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Automobiles Based Black-Box System Using IOT Based on CAN Protocol

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***Abstract* - Automobiles and computing technologies have enabled new levels of data services in automobiles. The functions of an automobile black box are quite similar to those of an airplane black box. It is employed to determine the reason behind auto accidents and to stop the loss of life and property that results from them. A vehicle-installable prototype of an automobile black box system is proposed in this project. By objectively recording what happens within the cars, the system seeks to accomplish accident analysis. By preventing the recorder data from being altered, the technology also improves security. The Arduino controllers are used to regulate the sensors, GSM and GPS. The primary goal of this project is to create a vehicle black box system prototype that can be placed in any car worldwide. Usually, this prototype is made using the fewest possible circuits. This lowers the death rate by creating safer cars, treating crash victims better, sharing the real-time location of collisions, assisting insurance companies with their vehicle crash investigations, and improving road conditions.**

Keywords: Automobiles, Arduino, GSM, GPS, Live location.

I. INTRODUCTION

According to the World Health Organization, there are about 1.35 million deaths and 20-50 million injuries as a result of the car accident globally every year. Especially, a certain proportion of deaths and injuries are due to untimely treatment and secondary accidents which results from that rescue agency and vehicles around accident cannot obtain quick response about the accident. Therefore, it is vital important to develop an efficient accident detection method, which can significantly reduce both the number of deaths and injuries as well as the impact and severity of accidents.

Road accidents can occur for a variety of reasons, such as poor road construction and maintenance, traffic congestion, and an increase in the number of cars on the road. In addition, the situation has been made more difficult by drivers' and other road users' lack of road etiquette. A significant loss for our country is the large number of young people dying on the highways due to reckless driving, intoxicated driving, and other causes.

This initiative aims to transform the field of auto accident investigation by recording data such as speed, vehicle temperature, and engine temperature. It can also be used for accident warning and vehicle mapping using GPS and GMS technology. Black box systems are the first step in resolving this issue, which crosses national boundaries and jeopardizes people's health and safety everywhere. As you are aware, the present rates of accidents can occur for a number of causes. It is important to consider the aftermath of an accident and to get ready for insurance and claims. The policy contains various clauses. Enforcing any agreements requires the appropriate paperwork. This dark box will assist you in reaching that Black Box aids in the settlement of your claim with your insurance provider. Additionally, an accident tracking system will be implemented. Your home contact number will receive a warning message with the vehicle's current GPS location when it is involved in an accident. This system is helpful in saving lives. A black box serves as a safe storage system in theory endures in its entirety in all environmental circumstances. The black box uses a memory card to store different vehicle parameters.

II. LITERATURE REVIEW

[1] In order to reduce the loss of life and property due to vehicle accidents, this research study suggests a prototype for an automobile black box system that may be fitted into cars. The system uses 12 sensors to track several aspects of driving behaviour, including the usage of external sensors like a camera and a Global Positioning System (GPS) to gather video and location information. For later retrieval in the event of an accident, the sensor data is stored on an SD card mounted on a Raspberry Pi controller. Data encryption is used by the system's security module to protect the data saved on the SD card. To get first assistance started as soon as possible, the suggested method uses GPS to transmit a brief message containing the location of the car to a family member, emergency services, and the closest hospital. The report also offers a summary of the system's major parts.

[2] The article talks about how important it is to drive safely and introduces a new black box device that can be installed in any kind of car to record what happens in an

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accident. The concept of intelligent transportation systems (ITS) and safety applications that help prevent accidents or respond appropriately in the case of an accident are explained in the article. The article examines the deployment of safety applications in networks of vehicles with On Board Units (OBUs) and Road Site Units (RSUs). The taxonomy of safety apps is based on communication type, and they are split into two categories: event-based applications, which rely on event recording to gather data and transmit alerts, and communication-based applications, which need a specialised infrastructure made up of OBUs and RSUs. The essay also discusses fundamental safety principles and how VANETs depend on dedicated short-range frequencies (DSR) and the global positioning system because they are latency-sensitive (GPS). The usage of specialised infrastructure or intelligent vehicles is not necessary for the new black box system described in the article.

[3] The design and creation of a "Black Box for vehicles" that can be installed in any vehicle to track the origin, occurrence, and location of accidents are covered in the article. The system includes several sensors, such as RPM, steering touch, and accident sensors. It also has an audio/video recorder that starts recording as soon as the airbags deploy in the case of an accident. When an accident occurs, the system logs the parameters it was tracking at the moment, and it also uses GPS/GSM to send a message to the control center containing the accident's location. According to the report, this method could enhance driver safety and avoid auto accidents, ultimately lowering the fatality rates from incidents involving transportation.

[4] A prototype black box for vehicles that may be fitted in any vehicle is discussed in the study paper. The black box technology can be crucial to car crash investigations, similar to flight data recorders in aircraft. The prototype offers comprehensive information about the vehicle, including a navigation system that works in tandem with Google Earth and artificial intelligence support through a channel of communication between the user and the vehicle. The report also covers the use of car-to-car communication to assess abruptness in the approaching vehicle prior to a collision. Also covered are the hardware and software resources needed for the black box system. Better crash research, collision data for research, limiting the speed of the car in accident-prone areas, and wireless communication through the transmission of an alert message in the event of a collision along with the time and location coordinates through GSM are all applications of the black box system.

[5] The development and application of a digital driving system for a semi-autonomous car that enhances the driver-vehicle interaction and incorporates black box features are discussed in the article. The system converts all control data from analogue to digital format using an ADC and displays it on an LCD using an Arduino-based data acquisition device. It incorporates GPS, GSM, and ESP01 for a variety of functions and utilises embedded networking through CAN for effective data transfer. The black box is physically mounted within the vehicle, connected to a GPS system, and equipped with a number of sensors that measure various data in order to pinpoint the root of any problems. The system also consists of MCP2515 modules for data transfer, and received data is passed by Arduino NANO to I2C LCD. A review of the literature is included in the methodology section of the paper and covers topics like programming an Arduino to accept messages from the CAN bus, simulating and testing an automotive CAN bus, and various hardware and software methods for collecting data from CAN buses. Keywords like "Black Box," "Passengers," "Incident Detection," "Data Parameters," "Micro Controller," etc. are used to summarise the content.

[6] This research study examines an improved black box for cars that can communicate with the driver and provide comprehensive information about the vehicle, including a navigation system that works with Google Earth and artificial intelligence help. In addition to outlining the value of black box technology in automobile crash investigations, this study also introduces a prototype that can be built with the fewest possible circuitry. Together with live analysis through tests, the prototype is also intended to allow car-to-car communication for assessing abruptness in the approaching vehicle before it wants to collision. The paper discusses the hardware and software resources employed by the black box system and its applications, such as better crash research, enhanced driver education programmes, safer road designs, and wireless communication by transmission of alert messages in the event of collisions along with the time and location coordinates through GSM.

[7] The article talks about a black box system for contemporary transportation vehicles that logs information on things like position, fuel level, speed, and engine parameters like temperature and pressure. The system uses measurement, identification, analysis, and reporting as its four data collecting and analysis layers. A pressure sensor, temperature sensor, fuel tank, and GPS receiver are just a few of the sensors that the first layer uses to gather data. A microcontroller processes the gathered data, which is then entered into a database. Based on the data gathered in the database, the last layer offers feedback. In order to give analysis as feedback to the driver and/or other parties, the system intends to capture information on the technical state of the vehicle and how it was operated.

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III. SYSTEM DESIGN

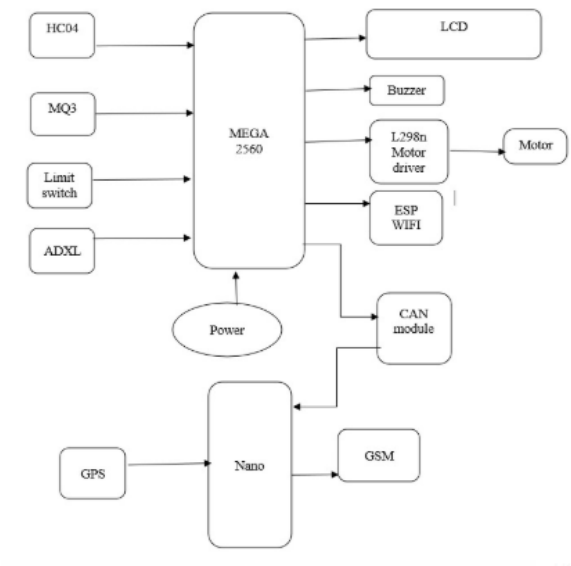

Figure 1: Block Diagram

- This proposed study uses GPS and GSM technology to track vehicles using an innovative accident detection system. Every time the vehicle starts, this system makes use of a temperature sensor, an alcohol sensor, a speed sensor, a microcontroller, an LCD, a GPS module, and a GSM module.
- At this point, the entire sensor begins reading parameters and enters active mode to monitor the vehicle's performance. since all sensor data is received by the control unit. After that, the LCD will show every parameter value at once.
- A microcontroller serves as the suggested system's central component in this setup. The microcontroller is connected to the peripheral sensor in its entirety.
- The system should ideally be able to read and display a variety of internal vehicle parameters, including temperature, speed, and alcohol content continuously on the LCD
- In this system, you also insert a memory card connected to the system's microcontroller. Save all parameter data When an accident occurs, GPS technology can be used to locate the specific all the time on the LCD. Additionally, a memory card linked to the system's microcontroller is inserted into this system. Save every parameter value.
- GPS technology can be used to pinpoint the exact location of an accident once it happens. The GPS module provides the system with the current location's coordinates when an accident is detected.
- To predetermine the contact number, the victim's relatives receive a warning message from the GSM module. Simultaneously, the memory card needs to contain current information that can be recovered at the gas station in order to assist insurance companies with their accident investigations.
- To read all of the data on the memory card, a PC at the service center will be connected to the memory card.

IV. RESULT AND DISCUSSIONS

This project introduces the Car Black Box System, an embedded system that uses the Arduino Mega 2560 microcontroller and Arduino NANO for design and implementation.

Experiments have been meticulously conducted. The outcome demonstrates that employing the embedded system does, in fact, result in improved efficiency.

When an accident occurs, the GPS module uses satellite data to determine the exact location of the vehicle or object. This data is shown as a latitude and longitude scale. Consequently, the Arduino is subsequently supplied the gathered data. After the necessary processing is finished, the data is sent to the GSM modem and LCD.

The information for the Arduino Uno is gathered by the GSM modem and then sent via text message (SMS) to the relevant mobile phone of the traffic police control room.

We monitor the properties of the sensor data for multiple simulated test cases or potential emergency situations. We took note of the sensor responses and divided the severity level into range values that represented low risk, minimal risk, and high danger. We will then alert the emergency responder or emergency contacts depending on these emergency scenario severity levels. The notification is also shown on LCD by the system.

V. CONCLUSION

The outcome demonstrates that employing the embedded system does, in fact, result in improved efficiency. This project is an intelligent, automated system that seldom ever interacts with humans. The suggested method addresses the detection and notification of accidents. These methods include smart phones, GPS, and GSM modules. In the event of an accident, contacting the closest ambulance using a GSM module significantly increases the victim's chances of survival. This technology helps in reducing the response time for rescue efforts, preventing further accidents, and supporting the legal process, making roads safer and improving post-accident care.

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