SMART BIKE USING IoT AND DEEP LEARNING

A Capstone Project Report submitted

in partial fulfillment of the requirement for the award of degree

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by

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CERTIFICATE

This is to certify that this project entitled **" SMART BIKE USING IoT AND DEEP LEARNING"** is the bonafied work carried out by **B.ARCHANA , R.AKSHITHA , K.AKSHAYA , R.SUDHAN JEE** as a Capstone Project for the partial fulfillment to award the degree **BACHELOR OF TECHNOLOGY in COMPUTER SCIENCE & ENGINEERING** during the academic year 2022-2023 under our guidance and Supervision.

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ABSTRACT

Every day there is an increase in the number of vehicles on the road. Additionally, technology has undergone development on vehicles that have accelerated speeds. We don't take safety seriously. The usage of helmets can reduce 69% of head injuries in an accident according to WHO and even bike theft is a common problem in India, especially in urban areas. According to a report by the National Crime Records Bureau (NCRB) for 2019, a total of 2,10,461 two-wheelers were stolen across the country. The purpose of this project is to develop a smart bike that ignites or starts only when the rider wears a helmet and also checks the condition of the rider, and has a Global Positioning System which tracks the position of the bike. The AI is connected to the motorcycle and it works in such a way that, the driver should wear a helmet in-order to start the motorcycle.The Machine Learning model is done by Deep Convolutional Neural Network (CNN) and the electrical part is done using the Raspberry Pi.

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LIST OF ACRONYMS

ACRONYM	ABBREVIATION
CNN	Convolutional Neural Network
GPS	Global Positioning System

1. INTRODUCTION

1.1 OVERVIEW

Motorcycle is an basic transport used by public in different countries.The main aim behind purchasing an motorcycle is low cost and less operation cost compared to other vehicles.In recent years there has been a rapid increase in innovating new motor cycles, which has been a way for the increase in road accidents, causing fatal injuries.Riding a motorcycle always thrills riders on open road. Among the motorcycle accidents, the highest 62 (41.1%) was due to High-speed driving, 50 (33.1%) was a collision with other vehicles, 23 (15.2%) due to failure to give way for the pedestrian, and 11 (7.3%) due to drunk driving.The reason behind motorcycle are more prone to accidents Because motorcycles are smaller in size and have less stability than a car or truck, they may be more susceptible to unsafe road conditions than other vehicles on the road. Speeding and Reckless Driving - Speeding and reckless driving are also common causes of motorcycle accidents.Most danger causes due to motorcycles are -Colliding with another vehicle – 55 percent of all fatal crashes, Not wearing a helmet – 41 percent of fatalities, Speeding – 33 percent of fatalities, Alcohol impairment – 25 percent of fatalities.

One major reason for the accident is the motorcycle biker who drive without wearing a helmet even though there are certain rules but many bikers ignored and use their vehicle without any safety equipment the policeman tried to control this problem manually but it is insufficient for the real situation.In India 70-85% deaths of motorists, due to accidents, happen because of not wearing a helmet.The major reason people don't wear helmets in India, is because of their compromising attitude - They prefer Comfort over Safety. Therefore the problem is to tackle this stubborn attitude of people and make sure that they wear helmets always.We cannot control the occurrences of accidents but taking precautions to avoid life-threatening injuries due to road accidents is in our hands - by wearing helmets. Helmets are the first line of defence against injuries due to road accidents for motorists. The most important thing of wearing helmet is to protect riders head. Ensures that rider's head is free from any major impact during an unfortunate traffic incident.

Other major reasons for ultimate deaths today is road accidents. Most of the time the drivers would lose their alertness and meet with unfortunate accidents. This loss of the state of alertness is due to fatigue and drowsiness of the driver. This situation becomes very dangerous when the driver is alone. Drowsiness or fatigue is one of the main reasons of low road safety and some severe injuries, economy loss, and even deaths. Collectively, these situations increase the risk of road accidents. Using computer for automatic fatigue detection, several misfortunes can be avoided. The drowsiness detection systems continuously analyze the drivers condition and warns before any unfortunate situation arises.System tries to detect if person's eyes are closed for a few seconds then alerts driver by giving Buzzer sound. So This system will alert the driver at the right time to prevent any mis-happening.

Bike theft is so common (and so hard to stop) for three main reasons: there's minimal risk, few defences, and lucrative rewards.We already know that just 5% of stolen bikes are returned to their owners. Thieves can be difficult to trace, especially if there's no CCTV in the area or if the bike isn't registered on a database. The incentive for police forces to catch these criminals is low, and proof of ownership can be tough to establish.Ultimately, the risks for thieves are minimal. The rewards, however, can be large-scale.Most stolen bikes are sold soon after the theft. According to Bike Register,the national cycle databases,roughly one bike is stolen every 90 seconds and most of those thefts occur around the victim's home.Some bikes can make thieves thousands of pounds, especially high-end e-bikes and mountain bikes, which can come with some seriously eye-watering price tags. Another factor is the lack of accessible defence technology. Secure, heavy-duty locks can cost a bomb, and the cheaper options can be easily broken with minimal force. GPS trackers are rising in popularity.GPS tracking systems typically consist of a GPS device that is attached to the object being tracked and a software platform that receives and processes the GPS data to provide real-time location information and other data such as speed, direction, and distance travelled. These systems can be customized to meet the specific needs of businesses and individuals and can provide valuable insights that can help improve efficiency, productivity, and safety.

1.2 EXISTING METHODS

1.2.1 EXISTING SYSTEMS ON HELMET DETECTION

The paper published by Philip D.Geneta, George L.Cay in 2019,titled “Motorcycle Engine Shut-Off Device”, was developed to protect it against thieves. The main objective of this system is to stop and start the motorcycle engine through Short Message Service(SMS) and can also track the location using Global Positioning System(GPS) module. Arduino Nano, relay, GPS module, GSM module, SIM card are the materials used for the prototype. This prototype has effective functionality, compatibility, durability and gained mean score of 4.65 satisfying all its objectives. Kill switch is a hardware or software that stops an operation immediately. Arduino Nano is a central processing board that controls the device. Relay switches on/off the engine of the motorcycle. The GPS module is used to know the location of motorcycle .The process starts when the user sends a code to the GSM module. The buzzer will be alert when the GSM module has a signal. The GSM module will receive it and send data to the arduino nano, then it controls the on and off switching of the relay, which on/off the engine of motorcycle and then starts to track the location of the motorcycle. If the relay turns off, the buzzer has a delay of 10 seconds. To track the location of motorcycle, the user again sends the SMS to GSM module indicating the location of the motorcycle to the mobile phones.Relay is used to turn on or off the engine of the motorcycle. The terminal block connects the wires from the battery and engine of the motorcycle to the prototype. Arduino nano will control the operation of the device. GPS module tracks the location of the motorcycle and sends it to the micro-controller. GPS antenna establishes signal to the GPS module. GSM antenna establishes signal to the GSM module. The buzzer alerts the motorcycle rider when turning off the engine of the motorcycle. GSM module serves as a communication link to the mobile device to send or receive SMS. The fan prevents the device from overheating. Step down power supply supplies power to the arduino nano. All the components are enclosed in casing. Switch serves as on or off button of the device. Hence the motorcycle engine shut-off device was successfully designed to turn on or off the engine of the motorcycle through Short Message Service(SMS), and tracks the location of the motorcycle in real-time.

1.2.2 EXISTING SYSTEMS ON DRIVER DROWSINESS DETECTION

The paper published by Subbarao, Sahithya in 2019 titled "Driver Drowsiness Detection system for vehicle safety" is an vehicle assisted automated safety system designed to scrutinize the eye blink.This system focuses on three unique ideas to prevent the accidents to be happen. First,it focuses on blink of eye using IR based eyeblink sensor, if the eye blink time is greater than normal blink then it is estimated that the driver is drowsy.If output is high it ensures eye closed else eye opened. If eye closed for more than 5 sec then the system raises an alarm to alert the driver when driving.Second, it focus on whether driver has drunk or not, using MQ-3 alcohol sensor to avoid accidents caused by drunken driver.If conductivity of sensor is higher then driver has drunk and warns the driver by displaying on LCD and through an buzzer, else is in normal condition. Third, using Tilt sensor it detects the fall i.e., whether vehicle met with an accident or not.Using GSM and GPS modules, authorized person can easily find the location of vehicle when met with an accident.Every sensor is under the control of micro-controller LPC2148.

1.2. 3 EXISTING SYSTEMS REAL - TIME LOCATION TRACKING

The paper published by Mohd HakimiBin and Mohd Fiqri Bin in 2021 titled "GPS based vehicle tracking system " is an application,displays the location of vehicles on google maps.Arduino Uno is the microcontroller, Neo 6m(GPS) used for routing the co-ordinates and SIM 900(GSM) tries to connect with user.GPS satellite is used to get the co-ordinates(latitude, longitude)and sends to the Arduino to extract the required data received by GPS.If it finds the co-ordinates successfully,then GPS LED blinks for 3-4 sec, tries to say the location is locked.GSM module is connected to Arduino to send co-ordinates to user by message.GSM LED blinks for 3-4 sec, to determine successful phone line connection.LED blink in GPS and GSM module, determines able to send information if it receives command from the user. User need to communicate through SMS by START command to activate the system, later it sends latitude ,longitude and URL link of google map to the requested number. To terminate the connection , user shall enter STOP command.Accuracy completely depends on the place. Using satellite view, real time location can be found easily.

1.3 PRESENT WORK

Existing model detects whether the person is wearing helmet or not. Proposed system ensures, for a safe ride, the rider has to wear an helmet to start a motorcycle.This project aims developing an AI model which checks whether the driver of the motorcycle is wearing a helmet or not Camera is connected to the motorcycle and function to act like a kill switch.If the driver wears the helmet then the ,internal circuits of the motorcycle will be closed and the driver will be able to start the bike. And if the driver doesn't wear a helmet then internal circuit will not be closed and driver cannot start the bike.The helmet detection is done using CNN machine learning model., then model is loaded into a pi module. From camera we get the visuals of the driver ,then the ML model works.

This project also includes an driver drowsiness detection and real time location tracking. Most of the time, the drivers would lose their alertness and meet with unfortunate accidents.This system implements an AI model in detecting the drowsiness of driver through the condition of rider based on opening an closing of eyes.If rider's eyes are closed for 3-4 sec, then our system will alert driver through an buzzer. So This system will alert the driver at the right time to prevent any mis-happening.

In recent times , bike theft has become an common issue. Every year lakhs of bikes were stolen and has lowest recovery rate .GPS monitoring has grown in popularity among companies and individuals who want to follow the whereabouts of their assets or cars in real time, and keep an eye on their movements. The proposed system tries to exhibit the live location of the vehicle to the corresponding user through Neo-6M (GPS) module ,tracks the location in real time and updates for every 2-3 min and requires an good internet connectivity to effective functioning.

1.3.1 OBJECTIVES & BENEFICIARIES

The main objective of this project is to ensure the driver wears a helmet while he/she is driving, tries to prevent accidents when driver feels drowsy,and automatically identify,track the location of object or person in real time.

The number of accidents that occur will be reduced through an drowsiness detection system ,if the driver met with an accident then the probability of death or head injuries will be less.The recovery rate of theft bikes will range high with real time location tracking system.

1.4 LITERATURE SURVEY

[1] The paper published by Kunal Dahiya, Dinesh Singh,Krishna Mohan in 2016,titled "Automatic Detection Of Bike Riders Without Helmet Using Survelliance Videos in Real-Time ",is all about developing an real-time detection of the individual who violates the traffic rules, includes riding an motorcycle without helmet and also helps traffic police in finding those violators through surveillance camera in odd environmental conditions that is; hot sun etc.In this approach, at first it detects the bike rider in a video frame from the surveillance video camera and then converts the image to grayscale image (binary image),separates the background that is; remove all the objects in motion apart from static objects like buildings etc;. Next, locates the head of rider and with the help of binary classifier, it determines whether the rider of bike is wearing helmet or not.To enhance the better performance of the system, it has been performed with three algorithms namely - History of Oriented Gradients(HOG) - proved as very efficient in detecting the objects, Scale-Invariant Feature Transform (SIFT) - it tries to capture key-point in image and for a key it extracts feature vectors like rotation etc; and Local Binary patterns (LBP)- capture texture info in a frame, for each pixel a binary number is assigned by threshold the pixel in neighbourhood for classification.For training and testing the model, it has an 2hr surveillance data, 1hour for training and remaining hour for testing. Training data includes - 42 bikes, 13 cars and 40 humans. Testing includes - 63 bikes, 25 cars and 66 humans.Among the specified three algorithms, HOG helps in achieving best performance with an accuracy of detecting the bike-rider is 98.88% and detection of violators is 93.80%. The average time taken to process each frame is 11.58ms. Further in future, this system can be extended to detect the number plate of a motorcycle of the individual who violates wearing helmet.

[2] The paper published by Yange Li,Han Wei,Zheng Han in 2020,titled " Deep Learning Based Safety Helmet Detection in Engineering Management Based on CNN", depicts about developing an real-time detection of safety helmet i.e; whether the construction workers wears helmet properly or not at the construction site using Deep-Learning methods (CNN).The model was trained with a data-set containing 3261 images of safety helmets collected from two sources, i.e., manual capture from the video monitoring system at the workplace and open images from websites. After the model was

trained, it was used to validate the collected validation set by using the Spyder software. The 153 images of the validation set were input into the model and the detected images were output. The output images show the predicted labels and the confidence scores of safety helmets. SSD - Mobile Net algorithm that is based on CNN and used to train the model with accurate value. The proposed model provides an opportunity to detect the helmets and improve construction safety management on-site.

[3] The paper published by Pramod Salunkhe, Tejashree Kakadae in 2022, titled " Helmet Detection Using Artificial Intelligence ", is all about developing an automated system to monitor motorcycle and to check whether the driver of a motorcycle is wearing helmet or not and also detects the number plate of a motorcycle of the one who violates wearing of a helmet to pay challan for violating traffic rules.This is an multitask learning (MTL)system that recognizes and track different motor cycles and register the helmets worn by the riders. Using the surveillance cameras which are positioned on highways , traffic it detects the rider wearing helmet or not and in case if he has not worn an helmet, then detects and extracts Number plate of a motorcycle through Optical Character Recognition to pay challan. Find the details in database and generates receipt for not wearing helmet and sends a SMS to register number to pay challan. To pay challan a user interface is also provided.This system mainly has two phases: in first phase, it tries to spot the bike-riders using YOLOv3 model - used for object detection appropriate frames from video are extracted. In second phase CNN based helmet is detected. YOLO v3 is an Open CV that tries to enhance high efficiency for recognizing the number of riders and usage of helmet and has an accuracy of 81% of training data.The whole model is tested with 300 images of motor cycle and has an better accuracy, also enhances efficiency for recognizing the number of riders and use of helmets or monitoring the two-wheeler.

[4] The paper published by Romuere Silva, Kelson R.T Aires in 2014,titled " Helmet Detection on Motorcyclists Using Image Descriptors and Classifiers ", mainly focuses on "detection of motorcyclists without helmets on public roads" using MLP algorithm and is all about developing a computational vision for vehicle classification and helmet detection. For vehicle classification, the wavelet transform is used as descriptor and random forest as classifier. For helmet detection, the HOG and Circular Hough Transform (CHT) are the two descriptors used to extract the image attributes and using MLP classifier, classifies the

objects. The system has two stages: [1] In vehicle segmentation and classification, it determines and classifies the moving objects. Certain parameters are required to operate the system, one such parameter defined is cross line-this should be marked by the system operator across the roads to capture the vehicles. The moving objects which crosses CL are extracted from video frame and using random forest classifier, it classifies the vehicles.[2] In helmet detection HOG defines different vectors of motorcyclist with and without helmet and using MLP algorithm classifies with or without helmet.There are two databases used for testing the algorithms obtained from videos captured through CCD camera on public roads. First image set includes classification of vehicles and second image set includes detection of helmets. The videos are recorded throughout the day and night under any circumstances and has a video resolution of 1280X720 pixels in 30 frames. Total duration of all videos is 150 min.First image set contains 110 minutes of video and has a 3245 images, out of which 2576 are non- motorcycles and 669 images are motorcycles. Second image set contains 40 minutes of video and has an 255 images, out of which 151 are motorcycles with helmets and 104 images are motorcycles without helmet.For testing the vehicle classification, using WT descriptor and a classifier, obtained accuracy is 0.9978, i.e; 3245 vehicles are classified only 72 are not classified exactly. And for helmet detection, using HOG it extracts features and Classification is done by MLP network, obtained accuracy is 0.9137, i.e; out of 255 images ,22 images are placed incorrectly.

[5] The paper published by Felix Wilhelm Sibert, Hanhe Lin in 2020, titled " Detecting Motorcycle Helmet Use With Deep Learning ", is all about detecting the active motorcycles, number and position of riders on motorcycle, and also helmet detection.The whole data is collected in an country named MYANMAR.Traffic was captured with two-video cameras with an resolution of 1920X1080 pixels and recorded for two consecutive days with 10 frames per second. Total of 254 hours of video data is available, this 254hours are divided into 10sec video clips i.e; has 100 frames each for training, testing and validating the data. YOLO9000 is an algorithm applied to detect number of motorcycles in each frame.Out of 254video clips, 1000 video clips are sampled together and from this 954clips are randomly divided as training set (70%), testing (20%) and validation (10%). The algorithm has a high accuracy for general detection of vehicles

where only two riders are allowed. It is also capable of identifying the riders, and position on vehicles and produces 14 frames per second. Is implemented to produce real-time helmet detection.In future, this work can be extended with a tracking system i.e; individual motorcycles can be identified in their subsequent frames, and also improves overall detection accuracy.

[6] The paper published by Prof. Swati Gade, Kshitija Kamble, Aishwarya Sheth in 2022 titled "Driver Drowsiness Detection Using ML", is an application developed to prevent accidents from happening,by alerting the rider at right time. The proposed Open CV algorithms find and help to normalize human faces. At first, algorithm starts with the detection of heads on colour pictures using deviations in colour and structure of the human face and that of the background.After that the eyes are detected from the region of interest. If an eye is detected then there is no blink and the blink counter is set to 20. If the eyes are closed in a particular frame, and a blink is detected, then the blink counter is decremented.When the eyes are closed for more than 4 frames then it is deducible that the driver is feeling drowsy. Hence drowsiness is detected through eye aspect ratio and an alarm sounded, if the aspect ratio value is less than 0.25 (0.25was chosen as a base case after some tests), user is warned.After that the whole process is repeated as long as the driver is driving the vehicle. This system also has an limitation - System focuses at the number of consecutive frames where the eyes are closed. At that point it may be too late to issue the warning.

[7] The paper published by Sukrit Mehta, Sharad Dadhich, Sahil Gumber, Arpita Jadhav Bhatt in 2019, titled "Real-Time Driver Drowsiness Detection System Using Eye Aspect Ratio and Eye Closure Ratio" ,is an Android application developed for detecting real - time drowsiness . This application deals with 2 level processes. At first the driver needs to login to application then add the start and end location of ride. When the rider starts the ride, the camera mounted captures the images of rider for every 1 sec, and is subsequently sent at local server. At the server's side, Dlib library is employed to detect facial landmarks and a threshold value is set to 0.25 and used to detect whether driver is drowsy or not. If the value is less than the threshold then the counter value is incremented, else the counter value is set back to zero in case of eye blink. If the counter value reaches to three, an alarm is triggered in the android device to alert the rider.For this whole

process , 50 volunteers data is collected for obtaining EAR values and has achieved 84% accuracy with Random Forest Classifier.

[8] The paper published by Rateb Jabbar, Mohammed Kharbeche , Mohsen Jafari in 2018,titled " Real-Time Driver Drowsiness Detection for Android Application using Deep Neural Networks Techniques",is an application based on multilayers perceptron classifiers.The role of the system is to detect facial landmark from images and deliver the obtained data to the trained model to identify the driver's state. This application follows different steps . At first ,theAndroid mobile camera is given permission to take facial pictures of the driver. Based on five simulated driving scenarios (with glasses, with sunglasses, without glasses, the night with glasses, and night without glasses) in which subjects in the training data sets were recorded. The videos of two states (sleepy and non-sleepy) were selected for every scenario. In total, 200 videos were used. Following the extraction of the videos, every frame was converted to an image. After taking the picture, it will be transferred to the Dlib Library. Then followed by second step, the Dlib detects and extracts facial landmarks from the image and sends the collected data to thedriver drowsiness detection algorithm based on the trained model; then, the algorithm evaluates the state or the level of drowsiness of the driver. Finally, if the result indicates the drowsiness of drivers, the application will signal to the driver with visual and audio messages. The whole process has achieved an accuracy of more than 80% through MLP Classifier.

[9] The paper published by Elena Magan, Pas Sesmero in 2022 , titled "Driver Drowsiness Detection by Applying Deep Learning Techniques to Sequence of Images",is an advanced driving assistance system focuses on driver drowsiness detection and alert the rider at right time.To detect whether the driver shows symptoms of drowsiness or not, two alternative solutions are developed.First focuses on CNN to analyze sequence of images of rider , a camera mounted on a vehicle will record frontal images of the driver. Next on Deep learning techniques (fuzzy logic which avoids in raising an false alarm),which will be analyzed by using AI techniques, such as deep learning, to detect whether the driver is drowsy or not. By using that information, the system will be able to alert the driver and prevent accidents.The combination of SVM and HOG is used to detect driver's face and then preprocessed and then sent to fuzzy logic(if p then q) to be analyzed to assess the

drowsiness of the driver.If the system estimates the driver drowsy then it raises an alarm to stop the vehicle . Although it produces an accuracy of 93% without raising false alarms.

[10] The paper published by Ameen Aliu, Kamilia Kamardin,Azizul Azizan in 2019 titled " Non - intrusive Driver Drowsiness Detection based on Face and Eye Tracking" , is based on tracking the eye state and face of the driver and classifies using various machine learning models.Unlike physiological methods(heart , eyes , brain activities are detected through sensors) behavioral methods(Percentage of eyelid closure)are nonintrusive. They are capable of capturing the driver's drowsiness state without having any physical contact with the driver. As soon as driver experience drowsiness ,around head area there are certain physical changes that occur in body. These changes can be easily found through behavioral methods .In order to detect these changes, behavioral methods usually go through a combination of video acquisition of the driver state and some computer vision techniques processes, encloses both image processing and machine learning. The model defined three measures: head poses, eye index, and pupil activity. The whole process include several steps .At first data is collected from NTHU computer vision lab and preprocessed using several video and image processing techniques to detect the driver's eye states, next step tries to extract key features that are inputs to the model.The result of these models K-nearest Neighbors (KNN), Support Vector Machine (SVM), Logistic Regression, and Artificial Neural Networks (ANN) machine learning algorithms is then evaluated for their accuracy, sensitivity, specificity, false alarm rate, and miss rate in the performance evaluation phase. The data set must be acquired from various drivers not belonging to the same family, since genetic similarities can directly affect the specificity of the algorithms.Then, the drowsiness classification process was used to classify the driver's state into either an awake or drowsy state. This process utilizes several machine learning classification. The accuracy of the system was found to be at most 70-75%.

[11] The paper published by Dheer Dhwaz Barak, Khushwant Singh, Prashant Ahlawat, Hitesh Kumar Sharma in 2020, titled "Real-Time Tracking System: An IoT Based Application", An Internet of Things based application will be developed, which can track down the position of your bag or vehicle in real-time and display that same position on Google Map. The end-user will be able to see the real-time position of his/her lost or stolen bag or stolen vehicle on a web portal, which is deployed on a cloud platform

(Microsoft Azure/AWS) we also developed an Android Based App, which will show the same real-time position of bag or vehicle on their smartphone, ease to use. The development of a Real-Time Tracking System requires hardware modules and sensors, such as Arduino Uno Board, GPS Module Sim 28M, GSM Module Sim 900A, Battery (12V | 1A), Power Bank, Antenna, GPS Receiver, Jumper Wires, ThingSpeak API, and Microsoft Azure/AWS subscription. The first step is to collect/purchase these components/subscriptions and then go for the next phase. The device will be placed in a bag or vehicle to track its position in real time and then used for analytics, mapping, or directions. The device will use ThingSpeak Cloud APIs to track the bag or vehicle, a GPS module to provide the exact position of the bag or vehicle, and a GSM module to send the latitude and longitude coordinates to the ThingSpeak channel via GPRS. The device will also use Google Map API and Google Map Direction Services to display the location on a map and the shortest path to reach the stolen/lost travel bag or vehicle.

[12] The paper was published by Baburao Kodavati, V.K.Raju, S.Srinivasa Rao in 2020, titled "GSM And GPS Based Vehicle Location And Tracking System". This project is designed using the 8051 microcontrollers to design an embedded system that is used for tracking and positioning vehicles using Global Positioning System (GPS) and a Global system for mobile communication (GSM). The AT89S52 microcontroller is interfaced serially with a GSM Modem and GPS Receiver, which are used to send the position (Latitude and Longitude) of the vehicle from a remote place. The GPS modem gives many parameters as the output, but only the NMEA data is read and displayed on the LCD. An EEPROM is used to store the mobile number. The hardware interfaces to the microcontroller are LCD display, GSM modem, and GPS Receiver.The design uses RS-232 protocol for serial communication between the modems and the microcontroller, and a serial driver IC is used for converting TTL voltage levels to RS-232 voltage levels. This project provides more security to the vehicle by automatically sending a return reply to the user indicating the position of the vehicle in terms of latitude and longitude.

[13] This paper was published by T. Sindhu, L. SaiRamesh, in 2020, titled, "Real-Time Vehicle Tracking Scheme by Analyzing Spatial Position Through GPS And GSM". This project is designed so that the users can add destinations and share them with their friends and family using this tracking tool. Latitude and longitude are used by the global

positioning system (GPS) to determine a location. A screen can display numerous vehicles being monitored simultaneously thanks to the user interface. The world is now connected via the internet, making it possible for anyone to learn anything at any time. In order to prevent unintentionally visiting undesirable locations, geo-fencing draws boundaries across the globe.The suggested method has a straightforward user interface that makes it convenient for users to utilize the system. The logic of the bird's eye perspective aids in determining the precise location where friends are loitering about their home and aids in locating the nearby individuals if they are in a restricted region.

[14] The paper published by Oktaf B Kharisma, Dzikra A A,Mustakum,Rian Vebrianto, Rice Novita,in 2019, titled "Development of location tracking system via short message service(SMS) based on GPS unblox neo-6m and Sim 8001 module", is for location tracking devices using mobile phone. There are four states of testing based on the SMS sent by the 800L SIM-First message when the tracking device is turned on,states of GPS module does not receive a signal when it is tracked,state of GPS module receives coordinate signals,State of reset condition to the location tracking device.This tool's design can be used with the ability to track location. An 800L SIM sends an SMS containing the coordinates received by the tracking device along with their location. Direct internet access is available to the message sent in the form of a Google Maps address. For students who have original ideas, this tool can be used as a learning resource to help them develop more cutting-edge safety system solutions.The placement of the tracking device affects the Ublox Neo 6-M GPS module's capacity to pickup parallel signals.Getting coordinates is simple of the device is located outside. It will be difficult to obtain coordinate signals if the device is present in the room.The way to track a device is from a mobile phone, by texting the "track" code to the device number.This tool can be used for bags,motorbikes and other valuable items that can be lost.

[15] The paper published by Sagar Karkare and Ashwini Andale in 2020, titled "Live Tracking system " track the real time location for every few seconds.This project aim to develop an application ,help parents for tracking real time location of their children through SMS using GPS and network provider and requires location and telephony enable to work system appropriately.Parent requests the child module to send the location through SMS service.USing GPS satellite, it tries to figure out the co-

ordinates(latitude,longitude)and then location is locked and sent as an reply to parent module from child module.SMS is best for communicating and receiving alert messages for knowing real time location.Internet connectivity is required at parent module to load the maps.If GPS doesnot find satellite signals then the application use network provider to detect the cellular ID and track the location.

1.4.1 OVERVIEW OF LITERATURE SURVEY

S.NO	TITLE	AUTHORS AND PUBLISHED DATE	DESCRIPTION AND ALGORITHMS USED	ACCURACY
1.	Automatic Detection Of Bike Riders Without Helmet Using Survelliance Videos in Real-Time	Kunal Dahiya,Dinesh Singh,Krishna Mohan in 2016	First recognises the bike rider in a video frame, transforms the picture to grayscale, separates the backdrop,and removes the background. Locates the cyclist's head next, using a binary classifier to assess whether or not the rider is wearing a helmet. Algorithms HOG,SIFT,LBP	Obtained 98.88% Accuracy by HOG
2.	Deep Learning Based Safety Helmet Detection in Engineering Management Based on CNN	Yange Li, HanWei, Zheng Han in 2020	Check whether the construction workers wears helmet properly or not at the construction site using CNN .After trained model it is used to validate using spyder software. Algorithm SSD-mobile net	Obtained 90% Accuracy through SSD

3.	Helmet Detection Using Artificial Intelligence	Pramod Salunkhe, Tejashree Kakadae in 2022	Using YOLO V3 algorithm, it detects the rider in frame and through CNN it checks whether rider has worn helmet or not . If No helmet detected ,extracts number plate through OCR and informs rider to pay challan . Algorithm -YOLO V3,CNN	Obtained 81% accuracy through CNN
4.	Helmet Detection on Motorcyclists Using Image Descriptors and Classifiers	Romuere Silva, Kelson R.T Aires in 2014	At first,the moving objects which crosses CL are extracted from video frame and using random forest classifier, it classifies the vehicles.Next through MLP classifier it classifies whether rider worn helmet or not. Algorithm MLP Classifier	Obtained 91% accuracy through MLP Classifier
5.	Detecting Motorcycle Helmet Use With Deep Learning	Felix Wilhelm Sibert, Hanhe Lin in 2020	Is all about detecting the active motorcycles, number and position of riders on motorcycle, and also helmet detection.YOLO9000 is an algorithm applied to detect number of motorcycles in each frame. Algorithm YOLO V3	Obtained 90% accuracy through YOLO V3

6.	Driver Drowsiness Detection Using ML	Prof. Swati Gade, Kshitija Kamble, Aishwarya Sheth in 2022	Algorithm start with eyes detection in frames.And threshold value is set to 20.If no blink value remains same, if closed eyes the value decreases and eyes closed subsequently then detected as drowsy.IF EAR >0.25 then alerted through buzzer. Algorithm - CNN	Obtained 92% accuracy through CNN
7.	Real-Time Driver Drowsiness Detection System Using Eye Aspect Ratio and Eye Closure Ratio	Sukrit Mehta, Sharad Dadhich, Sahil Gumber, Arpita Jadhav Bhatt in 2019	First ,rider need to login to app and performs necessary actions.Second, through camera it get visuals and detects facial landmarks and a value set to 0.25. Inc or Dec in value indicates drowsiness of rider. Algorithm Random Forest Classifier	Obtained 84% accuracy through Random Forest Classifier
8.	Real-Time DDD for Android Application using Deep Neural Networks Techniques	Rateb Jabbar, Mohammed Kharbeche , Mohsen Jafari in 2018	System tries to detect facial images in an frame and transfer the data to trained model to identify driver's state.Based on the condition the app sends audio messages to alert the driver Algorithm MLP Classifier	Obtained 80% accuracy through MLP Classifier

9.	Driver Drowsiness Detection by Applying Deep Learning Techniques to Sequence of Images	Elena Magan, Pas Sesmero in 2022	First ,a camera mounted on a vehicle records frontal images of driver.Next,uses DL to detect whether the driver is drowsy or not..If the system estimates the driver drowsy then it raises an alarm to stop the vehicle. Algorithm CNN, SVM and HOG.	Obtained 93% accuracy through SVM
10.	Non - intrusive Driver Drowsiness Detection based on Face and Eye Tracking	Ameen Aliu, Kamilia Kamardin,Azizul Azizan in 2019	System tracks the face and eye state of the driver and classifies using various ML models to check condition of rider and alert the rider at right time. Algorithm KNN, Various ML models	Obtained 70-75% accuracy through KNN,ANN
11.	Real-Time Tracking System: An IoT Based Application	Dheer Dhwaz Barak, Khushwant Singh,in 2020	Application tracks the position of bag in real-time through sensors and modules and can be acessed through Web portal by user. Components - Arduino , GPS(28Mmodule),GSM (900A),Battery,Antenna, GPS Receiver.	Deployed Platform AWS (or) Microsoft Azure

12.	GSM And GPS Based Vehicle Location And Tracking System	Baburao Kodavati, V.K.Raju, S.Srinivasa Rao in 2020	System tracks the position of vehicles using GPS and GSM , by storing the mobile number and sending the location to mobile number. Components 8051MC,GPS,GSM,RS-232 protocol for serial Communication	Deployed Platform Netlify
13.	Real-Time Vehicle Tracking Scheme by Analyzing Spatial Position Through GPS And GSM	T.Sindhu, L.Sai Ramesh in 2020	System aims in designing an UI through which user can add destination and share to family etc., Through GPS it trace out the location and family can locate the destination easily. Component - GPS	Deployed Platform Firebase
14.	Development of location tracking system via short message service(SMS) based on GPS unblox neo-6m and Sim 8001 module.	Oktaf B Kharisma, Dzikra A A,Mustakum ,Rian Vebrianto, Rice Novita,in 2019	Initially starts with enabling the tracking device,GPS receives signals,GSM sends an SMS along with Lat and Long,location to registered number and user can easily track the location by sending TRACK code to device. Components GPS(NEO-6M),GSM(SIM 800L),Raspberry pi.	Deployed Platform Netlify

15.	Live Tracking System	Sagar Karkare and Ashwini Andale in 2020	Aim to develop an app ,help parents for tracking real time location of their childrenthrough SMS.Parent requests the child module to send the location through SMS .Using GPS satellite, it figure out the lat,long location sent as an reply to parent from child module Components-GPS,GSM,Pi	Deployed Platform Render

Table 1 : Overview of Literature Survey

2. HARDWARE TOOLS

The proposed system “Smart Bike using IoT and Deep learning” is a combination of AI and IoT which ensures for a safe and joyful ride the rider of motorcycle should wear an helmet. Through the pi module, it detects the helmet and condition of rider if it is yes, the rider will be able to start the bike or else rider will not be able to start the bike.If rider feels drowsy then system alerts to prevent accidents.The motorcycle is modified with new feature i.e;Real time location tracking.This feature can automatically identify,track the location of object or person in real time using NEo-6M GPS module.

2.1 HARDWARE DESCRIPTION

2.1.1 RASPBERRY PI 4 (MODEL B)

Raspberry Pi 4 Model B is the latest product in the popular Raspberry Pi range of computers. It offers ground-breaking increases in processor speed, multimedia performance, memory, and connectivity compared to the prior-generation Raspberry Pi 3 Model B+, while retaining backwards compatibility and similar power consumption. For the end user, Raspberry Pi 4 Model B provides desktop performance comparable to entry-level x86 PC systems.

Specifications:

- Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- 1GB, 2GB, 4GB or 8GB LPDDR4-3200 SDRAM (depending on model)
- 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE
- Gigabit Ethernet, 2 USB 3.0 ports; 2 USB 2.0 ports.
- Raspberry Pi standard 40 pin GPIO header (fully backwards compatible with previous boards)
- 2 × micro-HDMI ports (up to 4kp60 supported)
- 2-lane MIPI DSI display port and CSI camera port
- Micro-SD card slot for loading operating system and data storage
- 5V /3A USB - C power supply required.
- Power over Ethernet (PoE) enabled (requires separate PoE HAT)
- Operating temperature: 0 – 50 degrees C ambient.

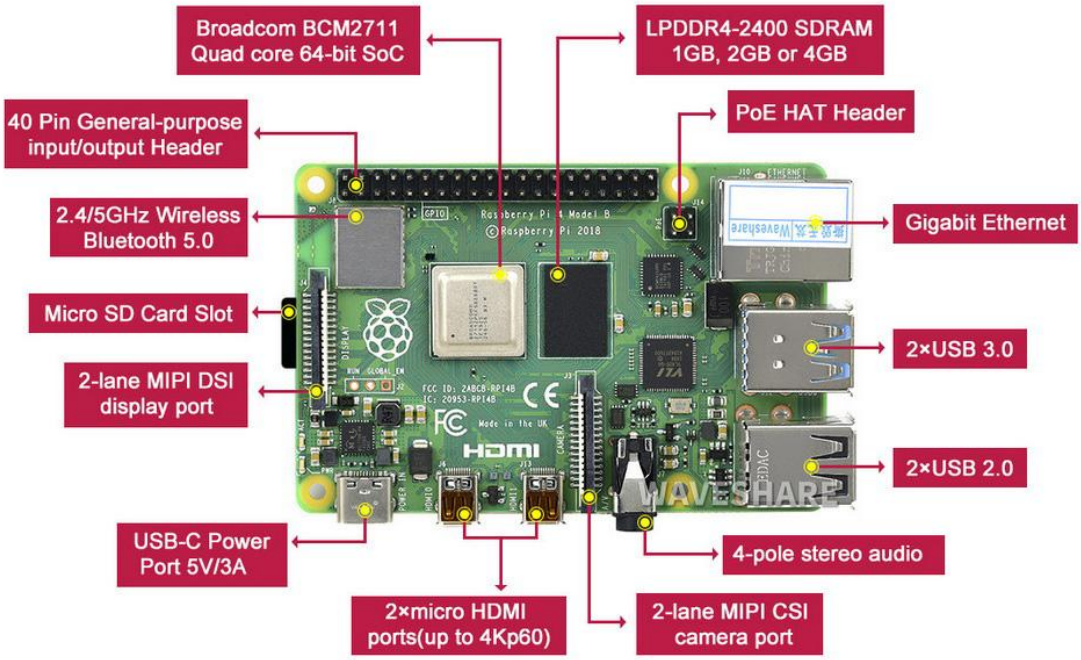

Fig 1: Raspberry Pi 4 (Model B)

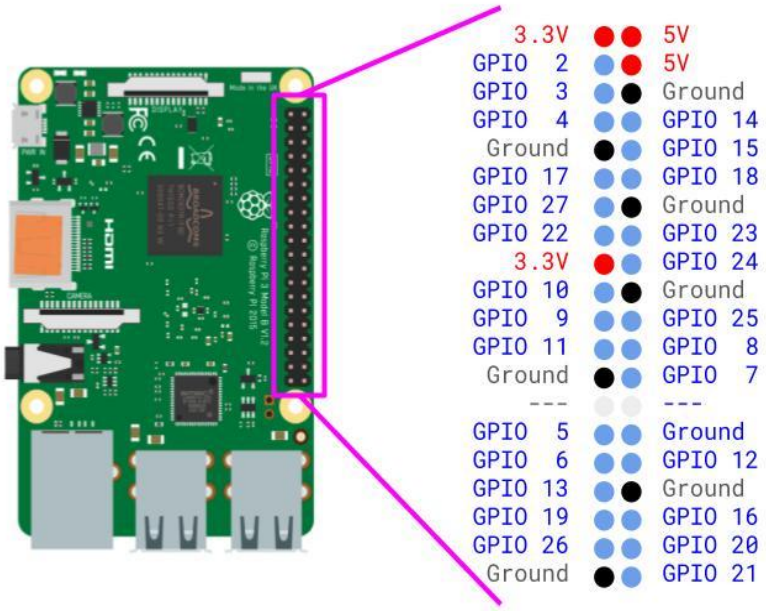

Fig 2: Pins of Pi Board

2.1.2 CAMERA MODULE

IR or night vision cameras use infrared light to illuminate images in the dark. We can't see it, but infrared light is actually all around us. IR cameras detect these invisible infrared wavelengths, enabling the camera to see in the dark.Active infrared night-vision combines infrared illumination of spectral range 700–1,000 nm (just over the visible spectrum of the human eye) with CCD cameras sensitive to this light. The resulting scene, which is apparently dark to a human observer, appears as a monochrome image on a normal display device.Night vision security camera is a type of surveillance camera that is able to see in low-light or no-light conditions. They typically have infrared (IR) LED illuminators, which emit invisible light that the camera can see. This allows the camera to produce a clear image, even in very low-light environments.

Features:

• Powerful IR illumination, preferably adaptive.

• Ability to switch from color mode to black and white.

• High light sensitivity of the sensor.

• ICR filter.

Fig 3 : Camera Module

2.1.3 RELAY

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.The traditional form of a relay uses an electromagnet to close or open the contacts, but relays using other operating principles have also been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays.Latching relays require only a single pulse of control power to operate the switch persistently. Another pulse applied to a second set of control terminals, or a pulse with opposite polarity, resets the switch, while repeated pulses of the same kind have no effects.

Features:

- Supply voltage – 3.75V to 6V
- Quiescent current: 2mA
- Current when the relay is active: ~70mA
- Relay maximum contact voltage – 250VAC or 30VDC
- Relay maximum current – 10A

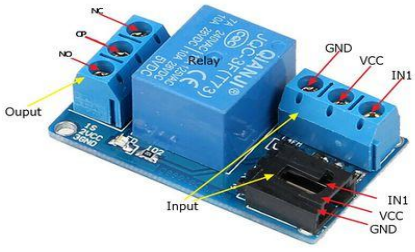

Fig 4 : Relay

2.1.4 BUZZER

An audio signaling device like a beeper or buzzer may be electro- mechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and are used in timers, alarm devices, printers, computers, etc.

Typically there are two types of buzzers namely - electromagnetic and piezoelectric buzzer. A piezo buzzer is a type of electronic device that's used to produce a tone, alarm or sound. It's lightweight with a simple construction, and it's typically a low-cost product. . Some of the piezoelectric buzzers are also equipped with light-emitting diodes.

The working principle of an piezo electric buzzer is -When an alternating voltage is applied to the piezo ceramic element, the element extends and shrinks diametrically. This characteristic of piezoelectric material is utilized to make the ceramic plate vibrate rapidly to generate sound waves.

Features:

- Operating voltage of ~3 to ~250 V.
- Typical current consumption of < 30 mA.
- Approximate resonant frequencies of 2 to 6 kHz.

Pin Configuration:

It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-'symbol or short terminal and it is connected to the GND terminal.

Fig 5: Buzzer

2.1.5 LIGHT EMITTING DIODE

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process. LEDs allow the current to flow in the forward direction and blocks the current in the reverse direction.

Light-emitting diodes are heavily doped p-n junctions. Based on the semiconductor material used and the amount of doping, an LED will emit a coloured light at a particular spectral wavelength when forward biased. As shown in the figure, an LED is encapsulated with a transparent cover so that emitted light can come out.

LEDs work on the principle of Electroluminescence. On passing a current through the diode, minority charge carriers and majority charge carriers recombine at the junction. On recombination, energy is released in the form of photons under forward bias.

LEDs find applications in various fields, including optical communication, alarm and security systems, remote-controlled operations, robotics, etc. It finds usage in many areas because of its long-lasting capability, low power requirements, swift response time, and fast switching capabilities.

Features:

- ✧ Operates at a much lower temperature (cool to the touch).
- ✧ Durable and capable of long hours of use.
- ✧ Low Energy Consumption.

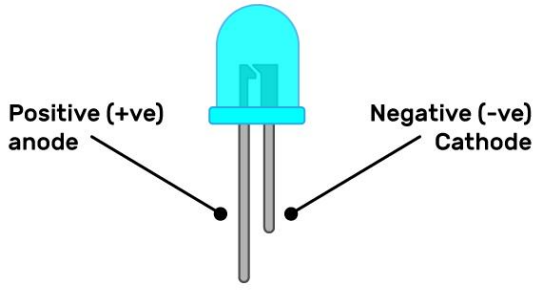

Fig 6 : LED

2.1.6 NEO 6M MODULE

The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capabilityand a data backup battery,the module can save the data when the main power is shut down accidentally. With power and signal indicators,the status of module can be monitored.This GPS module gives the best possible position information, allowing for better performance with Multirotor control platform.The GPS module has serial TTL output, it has four pins: TX, RX, VCC, and GND. The TxD and RxD pins are used to communicate with the micro-controller. The NEO 6M GPS Module be used in applications requiring global positioning and navigation, like automotive vehicles, drones, pets, etc.

Features:

• 5Hz position update rate.

• Operating temperature range: -40 TO 85°CUART TTL socket.

• EEPROM to save configuration settings.

• Rechargeable battery for Backup.

• The cold start time of 38 s and Hot start time of 1 s and Supply voltage: 3.3 V

• Configurable from 4800 Baud to 115200 Baud rates. (default 9600)

• Separated 18X18mm GPS antenna

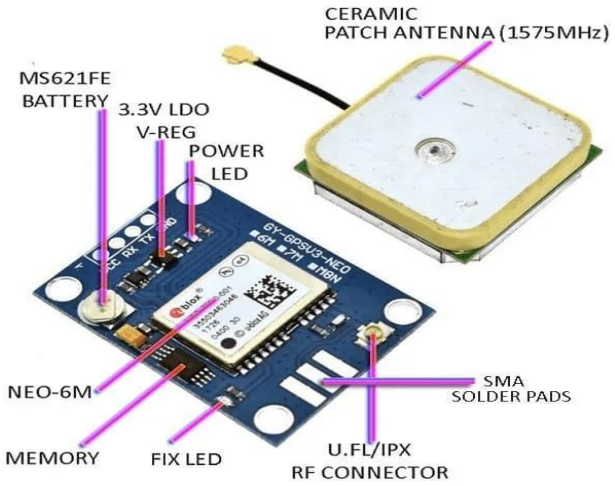

Fig 7 : NEO -6M GPS Module

2.2 UML DIAGRAM

Data Flow Diagram is a way of representing flow of data by a process or a system. It represents communication between a process and an entity . Here the Camera module captures image and sent to Raspberry Pi 4 module and classifies whether rider is wearing helmet or not .If Yes, the relay will be turned on, and rider will be able to start the bike.Else No, the relay will be turned off. Buzzer starts beeping , if rider removes helmet while riding a motorcycle. Camera module tries to capture the face of rider to check the condition of rider and raspberry classifies whether driver is drowsy or not. If it detects drows,y then system alert through an buzzer to the rider to be active. Neo 6M GPS Module tracks the location and update to database for every few seconds and the tracked location is sent to raspberry pi 4. By accessing the web page the rider an track real time location at any time irrespective of place.

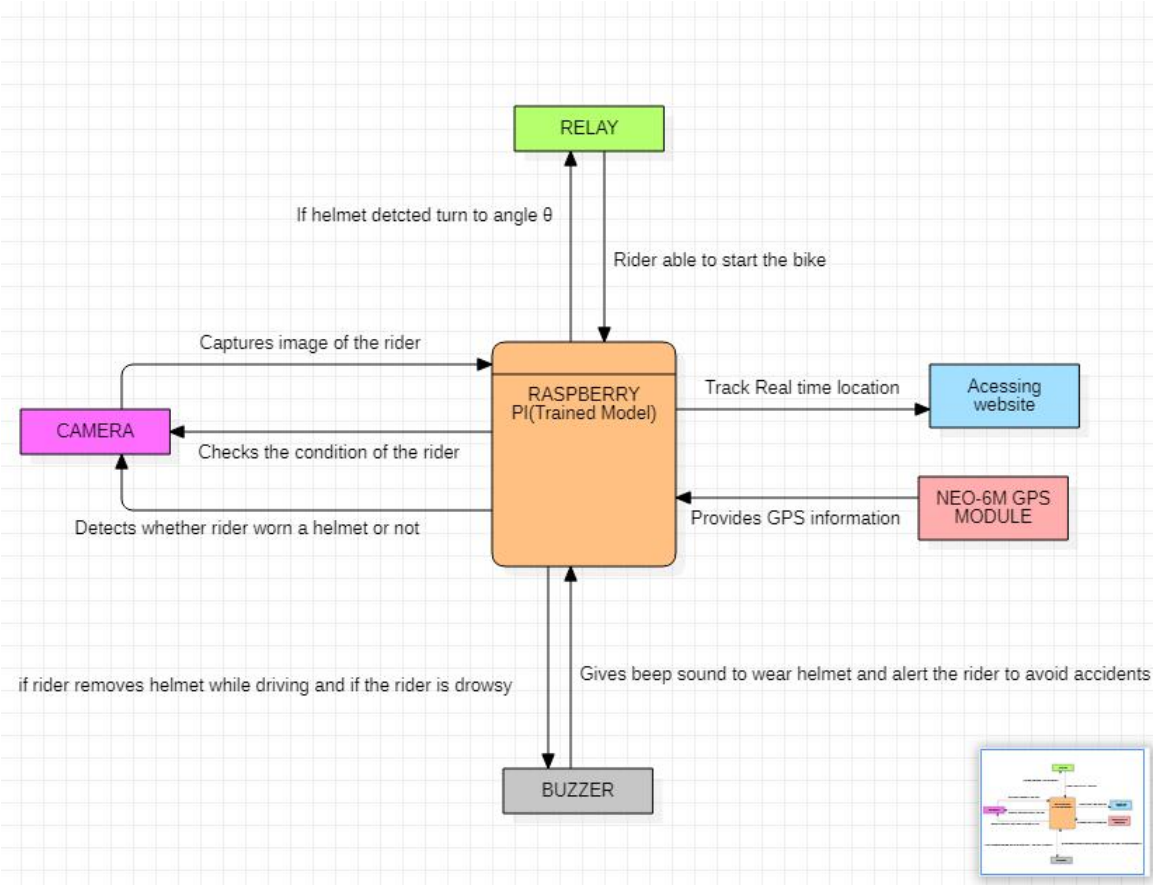

Fig 8: DFD

3. PROJECT IMPLEMENTATION

An implementation is a realization of a technical specification or algorithm as a program, software component, or other computer system through computer programming and deployment.

The goal of our project is to develop an smart bike system with salient features to ensure the safety of rider by following certain specified rules reduce the occurrence of accidents.Salient features include real-time helmet detection for bike ignition and detecting the drivers' condition and alerting them at right time through an buzzer and tracking the live location of person or an vehicle at any time.

3.1 FRAMEWORK OF SYSTEM

Fig 9 represents the complete framework of the system.Raspberry pi 4 is an micro controller, whole system is under the control of micro controller.Through an camera module it gets the visuals of the rider, detects for whether rider worn helmet or not.If helmet has been worn then relay turns on and internal circuit is closed, Rider will be able to start the bike.If no detection in helmet,relay turns of and internal circuit is not closed , rider will not be able to start the bike. In sequence, the camera module detects whether rider condition is in normal state or drowsy based on blinking of eyes.Score is calculated, if driver drowsy is detected the score raises and if it reaches maximum then the system alerts through an buzzer.If eyes are in blinking state , score gradually increases and reaches to zero .If no drowsy is detected then system works as usual. To track the location of person or theft bikes ,it often becomes difficult manually. Real time location tracking helps to find the location in no time .Through an GPS module it receives the signals and sends to raspberry pi ,at the user end ,an active internet connection is required to access web page and location gets updated for every span of time.

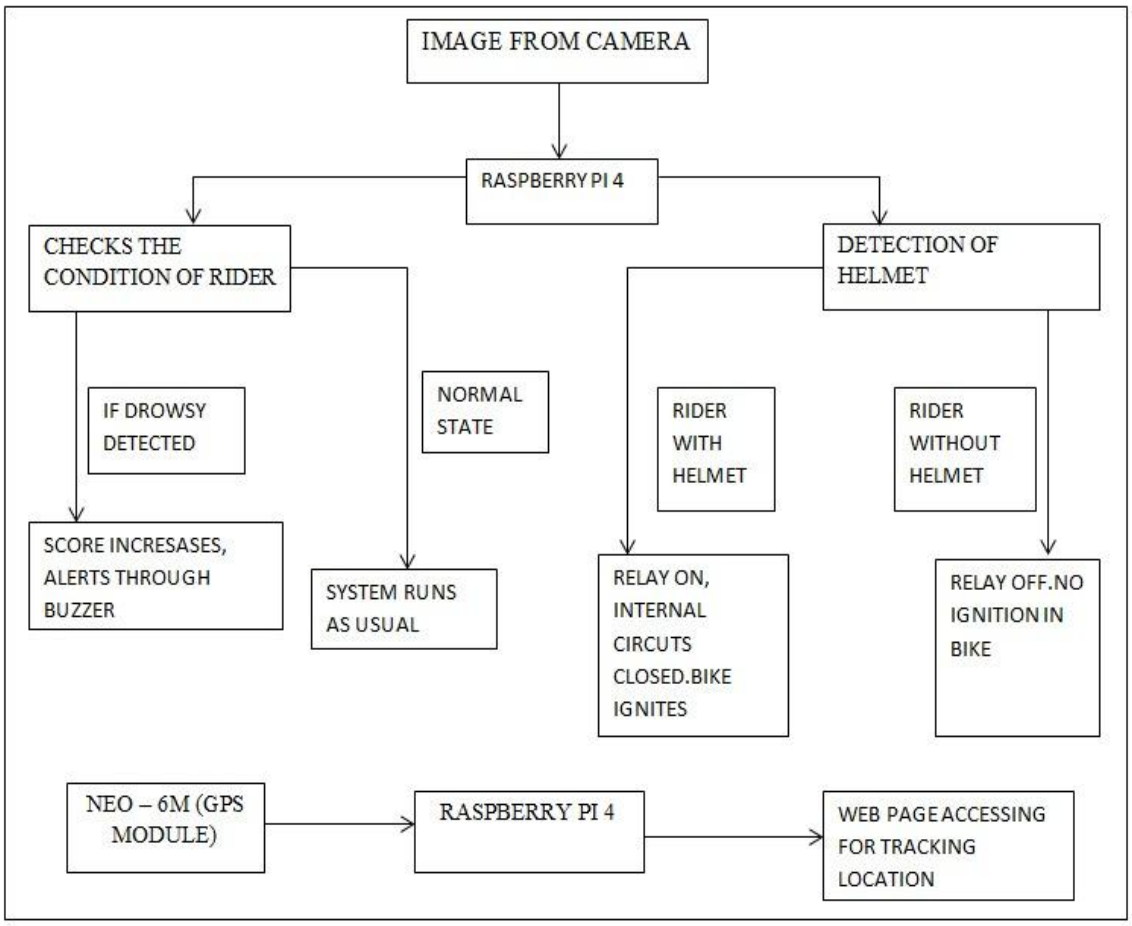

Fig 9 : Framework of the system

3.2 WORKING

The system works on three different aspects of helmet detection. Before the ignition, in the bike, the rider should wear a helmet. Through a camera module, it captures the rider's image every 5-6 sec. The captured image is sent to raspberry pi 4. The raspberry pi classifies whether the rider has worn a helmet or not. Based on the classification, if the rider has worn a helmet, then the Relay turns on, so he/she can start the bike, or else cannot be able to start the bike. The blink in LED, says that the bike can able to start. The second aspect includes - If the rider removes the helmet in driving, then an alarm alerts the rider for 5 seconds. Even if the rider doesn't wear a helmet after warning, then the engine of the bike comes to a halt state. The third aspect focuses on - if the key is on and no helmet is detected, it doesn't wait for 5-6 sec, immediately captures in the next second. If the helmet is detected then can able to start the bike.

Driver drowsiness detection plays a crucial role in reducing accidents by alerting the rider at right time. The system captures the image of the rider through a Camera module every 3-4 seconds and sends it to raspberry pi 4 modules. The pi module detects the condition of the rider whether the rider is in a drowsy or in a normal state. Then a score is calculated with a limit of 5 sec. If the score exceeds 5sec then the rider is alerted through a buzzer. If the rider blinks his eyes, then suddenly score increases and comes to zero. Based on the score calculation, the rider is alerted.

In recent days, bike theft has been a complicated issue where the recovery rate is very less. In order to increase the recovery rate of theft bikes, Real-time location tracking comes into existence. The system uses a NEO 6m GPS module connected to raspberry pi to track the real-time location of the bike. Through a Dongle and a sim card, it provides internet connectivity to the modules to update the location for a few seconds. The location is accessed through a web-page at the user end.

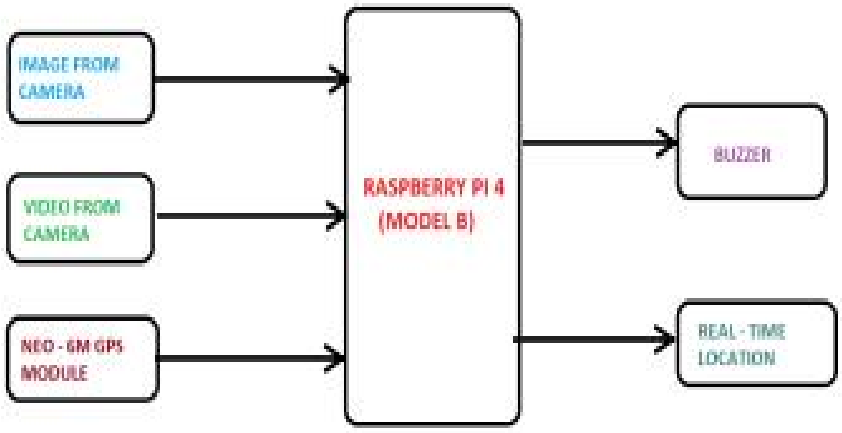

Fig 10 : Block Diagram

3.3 OVERVIEW TECHNOLOGY

This section talks about the algorithms used for the project. We used Inception V3, CNN algorithm for detecting driver drowsiness and helmet.In driver drowsiness detection ,Inception V3 produces best results for image classification.In helmet detection CNN model gives accurate results compared to other algorithms.The system is a vision based approach. It detects whether rider of motorcycle is wearing helmet or not.

3.3.1 CONVOLUTIONAL NEURAL NETWORK

Unlike regular Neural Networks, in the layers of CNN, the neurons are arranged in 3 dimensions: width, height, depth. The neurons in a layer will only be connected to a small region of the layer (window size) before it, instead of all of the neurons in a fully-connected manner. Moreover, the final output layer would have the number of classes, because by the end of the CNN architecture we will reduce the full image into a single vector of class scores.

The Convolutional Neural Network (CNN or ConvNet) is a subtype of Neural Networks that is mainly used for applications in image and speech recognition. Its built-in convolutional layer reduces the high dimensionality of images without losing its information. Some of the disadvantages of CNNs: include the fact that a lot of training data is needed for the CNN to be effective and that they fail to encode the position and orientation of objects. They have a hard time classifying images with different positions.

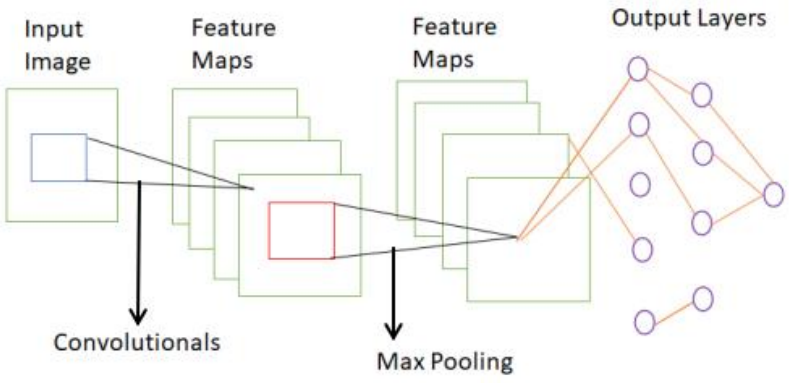

Fig 11: CNN Model

1. Convolution Layer : In convolution layer we consider a small window size [typically of length 5*5] that extends to the depth of the input matrix. The layer consist of learnable filters of window size. During every iteration, we slid the window by stride size(1), and compute the dot product of filter entries and input values at a given position. As we continues, this process well create a 2-Dimensional activation matrix that gives the response of that matrix at every spatial position. That is, the network will learn filters that activate when they see some type of visual feature such as an edge of some orientation or a blotch of some color

2. Pooling Layer : We use pooling layer to decrease the size of activation matrix and ultimately reduce the learnable parameters. There are two type of pooling :

a) Max Pooling : In max pooling we take a window size [for example window of size 2*2], and only take the maximum of 4 values. As we continue this process, finally we get a activation matrix half of its original Size.

b) Average Pooling : In average pooling we take average of all values in a window.

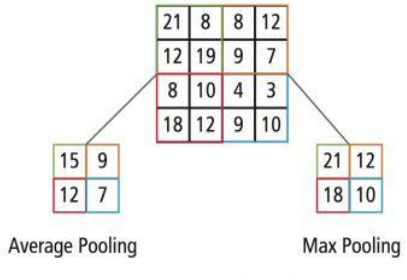

Fig 12 : Difference between Max and Avg Pooling

3. Fully Connected Layer : In convolution layer neurons are connected only to a local region, while in a fully connected region, we will connect all the inputs to neurons.

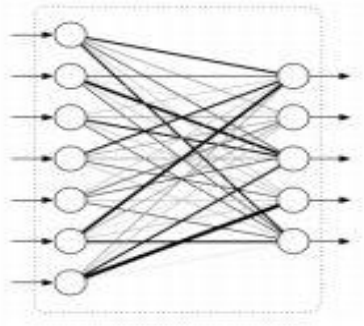

Fig 13: Fully Connected Layer

4. Final Output Layer : After getting values from fully connected layer, we will connect them to final layer of neurons[having count equal to total number of classes], predicts the probability of each image to be in different classes.

FLOW CHART OF CNN PROCESSING

To check whether person is using helmet or not , firstly requires an model ,pass the data set containing different images of helmets to the model and trained the model with Convolutional Neural Network as it gives better accuracy compared to other algorithms. After successful model training, we obtain the weights to that model and it is loaded into the pi module . In Pi module it detects whether the person is wearing helmet or not, Using binary classifier produces output. If the Person worn a helmet and it is detected, then relay is turned to angle theta and if person doesn't wear an helmet then he/she is unable to start the bike and thus moves to next frame.

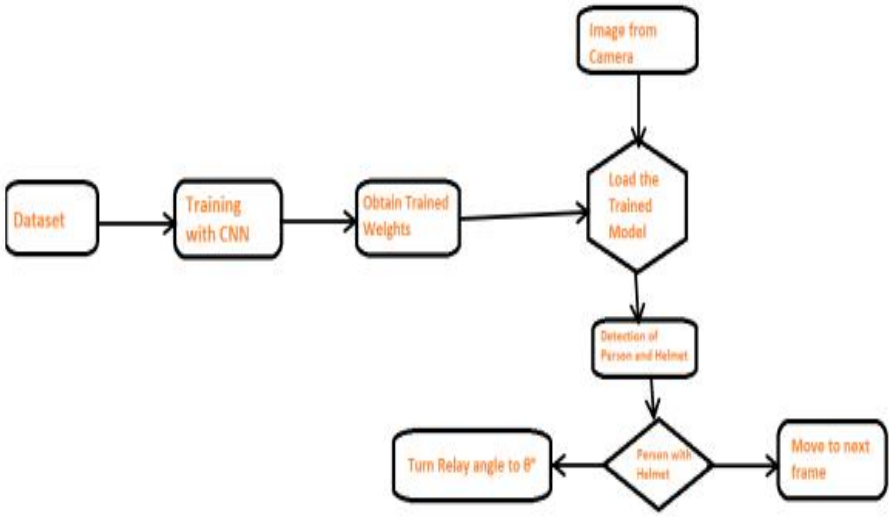

Fig 14 : Flowchart of CNN in helmet detection

3.3.2 INCEPTION V3

The Inception V3 is a deep learning model based on Convolutional Neural Networks, which is used for image classification. The inception V3 is a superior version of the basic model Inception V1 which was introduced as GoogLeNet in 2014. The inception v3 model was released in the year 2015, it has a total of 42 layers and a lower error rate than its predecessors.The model itself is made up of symmetric and asymmetric building blocks, including convolutions, average pooling, max pooling, concatenations, dropouts, and fully connected layers. Batch normalization is used extensively throughout the model and applied to activation inputs. Loss is computed using Softmax.Inception v3 is an image recognition model that has been shown to attain greater than 78.1% accuracy on the ImageNet dataset.The Inceptionv3 architecture has been reused in many different applications, often used "pre-trained" from ImageNet. One such use is in life sciences, where it aids in the research of leukemia.

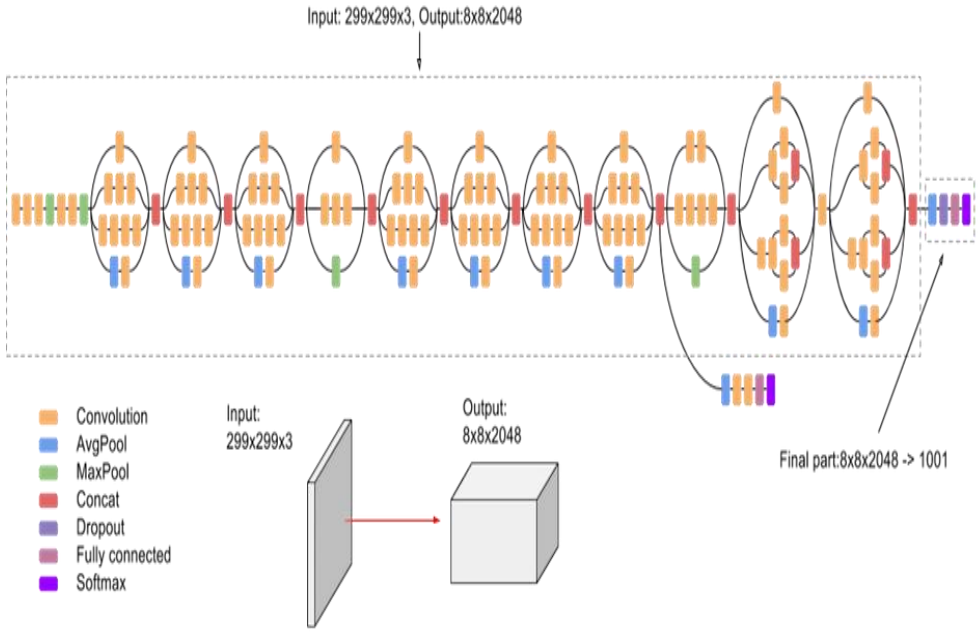

Fig 15 : Inception V3

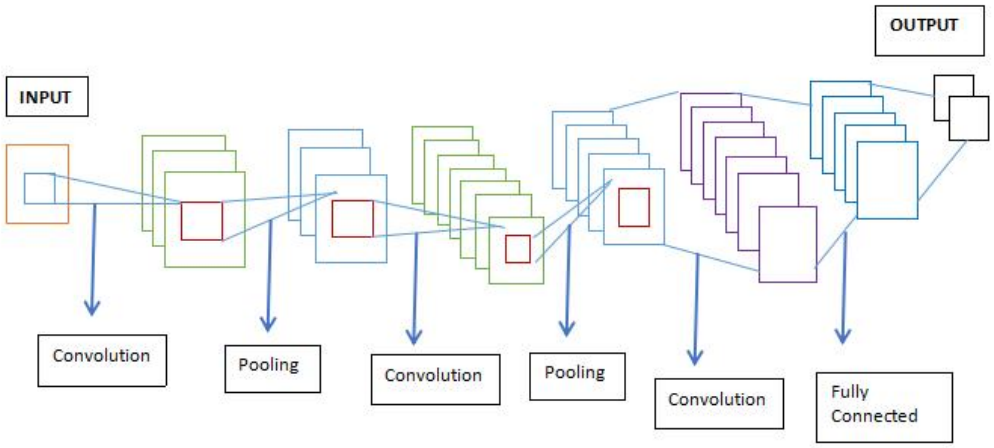

Fig 16 : Inception V3 model

1. Factorization into Smaller Convolutions

This helps to reduce the computational efficiency as it reduces the number of parameters involved in a network. It also keeps a check on the network efficiency.

2. Spatial Factorization into Asymmetric Convolutions-

Smaller Convolutions : Replacing bigger convolutions with smaller convolutions definitely leads to faster training. Say a 5 × 5 filter has 25 parameters; two 3 × 3 filters replacing a 5 × 5 convolution has only 18 (3*3 + 3*3) parameters instead.

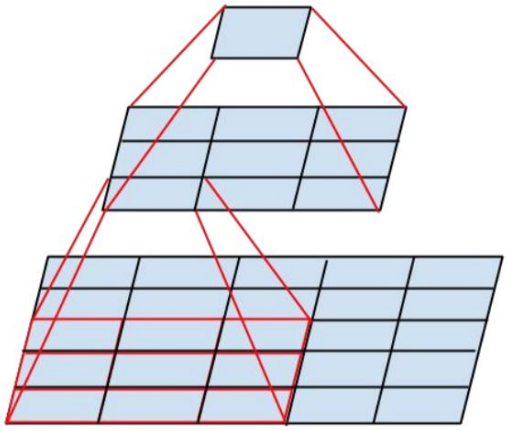

Fig 17 : Layers in Inception model

❖ In the middle we see a 3x3 convolution, and below a fully-connected layer. Since both 3x3 convolutions can share weights among themselves, the number of computations can be reduced.

Asymmetric Convolutions : A 3 × 3 convolution could be replaced by a 1 × 3 convolution followed by a 3 × 1 convolution. If a 3 × 3 convolution is replaced by a 2 × 2 convolution, the number of parameters would be slightly higher than the asymmetric convolution proposed.

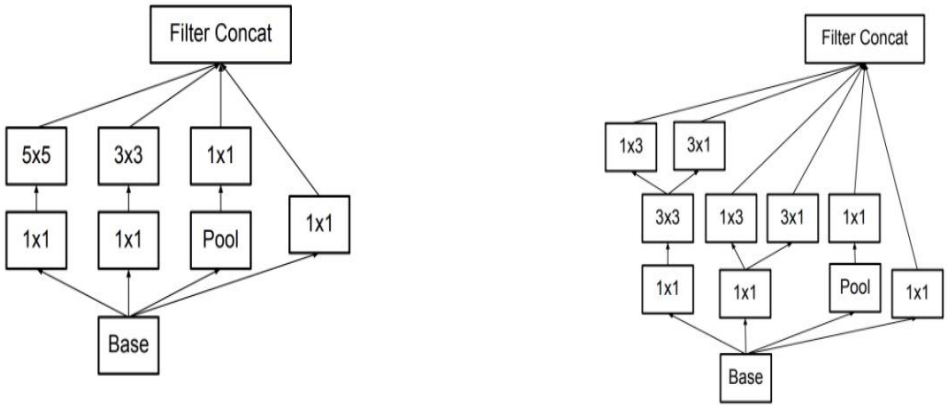

Fig 18 : Convolutional Layers

3. Utility of Auxiliary Classifiers

An auxiliary classifier is a small CNN inserted between layers during training, and the loss incurred is added to the main network loss. In GoogLeNet auxiliary classifiers were used for a deeper network, whereas in Inception v3 an auxiliary classifier acts as a regularizer.

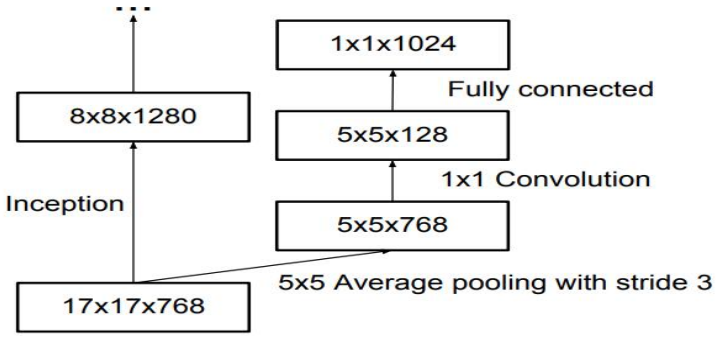

Fig 19 : Auxiliary Classifiers

4. Efficient Grid Size Reduction

Traditionally max pooling and average pooling were used to reduce the grid size of the feature maps. In the inception V3 model, in order to reduce the grid size efficiently the activation dimension of the network filters is expanded.For example, if we have a d×d grid with k filters after reduction it results in a d/2 × d/2 grid with 2k filters.And this is done using two parallel blocks of convolution and pooling later concatenated.

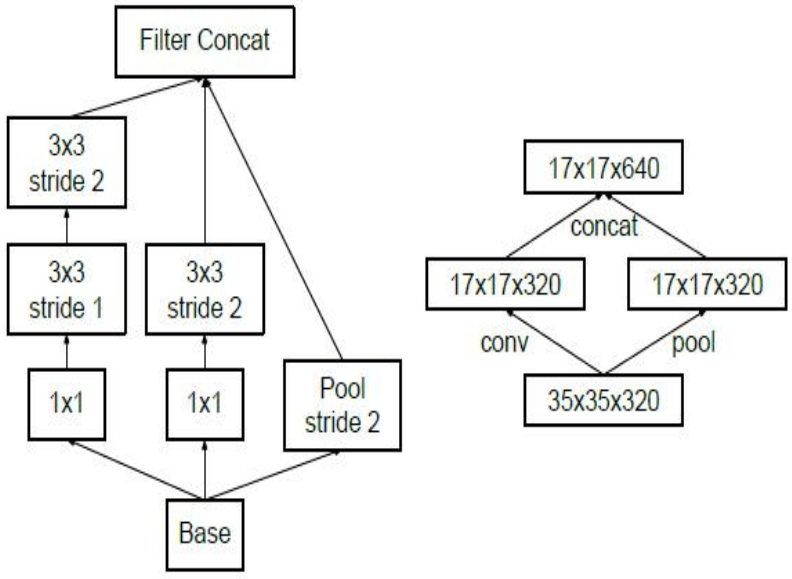

Fig 20 : Grid Size

Outline of Inception V3 : Here the output of each model is the input of next model.

TYPE	PATCH / STRIDE SIZE	INPUT SIZE
Conv	3×3/2	299×299×3
Conv	3×3/1	149×149×32
Conv padded	3×3/1	147×147×32
Pool	3×3/2	147×147×64
Conv	3×3/1	73×73×64
Conv	3×3/2	71×71×80
Conv	3×3/1	35×35×192
3 × Inception	Module 1	35×35×288
5 × Inception	Module 2	17×17×768
2 × Inception	Module 3	8×8×1280
Pool	8 × 8	8 × 8 × 2048
Linear	Logits	1 × 1 × 2048
Softmax	Classifier	1 × 1 × 1000

Table 2 : Outline of Inception V3

FLOW CHART OF INCEPTION V3 PROCESSING

To check whether person is drowsy or not , firstly requires an model ,pass the data set containing different images of person to the model and trained the model with Inception V3, gives better accuracy compared to other algorithms. After successful model training, we obtain the weights to that model and it is loaded into the pi module . In Pi module it detects whether the person is drowsy or not, Using Harcasscade algorithm, it tries to extract the features from the person. If the Person is drowsy and it is detected, then score is calculated and when score reaches to max ,alerts through an buzzer and if person is in normal condition score is being reset.

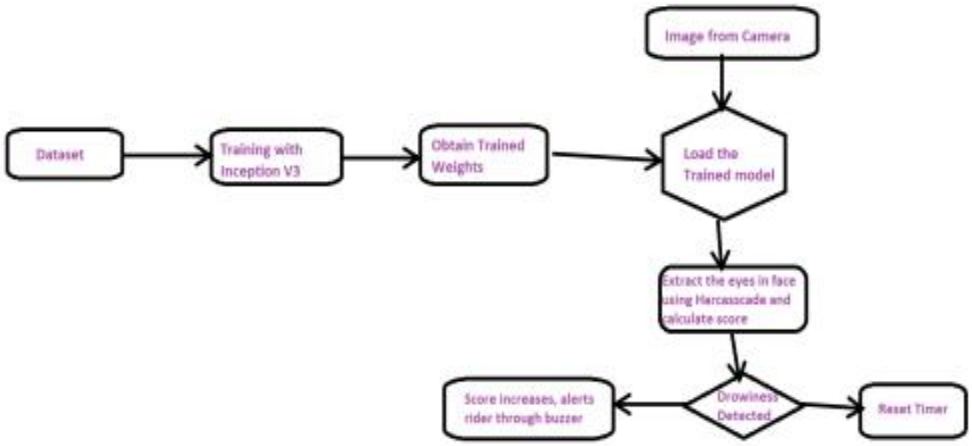

Fig 21 : Flowchart of Inception V3 Processing

HAAR CASCADE :

The role of image processing phase is to recognize the face of the driver and then extracts the image of the eyes of the driver. This phase uses Haar face detection algorithm that takes captured frames of image as input and then the detected face as output.Inception-v3 is a convolutional neural network that is 48 layers deep. You can load a pretrained version of the network trained on more than a million images from the ImageNet database . The pretrained network can classify images into 1000 object categories, such as keyboard, mouse, pencil, and many animals.The Inception V3 model used several techniques for optimizing the network for better model adaptation

3.4 DATASET

Typically Smart Bike using IoT and Deep Learning focuses on two different kinds of datasets for Helmet Detection and Driver Drowsiness Detection.In two of these ,it has two different folders namely - Train and Test.

- Helmet Detection

  Train Data

  With Helmet ---- contains 657 images

  Without Helmet ---- contains 396 images

Test Data

With Helmet ---- contains 151 images

Without Helmet ---- contains 330 images

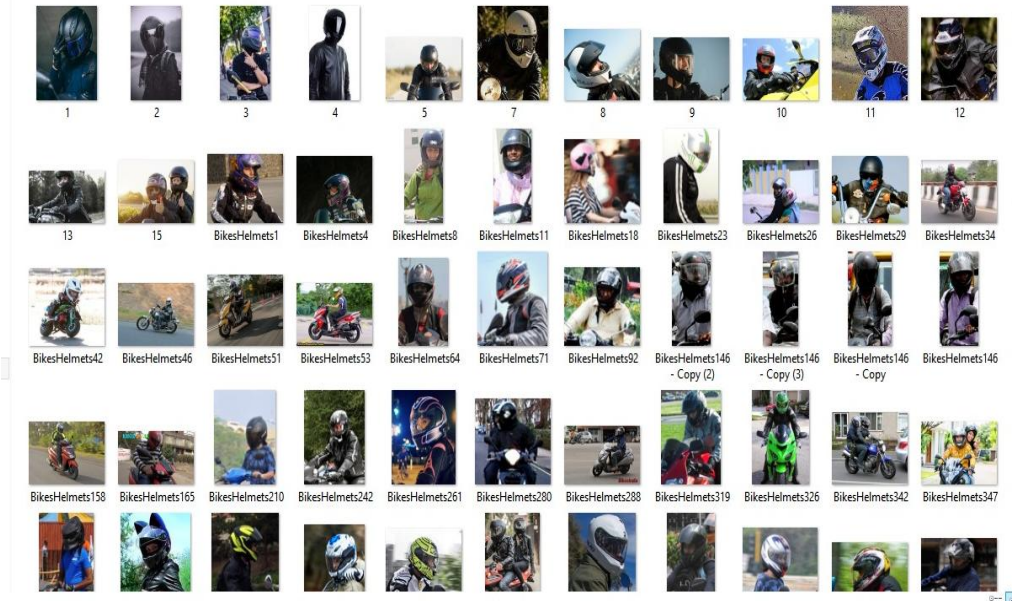

Fig 22 : Helmet Dataset

Fig 23 : No Helmet Dataset

- Driver Drowsiness Detection

Train Data

Open Eyes ---- contains 12000 images

Close Eyes ---- contains 12000 images

Test Data

Open Eyes ---- contains 2135 images

Close Eyes ---- contains 2102 images

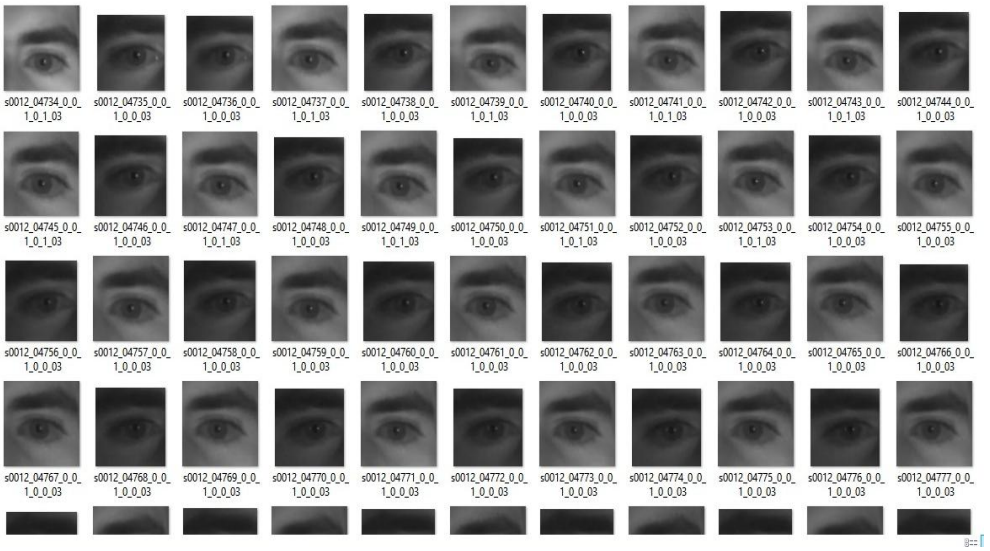

Fig 24 : Open Eyes Dataset

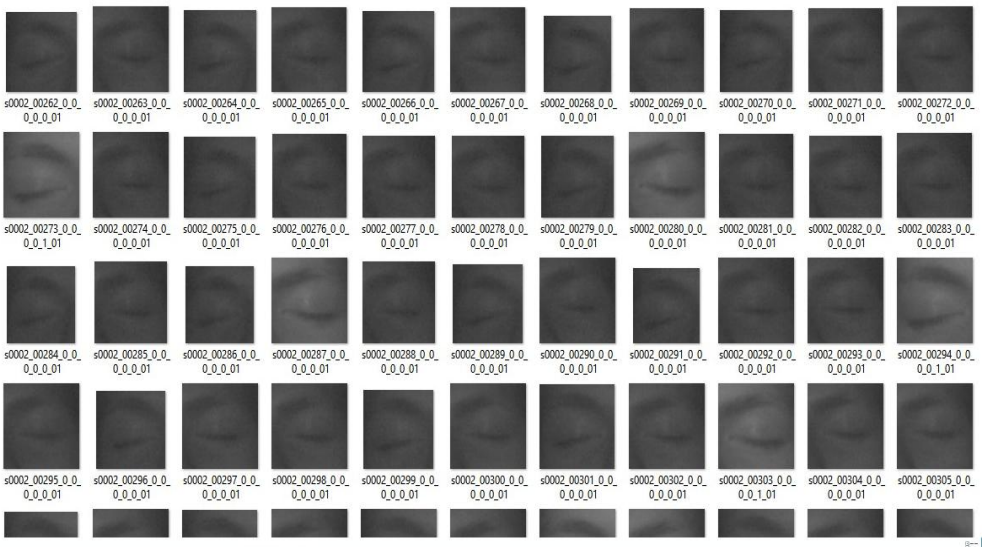

Fig 25 : Closed Eyes Dataset

4. SIMULATION RESULTS & ANALYSIS

4.1 OVERVIEW OF SYSTEM

Smart Bike Using IoT And Deep Learning has many features, some of them include - Helmet Detection , Driver Drowsiness Detection, Real - Time Location Tracking.The whole process begins when bike is ignited.Through Camera,it gets the visuals of rider and these visuals are processed through CNN and Inception V3.Here , CNN classifies whether rider has worn helmet or not in order to start the bike and LED flickering indicates rider is able to start the bike.If no helmet detected, there is no glow in LED.If rider removes helmet while driving then through buzzer,it is alerted to wear helmet. Through Inception V3 , it checks the condition of rider. If drowsy detected , then it alerts the rider through an buzzer. Real-time Location Tracking System enables as soon as NEO - 6M module receives signals and gets updated in web portal.

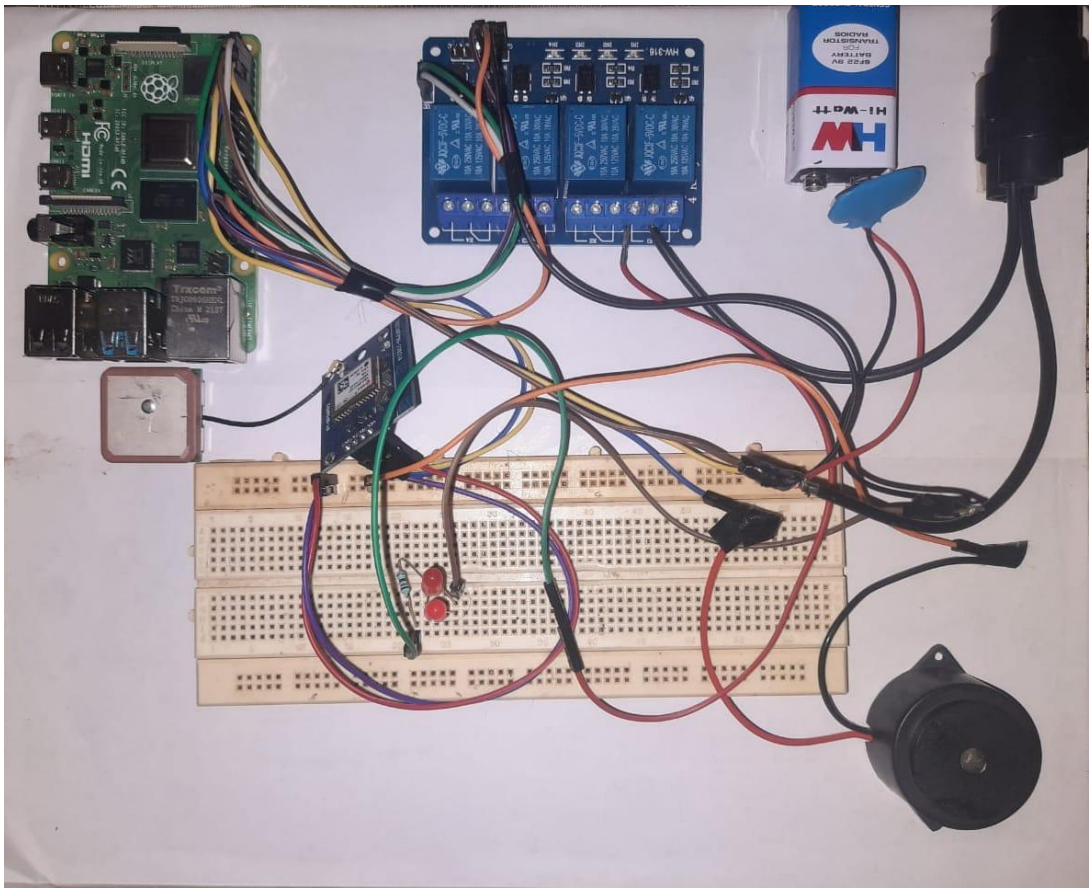

Fig 26 : Overview Of System

4.2 HELMET AND NO HELMET DETECTION

Helmet Detection is an real time application . An image is captured from the camera and given as an input to CNN model where it classifies the image as "Helmet" or “No Helmet”.Based on the classification the internal circuits work accordingly and LED on indicates rider can able to start the bike

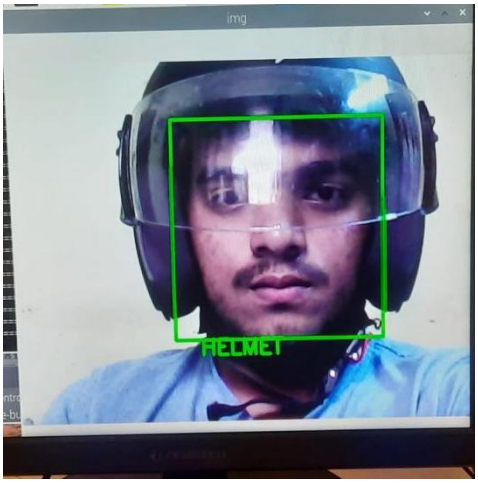

Fig 27 : Helmet Detection

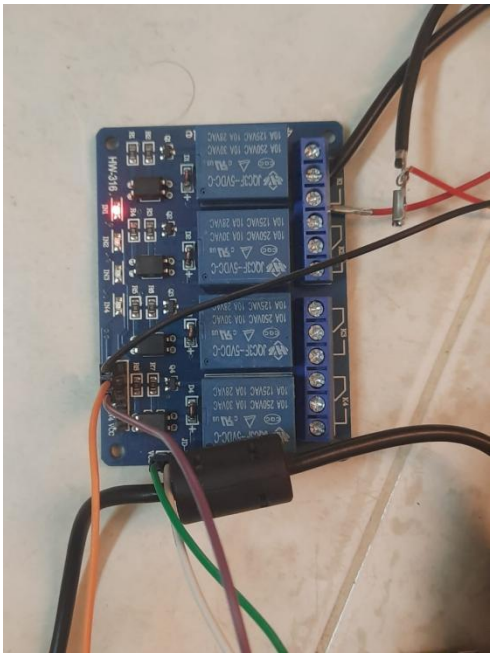

Fig 28 : Relay on

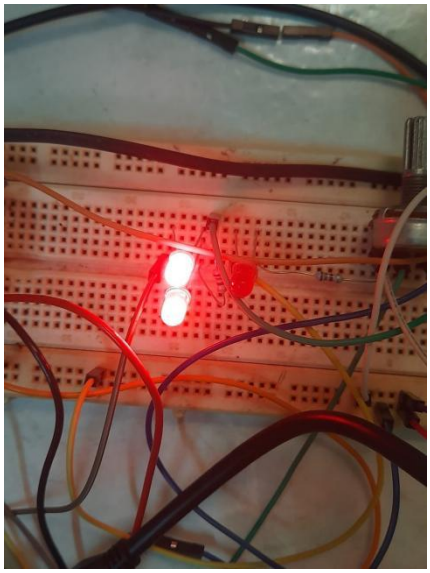

Fig 29 : LED flickering

- Figures 27,28, 29 Depicts Helmet Detection.When the rider wears helmet , through camera we get the visuals and the image is being processed through CNN and classifies whether helmet or no helmet and it sends the response through Raspberry Pi.
- Relay on, LED on indicates rider has worn helmet and he/she will be able to start the bike.

Fig 30 : No Helmet Detection

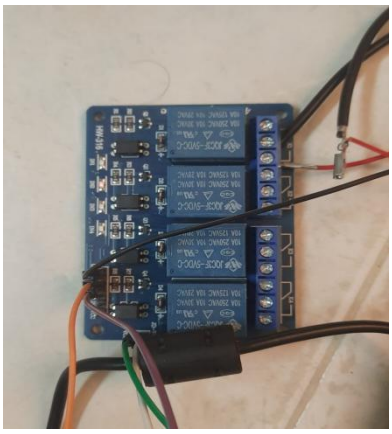

Fig 31 : Relay off

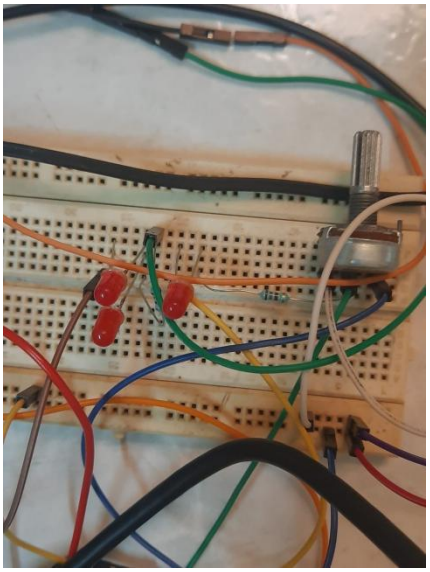

Fig 32: No flickering in LED

- Figures 30,31, 32 Depicts No Helmet Detection.When the rider wears helmet , through camera we get the visuals and the image is being processed through CNN and classifies whether helmet or no helmet and it sends the response through Raspberry Pi.
- Relay off, LED off indicates rider has not worn helmet and he/she will not be able to start the bike.
- While driving if rider removes helmet,it alerts through buzzer and even if instruction has not followed then the raspberry ensures in turning off the engine.

4.2 DRIVER DROWSINESS DETECTION

Drowsiness Detection is an real time application . An image is captured from the camera and given as an input to Inception V3 model where it classifies the image as "Drowsy" or “No Drowsy”.Based on the classification the model works.If drowsy detected it alerts through an buzzer to the rider at right time or else no change in the system.

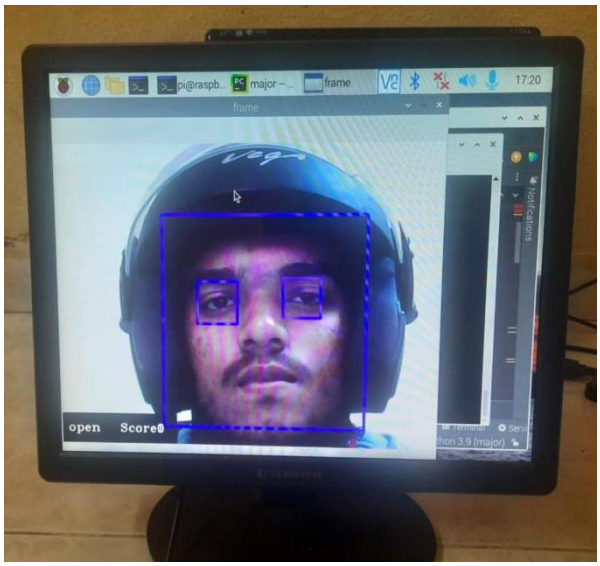

Fig 33 : Open eyes detection

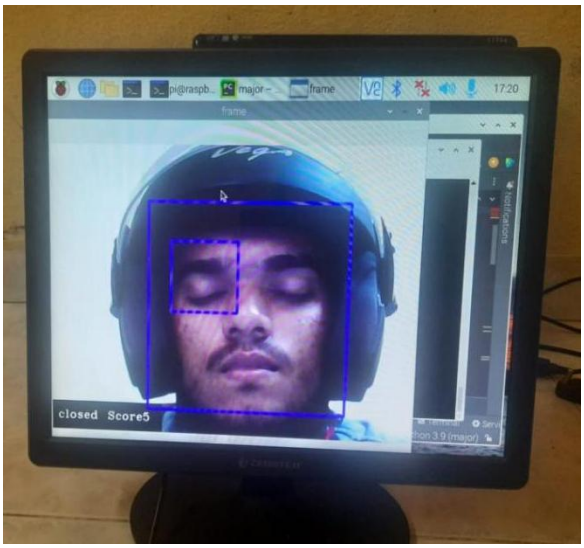

Fig 34 : Closed eyes detection

4.3 REAL - TIME LOCATION TRACKING SYSTEM

Real-time tracking system is an real time application .Using Neo - 6m module it tries to send the location to raspberry pi module and raspberry updates the location for every span of time in the web page.

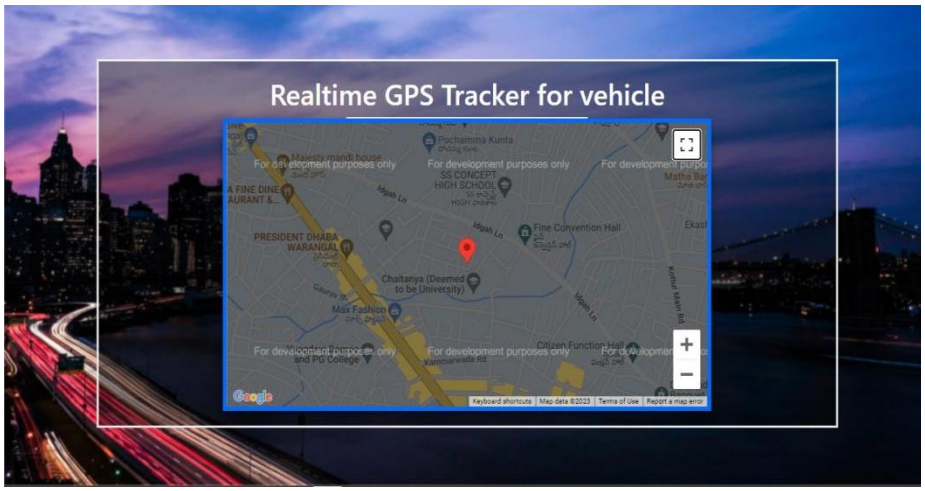

Fig 35 : Real - time location application

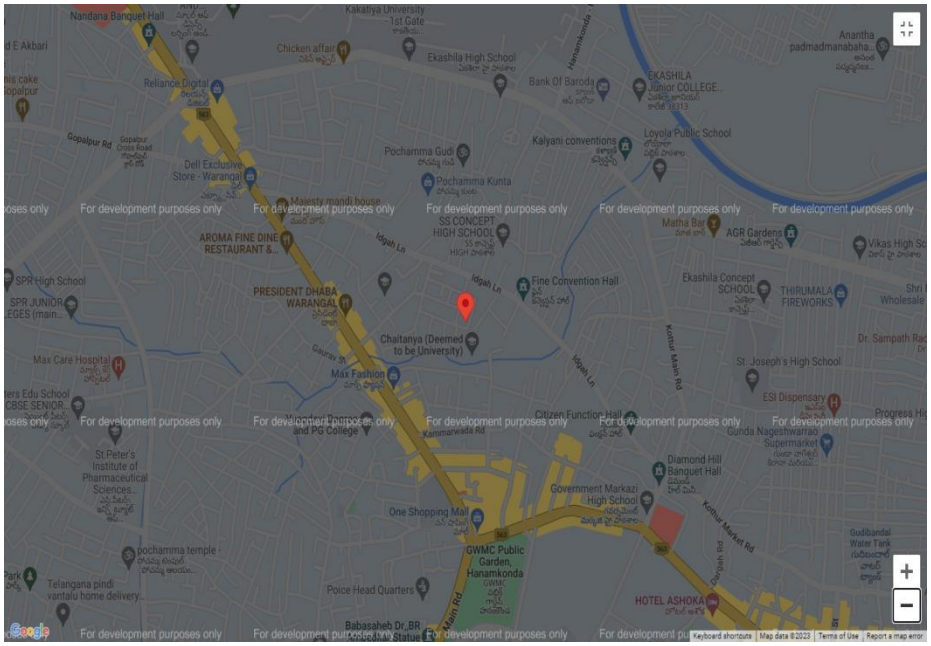

Fig 36 : Location

4.4 ANALYSIS OF ALGORITHMS

Smart Bike Using IoT And Deep Learning mainly focuses on three different features - Helmet Detection to check whether rider has worn helmet or not and Driver Drowsinesss Detection to check the condition of rider and alert the rider at right time and Real-Time Location tracking system enables to find theft bikes by tracking the location in Real-Time.

FEATURES IN SMART BIKE	**ALGORITHM USED**	**ACCURACY OBTAINED**
Helmet Detection	Convolutional Neural Network (CNN)	91%
Driver Drowsiness Detection	Inception V3 ➢ Uses Haar-Cascade algorithm to detect eyes in the face	93%
	COMPONENTS USED	**DEPLOYED PLATFORM**
Real - Time Location Tracking	GPS (NEO - 6M) with an antenna	netlify

Table 3 : Analysis of Algorithms

Among all the algorithms CNN for Helmet Detection and Inception V3 for Driver Drowsiness works effectively.

https://majorprojectsr.netlify.app/

Real-Time Location of bikes or any objects can be tracked through above website ,it receives signals from NEO - 6M GPS Module.

5. CONCLUSION & FUTURE SCOPE

5.1 CONCLUSION

By the end of the project we will be able to develop new features in the motorcycle in which the ignition depends on the drivers helmet, alerts the driver at right time to prevent mis-happening of accidents and can track the location of bike anytime anywhere.

5.2 FUTURE SCOPE

Our project is new in innovation in the market, it gives benefits to the society in reducing accidents.The present system had few limitations.

- For drowsiness detection the model can be trained with different features like lighting conditions and more.
- Location could not be updated,if there is poor internet connectivity.

As scope for the future work we can look into these limitations and can resolve or eliminate or minimize in order to build up an efficient system. Also there is a scope to develop the system to protect the person and decrease the causes of an accident.. These can be carried out as future work.

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