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DEVELOPMENT OF A DRIVER DROWSINESS DETECTION MODEL (DDDM)

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Abstract
Worldwide, driving weariness and drowsiness are key causes of traffic accidents and present serious risks to other road users as well as the driver. A person's level of alertness is determined via machine learning (ML)--based drowsiness detection, which looks at a range of physiological and behavioural indicators. This study aims to develop a robust Driver Drowsiness Detection Model (DDDM) using Machine Learning with Python, aiming to enhance road safety by proactively identifying signs of driver fatigue in real-time with the objectives; Dataset Collection and Preprocessing, Integration with Automotive Systems and Algorithm Exploration and Model Development. Python programming language was for the system development. The system was found to be effective and the proposed framework forestalls mishaps because of the drowsiness while driving. Therefore, the new drowsiness detection system is thereby considered effective in protecting the lives of the driver. Further research on various aspects such as data collection, data processing, and continuous improvement is recommended to keep effective and up-to-date.

Keywords: Drowsiness, Fatigue, Python, PERCLOS, Eyes

Introduction

Worldwide, driving weariness and drowsiness are key causes of traffic accidents and present serious risks to other road users as well as the driver. The efficacy of traditional approaches to tackling this problem, like driver education and awareness campaigns, is constrained. Around the world, a lot of individuals lose their lives in tragic traffic accidents each year. Being sleepy while driving is one of the main causes of serious accidents, along with fatigue and micro-slumbering at the wheel. The US Department of Transportation estimates that drowsy drivers were involved in 4.5 million recorded incidents globally in 2017. An estimated 2 million individuals were hurt and almost 1.4 million people died as a result of these crashes (Bhatia et al., 2022). Thus, it's critical that the problem revolves around the need for a robust and efficient system that can accurately identify signs of driver drowsiness in real-time. Fatigue-related accidents pose a significant risk on the roads, and the objective is to create a model that can analyze various features, such as facial expressions, eye movements, and driving behaviour, to reliably detect instances of driver drowsiness. This entails the collection of a diverse dataset, the exploration of suitable machine-learning algorithms, and the implementation of a Python-based solution that integrates seamlessly with existing automotive systems. The goal is to create a proactive system that can alert drivers or trigger safety mechanisms to prevent potential accidents caused by drowsy driving, ultimately contributing to enhanced road safety and the well-being of both drivers and other road users.

This study was to develop a robust Driver Drowsiness Detection Model using Machine Learning with Python, aiming to enhance road safety by proactively

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identifying signs of driver fatigue in real-time. The study will focus on gathering a diverse dataset from Nigerian drivers, considering cultural and environmental factors that may influence drowsiness.

Methodology

i. Matching

Dashboard-mounted cameras are used to monitor the eyes of the driver in real-time to detect drowsiness.

ii. Drowsiness Detection Design

A camera is set up that looks for faces in the input video stream and monitors frames of faces. If a face is identified, facial milestone identification is connected and the eye districts are removed from the edges of the video stream. Based on the work by Soukupova and Cech (2016) and Tanseer and Mehtab (2020) Real-Time Eye Detection Using Facial Landmarks derives an equation that reflects this relation called eye aspect ratio (EAR).

$$EAR=\|P2-P6\|+\|P3-P5\|\div 2\|P1-P4\|$$

Where p1, p2,… p6 are 2D facial milestones areas.

The numerator of this condition registers the distance between the vertical eye milestones while the denominator figures the distance between flat eye tourist spots, weighting the denominator around since there is just one bunch of level focuses yet two arrangements of vertical focuses. On the off chance that the angle proportion of the eye shows that they have been shut for more than a committed fixed time, we will sound an alert framework so the driver awakens. We notice the viewpoint proportion of the eye stays consistent for a while demonstrating that the eye was open, at that point it falls quickly to nothing and afterwards increments again which shows the individual flickered. We will be noticing this eye angle proportion in our laziness identifier case to check whether the remaining parts are consistent or tumble to zero yet not increment again inferring that the driver has shut his eye for an all-encompassing period.

Experimental Analysis

In this stage, it was tracked down that perhaps the most ideal approach to distinguishing eyes and yawning is by calculation. A portion of the current calculations that are identified with this undertaking are inspected to help build up the task. The reason strategy estimates the ideal opportunity for an individual to close their eyes and if their eyes are shut longer than the typical eye squint time, it is conceivable that the individual is nodding off. In light of investigations of natural eye flickers, it has been recognized that the normal human squint term takes about 202.24ms while the flicker length of a lazy individual takes about 258.57ms.

A couple of instruments have been utilized to identify the face and further concentrate the eye and mouth district to catch pictures of the driver's face before narrowing it down to the eye area and mouth. One of the major instruments or devices of this new design is the webcam utilized as an instrument to catch pictures of the driver's face before narrowing it down to the eye area and mouth.

Programming Language

Contrasted with dialects like C/C++, Python is slower. All things considered, Python can be effectively stretched out with C/C++, which permits us to compose computationally concentrated code in C/C++ and make Python coverings that can be utilized as Python modules. This gives us two benefits: first, the code is just about as quick as the first C/C++ code (since it is the real C++ code working in foundation) and second, it is simpler to code in.

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Python is a programming language used for mediation, unquestionable level, and general reasoning (Navyasree & Jain, 2021). Python's plan theory makes excellent use of large amounts of whitespace, which highlights the significance of the code. Primoz (2019) states that the language constructs and article-arranged technique of this approach are designed to help software engineers write reasonable code for both small and large-scale projects. Python is gradually constructed and adheres to many programming conventions, such as procedural, object-oriented, and practical programming. The use of PC computations to carry out picture preparation in computerized images is known as sophisticated picture handling in software engineering. Open CV, Numpy, Pandas, Frames, and Tensor Flow are a few of the Python packages that are employed (Navyasree & Jain, 2021).

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Python is an interpreter, verifiable level and comprehensively helpful programming language. Python is logically made and rubbish assembled and it maintains various programming ideal models including structure, object organisation, and utilitarian programming. It is a customer-described language, also an overall programming language that allows you to focus on the convenience of the application by managing typical programming tasks. Python is an extraordinarily extensively helpful programming language and it is used in web progression, data science, making programming models, and so forth. It is moreover used for math and structure scripting.

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Use Case Diagram

The use case diagram is a UML tool used to analyse the relationship between the module of a system and the external entity operating with the system.

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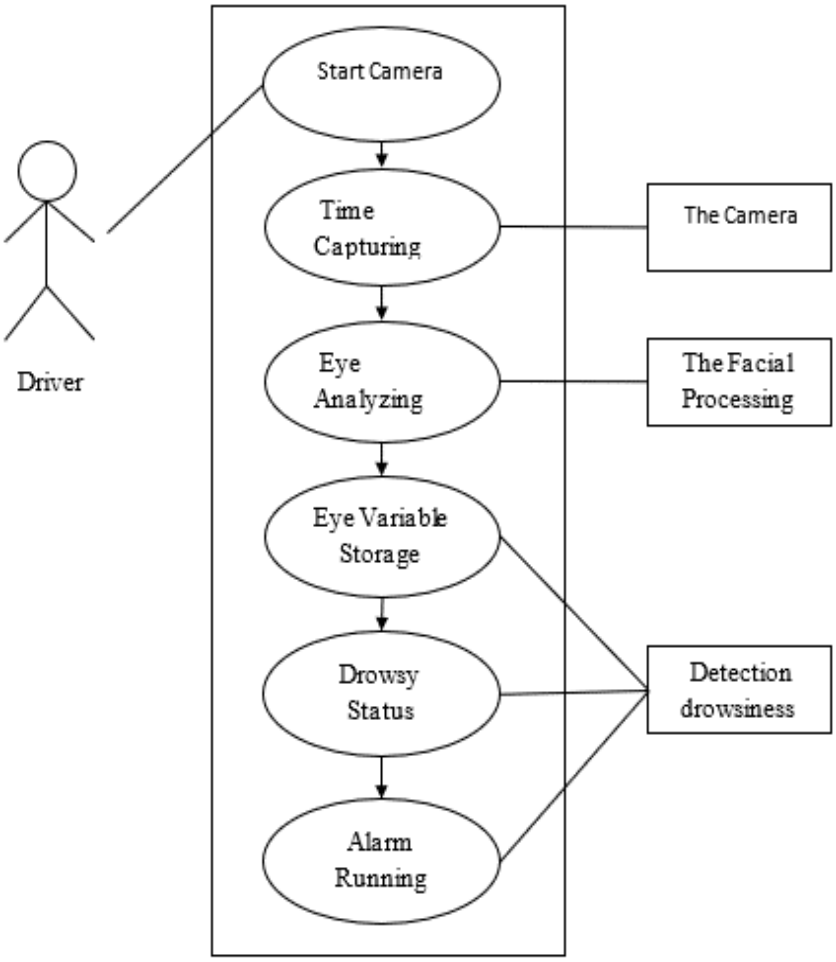

Figure 1: Detecting and Analyzing Drowsiness

The System Flow Chart

The flow chart consists of different diagrams which are used to determine the operation of the system. Some of the diagrams represent input and output, decisions to be made, operations to be carried out on data, etc. Figure 1 shows the flow chart of the proposed system.

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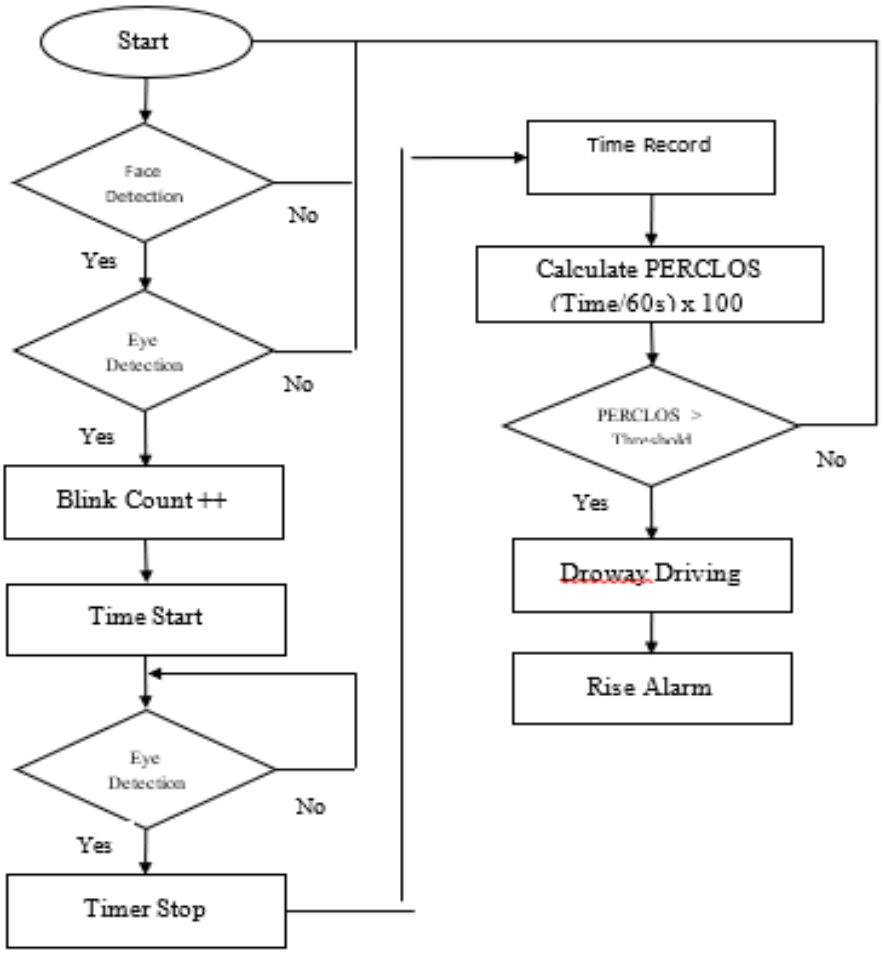

Figure 2: Flow Chart of the System

At this point, the system should have been able to recognize the driver's face, as well as confirm that he is present, that his condition is accurate, and that there is no threat. Furthermore, since the driver is specified as being awake and the counter is set detection, which means it won't do anything, the system will have been able to determine that there is no danger.

Finding a driver who has closed their eyes: When driving, if the driver displays any facial expressions that are inconsistent with appropriate awareness, such as yawning or closing their eyes,

Conclusion

The system can prevent accidents caused by sleepiness while driving. It works well even when drivers wear scenes and surprisingly well in low light if the camera provides better yield. Information regarding the head and eye position is obtained through various self-created picture-handling computations. During the observation, the system can determine whether the eyes are open or closed. When the eyes have been closed for a prolonged period. The system evaluates the driver's preparedness level for the intricacies of frequent eye terminations. As a result, we would have efficiently planned and created fractional execution of the driver tiredness recognition using Python and Opencv in conjunction with a camera.

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