



# Early Identify And Notify Driver's Drowsiness By Machine Learning

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**Abstract:** Driver drowsiness is one of the major causes of road accidents worldwide, leading to serious injuries and loss of life. Detecting driver fatigue at an early stage can significantly reduce the risk of accidents. This paper presents a real-time Driver Drowsiness Detection and Alert System using Machine Learning and Computer Vision techniques. The proposed system continuously monitors the driver's facial expressions using a camera and analyzes eye movements, blinking patterns, and yawning behavior. Facial landmark detection and Eye Aspect Ratio (EAR) are used to identify signs of drowsiness. A Support Vector Machine (SVM) classifier is employed to classify the driver's state as alert or drowsy. When drowsiness is detected, the system triggers an alarm to alert the driver and can also send the vehicle's live location to a registered contact for emergency assistance. The proposed system is cost-effective, reliable, and suitable for both personal and commercial vehicles. Experimental results demonstrate an accuracy of 83.25% in detecting changes in facial expressions under varying lighting conditions.

**Index Terms** - Driver drowsiness, Machine Learning, Facial Landmark Detection, Support Vector Machine, OpenCV, Eye Aspect Ratio.

## I. INTRODUCTION

Driver drowsiness is one of the leading causes of severe road accidents in daily life. Fatigue and sleepiness reduce a driver's attention, reaction time, and decision-making ability, increasing the chances of collisions. According to road safety studies, a significant percentage of accidents occur due to driver fatigue, especially during long-distance driving or night travel.

The proposed Driver Drowsiness Detection System aims to prevent such accidents by monitoring the driver's facial behavior in real time. The system captures continuous video input and detects signs such as prolonged eye closure, frequent blinking, and yawning. By applying machine learning algorithms and image processing techniques, the system can determine whether the driver is alert or drowsy.

If drowsiness is detected, the system immediately activates an audio alarm to warn the driver. In advanced situations, the system can also send the driver's live location to a predefined emergency contact. This technology helps improve road safety and can be integrated into modern intelligent transportation systems

### 1.1 Motivation

Drowsiness-related accidents cause major human and economic losses every year. A reliable real-time system that detects driver fatigue can help reduce accidents and save lives. With advancements in computer vision and machine learning, it is now possible to develop affordable and efficient drowsiness detection systems.

## 1.2 Objectives

1. To detect early symptoms of driver drowsiness before complete loss of attentiveness.
2. To continuously capture and analyze driver facial expressions.
3. To trigger an alarm when drowsiness is detected.
4. To improve road safety for passenger and commercial vehicles.
5. To provide location tracking and emergency notification support

## II. LITERATURE SURVEY

Driver Drowsiness Detection has become an important research area in intelligent transportation systems. Many studies have proposed different methods for detecting fatigue and preventing road accidents.

Several researchers have used facial recognition and machine learning techniques to monitor driver behavior. Facial landmark detection helps identify eye closure, blink frequency, and yawning, which are common indicators of drowsiness.

A study by **F. Guede-Fernández et al.** implemented Support Vector Machine (SVM) and image processing techniques for real-time driver monitoring. Their system achieved high accuracy under proper lighting conditions and reported **83.25% accuracy** in emotion and gesture recognition.

Another research focused on **Advanced Driver Assistance Systems (ADAS)** using facial landmarks to detect driver fatigue. These systems analyze eye and facial movements continuously and provide warnings when signs of drowsiness are detected.

Some existing systems also use **GPS-based vehicle tracking**, allowing live location monitoring in emergencies. However, many current systems face limitations such as poor performance in low-light conditions and difficulty detecting eyes behind tinted glasses

The literature survey indicates that combining **Machine Learning, Computer Vision, and Real-Time Alert Mechanisms** can significantly improve driver safety and reduce road accidents

### 3.1 PROPOSED SYSTEM

The proposed system is designed to detect driver drowsiness in real time using Machine Learning and Computer Vision.

The system captures continuous video from a camera installed inside the vehicle. The captured images are processed using OpenCV to detect the driver's face and identify important facial landmarks such as the eyes and mouth.

#### *Working of the System*

The system follows these steps:

1. **Image Capture:**

A camera continuously captures the driver's facial images.

2. **Face Detection:**

OpenCV detects the driver's face from each video frame.

3. **Facial Landmark Detection:**

Specific facial points such as eyes and mouth are identified.

4. **Eye Aspect Ratio (EAR) Calculation:**

The EAR is used to determine whether the eyes are open or closed.

5. **Yawning Detection:**

Mouth movements are analyzed to detect yawning.

6. **Machine Learning Classification:**

A **Support Vector Machine (SVM)** classifies the driver as **Alert** or **Drowsy**.

7. **Alert Mechanism:**

If drowsiness is detected, an alarm is triggered immediately.

## 8. Emergency Location Sharing:

The driver's live location can be sent to a registered contact for assistance

### 3.2 Advantages of the Proposed System

- Real-time monitoring of driver behavior
- Early detection of drowsiness symptoms
- Immediate audio alert system
- Improved road safety
- Low-cost implementation
- Can be integrated with vehicle electronics
- Emergency location sharing capability.

### 3.3 Limitations

Reduced accuracy in low-light conditions  
 Difficulty detecting eyes behind dark glasses  
 False alarms may occur in some situations  
 Performance depends on camera quality.

## IV. SYSTEM REQUIREMENTS AND METHODOLOGY

### 4.1 Hardware Requirements

The following hardware components are required for the development and execution of the Driver Drowsiness Detection System:

Processor: Any standard processor

RAM: Minimum 4 GB

Storage: Minimum 128 GB HDD/SSD

Built-in or External Camera

Speaker for alarm notification

Table 4.1: Descriptive Statics

### 4.2 Software Requirements

The system can run on the following platforms:

Operating System: Windows 7/8/10, Linux, macOS

Programming Language: Python

Python Libraries: OpenCV, NumPy, Dlib, Scikit-learn

Development Tools: VS Code / PyCharm / Jupyter Notebook

### 4.3 Methodology

The proposed system uses a combination of image processing and machine learning techniques.

#### Step 1: Image Preprocessing

The captured images are processed to improve quality and normalize lighting conditions. Noise reduction and grayscale conversion are applied to improve detection accuracy.

#### Step 2: Face Detection

The system uses OpenCV Haar Cascade classifiers to identify and locate the driver's face.

#### Step 3: Facial Landmark Detection

Specific facial points such as eyes and mouth are detected using facial landmark algorithms.

#### Step 4: Eye Aspect Ratio (EAR)

EAR is calculated to determine whether the eyes are open or closed.

The formula is:

$$EAR = 2 \|p1 - p4\| \|p2 - p6\| + \|p3 - p5\|$$

If the EAR remains below a predefined threshold for several frames, the driver is considered drowsy.

#### Step 5: Machine Learning Classification

A Support Vector Machine (SVM) model classifies the driver's condition as:

Alert

Drowsy

#### Step 6: Alert Generation

When drowsiness is detected:

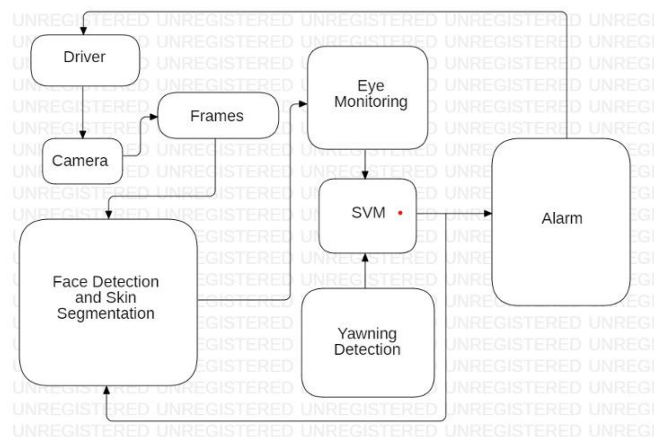
Audio alarm is activated

Driver receives immediate warning

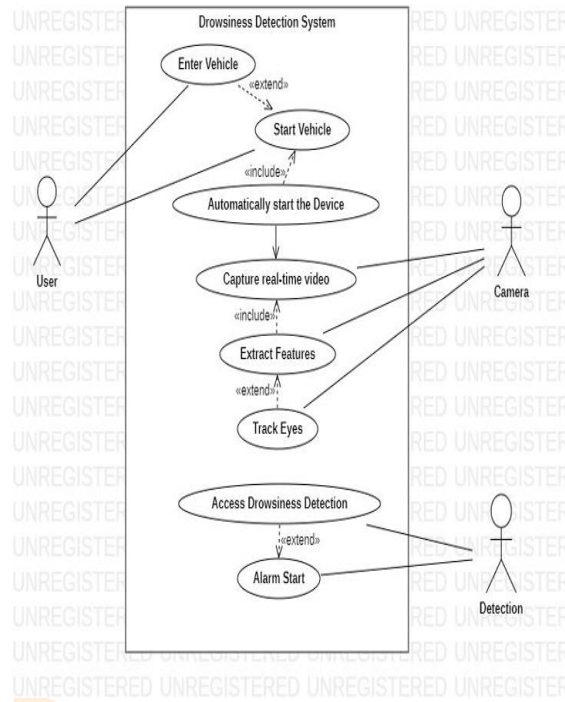
Live vehicle location may be sent to emergency contacts

#### System Architecture

represents the System Architecture. The camera captures the image and sends to the arduino Nano chip. This is connected to the monitor and it consists of 32 bit memory card installed with open CV which helps in image processing. The encoder encodes the data. The encoded signal is decoded back in the decoder. Arm used is the LPC2148 which is the microcontroller. If the decoded signal crosses threshold of 2-3 sec, it will automatically makes the alarm beep and the parking light will be on in order to alert the driver, otherwise that signal is rejected and next signal is processed.

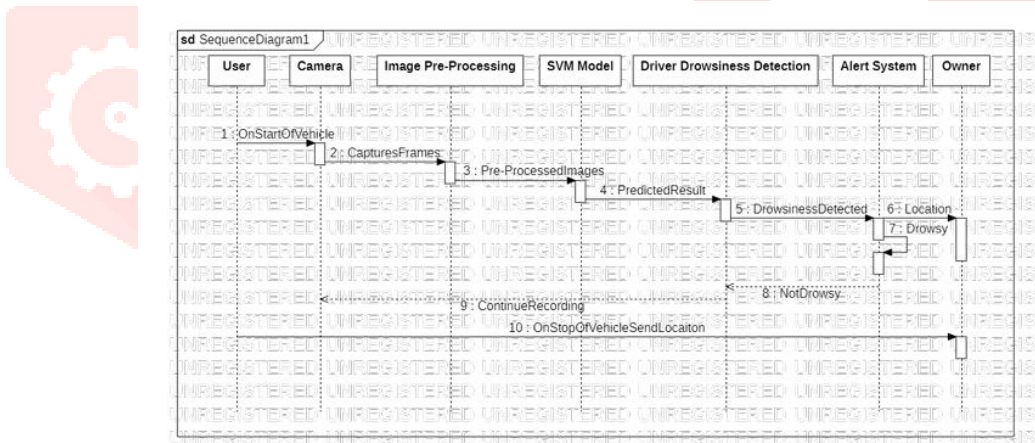


#### Use Case Diagram



### Sequence Diagram

High-level interaction between active objects in a system is visualized using sequence diagram. In figure 4.6 the sequential flow of system and the exchange of messages between the object is shown. Active Objects/Actors in the sequence diagram are User, Camera, Alarm and Detection System.



Sequence Diagram

## V. EXPERIMENTATION AND RESULTS

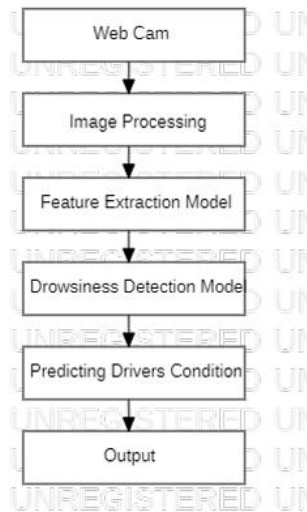
### 5.1 Experimental Setup

The system was tested using:

- Webcam-based real-time image capture
- Different lighting conditions
- Multiple facial expressions and head positions

## PROJECT IMPLEMENTATION

## Overview of Project Module

**5.2 Results**

The proposed system successfully detected:

- Eye closure
- Frequent blinking
- Yawning behavior
- Driver fatigue symptoms

The overall accuracy achieved was:

**83.25%**

The system performed well under normal lighting conditions and demonstrated reliable real-time response

**5.3 Advantages of Results**

- Fast detection response
- High detection accuracy
- Real-time performance
- Low computational cost

**VI. CONCLUSION**

Driver drowsiness is a major cause of road accidents and can lead to serious injuries and loss of life. The proposed Driver Drowsiness Detection and Alert System provides an intelligent and effective solution to monitor driver behavior in real time and detect early signs of fatigue.

By using Machine Learning and Computer Vision techniques such as facial landmark detection, Eye Aspect Ratio (EAR), and Support Vector Machine (SVM), the system can accurately determine whether the driver is alert or drowsy.

When drowsiness is detected, the system immediately alerts the driver through an alarm and can also provide emergency location tracking support. This helps prevent accidents and improves road safety.

The experimental results demonstrate that the system is reliable, cost-effective, and suitable for both personal and commercial vehicles.

## VII. FUTURE ENHANCEMENT

### The following improvements can be made in the future:

Integration with IoT-enabled smart vehicles.

Improved detection accuracy using Deep Learning models such as CNN and RNN.

Better performance in low-light and night-driving conditions.

Detection of additional driver emotions such as stress or anger.

Cloud-based storage for driver behavior analytics.

Mobile application support for real-time monitoring and notifications.

Automatic vehicle speed reduction in emergency situations.

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