Drowsy Driving Detection System using IoT

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Abstract - *As of late, sleepy driver recognition is the most vital strategy to forestall any street mishaps, presumably around the world. The point of this study was to develop a brilliant ready procedure for building wise vehicles that can consequently keep away from tired driver hindrance. Yet, languor is a characteristic peculiarity in the human body that occurs because of various elements. Subsequently, it is expected to plan a strong ready framework to stay away from the reason for the incident. In this proposed paper, we address a tired driver-ready framework that has been created involving such a method in which the Video Stream Processing (VSP) is dissected by an eye squint idea through an Eye Aspect Ratio (EAR) and Euclidean distance of the eye. Face milestone calculation is additionally utilized as an appropriate method for looking at location. Whenever the driver's weariness is distinguished, the IoT module gives an admonition message alongside the effect of impact and area data, accordingly cautioning with the assistance of a voice talking through the Raspberry Pi observing framework. Likewise, assume any abrupt impact occurs because of languor. The mishap area can be identified effectively and an alarm message will be sent through IoT about the area to the watchmen, police headquarters, or a salvage group so prompt move can be made by following the area of the mishap through the Global Positioning System module not long after getting the data.*

Key Words: Raspberry Pi camera module v2, Raspberry Pi3 model B, Accelerometer sensor, Speaker module, GPS module.

1. INTRODUCTION

Driver fatigue has been the primary issue for endless incidents because of sluggishness, drawn-out street condition, and negative environmental circumstances. Consistently, the National Highway Traffic Safety Administration (NHTSA) and World Health Organization (WHO) have detailed that roughly 1.23 million individuals bite the dust because of vehicle crashes across the world. By and large, street mishaps generally happen because of a lacking approach to driving. These circumstances emerge assuming the driver is dependent on liquor or in laziness. The greatest kinds of deadly mishaps are perceived as an extreme component of the sluggishness of the driver. At the point when drivers nod off, the command over the vehicle is lost. There is a need to configure savvy or smart vehicle frameworks through trend-setting innovation. This paper carries out a component to alarm the driver on the state of tiredness or fantasizing. A camera screens the driver's eye flickering, eye conclusion, face identification, head pose, and so forth with face landmark calculation and Euclidean distance in the behavioral-based approach. These attributes help to gauge driver weakness and immediately alert him with the assistance of a voice speaker and sending an email to an individual (proprietor of the vehicle) who can make him cognizant. An email is being sent to an objective utilizing an IoT module, which depends on remote transmission. However, the proposed framework is being incorporated by a charge card measured PC known as Raspberry Pi3 and Pi camera which can follow an eye development subsequently checking force of crash impacts that occur at the hour of mishap and This alarm rub is been shipped off the crisis server which will illuminate the rescue vehicle, police headquarters close to that area and furthermore to the protection office, which will assist with saving the important lives. A switch is likewise given close to the jumper seat to end the sending of messages in an intriguing situation where there is no setback, this can save the valuable season of emergency vehicles, police. Whenever the mishap happens the alarm message is been sent naturally to the crisis server. The message is sent through the GSM module and the area is been recognized with the assistance of the GPS module. The mishap can be identified definitively utilizing a vibration sensor. This application gives the amazing answer for the unfortunate crisis offices which are given to the street mishaps in most potential ways.

1.1 Literature review

Paper 1:*"Face and Eye Detection by Machine Learning (ML) and Deep Learning (DL) Algorithms":* Jabbar et al. proposed Convolution Neural Network (CNN) method of the ML calculation to distinguish miniature rest and sluggishness. In this paper, identification of driver's facial milestones can be accomplished through a camera that is then passed to this CNN calculation to appropriately distinguish laziness. Here, the exploratory grouping of eye identification is performed through different informational indexes like without glasses and with glasses in day or night vision. Thus, it works for compelling sluggishness identification with high accuracy with android modules. The calculation of Deep CNN was utilized to distinguish eye squint and its state acknowledgment as given by Sanyal and Chakrabarty. Saleh et al. fostered a calculation of LSTM and Recurrent Neural Networks (RNN) to group driver's practices through sensors. Ed-Doughmi et al. examined the driver's practices through

the RNN calculation. It extraordinarily centers around the development of constant weariness location to forestall side of the road mishaps. This framework figures out some of drivers' countenances, which chips away at diverse 3D CNN models to recognize sluggish drivers and give 92 rate acknowledgment rates.

Paper2: *"FPGA-Based Drowsiness Detection System":* A lowintrusive sluggishness identification framework utilizing fieldprogrammable door cluster (FPGA) has been planned by Vitabile et al. This framework centers around splendid students of eyes which are recognized by IR sensor light source implanted in a vehicle. Because of this enhanced visualization, the retinas recognized up to 80%, which assists with tracking down drivers' eyes for dissecting sluggishness through various edges for keeping away from genuine accidents. Navanee than et al. carried out a constant framework to follow natural eyes utilizing typhoon II FPGA.

Paper 3: "*Eye Recognition System Based on Wavelet Network Algorithm":* Jemai et al. presented a method for tired advance notice framework utilizing wavelet organizing. That organization tracks eyes with the assistance of grouping calculations like Wavelet Network Classifier (WNC) that depends on Fast Wavelet Transform (FWT), which explicitly prompts twofold way choice (cognizant or not). The physiological angles are heart beat rate and electrocardiogram that are over and over extricated through wavelet change with relapse strategy for weakness recognition, planned by Babaeian et al. This standard dealt with pulse information arrangement through wavelet network which can observe a normal method of sleepiness ready framework.

Paper 4: *"Fatigue Detection Using Vehicle State (Steering Wheel)Algorithm":* Arefnezhad et al. proposed a no meddling languid identification framework in light of vehicle directing information utilizing neurofuzzy framework with help vector machine and molecule swarm improvement calculation. Mutya et al. laid out a framework to determine the issue of laziness utilizing directing wheel calculation. It is fundamentally founded on picture framed or pictorial-based controlling development and the CNN calculation for appropriate order of sleepiness, which can likewise decrease bogus sleepy location rates.

Paper 5: *"Fatigue and Collision Alert System Using Smart Technique":* Chen et al. executed a shrewd glass to recognize weariness. The back light of the vehicle is consequently streaked with a message being sent utilizing the IoT module or cloud climate. Kinage and Patil proposed a framework to distinguish the tiredness utilizing eye flickering sensors and any mishaps or crashes that occurred; then, at that point, the vibration sensor was coordinated with pulse estimation sensor for sending ready message to the approved client. Along these lines, it is additionally connected to the GPS and GSM gadget for following the area and transmission of message. Siva Reddy and Kumari acquainted a framework with control reason for genuine setbacks utilizing Arduino board with sensors which worked through camera. Be that as it may, it is a productive framework with less assessment cost for development of it. Jang and Ahn executed a framework to recognize a liquor someone who is addicted and lazy drivers through sensors, where these components are coordinated with the Raspberry Pi regulator module. Along these lines, the IOT modules are additionally used to send messages for any unusual driver exercises, which are appropriately invigilated with the assistance of a webcam (picture handling) and regulator unit. Another interaction has been produced for standard watchfulness of facial identification and eye flicker state, which predicts the driver's languor. Notwithstanding additional sensors, voice acknowledgment application and AI strategies are utilized to improve the course of caution.

2. Proposed Method:

The proposed system has been planned to conquer the downsides of the past transportation and drivers the executive's frameworks and to diminish the number of mishaps happening consistently all over the planet. The goal of our framework is to cause a brilliant framework that will work completely consequently for taking care of the languid driver identification issue. This is finished by awakening the driver utilizing a bell when he is distinguished with sleepiness and telling the proprietor of the vehicle. A natural eye without the impact of laziness has an Eye Aspect Ratio (EAR) above 0.25, which is the limited esteem. At the point when a driver is in a progress to rest his eyes will naturally generally close down along these lines diminishing his EAR. When the EAR esteem falls beneath the limit esteem, the length of eye conclusion is thought of. To recognize according to the driver from the typical eye flicker design, edge esteem, addressing the complete number of video outlines the driver has shut his eyes, is utilized. In the event that the quantity of progressive edges surpasses this limit esteem, the framework distinguishes the driver with languor. A ringer is turned on quickly to awaken the driver. A Pi Camera Module is utilized to consistently record his eye developments with the goal that the EAR can be determined progressively. Besides, a counter is utilized to identify the times he is distinguished with tiredness. For our framework, as far as possible was viewed as 3. On the off chance that it surpasses this cutoff, the proprietor of the vehicle will be informed to let him/her realize that the driver nodded off two or multiple times while driving. As the framework is associated with IoT, it will send an email to the Android gadget of the approved proprietor when the languor is identified. This will alarm the proprietor about the driver's driving example and will assist him with taking further choices in light of his driver's activities and impact alert used to caution of mishap it additionally finds the area of the vehicle and send it to crisis numbers and enlisted versatile number and send an alarm on email. The framework we made is at a lower cost than others as we are not utilizing

any costly gadgets like gsm and different sensors. we are utilizing Raspberry Pi3 model B 3 Axis Accelerometer and Gyroscope sensor to identify the mishap happens and NE0-6M GPS module to find the specific place of the vehicle. Fig 2 shows the square outline and the flowchart of our proposed system.

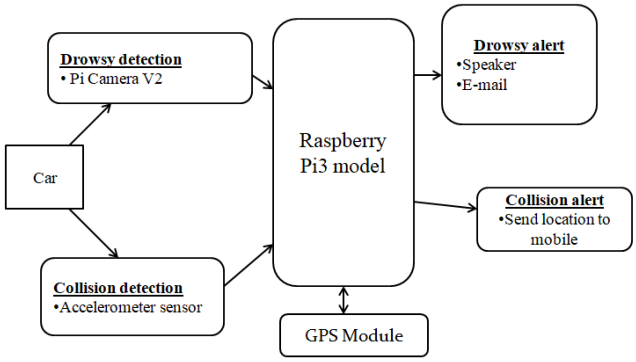


Fig. 1. A Block Diagram of the Proposed System

3. COMPONENT DESCRIPTION: The proposed system consists of the following major components:

RASPBERRY PI: The Raspberry Pi is a charge card estimated single-board PC. Raspberry Pi has a Broadcom BCM2835 framework on chip (SoC),which incorporates an ARM1176JZFS 700 MHz processor, Video Core IV GPU ,and was initially sent with 256 megabytes of RAM, later redesigned (Model B and Model B+) to 512 MB. Pi 2 Model B runs 6X Faster than the B+, and accompanies 1GB of RAM that is twofold how much RAM of the past model.

PI CAMERA MODULE V2: This Raspberry Pi Camera module v2 can be utilized rather than the first camera module, to catch a superior quality video with still picture with the assistance of Sony IMX219 8-megapixel sensor It works with 1080p30, 720p60, and VGA90 video modes which interface with a CSI port through a 15 cm strip link on the Raspberry Pi module that is portrayed as in Fig 1.

SPEAKER: It is a sound or voice-creating gadget which can change over electromagnetic waves into sound. On the off chance that the driver's sleepiness is distinguished, a voltage is provided as a caution to produce normal customized voice sound, which is portrayed as in above Fig 1.

MPU6050 SENSOR MODULE: It is a consolidated 6-turn development gadget. It has a 3-hub accelerometer, 3-hub spinner, advanced development processor and a temperature sensor, all in a singular IC. The sensor can get inputs from various sensors like tension sensor or 3-hub magnetometer through its optional Inter-IC (I2C) transport. MPU6050 module is utilized to decide the mishap when the vehicle is shifted. Raspberry pi 3b can chat with MPU6050 module utilizing I2C correspondence convention.

GPS MODULE: It is utilized to follow the mishap area. An outer 5V power supply will be given to driving the raspberry pi 3b. Whenever a vehicle met with a mishap, raspberry pi 3b will get signals from press button or MPU 6050 that will sets off the GPS module to follow the vehicle area and sends longitude and scope of mishap area to raspberry pi 3b.Further, raspberry pi 3b will transfer the area to cloudland then the area data will be recovered by push projectile application present in the android gadgets.

4. Methodology:

Whenever the Pi camera model V2 is effectively coordinated with Raspberry Pi3, it consistently records every development of the driver's face. This proposed work uncommonly centers around conduct proportions of the driver with seriousness estimation of impact in following segments. The EAR (Eye Aspect Ratio) is precisely determined because of the utilization of Raspberry Pi3 model B and Pi camera modules to make a diligent recording of face tourist spots that are limited through facial milestone focuses. Yet, the Raspberry Pi3 model B and Pi camera modules are safely handled because of the working arrangement of the regulator and unsurprising secure shell (SSH) keys. The utilization of SSH have keys gives secure organization interchanges and assists with forestalling unapproved correspondences or record moves. The IoT-based application is being created through the reconciliation of some IoT modules like remote sensors, GPS tracker, Pi camera, and shrewd code for identifying the sluggishness of the driver. So the above modules are appropriately incorporated with the Raspberry Pi regulator module that shrewdly controls and sagaciously cautions a sluggish driver. The fruitful coordination of IoT modules is heartily used to forestall the reason for incidents and furthermore cautions the lazy driver to keep away from reckless driving. The Internet of Things (IoT) is assisting with overseeing different ongoing intricacies like taking care of perplexing detecting conditions and furthermore gives a truly adaptable stage to control various availability. The IoT module is an entirely solid approach to catching pictures of the sleepiness of the driver as well as sending an alarm message to the proprietor for mindfulness.

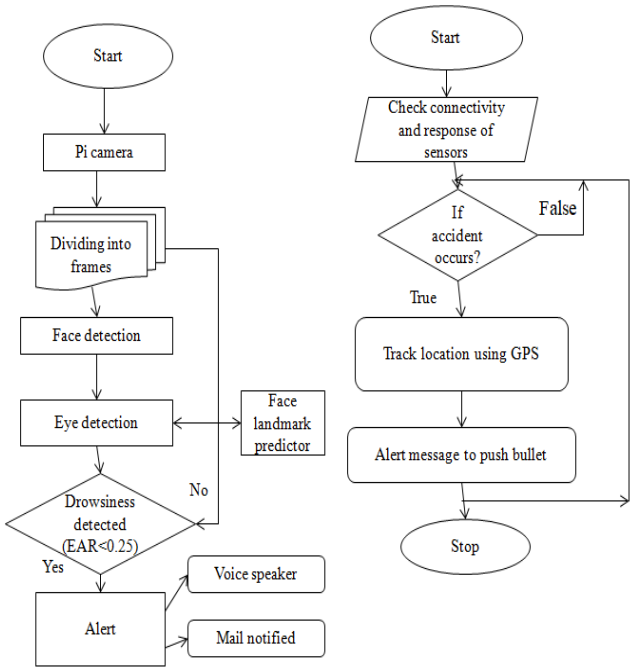


Figure 2: A flowchart of the (a) drowsy detection system and (b) collision detection system.

DROWSY EYES AND FACE DETECTION: The bit by bit strategies for the discovery of drowsy drivers in the situation are recently clarified in Flowchart, and the different advances are as per the following:

- Step 1: video recording
- Step 2: face detection
- Step 3: eye detection
- Step 4: drowsiness detection (combination of steps 2 and 3)

The Raspberry Pi3 camera is an 8-megapixel camcorder that catches persistent video transfer in great quality. The recorded video transfer is changed over into various edges which are sent to confront location step. The face discovery is dissected by face milestone calculation, which can recognize eye, mouth, and nose from facial appearance. As a matter of fact, this identification procedure works with Python-based library bundles like OpenCV. OpenCV is utilized for continuous picture handling which is carried out by PC vision calculation. Whenever facial highlights are effectively-recognized, the following stage, similar to eye identification of languid drivers, is feasible to concentrate through facial milestone indicator calculations. In this way, it can change over that picture outline configuration to dim scale level, where identified eye regions are followed by six directions as portrayed in Figure 2 Now, it is expected to compute EAR which estimates the distance among vertical and even eye milestone focuses by utilizing a Euclidean distance (ED) strategy as in Equation. The computation of the distance of the eyelid area is made as

$$IED(X_i, Y_i)=\sqrt{\sum_{n=1}^{n}(y_i - x_i)^2} \quad (1)$$

Where IED(X, Y) is meant as a Euclidean distance among Xi and Yi; these are two Cartesian direction focuses. So it is addressed in the Python program which is clarified beneath:

- A = dist.euclidean(eye[2], eye[6])
- B= dist.euclidean(eye[3], eye[5])
- C = dist.euclidean(eye[1], eye[4])

From the above assertion, dist is an object of distance bundle that has a place with scipy library document which is summoned a Euclidean (Xi, Yi) Here, there are two direction points of an eye milestone. The factors (A, B, and C) are utilized for the computation of the EAR worth of an eye. To observe the EAR by utilizing distinguished eye milestone coordinate qualities from ever video outline, it is being processed as

$$EAR = \frac{\|x_2 - x_6\| + \|x_3 - x_5\|}{2\|x_1 - x_4\|}, \quad (2)$$

where x1, x2, x3, x4, x5, and x6 are 6 milestone. The EAR worth of the left and right eyes is found the middle value of during simultaneous eye squint. The edge worth of EAR stays steady when the two eyes keep on being open, where values will be haphazardly different during eye flicker. The edge scope of EAR is above 0.25 which implies the driver's eyes are unlatched. Assuming any sluggishness of the driver is recognized from video outlines, it occurs because of the dropping of its edge esteem beneath 0.25. Whenever the quantity of casings is more than 30, then, at that point, the voice speaker is turned on and mail is sent. In this way, the Raspberry Pi3 is modified to work a speaker by utilizing programming that can change text-over to discourse (TTS) transformation method. TTS in speaker is more solid for a drowsy driver to be alarmed than another sound. Every one of the assertions of the speaker is coded as follows: The above code is having an instant message like wake up; it will be changed over to discourse by espeak synthesizer and working framework (os) module in Python. The Raspberry Pi likewise advances a mail at the hour of weakness recognition to the driver to be more watchful to stay away from various accidents. The sends are moved through Simple Mail Transfer Protocol (SMTP) that is gotten to as a predefined library smtplib in Python. The SMTP client meeting object is made by utilizing smtplib module to send letters source to objective. Here, the MIME convention is utilized to characterize a multipart segment of a mail-like subject, to and from parts. The mail is safely moved from the tired driver unit to an approved individual (proprietor of the vehicle or any) through Transport Layer Security (TLS) and server port number 587 for http://smtp.gmail.com server, which is displayed in the program section.

COLLISION DETECTION: The impact ready framework is by and large built by a mix of an accident sensor and a power

touchy register for giving information about crash sway. Along these lines, the information connected with effects of crashes are gathered to quantify the seriousness of disasters because of languor or oblivious driving. The reason for seriousness is observed through the accompanying stages:

Stage 1: Python script

Stage 2: local database

Stage 3: update server (web page)

The IoT module or server advances recognized information to the program script which depends on Python. Here, Python script is particularly liked for dependable correspondence with associated sensors. Whenever any accidents of a vehicle happen, then, at that point, the separate sensors produce data that recognizes the scope of seriousness as well as the area of impacts that are recorded in the data set. The area of the mishap is gotten from Google Maps interface with longitude, scope, time, and date that are gotten to through the Raspberry Pi module. The longitude and scope of an area are uniquely determined by utilizing the haversine procedure to gauge the distance of earth surface between two focuses which is addressed as in Equations (3) to (5):

$$X=sin^2\left(\frac{\Delta\emptyset}{2}\right)+\cos\emptyset_1+\cos\emptyset_2+\sin^2\left(\frac{\Delta\gamma}{2}\right) \quad (3)$$

$$Y=2*x\tan 2\left(\sqrt{x},\sqrt{(1-x)}\right), \quad (4)$$

$$z=Rad*y, \quad (5)$$

where ϕ is signified as scope, λ is indicated as longitude, and earth's sweep is meant as Rad. Here, the mean range is addressed as 6,371 km.

The GPS is naturally followed by involving this equation in Python script which impeccably puts the upsides of scope and longitude of the place where the mishap happened. In this way, the following content is executed by utilizing a saved library bundle, i.e., pynmea which is utilized for NMEA 0183 convention. This convention gives a point of interaction to parse date, time, elevation, longitude, scope, and area pin code with Google Maps joins, which is automatically addressed as follows:

Parameter	Value
Date time	17-22-45-25
Latitude	20.4267
Longitude	85.9887
Altitude	110.01
Station_ID	00013*7D
GEO_setupID	M

TABLE 1: Parameter of pynmea package

This shows the sequential library for the port number of the GPS module; shutil library was utilized for replicating nmea document to other text records in the content, and different libraries are utilized for a few extra exercises in the framework. These boundaries are parsed through the pynmea library object to make the plot area of a vehicle mishap because of sluggishness or oblivious psyche. After these boundaries are recovered for the setback area, they are sent simultaneously, a crisis message (URL connection of crash web-based interface) is shipped off a closer emergency clinic or proprietor of the vehicle for finding a way ways to recuperate from that circumstance that addresses the crash sway with map program segment.

5. Experimental results

This section provides a successful experimental consequence which is obtained from the proposed method at the time of driving. The drowsiness is calculated through the observation of EAR of the driver. This process provides the status of eyes if they are open or closed thereby providing data about collision impact on the mobile.

Fig. 3. The EAR value before closing the eyelids

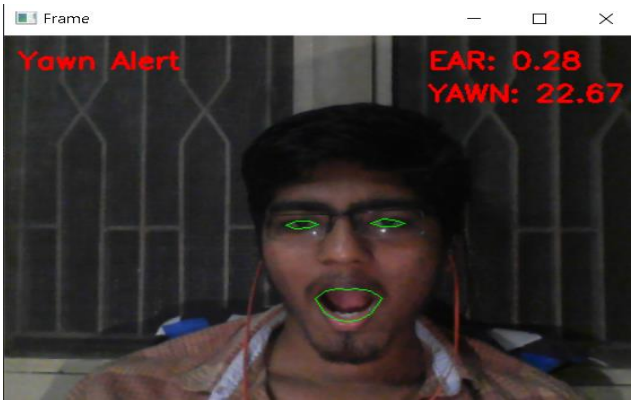


Fig. 4. The EAR value before closing the eyelids

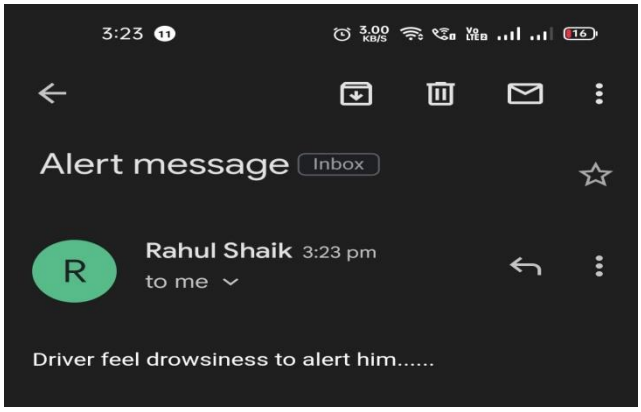
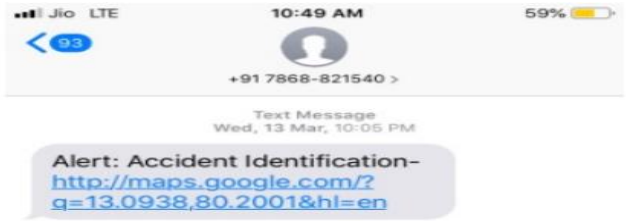


Fig. 5. Result displayed on mobile through email

PREDICTION OF DROWSINES: When the EAR value is greater than 0.25, it indicates the eyes are open. This test shows that the driver has not fallen into drowsiness and detected the face is not recognized as a drowsy one as shown in fig 3. Similarly, the drowsiness of the driver is detected due to the EAR value being less than 0.25 graphically, and finally, a drowsy face is detected as shown in fig 4. The EAR values are frequently changed due to movements of the eyelids. When drowsiness is found, then the driver is alerted with repeated voice sounds, and an email message is forwarded to the owner or related authority. Here, a speech speaker is implemented instead of a buzzer for more vigilance; if it fails, then the owner will provide any warnings after receiving the message from its mail as represented as shown in fig 5.

IMPACT OF COLLISION:

The alarm given utilizing the message signals is gotten as follows: In Figure 6, it portrays the framework is tried for remote access over the web involving the remote association and a battery as power source giving it an independency. This assists with getting to and controlling the framework from any geological area which is displayed in Figure 6.1



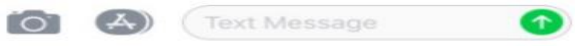


Figure 6

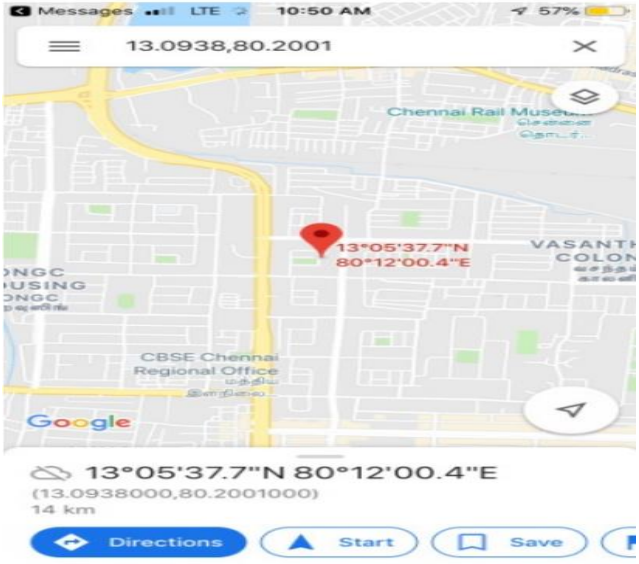


Figure 6.1

6. Conclusion:

The proposed system mainly improves the emergency action for the accident victim by providing an accurate accident location so that the life of the victim can be saved in a simple possible way. Emergency actions are taken when the accident alert is received. The work can be improvised by including additional tasks like accident alert system for the vehicle to detect the impact from all the sides and to detect the emergency situation like fire accidents in the vehicle.

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