PCET's

Pimpri Chinchwad College of Engineering,

Nigdi, Pune-44

<u>Department of Electronics & Telecommunication</u>

PBL VI Synopsis

Year 2022 – 2023

Sem-VI

Project Synopsis

1. Project Title: Driver Drowsiness Detection System using CNN

2. Details of Group Member:

Roll No	PRN No.	Class	Division	Name of Student	Mobile Number	Email Id
TYETC175	120B1E175	TY	C	Atharva Jadhav	9167427126	atharva.jadhav20@pccoepune.org
TYETC179	120B1E179	TY	C	Kaustubh Kale	8530861485	kaustubh.kale20@pccoepune.org
TYETC187	120B1E187	TY	C	Kshitij Wani	9371597477	kshitij.wani20@pccoepune.org

3. Project Overview / Background:

- Need of Work / Reason for selection of this project:

  A countless number of people drive on the highway day and night. Taxi drivers, bus drivers, truck drivers and people traveling long-distance suffer from lack of sleep. Due to which it becomes very dangerous to drive when feeling sleepy.
  A driver drowsiness detection system is an important safety feature that can help prevent accidents caused by driver fatigue. Drowsy driving is a serious problem that can lead to reduced reaction times, impaired judgment, and an increased risk of crashes. According to the National Highway Traffic Safety Administration (NHTSA), drowsy driving is responsible for an estimated 100,000 crashes, 1,550 deaths, and 71,000 injuries annually in the United States alone.
  In addition to preventing accidents, a driver drowsiness detection system can also help reduce the cost of accidents caused by driver fatigue, such as medical expenses, property damage, and lost productivity.
  Overall, a driver drowsiness detection system is an important safety feature that can help prevent accidents caused by driver fatigue, reduce the risk of injuries and fatalities, and save lives.

- Objective:

  1. To detect the driver's face and eyes: The system should be able to detect the driver's face in real-time video feed and identify the location of the eyes.
  2. To determine whether the eyes are open or closed: The system should be able to accurately classify the driver's eyes as open or closed in real-time.
  3. To train a CNN to detect driver drowsiness: The system should use a dataset of labeled images of open and closed eyes to train a CNN that can accurately detect driver drowsiness.
  4. To integrate face detection, eye detection, and CNN: The system should combine face detection, eye detection, and CNN to create a real-time driver drowsiness detection system that can sound an alarm or alert the driver when they are becoming drowsy.
  5. To improve road safety: The system should help reduce the risk of accidents caused by driver fatigue by alerting drivers when they are becoming drowsy and encouraging them to take a break or switch drivers.

- Problem Statement (explain what you want to implement in this project in short sentence):

  To implement a real-time driver drowsiness detection system using OpenCV and Keras that can detect when a driver's eyes are closed or drooping and alert them to take a break or switch drivers to prevent accidents caused by driver’s sleepiness.

- Algorithm selected for implementation:

  The model we used is built with Keras using Convolutional Neural Networks (CNN). A convolutional neural network is a special type of deep neural network which performs extremely well for image classification purposes. A CNN basically consists of an input layer, an output layer and a hidden layer which can have multiple layers. A convolution operation is performed on these layers using a filter that performs 2D matrix multiplication on the layer and filter.

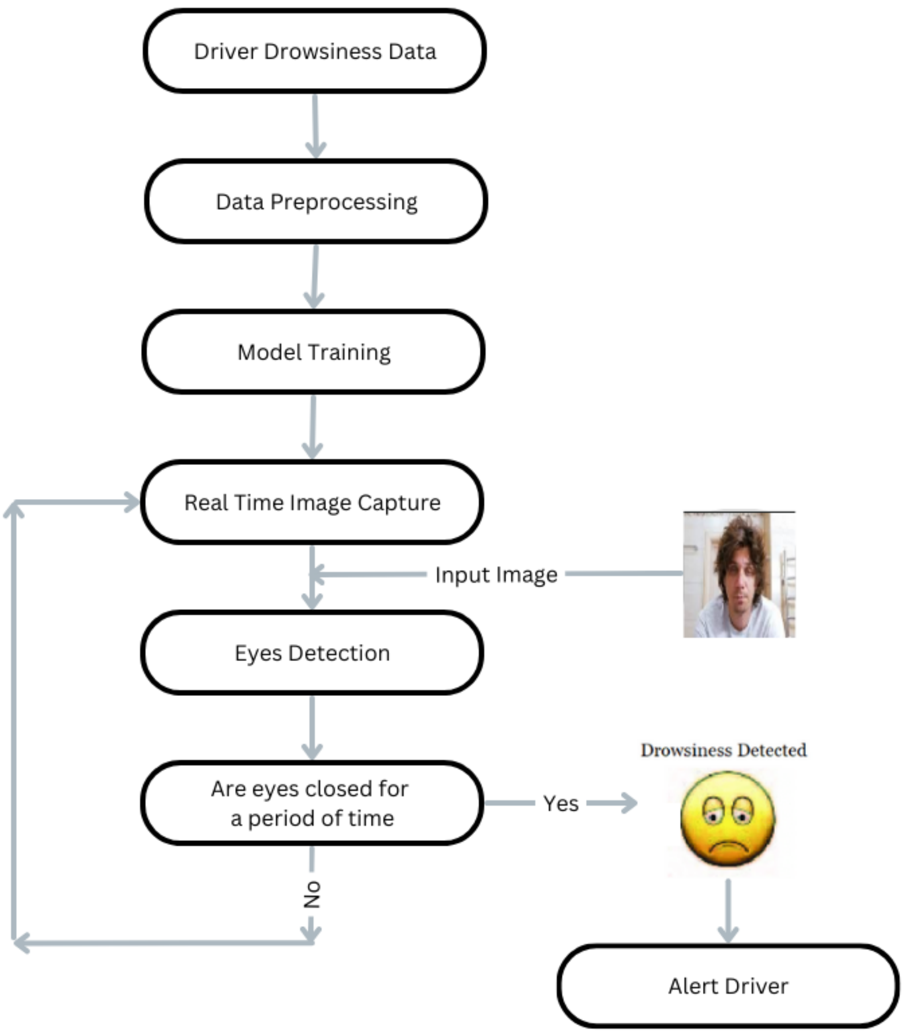
  The CNN model architecture consists of the following layers:

  - Convolutional layer; 32 nodes, kernel size 3
  - Convolutional layer; 32 nodes, kernel size 3
  - Convolutional layer; 64 nodes, kernel size 3
  - Fully connected layer; 128 nodes

  The final layer is also a fully connected layer with 2 nodes. A Relu activation function is used in all the layers except the output layer in which we used Softmax.

4. Methodology:

- Flowchart:



- Explanation:

1. Collecting and Preprocessing Data: A dataset of images containing closed and open eyes is collected and preprocessed. This includes resizing the images, normalizing the pixel values, and splitting the dataset into training and testing sets.
2. Building and Training the CNN Model: A CNN model is built using Keras. The model is trained using the training set of images. The model is designed to learn to identify patterns and features that distinguish between closed and open eyes.
3. Real-time Image Capture: A camera captures real-time video frames of the driver's face. The frames are processed by the CNN model to identify whether the eyes are closed or open.
4. Drowsiness Detection: The CNN model analyzes the real-time video frames and detects changes in the driver's eye state that are indicative of drowsiness. If the model predicts that the eyes are closed, an alert is generated to notify the driver.

- Advantages:

    1. Improved road safety: Drowsy driving is a significant cause of road accidents worldwide. Implementing a driver drowsiness detection system can significantly reduce the number of accidents caused by driver fatigue, thus improving road safety.
    2. Real-time detection: The system can detect driver drowsiness in real-time, alerting the driver to take a break or switch drivers before an accident occurs.
    3. Non-intrusive: The system does not require any invasive or uncomfortable equipment to be worn by the driver, making it a non-intrusive method of detecting driver fatigue.
    4. Easy to implement: The system can be easily integrated into existing vehicles or driver monitoring systems.
    5. Cost-effective: The cost of implementing a driver drowsiness detection system is relatively low compared to the potential costs associated with road accidents caused by drowsy driving.
    6. Customizable: The system can be customized to suit different driver preferences, such as alert levels and warning sounds.

- Limitations:

1. Limited effectiveness: Although driver drowsiness detection systems can significantly reduce the risk of accidents, they are not 100% effective. In some cases, drivers may still fall asleep or become fatigued despite the system's alerts.
2. False alarms: The system may generate false alarms, such as when the driver blinks or closes their eyes for a prolonged period, or when the system fails to recognize certain facial features or expressions.
3. Limited applicability: The system may not be effective for all drivers, such as those with certain medical conditions, disabilities, or unusual facial features.
4. Technical limitations: The system's accuracy and performance may depend on factors such as lighting, camera quality, and the speed of the vehicle.
5. Driver behavior: The system's effectiveness may also depend on the driver's behavior and their willingness to respond to the system's alerts.
6. Ethical and legal concerns: There may be ethical and legal concerns regarding the use of driver monitoring systems, such as privacy, consent, and data security.

- Applications:

1. Automotive industry: The system can be integrated into vehicles to prevent accidents caused by drowsy driving. It can also be used in commercial vehicles such as trucks and buses to ensure the safety of drivers and passengers.
2. Driver monitoring systems: The system can be used in driver monitoring systems to detect drowsiness and prevent accidents in industries such as aviation, shipping, and rail transportation.
3. Healthcare: The system can be used in healthcare to monitor the sleep patterns of patients with sleep disorders such as insomnia and sleep apnea.
4. Military: The system can be used in military vehicles and aircraft to ensure the safety of military personnel during long missions.
5. Public safety: The system can be used in public safety applications such as transportation systems, public transit, and emergency vehicles.

Overall, the Driver Drowsiness Detection System has a broad range of applications that can improve safety and reduce the risk of accidents caused by drowsy driving.

5. Project requirements:

- Facilities required:

1. Database on Driver Drowsiness data: The dataset consists of 2900 images which include both normal and yawning images.
2. IDE with Python 3.7 and openCV and Keras.

6. References:

1) Roy, A.M.; Bhaduri, J. A Deep Learning Enabled Multi-Class Plant Disease Detection Model Based on Computer Vision. AI 2021, 2, 413–428. [Google Scholar] [CrossRef]
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5) Bagus G. Pratama, IgiArdiyanto, Teguh B. Adji, A Review on Driver Drowsiness Based on Image, Bio-Signal, and Driver Behavior, IEEE, July 2017.
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Signature of Guide:

Signature of PBL-VI Co-Ordinator:

Signature of PBL Mentor :