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MOTORCYCLE CRASH DETECTION USING IOT

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ABSTRACT
Motorcycle accidents pose a significant risk to riders due to their vulnerability on the road. This project report presents an IoT-based motorcycle crash detection system aimed at enhancing rider safety by detecting and notifying relevant parties about accidents in real-time. The system consists of several key components, including sensors, a microcontroller, a communication module, and a cloud-based application. The sensor array, strategically placed on the motorcycle, monitors various parameters such as acceleration, orientation, and impact force. These sensors continuously collect data, which is processed by the microcontroller. The microcontroller, typically an Arduino or similar device, is responsible for processing the sensor data and determining whether an accident has occurred. It uses a predefined algorithm to analyze the sensor data and detect abnormal events, such as sudden deceleration or changes in orientation indicative of a crash.
Keywords: smart farming, Artificial intelligence, Internet of Things, sensors.

Introduction
Motorcyclists face higher risks on the road, and accidents can result in severe injuries or fatalities. A staggering 44.5 per cent of the deaths involved two-wheelers which are a common mode of transportation in India. Due to the high amount of traffic on roads and lower costs of procurement and running, two-wheeler sales in India are much higher than in the rest of the world. However, this mode of transportation also leaves the rider and the passenger more vulnerable in case of an accident. According to a report released by the National Crime Records Bureau, the number of traffic-related accidents in 2021 has risen by 14.6 per cent to 4,22,659. A major contributor to this figure was road accidents which amounted to 4,03,116. This figure itself has seen a rise of 13.6 per cent compared to the previous year. These road accidents took 1,55,622 lives while 3,71,884 people were left injured.
The project is motivated by the overarching goal of enhancing rider safety by leveraging IoT technology to detect and respond to crashes in real-time. The critical moments following a motorcycle accident are crucial for emergency response. The project aims to minimize response times by automating crash detection and alerting emergency services promptly, potentially saving lives and minimizing the severity of injuries. Motorcycles lack the protective features of larger vehicles, making riders more vulnerable to accidents. The project is motivated by the desire to provide an additional layer of safety through advanced crash detection, offering riders a proactive safety mechanism. The continuous advancements in IoT technology present an opportunity to create innovative solutions for pressing challenges. The project is motivated by the potential of IoT to revolutionize motorcycle safety, utilizing sensors and connectivity to create a smart system that actively contributes to accident prevention. Accidents can lead to a decline in rider confidence. The project aims to motivate riders by providing them with a reliable and intelligent system that actively contributes to their safety, fostering a sense of confidence and security on the road.

Literature
Simone Gelmini, Silvia Strada, Mara Tanelli, Sergio Savaresi, and Claudio De Tommasi ‘A novel crash detection algorithm for two-wheeled vehicles’.The proposed approach follows a new paradigm that improves the detection performance, better generalizing the motorcycle dynamics with respect to the specific vehicle and the driving style.

Jussi Parviainen, Jussi Collin, Timo Pihlstr¨om, Jarmo Takala 'Automatic Crash Detection for Motorcycles'.In this concept, three different inertial measurement units are attached to head of the motorist, torso of the motorist and to the rear of the motorcycle. Crash dummy tests are done by throwing the dummy with different altitudes to simulate the effect of crash to the motorist and real data is collected by driving the motorcycle.

Cismas Alexandru, Casu George 'Crash detection using IMU sensor'.This document explains how to use the MPU6050 IMU sensor in an embedded device for measuring the Euler angles (roll, pitch, yaw) and also the G Forces on different axes

Shaheryar Ahmad Khan, Umar S. Khan, Saad Ur Rehman 'IoT-based Accident Detection and Emergency Alert System for Motorbikes'.This paper proposes the design of an accident detection system for motorcycles that notifies the emergency contact of the injured motorcycle driver about their precise location so that necessary medical help can be provided timely.

Yifu Liu, Paul Watt,Bochen Jia and Yi Lu Murphey 'Vehicle Position and Context Detection using V2V Communication with Application to Pre-crash Detection and Warning'.These systems allow vehicles to share GPS-based information, such as latitude, longitude, speed and heading, as well as important vehicle data such as brake events, throttle position, turn signal status, etc. A pre-crash detection and warning system in a host vehicle (i.e. vehicle of interest) needs to accurately determine not only the position of each remote vehicle in its vicinity, but also the context of the driving environment because the context can provide important information about whether or not the remote vehicle poses a threat to the host.

Dr. D. Selvathi, P. Pavithra, T. Preethi 'Intelligent Transportation System for Accident Prevention and Detection.'This paper provides an intelligent system for two wheeler accident prevention and detection for human life safety. The prevention part involves Smart Helmet, which automatically checks whether the person is wearing the helmet and has non- alcoholic breath while driving. The relay does not ON the engine if these two conditions are not satisfied.

N. Watthanawisuth, T. Lomas and A. Tuantranont. 'Wireless Black Box Using MEMS Accelerometer and GPS Tracking for Accidental Monitoring of Vehicles'.In this work, wireless black box using MEMS accelerometer and GPS tracking system is developed for accidental monitoring. The system consists of cooperative components of an accelerometer, microcontroller unit, GPS device and GSM module.

Md. Motahar ul Islam A. E. M Ridwan Mekhala Mariam Mary 'Design and Implementation of a Smart Bike Accident Detection System' In this paper, we have proposed a system that detects bike accidents using MPU6050(gyrosensorandaccelerometer), SIM808(GPS+GPRS+GSM),Raspberry Pi 3 Model B and Arduino Uno.

Sayanee Nanda, Harshada Joshi, Smita Khairnar 'An IOT Based Smart System for Accident Prevention and Detection'.This system detects accidents by vibration sensors, accelerometers. For detection, we use GPS and GSM module which locates the site of the accident and correspondingly informs the person's near ones and nearby hospitals through a text message.

Amir Mukhtar, Tong Boon Tang'Vision Based Motorcycle Detection using HOG features'.This method involves the fusion of shape, color and corner features to hypothesize motorcycle locations in a video frame. The hypothesized locations are then classified using a support vector machine (SVM) classifier trained on histogram of oriented gradients (HOG) features of motorcycle database.

KEY COMPONENTS AND MODULES OF THE APPLICATION

1. Internet of Things (IoT): The Internet of Things (IoT) refers to the interconnected network of physical devices, vehicles, appliances, and other objects embedded with sensors, software, and network connectivity, enabling them to collect and exchange data. This seamless communication allows for efficient datadriven decision-making and automation across various domains, such as healthcare, agriculture, smart homes, and industrial processes. IoT enhances real-time monitoring,

facilitates predictive analysis, and promotes intelligent interactions between devices, ultimately improving productivity and user experience.

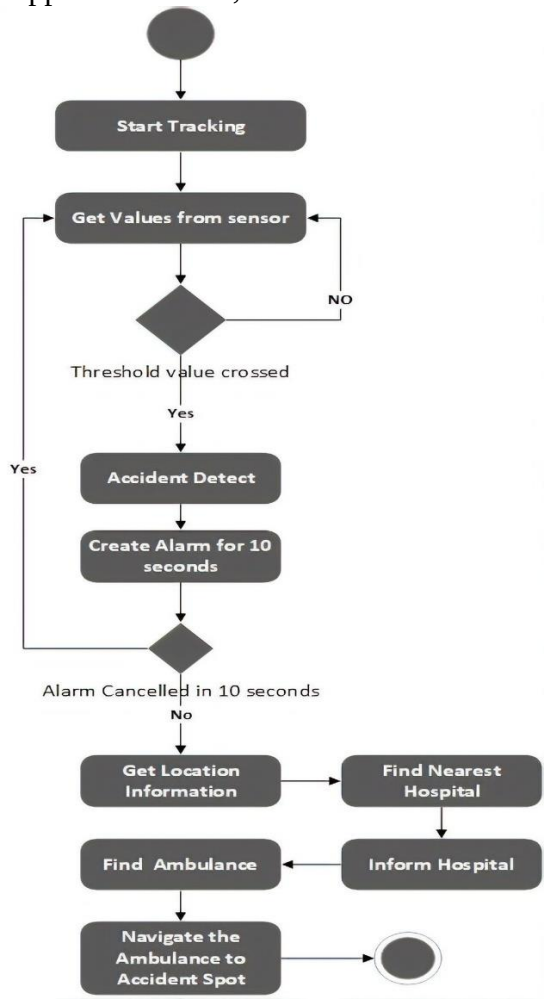
2. Sensor Fusion: Sensor fusion integrates data from multiple sensors to enhance accuracy and reliability in understanding an environment. By combining inputs from diverse sources like cameras, accelerometers, and gyroscopes, it creates a comprehensive and more robust representation of the surroundings. This synergistic approach compensates for individual sensor limitations, reducing errors and improving overall system performance.

3. GPS Module: A GPS (Global Positioning System) module is a compact electronic device that receives signals from a network of satellites to determine its precise location on Earth. It integrates a receiver to capture signals transmitted by multiple satellites, enabling accurate triangulation to calculate latitude, longitude, and altitude. These modules typically consist of a GPS receiver chip, antenna, and processing unit. Widely used in navigation systems, mapping applications, and location-based services, GPS modules provide real-time positioning information.

4. Microcontroller: A microcontroller is a compact integrated circuit containing a processor core, memory, and programmable input/output peripherals. It serves as the brain of embedded systems, executing pre-programmed tasks in devices like appliances, automobiles, and electronic gadgets. Designed for specific applications, microcontrollers facilitate real-time control, sensing, and data processing. They range from simple 8-bit controllers to advanced 32-bit architectures, each tailored to diverse tasks.

ACTIVITY DIAGRAM

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency.



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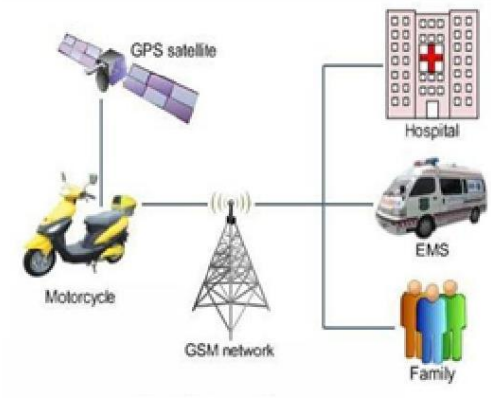
Architecture of Motorcycle Crash Detection using IoT



RELEVANT MATHEMATICS ASSOCIATED WITH THE PROJECT

The following terms shows in detail working of project:

$S = \{s, e, X, Y, \varphi\}$

Where,

s = Start of the program.

1. Log in before ride.
2. Access contacts and location.

e = End of the program.

User can download file.

X = Input of the program.

Input should be File which is uploaded by user.

Y = Output of the program.

User can download file if and only if user have both OTP and secrete key.

$X, Y \in U$

Let U be the Set of System.

U = Client, OTP, Sk.

Where,

Client, OTP, Sk are the elements of the set.

Client = User

OTP = One Time Password

OTP is generated by system and required to user for downloading file.

Sk = Secret key

Sk is generated by system and required to user for view or downloading file.

φ = Failures and Success conditions.

• Success Conditions:

1. Search the required information from available in Datasets.
2. User gets result very fast according to their needs.

• Failure Conditions:

1. Unable to access location during emergency.
2. Hardware failure.
3. Software failure.

TECHNOLOGIES USED IN MOTORCYCLE CRASH DETECTION

1.Internet of Things (IoT):

IoT is at the core of this project, as it involves the use of interconnected sensors, devices, and networks to collect, transmit, and analyse data related to motorcycle Crashes.

2.Sensor Technology:

The project relies on various sensor technologies, including accelerometers, gyroscopes, and GPS modules, to gather data about the motorcycle's motion and location.

3.Embedded Systems:

The development of the system involves creating embedded systems using microcontrollers or microprocessors to process sensor data and trigger responses.

4.Data Analysis and Machine Learning:

Data analysis is crucial for accurate Crash detection. Machine learning algorithms may be employed to process and interpret sensor data effectively.

5.Mobile Application Development:

The user interface is facilitated through a mobile application, requiring expertise in mobile app development, user experience (UX) design, and user interface (UI) design.

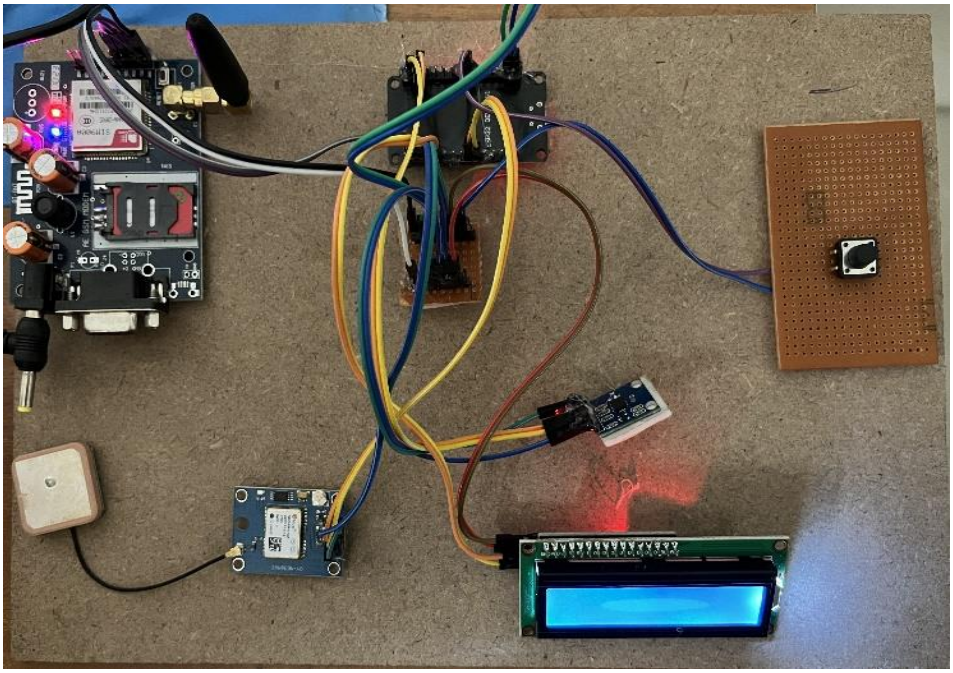
6.Wireless Communication:

The project utilizes wireless communication protocols to transmit data from the motorcycle to remote servers or emergency services, which involves knowledge of communication standards such as Wi-Fi, cellular networks, or IoT-specific protocols.

7.Geospatial Technology:

Accurate location tracking is vital, and this involves geospatial technologies like GPS and potentially geographic information systems (GIS).

Results Of The Research



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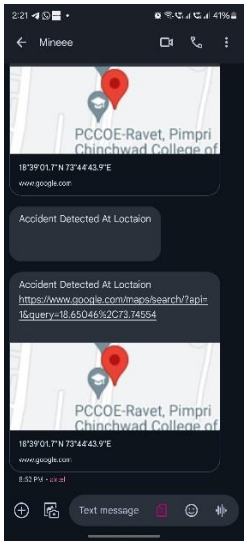
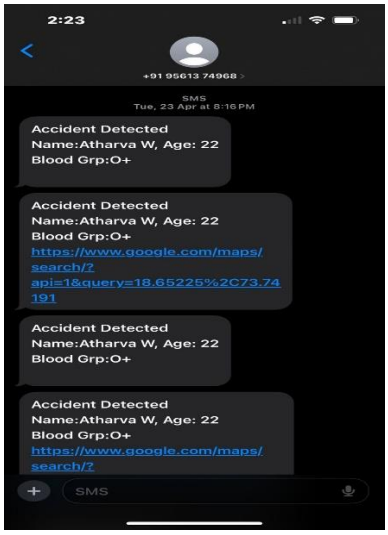
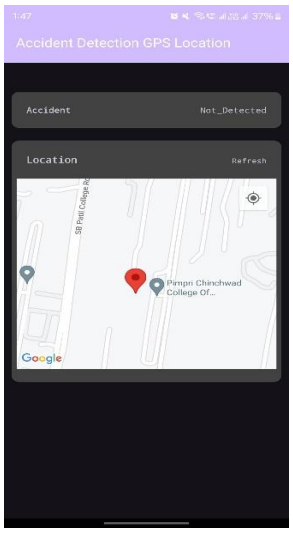


1.Parent Message



2.Emergency Message



3. Andriod Application

Conclusion

Motorcycle Crash Detection using IoT holds great promise for improving rider safety and minimizing the severity of injuries resulting from accidents. By leveraging the capabilities of IoT, this system addresses the critical issue of response time in emergency situations. Early detection and rapid communication of crash events empower emergency services to provide timely assistance, potentially saving lives. However, successful implementation requires careful consideration of factors such as sensor accuracy, algorithm reliability, and communication robustness. Additionally, user acceptance and privacy concerns must be taken into account to ensure widespread adoption of such systems. As technology continues to evolve, there is the potential for further enhancements, including the integration of artificial intelligence for more sophisticated crash detection algorithms and the development of smart protective gear that can communicate with the motorcycle and emergency services. Ultimately, Motorcycle Crash Detection using IoT represents a significant step towards creating a safer environment for motorcyclists and reducing the impact of accidents on both riders and society as a whole

References

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