IoT Based Accident Detection System

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Abstract*— IoT-Based Accident Detection System helps save life of travellers. Traffic accidents are a major global concern, causing fatalities, injuries, and economic losses. Delays in receiving emergency assistance significantly impact these outcomes. This paper proposes an IoT-based Accident Detection System to expedite aid arrival. The system utilizes sensors like tilt sensors and vibrational sensors to detect sudden vehicle jolts or rollovers indicative of accidents. Embedded GPS modules pinpoint the accident location. Upon detection, the system transmits real-time data - including location, potential severity (based on sensor readings) to a central server. The server then triggers automated emergency response protocols, notifying emergency services and potentially pre-registered contacts. This intelligent system aims to reduce response times, streamline emergency response, and ultimately, save lives by ensuring faster medical attention to accident victims.

Index Terms*— accidents, fatalities, IoT, location, protocols, sensors, victims

I. INTRODUCTION

Humans are now able to live above all other living beings on the globe in terms of civilization because to the development of transportation. Cars have a big impact on our daily lives. Individuals utilise it to commute to work, communicate with friends and family, and move their goods. However, it may also hurt us and maybe lead to our accidental deaths. Speed is one of the biggest and most basic causes of hazard when driving. It affects both the severity of a crash and the probability of one occurring. Even with the massive efforts made by different governmental and non-governmental organisations worldwide through various programmes to raise awareness against irresponsible driving, accidents still happen periodically and so is the emergency. As a result, there are more car crashes in different cities. The number of deaths that occur by accident is rising in contemporary times. There won't be anyone there to save the victims of an accident on a national highway since there aren't enough emergency rooms or rescue teams. In the event of a car accident, our publication recommended that as soon as practical, an automatic signalling mechanism be employed to alert people to the risk. This is due to the possibility of fatalities from waiting too long. Consequently, an accident will be promptly identified by this technology, which will then relay the information to the correspondent relative and the rescue team. [1]

II. LITERATURE SURVEY

Murat Ozbayoglu et al [2016], In their article, Murat Ozbayoglu and Gokhan Erdogan suggest utilising big data and computational intelligence to create an autonomous system that can predict highway accidents in real time. The system gathers real-time video feeds of highways via a network of cameras. The video streams are subjected to computer vision techniques like as background removal in order to identify stopped vehicles, which could potentially signify an accident. The video contains a number of features that are retrieved, including the vehicle's speed, direction, and location. To determine whether an occurrence is an accident or not, these features are fed into a neural network model that has been trained on a variety of traffic event datasets. The neural network gains accurate accident recognition through training. The suggested system demonstrated 95% accuracy in real-time accident detection during testing, with low rates of false positives and false negatives. The system makes use of big data frameworks like Apache Spark to handle the massive volumes of multimedia data, enabling scalable and quick processing. The authors show how the integration of deep learning and big data analytics might facilitate the development of intelligent transport systems that increase road safety by automatically identifying incidents in a timely manner and alerting relevant parties. [2]

Kavya K1 et al [2016], In this study, an automated system utilising a Raspberry Pi microcontroller for accident detection and informed emergency service dispatch is proposed. An accelerometer is used by the system to identify abrupt changes in velocity that point to an accident. In addition to a GPS module to determine the coordinates of the accident. Using a GSM module, the system immediately notifies emergency contacts by text message when an accident is detected, including information such as the position and time of the incident. In order to assist emergency responders in determining the seriousness of the accident, a camera module that has been triggered on accident detection takes pictures of the site, uploads them to cloud storage, and sends them. The closest hospital or ambulance to dispatch for rescue operations is found using the GPS's position coordinates. The Raspberry Pi serves as the system's brain, analysing sensor data, notifications and media uploads are initiated in the event of an accident. The system's primary innovation is the integration of several sensors and modules via the Raspberry Pi, which enables speedy accident detection, alerting, and informed emergency service dispatch for faster reaction times. The Raspberry Pi platform enables low-cost, rapid prototype development. All things considered, the system shows how automated accident detection and knowledgeable rescue actions may be performed with inexpensive technology to save lives. [3]

Asad Ali et al [2015], In order to speed up emergency services' reaction times, the study describes an automated method for identifying traffic accidents and notifying them. The system interfaces with a microcontroller using a variety of sensors and modules that are mounted in a car. An accelerometer recognises abrupt variations in acceleration that indicate a collision. When an accident is detected, a GPS module tracks the location coordinates of the car and transmits them via GSM/GPRS connection. Emergency agencies can precisely dispatch services to the accident site with the use of the geographical coordinates. When an accident is detected, a camera module snaps pictures of the scene that are uploaded over GPRS. Authorities can evaluate the accident's severity with the use of these photos. When an incident is recognised, the microcontroller integrates all the parts and initiates predetermined actions, such as uploading photographs and sending location notifications for accidents. Through the automation of location tracking, accident detection, and the suggested system intends to expedite the delivery of rescue services by means of emergency notifications. The system's ability to identify incidents and instantly notify pertinent entities was demonstrated through accident simulation testing. [4]

Dogru et al [2018], In this research, a machine learning technique based on random forest classifier is presented for the purpose of detecting traffic accidents. Worldwide, traffic accidents are becoming a bigger problem, resulting in material damage, fatalities, and injuries. Rapid and precise identification of incidents can speed up emergency response times and enhance results. The suggested method creates a vector that represents the traffic state by extracting characteristics pertaining to traffic conditions from surveillance camera feeds. A random forest classifier model is trained using this vector in order to distinguish between typical and unusual traffic circumstances. Unusual circumstances could be a sign of an accident. When evaluated using real traffic surveillance data, the system outperforms competing classifier systems, recognising traffic incidents with an accuracy of 98.57%. In conclusion, this work proposes a method for detecting traffic accidents utilising random forest classifiers and computer vision techniques. By taking traffic video data and extracting feature vectors, one can train a machine to detect abnormalities in the settings, the system has a 98.57% accuracy rate for automatically and quickly detecting accidents. First responders can be dispatched to the accident scene more quickly as a result. [5]

Sumi et al [2018], In order to give emergency vehicles priority access in smart cities, this study suggests a traffic control system based on the Internet of Things (IoT) and Vehicular Ad-Hoc Networks (VANETs). Fire trucks and ambulances must arrive at the scene or destinations quickly in order to prevent fatalities. However, traffic congestion frequently makes it difficult to access and move quickly. The system makes use of VANET-enabled vehicle-to-vehicle and infrastructure-to-vehicle communication, as well as real-time traffic monitoring using IoT sensors. This makes it possible to identify emergency vehicles' routes and operate traffic lights intelligently. In order

to provide a free flow of traffic, the system can monitor emergency vehicles, assess traffic conditions in real time, and adjust lanes and signals. Its use in a mock urban setting showed that it may cut the trip time for emergency vehicles by 83%. In conclusion, this article creates a traffic management system for smart cities that combines VANET connectivity and IoT sensors to allow emergency cars to be routed first. In comparison to traditional methods, a simulation-based study verifies that the system can greatly cut down on travel time to emergency situations. This demonstrates the promise of intelligent transport systems of the future in rapidly expanding urban areas. [6]

N. Chaturvedi et al [2013] This study presents a GPS and GSM-based car accident detection and messaging system. The degree of an accident and the ensuing emergency response time are critical factors in determining the survival rate of victims. However, there are frequently delays when accident detection is dependent on eyewitness reporting. The suggested system combines vibration sensors and microcontrollers to detect accidents with GPS to identify the motion and orientation characteristics of vehicles. When a crash is detected, the system uses the GPS module to gather the accident site coordinates and uses the GSM modem to send emergency notification SMS messages to pre-programmed contacts. This makes prompt medical intervention possible. Results from testing the prototype demonstrate that accident situations are accurately identified and that text messages are sent to emergency contacts with the exact location of the incident promptly. The system's hardware is inexpensive, and it can identify and report emergencies in real time. In conclusion, this article reduces accident victim fatality rates by developing an effective vehicular accident response system that integrates off-the-shelf GPS and GSM components to automatically inform emergency services. [7]

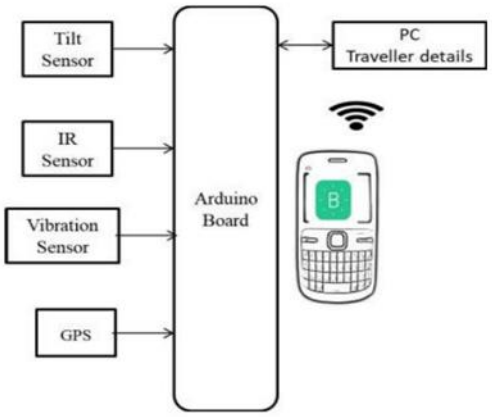
Aboli Ravindra Wakure et al [2014] This study provides an autonomous automobile accident detection and reporting system based on GPS and GSM technologies. An on-board microprocessor, sensor unit, and GPS and GSM modules are used by the system. The sensors identify events like rollovers, abrupt deceleration, and airbag deployment that point to a car collision. As soon as the GPS module detects an accident, the location coordinates are promptly obtained. The microcontroller then uses the GSM modem to relay this accident data, including location, via SMS to pre-assigned emergency contacts. This makes it possible to send medical help to the exact accident scene in a timely manner. The system's benefits include cheap cost, location-aware emergency messaging that might potentially save lives, and real-time crash reporting capabilities. [8]

Kalyani T et al [2019] An accident detection and alert system is covered in the article. It suggests a system that detects accidents instantly by utilising a variety of sensors and communication technologies. The system's goal is to automatically identify mishaps and notify emergency services in a timely manner so they can take quick action. The writers stress the need of prompt action in lowering fatalities from accidents and enhancing traffic safety. Using sensors and communication technologies, the Accident Detection and Alert System presented in the first paper seeks to identify accidents instantly. The system collects information about the motion and location of the vehicle using a variety of sensors, including GPS, gyroscopes, and accelerometers. After that, this data is examined to see if an accident has happened. In order to facilitate a prompt reaction, the system automatically notifies emergency services of any accidents it detects. It does this by giving them the location and other pertinent information. The authors stress how important it is to respond quickly in order to prevent accidents and save lives. [9]

Manisha Madhukar Ruikar et al [2013] The national statistics on traffic accidents in India are presented in this document. It focuses on the frequency of traffic accidents, their effects, injury trends, and death rates. In order to lessen the effects of traffic accidents, the author emphasises the necessity of efficient accident prevention strategies and enhanced emergency response networks. An overview can be found in the National Statistics of Road Traffic Accidents in India report of the frequency and consequences of traffic accidents around the nation. It provides data on accidents, injuries, and fatalities, emphasising the need for better emergency response systems and efficient accident prevention measures. The author stresses the significance of comprehending the trends and factors that lead to traffic accidents in order to create focused

interventions that can lessen collisions and their effects. [10]

B Sumathy et al [2021] In order to facilitate a quicker emergency response and preserve lives, this article suggests a car accident emergency alert system. The system makes use of an Arduino board that is linked to a number of installed sensors, including an accelerometer and vibration sensor in cars. As soon as these sensors are activated by the strong vibrations that follow an accident. The GPS module and GSM modem provide the accident location coordinates, which are then texted to the closest hospitals and emergency contacts. To help with emergency care, an Android app can also show patient details. To classify the severity of an accident, the vibration sensor measures the force of the collision. If the incident is serious, the system notifies an emergency centre of the event and provides its location. By using the best navigation, ambulances can arrive at accident scenes more quickly and offer medical assistance, reducing the number of fatalities. Notifications of accidents are also sent by the system to registered next of kin. In order to emulate the suggested architecture, vehicle motions and collision situations. A number of metrics, including SMS delivery time and sensor signal latency, were used to assess performance. The findings show that the system for detecting accidents and notifying emergency personnel is dependable and capable of promptly alerting medical response teams to incidents, as well as sharing victim information and location. When considering emergency reaction times, this can be far shorter than manual reporting nd coordination following incidents. [11]



III. PROPOSED METHODOLOGY

To guarantee efficient and prompt reporting of accidents, the suggested accident detection and reporting system includes a number of design features. The Following Architecture and Design Elements Can Be Inferred: A Central block which is a representation of the phone's primary processor, the Arduino B board. It is in charge of managing the other parts and operating all the software. Sensors such as tilt sensor can track when the phone tilts to navigate through a menu, among other orientational changes. IR sensor, capable of identifying infrared light, this sensor can be applied to a number of tasks such as proximity sensing and remote control. Vibration sensor, it senses when the phone vibrates and can be used to provide alerts or notifications. The acronym for the Global Positioning System is GPS. Satellites are used to ascertain the location of your phone, which you may share with others, track, or use for navigation. Traveller details, a section where personal data, including name, contact details, or emergency information, is stored for the phone's owner or user. The phone is powered by a battery. The phone's display and buttons serve as its user interface, allowing you to see content and interact with it. [12]

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