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Driving Assistant with Crash Detection and Alert System using ML and IOT

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***Abstract*— In today's world, almost everything we do has been simplified by automated tasks. In an attempt to focus on the road while driving, drivers often miss out on signs on the side of the road, which could be dangerous for them and for the people around them. 85 percent of road accidents occur due to the drivers not being able to control or stop the car on time. So to prevent this we have come up with an idea of car crash prevention and detection and also detecting the road signs simultaneously. So, In our project, Traffic Sign Detection and recognition(TSDR) plays an important role here by detecting and recognizing a sign, thus notifying the driver through voice of any upcoming signs. TSDR application not only ensures road safety, but also allows the driver to be a little more at ease while driving on tricky roads. In car crash prevention and detection on normal roads we are going to implement a cheaper and easier way to stop accidents. For crash prevention we use ultrasonic sensors to detect and calculate the distance between cars to alert the driver using the LED and buzzer installed. Most of the time it has been seen that the injured person did not die from the injury suffered due to the accident but due to the late response from the emergency department. So, in crash detection we use GPS and GSM to locate the place of accident and alert the registered number about the accident.**

***Keywords*— Crash Detection, Crash Prevention, Traffic Sign Detection and Recognition, Convolutional Neural Network, Ultrasonic Sensor, GPS, GSM, Accelerometer**

I. INTRODUCTION

In the twentieth century, the number of vehicles exponentially increased due to growth in the automobile industry. As the number of vehicles increases, the number of accidents also increases. The reasons for most of the road accidents are heterogeneous traffic and lack of traffic separation. According to the World Health Organization(WHO), India is the leading country in road accident deaths. In India, 13 million People died in road accidents in the year of 2014-15. In today's world, almost everything we do has been simplified by automated tasks. So we have come up with an idea of car crash prevention and detection at the same time and also detecting the road signs simultaneously.

1. *Bluetooth car*

Smartphones have quite changed the traditional ways of human to machine interaction. Smartphones are now a vital part of a person's life. Android is a software platform for mobile devices that includes an operating system, middleware and key applications. Android is a safe and secure operating system. Bluetooth is used for its various advantages over other wireless technologies. Hence, we can say that Android smartphones will serve a great benefit for industrial, commercial and other general-purpose applications. The system hardware consists of a controller equipped with a Bluetooth module. It'll be connected to the motors and other alternative components of the car. The DC motors are widely used for providing variable speed drive system in industrial applications resembling automation, electrical traction, military instrumentality, fixed disk drives, thanks to their high potency, noise-free operation, compactness, dependability and low maintenance and cost. When the app is turned on and is connected with the current system via Bluetooth, one will operate the car by giving wireless commands from the app using the functions already programmed in the app. The vehicle will move all four told directions: left, right, front and back.

2. *Crash Prevention and Crash Detection*

Every day a lot of road accidents are reported. Sometimes an accident is so severe that the victim could not sustain it. However, most of the time it has been seen that the injured person did not die from the injury suffered due to the accident but due to the late response from the emergency department. This incident happens, because the information of an accident could not reach the rescue department instantly. As a result of this delay the victim could not sustain and lost his life. So there must be an automatic system in every car that not only detects a road accident efficiently but also notify it to the emergency contact very instantly.

Accident prevention using ultrasonic sensor is a novel idea. An ultrasonic sensor is used to measure the distance. It transmits sound wave and wait for the wave to come back after colliding with an obstacle. The time taken by the wave to come back, determines the distance between the sensor and the obstacle. Accelerometer detects the sudden change in the axes of the vehicle for the detection of an accident. When an accident occurs, it is detected with the help of a sensor which activates the device, the sensor gives its output to the GSM.The alert message is sent via the GSM module with the location of the accident. Location of accident is sent in the form of Google Map link, derived from the latitude and longitude from the GPS module. The system implemented by us aims at automatically detecting an accident and alerting the emergency contacts about the exact location of the accident. This device can detect accidents and sends an alert message to the contacts in

significantly less time which will help in saving the lives of the people.

3. *Traffic Sign Detection and Recognition*

Traffic signs are road facilities that convey, guide, restrict, warn, or instruct information using words or symbols. With the development of automotive intelligent technology, famous car companies, such as Mercedes-Benz, BMW, etc., have actively invested in ADAS (Advanced Driver Assistance System) research. Commercialized ADAS systems include TSR (Traffic Sign Recognition) systems to remind drivers to pay attention to the speed and other traffic signs. If drivers do not notice this information, it can lead to the occurrence of traffic accidents. With the increasing demand for the intelligence of vehicles, it is extremely necessary to detect and recognize traffic signs automatically through computer technology. A traffic sign detection and identification method on account of the image processing is proposed, which is combined with convolutional neural networks (CNN) to sort traffic signs. On account of its high recognition rate, CNN can be used to realize various computer vision tasks. TensorFlow is used to implement CNN. For example, the speed limit 60 traffic sign is a circular shape with a strong number "60".

II. LITERATURE SURVEY

Alexander Shustanov, Pavel Yakimov in 2017 studied "CNN Design for Real-Time Traffic Sign Recognition". Under this study they proposed an implementation of traffic signs recognition algorithm using a convolution neural network. The paper also shows several CNN architectures, which are compared to each other. Training of the neural network is implemented using the TensorFlow library and massively parallel architecture for multithreaded programming CUDA. The entire procedure for traffic sign detection and recognition is executed in real time on a mobile GPU. The experimental results confirmed high efficiency of the developed computer vision system.

Wang Canyong in 2018 studied "Research and Application of Traffic Sign Detection and Recognition Based on Deep Learning". Under this study Traffic sign detection and recognition[1], has become a hot research direction of researchers at home and abroad. It is mainly the use of vehicle cameras to capture real-time road images, and then to detect and identify the traffic signs encountered on the road, thus providing accurate information to the driving system. With the development and progress of science and technology, more and more scholars use deep learning technology to solve this problem. The main reason that the deep learning method is widely accepted is that the model can learn the deep features inside the image autonomously from the training samples, especially for many cases that do not know how to design the feature extractor, such as expression recognition, target detection Wait. Based on the application of road traffic sign detection and recognition, this article focuses on the correctness and high efficiency of detection and recognition.

Naji Taaib Said Al Wadhahi, Shaik Mazhar Hussain, Kamaluddin Mohammad Yosof, Shaik Ashfaq Hussain, Ajay Vikram Singh in 2018 studied "Accidents Detection and Prevention System to reduce Traffic Hazards using IR Sensors". This proposed paper mainly focused on Accident detection and Prevention system. Simulation and Prototype results were discussed in detail. The proposed system could be helpful for traffic officials to track the accidents through receiving SMS and Locations to aid before leading to any disaster to the lives of people. The paper presented the existing issues of Transportation system and discussed various technologies that have contributed to reduce traffic hazards.

Jayesh George M, Adithya Sreyaj P P, Daniel Joseph, Sajeer P in 2015 studied "Android controlled Smart Car" this proposed paper mainly focused on SMART CAR which try to control the car with the help of android application in Smartphone. Thus reducing the effort of controlling car in rough terrain and it also helps in reducing The difficulties of parking a car in tight parking conditions. The communication between the car and Smartphone is done with the help of Bluetooth communication. The commands are sent to the Bluetooth module in microcontroller with the help of Bluetooth in Smartphone.

UNAIZA ALVI, MUAZZAM A. KHAN KHATTAK, BALAWAL SHABIR, ASAD WAQAR MALIK AND SHER RAMZAN MUHAMMAD in 2020 studied "A Comprehensive Study on IoT Based Accident Detection Systems for Smart Vehicles". In this paper various strategies were discussed which focused not only on accident detection but also on its prevention. These strategies utilized various sensors such as accelerometer sensors, shock sensors, pressure sensors etc. and various machine learning techniques such as neural net- works, support vector machines, representation learning etc. for accident detection. Various strategies for accident prevention were also addressed, which include detection of drunk and drowsy driver, regulating vehicle speed, maintaining safe distance from obstacles etc. Once the accident is detected, the information is communicated to emergency services to provide timely aid.

Darwin Nesakumar A1 *, T Suresh2 , M Aarthi3 , K Gomathi4 , G Aarthi5, P Mugilan6 in 2020 Studied "Accident Detection, Alert and Tracking System Based on IoT" In the proposed paper, WSN is used to work more efficient than the other manual functions. Our model is fully automatic whereas the other involves manual functions. This can be able to find the system's location easily. The specifications we used will give the better results than any other models. As this is fully automatic, the system ensures good prevention, safety and more security. The system we use utilizes wireless sensors to alert the drivers which are user friendly. Each sensor performs their own operation and gives alarm. In future it can be further enhanced by finding this usage in network less places.

Arif Shaik, Natalie Bowen, Jennifer Bole, Gary Kunzi, Daniel Bruce, Ahmed Abdelgawad, Kumar Yelamarthi in 2018 studied "Smart Car: An IoT Based Accident Detection System". In this paper the authors discussed that upon accident trigger, notification and GPS location were automatically sent to the cloud. The accident notification was immediately sent to cells phones using Twilio and the GPS location was made available on ThingSpeak for anyone with the login credentials to access. The proposed device is designed to save lives by having emergency personnel respond to accident scenes quicker, as well as track the felons who decide to flee the area of an accident in which they were involved.

III. PROPOSED SOLUTION

1. *Crash Detection and Alert System*

In this a ultrasonic sensor is used which will calculate the distance between the car and the car/object in front. If the distance is normal or far then no actions will be taken. If the distance is relatively close and the driver does not apply brakes then the sensor will trigger the circuit and the buzzer will indicate.

In case an accident occurs the message sent by the GSM module will be used as a distress signal which will be sent to the nearest hospital and the user's SOS number. The message to be sent will contain the latitude and longitude of the accident spot.

2. *Crash Detection and Alert System*

The detection phase simply discovers a sign from the environment. When a car is moving at a certain speed, the camera captures the environment, and our algorithm checks to see if a sign is present in that frame or not.

In the recognition phase, the proposed algorithm classifies the detected sign. This is achieved with the help of a Convolutional Neural Network ensemble. A system exploiting the visual information already available to the driver. It recognizes traffic signs by analysing live/real-time video input taken from a camera installed on the car. If an image contains signs, the system gives an output to the driver, indicating the respective sign.

IV. METHODOLOGY

1. *IOT based Smart Car:*

In this method, we have divided the system into two parts. Decision of Smart Car technology has gained massive popularity from users due to expanded usage of IoT in automobile Systems.

They proposed some smart features that will help drivers and reduce human handling with cars. Those smart features will give an update/alert about driving conditions to the driver and it will make the driver smarter in driving. In addition to that they are providing security measure against accidents. The features are as follows:-

2. *Crash Detection and Alert System:*

Object Detection feature is used in detecting obstacles/pedestrians on roads. We are developing such a hardware system that will show the indicator automatically when the driver needs to apply brakes. While driving on roads if obstacle or pedestrian comes that will detect by the system and alert about the obstacle to the driver and this is done by using Ultrasonic sensors.

3. *Traffic Sign detection using Machine Learning:*

The construction of Traffic Sign consists of three parts: First is to train and test data using Machine Learning algorithms so that the model detects all the passing Traffic signs. Second is to connect the ML model to the arduino using NRF module. Third is the coding of Arduino UNO and connecting it to the LCD screen and also speakers and thereby implementing our ML model. This model will alert the driver about the Traffic signs and potholes by displaying it on the LCD screen and also informing him/her by voice alert.

V. SYSTEM ARCHITECTURE AND IMPLEMENTATION

1. *Hardware*

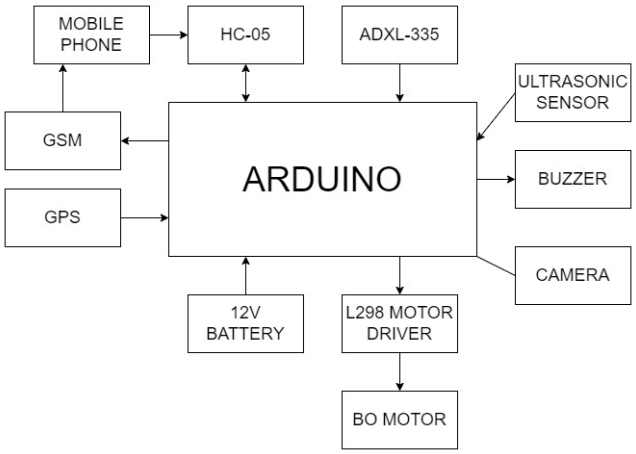

Fig-1: Complete IOT Block Diagram of Proposed System

As a smart mobile device and an embedded system side are used in this project. The overall framework should contain a user, an Android smartphone field, an Arduino-based car, namely the embedded system field and a personal computer. With assistance from the Arduino integrated development environment (IDE) in the PC, sketches are compiled and uploaded into the Arduino board via a USB transmission line. The car and mobile phone are linked via wireless communication. By touching or pressing on the screen or user interface (UI) of an Android phone, a manipulator can send commands to the Arduino on the car through Bluetooth and observe the corresponding executions accomplished by actuators, for example motors. The car is controlled by the smartphone via Bluetooth communication. Four functions are achieved here. The fundamental ones are forward, left, right and reverse movements as well as a stop.

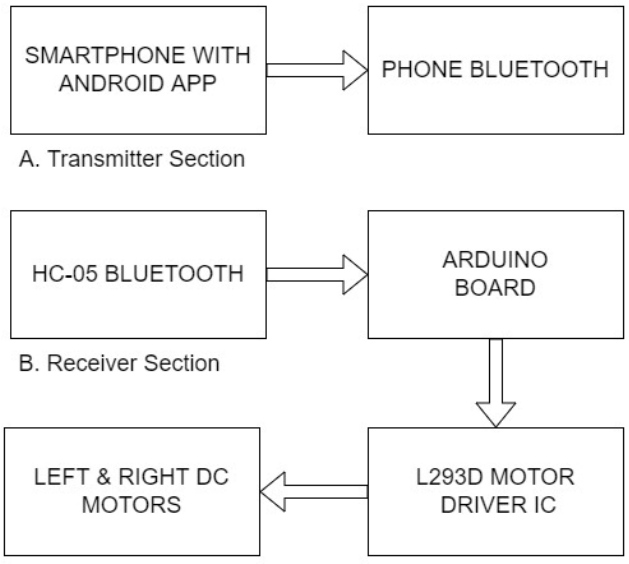

Fig-2: Working of Bluetooth

In this the ultrasonic transmitter will emit waves which will go and crash to the object in front and the waves will receive back to the ultrasonic receiver in the sensor then the distance between the car on which the sensor is placed and the object in front will be calculated. If the distance is normal no actions will be taken.If there is a car in sight then the driver need to pay attention which will be indicated by a Led light glowing . And if the distance is relatively close then the driver will be indicated by a buzzer and led which will help driver to control the car and prevent the car from accident.

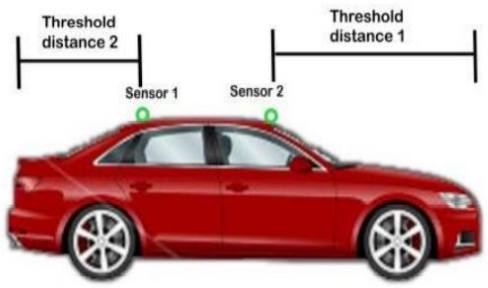

Fig-3: Ultrasonic positioning

Fig-4: Zones of ultrasonic sensor

In this project, Arduino is used for controlling the process with a GPS Receiver and GSM module. GPS Receiver is used for detecting coordinates of the vehicle, GSM module is used for sending the alert SMS with the coordinates and the link to Google Map. Accelerometer ADXL335 is used for detecting accidents or sudden change in any axis. We have used GPS Module SIM28ML and GSM Module SIM900A. When the accident occurs the alert message is sent automatically to the Hospital , registered number and to the police station. The message is sent through the GSM module and the location of the accident is detected with the help of the GPS module.This application provides the optimum solution to poor emergency facilities provided to the roads accidents in the most feasible way.The GPS detects the latitude and longitudinal position of a vehicle.

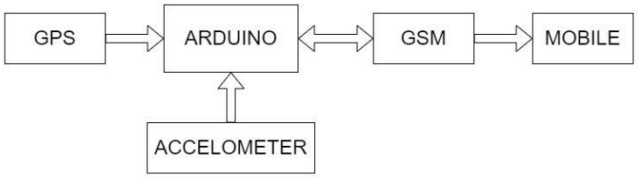

Fig-5: Block diagram of accident detection system

2. *Software*

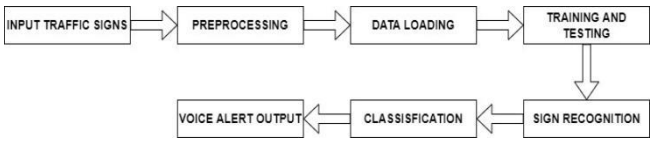

Fig-6: Block diagram of traffic sign detection and recognition

The traffic sign detection and recognition system we propose is divided into two phases: detection and recognition. The detection phase simply discovers a sign from the environment. When a car is moving at a certain speed, the camera captures the environment, and our algorithm checks to see if a sign is present in that frame or not. Detecting the traffic sign is based on color and shape. In the recognition phase, the proposed algorithm classifies the detected sign. This is achieved with the help of a Convolutional Neural Network ensemble. Once the sign is detected, the sign must also be classified. With the help of Google's open source machine learning framework, TensorFlow, a convolutional neural network can be implemented. After the traffic sign is detected and recognised, the 30 program will notify the driver about the sign through voice notification, so that the driver can follow the traffic rules.

VI. FLOWCHARTS / ALGORTIHMS

1. *Crash Prevention:*

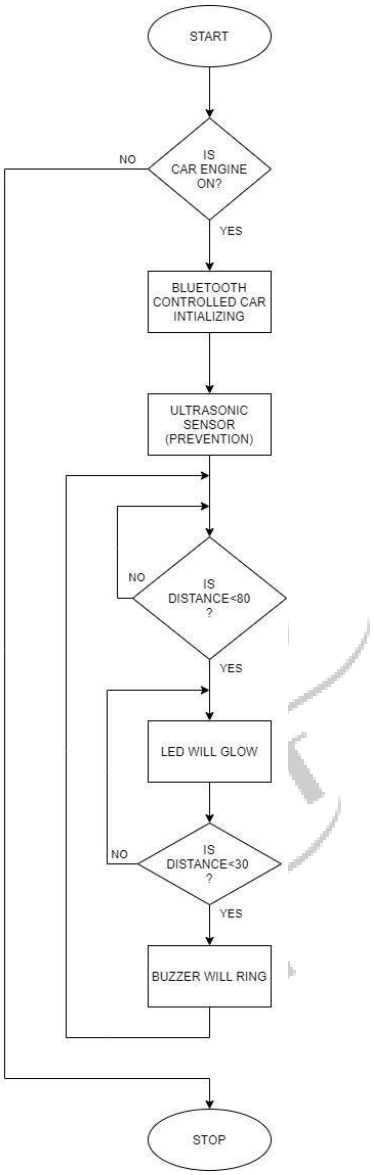

Fig-7: Flowchart of crash prevention

For Crash prevention, We are using Ultrasonic Sensor. In this, When the Car engine is on, Bluetooth controlled car and Ultrasonic Sensor will be initialized. it will check if the distance is less than 80. If the distance is less than 80, LED light will glow and it will again check if the distance is less than 30. If the distance is less than 30, then buzzer will ring and if not, it will again check if the distance is less than 30. This process will continuously work in loop until the system is switched off.

2. *Crash Detection:*

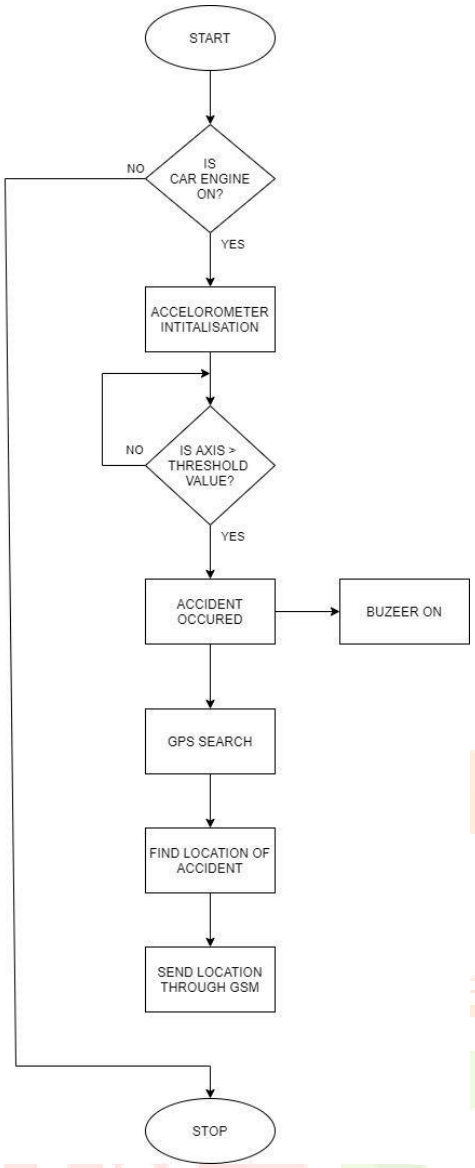

Fig-8: Flowchart of crash detection

For Crash detection, We are using Accelerometer, GPS and GSM. In this, When the Car engine is on, Bluetooth controlled car and Accelerometer will be initialized. The Axis of the Accelerometer is continuously checked and it should be 0 on x,y and z axis. The axis will continuously be compared to the threshold value until it is greater than it. When the Axis will be greater than the threshold, it will indicate that the accident has occurred and the buzzer will ring. Now, the GPS will start searching and it will send the exact location of the accident to the registered numbers through GSM.

3. *Traffic Sign Detection:*

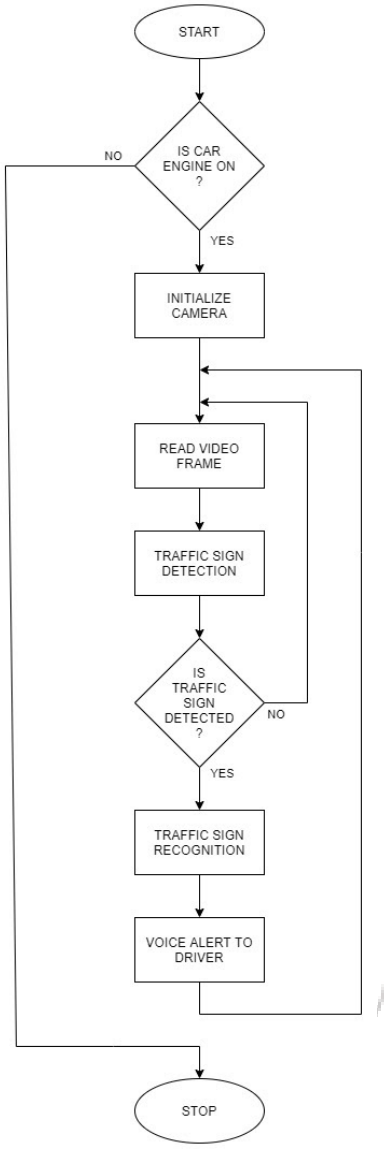

Fig-9: Flowchart of traffic sign detection and recognition

A camera is used for the detection of traffic signs. The software will read the input video from the camera frame by frame. If no sign is detected then the loop will repeat. If there's a traffic sign detected the software will recognise the sign and identify it. The software will also alert the driver by giving a voice alert of the name of the recognised sign. This loop is continuously repeated until the car is switched off.

VII. RESULTS

1. *Traffic Sign Detection:*

After training the data we plotted the accuracy and loss graph. Accuracy measures the model performance is growing over time, which means the model is improving with experience (it's learning). So higher the curve, the better our model becomes.

Loss measures our model error, or "how bad our model is doing". So, for now, the lower our loss becomes, the better our model performance will be.

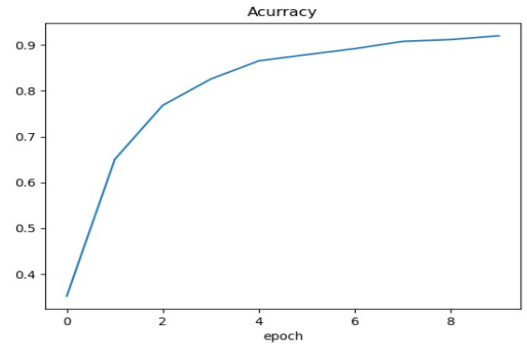

Fig-10: Graph of Accuracy vs Epoch

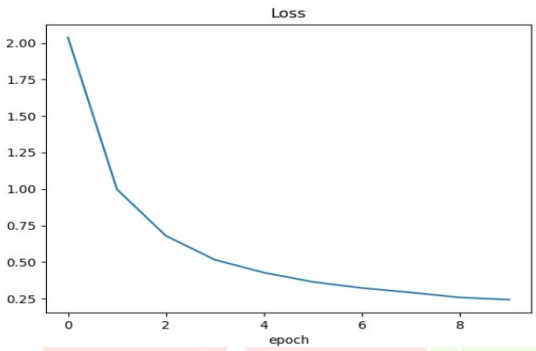

Fig-11: Graph of Loss vs Epoch

Real-time results of sign detection:

Fig-12: Real-time results of sign detection

2. *Crash prevention:*

We have defined three different zones:

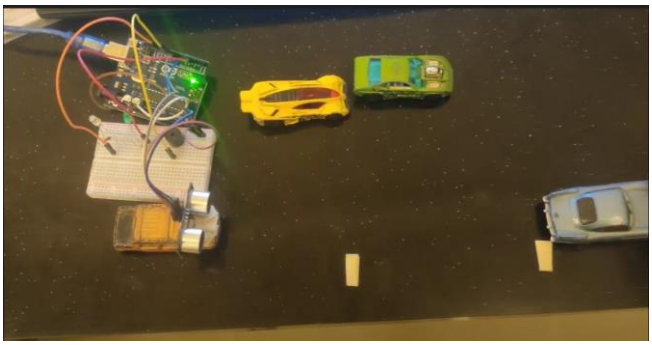

Fig-13: No warning

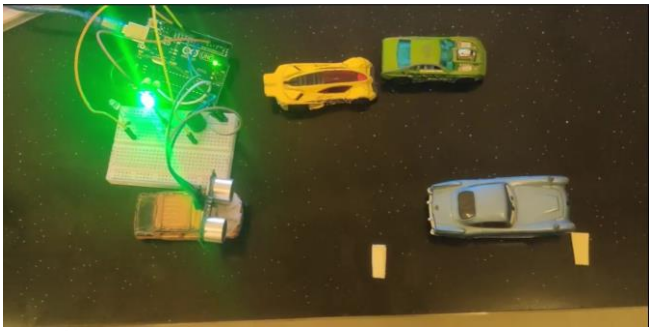

Fig-14: Only visual warning (with green LED)

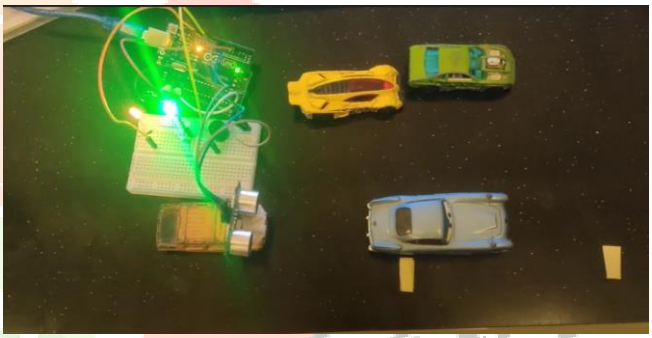

Fig-15: Both visual and audio warning (with orange LED and buzzer)

3. *Crash detection:*

Whenever there is a crash detected the GPS module is triggered and start searching the location. This latitude and longitude is then send via GSM module as an alert message to the registered mobile number.

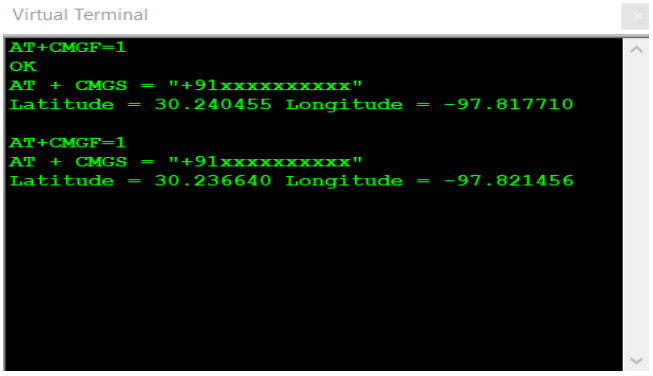

Fig-16: Message of accident received with crash location

VIII. CONCLUSION

In this way the car crash prevention and detection system is being developed on normal as well as curved roads with the help of sensors, reducing the percentage of deaths by reducing the window for human errors.

Upon training our CNN ensemble, we achieved an accuracy of 96% for all traffic signs and after detecting the signs with the help of ML, the model will also tell us what the signs are and alert the driver by voice which will help the driver in ease of driving and following traffic rules.

Using the above features of "Crash Detection and Prevention" and "Traffic Sign Recognition using Machine Learning" we have created a smart car system which will improve road safety.

IX. REFERENCES

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