Accident Prevention and Blackbox System for Automobiles

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***Abstract*— The enhanced growth of technology adopted various solutions to the social problems in terms of vehicle and transport. Smart transport and intelligent vehicle dynamics provide reliable results on accident detection, frequency of accident, cause of accidents by collecting data from the real time environment. Smart sensors are installed in the highways to monitor the speed limits of the vehicles etc. the proposed system developed an intelligent accident detection and vehicle information storage system through ESP32 CAM and immediate update mechanism. The system also provides a diverse support through range of sensors such as DHT11 for temperature monitoring, Gas sensor for driver alcohol consumption detection, obstacle identification, vibration sensor for accident monitoring is included. The proposed system also considers the SD module for storage of all the event-oriented information into the cloud. Similarly, the recorded data is transmitted into Telegram bot, leveraging the IoT enabled cloud for prompt response. The system also framed with diverse communication and capable of delegating the information as self-serving model.**

***Keywords*— *Accident detection, Vehicle dynamics, Internet of things, Smart transport, Black box mechanism*.**

I. INTRODUCTION

The development of smart city considers various drawbacks in the existing transport model and evaluate solutions using latent technology. Installation of sensors for emergency scenario detection, accident monitoring, over speed monitoring are developed. Integration of large storage space of helpful to make massive storage of vehicle data into the cloud. The relevant information from the highways is stored into the solid-state storage device called SSD. These data are prompted into the cloud with secure protocols. Developing an automated logging system to keep the vehicle parameters into the cloud is considered here. The development of IoT platforms, provides secure communication and data management model. The vehicle monitoring includes fuel monitoring, speed monitoring, engine health check-up, and relevant parameters to enable centralized support.

The remote monitoring and data collection on vehicle management system provides various insights on proactive maintenance, improving the fuel efficiency, enhancing the vehicle performance etc. The automated vehicle safety monitoring system considers the security as important constraints and evaluate robust encryption standards towards the data integrity.

In certain cases, remote monitoring and diagnostics are formulated in which automated trouble shooting of smart vehicles are feasible. The security patches are altered together to form an activated security, and online troubleshooting etc.

Vehicle dynamics includes analysing the health of the vehicle engines, the prompt study on fuel usage etc. developing a smart transport system includes all the parametric on the vehicles need to be considered. The embedded system using ARDUNIO, supporting components, sensors create a robust monitoring model for vehicle management. The reliability of the embedded components are high and thus the incorporation of embedded hardware with software is considered for various innovative consumer products.

- The proposed framework fostered a clever mishap recognition and vehicle data capacity framework through ESP32 CAM and quick update component. The framework likewise offers a different help through scope of sensors, for example, DHT11 for temperature checking, Gas sensor for driver liquor utilization location, obstruction ID, vibration sensor for mishap observing is incorporated.
- The proposed framework additionally considers the SD module for capacity of all the occasion situated data into the cloud. Essentially, the recorded information is communicated into Wire bot, utilizing the IoT empowered cloud for brief reaction. The framework additionally outlined with different

correspondence and equipped for designating the data as self-serving model.
- A push-button mechanism checks for seat belt usage, contributing to passenger safety.
- The LCD display provides real-time updates on critical parameters, creating an intuitive interface for monitoring.

The remainder of the journal is figured out with existing articles study and thoughts investigation in Segment II, trailed by the framework configuration key contemplations in Area III, the framework execution technique, the cycle and the assessment of different measurements are investigated in area IV. The outcomes got in the proposed plan and its difficulties are talked about in Segment V.

II. BACKGROUND STUDY

K. Karthika et al. (2023) The presented system is based on real time recording and storage of accident data through artificial intelligence enabled camera module. The system detects the surrounding information and store the accident-related captures into the black box storage. A microcontroller enabled smart intelligent framework is implemented. Still the challenge persist with the existing development is that massive recording and data handling problems impact the results[7].

S. Yuvaraj, et al. (2023) The author presented a system in which smart black box mechanism is developed in which GPS(global positioning system) based accident location identification, tracking and information storage system is developed. With ESP32 camera, the environmental status is recorded. The system is developed towards the highways accidents monitoring, vehicle safety management and prediction of common pattern of accident scenario [8].

A. Bhakat et al. (2021) the author explored the system in which gyroscope, accelerometer enabled vehicle accident detection and alert system using IoT(Internet of things) is focused. An artificial intelligence(AI) enabled edge computing and data transfer model is evaluated. The time optimized mechanism provides optimum result in communicating the sensor data into the cloud with centralized servers [9].

G. T. Selvi et al. (2022) the author explored the accident detection and smart communication framework through GPS, sensors and IoT enabled network model. The major reason for life threatening problems in accidents are due to the time latency of emergency vehicles, to reach the location, lagging of medical help, lack of communication etc. keeping these critical constraints as important drawbacks in the existing systems, the author proposed network protocol that transfer the information rapidly into the emergency cell [10].

S. Y. B, K. Baiju et al. (2023) a smart accident detection and rescue system is discussed in the presented system. The discussed model focused on reaching the rescue team immediately when the accidents are held in the highways. An embedded system enabled rapid help seeking mechanism is discussed here. In addition, a rescue system is developed with patient monitoring system, hence the first aid treatment and monitoring of critical condition is focused [11].

III. PROPOSED METHODOLOGY*System Model proposed Black box protection system*

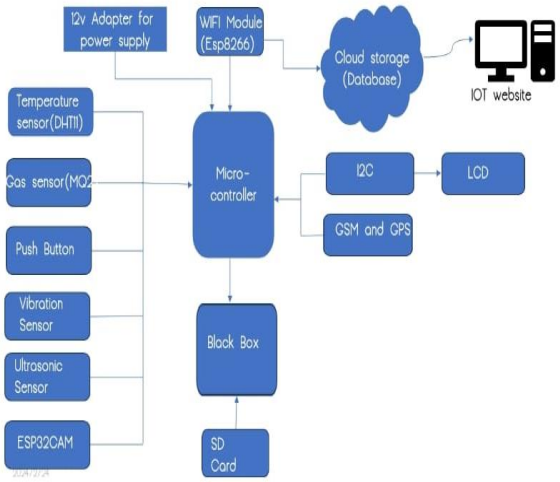

Fig 1. System model of proposed black box enabled protection system

Fig 1. Shows system architecture of proposed black box protection system using Arduino.

In proposed technique, the end vehicle is associated with the cloud utilizing ESP8266. This technique assists with following the vehicle and furthermore get the alarm from the vehicle.

The Arduino Uno fills in as the focal handling unit, working as the venture's cerebrum. Utilizing a DHT11 sensor, it identifies encompassing temperature, while a gas sensor decides the presence of poisonous gases. A ultrasonic sensor guarantees obstruction discovery, improving in general security. The ESP32CAM catches and updates pictures to a Wire bot, giving visual data. The incorporation of IoT and a SD module works with complete information stockpiling. A vibration sensor fills

in as a significant component, effectively observing for possible mishaps.

In case of a mishap, a fast ready framework is set off, scattering messages to both assigned care individuals and crisis responders. A press button component is utilized to find out safety belt utilization, adding to traveler security. The LCD show fills in as a constant data interface, introducing the most recent updates. This diverse framework exhibits an all encompassing way to deal with security, incorporating different sensors and correspondence channels to guarantee the prosperity of vehicle inhabitants and work with quick reactions to unanticipated occasions.

GAS SENSOR

Fig 2. Gas sensor

Fig 2. Shows the Gas sensor utilized for hazardous gas detection, or the existence of alcohol inside the vehicle. The sensor data is recorded and promted itno the cloud for analysis.

ULTRASOUND SENSOR

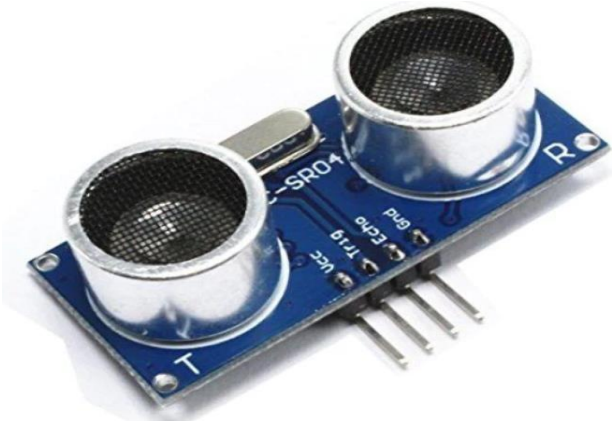

Fig 3. Ultrasound sensor

Fig 3. Shows the ultrasound sensor utilized to measure the distance. The sensor work with +5V DC supply providing the continous variations of voltage levels with respect to the distance variation.

ESP32 CAM

Fig 4. ESP32CAM

Fig 4. Shows the ESP32CAM model for recording the live visuals kept in the black box system. The data is immediately forwarded into the centralized cloud, as well as store the visuals inside the storage system for further analysis.

VIBRATION SENSOR

Fig 5. Vibration Sensor

Fig 5. Shows the vibration sensor utilized in the proposed model to detect the accident and macilanious activity in the vehicles. The sensor work with +5V DC, prompt the recorded data in the form of digital levels.

TEMPERATURE SENSOR

Fig 6. Temperature sensor

Fig 6. Shows the temperature sensor utilized to detect the engine performance, catching of fire etc. the sensor is a small electronic component convert the temperature changes into elctrical pulses. The sensor is used for crucial condition monitoring and control purposes.

GSM MODULE

Fig 7. GSM module

Fig 7. Shows the GSM module utilized to send the live location data of the accident scenario into the cloud. In case of emergency, the control unit send the location data as lattitude and logitude to the cloud to get emergency vehcile facility on time. The GSM module is provided woth dedicated SIM in which the data of important contact numbers are stacked.

IV. RESULTS AND DISCUSSIONS

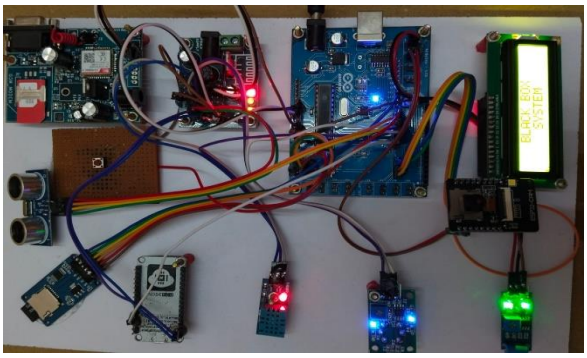

Fig 8. Integrated Hardware

Fig 8. Shows the integrated haradware on smart vehicle information management system proposed here. The system is connected with all the necessary sensors, communicate all together through Inter integrated communication (I2C) protocol. The data is prompted into the cloud for centralized accessibility.

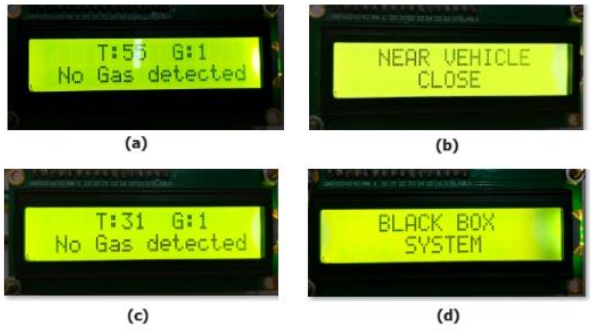

Fig 9. LCD display outputs

Fig 9. Shows the various outcomes of the proposed model having the Sensor values in (a) and (b), as well as the detection of near vehicle that alert the driver shows in (b). The enabling of black box system process is depicted in the Fig 9(d).

Fig 10. IoT Screening

Fig 10. Shows the results of IoT cloud screening showing the sensor data as live streaming. These data are recorded with time stamps. In case of any sensor range overhead from the threshold value then the IoT system send alert to the telegram bot.

The presented system is further explored by adding future forecast methods through neural network, machine learning algorithms developed within the hardware.

V. CONCLUSION

The upgraded development of innovation embraced different answers for the social issues regarding vehicle and transport. Shrewd vehicle and keen vehicle elements give dependable outcomes on accident location, recurrence of mishap, reason for mishaps by gathering information from the continuous climate. Savvy sensors are introduced in the thruways to screen the speed furthest reaches of the vehicles and so on. the proposed framework fostered a clever mishap recognition and vehicle data capacity framework through ESP32 CAM and quick update component. The framework likewise offers a different help through scope of sensors, for example, DHT11 for temperature checking, Gas sensor for driver liquor utilization location, obstruction ID, vibration sensor for mishap observing is incorporated. The proposed framework additionally considers the SD module for capacity of all the occasion situated data into the cloud. Essentially, the recorded information is communicated into Wire bot, utilizing the IoT empowered cloud for brief reaction. The framework

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