

Automatic Accident Detection And Ambulance Rescue System Using Smart Bios Services And Arduino

Attoffa jabeen, Archana, Pavan, Priyanka¹

Dr. Sharanbasappa Shetkar²

¹UG Students of Department of Electronics & Communication,

²Faculty of Department of Electronics & Communication,

Lingaraj Appa Engineering College Bidar, Karnataka.

Emails: sshetkar@gmail.com

ABSTRACT

Road traffic accidents are a major cause of fatalities, particularly in developing countries, due to delayed emergency response and lack of automated accident detection mechanisms. Timely medical intervention during the golden hour significantly increases the survival probability of accident victims. This paper presents an Automatic Accident Detection and Ambulance Rescue System using Arduino-based embedded technology. The proposed system integrates accelerometer sensors, GPS, GSM, RF communication, and biomedical sensors to automatically detect accidents, transmit location information to emergency services, and provide traffic signal preemption for ambulances. Additionally, patient vital parameters such as temperature and heart rate are monitored and transmitted to hospitals in real time. The system enhances emergency response efficiency, reduces rescue time, and improves patient survival outcomes. Experimental results demonstrate the feasibility and effectiveness of the proposed approach for smart city and intelligent transportation system applications.

Keywords— Accident Detection, Arduino, GPS, GSM, Ambulance Rescue, RF Communication, Smart Traffic, Intelligent Transportation Systems.

I. INTRODUCTION

Road accidents contribute significantly to global mortality rates, with India being among the most affected countries due to high traffic density and infrastructure limitations. A major challenge in accident management is the delay in detecting accidents and dispatching emergency services. Traditional systems rely on manual reporting, which often results in delayed medical intervention.

The golden hour, the critical period immediately following a traumatic injury, is frequently lost due to traffic congestion, lack of automated accident reporting, and inefficient communication between vehicles, ambulances, and hospitals. To address these challenges, this paper proposes an automated accident detection and ambulance rescue system that integrates sensor-based accident detection, GPS-based location tracking, GSM-based emergency notification, and RF-based traffic signal control. The system also monitors patient vital signs and transmits them to hospitals in advance, enabling better medical preparedness.

II. RELATED WORK

Several studies have explored automated accident detection and traffic management systems. Wang Wei and Fan Hanbo proposed an automatic traffic accident detection and alarm device, which lacked advanced location tracking and traffic signal integration. Xiaolin Lu developed intelligent transportation applications using GIS technology for traffic management but did not focus on emergency vehicle prioritization.

Malik Tubaishat et al. proposed wireless sensor-based traffic light control for general traffic optimization without emergency prioritization. Katsunori Tawara and Naoto Mukai introduced pheromone-based traffic congestion prediction, which relied on historical data and lacked real-time emergency handling.

These studies highlight the need for an integrated, real-time system capable of accident detection, emergency communication, and ambulance traffic prioritization, which is addressed in the proposed work.

III. PROPOSED SYSTEM ARCHITECTURE

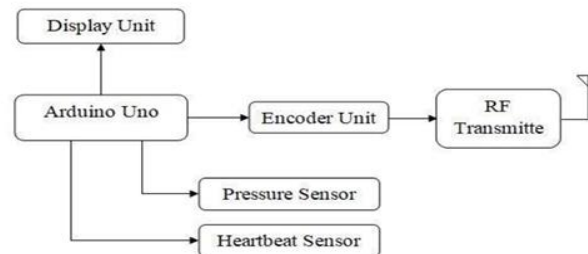


Fig: Block Diagram Of Ambulance Section

The proposed system consists of three main units:

A. Vehicle Unit

The vehicle unit includes an Arduino Uno microcontroller, ADXL345 accelerometer, GPS module, and GSM module. The accelerometer detects sudden impact or abnormal acceleration patterns indicating an accident. Upon detection, GPS retrieves the vehicle's latitude and longitude,

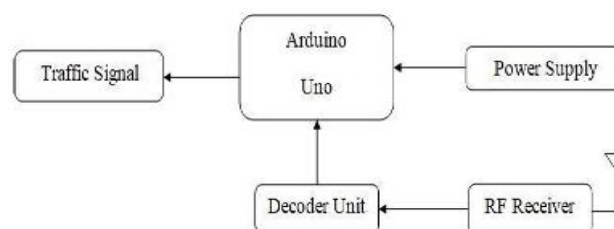
and the GSM module sends an alert message containing the location to the emergency server and rescue teams.

B. Ambulance Unit

The ambulance unit monitors patient vital parameters such as body temperature using an LM35 sensor and heart rate using an optical heartbeat sensor. These parameters are transmitted to the hospital in real time. The ambulance is also equipped with an RF transmitter to communicate with traffic signal units.

C. Traffic Signal Unit

Traffic signals are integrated with RF receivers. When an ambulance approaches a signal, RF communication triggers the signal to turn green, ensuring a clear path for the ambulance and reducing travel time.



IV. HARDWARE AND SOFTWARE IMPLEMENTATION



The system is implemented using the Arduino Uno platform based on the ATmega328P microcontroller. Key hardware components include:

ADXL345 Accelerometer for accident detection

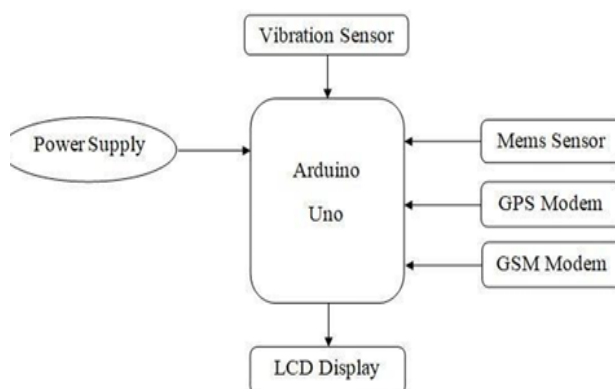
- GPS (Neo-6M) for location tracking
- GSM module for SMS-based emergency alerts
- RF Transmitter and Receiver for traffic signal control
- LM35 Temperature Sensor
- Optical Heartbeat Sensor
- 16×2 LCD for status display

The software is developed using the Arduino IDE. Embedded C programs handle sensor data acquisition, accident detection logic, RF communication, and GSM-based alert transmission.

V. RESULTS AND DISCUSSION

The prototype system was tested under simulated accident and ambulance scenarios. The accelerometer successfully detected high-impact conditions and triggered automatic alert messages. GPS and GSM modules accurately transmitted accident location coordinates to predefined emergency contacts.

RF-based traffic signal control demonstrated effective ambulance prioritization by switching signals to green upon ambulance approach. Vital parameter monitoring provided real-time temperature and heart rate data, enabling hospitals to prepare in advance for patient treatment. The results confirm that the proposed system significantly reduces emergency response time and improves coordination between vehicles, ambulances, and hospitals.



VI. APPLICATIONS

-
- The proposed system is suitable for:
 - Emergency medical services automation
 - Smart city traffic management
 - Vehicle safety systems
 - Fleet management and monitoring
 - Intelligent transportation systems (ITS)

VII. CONCLUSION

This paper presented an Automatic Accident Detection and Ambulance Rescue System using Arduino, GPS, GSM, and RF communication. The system provides real-time accident detection, emergency notification, ambulance traffic prioritization, and patient vital monitoring. The proposed approach improves emergency response efficiency and has strong potential for deployment in smart city and intelligent transportation infrastructures. Future work may include integration with cloud platforms, AI-based accident classification, and secure data transmission protocols.

VIII. FUTURE WORK

An automatic accident detection and ambulance rescue system using Arduino and smart bio-sensors operates by leveraging an accelerometer or vibration sensor to detect high-impact collisions, immediately alerting a central microcontroller. Upon detecting a crash, the Arduino triggers a GPS module to capture real-time, precise location coordinates and utilizes a GSM module to send an emergency SMS to nearby hospitals or pre-defined contacts. This system can also incorporate smart bio-sensors to monitor vital signs such as heart rate or temperature, sending this crucial health data to the receiving medical team while simultaneously activating a siren/buzzer to alert surrounding traffic. This IoT-based approach minimizes response times to improve survival rates.

REFERENCES

- [1] Wang Wei and Fan Hanbo, "Traffic Accident Automatic Detection and Remote Alarm Device," 2000.
- [2] Z. Yang, "Traffic Signal Timing for Priority Vehicles Based on Navigation System," 2000.
- [3] X. Lu, "Web GIS Based Intelligent Transportation Applications," Proc. ITS Telecommunications, 2006.
- [4] K. Tawara and N. Mukai, "Traffic Signal Control Using Congestion Prediction," Proc. Int. Conf. on Tools with AI, 2010.
- [5] M. Tubaishat et al., "Wireless Sensor-Based Traffic Light Control," IEEE CCNC, 2008.
- [6] Q. Huang and Y. Zhang, "Dynamic Balancing of Push and Pull in Distributed Traffic Information Systems," IEEE CCNC, 2007.
- [7] J. Gan et al., "Integrated WSID Traffic Monitoring Network System," Chinese Control and Decision Conf., 2009.