

Identification and Prevention of Accidents using Smart Helmet and GPS system

Allanki Sanyasi Rao¹, P Reena², K Amaravathi³, P Akhila⁴, K Aravind⁵

¹Associate Professor, ^{2,3,4,5} UG Student, Dept. of Electronics & Communication Engineering,
Christu Jyothi Institute of Technology & Science, Jangaon, Telangana, India

ABSTRACT

This paper discusses the global issue of motorcycle accidents, highlighting the vulnerability of riders on the road. Many accidents involve riders without helmets or under the influence of alcohol. The solution proposed prevents the motorcycle from starting if the rider lacks a helmet or has consumed alcohol. Moreover, the system detects accidents and sends SMS alerts to rescue services, police, and family, with precise GPS location. Sensors embedded in the helmet transmit data wirelessly to the motorcycle's receiver unit. This setup includes two modules: helmet (transmitter) and motorcycle (receiver), with alcohol and tilt sensors in the helmet and GPS/GSM modules in the vehicle. Zigbee technology enables wireless communication, enhancing rider safety and emergency response efficiency.

Keywords: GPS, GSM, Zigbee Technology, Wireless Communications.

I. Introduction

India witnesses a significant number of road accidents annually, attributed to various factors such as drink driving, reckless behaviour, and exceeding speed limits. Unfortunately, responsibility for accidents isn't always accurately assigned, leaving both parties affected. Tragically, delayed first aid and medical services often result in fatalities, exacerbated by ambulances' inability to reach accident sites promptly. To address this critical issue, a system is proposed to ensure rapid attention to injured riders. With two-wheelers being prevalent in India due to their affordability and simplicity, the Smart helmet concept emerges for societal betterment. Mandated by the Motor Vehicles Act (section 129), helmets are now compulsory, aiming to mitigate accidents caused by negligence. The Smart helmet, designed to prevent vehicle ignition without it, serves as an initial warning to riders. Moreover, it aids law enforcement and compliance with government regulations, ensuring rider safety and timely medical response, vital for saving lives. In many accidents, the rider gets injured mainly on the head. helmet plays a very important role in saving the life of the ridden So to encourage people to wear helmets and to avoid accidents, a design is proposed that synchronizes the module present in bike.

II. Literature Survey

Mingi Jeong and colleagues developed a system that includes a variety of sensors, such as cameras(thermal, visible light, and drone), sensors (oxygen remaining, inertia, smart watch, and HMD), and a command center. The goal of this system is to reduce the number of accidents that occur on the road. This framework makes it possible for IoT services to be easily integrated,

controlled in an effective manner, and able to notify information in real time. Sayan Tapada et al. has developed a prototype that measures the pace at which alcohol is ingested by the rider as well as identifying accidents using IOT modules and sensors. By training the device with real-time simulation, they are attempting to make a prediction using Support Vector Machines regarding whether or not the values of the sensors correspond to an accident. The outcomes achieved by using this method are satisfactory. Both the accuracy and precision are of a very high standard.

In his study, Risto Öörni examines the demand for four intelligent vehicle safety systems (IVSSs) - emergency braking, speed alert, blind spot monitoring, and lane-keeping support. Öörni constructs demand curves for these systems based on data gathered from user interviews and a literature review. The study introduces a method for creating both linear and exponential demand curves using interview data. Least-squares fitting tests were conducted to assess the estimated curves, revealing a consistently larger mean absolute error for the linear model compared to the exponential model across all systems. This suggests that the exponential model more accurately reflects the demand for IVSSs than the linear model.

Authors Hussain A. Attia and Shereen Ismail present an advanced electronic safety system tailored for teenagers and older drivers in this paper. This system addresses driving errors stemming from physiological traits by incorporating two new parameters: the number and duration of errors. If the total errors exceed a set threshold, the system initiates a safety response. Simulation results highlight the system's ability to discern between safe front distance, short front distance alarm, and long front distance alarm scenarios.

Md. Atiqur Rahman, Toufiq Ahmed, S.M Ahsanuzzaman, Abid Ahsan, Ishman Rahman, IoT Based Smart Helmet and Accident Identification System. This project contains mobile application so it can be implemented on a large scale. This project is using inbuilt Bluetooth of mobile, So in case of battery drainage or if person forget to take mobile with him/her. It will not send any details about accident. This is smart and can be scalable.

III. Embedded system

Embedded systems are specialized computer systems designed for specific functions, often with real-time constraints, and are integral parts of complete devices. Unlike general-purpose computers, like personal computers, which are versatile and perform various tasks based on programming, embedded systems are tailored for particular applications. While the term "embedded system" lacks precise definition due to varying programmability, handheld computers, though sharing components like operating systems and microprocessors, differ as they allow diverse applications and peripherals. These systems combine hardware and software, either fixed or programmable, for specific devices like industrial machines, automobiles, and medical equipment. Programmable embedded systems offer a programming interface, requiring specialized embedded systems programming. Some systems utilize tailored operating systems or languages like Embedded Java and Windows XP Embedded, while others integrate application and operating system into a single program stored permanently in memory, unlike personal computers where programs are loaded into RAM.

IV. Existing System

There are three kinds of setback acknowledgments they are 1) Manual location framework 2) Driver started identification framework 3) Automatic discovery framework. As indicated by similar review if 698 accidents happen each year, about a large portion of the harmed individuals pass on because of absence of treatment in legitimate time. The explanations behind this may again be numerous, for example, late appearance of rescue vehicle, no individual at spot of mishap to offer data to the emergency vehicle. The current framework the helmet parts comprise of just only one feature rider is wearing the head protector or not. But proposed structure adds some extra features like liquor discovery utilizing alcohol sensor.

Another significant disadvantage of existing system is bike and helmet is wired connection. But proposed framework bike and head protector are wirelessly share the data and the person meet an any mishaps identify the location of mishaps area using GSM and GPS module and send message to enrolled mobile number like ambulance, police headquarters and relatives. So we can undoubtedly give clinical administrations to rider in brief time frame period.

V. Proposed Method

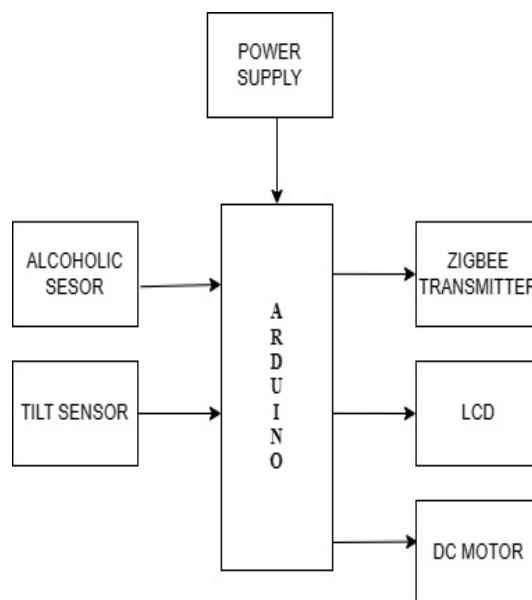


Fig 1: Block diagram of Transmitter side

Road accidents involving two-wheeler motorcycles are a major cause of injury and death worldwide. Despite the various safety measures taken, the number of accidents continues to rise. One of the main reasons for this is the delay in receiving medical attention due to the inability to detect accidents immediately. There is a need for a system that can quickly detect accidents involving two-wheeler motorcycles and notify emergency services to reduce the response time and improve the chances of survival for the riders. A potential solution to this problem is a smart helmet-based accident detection and notification system that can automatically detect accidents and alert emergency services

In this proposed framework if person is consuming any alcohol the bike will won't start by using MQ-3 sensor. At whatever point this condition is fulfilled the bike will start otherwise the bike never start. Additionally include another one smart feature in proposed framework. This smart feature is used to identify the specific location of mishaps happened area by sending a message to ambulance and relatives. So immediately give a medical service to the riders. In this proposed system if any accident is meet by a rider to easily identify the exact location of accident occurred area and send a message to registered mobile numbers.

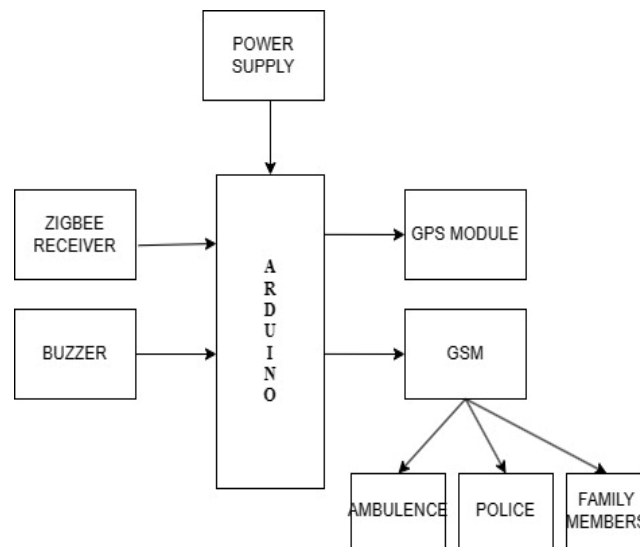


Figure 2: Block diagram of Receiver side

VI. Software Used

Arduino, an open-source prototype platform, revolutionizes hardware development with its user-friendly approach. Comprising a programmable circuit board (microcontroller) and the Arduino IDE (Integrated Development Environment), it empowers enthusiasts and professionals alike to create innovative projects. The Arduino IDE features a comprehensive toolkit, including a text editor for coding, a message area for feedback, and a console for debugging. Its intuitive interface includes a toolbar with common functions and a range of menus for seamless navigation.

Moreover, the IDE facilitates communication with Arduino hardware, enabling users to upload programs effortlessly. This integration of hardware and software fosters creativity and experimentation in diverse fields such as robotics, home automation, and wearable technology. With Arduino, the possibilities are endless, making it a cornerstone in the maker community and beyond.

VII. Results and discussions

The design is divided into two main parts: the transmitter and the receiver, as illustrated in Figure 3. The transmitter includes the alcohol sensor and the tilt sensor. The alcohol sensor detects alcohol substances prior to riding, while the tilt sensor identifies angular movement. The receiver comprises the GPS and GSM modules.

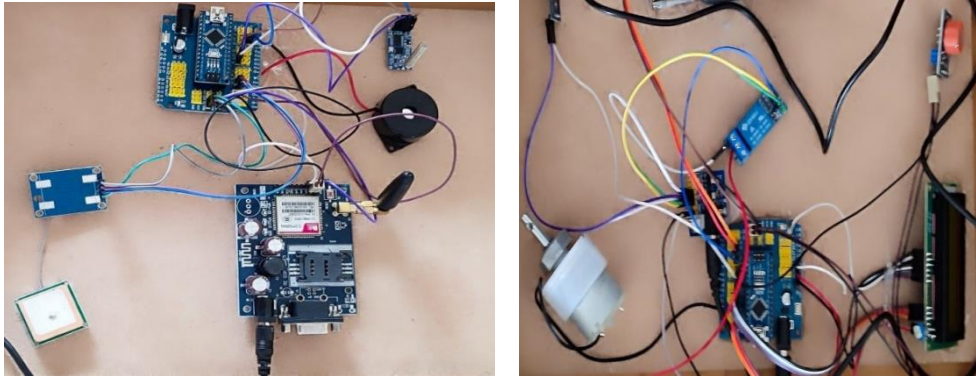


Fig 3: Transmitter and Receiver circuits



Figure 4: LED Display when alcohol not detected



Figure 5: LED display when alcohol detected

If the person is not consuming any alcohol substances, the alcohol sensor will detect it and display "No alcohol detected" on the LCD, as shown in Figure 4. However, if the person is consuming alcohol, it will be detected by the sensor, and "Alcohol detected" will be displayed on the LCD, as illustrated in Figure 5.

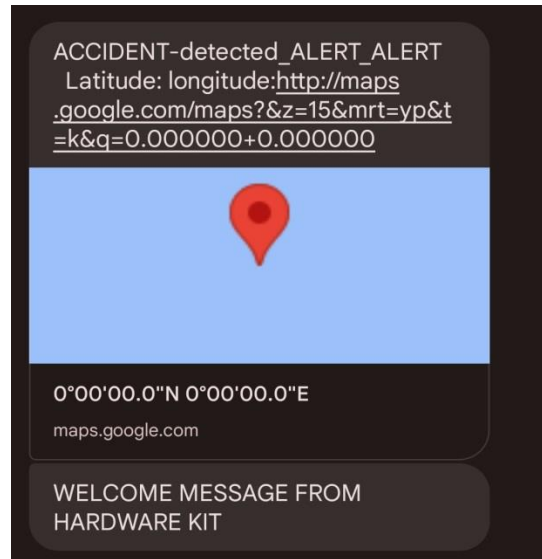


Figure 6: Sample Accident Message

Utilizing a tilt sensor enables identification of the vehicle's angular movements, measuring slope and tilt within a limited range. This sensor facilitates accident detection, triggering automatic SMS alerts to family members via the GSM module. Figure 6 displays a sample accident message containing a location link, allowing for easy tracking of the accident location through GPS, as demonstrated in Figure 7. This enables swift identification of the location to potentially save lives.

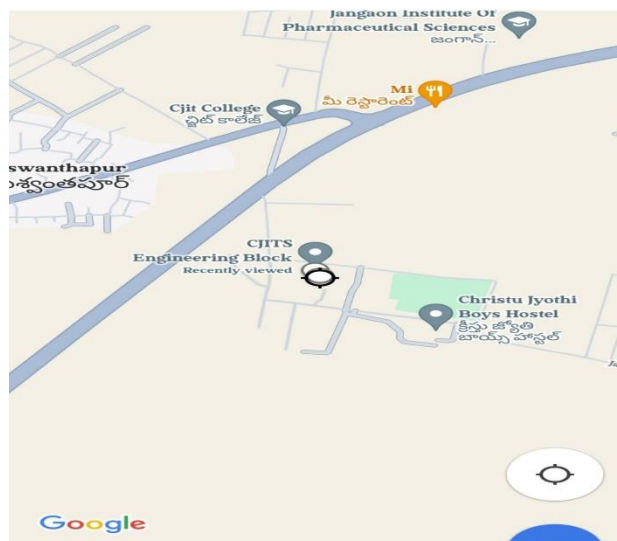


Figure 7: Sample Accident Location Area

VIII. Conclusion

A smart helmet equipped with immediate accident detection and notification capabilities could significantly enhance road safety for riders, particularly in the Indian subcontinent. The developed system ensures continuous helmet usage and prevents riding under the influence of alcohol. It swiftly detects accident locations, facilitating prompt medical assistance.

To meet potential demand, the entire circuitry can be integrated into a printed circuit board, reducing size for easy helmet integration. This study utilizes Zigbee technology for effective communication, with future improvements possible through high-efficiency RF Transmitters. Notably, the system promptly alerts registered mobile numbers in case of accidents, potentially saving lives.

References

- [1] Intelligent Gadget for Accident Prevention: SmartHelmet Syed Umaid Ahmed; Riaz Uddin; Muhammad Affan 2020 International Conference on Computing and Information Technology (ICCIT-1441) Year: 2020 | Conference Paper | Publisher: IEEE
- [2] Aboli Ravindra Wakure et al., "Vehicle Accident Detection and Reporting System Using GPS and GSM", vol. 10, April 2014.
- [3] Sayan Tapadar, Arnab Kumar Saha, Dr. Himadri Nath Saha, Shinjini Ray, "Accident and Alcohol Detection in Bluetooth enabled Smart Helmets for Motorbikes" 978-1-5386-4649-6/18 © 2018 IEEE.
- [4] N. Divyasudha and P. Arulmozhivarman, "Analysis of Smart helmets and Designing an IoT based smart helmet: A cost-effective solution for Riders," in 1st International Conference on Innovations in Information and Communication Technology (ICIICT), 2019.
- [5] D. Sathish Kumar, P. Prithika, B. Elizabeth Caroline, "Investigating the Performance of Microstrip Patch Antenna With Photonic Crystal on Different Substrate", Proceeding of International Conference on Systems Computation Automation and Networking 2019, DOI: 10.1109/ICSCAN.2019.8878861