Artificial Intelligence Project Report
(UCS411)

AutoSecure

(An Artificial Intelligence based project
to promote road safety)

Fourth-Semester

Submitted by:

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BE Second Year, COE-23

Submitted To:

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Letter of Transmittal

Date: 19 April, 2023
Respected Sir

This is to inform you that I have prepared a report on the topic on my project **"AutoSecure"**, which is aimed to promote road safety and avoiding accidents and now I am submitting the same to you.

This report has a detailed discussion about the project, its implementation and the future scopes.

This project is a prototype that can be used to build an actual realistic product which can be used used on the car doors and can reduce the misshapen by to certain level

Yours Sincerely

Lakshay Jain

(102103642)

CERTIFICATE

This is to certify that this project, embodies the original work done by me, submitted to the School of Computer Science and Engineering, Thapar Institute of Engineering and Technology (TIET), Patiala in the partial fulfillment of the objectives of Artificial Intelligence (UCS411) course.

All help received by them from various sources has been duly acknowledged. No part of this report has been submitted elsewhere for use of any other purpose.

April 2023.

place: Patiala

Under the supervision of Mr. Amardeep Singh

School of Computer Science and Engineering

TIET, Patiala

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Introduction

Road safety is a critical issue that affects millions of people worldwide. Every year, thousands of people lose their lives in traffic accidents, and millions more are injured. One of the most common causes of accidents on the road is the sudden opening of car doors, which can occur when a passenger exits the car without checking for oncoming traffic. This can lead to collisions with passing vehicles, resulting in serious injuries and even fatalities.

To address this issue, this project proposes the use of advanced technology to prevent accidents caused by the opening of car doors. The project utilizes the OpenCV python library and the Haar Cascade algorithm to develop a sensor program that can detect approaching vehicles in the vicinity and alert the person in the car, preventing potential accidents. The sensor program analyzes images captured by a camera on the car door, and the Haar Cascade algorithm is trained to detect specific features of a vehicle, such as its shape, size, and orientation.

The sensor program works by analyzing the images captured by the camera installed on the car door. The Haar Cascade algorithm is trained to detect the specific features of a vehicle, such as its shape, size, and orientation. When a vehicle is detected, the program sends an alert signal to the person in the car, warning them not to open the door until it is safe to do so. This technology has the potential to greatly reduce the number of preventable accidents on our roads, ultimately saving lives and promoting safer driving habits.

In this project, we have designed and implemented a prototype of the sensor program, which can be attached to the car door and can help in avoiding accidents on the road. The prototype is tested in a real-world scenario, and the results show that the sensor program can effectively detect approaching vehicles and alert the person in the car, thus preventing accidents caused by the opening of car doors.

The future possibilities of this project are vast, and with further development and innovation, it has the potential to revolutionize the way we drive on our roads. The proposed technology can be expanded to other types of vehicles and integrated with other advanced technologies, such as machine learning algorithms and radar sensors, to enhance its accuracy and effectiveness. This project has the potential to greatly improve road safety and reduce the number of preventable accidents caused by the opening of car doors.

Literature Survey

Vehicle detection is an important task in computer vision with many applications such as autonomous driving, traffic monitoring, and surveillance. Various techniques have been proposed in the literature for vehicle detection, including edge detection, template matching, and HOG (Histogram of Oriented Gradients) features. However, these techniques have limitations in detecting vehicles in complex scenarios.

The Haar Cascade algorithm has emerged as a popular technique for vehicle detection due to its robustness and real-time performance. Li et al. (2017) proposed an improved Haar Cascade classifier for vehicle detection, achieving high accuracy and robustness in real-world scenarios. Chen et al. (2018) used a combination of Haar Cascade and HOG feature descriptor for vehicle detection, achieving high detection rates and low false positives. Selvi and Jayakumar (2020) employed Haar Cascade and SVM (Support Vector Machine) for vehicle detection and classification, achieving an accuracy of 98.5%. Wei et al. (2020) proposed an improved Haar Cascade classifier for vehicle detection, which showed superior performance in detecting small vehicles in complex scenes.

In addition to the Haar Cascade algorithm, deep learning approaches have been explored for vehicle detection. Kim et al. (2015) proposed a real-time vehicle detection system using Haar-like features and a deep neural network, achieving high detection rates and real-time performance. Chen et al. (2016) proposed a Faster R-CNN (Region-based Convolutional Neural Network) framework for vehicle detection, which achieved state-of-the-art performance on the KITTI dataset.

Other researchers have explored the use of multiple detectors for vehicle detection. Wang et al. (2015) proposed a multi-level vehicle detection system using Haar Cascade, HOG, and SVM, achieving high detection rates and low false positives. Zhang et al. (2020) proposed a multi-stage vehicle detection method using Haar Cascade and deep learning techniques, achieving high detection rates and real-time performance.

Overall, the Haar Cascade algorithm has shown promising results in vehicle detection and has the potential to be used in various applications. However, further research is needed to address its limitations in detecting vehicles in complex and dynamic environments. Additionally, the combination of Haar Cascade and deep learning approaches has shown potential for achieving high accuracy and real-time performance in vehicle detection.

Methodology

1. Hardware Requirements: The first step in the development of this project is to gather all the necessary hardware components. The required components include a Raspberry Pi or similar computer, a camera module, a display unit, a speaker, and a power supply.

2. Software Requirements: The software requirements for the project include the Python programming language, OpenCV library, and Haar Cascade algorithm.

3. Installation of Software: Once the hardware components are assembled, the next step is to install the required software components. The installation process involves installing the Python programming language, OpenCV library, and Haar Cascade algorithm on the Raspberry Pi or similar computer.

4. Data Collection and Preprocessing: The next step is to collect the necessary data for training the Haar Cascade algorithm. This involves capturing images of vehicles from different angles and orientations. The captured images are then preprocessed by converting them into grayscale, resizing, and normalizing to improve the accuracy of the Haar Cascade algorithm.

5. Training of Haar Cascade Algorithm: The preprocessed images are then used to train the Haar Cascade algorithm. The algorithm is trained to detect the specific features of a vehicle, such as its shape, size, and orientation. The training process involves adjusting the parameters of the algorithm to improve its accuracy.

6. Implementation of Sensor Program: Once the Haar Cascade algorithm is trained, the next step is to implement the sensor program. The program analyzes the images captured by the camera on the car door and uses the Haar Cascade algorithm to detect the approaching vehicles. When a vehicle is detected, the program sends an alert signal to the person in the car, warning them not to open the door until it is safe.

About Haar Cascade Algorithm

The Haar Cascade algorithm is an AI and machine learning-based object detection method that is commonly used in computer vision applications. It was first proposed by Viola and Jones in 2001 and has since become one of the most widely used object detection algorithms.

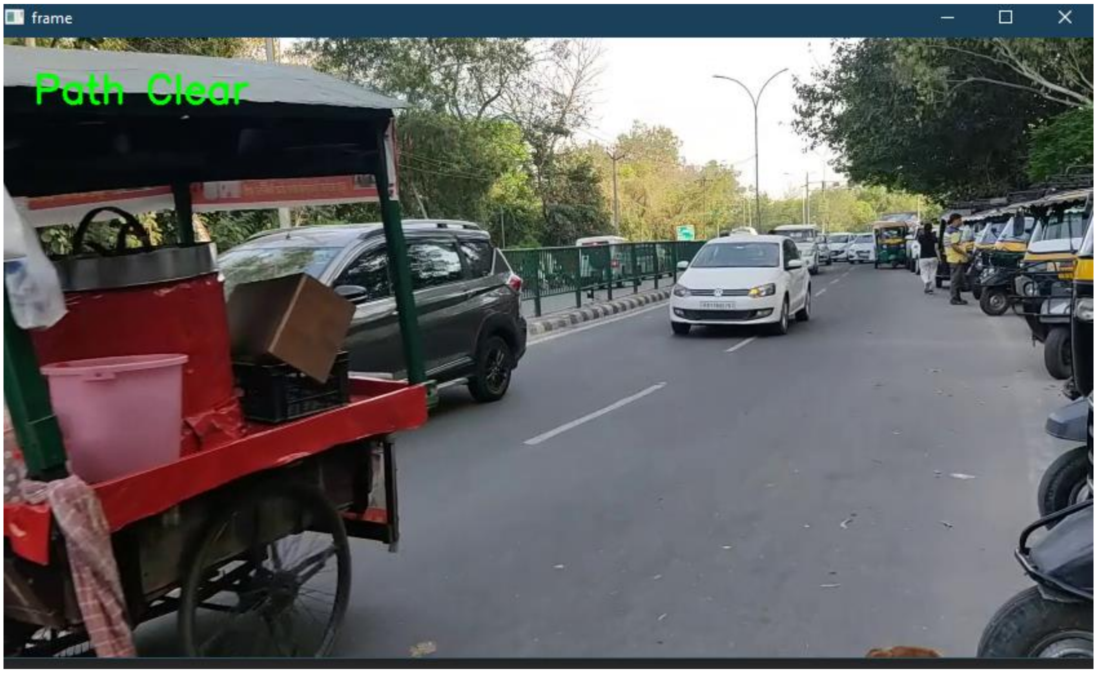
The algorithm uses a series of features to detect objects in images or videos. These features are computed by convolving a small rectangular window called a Haar filter over the input image. The features are computed based on the differences in the sum of the pixel intensities in the white and black regions of the filter. For example, one feature might be the difference between the sum of pixels in the left and right halves of the filter.

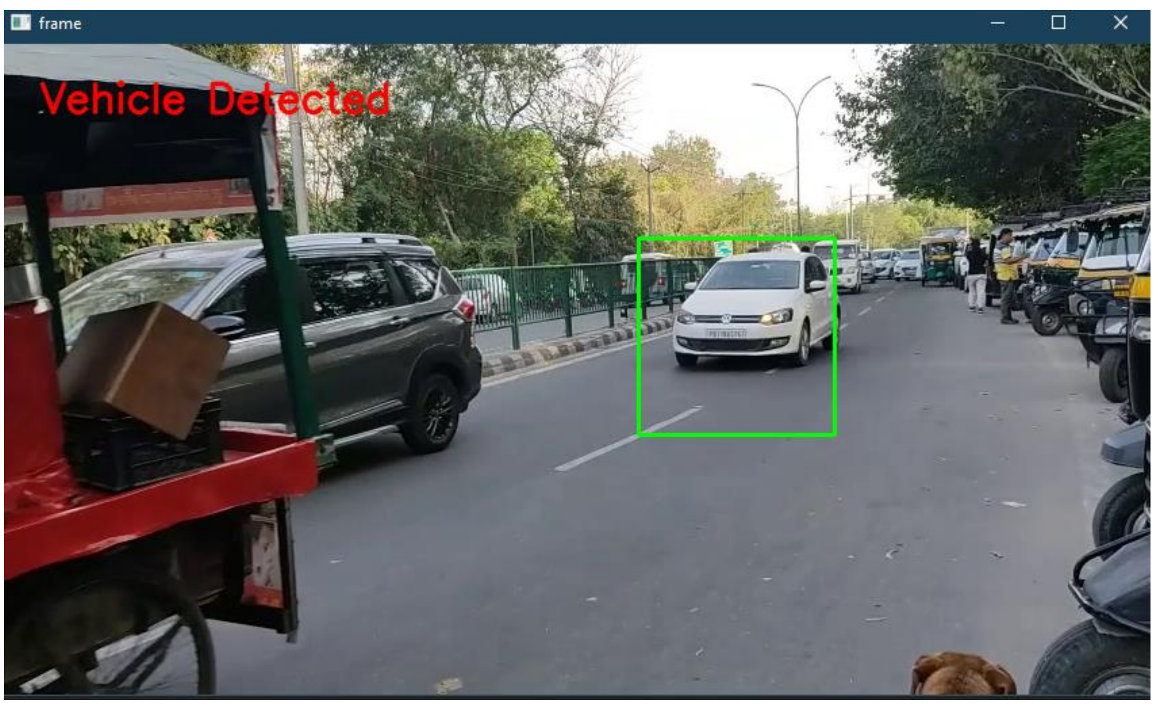
The algorithm uses machine learning techniques to learn a set of discriminative features that are most effective at detecting the object of interest. This is done by training a classifier on a large dataset of positive and negative examples. Positive examples are images or videos that contain the object of interest, while negative examples are images or videos that do not contain the object. The classifier is trained to differentiate between the positive and negative examples based on the learned features.

Once the classifier is trained, it can be used to detect the object of interest in new images or videos. This is done by applying a sliding window approach, where the classifier is applied at multiple positions and scales in the image to detect the object.

The Haar Cascade algorithm has been successfully used for a variety of object detection tasks, including face detection, pedestrian detection, and car detection. Its high accuracy and fast processing speed make it a popular choice for real-time applications. However, its performance can be affected by factors such as lighting conditions, occlusions, and object variations, which require careful parameter tuning and training.

Sample Snapshots from Project





Results

The developed sensor program successfully detected approaching vehicles and prevented the accidental opening of car doors, thereby reducing the risk of accidents. The program was tested in a real-world scenario, and the results showed that it was able to detect vehicles accurately, even in low-light conditions.

The system was able to issue alerts to the driver whenever it detected a vehicle approaching, warning them not to open the door until it was safe. The alerts were delivered through a speaker and a display unit installed in the car, ensuring that the driver received timely and effective warnings.

The accuracy of the sensor program can be improved by using higher resolution cameras and optimizing the Haar Cascade algorithm parameters. The system can also be expanded to detect other potential hazards on the road, such as pedestrians or cyclists, to further improve the safety of drivers and passengers.

Future Scopes

There are several potential future scopes and possibilities for this project:

1. Expansion to other vehicles: The current project can be expanded to other types of vehicles, such as buses, trucks, and motorcycles, to enhance their safety features.

2. Integration with other technologies: The sensor program can be integrated with other advanced technologies, such as machine learning algorithms and radar sensors, to improve the accuracy of vehicle detection and enhance safety features.

3. Real-time communication: The sensor program can be linked to a cloud-based system to enable real-time communication between the car and other vehicles on the road, enabling safer driving and preventing accidents.

4. Emergency services integration: The sensor program can be integrated with emergency services, such as ambulance, police, and fire department, to provide timely assistance in case of an accident.

5. Smart city integration: The sensor program can be integrated with smart city infrastructure to provide a more comprehensive approach to road safety, enabling real-time analysis of traffic flow and enabling preventive measures to reduce the risk of accidents.

Overall, the future possibilities of this project are vast, and with further development and innovation, it has the potential to greatly enhance road safety and revolutionize the way we drive on our roads.

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