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Raspberry pi based Anti-Theft Vehicle Starter System using Face Recognition

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ABSTRACT:Automobiles are currently one of the most popular IoT applications, as they are being made smarter through the use of IoT technology. Regrettably, these autos are a target for a variety of crimes. As a result of both of these developments, preventing professional criminals from committing such crimes becomes a significant challenge for the Internet of Things. The purpose of this research is to propose the development of an IoT-enabled car guard and alarm system that utilises biometric verification. The automobile business has increased in popularity worldwide in recent years. Automobile crime, on the other hand, has exploded in recent years. Currently, the majority of autos are controlled using mechanical keys, security cards, and passwords/patterns. On the other hand, vehicle security systems are constantly improving as a result of improvements in IoT technology and other connected procedures. These adjustments are made in accordance with the owner's wishes and the specifications of police workstations. They are concerned not only with the theft of automotive equipment, but also with the loss of autos and personal security concerns of car owners. Numerous security measures, such as code pins, dual control processes, and identification cards, are available. However, those devices have the potential to be lost, stolen, or copied. As a result, using the driver's face as a form of authentication is a realistic option. In this proposed system, a camera is utilised to recognise a person's face in real time. After the face has been processed, the system recognises it. Numerous security measures, such as code pins, dual control processes, and identification cards, are available. However, those devices have the potential to be lost, stolen, or copied. As a result, one potential approach is to validate drivers' faces. In this proposed system, a camera is utilised to recognise a person's face in real time. After the face has been processed, the system recognises it. The Arduino takes the recognised face as an input and uses the technique to detect and crop the facial area of the face image. The Canny edge approach is used to segment the recognised face. Canny edge recognition recognises a broad variety of edges on a face while minimising image noise. The Fast Fourier Transform is used to extract features from the segmented face image. After recovering the image, it is fed into an Artificial Neural Network (ANN) that recognises the face of the authorised person.

KEYWORDS: Vehicle security system- Iot , Digital image processing , Machine Learning , Face Recognition.

I. INTRODUCTION

The automobile business has increased in popularity worldwide in recent years. On the other hand, automobile crime has increased dramatically. The majority of autos are currently controlled using mechanical keys, security cards, and passwords/patterns. On the other hand, vehicle security systems are constantly improving as a result of improvements in IoT technology and other connected procedures. These upgrades are determined by the vehicle's owner's requirements. They are concerned not only with the theft of automotive equipment, but also with the loss of autos and personal security concerns of car owners. There were a plethora of well-known biometric identification and verification technologies available. Historically, security factors such as fingerprints, facial features, and the iris have all been used. Face recognition is a popular biometric technique for automotive security and alarm systems since it is based on human facial characteristics and may be used in a number of circumstances. As a result, the majority of face recognition algorithms are built with a higher discriminating rate in mind. When this system recognises an unauthorised person's face, it analyses it and sends the unauthorised person's image to the vehicle's owner mail, warning the owner as well. Vehicle face detection is a critical and difficult problem in the field of facial recognition. On the one hand, the complex surroundings of driving has an effect on the face image, easily obscuring facial details. However, there is no complete record of the faces of public transportation vehicles. To overcome these concerns, this paper presents cascaded convolutional neural networks, an improved convolutional neural network approach. Cascaded convolutional neural networks are composed of three simple convolutional neural networks. Each convolutional neural network makes use

of multi-task learning. Feature fusion technology is utilised to learn the attributes of the vehicle's facial picture in cascaded convolutional networks. Second, because vehicle face image samples are in short supply, we generated our own Driver FACE vehicle face dataset. Experiments on the Driver FACE dataset demonstrate that our technique outperforms the industry standard in detecting vehicle faces.

II. LITERATURE SURVEY

Jie Yuan, Weihua Cheng, Lingqing Sun, Yiqing Cheng," A Constructing Vehicle Intrusion Detection Algorithm Based on BOW Presentation Model."[1]. Existed algorithms to detect constructing vehicles intrusion in order to prevent power grid transmission line from damage by using video/image processing can only detect constructing vehicles in a single color. In this paper, a new algorithm to detect invasive constructing vehicles based on BOW presentation model is proposed. Firstly, Gaussian fuzzy operation is imposed on the image and Gaussian mixture modeling method is used to separate the foreground regions from background. Then dense SIFT features are extracted from the foreground regions and the features are quantified by using visual dictionary which have been studied previously. Next, the SVM classifier based on histogram intersection kernel function is applied for vehicle type recognition. Finally, duplicated vehicles are removed and alarming signal is sent to workers who need to deal with the hidden damage actions. The experimental results show that the proposed method can effectively detect large constructing vehicles of different colors and categories.

Abdellatif Hamdoun," An automated night-time vehicle detection system for driving assistance based on cross-correlation."[2]. Recently, real-time vehicle detection become an important task and big challenge in Driver Assistant Systems (DAS), such as collision mitigation and avoidance and dimming of the headlights. However, the most researchers in the field carried out their research in daytime with good light conditions. In this paper, we propose an efficient night-time vehicle detection method in real-time based on image processing. The principle of the proposed method is to detect the vehicle headlamps and rear lamps using thresholding method and cross-correlation. First, the bright regions (regions of interest) caused by the rear-lamps and headlamps are detected by a white and red color threshold, followed by performing connected component method to label the generated components (potential lamps) by the color threshold, then the potential lamps are regrouped according to their color label and their position and finally, the lamps are filtered by pairing the symmetrical lamps and omitting the other bright regions using the cross-correlation. The experiment results demonstrate that proposed method has good performance in terms of accuracy and robustness and it can meet the requirements in real time. The experiments were done using C++ and OpenCV on Hardware Processor System (HPS) placed in a VEEK-MT2S provided by Terasic

Chao Cui, Nong Sang, Changxin Gao, Lei Zou," Vehicle Re-identification by Fusing Multiple Deep Neural Networks."[3]. Vehicle re-identification has become a fundamental task because of the growing explosion in the use of surveillance cameras in public security. The most widely used solution is based on license plate verification. But when facing the vehicle without a license, deck cars and other license plate information error or missing situation, vehicle searching is still a challenging problem. This paper proposed a vehicle re-identification method based on deep learning which exploit a two-branch Multi-DNN Fusion Siamese Neural Network (MFSNN) to fuses the classification outputs of color, model and pasted marks on the windshield and map them into a Euclidean space where distance can be directly used to measure the similarity of arbitrary two vehicles. In order to achieve this goal, we present a method of vehicle color identification based on Alex net, a method of vehicle model identification based on VGG net, a method of pasted marks detection and identification based on Faster R-CNN. We evaluate our MFSNN method on VehicleID dataset and in the experiment. Experiment results show that our method can achieve promising results.

Shibani Hamsa, Alavikunhu Panthakkan, Saeed Al Mansoori," Automatic Vehicle Detection from Aerial Images using Cascaded Support Vector Machine and Gaussian Mixture Model"[4]. This paper proposes a novel approach for automatic vehicle detection from aerial images using cascaded Gaussian Mixture Model (GMM) and Support Vector Machine (SVM) algorithm. The GMM based background removal technique eliminates the image background to achieve efficient color classification using SVM classifier. The GMM classifier followed by SVM classification to ensure better results. In the proposed algorithm, the color and local features are the main cues for vehicle detection. To evaluate the performance of the proposed vehicle detection system, the metrics such as hit rate, accuracy and precision valued are used. This paper analyses the system performance and compared it with other background removal methods and classifiers.



Sissi Xiaoxiao Wu, Qiang Li, Anthony Man-Cho," Rank-Two Beamforming and Stochastic Beamforming for MISO Physical-Layer Multicasting with Finite-Alphabet Inputs."[5]. This letter considers multi-input single-output (MISO) downlink multicasting with finite-alphabet inputs when perfect channel state information is known at the transmitter. Two advanced transmit schemes, namely the beam formed (BF) Alamouti scheme and the stochastic beamforming (SBF) scheme, for maximizing the finite-alphabet-constrained multicast rate are studied. We show that the transmit optimization for these two schemes can be formulated as an SNR-based max-min-fair (MMF) problem with Gaussian inputs, which can be handled via the semidefinite relaxation (SDR) technique. Apart from transmit optimization, we analyzed the rate performance of the two schemes. Our analytical results show that for BF Alamouti, the multicast rate degrades with the number of users at a rate of , which is better than the traditional transmit beamforming scheme. For SBF, the multicast rate degradation is less sensitive to the increase in the number of users and outperforms BF Alamouti for large . All the results were verified by numerical simulations.

III. PROBLEM DEFINITION

While the unauthorised individual's access to the vehicle's security system is a worry, the true challenge is identifying him or her. Although the majority of looted vehicle systems will aid in recovery, the crime has already taken place. As a result, effective vehicle systems should be designed to incorporate cutting-edge technology-based security. A demonstration of an embedded vehicle security system dubbed "POLLUX" was conducted. The security of the system is provided using machine vision technology. It is a new level of theft protection that secures the vehicle without interfering with the driver's activities. A Haar Cascade was used to detect faces, while support vector machines were used to recognise them (Haar Cascade classifiers).

IV. METHODOLOGY

Proposed Methodology

1-Machine Learning: Machine learning (ML) is the study of computer algorithms that improve automatically through experience. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so. Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it to learn for themselves. What is machine learning? Machine learning is a subfield of artificial intelligence, which is broadly defined as the capability of a machine to imitate intelligent human behavior. Artificial intelligence systems are used to perform complex tasks in a way that is similar to how humans solve problems. Machine learning (ML) is the study of computer algorithms that improve automatically through experience and by the use of data.^[1] It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

A subset of machine learning is closely related to computational statistics, which focuses on making predictions using computers; but not all machine learning is statistical learning. The study of mathematical optimization delivers methods, theory and application domains to the field of machine learning. Data mining is a related field of study, focusing on exploratory data analysis through unsupervised learning.^{[5][6]} In its application across business problems, machine learning is also referred to as predictive analytics.

Machine learning involves computers discovering how they can perform tasks without being explicitly programmed to do so. It involves computers learning from data provided so that they carry out certain tasks. For simple tasks assigned to computers, it is possible to program algorithms telling the machine how to execute all steps required to solve the problem at hand; on the computer's part, no learning is needed. For more advanced tasks, it can be challenging for a human to manually create the needed algorithms. In practice, it can turn out to be more effective to help the machine develop its own algorithm, rather than having human programmers specify every needed step.

2- Image Processing: Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Image processing aims to transform an image into digital form and performs some process on it, to get an enhanced image or take some utilized information from it. Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.

Image processing basically includes the following three steps:

- Importing the image via image acquisition tools;
- Analysing and manipulating the image;
- Output in which result can be altered image or report that is based on image analysis.

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction.

In this lecture we will talk about a few fundamental definitions such as image, digital image, and digital image processing. Different sources of digital images will be discussed and examples for each source will be provided. The continuum from image processing to computer vision will be covered in this lecture. Finally we will talk about image acquisition and different types of image sensors.

V. SYSTEM ARCHITECTURE

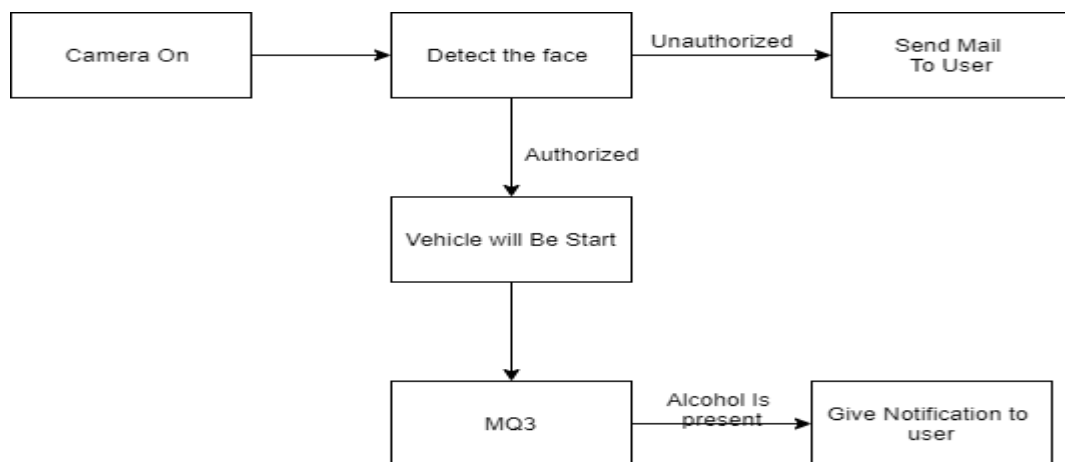


Fig. 1 System Architecture

Using the device's built-in camera, we recognised the driver's face. determining whether or not a person is authorised If the individual is not approved, the system will send an email to the vehicle's owner informing them that their vehicle has an issue. If the person is approved, the vehicle will start, and we will use the MQ3 sensor to detect whether the passenger is intoxicated or drowsy. If alcohol is found and the driver appears to be drowsy, the car's user or owner will be notified that the driver is inebriated. A webcam is a gadget that takes images by using light. Cameras, in their most

basic, are closed boxes with a small hole (the aperture) that allows light to pass through and capture an image on a light-sensitive surface (usually photographic film or a digital sensor). Cameras are using a variety of techniques to manipulate how light strikes the light-sensitive surface. Module for Alcohol Sensors The Alcohol Gas Sensor was used to construct this module. It is a low-cost semiconductor sensor that can detect alcohol gas concentrations as high as 10 mg/L. This sensor's sensitive substance is SnO_2 , which has a reduced conductivity in clean air. A buzzer is a type of auditory signalling device that can be mechanical, electromechanical, magnetic, electromagnetic, electro-acoustic, or piezoelectric. An oscillating electrical circuit or another audio signal source can power a piezo electric buzzer. A button press can be indicated by a click, beep, or ring. A microcontroller is a Raspberry Pi (Raspberry Pi). In collaboration with Broadcom, the Raspberry Pi Foundation in the United Kingdom created a line of compact single-board computers. The Raspberry Pi initiative began with the goal of increasing access to core computer science instruction in schools and underdeveloped countries. The initial model proved to be more successful than expected, selling for unintended uses such as robotics. For its low cost, versatility, and open architecture, it is widely utilised in a number of applications, including weather monitoring. For its interoperability with HDMI and USB devices, this is mostly utilised by computer and electronic hobbyists.

VI. ALGORITHM

HARR CASCADE ALGORITHM:

Various approaches in the field of face detection are developed in recent years. Such as surveillance system and gender classification are using face detection technology as a part of face identification. Whereas, Face detection techniques focused on determining the frontal of human faces like locations and size in any digital image. Hence, it detects only the facial expression then treat with the rest of the image as background. This paper present a robust vehicle security system using rapid face detection technique Haar cascade. It considers as a machine learning object detection algorithm used to identify objects in image or video based on the concept of Haar feature which proposed by viola and Michael .

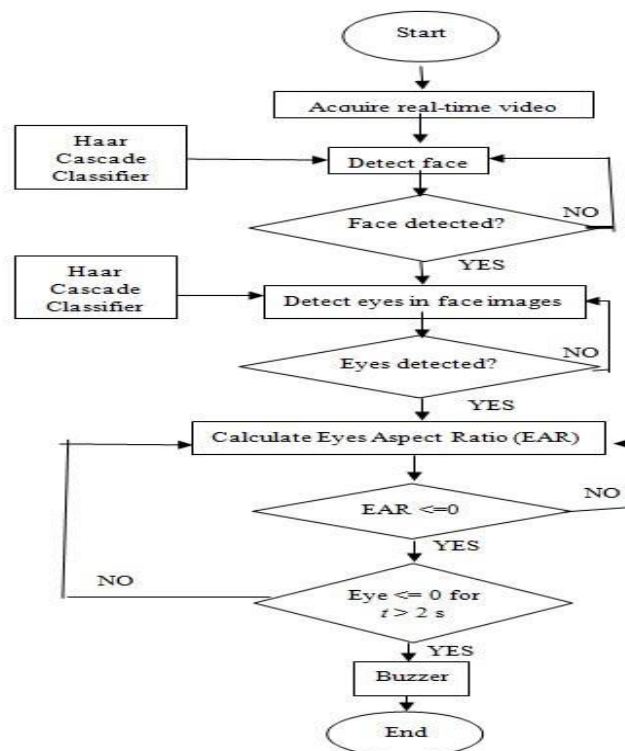


Fig 2.Flow of the System

The most aim of the Haar cascade Classifier is that it reject the regions that unlikely to have consisted in the digital image. This algorithm divides into four stages:

– Haar feature selection: the core step of Haar cascade classifier is to collect the Haar Features. Where a Haar feature considers adjacent rectangular groups of pixels at a specific location in a detection region. Then sums up all pixel intensities in each region and calculates the variance between these sums to determine relative light and dark regions.

I.e. $f(x) = \text{Sum}_{\text{black rectangle}}(\text{pixel intensities}) - \text{Sum}_{\text{White rectangle}}(\text{pixel intensities})$

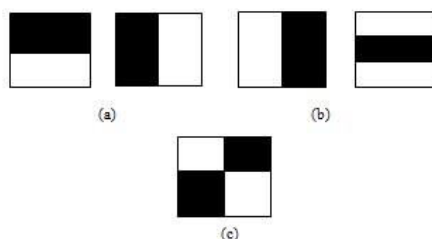


Fig 3. Harr cascade Description

– Creating integral images: for rapid computing of these features; the integral image is done. Equation 5 shows the calculation of the sum of all pixels inside any given rectangle. It needs only four-pixel values, which start from top left of the cornered pixel (x, y).

– AdaBoost training: The next step to construct Haar cascade classifier to select the important Haar features is using AdaBoost learning algorithm. It is used to detect the faces in the digital image by extracting the best features. A combination of weak classifiers can produce a strong classifier.

– Cascading classifiers: the Haar cascade classifier is a series of stages. Each stage contains a weak classifier which trained to be strong. Therefore, if the image passes all stages then the image said to be a human face, otherwise, means it is not a human face.

VII. HARDWARE DESCRIPTION

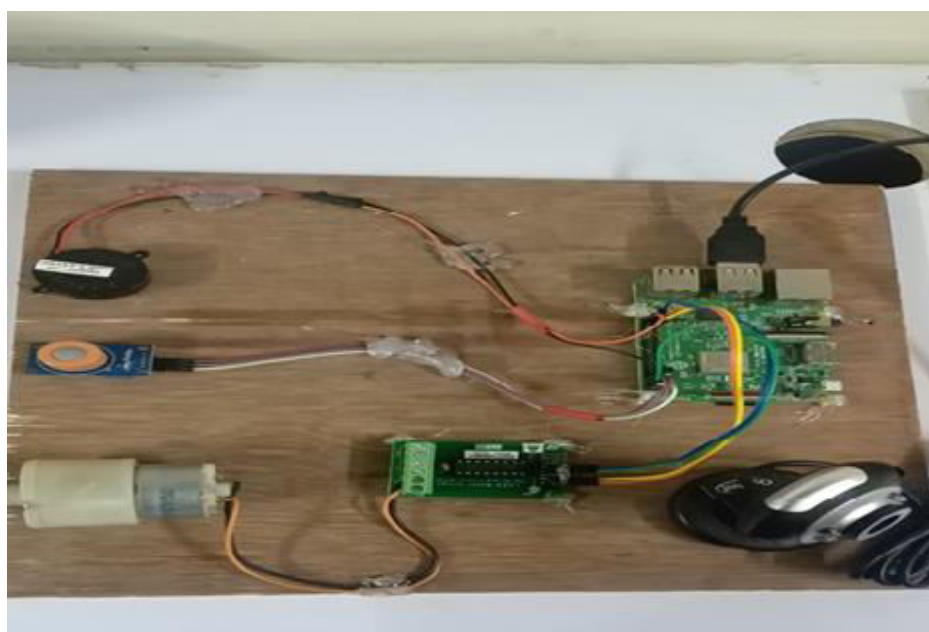


Fig 4. Hardware Specification

A. Camera

A camera is an optical instrument used to capture an image. At their most basic, cameras are sealed boxes (the camera body) with a small hole (the aperture) that allows light in to capture an image on a light-sensitive surface (usually photographic film or a digital sensor). Cameras have various mechanisms to control how the light falls onto the light-sensitive surface.

B. MQ3 Sensor

Alcohol Sensor Module - MQ3. 4753. This module is made using Alcohol Gas Sensor MQ3. It is a low cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L. The sensitive material used for this sensor is SnO₂, whose conductivity is lower in clean air.

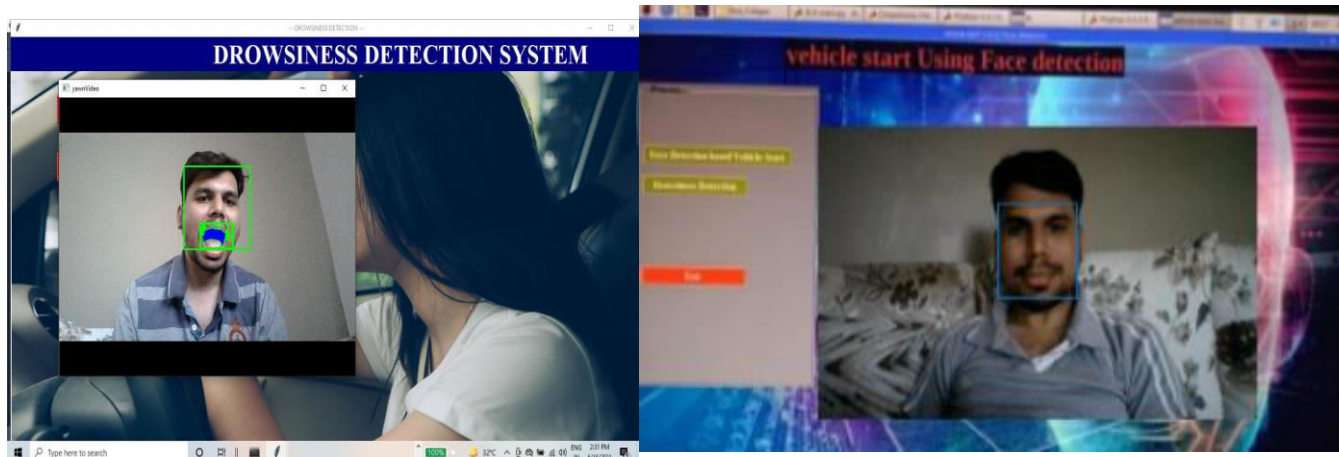
C. Buzzer

A buzzer is a mechanical, electromechanical, magnetic, electromagnetic, electro-acoustic or piezoelectric audio signaling device. A piezo electric buzzer can be driven by an oscillating electronic circuit or other audio signal source. A click, beep or ring can indicate that a button has been pressed.

D. Raspberry Pi-

Raspberry pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom. The Raspberry Pi project originally leaned towards the promotion of teaching basic computer science in schools and in developing countries. The original model became more popular than anticipated, selling outside its target market for uses such as robotics. It is widely used in many areas, such as for weather monitoring, because of its low cost, modularity, and open design. It is typically used by computer and electronic hobbyists, due to its adoption of HDMI and USB devices.

VIII. RESULTS



IX. FUTURE WORK AND CONCLUSION

Our mission in this endeavour is to drive the vehicle safely and to keep it secure from thieves. The vehicle is started automatically when the face of the designated individual is detected. Additionally, if the driver of the vehicle is sleeping, an automatic notification is generated and sent to the owner via the Image Processing and Machine Learning concepts. This article proposes a new intelligent vehicle security system dubbed VSS IoT that would be based on a secure, efficient, low-cost, and low-power processing chip and would heavily rely on the Internet. Additionally, this work used a hybrid technique (HaarCascade+PCA) to detect and recognise faces in images acquired by a USB camera. Alternatively, the Haar Cascade can be used to reject regions that are highly improbable to have been included in the digital image. Additionally, it is used to recognise faces in digital images by extracting the most prominent features. Today, firms are touting facial recognition technologies as the future of... The process of controlling vehicle entry and exit... This technology has enormous potential in India and has the potential to significantly benefit the country in a variety of ways.

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