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Artificial Intelligence Based Car Door Accident Prevention

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Abstract

Road accidents are a serious cause for concern across the Indian subcontinent. Each year, about three to 5 percent of the country's GDP was invested in road accidents. Remarkably, India has about more indented vehicle population, it also observed we contribute 6 % of world vehicle accident.[9] As per the statistics its inferred that 70% of accidental death occurs for every hour. Fewer cops and empty roads in the dark, and sometimes even during the day seem to enable motorists to drive away with the traffic rules. The road network has played an important role in India's economic development and therefore the government is probably going to still invest resources in making road safety an important component of everyday commute. As per the amendment of the Motor vehicles act, the penalty for over speeding is keep on enhancing day by day. Even our government is under crucial, the road network rolls a critical role in our country's economic development and the government is supposed to continue to invest resources in ending road safety a most important ingredient of daily life. This paper is focused on preventing road accidents that occur from opening a car door in the road.

Keywords: Artificial Intelligence, Car module, Relay

1.INTRODUCTION

India is one of the hustling countries in the world in condition of road traffic. The across the south Asian country has topped up the fourth largest automotive industry in the world during the year 2017. In 2019, its observed that there were almost three million new car booking in the country[1]. The Indian road network, extending over five million kilometres, carried almost 90 percent of the country's passenger traffic and about 65 percent of the goods. Also, in the context of automated driving, the driver mental state assessment will be an important part of cars in future[2]. With highly enhanced count of the number of cars and the relentless glutted Indian roads, road safety has turned into an important attribute for the country's citizens**.**

Shortage of proper infrastructure for vehicles in addition with the pedestrians has presumably caused an impale in road accidents in India. The possibility of an accident is determined based on the reconstruction error and the likelihood of the deep representation[3].As per the statistics made in the year 2018, its observed that Delhi had recorded the highest number of deaths across the major cities, at approximately 1.4 thousand . The strollers of New Delhi were the leading sufferer of road accidents in the same year. Substantial attempts were made by the Delhi Traffic Police to restrain down traffic incidents. An accelerated evaluation method is proposed to assess the safety performance of Automated Vehicles (AV) in the car-following scenario[4]. Over 141 thousand on-the-spot pursuit were made by the police for over-speeding.

In order to compensate the loss of suffers, third-party insurance was made compulsory for all motor vehicles as per the Motor Vehicle Act of 1988. The insurance has unlimited accountability and the premium amounts were calculated by courts based on victims age and financial earnings.In addition, with the promotion of electric traction vehicles due to new environmental policies and the current proliferation of personal mobility vehicles, this problem could even be increased in the coming years[5]. During the interval 2009 and 2014, there was an incline of about 250 percent in the third-party insurance earned premium.

To further weaken the damage to lives, the penalty for speeding has enhanced by tenfold times under the new Motor Vehicles Act of 2019. The amends for drunk driving were also lifted. An opportunity for imprisonment for illegal street racing was also popularized by the law. Strict execution of these laws, however, will likely be a major constituent in alleviating the road accident cases across India([6]-[8]). Proper driver training and consientness planning of the fast-growing road networks could also be key factors towards improving road safety in India. Increasing automation in road vehicles moves decision making from humans to algorithms. [10].Thus the objective of this paper is to ensure secure and reliable system to prevent accidents from occurring in case of opening a car door carelessly while the car is in rest position, to develop a system with a camera module that detects nearby vehicles to prevent from collision.

2.EXISTING SYSTEM

The existing system is primarily focused on to the problem of electric vehicles going unnoticed due to its noise levels being close to null which may cause the pedestrians going unnoticed of the electric car, causing fatal accidents from occurring. The system evaluates the acoustic characteristics of the sound that should be emitted by electric vehicles so that pedestrians can easily detect them and the optimal sound pressure level they should emit to not unessentially raise noise pollution levels**.** Therefore, there is an increasing interest in developing driving assistance systems to avoid these situations, among others[11].

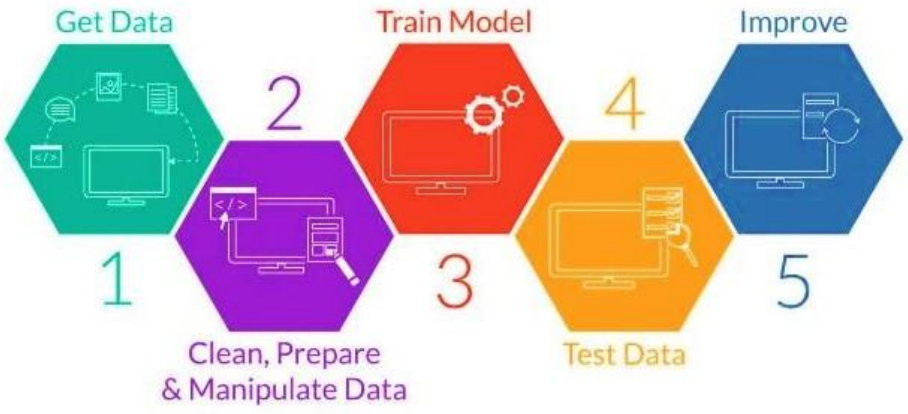
The present scenario utilizes the speed sensors which observe the average speed value of the cars at regular time intervals and adopt a threshold-based approach to generate local predictions[12],[13]. The system makes use of the sensors to detect cars making it expensive and tiresome[14].

3.SYSTEM OVERVIEW

This paper reports a novel approach for detecting and identification of vehicles approaching near the car preventing the user from opening the door preventing from an accident taking place. The camera detects any vehicle approaching near the car. If no vehicle is detected, no steps are taken further. If the camera does not detect any vehicle, the system then signals the arduino to activate the relay unit, permitting the door to open. By this paper, we are proposing a system which avoid any accident by open door while car is in rest position. We propose a system which provides an effective solution with very accurate and reliable. Here we proposed a system which is fully automated and does not require human interference and removes human error completely thereby saving the life of people.

Artificial Intelligence is based on the following phases: acquiring the data, clean/manipulate/ prepare the data, train model, test data, and improve the data as mentioned in figure 1. Before using the data, one must verify the quality of the data to ensure that it meets the requirement.

Figure 1: Phases of artificial intelligence development



AI nowadays is being enforced in almost every field of study through various models such as SVM and ANN. We should be able to proceed with knowing and understanding the de merit sequences of every technological trend. Being in Artificial intelligence proclamation era there is a need to get modified into this change and welcome it too by embracing AI and moving towards a better society. We had utilised artificial intelligence system for object detection. Background subtraction process helps to pre-process the images. Template matching is used to match the image with the templates.

A data set is an accumulation of data. Deep Learning has become the perfect option for solving many confronting real-world problems. It's undeniably the best achieving process for computer vision tasks. With abundant training, a deep network can sector and diagnose the "key points" of every person in the image. These deep learning machines that have been working so well need fuel lots of fuel; that fuel is data. The more and more labelled data we acquire, the better the performance of our model.

In this proposal, the mobile net-SSD algorithm is used for training the dataset. Mobile Net, primarily a lightweight deep neural network prospected by Google to elucidate the problem that mobile embedded terminals cannot be enforced. Its research direction deceit in the manner of model compression, and its essence idea is the ingenious decomposition of convolution kernel. It can effectively reduce network parameters while taking into account optimization delay.

SSD is a single-shot detection model. The essential idea is to obtain the neighbourhood and category of the target in a regression manner on the multi-scale feature map. Nonetheless, there is a trouble of unreliable detection of small targets. Through analysis, the aspects influencing the detection of small targets are primarily the resolution of the feature map, global information and feature extraction capabilities. The residual block structure of MobileNetV2 can enhance the high-resolution low-level feature expression of the feature map utilised for SSD detection.

Object detection method indicated in figure 2, is an important task, yet challenging vision task. It is an exacting part of many employments such as image search, image auto-annotation and scene understanding, object tracking.

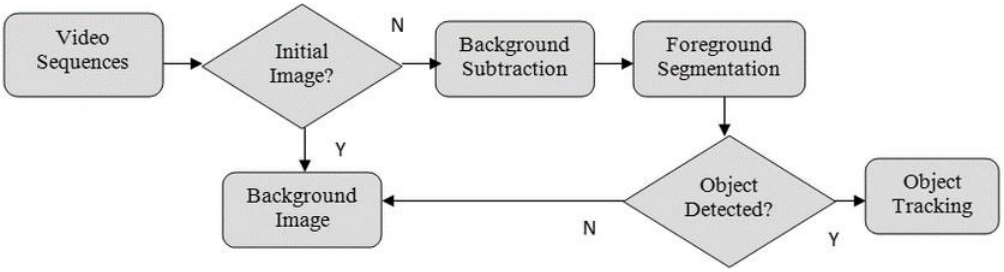


Figure 2: Robust method of object detection

The background subtraction method, was able to endure with local radiance changes, such as shadows and highlights, even globe radiance changes. In this method, the background model was statistically modelled on each pixel. Computational colour mode, include the brightness distortion and the chromaticity distortion which was used to distinguish shading background from the ordinary background or moving foreground objects.

Both short-term and long-term strategies to acquire the recurrent background variations were utilised. An algorithm converged on obtaining the stationary foreground regions, utilised for applications such as the detection of abandoned/stolen objects and parked vehicles. This algorithm mainly used two steps. Primarily, a sub-sampling scheme established on background subtraction techniques was realized to acquire stationary foreground regions. This reveals foreground changes at various time instants in the same pixel locations which is cultivated by incorporating a Gaussian distribution function. Secondly, some alterations were proposed on this base algorithm such as thresholding the earlier computed subtraction. The essential ultimate ambition of this algorithm is to minimize the amount of stationary foreground detected.

In this paper, a dataset is collected of images of all the types of vehicles in their respective classes. The dataset undergoes augmentation where the dataset is taken in different orientations by zooming, rotating, changing sizes of the dataset. The images then undergo data pre-processing where all the images are brought to a standard format. The images then undergo labelling where the images are annotated for object detection indicated in figure 4. The mobile net SSD algorithm is used for effectively training the dataset for proper object detection.

This project makes use of a processing module with a camera to look and detect for any vehicles nearby to prevent collision. The camera is connected to the processor module. The processing module is connected to an Arduino with a relay. This part of the project is used to permit the opening of the door based on the camera input from the processing module. When the processing module does not detect a vehicle then it signals through the serial converter to the Arduino to activate the relay unit permitting it to open the door.

If a vehicle is not detected by the processing module no signal is sent to the Arduino. Actually, object tracking initiates with object detection —tracing objects in an image and allocating them bounding boxes. The object tracking algorithm empowers an ID to each object diagnosed in the image, and in consequential frames tries to carry across this ID and identify the new position of the same object.

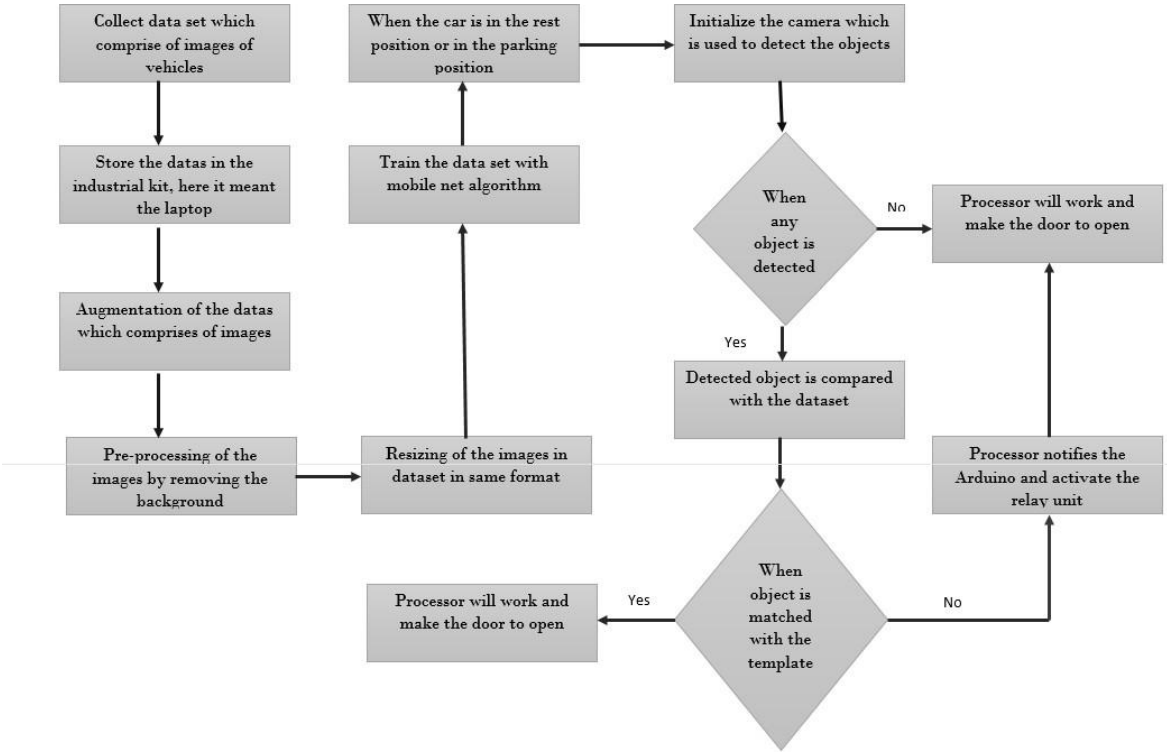


Figure 3: System Architecture

The door automation module makes use of the relay module. A relay is an electrically operated switch. In most cases, the relays use an electromagnet to mechanically operate a switch, apart from this we have some principles too, such as solid-state relays. Relays are utilised to administer a circuit by a separate low-power signal, or where several circuits must be controlled by single signal. The pioneer relays were used for long proximity telegraph circuits

.Figure 4: Dataset collection

The environment and setup on which run the code is being installed in the system and the below figure 5 shows the environment and setup to run the python code:

Figure 5: Python environment setup

The next step is data augmentation, the process involves in several operations like rotation, zooming to increase the dataset. The datasets are represented in different angles.

The below figure 6 shows the dataset augmentation process:

Figure 6: Dataset augmentation

After the data augmentation the next step is data pre-processing, in this phase the images collected are set to standard resolution format. The figure 7 shows the data image before undergoing pre-processing as well s after pre processing

Figure 7: Before and after Pre-Processing of image respectively

After the data pre-processing module the next step is labelling of data where the images collected are labelled according to their nature and the images are annotated and saved in xml format. The figure 8 shows the labelling the dataset.

Figure 8: Labelling the dataset

After this implementation the xml files of the images are loaded for training where we train the dataset with mobile net SSD and generate the model file for further process. The figure 9 shows the training algorithm being used.

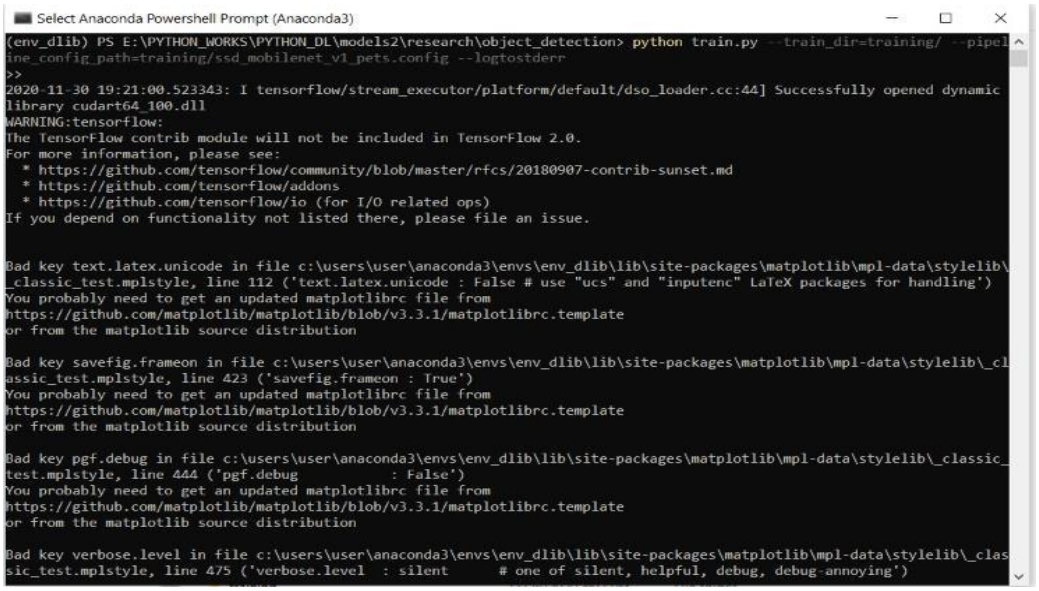


Figure 9: Training output

Hardware setup of the proposed system is referenced in figure 10 as

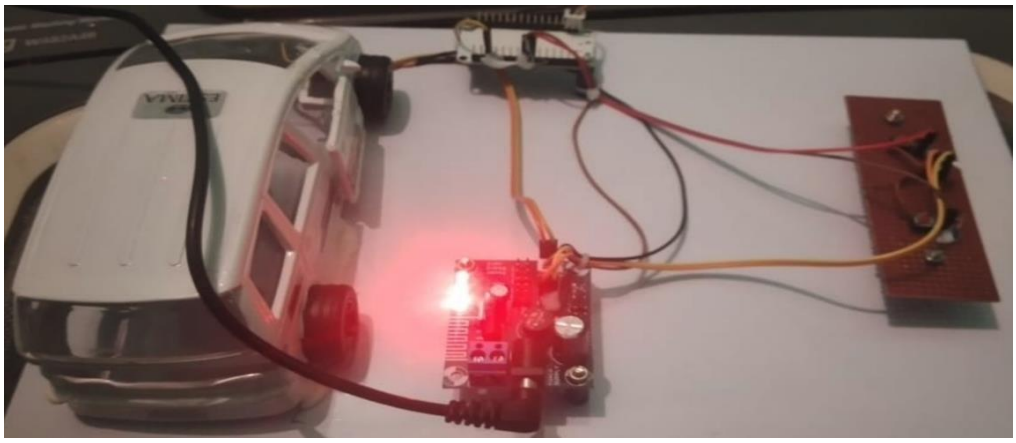


Figure 10: Hardware setup of the proposed system

On clicking the open button when no vehicle or person is detected from the camera as shown in figure 11(a)

Figure 11(a) Clicking open when no vehicle or person is detected

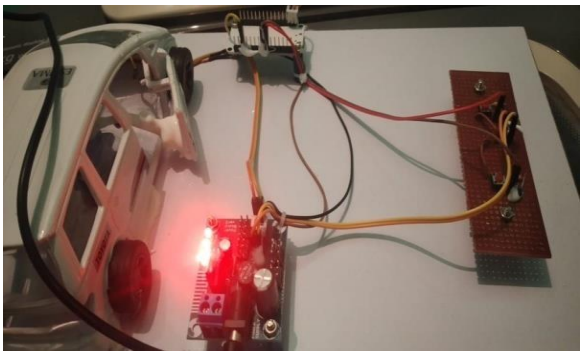


Figure 11 (b)Car door opens when no vehicle or person is detected

If no vehicle or person is detected by the camera of the hardware module the car door is let open on clicking the open button as shown in the figure 11(b).On clicking the open button when a person is in front of the camera as shown in the figure 11(c), Bounding boxes are de meritstructed meaning a person has been detected in front of the camera module as shown in the figure 11(d). The car door remains locked even after clicking the open button since a person has been detected in front of the camera module shown in figure 11(e).

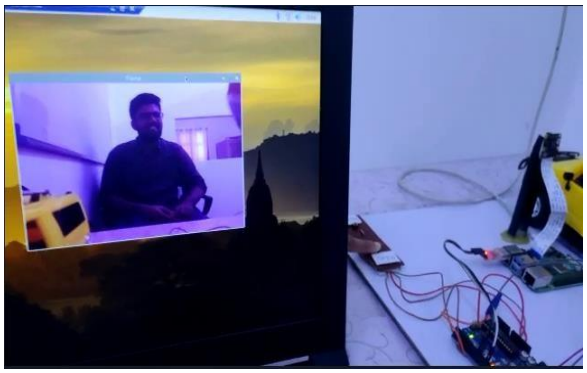


Figure 11(c) Clicking open when person is front of the camera

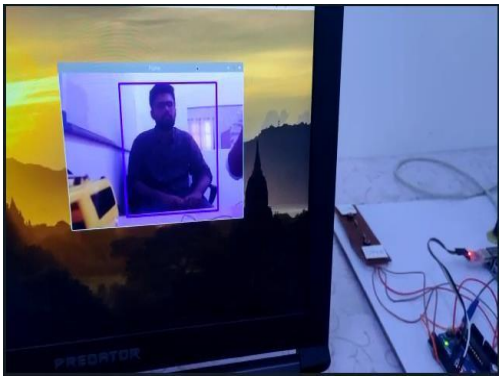


Figure 11(d)A person is detected

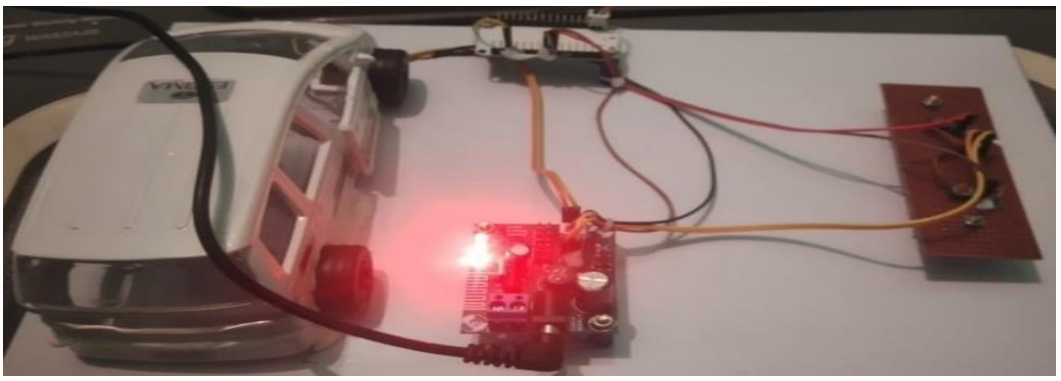


Figure 11(e) Car door is locked

When a vehicle is detected in front of the camera module , bounding boxes are demeritstructed meaning a vehicle has been detected in front of the camera module as shown in the figure 11(g).

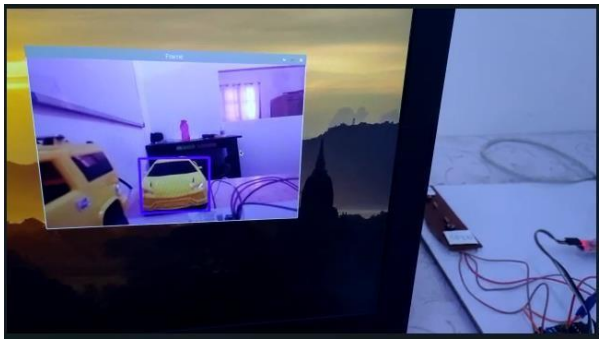


Figure 11(f) Vehicle in front of the camera module

Figure 11(g) A vehicle is detected

The car door remains locked even after clicking the open button since a vehicle has been detected in front of the camera module as shown in the figure 11(h).

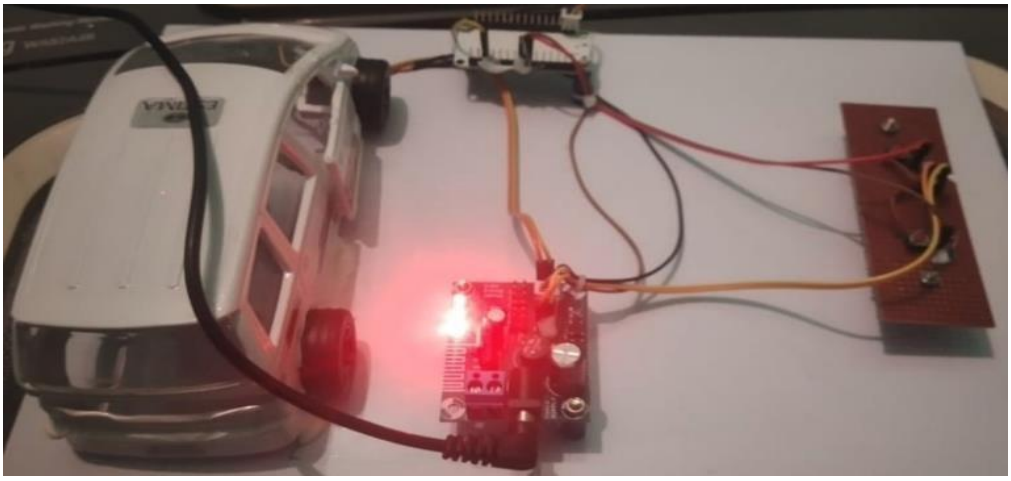


Figure 11(h) Car door is locked

On clicking the open button again with no person in front the camera as shown in the figure 12(a), Since no vehicle or person is detected by the camera of the hardware module the car door is let open on clicking the open button as shown in the figure 12(b)

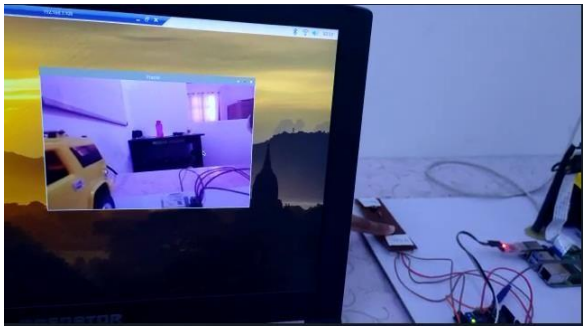


Figure 12(a) Clicking open when no vehicle or person is detected

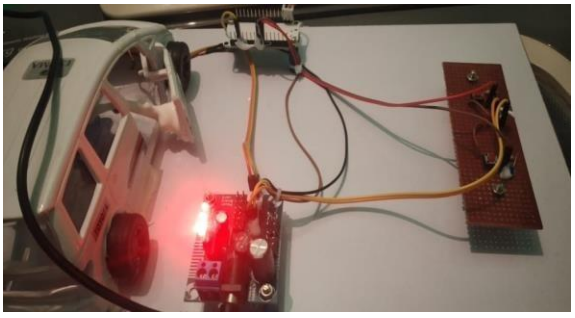


Figure 12(b) Car door is opened

4. CONCLUSION AND FUTURE SCOPE

The proposal is successfully implemented for preventing a fatal accident from happening when opening a car door carelessly using a processing module . The project is completely automatic does not require any human intervention. So, this project, reduces the accident rates and damages in properties significantly.

In the coming future, we review the application of the car door technology in the automobile industry and it can promote for advancement in passenger safety technology with more accuracy. In this field, they are more chance to develop or convert this proposed system in many ways. Thus, this proposed system has an efficient scope in coming future where this idea can be converted to computerized production in a cheaper way.

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