

Detection of Speed Breaker and Accident Using RFID & GSM

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ABSTRACT

Road accidents caused by excessive vehicle speed, unexpected speed breakers, sharp turns, road dividers, poor visibility, and delayed emergency response continue to be significant safety concerns. This paper presents a microcontroller-based **Detection of Speed Breaker and Accident Using RFID and GSM** system designed to provide advance road-condition warnings and emergency accident notifications. RFID tags are positioned at important road locations such as speed breakers, turns, and dividers, while an RFID reader installed in the vehicle detects the corresponding tag. A PIC18F452 microcontroller processes the received RFID information and provides warnings through a 16×2 LCD, LED, and buzzer. The system also incorporates GPS and GSM modules for accident notification. When the accident/emergency switch is activated, the GPS module determines the vehicle location and the GSM module transmits the location information through SMS to predefined contacts. Experimental prototype operation demonstrated successful identification of RFID-tagged road conditions and corresponding warning messages. The proposed system provides a simple approach for improving driver awareness and facilitating faster emergency communication.

Keywords— RFID, GSM, GPS, PIC18F452, Accident Detection, Speed Breaker Detection, Road Safety, Vehicle Alert System.

INTRODUCTION

Road transportation plays an essential role in everyday life, but increasing vehicle density and unsafe driving conditions have contributed to a considerable number of road accidents. Accidents may occur because of excessive vehicle speed, unexpected speed breakers, road dividers, sharp turns, and poor visibility. During nighttime, fog, or rainy conditions, drivers may fail to identify road obstacles sufficiently early to reduce vehicle speed. An advance warning mechanism can therefore improve driver awareness and potentially reduce accidents.

Another important concern is the delay in providing emergency assistance after an accident. When an accident occurs in an isolated location, information regarding the accident and its geographical position may not immediately reach relatives, police, or emergency services.

The proposed system combines RFID-based road-condition identification with GPS- and GSM-based emergency communication. RFID tags associated with different road conditions are detected by an RFID reader installed in the vehicle. The PIC18F452 microcontroller processes the RFID information and generates visual and audible warnings. During an accident condition, GPS determines the location and GSM transmits the corresponding location through SMS. The project therefore combines preventive road-condition warning and post-accident communication within a single embedded system.

LITERATURE SURVEY

Several researchers have investigated RFID-based traffic monitoring, vehicle-speed control, and road-safety systems. Hiasat and Almomani [1] presented a real-time RFID vehicle data-logging system for traffic-management applications, while Singh and Teja [2] proposed a vehicle speed-limit alerting and crash-detection system for different

zones. Thirukkovulur *et al.* [3] developed an intelligent vehicle-control approach based on RFID transponders associated with roads and traffic signals. Aloul *et al.* [4] introduced an RFID-based traffic-monitoring system, whereas Rubini and Makeswari [5] investigated overspeed-violation management using Zigbee communication. Aishwarya and Nataraj [6] considered automatic vehicle-speed control while approaching road humps, Gaikwad *et al.* [7] proposed the design and development of a smart speed breaker, and Kiran *et al.* [8] presented an early detection and warning approach for identifying speed breakers and bumpy roads using smartphone sensors.

Further studies have concentrated specifically on automatic speed-breaker detection and control. Sureshkumar *et al.* [9] developed an automatic speed-breaker control system using a PIC controller. Kanavi *et al.* [10] proposed an automatic vehicle speed-breaker alert and controlling system intended to improve road safety and facilitate emergency-vehicle movement. Sattibabu [11] demonstrated automatic vehicle-speed control with wireless speed-breaker detection, emphasizing a simple, low-cost, and low-power implementation. Manikandan and Bharathi [12] investigated speed-breaker detection using BLOB-based image analysis; the technique performed effectively for coloured speed breakers but showed limitations for uncoloured speed breakers. Collectively, these studies provide the basis for the proposed system, which combines RFID-based identification of speed breakers, turns, and dividers with GPS/GSM-based accident-location notification to improve road safety and emergency response.

PROBLEM STATEMENT

Drivers may encounter speed breakers, sharp turns, and road dividers without sufficient advance warning, particularly during poor visibility, nighttime, fog, or rainy conditions. Sudden identification of such road conditions can result in unsafe braking, loss of vehicle control, or accidents. Furthermore, after an accident, emergency assistance may be delayed because the exact location of the vehicle is not immediately communicated to relatives or emergency services

OBJECTIVES

1. To develop an RFID-based road-condition warning system capable of identifying speed breakers, road dividers, and turns and alerting the driver through an LCD, LED, and buzzer.
2. To develop an accident-location notification system using GPS and GSM that transmits the geographical position of the vehicle through SMS to predefined contacts when an emergency condition is activated.

PROPOSED SYSTEM

The proposed system consists primarily of a PIC18F452 microcontroller, RFID reader and RFID tags, GPS module, GSM modem, 16×2 LCD, LED, buzzer, emergency/accident switch, and regulated power supply. The operation is divided into two major functions: road-condition identification and accident notification.

RFID tags are installed at selected locations near speed breakers, turns, and dividers. When the vehicle approaches one of these locations, the RFID reader detects the corresponding tag and transfers the information to the PIC18F452 microcontroller. The controller identifies the road condition and activates the LCD, LED, and buzzer to warn the driver. For accident notification, activation of the emergency switch causes the controller to obtain geographical coordinates through the GPS module and transmit the accident-location information through the GSM modem to predefined contacts.

BLOCK DIAGRAM

The Fig 1 represents the proposed RFID- and GSM-based road safety system, in which the microcontroller processes inputs from the RFID reader, GPS receiver, and accident button. Based on these inputs, it controls the LCD, buzzer, LED indicator, and GSM modem to warn the driver and transmit emergency accident-location information.

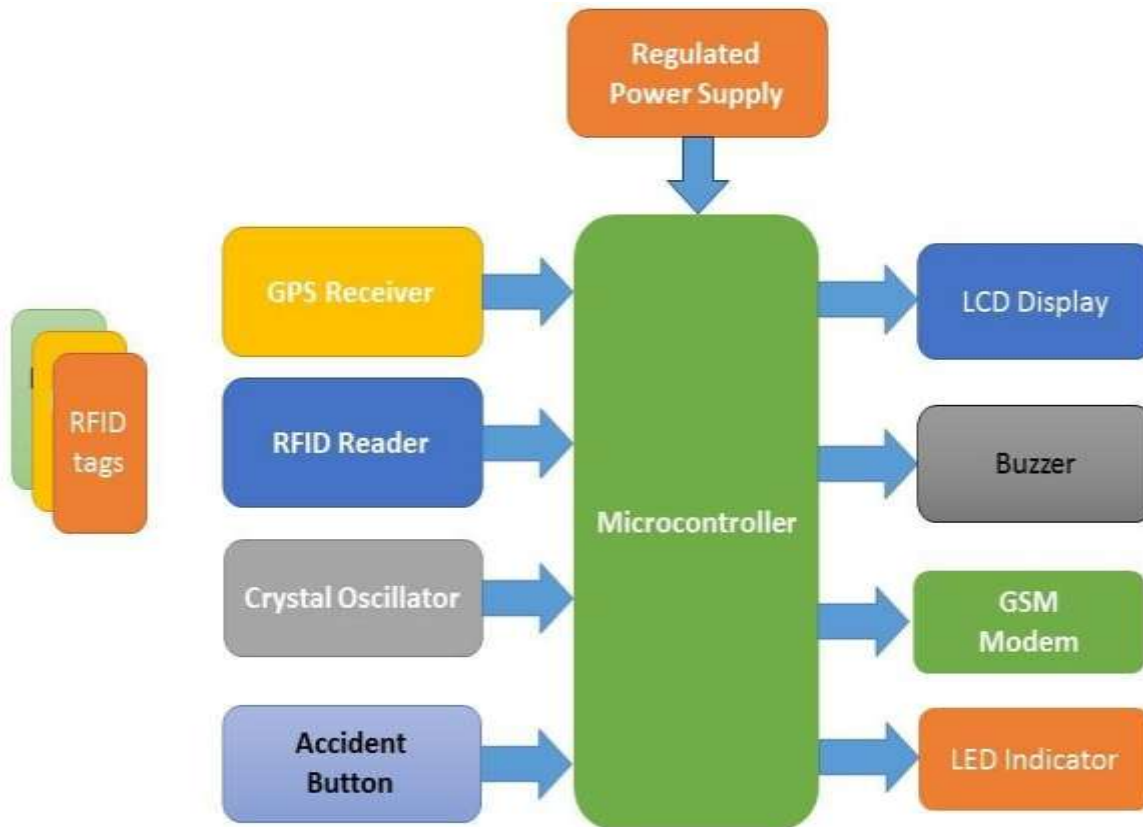


Fig 1 Block Diagram

CIRCUIT DIAGRAM

The Fig 2 shows the **PIC18F452 microcontroller** interfaced with the RFID reader, GPS module, GSM modem, LCD display, buzzer, LED indicator, and accident switch. The regulated power supply and crystal oscillator support stable operation, while the controller processes road-condition and accident inputs to generate warnings and emergency notifications.

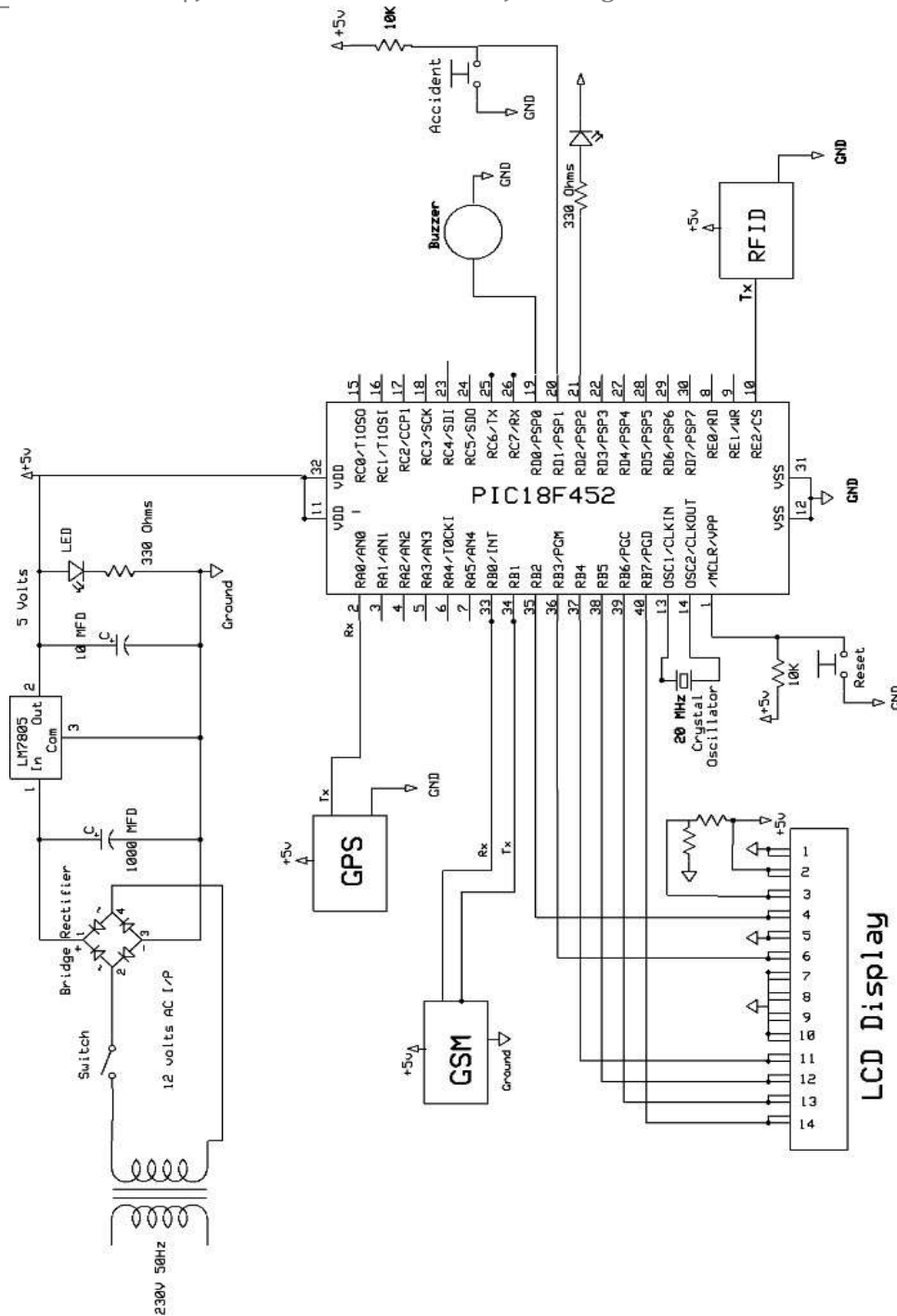


Fig 2 Circuit Diagram

METHODOLOGY

The methodology begins with initialization of the PIC18F452 microcontroller and the connected peripheral modules. The controller continuously monitors the RFID reader and accident switch. RFID tags are assigned to specific road conditions such as speed breakers, right turns, and dividers. When the RFID reader detects a valid tag, the tag information is transferred to the microcontroller through serial communication.

The microcontroller compares the received RFID data with stored tag information. When a speed-breaker tag is detected, the LCD displays a warning such as **“Speed Breaker—Please Go Slow.”** Similarly, corresponding messages are generated for right turns and road dividers. Simultaneously, the buzzer and LED provide audible and visual indications to attract the driver's attention.

During an emergency condition, the accident switch provides an input to the microcontroller. The GPS module obtains the latitude and longitude coordinates of the vehicle. These coordinates are processed by the controller, after which the GSM module sends an SMS containing the accident-location information to the predefined number. Communication between the controller, GPS, GSM, and RFID modules is implemented through serial communication.

RESULTS AND DISCUSSION

The developed prototype was evaluated for both RFID-based road-condition detection and GPS/GSM-based emergency communication. Different RFID cards were assigned to road conditions such as speed breakers, turns, and dividers. When the RFID reader detected the respective RFID tag, the controller successfully generated the corresponding LCD warning, including messages such as **“Speed Breaker Ahead,” “Right Turn Ahead,”** and **“Divider.”** The LED and buzzer provided additional warning indications to the driver.

The prototype was tested on a track containing a hump-like structure with the RFID arrangement positioned near the simulated road obstacle. The vehicle prototype carrying the RFID reader successfully detected the tag and generated the required indication. The report states that the experimental RFID module, having an approximately **5 cm range**, operated properly during prototype testing. For practical road implementation, however, the report notes that a detection range of approximately **3–4 m** would be required, making appropriate RFID reader selection important.

The accident-alert section was designed to obtain the geographical position of the vehicle using GPS and transmit it through GSM as an SMS. This allows accident information and location to be communicated to predefined contacts and potentially to police or ambulance services. Thus, the integrated prototype demonstrates both preventive driver warning and emergency communication functions.

CONCLUSION

An RFID- and GSM-based system for speed-breaker detection and accident notification has been developed and tested as a prototype. The system integrates RFID-based road-condition identification, PIC18F452-based processing, LCD and buzzer warnings, GPS location acquisition, and GSM-based SMS communication. Experimental operation demonstrated that RFID tags representing speed breakers, turns, and dividers could be detected and the corresponding warning messages displayed to the driver. The GPS and GSM subsystem provides a mechanism for communicating vehicle-location information during an emergency. The integrated hardware implementation therefore demonstrates the feasibility of combining advance road-condition warnings with accident-location notification in a single embedded vehicle-safety system. The project report concludes that the integrated hardware was successfully designed, implemented, and tested.

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