# Review of the Development of Ride Safe: Intelligent Bike Safety Management

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***Abstract*-Road safety is one of the major concerns in developing countries, where two-wheeler vehicles account for a large share of road accidents. This project, titled "Ride Safety Management System for Two-Wheelers", is designed to ensure the safety of both the rider and the vehicle. The system integrates various sensors and modules to provide multiple safety features such as helmet detection, accident detection, RFID-based vehicle authorization, and GPS-based location tracking. The project employs two microcontrollers — ATmega328 as the main controller and ATtiny85 as the helmet unit controller. The ATmega328 manages GPS, GSM, ADXL335 accelerometer, RFID authentication, and HC12 wireless communication. The ATtiny85, mounted in the helmet, uses an IR sensor to ensure that the helmet is worn before the bike can be started. Communication between the helmet and vehicle is achieved using the HC12 RF module. This intelligent system enhances rider safety by preventing vehicle start without helmet detection and provides accident alerts with real-time location to emergency contacts through GSM and GPS modules**.

***Keywords*—*RFID ,GPS ,GSM , ADXL345, HC12***

## 1. INTRODUCTION

Two-wheeler vehicles are widely used for their affordability and convenience, but they are also more prone to accidents compared to four-wheelers. A major cause of fatalities is riding without helmets and delayed emergency response after accidents. This project introduces a Ride Safety Management System that integrates safety and security mechanisms, such as a helmet detection system, an accident detection system,

RFID vehicle authentication, and a GPS and GSM system for real-time location tracking and SMS alerting.

The system ensures that the motorcycle can only be started when the rider is wearing a helmet and has been authenticated by RFID authentication| Due to this dual-check mechanism, unauthorized access is prevented and responsible riding behavior encouraged| To increase safety, the system has an accident detection module with an accelerometer sensor that keeps track of motion and orientation| When a sudden impact or abnormal tilt indicates a possible accident, the GPS module immediately records the location coordinates in real time, and the GSM module automatically sends an SMS alert with these details to pre-stored emergency contacts or rescue service

## 2. LITERATURE REVIEW

**1.** Helmet detection

Automatic helmet detection is a well-studied problem tackled in two broad ways: (A) vision-based systems that analyze images or video (often using deep learning like YOLO variants or CNN classifiers), and (B) wearable/helmet-mounted sensors that directly report helmet presence. Vision approaches enable large-scale roadside enforcement (detecting violators in traffic camera footage) and have seen strong gains using YOLO, Faster R-CNN, and other object-detection models; recent surveys and papers document improved detection accuracy using YOLOv8 and other modern networks.

2. RFID

RFID tags and biometric sensors (fingerprint scanners) have been used to replace or augment traditional mechanical keys to prevent unauthorized starting of bikes. RFID offers a low-cost, keyless approach for ignition interlocks; biometric systems increase security but add cost and enrollment complexity.

**3.** GPS–GSM

A large body of prototype work integrates GPS modules (e.g., NEO-6M) with GSM modems (SIM800/900) to fetch coordinates and send SMS alerts after crashes or when theft is suspected. Many student and research projects show effective proof-of-concept systems using ATmega328/Arduino as the main controller for GPS parsing and GSM messaging.

4. Microcontrollers

Prototypes commonly use ATmega328 (Arduino Uno/Pro Mini) as the main controller because of ease of development and available libraries for GPS/GSM/IMU. Lightweight controllers like ATtiny85 are used for helmet-mounted sensor units where small size and low power are priorities. For helmet–vehicle wireless links, low-power RF modules (such as the nRF24 series, HC-12, and Bluetooth Low Energy) are used, depending on the range, reliability, and regulatory constraints.

## 3. OBJECTIVES

1. To design and develop a smart ride safety system for two-wheeler.
2. To ensure that the vehicle starts only when the rider wears a helmet.
3. To provide RFID-based authentication for owner verification before ignition.
4. To detect accidents through ADXL345 and automatically send location alertsvia GSM and GPS.
5. To establish wireless communication between helmet and vehicle using the HC12 RF module.
6. To increase the overall safety and security of two wheeler users.

## 4. STATEMENT OF THE PROBLEM

- Road accidents involving two-wheelers are increasing at an alarming rate due to factors such as not wearing helmets, rash driving, and over-speeding.
- Conventional vehicles lack intelligent systems that can monitor rider behavior, enforce helmet usage, and prevent accidents in real-time.
- Ensure helmet detection before engine start.
- Monitor and control rash driving behavior.
- Detect over-speeding and take preventive actions.
- Provide real-time alerts and emergency communication.

## 5. SCOPE AND LIMITATIONS

### A. Scope

- IoT integration for cloud monitoring.
- Bluetooth helmet communication.
- Drunk driving detection using MQ3 sensor. Enhanced GPS live tracking IoT integration for cloud monitoring.
- Bluetooth helmet communication.
- Drunk driving detection using MQ3 sensor.
- Enhanced GPS live tracking.

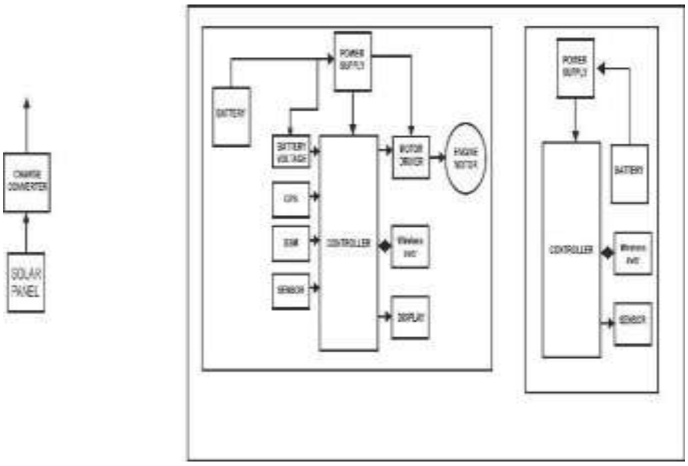
### B. Limitations

- GSM coverage dependent.
- Possible false accelerometer triggers.
- Helmet unit battery limitation .

## 6. PROCEDURE

When the ignition is turned ON, the ATmega328 microcontroller initializes all connected modules. The system then waits for two conditions to be satisfied: valid RFID authentication and a helmet-worn signal received via the HC12 module. Once both conditions are met, the ignition relay is energized, allowing the engine to start. The ADXL345 accelerometer continuously monitors the bike's motion and orientation, and in the event of an accident—detected through sudden jerks or unusual tilts—the ATmega328 reads the abnormal acceleration values. Immediately, the GPS module retrieves the current location coordinates, and the GSM module sends an SMS alert to a pre-stored emergency contact number. If the RFID tag is invalid or the helmet is not detected, the ignition remains disabled, ensuring that only authorized users can start the vehicle safely. Once both these conditions are fulfilled successfully, the ATmega328 activates the ignition relay. This lets current flow to the engine circuit and starts the bike। The ADXL345 accelerometer monitors the bike's motion, acceleration, and orientation all the time। The accelerometer detects unusual acceleration patterns or tilting angles during an accident or sudden impact। The ATmega328 handles these unusual values immediately and initiates an emergency response। The GPS module records the accident location's geographical coordinates in real time. In order to provide prompt assistance, the GSM module automatically sends an SMS alert with the location information to a pre-stored emergency contact number at the respective speeds.

## 7. BLOCK DIAGRAM




## 8. TOOLS AND TECHNIQUES

1. ATmega328 Microcontroller – Main controller handling sensors and communication.
2. ATtiny85 Microcontroller – Helmet controller for IR sensing.
3. ADXL345 Accelerometer – Accident detection through acceleration sensing.
4. GPS Module – Provides latitude and longitude data.
5. GSM Module – Sends SMS alerts.
6 RFID Module – Ensures authorized access.
7. RF Module – Wireless communication between
- helmet and the bike.
8. IR Sensor – Helmet detection sensor.
9. Power Supply – 12V to 5V regulated supply.
10. System initializes on ignition.
11. RFID verifies the owner tag.
12. Helmet detection signal received via RF Module.
13. Vehicle starts only when RFID and helmet detection are both valid.
14. ADXL345 monitors tilt and sends an alert if an accident occurs.
15. GPS provides coordinates; GSM sends SMS to the emergency contact.

## 9. CONCLUSIONS

The proposed Ride Safety Management System integrates multiple safety and security features to protect riders and vehicles. It ensures the rider cannot start the bike without wearing a helmet and being an authorized user. The system's ability to detect accidents and alert emergency contacts with GPS location can save lives by enabling quicker medical response.

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