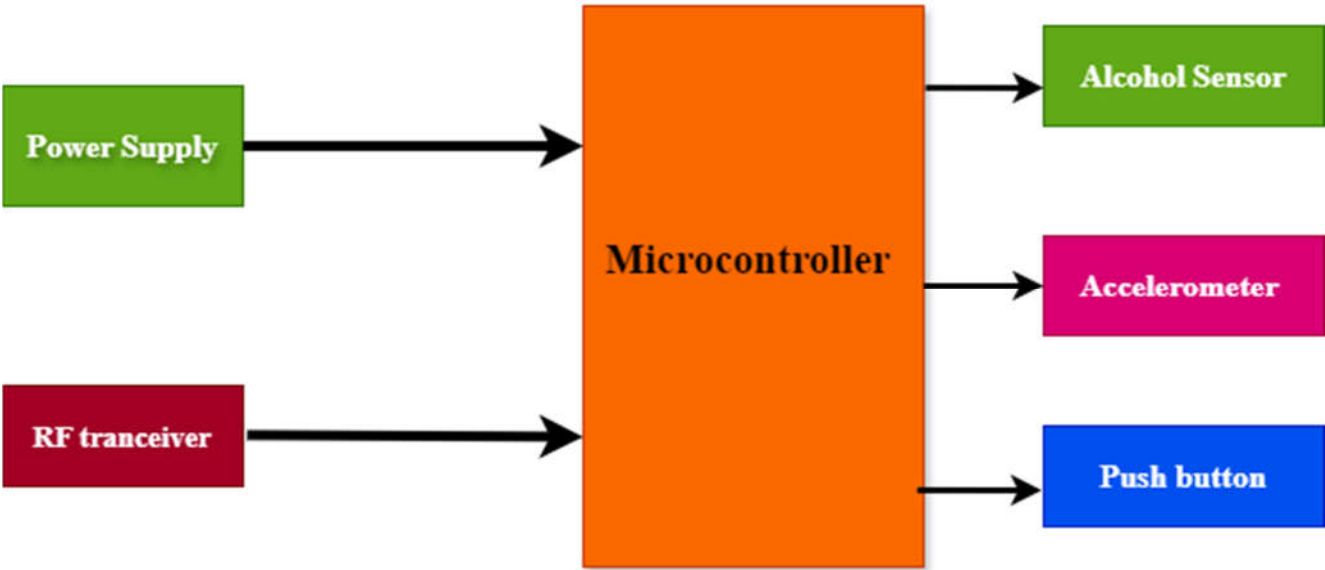


Fig:3 Helmet Section

The helmet's integration of sensors and communication modules to enhance rider safety should be highlighted in Fig. 3: Helmet Section of the IoT-driven accident avoidance system. IoT components integrated within the helmet portion are meant to identify rider activity and safety situations. It could involve. Make that the cyclist is wearing the helmet with the wear detecting sensor.Gyroscope/accelerometer (identifies collision or descent).The two-wheeler unit is connected to the Bluetooth/IoT module. Speaker/microphone (optional for emergency communication or voice warnings).Power source (battery) for helmet electronics. Block diagram suggestion for Fig. 3:The helmet has an accelerometer/gyroscope, wear detection sensor, an IoT controller that connects by Bluetooth, LoRa, and Wi-Fi, a two-wheeler control unit, an accident detection system, and an SMS alert system.This picture would graphically demonstrate how the helmet part works along with the vehicle-mounted IoT device for accident avoidance and emergency response.

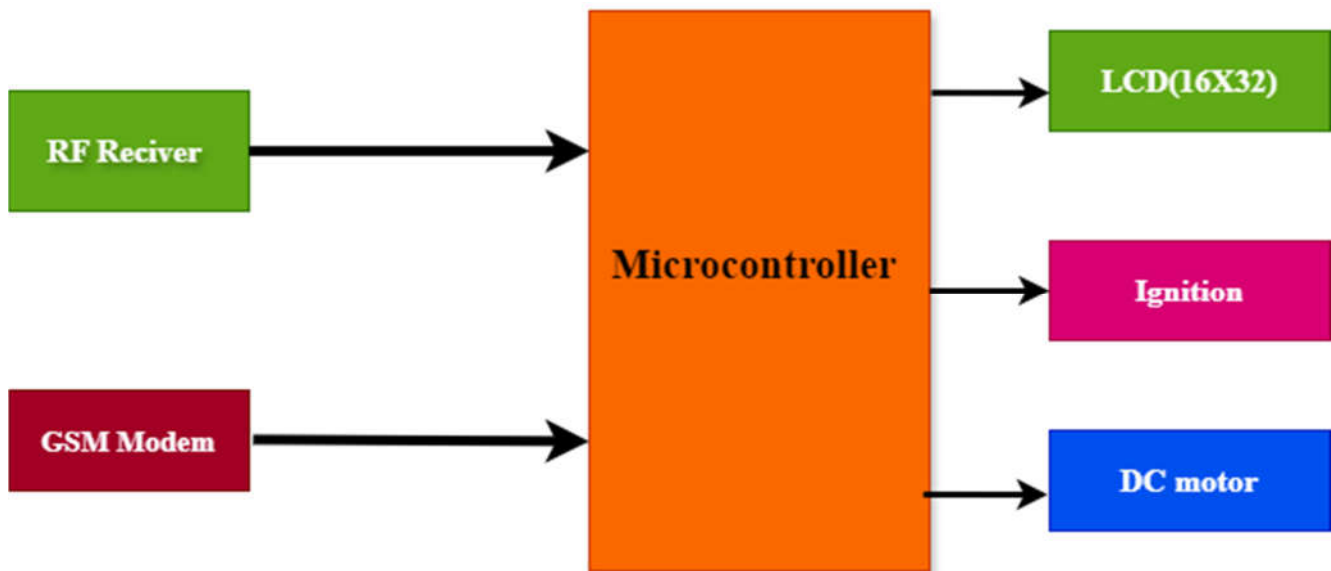


Fig:4 Bike Section

In order to complement the helmet section, Fig. 4: Bike Section of the IoT-driven accident prevention system should show the IoT-enabled parts mounted on the two-wheeler itself. To improve rider safety and accident detection, the bike portion incorporates sensors and communication modules that cooperate with the helmet. Typical key components were The bike won't start unless the helmet is on thanks to the ignition interlock. Gyroscope/accelerometer (identifies abrupt drops, tilts, or collisions).GPS module, which tracks location in real time.GSM/4G module (sends coordinate-based SMS notifications).IoT board/microcontroller (e.g., Arduino, ESP32, NodeMCU).LCD display with the following statuses: "Accident Alert Sent," "System Active," and "Helmet not detected. "connection to the two-wheeler battery for power.

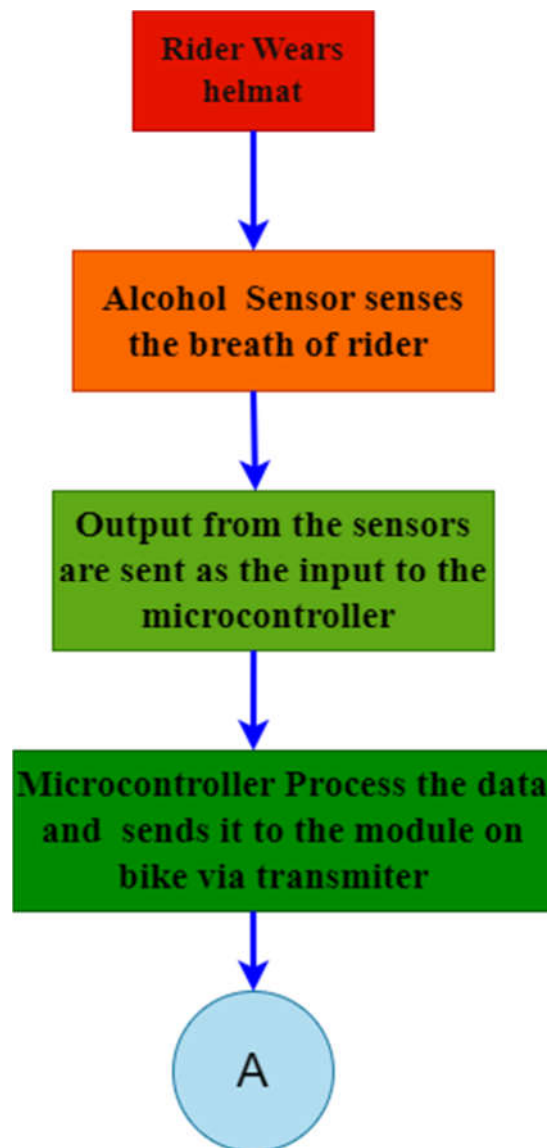


Fig:5. Rider were the helmet

After being received by an RF receiver, the data is sent to the microcontroller. The microcontroller bases its judgment on the helmet section's output. Two prerequisites must be met in order for a bike to start: When wearing a helmet, the rider should press the push button. A rider shouldn't be intoxicated. When the helmet section's output satisfies these two requirements, The bike's ignition will then turn on. The cyclist will receive an alert to reduce their speed if they over the threshold speed. An accident has happened when the accelerometer reads 0 for the helmet's tilt with respect to the ground. [3] Through the "ACCIASSISTO" application, an accident notice will be sent instantly over GSM to the registered phone number.

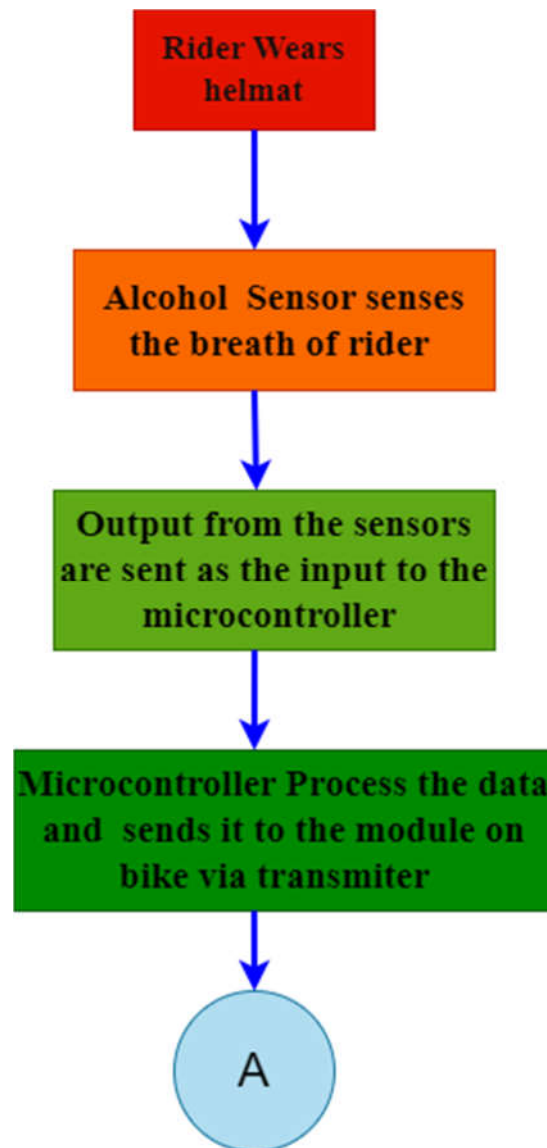


Fig:6 .Rider were helmet

After receiving the message, the registered user can ask for the location and image for more information. After that, they may alert the police station about the occurrence and give the urgent medical care that is required. The rider has the option to stop notifying the registration number of the accident if it is small. The notice is sent to guardians or local authorities via this Android application. In the event of an accident, it has two side applications: the guardian side application and the IOT side application. IOT side use: We have recorded a few emergency phone numbers in our user-side application.

After receiving the message, the registered user can ask for the location and image for more information. After that, they may alert the police station about the occurrence and give the urgent medical care that is required. The rider has the option to stop notifying the registration number of the accident if it is small. The notice is sent to guardians or local authorities via this Android application. In the event of an accident, it has two side applications: the guardian side application and the IOT side application. In order for the registered phone number to get an alert notification about the accident's details and location.

7.Components of Two-Wheeler Safety System.



Fig:7. Alcohol sensor

This gas sensor is capable of detecting alcohol concentrations ranging from 0.05 mg/L to 10 mg/L. This inexpensive semiconductor sensor has a high sensitivity to alcohol, responds quickly, and produces both digital and analog output. How the alcohol sensor functions as a component of the safety mechanism should be the main emphasis of Fig. 7: Alcohol Sensor in an IoT-driven accident prevention system for two-wheeler safety. If the rider's breath contains more alcohol than a certain level, the alcohol sensor detects it and stops the car from starting. Prior to the ride starting, it serves as a preventative measure.

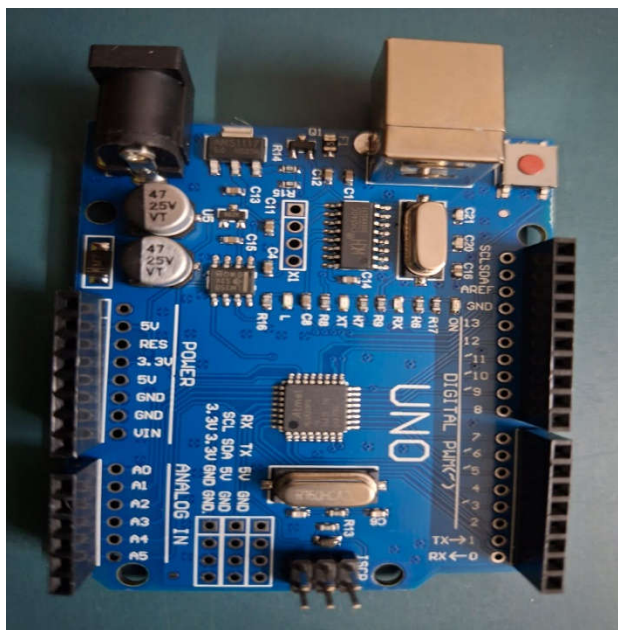


Fig:8. MPU Madule Accelerometer (MMA7361)

The acceleration in relation to the item to which the accelerometer is connected is measured by an integrated circuit. Here, the accelerometer is attached to the helmet and used to detect accidents by tilting the helmet relative to the ground. Your IoT-driven accident prevention system's Fig. 8: MPU Module Accelerometer (MMA7361) should demonstrate how the accelerometer is utilized to identify collisions and abrupt two-wheeler motions. The MMA7361 accelerometer detects abrupt acceleration or deceleration, tilt, and vibration. It sends a signal to the IoT controller when it senses unusual motion in an accident or fall. This data is subsequently processed by the controller to initiate alarms (automated accident detection, buzzer, or SMS). Mounted on the bike frame is the MMA7361 accelerometer sensor. produces analog signals with readings on the X, Y, and Z axes. Sensor data is sent to an Arduino, ESP32, or NodeMCU IoT controller. No warning, normal movement The accident detection system is activated by a sudden tilt or collision. GPS (location), GSM (text message alarm), and LCD (status display) are connected modules. Block diagram suggestion for Fig. 8: IoT Controller (Arduino/ESP32), GPS module (retrieve coordinates), GSM module (send SMS alert), LCD/Buzzer (local alert), MMA7361 (accelerometer sensor), and accident detection algorithm

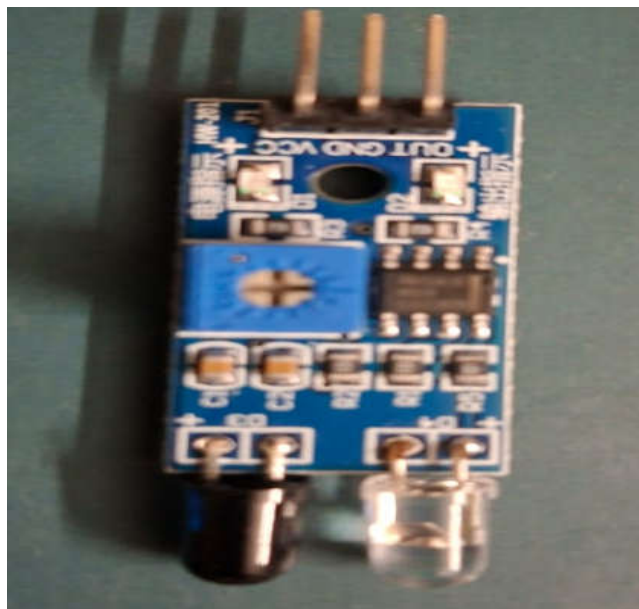


Fig:9. GSM modem (sim900)

It features a sim card port that requires the sim to be inserted in order to use a mobile operator to communicate via a mobile network. Messages are sent and received via internet access. Your IoT-driven accident prevention system's Fig. 9: GSM Modem (SIM900) should show how the GSM module facilitates communication by notifying emergency contacts. Report description: When an accident is detected, the SIM900 GSM modem enables the IoT controller to deliver location-based SMS notifications. It interacts over the GSM/2G network and makes use of a SIM card. The SIM900 GSM modem with antenna and SIM card slot are the main components of the figure. An Arduino, ESP32, or Node MCU serial connection to an Internet of Things controller. The GSM modem receives AT commands from the IoT controller. Alert flow: GPS module delivers coordinates once sensors (accelerometer, alcohol sensor, etc.) identify an accident. The controller uses a GSM modem to transmit SMS. Recipients: Hospital phones, emergency services, or relatives. Block diagram suggestion for Fig. 9: IoT controllers provide location-based SMS messages to mobile phones (emergency contacts), connect with SIM900 GSM modems (via UART), and mobile network towers. You did a great job summarizing Fig. 9 (GSM Modem SIM900). The diagram for your report figure can be shown as follows: Block Diagram (Fig. 9: GSM Modem SIM900), IoT Controller (Arduino/ESP32/NodeMCU): transmits AT commands, SIM900 GSM Modem (with SIM + antenna),

Emergency Contacts (Police, Hospital, Family) receive SMS with GPS coordinates, and the Accident Detection Unit (sensors: accelerometer, alcohol, etc.). The design should display clear arrows for data flow and underline that the SIM900 functions as the communication bridge between the IoT system and external phones.



Fig :10. P89V51RD2 microcontroller

This 80C51 microcontroller has 1024 bytes of RAM and 64KB of flash. It has software that allows you to choose between the 12 and 6 clock modes. The flash software supports both serial and parallel system programming. It provides a fast program and lowers programming costs. The push button is pressed once the rider has put on the helmet. [2] An alcohol sensor detects if the rider's breath contains alcohol. The accelerometer gauges the helmet's tilt. These parts' output will serve as the microcontroller's input on the helmet. After processing the data, the microcontroller uses an RF transmitter to transfer it to the bike part. A key component of an Internet of Things-based two-wheeler safety accident prevention system is the P89V51RD2 microprocessor (Fig. 10). It fits into such a system as follows: P89V51RD2's function in preventing IoT accidents The central controller serves as the safety system's brain, analyzing sensor data instantly. Memory Support: It can store and run safety algorithms thanks to its 64KB Flash and 1KB RAM. I/O Handling: Several ports provide connectivity to actuators, sensors, and communication modules. Ultrasonic/IR Sensors: Identify impending vehicles or obstructions. The Gyroscope and Accelerometer: The P89V51RD2 microprocessor is a crucial part of an Internet of Things-based two-wheeler safety accident prevention system (Fig. 10). This is how it fits into such a system: The role of the P89V51RD2 in preventing IoT mishaps The central controller rapidly analyzes sensor data, acting as the brain of the safety system. Support for Memory: Its 64KB Flash and 1KB RAM allow it to store and execute safety algorithms. I/O Management: Actuators, sensors, and communication modules are connected to a number of ports. Ultrasonic/IR Sensors: Identify impending vehicles or obstructions. The Accelerometer and Gyroscope:



Fig:11.Bike Section LCD Display

Without viewing the cited figure, it is hard to offer information about "Fig:11.Bike Section LCD Display" because the arrangement and content might differ significantly depending on the bike type. Nonetheless, the following data is frequently shown on a bike's LCD screen: Miles per hour (mph) or kilometers per hour (km/h) are common units used to display your speed in real time. Odometer: Keeps track of how far the bike has gone overall during its lifetime. Trip distance: Indicates the current ride's distance traveled; this can be changed for other trips. Trip timer: Keeps track of how long your current travel is. Clock: Indicates the time of day.

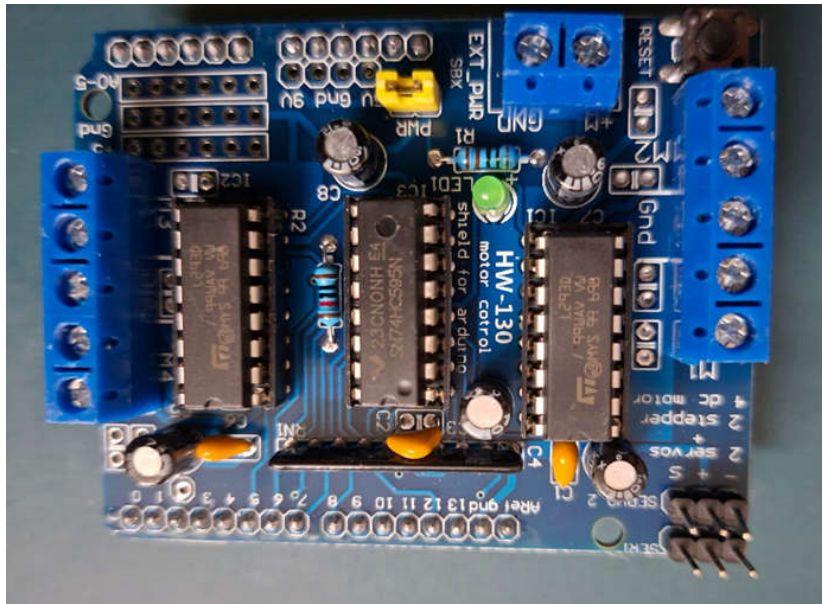


Fig:12 Arduino

Similar to the last question, describing "Fig:12 Arduino" in detail is impossible without looking at the cited text. "Figure 12" might refer to any number of Arduino microcontroller schematics in a technical or scholarly setting. Nonetheless, "Fig:12 Arduino" most likely refers to one of the following, according to technical literature and typical Arduino projects seen in search results. The many components of an Arduino board, such as the Arduino Uno, are depicted and explained in this diagram. Important details that are frequently emphasized include: Pins 0–13 are digital I/O pins, which are used for digital input and output. A general-purpose digital pin is usually pin 12. Pins A0-A5 are analog pins that are used to read analog signals from sensors. Connectors for supplying electricity to the board and other parts are called power and ground pins. The primary chip that controls the software is called a microcontroller. The board is powered and programmed via the USB port and power jack. "Fig:12" frequently displays the wiring schematic for a particular project in a research paper or project guide. Figure 12 schematics, for instance, are included in search results and include: To transmit battery voltage data to a mobile application, an Arduino is linked to a Bluetooth module. sensor readings or other output from an Arduino during a test run. implementation specifics for an Arduino project, such as a system for regulating traffic congestion. Digital pins 10, 11, 12, and 13 are linked to SPI communication in a lot of Arduino pinout layouts.

Pin 12 is specifically MISO (Master In, Slave Out), which is used to receive data. It is impossible to provide specifics for "Fig:11.Bike Section LCD Display" without seeing the referenced figure, as the content and layout can vary dramatically by bike model. However, the most common information displayed on a bike's LCD screen includes:



Fig :13 GPS Module

In the context of an Internet of Things-driven accident prevention system for two-wheeler safety, you may illustrate the GPS hardware and its operation in Fig. 13: GPS Module. The GPS module is used to determine the two-wheeler's current location coordinates. The GPS's latitude and longitude are retrieved by the IoT controller in the case of an accident, and they are either displayed on a dashboard for monitoring purposes or sent to emergency contacts via GSM/SMS. A suggested diagram flow for Figure 13. GPS satellite signals, an Arduino, NodeMCU, or ESP32 IoT controller, a cloud GSM module, a GPS module (such the NEO-6M or Ublox), and an emergency contacts/tracking interface. In the context of an Internet of Things-driven accident prevention system for two-wheeler safety,

you may illustrate the GPS hardware and its operation in Fig. 13: GPS Module. The GPS module is used to determine the two-wheeler's current location coordinates. The GPS's latitude and longitude are retrieved by the IoT controller in the case of an accident, and they are either displayed on a dashboard for monitoring purposes or sent to emergency contacts via GSM/SMS. Internet of Things controller (Arduino/NodeMCU/ESP32), GPS satellite signals, GPS module (such NEO-6M/Ublox), cloud/GSM module, tracking interface, emergency contacts,

You might illustrate the GPS hardware and how it works within the system. for Fig. 13: GPS Module in the framework of an Internet of Things-based two-wheeler safety accident prevention system. The GPS module is used to determine the two-wheeler's current location coordinates. The GPS's latitude and longitude are retrieved by the IoT controller in the case of an accident, and they are either displayed on a dashboard for monitoring purposes or sent to emergency contacts via GSM/SMS. GPS satellite signals, GPS modules (such as NEO-6M/Ublox), cloud/GSM modules, Internet of Things controllers (such as Arduino/NodeMCU/ESP32), emergency contacts, and a tracking interface are all included in the flow diagram for Figure 13.

8. Results and Discussions.

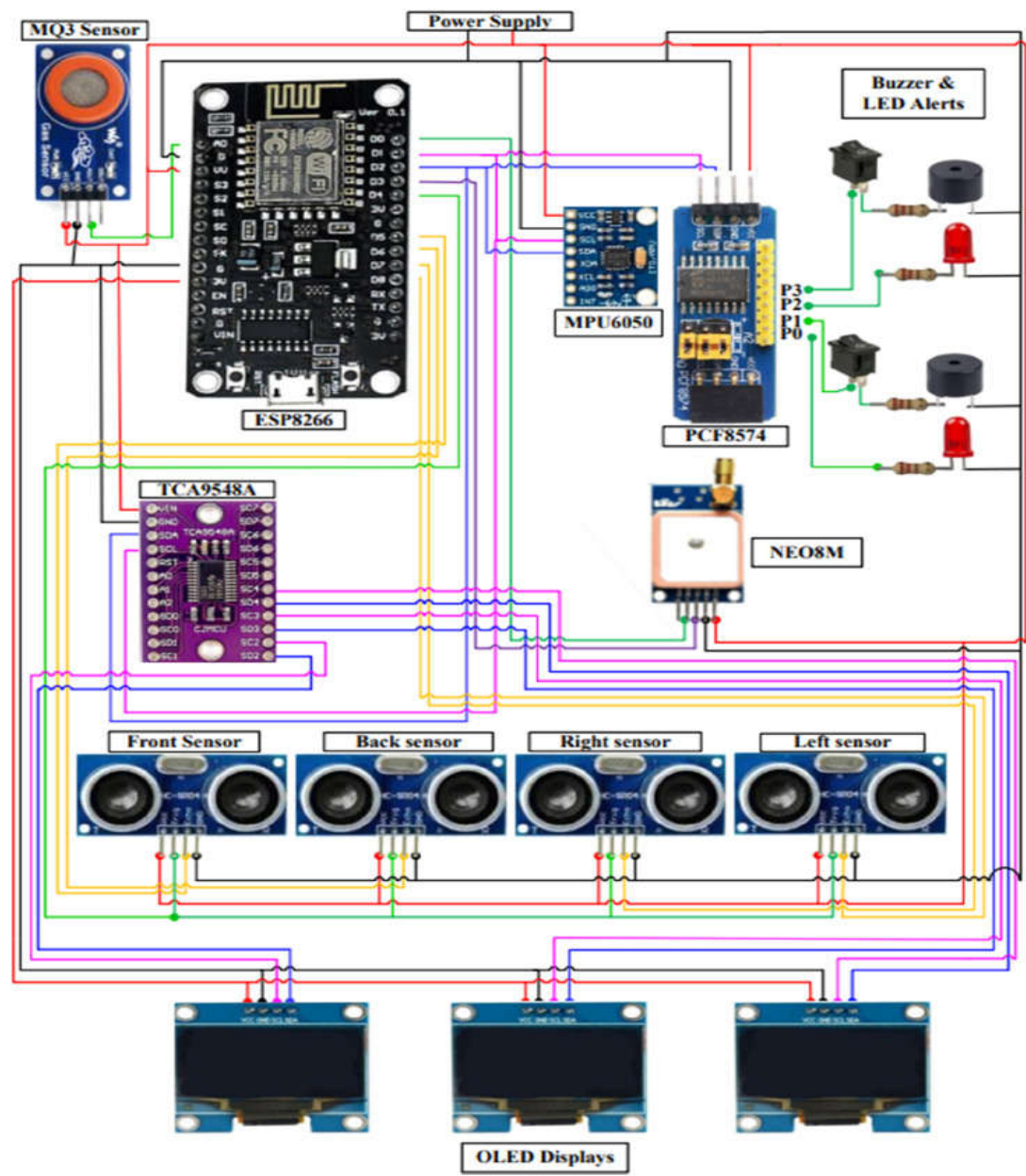


Fig:14 Next generation road safety solutions by using Internet of Things

Fig.14 illustrates how IoT-based technologies enhance road safety by enabling real-time monitoring, communication, and intelligent decision-making. Smart sensors, connected vehicles, and cloud platforms exchange data to minimize accidents and improve traffic efficiency. Key components include:

- Smart Vehicles – Equipped with IoT sensors for collision detection, lane departure alerts, and adaptive cruise control.
- Vehicle-to-Vehicle (V2V) Communication – Enables cars to share speed, location, and braking information to prevent collisions.
- Vehicle-to-Infrastructure (V2I) Systems – Traffic signals, streetlights, and road signs interact with vehicles to optimize traffic flow.
- Intelligent Traffic Management – IoT-based platforms analyze real-time traffic conditions to prevent congestion and enhance emergency response.
- Pedestrian & Cyclist Safety – Wearable IoT devices and smart crosswalks alert drivers about nearby pedestrians.
- Accident & Hazard Alerts – IoT sensors report road hazards, weather conditions, and accidents to nearby vehicles and control centers.

This integrated IoT ecosystem reduces human error, improves road user awareness, and enables safer, more efficient transportation networks. The following is a list of the contributions made by this planned study. To reduce two-wheeler accidents, a fully automated combination model is created for both accident prevention and post-accident management. Ultrasonic sensors are used in the development of an effective distance-based accident prevention system. Alcohol sensors are used in the creation of an effective drunk driving warning system. In order to manage after an accident, for prompt emergency medical assistance, an automated SMS notification system is implemented. Using a Google Sites dynamic monitoring system and a Things Speak time series database, an IoT integrated automated accident details report collection system is created. The remainder of the study article is in line with this: The research approach used to accomplish the goals of the study is shown in Section 2. We provide a brief description of hardware deployment in Section 3. Results and their analysis of the suggested study project are described in Section 4. The planned research study's general overview and a comparison of earlier similar studies are covered in Section 5. We touched on the limitations of our research and its potential future scope in Section 6. The paper's conclusion and the whole research endeavor are finally examined. The block diagram of the whole research framework used in this study is displayed in Fig. 3. The Node MCU (ESP-8266) is linked to all of the sensors and additional hardware modules. There are three stages in the suggested model. 3. Automatic database management system for traffic accidents; 2. Post-accident reporting system; and 3. Pre-accident alarm system.

The hardware circuit schematic connections utilized to carry out the suggested task are shown in Fig. 6. Ultrasonic sensor (HC-SR04), alcohol sensor (MQ3), vibration sensor (MPU6050), 1.3-inch OLED display, buzzers, LED, I2C multiplexer (TCA9548A), and GPS (NEO 8M) are some of the modules that make up this device. To guarantee the correct output response of the entire established model, the final customized connections are made in accordance with Fig. 6 for the condition of each individual hardware module in the bread board.

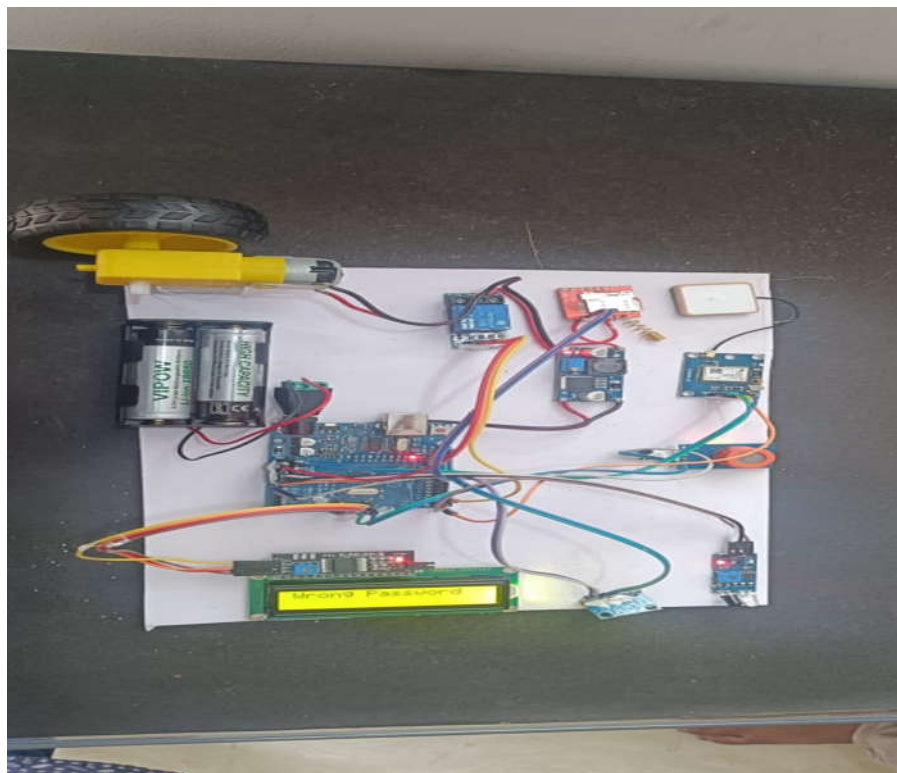


Fig:15. Smart vehicle management system

Since the smart vehicle management system was implemented, motorcycle safety has significantly improved. The successful implementation of helmet regulations and the ban on drunk driving, which must significantly reduce the risk of accidents, are two of the main results. Additionally, the technology ensures timely readiness and enables instant help by sending an SMS message with a specific GPS position to pre-configured contacts in the case of an accident. By detecting illegal movement and instantly notifying the owner through a secure SMS-based code, the anti-chori mechanism ensures a distance-locking system and improves safety. You appear to be interested in a Smart Vehicle Management System figure (Fig. 15). Could you be more specific about the output you are looking for? Would you want a block diagram,

flowchart, or architecture design of the system made by me? Or are you seeking an explanation or description of the operation of a smart car management system? Blocks such as sensors and Internet of Things devices (GPS, gasoline, speed, and engine health) might be included in a schematic, for instance. Data Processing & Analytics (AI/ML, vehicle diagnostics, predictive maintenance), Communication Module (4G/5G, IoT gateway, cloud connection), User Interface (mobile app, fleet manager dashboard), and Cloud Database (car and trip data storage).

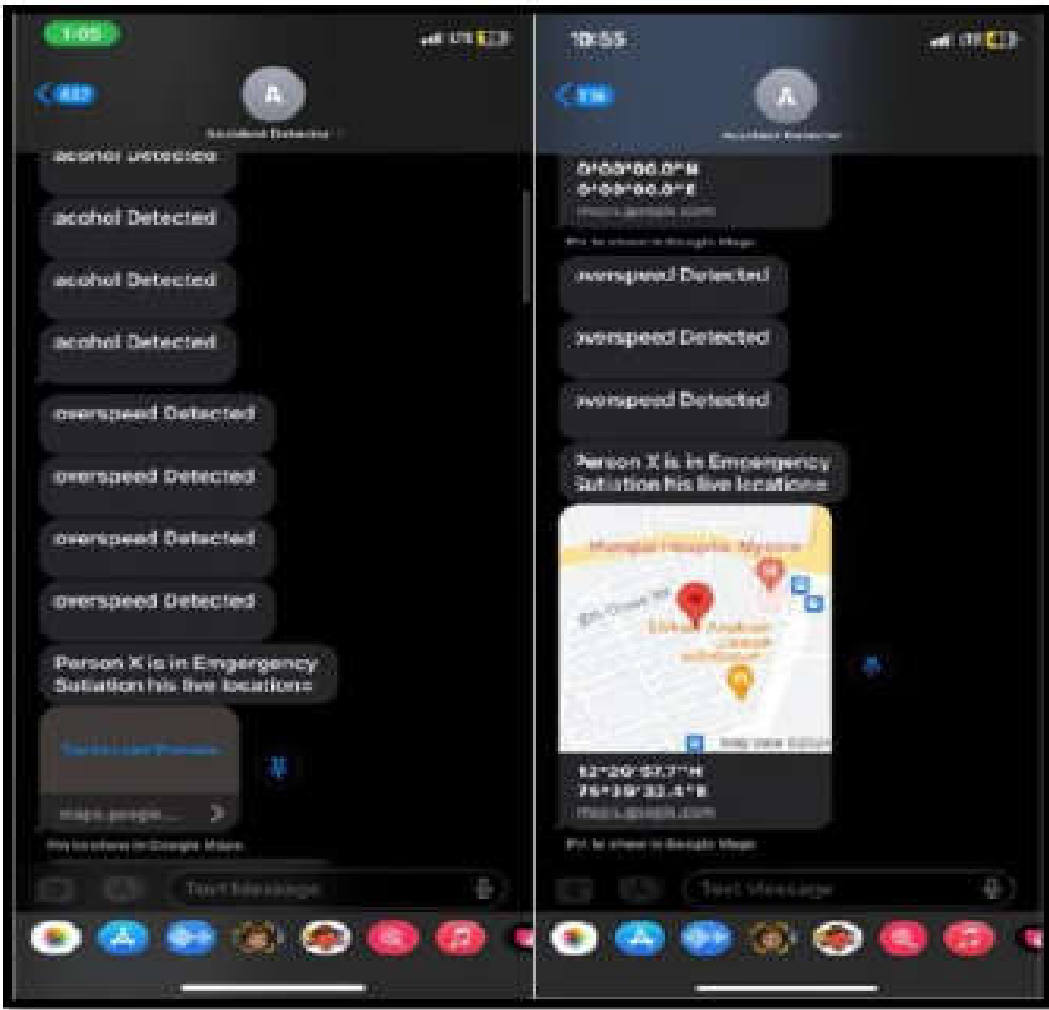


Fig 16:SMS alert

Figure 16 shows how an Internet of Things (IoT)-based two-wheeler accident prevention system may send an SMS alert in an emergency. sensor-equipped two-wheeler (accelerometer, gyroscope, GPS, collision detection). The onboard IoT module detects falls and accidents. A signal is transmitted to the cloud or server using a GSM, 4G, or 5G module. An automated SMS alert is set up. The SMS containing location information is sent to the recipient phones (family, emergency services, or a local hospital).

A straightforward block diagram of the figure might be created: Mobile phones (alarm received with location info), cloud/server, IoT controller + GSM module, two-wheeler (IoT sensors), and SMS gateway

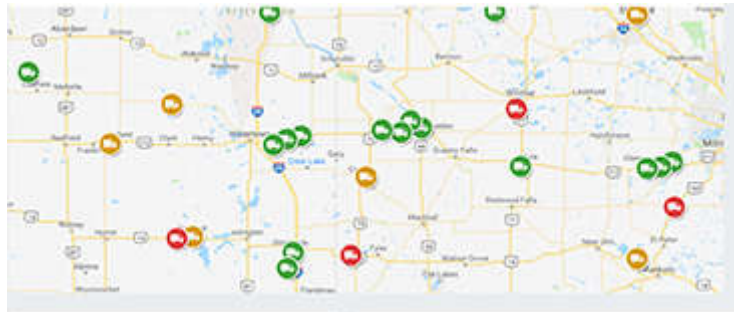


Fig 17:Location tracking

The position of the vehicle is continually tracked and communicated as necessary, as shown in Fig. 17: position Tracking in the context of IoT-driven accident prevention for two-wheeler safety systems. This is an obvious idea for Fig. 17:GPS-equipped two-wheeler that is part of an Internet of Things safety system. Real-time location data is processed by an IoT controller. GPS data is sent to a tracking platform or cloud server. Map-based location visualization (web/mobile app). Real-time tracking is possible for authorized users, such as family members and emergency services.

9.Conclusion and Future Scope.

This project integrates an AI-implemented monitoring system with sensor-based safety measures to enhance traffic and vehicle safety. This reduces the risk of accidents and prevents ignition in cases where a helmet is absent or there is an alcohol holding area by identifying accidents and putting in place an anti-THFT system for increased security. The YOLOV7-based helmet detection module for security verification without interfering with the primary control demonstrates the potential of data vision. Despite the challenges, such the sensor blind region, By depending on an external laptop and network, the FAIL-SAFE technology guarantees the smart vehicle management approach. Cloud-based monitoring, real-time treatment, vehicle control, enhanced sensor accuracy, and enhanced impact efficiency through AI integration are some potential future advances. The system may be extended for RIDE sharing, fleet management, and public transit in order to ensure security compliance. While present design maintains separation for reliability, future developments might enable secure integration and a full shift to autonomous AI-controlled automobile safety systems.

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