# IoT-BASED CRASH PREVENTION, DETECTION AND EMERGENCY ALERT SYSTEM FOR MOTORBIKES

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***Abstract*-This paper outlines the development of a motorcycle accident prevention, detection system along with an emergency alert mechanism that can inform emergency contacts of the injured motorcycle driver's exact location. The IoT-based crash prevention, detection and emergency alert system for motorbikes is designed to provide real-time notification and location tracking during a bike accident. The system is equipped with MPU6050, a crash sensor, an A9G module, a tilt sensor, an emergency stop button, dc motor, hall effect sensor, two relays - one for cutting off the battery of bike during a crash. The speed of the moto bike is controlled maximum 80km/hr. Additionally, an LCD screen is used for displaying the accident status. The system processes the sensor data to determine whether the bike has crashed or not. If a crash is detected, the relay cuts off the bike's battery to prevent any hazards.**

***Keywords*- A9G module, tilt sensor, crash sensor, hall effect sensor, MPU6050, slot sensor, relay, emergency stop button, DC motor.**

## 1 INTRODUCTION

In recent years, the number of people who die due to road accidents has continued to increase as more people use personal vehicles for transportation. In many cases, victims of accidents do not die immediately after the impact, so timely notification of authorities can save lives. However, many vehicular accidents occur in remote areas or on highways where there are no bystanders nearby to inform authorities immediately, leading to more fatalities. According to the Global Health Observatory (GHO) data made by the World Health Organization (WHO) in 2020, there were nearly 1.38 million road traffic deaths globally. This number is significantly higher than the number of deaths due to natural causes. In India, the number of people who died in road accidents was 154,732, according to the Road traffic deaths by a country report from the Global Health Observatory data repository made by WHO. According to the latest projections from the National Highway Traffic Safety Administration, it is estimated that approximately 31,785 individuals lost their lives in traffic accidents during the 1st nine months of 2022.The accident rates are been increasing year by year . Without an accident detection and emergency alert system, several things can happen in the event of an accident. Firstly, the occupants of the vehicle may be unable to call for help themselves, which can lead to delays in emergency services arriving at the scene. Secondly, the location of the accident may not be immediately clear, which can further delay the response time of emergency services. Thirdly, there may be a lack of information about the cause of the accident, which can make it difficult to prevent similar accidents from occurring in the future. Lastly, if the vehicle is stolen, the owner may not be immediately aware of the theft, which can further increase the risk of harm to the vehicle and its occupants. Overall, the absence of an accident detection and emergency alert system can increase the risk of harm to the vehicle and its occupants, and may result in delays in providing assistance and preventing future accidents.

THE NEED OF CRASH DETECTION AND EMERGENCY ALERT SYSTEM

A crash detection and emergency alert system is introduced to help improve road safety for motorcycle riders and reduce the risk of fatalities or serious injuries resulting from accidents. The system uses various sensors and modules to detect a crash or accident and immediately sends an emergency alert to designated contacts or services. This prompt response can be critical in providing timely medical assistance to the injured rider, potentially saving their life. Additionally, the system can also help locate the exact location of the accident, which can be particularly useful in cases where the rider may be unable to communicate their location to emergency services. The implementation of a crash detection and emergency alert system for motorcycles can help improve rider safety and potentially save lives.

## 2 RELATED WORKS

In [1] The design of an accident detection system for motorbikes is suggested in this research to quickly deliver essential medical care to the wounded motorcycle driver's emergency contact. The suggested system is based on an accelerometer sensor that determines the motorcycle's acceleration and deceleration and then sends an alert to those who need to know via SMS and GPRS via an online server utilizing a GSM module. The primary contribution of this paper is the rigorous real-world testing of the designed system and the data collection from 10 different bikes to identify the ideal tilt angle. Moreover, crash tests have been carried out. The system has a 97.33% detection rate. In [3] The study describes a new method for detecting motorbike crashes using GPS/GNSS and inertial data collected by telematic e-Boxes. The primary objective of the method is to reduce emergency services' response time and accurately record the event dynamics for future accident investigations.[5] In this, the sensors were employed to gauge the

severity of the crash. The sensors are kept on the motorcycle's back, in the driver's head, and in his or her body. It can be challenging to determine the severity of a crash after it has happened, but it can be determined by the intensity at which the helmet has fallen. The crash dummy tests were done by using Crash dummy testing are performed by tossing the dummy with various actual data gathered when operating the motorcycle at simulated crash altitudes for the driver.

**3 EXISTING SYSTEM**

The objective of this paper is to propose a motorcycle accident detection system that can immediately alert emergency contacts with the injured rider's precise location, enabling prompt medical assistance. The proposed system is based on a tilt sensor that measures the inclination of the motorcycle and transmits notifications to designated contacts via SMS and GPRS using a GSM module and an online server. One of the significant contributions of this paper is the extensive real-time testing of the developed system, which involved collecting data from ten different motorcycles to determine the optimum tilt angle. Additionally, the system underwent crash testing, which showed a detection rate of 97.33%. Arduino Nano is based on an ATmega328P microcontroller having 22 digital Input Output pins and 8 Analog IN pins. It has a 16MHz crystal, a power jack, a USB cable, and a reset button. They use the Software serial library to access UART and SPI a facility on multiple Analog pins as Arduino Nano just has 1 pair of Tx/Rx pins. The MPU6050 is used to detect sudden changes in motion or orientation, which can indicate that an accident has occurred The MPU6050 works by measuring the acceleration and angular velocity of the module in each of the three dimensions. These measurements are then processed using algorithms to determine the orientation and motion of the object. The module also includes internal temperature sensors and an onboard Digital Motion Processor (DMP), which can be used to perform calculations and filter out noise from the measurements. the MPU6050 can be used to detect sudden changes in motion or orientation that may indicate that an accident has occurred. For example, if a motorcycle equipped with an MPU6050 suddenly decelerates or changes direction abruptly, the MPU6050 can detect these changes and trigger an alert to emergency services or designated contacts. Once an accident is detected, the system triggers an alert using the SIM800L module, which is a communication module that enables the system to send messages or make calls. The SIM800L is a communication module that provides GSM/GPRS capabilities to a device, enabling it to send and receive messages or make calls over a cellular network. The SIM800L module is typically controlled using AT commands, which are sent from a microcontroller or other device to the module to initiate various operations. The SIM800L module works by connecting to a cellular network and establishing a data connection with the network. This connection can then be used to send and receive messages or make calls. To establish a connection, the module typically requires a SIM card, which contains the necessary information to access the cellular network.The communication is passed on the Thing Speak platform, which is an Internet of Things (IoT) platform that allows devices to send and receive data over the internet. The platform enables the system to send the alert to emergency services or designated contacts, providing them with the location of the accident and other relevant details. The information about the accident is also stored in the ThingSpeak platform, which enables the system to provide a record of the accident that can be used for analysis or future reference. This can help to identify patterns or trends in accidents, enabling the system to be improved over time and reducing the risk of accidents in the future. Thinger.io is an Internet of Things (IoT) platform that provides a cloud-based infrastructure for connecting and managing IoT devices. The platform offers a variety of features for collecting and analyzing data from connected devices, as well as tools for managing device configurations and communicating with connected devices. The Thinger.io platform works by providing a set of APIs and libraries that can be used to connect devices to the platform. These APIs and libraries support a variety of programming languages and protocols, allowing devices to be connected using a wide range of technologies. Once a device is connected to the Thinger.io platform, it can be configured to collect and transmit data to the platform using a variety of protocols, including MQTT, HTTP, and CoAP. The platform provides tools for managing device configurations and data streams, enabling users to control and monitor devices remotely. Internet of Things IOT provides us the ability to upload the tilt angle on its server using its free and easy-to-use API made for Arduino. It also provides a digital dashboard that comprises maps and periodic readings of all devices where the proposed system is installed. All the components are connected to the 12V battery.

- In this system they fail to track the location of the injured person.
- They did not include an emergency button to stop the SMS and call notifications from the SIM800L module in case of a minor accident.

**4.PROPOSED SYSTEM**

We developed a device that aims to prevent, detect accidents and alert emergency services in case of any occurrence. The system comprises several hardware components, including an ESP32 microcontroller, MPU6050 accelerometer and gyroscope, tilt sensor, crash sensor, indication light, LCD display, emergency button, relay and battery. The software components will run on the ESP32 microcontroller and include code for reading sensor data, analyzing the data to detect accidents, triggering alerts and notifications, and interfacing with the LCD display. The system will process sensor data from the MPU6050 accelerometer and gyroscope, tilt sensor, and crash sensor to detect accidents. When an accident is detected, the indication light will be triggered to indicate the location of the vehicle, and notifications will be sent to emergency contacts via SMS, email, or other methods. The LCD display and emergency button will provide a user interface for interacting with the system. The system will also manage power to ensure reliable operation. this system aims to provide a reliable and effective solution for detecting accidents and alerting emergency services in a timely manner, potentially saving lives and reducing the impact of accidents.

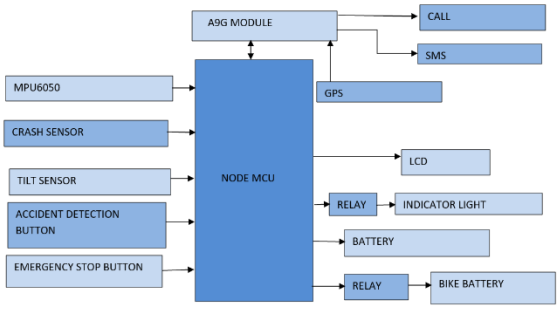


Fig.No.4.1 Block Diagram of Accident Detection And Emergency Alert System

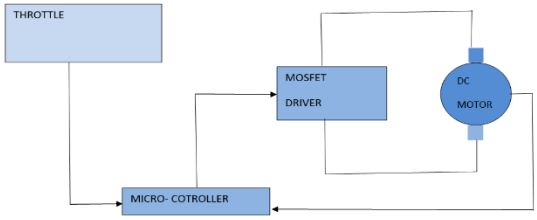


Fig.No.4.2 Block Diagram of Speed Control System

## 5. OUTPUT AND RESULTS

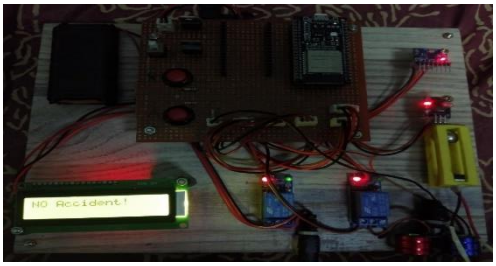


**Fig.No5.1 System Prototype**

Initially, there were no occurrences of accident.

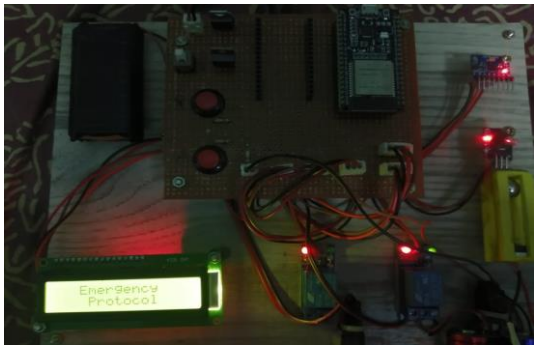


Fig.No 5.2

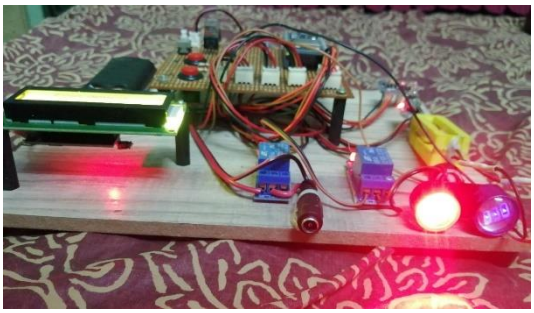

Fig.No 5.3

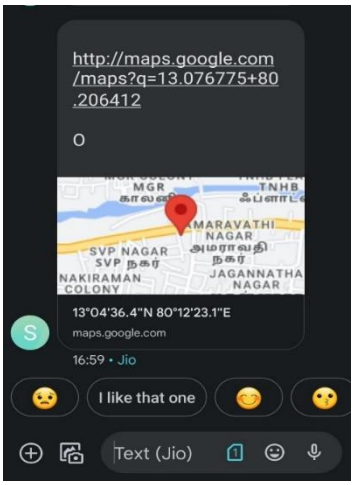

Fig 5.4

In the event of an accident, the A9G module installed in the vehicle will detect the impact and automatically trigger an emergency alert. The A9G module will then send a call, SMS, and location information to the designated contacts, alerting them of the accident and the location of the vehicle.The indicator light gets on during the occurrence of an accident.

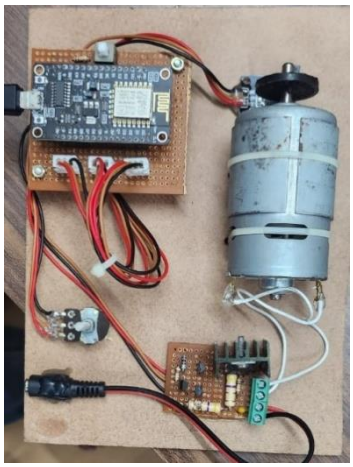
Fig No 5.5 Speed Control

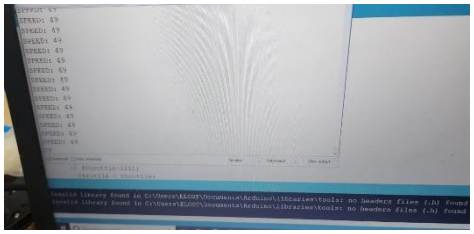
Fig No 5.6

The output of this module would be a bike that is limited to a maximum speed of 80. The module would continuously monitor the speed of the bike and adjust the power to the DC motor as needed to maintain the speed limit.

**6.CONCLUSIONS**:

The motorcycle accident detection system with an emergency alert mechanism is a promising solution that can significantly reduce the risks associated with motorcycle accidents. The system can provide real-time notification and location tracking during a bike accident, enabling emergency responders to reach the accident site quickly and the maximum speed of the motorcycle to 80km/hr can prevent further hazards. The system's reliability and robustness ensure that the rider's safety is a top priority. IoT-based crash prevention, detection, and emergency alert system for motorcycles is a promising development in motorcycle safety. Its potential to prevent or reduce the severity of accidents and provide prompt medical attention to the injured motorcycle driver can save lives and prevent injuries.

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