IOT BASED CAR SAFETY SYSTEM

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Abstract*— The IoT-based car safety system offers a unique way to increase road safety because it can foresee threats or accidents and react to them before they happen, as well as offer immediate aid in an emergency. We created an IOT-based car safety system as part of this project. Basically, this prevents collisions and responds quickly to fires by sprinkling water on the affected area. The system makes use of a flame sensor to quickly respond to a fire by sprinkling water on the affected area, an IR sensor to track the proximity of nearby cars and buzz if they are very close, a temperature sensor to automatically control the air conditioning, and an accelerometer sensor to recognize abnormal vibrations and deploy the air bag. These scenarios are examined, and if a fire or accident is discovered, the system will automatically send out a distress signal, alerting emergency personnel and providing information about the car's location using GPS and GSM. The driving experience is safe and comfortable thanks to this system.

Keywords—IOT, emergency, GPS.

I. INTRODUCTION

Since a few years ago, road safety has consistently risen to the top of the list of national public health concerns. For an individual's, as well as the country's, happy, healthy, and wealthy life, road safety is a crucial issue that must be addressed. Travel dangers and traffic exposure increase substantially rapidly with increasing automobile usage and a growing road network since the number of registered vehicles continue to grow faster than the population and more roads are built. According to the most recent study on "Road Accidents in India," which was conducted in 2021, "there were about 4,12,432 terrible road accident incidents, which resulted in 1,53,972 fatalities and 3,84,448 injuries in India. According to statistics, there are roughly 16 accident-related fatalities in India every hour.

One of the major causes of vehicular accidents is excessive speed. According to NHTSA, there were 5,250,873 police reported car accidents in 2020, or one accident every six minutes. Most fatalities resulting from vehicular or other types of accidents are brought on by a lack of quick medical attention and a lack of local awareness of the accident . Therefore, it appears that there is a need for quick assistance, which can be met by developing a system that can notify emergency contacts. This project specifically addresses this issue.

Since most vehicles run on combustible fuels, fires involving them are inevitable. The materials used in manufacturing them, such as plastic, foam, textiles, or electrical wiring, are the main causes of fire dangers. Unlike petrol automobiles, which caught fire owing to the fuel, electric vehicles (EVs) catch fire as a result of excessive battery heating. When it is in a minor stage, this can be examined and resolved, and a resolution for that has been considered in this project. Imagine a person travelling alone in a car on a busy road who needs to turn on the air conditioning because the temperature outside is rising. He or she cannot move to turn on the air conditioning since even a tiny lapse in vision could result in mishaps. An automatic air conditioner that turns on when it appears that the temperature is rising is necessary in these circumstances to ensure the person's safety and comfort. The project also provides a description of the remedy.All standard paper components have been specified for three reasons: (1) ease of use when formatting individual papers, (2) automatic compliance to electronic requirements that facilitate the concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceedings. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses,

following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

II. LITERATURE REVIEW

M. Vikrant et al. [1] noted a lack of a device that may be mounted on a vehicle to remind drivers of following cars to maintain a safe following distance. the main specifications for such a gadget. A flexible, self-contained device prototype was conceived, created, and tested using the study's findings as a basis. The gadget is designed to be put on a vehicle's back. Its primary distance sensor is radar, with a GPS receiver helping to estimate velocity. Data collection and processing are performed using a Raspberry Pi single-board computer. An LED-matrix display installed on the back of the host car displays the alerts. The device's Python-written software allows for automated functioning without the need for user input. The gadget may be used on practically any motor vehicle and operates dependably in both simulated and actual traffic, according to the studies.

W. Chang, L. et.al., [2] proposed a deep learning-based Internet of Vehicles (loV) system called Deep Crash, which detects high-speed head-on and single-vehicle collisions and raises alarm when the collision occur a method for detecting high-speed head-on and single-vehicle collisions, analyzing the situation, and raising an alarm is needed When a head-on or single-vehicle collision is detected, accident detection information is uploaded to the cloud-based database server for self-collision vehicle accident recognition, and a related emergency notification is provided. The experimental results show that the accuracy of traffic collision detection can reach 96% and that the average response time for emergency-related announcements is approximately 7.

S. H. Sankar et.al., [3] proposed a system to minimize the delay of emergency medical services using in- vehicle accident detection systems. The model informs the server whenever an accident occurs. The server tracks the nearest ambulance and sends the accident location to the ambulance driver. There is delay involved in each and every stage of the process, right from reporting an accident to dispatching an ambulance, till the patient is safely handed over to the casualty. Minimizing this delay can help save lives. We propose a comprehensive solution to both accident detection and ambulance management. When the in-vehicle accident detection module reports an accident, the main server automatically dispatches the nearest ambulance to the accident spot.

Halim et al., [4] surveyed Al techniques for the detection of unsafe driving system and crash predictions. A number of statistical methods that are used to predict the accidents by using different vehicles and driving features are also covered. a list of datasets and simulators available for the scientific community to conduct research in the subject domain. The paper also identifies some of the critical open questions that need to be addressed for mad safety using Al techniques.

R. S. Priya et al., [5] has proposed a implemented an idea to detect fire . Although the model is highly accurate, it provides inaccurate results when tested with close proximity images of fire. Such images are obtained through a webcam imtalled inside the forest region. Presence of smoke in the atmosphere is the indication of forest wildfires. In fire alarm systems, fire detection plays a crucial part in avoiding damages and other fire disasters that lead to social ramifications. Avoiding large scale fire, effective fire detection from visual scenes is important.

III. METHODOLOGY

To assure the driver's safety, this project consists of three steps. The fire detection and suppression system is the first phase. The accident detection and reporting to emergency centers is the second phase. The third phase combines preventing adjacent crashes with reducing the cognitive strain on the driver by automating the air conditioning.

Since most vehicles run on combustible fuels, fires involving them are inevitable. Thus, this phase comprises fire detection and automatic sprinkler systems. The fire sensor detects a fire whenever the catches, and water is automatically sprayed. In order to communicate the fire detection message to the emergency center, it also comprises GPS and GSM modules.

The jerks and odd vibrations that cause the accidents could result in severe injuries, therefore it's important to make sure that the necessary medical assistance is given. This phase includes an accelerometer sensor that continually monitors acceleration values and sends a message to an emergency center if the value is greater than a threshold value.

Accidents can also happen when vehicles in the vicinity approach without the driver's awareness. Here, IR sensors are utilized to detect the separation between vehicles and warn the driver with a buzzer if they are getting closer. In order to lighten the stress on the driver, this phase also includes automation of the AC with the aid of a temperature sensor.

IV. DESIGN AND IMPLEMENTATION

A. Block Diagram

Three phases make up the proposed system automation of the AC, fire detection, water sprinkler, accident detection and alerting, and preventing neighbouring collisions. As seen in block diagram which is illustrated in Figure 1.

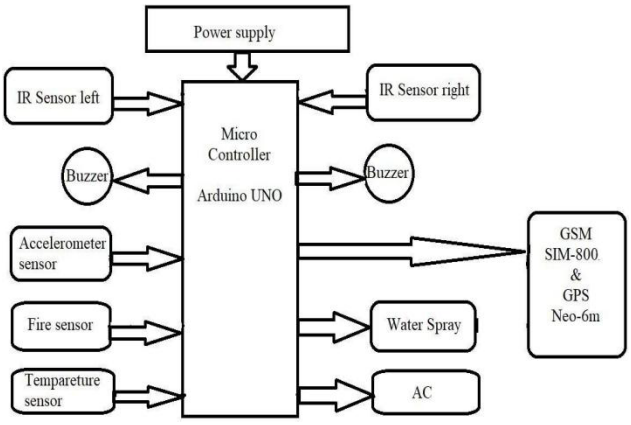

Fig. 1. Block diagram of proposed system

Steps involved in the system interface are:

Step 1: The Arduino UNO microcontroller is interfaced with the fire sensor, infrared sensor, temperature sensor, and accelerometer sensor (ADXL335).

Step 2: The output of the fire sensor is checked, and if it is high, the water sprinkler is activated, and a message with the position is transmitted through GSM and GPS to the emergency center.

Step 3: The output of the accelerometer sensor is measured and compared to a program-specified threshold value. The GPS and GSM are engaged, and the message and location are automatically sent to the emergency center if it rises above the threshold value.

Step 4: The AC automatically turns on when the output of the temperature sensor exceeds the threshold value.

Step 5: A buzzer will sound to alert the driver when the IR sensor detects other vehicles that are closer by.

B. Fire Detection and Suppression System

Figure 2 illustrates a fire detection and suppression system that uses a fire sensor to find fires. The water pump's inlet valve is coupled to a small water tank, and the sensor output is connected to the pump upon detection. To temporarily stop the fire from spreading, the pump's outlet valve is pointed directly at the fire.

The system also has an alert message feature that notifies the emergency authority of the fire's location and sends a message to them. This location detecting capability may be useful for speeding up emergency responders' arrival times and avoiding unforeseen delays in locating the fire. More importantly, this device will only operate in the event of a fire and won't do so proactively, preventing false alarms and excessive water use.

With the added benefit of a location detecting capability to aid emergency responders, this fire detection and suppression system has the potential to offer an efficient first response to a fire emergency.

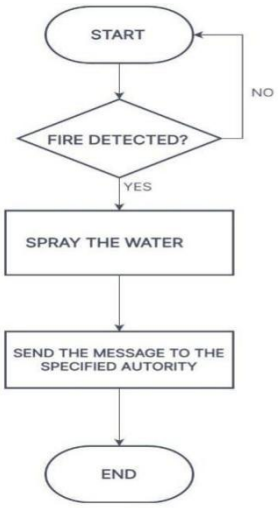

Fig. 2. Flow chart of Fire detection system

C. Accident Detection and Alert System

The X, Y, and Z axes of the ADXL335 sensor are utilized to measure the acceleration of a moving object. The microprocessor continuously receives the accelerometer's acceleration data, which are then combined with a pre-set threshold value. If the acceleration value is higher than the threshold, an anomalous vibration that could cause an accident is present. The alert system is then prompted to notify the emergency centers. The accelerometer constantly measures the acceleration values even if no accident has been observed.The process flow for the same is shown in Figure 3.

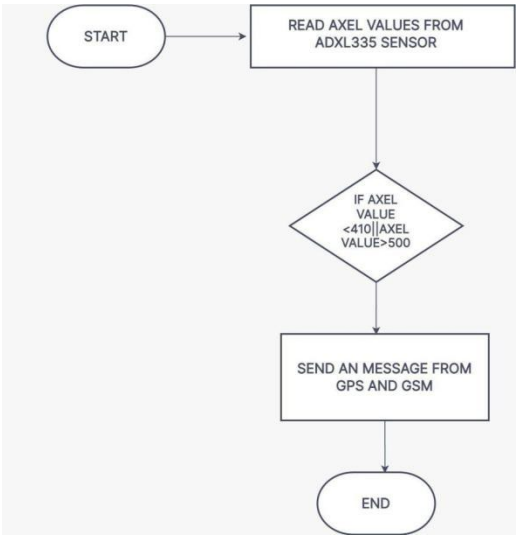

Fig. 3. Flowchart of Accident Detection system

D. Automation of AC and Adjacent Collision System

To determine the distance between vehicles and warn drivers of impending collisions, IR sensors are utilized. The vehicle's front and rear mounted IR sensors are used to identify adjacent objects, including other moving cars. A buzzer is activated to alert the driver and lower the risk of accidents brought on by driver distraction if the IR sensors determine the vehicle is too close to another object.

The technology offers an automation feature for the vehicle's air conditioning system in addition to the accident prevention feature. A temperature sensor is used to gauge the interior temperature of the car, and the air conditioning system automatically modifies to maintain a comfortable temperature based on the measurement. The goal of this automation function is to reduce the strain of the driver and free them up to focus on driving, improving overall safety and comfort for the driver and passengers.

V. RESULT ANALYSIS AND DISCUSSION

Figure 4 demonstrates that there is no fire detected since the fire sensor is off, however Figure 5 depicts the fire being detected and the sensor turning ON when the flame is moved closer to the sensor. When both sensor's LEDs are on, we may determine that the Fire sensor is ON.

Fig. 4. Fire sensor in OFF state

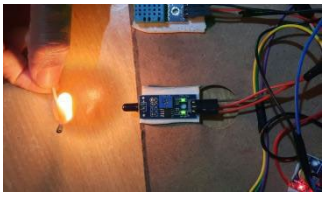

Fig. 5. Fire sensor in ON state

When fire is detected, the water sprinkler is activated, as shown in Figure 6

Fig. 6. Water sprinkler ON

Additionally, a message is sent to the registered emergency contacts containing the current position and an alarm is delivered to them through GSM and GPS modules. Figure 7 depicts the received message notice.

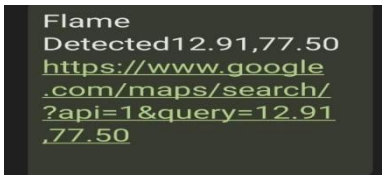

Fig. 7 Message snapshot

The alert alarm will be activated when a vehicle or item is in close proximity to a vehicle that has the aforementioned built-in system, advising the driver to take the necessary precautions.This was created with IR sensors. The same is described in Figures 8 and 9.

Fig. 8. IR sensor in OFF state

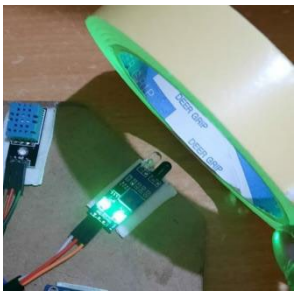

Fig. 9. IR sensor in ON state

The accelerometer will exceed a predefined threshold value in the case of a vehicle collision that causes noticeable vibrations, which will cause the delivery of an accident alert message to the registered contacts. The location of the accident will be included in this communication, enabling the right parties to react quickly and efficiently.Figure 10 depicts a screen capture of the accident detected notification.

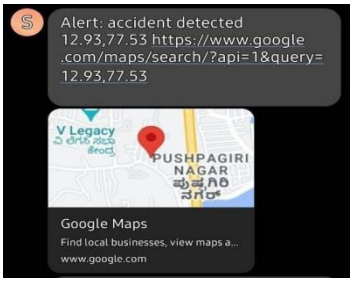

Fig. 10. Snapshot of accident alert message

Our project uses a dc motor to illustrate how the AC has turned on when the temperature rises over the predetermined value, as illustrated in Figure 11.

Fig. 11. DC motor in turned ON state.

VI. CONCLUSION

To summarize, an IoT-based auto safety system is a novel and effective solution to improve the safety and security of cars and their occupants. The system may identify possible accidents or collisions and rapidly warn emergency services or other relevant parties by combining sensors, GPS, and GSM modules.

The ADXL335 sensor, in particular, is critical to the system since it measures acceleration in three dimensions and detects rapid changes in acceleration that may suggest a collision or other safety threat. The GPS module offers real-time position data, while the GSM module allows for communication and messaging between the system and third-party entities.

To assure the system's accuracy, dependability, and efficacy, the creation and deployment of an IoT-based automobile safety system necessitate thorough planning, design, and testing. The project also necessitates expertise in programming, electronics, and IoT technologies, as well as an awareness of the target market's unique requirements and laws.

In the case of a car collision, an IoT-based auto safety system has the ability to save lives and prevent injuries. As technology advances, we can expect additional innovations and improvements in automobile safety systems, resulting in safer and more secure driving experiences for everyone.

REFERENCES

[1] M. Virant and M. Ambrož," Universal Safet y DistanceAlert Device for Road Vehicles," Electronics, vol. 5, no. 4, p. 19, Apr. 2016.

[2] W. Chang, L. Chen and K. Su, "Deep Crash: A Deep Learning-Based Internet of Vehicles System for Head-On and Single-Vehicle Accident Detection with Emergency Notification"; in IEEE Access, vol. 7, pp. 148163-148175, 2019.

[3] S. H. Sankar, K. Jayadev, B. Suraj and P. Aparna, "A comprehensive solution to road traffic accident detection and ambulance management" 2016 International Conference on Advances in Electrical, Electronic and Systems Engineering (ICAEES)Putrajaya, Malaysia, 2016, pp. 43-47, doi:10.1109/1CAEES.2016.7888006.

[4] Z. Halim, R. Kalsoem, S. Bashir, and G. Abbas," Artificial intelligence techniques for driving safety and vehicle crash predict ion," Artificial Intelligence Review, vol. 46, no. 3, pp. 351-387, Feb, 2016.

[5] S. priya and K. Vani, "Deep Learning Based Forest Fire Classification and Detection in Satellite Images", 11th International Conference on Advanced Computing (ICOAC), pp. 61-65, 2019.

[6] Z. Wang, Q. Wan, Y. Qin, S. Fan, and Z. Xiao, "Intelligent algorithm in a smart wearable device for predicting and alerting in the danger of vehicle collision," Journal of Ambient Intelligence and Humanized Computing, vol. 11, no. 9, pp. 3841-3852, Dec. 2019.

[7] Wan Q. Deng Y, Su. Optimization of a Localized Air Conditioning System Using Thermoelectric Coolers for Commercial Vehicles[J]. Journal of Electronic Materials, 2016.

[8] Pan, Hongyi & Badawi, Diaa & Zhang, Xi & Cetin, Ahmet, "Additive neural network for forest fire detection. Signal, Image and Video Processing", 2020.

[9] J.T. Su, F.H. Lin, X. W. Zhou, X. Lv, Steiner tree based optimal resource caching scheme in fog computing, China Communications, vol. 12, no.8,2015, pp: 161-168.

[10] Hui, C.C. Zhou, S.G. Xu, F.H. an, A Novel Secure Data Mission Scheme in Industrial Internet of Things,China communications, vol. 17, no. 1, 2020, pp: 73-88.

[11] J. B. K. Gangone," An Ineligible and Unauthorized Motor Vehicle Driver Access control and Sleep State Alert System: An Offline based Model," 2019 10th International Conference on Computing Communication and Networking Technologies (ICCCNT), Jul. 2019.

[12] J. K. Naufal, J. B. Camargo, L. F. Vismari, J. R. de Almeida, C. Molina, R. L. R. Gonzalez, R. Inam, and E. Fersman," A2CPS: A Vehicle-Centric Safety Conceptual Framework for Autonomous Transport Systems," IEEE Transactions on Intelligent Transportation

[13] S. Al-Youif, M. A. M. Ali and M. N. Mohammed, "Alcohol detection for car locking system" 2018 IEEE Symposium on Computer Applications & Industrial Electronics (ISCAIE). Penang, Malaysia, 2018, pp 230- 33, doi:10.1109/ISCAIE 2018,8405475.

[14] D. Tian, C. Zhang, X. Duan, and X. Wang, "An Automatic Car Accident Detection Method Based onCooperative Vehicle Infrastructure Systems" in IEEE Access, vol. 7, pp. 127453- 127463, 2019.

[15] Mukht ar, L. Xia, and T. B. Tang," Vehicle Detection Techniques for Collision Avoidance Systems: A Review," IEEE Transactions on Intelligent Transportation Systems, vol. 16, no. 5, pp. 2318-2338, Oct. 2015