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An Iot Based Vehicle Detection And Prevention System

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Abstract- In a population growth, traffic congestion and auto accidents have reached dangerous levels. Both the number of fatalities brought on by accidents and the percentage of traffic accidents are rising significantly. The loss of a person during their lifetime can harm an entire family, even in the case of a minor traffic accident. Anywhere in the world, road safety is a serious worry. With the use of cutting-edge IoT technology, the staggering number of fatalities brought on by traffic accidents can be decreased. Platforms from the Internet of Things (IoT) have been heavily used recently to cut down on how long it takes to rescue someone after an accident. To deliver aid quickly, automatic road accident detection systems must be put in place. The literature contains numerous solutions for automatic accident detection. In the proposed system crash prediction utilizing IOT sensors and smartphones. When an accident occurs, this technology uses Wi-Fi and the internet to send a brief message to a mobile phone on WhatsApp. Sends calls and messages to emergency numbers. These techniques can be used to pinpoint the accident's site. In order to preserve road safety and save precious lives, we give a critical review of the many existing approaches used for forecasting and preventing traffic accidents in this study. We highlight their advantages, drawbacks, and issues that must be resolved.

Keywords- Accelerometer sensor, Proximity sensor, GPS

I. INTRODUCTION

IoT now play a significant part in software. IoT sensors are small, connected devices that collect and transmit data from the physical world to the digital realm, enabling real-time monitoring and automation in various applications, from smart homes to industrial processes. Numerous accidents lead to death each day. Many people die in accidents, including those who have the potential to do great things in the future like athletes, parents, and children. The primary cause of the increased risk of mortality is, however, the delay in providing emergency assistance. Many lives could be saved by successful rescue operations. The delay is due to traffic congestion or sporadic communication with the medical units. The existing system uses machine learning methods such as Classification and Regression Trees (CART), Naive-Bayes Tree (NB), Decision Tree (DT), and Gaussian Mixture Model (GMM) also used a number of IoT techniques, including GPS, RF, and GSM.The helmet was utilized to avoid accidents with IoT sensors in the prior setup.Rapid aid delivery requires the installation of automatic technologies for spotting traffic accidents.

Two sensors were used in the IoT accident detection and prevention system. Accelerometer and proximity sensors are present. Proximity sensors can indeed be used in various vehicles, including buses, bikes, and cars, to help prevent accidents. These sensor work by detecting objects or obstacles in close proximity to the vehicle and providing feedback or taking automated actions to avoid collisions. The event was detected using an accelerometer sensor. As soon as

an accident is detected, GPS collects the current position values, including latitude (N or S), longitude (E or W), and any nearby hospitals' names.

Sensors should be able to identify functions using their individual algorithms. Object tracking and Prediction Algorithm for Accident Prevention were employed in Proximity Sensor. GPS-Based Accident Detection Algorithm using Accelerometer Sensor

Accidents can be prevented with the use of an IoT accident detection and prevention system. Provide a critical analysis of the numerous existing methodologies utilized for predicting and preventing traffic accidents in order to preserve road safety and save priceless lives.

II. LITERATURE SURVEY

1. VANET

Vehicular Ad Hoc Networks (VANETs) play a crucial role in enhancing road safety through accident detection and communication. In a VANET, vehicles equipped with wireless communication capabilities exchange information with each other and with roadside infrastructure. This real-time communication enables rapid accident detection and response. When a vehicle encounters an accident or hazardous situation, it can send out warning messages to nearby vehicles, providing them with essential information about the incident, such as its location and severity. These warnings can help surrounding drivers take appropriate actions, such as slowing down or changing lanes, to avoid the accident and mitigate its consequences. Furthermore, VANETs can relay this information to emergency services, enabling a faster response time and potentially saving lives. This proactive approach to safety can significantly reduce the number of accidents on the road, improve response times, and enhance overall road safety for all users.[1]

2. MQ-3 Alcohol sensor, Infrared and webcam sensors.

These sensors can be integrated into a system to monitor and detect accidents in different contexts, such as automotive safety.MQ-3 is a gas sensor that is primarily used to detect alcohol vapor concentrations in the air. The context of accident detection, it can be integrated into a system to monitor for alcohol-impaired drivers or individuals. When alcohol vapor is detected above a certain threshold, it can trigger an alert or warning to the driver or relevant authorities. Infrared (IR) sensors are commonly used for proximity and motion detection. In an automotive context, IR sensors can be placed around the vehicle to detect nearby objects, pedestrians, or other vehicles. Sudden changes in IR sensor readings can indicate potential collisions or obstacles, which can trigger accident avoidance systems or warnings. Webcam or camera sensor can be used for visual monitoring and accident detection. In a vehicle, a dashcam or multiple cameras can record video footage of the road and surroundings. Video analysis algorithms can be employed to detect patterns of accidents or unusual events, such as sudden stops, collisions, or road anomalies.[16]

3. Automotive Accident Detection and Categorization

Automotive accident detection and categorization have become increasingly important in recent years due to advancements in technology and the pursuit of safer roads. These systems rely on a combination of sensors, cameras, and machine learning algorithms to identify and analyze incidents on the road. Accident detection typically involves the immediate recognition of events such as collisions, sudden braking, or abrupt changes in vehicle movement. Sensors like accelerometers and gyroscopes can provide crucial data to trigger alerts when unusual patterns are detected. Cameras, both external and internal, play a significant role in capturing visual evidence of accidents. Categorization is the subsequent step, where the nature and severity of the accident are determined. Machine learning models can classify incidents into various categories, such as minor fender benders, moderate collisions, or severe accidents. This categorization helps emergency services respond appropriately and dispatch resources effectively.[15]

4. NB-IoT based Road Accident Alert System

The NB-IoT (Narrowband Internet of Things) based Road Accident Alert System is a cutting-edge technology solution designed to enhance road safety by leveraging low-power, wide-area connectivity for vehicles and infrastructure. This system integrates IoT sensors, such as accelerometers and collision detectors, into vehicles to monitor real-time data regarding vehicle speed, acceleration, and impact forces. In the event of a road accident, these sensors transmit immediate alerts to a central monitoring station via the NB-IoT network, enabling rapid

response from emergency services and minimizing the time it takes to reach the accident scene. This system not only facilitates quicker emergency assistance but also aids in traffic management and accident analysis, ultimately contributing to improved road safety and reduced fatalities.[8]

5. GPS Modem

A GPS modem designed for accident detection is a compact and specialized device that integrates Global Positioning System (GPS) technology with other sensors and communication capabilities. Its primary function is to continuously track the real-time location of a vehicle or individual and analyze sensor data to identify potential accidents or collisions. In the event of a crash or sudden impact, the GPS modem can rapidly transmit location coordinates and other relevant data to a central monitoring system or emergency services, facilitating quick response and assistance. This technology plays a crucial role in enhancing road safety and reducing emergency response times by automating accident detection and reporting.[7]

6. Smart Sensors for the Bike Helmet

Smart sensors integrated into bike helmets are designed to enhance rider safety by detecting accidents and impacts in real-time. These sensors typically employ accelerometers, gyroscopes, and possibly additional technologies like GPS or Bluetooth connectivity to monitor the rider's movements and helmet orientation. In the event of a sudden and severe impact or an unusual change in helmet position, these sensors can trigger immediate alerts, such as sending notifications to emergency contacts or activating built-in safety features like automatic emergency lighting or airbag deployment. By providing rapid accident detection and response capabilities, these smart sensors aim to reduce the severity of injuries and improve the overall safety of cyclists on the road.[2]

7. RFID and Ultrasonic Sensor

Implementing Radio-Frequency Identification (RFID) technology in driving licenses has significantly enhanced accident detection systems. By embedding RFID chips in these licenses, crucial driver information, such as identity and license status, can be instantly accessed by law enforcement and emergency responders at accident scenes. In the event of an accident, RFID-equipped licenses facilitate the immediate identification of drivers involved, allowing authorities to verify their credentials and medical information. Ultrasonic sensors play a vital role in Vehicle-to-Vehicle (V2V) communication for accident prevention. These sensors enable vehicles to constantly exchange distance and proximity data with nearby vehicles. In the event of an impending collision or unsafe proximity, the ultrasonic sensors trigger instant warnings or even autonomous braking systems, reducing the risk of accidents. This real-time V2V communication enhances road safety by providing drivers with critical information about nearby vehicles, improving their ability to respond to potential hazards and avoid accidents. [3]

8. Two wheeler Accident with call control

In the unfortunate event of a two-wheeler accident, call control systems integrated into modern vehicles can prove to be lifesaving. These systems utilize various sensors, including accelerometers and GPS, to detect a collision. Upon impact, the system automatically initiates a call to emergency services, providing them with the precise location of the accident. Simultaneously, it can alert predefined emergency contacts, such as family members, through SMS or phone calls. This swift response ensures that help arrives promptly, potentially reducing the severity of injuries and improving the chances of survival for the rider involved in the accident. Such technology showcases the valuable role of connectivity in enhancing safety on the road.[6]

9. Iot Detection System with Smart Brake Control

An IoT (Internet of Things) detection system with smart brake control is a cutting-edge technology that significantly enhances road safety. In this system, various sensors, such as accelerometers, GPS, and collision detectors, continuously monitor a vehicle's speed, position, and surroundings. When a potential collision or hazard is detected, the system triggers an alert. One of the standout features of this system is its smart brake control. It can autonomously engage the vehicle's brakes or provide assistive braking to reduce the severity of a collision.

Moreover, the system can transmit real-time data to a central monitoring center, which can swiftly dispatch emergency services if needed. This integration of IoT and smart brake control not only helps prevent accidents but also mitigates their impact when they occur. It represents a significant advancement in vehicle safety, showcasing how technology can actively protect drivers and

passengers on the road, ultimately saving lives and reducing the severity of accidents.[17]

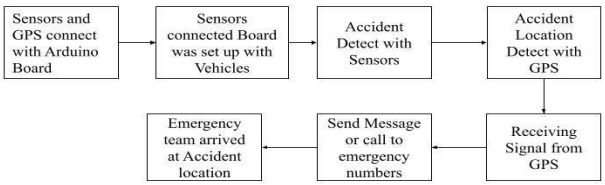
10.Shock Sensor and GPS

A shock sensor, typically installed in vehicles, detects sudden and significant impacts, such as those caused by accidents or collisions. When an impact is detected, the system immediately triggers an alert.The integrated GPS technology plays a pivotal role by providing precise location data at the moment of impact. This location information is transmitted to emergency services, allowing them to swiftly respond to the accident scene.

Additionally, the GPS data can be sent to authorized contacts or a central monitoring center, enabling quick assistance from loved ones or professional assistance, depending on the severity of the accident. Together, the shock sensor and GPS system enhance road safety by reducing response times and ensuring that help arrives at the accident site promptly. This technology is crucial in saving lives and minimizing the consequences of accidents on the road.[18]

III. METHODOLOGY

IoT vehicle accident detection systems use sensors and GPS to find accidents. The Arduino Board's pins for the sensors and GPS are linked. There are two distinct kinds of sensors. Both proximity sensors and accelerometer sensors are included. Proximity sensors use an algorithm called Object Tracking and Prediction to identify objects. Proximity sensors keep track of nearby objects or vehicles, alerting users and instituting safety precautions as they approach designated danger zones.Through satellite earth, an accelerometer sensor may find the location of an accident. Accelerometer sensors are used to locate accident locations using a GPS-based algorithm. It is used to identify unexpected changes in movement or speed that could indicate accidents. GPS trackers locate objects and alert emergency services. GPS can call or send messages to hospital helplines or emergency numbers. When the healthcare team finally arrives at the scene of the accident, everyone is safe



1. Accident Prevention

Proximity sensors are used in accident prevention in a variety of ways. It works by emitting a signal, such as infrared light or ultrasonic waves, and measuring the time it takes for the signal to bounce back after hitting an object. Proximity sensors to maintain a safe distance between the vehicle and the vehicle in front of it, detect when an obstacle is in front of the vehicle and apply the brakes automatically if the driver does not react, detect vehicles in the driver's blind spots and alert them with a visual or audible warning and detect when the vehicle is drifting out of its lane and alert the driver with a visual or audible warning.

1.1 Object Tracking and Prediction Algorithm

Object tracking and prediction algorithms are fundamental in computer vision and autonomous systems, enabling the continuous monitoring and forecasting of object movements within a dynamic environment. Object tracking involves detecting and following objects over time, employing techniques like feature extraction and data association to maintain their identity across frames. Concurrently, object prediction algorithms utilize motion models and state estimation to anticipate an object's future position, incorporating environmental factors and uncertainty estimates. These algorithms are pivotal in applications such as autonomous vehicles, surveillance, and robotics, allowing for real-time situational awareness, collision avoidance, and informed decision-making in scenarios where objects' trajectories must be understood and predicted for safe and effective interactions.

1.2 Accident Detection

To detect accidents, accelerometer sensors are typically programmed to look for sudden changes in acceleration. For example, if a vehicle is involved in a collision, the accelerometer sensor will detect the sudden change in speed and send a signal to a

microcontroller. The microcontroller can then trigger an alarm, send a message for help. Accelerometer sensors are used in conjunction with other sensors, such as GPS, to provide more accurate information about the accident location and severity. GPS data can be used to determine the latitude and longitude of the accident. Accelerometer sensors are a key component of many accident detection systems. They are relatively inexpensive and easy to use, making them ideal for a wide range of applications.

1.3GPS Based Algorithm

A GPS-based algorithm for accident location detection utilizes Global Positioning System data to estimate the location of a vehicular accident. By analysing the vehicle's GPS coordinates before and after the incident, the algorithm can calculate the accident's approximate geographical position. However, the accuracy of this method may be influenced by factors like signal obstructions, urban environments with tall buildings, and the quality of GPS receivers. To improve precision, some systems may incorporate additional sensor data, such as accelerometers or gyroscopes, for a more comprehensive understanding of the accident's dynamics and location.

IV. PROPOSED SYSTEM

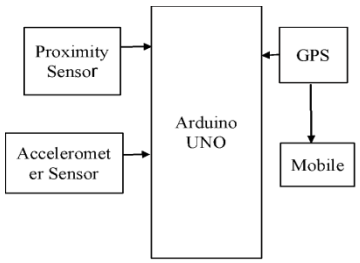
In order to build a complete safety solution, the suggested system for IoT accident detection and prevention combines proximity sensors, accelerometer sensors, and GPS technology. Proximity sensors placed on vehicles can continuously monitor the distance between them, enabling the system to detect potential collisions in real-time. The accelerometer sensor provides crucial data on vehicle acceleration, deceleration, and sudden movements, helping the system identify erratic driving behavior and trigger alerts.

Meanwhile, GPS technology tracks the precise location of vehicles , allowing the system to calculate their relative positions and predict potential accident scenarios. When a potential accident is detected, the system can instantly send alerts to the vehicle , or even autonomously apply vehicle brakes or warn drivers to take corrective actions, thus significantly reducing the risk of accidents in various traffic. Additionally, this system can collect valuable data for analysis, helping authorities and organizations better understand accident-prone areas and take proactive measures to enhance road safety. By integrating these sensors and technologies into a cohesive IoT framework, the proposed system aims to mitigate accidents and improve overall safety on the roads, ultimately saving lives and reducing the societal and economic costs associated with accidents.

1. Working Principle

The sensors in the IoT-based accident detection system are operated by an Arduino board. The appropriate pins on the sensors are used to link them to the Arduino board. Connect the proximity sensor to the Arduino Uno by connecting its VCC pin to 5V, GND to GND, and the OUT pin to any digital input pin, like pin 2. This sensor will help detect the presence of objects or obstacles in the vicinity of the vehicle. For the accelerometer, connect its VCC to 3.3V (to ensure compatibility with the Arduino Uno), GND to GND, SDA to A4 (SDA), and SCL to A5 (SCL). Install the necessary libraries, such as the "Wire" library, to communicate with the accelerometer over I2C. Collect accelerometer data to monitor the vehicle's acceleration and detect unusual movements or collisions. Wire the GPS module by connecting its VCC to 5V, GND to GND, TX to RX (pin 0), and RX to TX (pin 1) on the Arduino. Install the "TinyGPS++" library to parse GPS data effectively. Continuously read GPS data, including latitude and longitude, to track the vehicle's position.

In your Arduino code, integrate logic that combines data from these sensors. Analyze the accelerometer data to detect abrupt changes in motion, which may indicate an accident. Use GPS data to determine the vehicle's location at the time of the event. When an accident condition is met, trigger actions like sending alerts, recording accident details with GPS coordinates, or activating safety measures. This comprehensive system allows for real-time accident detection and precise accident location tracking for improved safety and response.[21]



2. REQUIREMENTS

	
I : Arduino UNO	II : Accelerometer Sensor
	
III : Proximity Sensor	IV : GPS

3.Arduino UNO

The ATmega328P microprocessor is the foundation of the Arduino UNO. Compared to other boards, like the Arduino Mega board, etc., it is simple to use. The board is made up of shields, various circuits, and digital and analogue Input/ Output pins. The Arduino UNO has 14 digital pins, a USB port, a power jack, and an ICSP (In-Circuit Serial Programming) header in addition to 6 analogue pin inputs. The programming language used is called IDE, or integrated development environment. It is compatible with offline and online platforms. The Arduino is a single-board microcontroller designed to improve accessibility for applications involving interactive objects and their environment.

V. ACCELEROMETER SENSOR

An accelerometer sensor is a device that measures acceleration along multiple axes, typically three: X, Y, and Z. In the context of accident location detection, the accelerometer is often integrated into smartphones or vehicle safety systems. When an accident occurs, the sensor detects the sudden change in acceleration, which is indicative of a collision or abrupt stop. This information can be processed by software algorithms to determine the severity and location of the accident. For instance, by analyzing the direction and magnitude of the acceleration change, the system can estimate the impact's direction and, in some cases, triangulate the accident's location. This data can then be used to trigger automatic emergency services calls, notify emergency contacts, or log the accident's location for future reference, enhancing overall safety and response efficiency.

VI. PROXIMITY SENSOR

Proximity sensors play a crucial role in accident prevention by detecting the presence or proximity of objects or obstacles in the vicinity of a vehicle or machinery. These sensors typically use various technologies, such as infrared, ultrasonic, or capacitive sensing, to measure the distance between the sensor and nearby objects. In accident prevention systems, such as those in autonomous vehicles or industrial machines, proximity sensors continuously monitor the surroundings. If an object comes too close to the sensor, the system can trigger various safety measures. For example, in an autonomous car, a proximity sensor might detect an approaching vehicle or pedestrian and prompt the vehicle's autonomous system to slow down or take evasive actions to avoid a collision. In industrial settings, proximity sensors can shut down or slow down machinery if they detect the presence of an operator or an object within an unsafe proximity, preventing accidents and ensuring worker safety.

VI. GPS

In an accident detection system, GPS (Global Positioning System) works by continuously receiving signals from a network of satellites orbiting the Earth. These satellites transmit precise timing and location information to GPS receivers installed in vehicles. The GPS receiver calculates the vehicle's exact latitude and longitude coordinates based on the time it takes for signals from multiple satellites to reach it. In the event of an accident, the system records the vehicle's GPS coordinates before and after the incident. By comparing these coordinates, the algorithm estimates the accident's location. However, GPS-based accident detection may have limitations in densely populated urban areas with signal obstructions or in tunnels. To enhance accuracy, the system may incorporate data from other sensors, such as accelerometers, to detect rapid changes in the vehicle's speed and direction associated with an accident, providing more reliable accident location information.

VII. CONCLUSIONS

IoT sensors were used to automatically detect and prevent accidents. Different kinds of sensors are used by different kinds of vehicles. This method allows us to immediately recognize mishaps when they

happen. Accident rates are rising along with the number of cars on the road. Accidents are primarily caused by drinking alcohol, being sleepy, and poorly constructed vehicles. The suggested system offers a quick, affordable, and effective answer to each of these issues. Also offers a practical means of reducing the rising number of accidents. This project offers a vehicle accident alert and detection system that sends SMS messages to user-defined mobile numbers. The brain of the system, Arduino, assists in sending messages to various system components.

This accident detection system can automatically track geographic data and issue an SMS accident notice. When an accident occurs, accelerometer sensors will be triggered, and information will be sent through GPS module to the registered number. The location can be provided through the tracking system using GPS to cover the area's geographic coordinates. This improved the project's dependability and user- friendliness.

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