**FYP SRS Document**

Final Year Project

Software Requirement Specification

For

Drowsy Guard Vigilance Enhancement system

(BSCS)

By

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S# | **Name** | **Registration #/Roll #/Section** | **Mobile #** | **E-Mail** |
| 1. | Waleed Khan | FA-19-BSCS-241 | 0321-1673617 | hafizwaleed973@gmail.com |
| 2. | Usama Malik | FA-19-BSCS-148 | 0319-4744079 | um591837@g,ail.com |

**Supervised by:**

Dr.Muhammad Sajid Farooq **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (**Signature**)**

****

Department of Computer Science

Lahore Garrison University

Lahore

Contents

[**Introduction** 3](#_Toc149063759)

[**1.1 Purpose** 3](#_Toc149063760)

[**1.2** **Document Conventions** 4](#_Toc149063761)

[**1.3 Intended Audience and Reading Suggestions** 4](#_Toc149063762)

[**1.4 Product Scope** 5](#_Toc149063763)

[**2. Overall Description** 5](#_Toc149063764)

[**2.1 Product Perspective** 5](#_Toc149063765)

[**2.2 Product Functions** 6](#_Toc149063766)

[**2.3 User Classes and Characteristics** 6](#_Toc149063767)

[**2.4 Operating Environment** 6](#_Toc149063768)

[**2.5 Design and Implementation Constraints** 7](#_Toc149063769)

[**2.6 User Documentation** 7](#_Toc149063770)

[**2.7 Assumptions and Dependencies** 7](#_Toc149063771)

[**3. External Interface Requirements** 8](#_Toc149063772)

[**3.1 User Interfaces** 8](#_Toc149063773)

[**3.2 Hardware Interfaces** 8](#_Toc149063774)

[**3.3 Software Interfaces** 8](#_Toc149063775)

[**3.4 Communications Interfaces** 8](#_Toc149063776)

[**4. System Features** 9](#_Toc149063777)

[**The project consists of features** 9](#_Toc149063778)

[**4.1 Description and Priority** 9](#_Toc149063779)

[**4.2 Stimulus/Response Sequences** 9](#_Toc149063780)

[**4.3 Functional Requirements** 9](#_Toc149063781)

[**5. Other Nonfunctional Requirements** 10](#_Toc149063782)

[**5.1 Performance Requirements** 10](#_Toc149063783)

[**5.2 Safety Requirements** 10](#_Toc149063784)

[**5.3 Security Requirements** 11](#_Toc149063785)

[**5.4 Software Quality Attributes** 11](#_Toc149063786)

[**5.5 Business Rules** 11](#_Toc149063787)

[**References** 11](#_Toc149063788)

# 

# **Introduction**

The Drowsy Driver Vigilance Enhancement System is an innovative and cutting-edge solution designed to combat the dangers posed by fatigued or drowsy drivers on our roadways. This state-of-the-art technology employs a multifaceted approach, utilizing a combination of advanced sensors, artificial intelligence algorithms, and real-time data analysis to detect signs of driver fatigue. The system monitors a range of physiological and behavioral indicators, such as eye movements, steering patterns, and changes in heart rate, to swiftly identify a driver's diminishing alertness levels. Once the system identifies these warning signs, it activates a series of proactive countermeasures, including audible alerts, seat vibrations, and even subtle temperature and lighting adjustments within the vehicle to rouse the driver from their drowsy state. This innovative technology not only enhances driver vigilance but also prioritizes safety on the road, reducing the risk of accidents caused by driver fatigue. Its ability to intervene and prevent potential hazards makes it an indispensable component in the ongoing efforts to create safer and more secure roadways for everyone.

# **1.1 Purpose**

The purpose of a Drowsy Driver Vigilance Enhancement System (DDVES) is to address the critical issue of driver fatigue and enhance road safety significantly. Operating on the fundamental principle that drowsy driving poses a severe risk to both the driver and others on the road, DDVES employs a combination of cutting-edge technologies to detect signs of driver fatigue and prevent potential accidents.

By utilizing advanced sensors, such as infrared cameras and steering pattern analysis, DDVES monitors the driver's behavior and detect the drowsiness in real-time. This system can identify subtle signs of drowsiness, including erratic steering, slow reaction times, and drooping eyelids. When these signs are detected, the system issues timely alerts to the driver, such as visual or auditory warnings, vibrations, or even seat adjustments, to jolt them back to alertness.

The primary purpose of DDVES is to prevent accidents caused by drowsy driving, a leading factor in road accidents globally. By intervening before a driver succumbs to fatigue, the system not only protects the occupants of the vehicle but also safeguards pedestrians and other drivers on the road. Ultimately, DDVES aims to reduce the number of accidents and fatalities caused by drowsy driving, making roads safer for everyone and contributing significantly to the overall improvement of public safety.

## **Document Conventions**

Primary heading:

* + Font family: times new roman
  + Font Face: Normal
  + Font Size: 16, Heading 1

Sub heading:

* + Font Family: Times new roman
  + Font Face: Normal
  + Font Size: 13, Heading 2

Other content clarification:

* + Font Family: Times new roman
  + Font Face: Normal
  + Font Size: 12
  + Line Spacing: 1.5

## **1.3 Intended Audience and Reading Suggestions**

The intended audience for information about the Drowsy Driver Vigilance Enhancement System is broad, encompassing both the general public and specific stakeholders in the realm of road safety and transportation.

This information is crucial for all drivers, as drowsy driving is a universal concern. It's essential for individuals who operate vehicles to be aware of such technologies and the importance of staying alert while driving. Families, friends, and employers can also benefit from understanding the system to promote safe driving practices among their loved ones and employees.

Road safety agencies, law enforcement, and policymakers are key stakeholders. They need to be informed about the technology's potential to reduce accidents and fatalities caused by drowsy driving. Such knowledge can lead to the implementation of regulations or incentives to encourage its adoption in vehicles.

The automotive industry plays a significant role in integrating this technology into vehicles. Car manufacturers and technology developers should be aware of the system's capabilities and how it can be seamlessly integrated into their products to enhance safety and market competitiveness.

Insurance providers have a vested interest in reducing accidents and claims. They should explore the potential benefits of offering incentives or discounts to policyholders who use vehicles equipped with this technology.

## **1.4 Product Scope**

The product scope of the Drowsy Driver Vigilance Enhancement System encompasses a comprehensive range of features and functionalities designed to address the critical issue of driver fatigue and enhance road safety. At its core, this system includes advanced sensors and monitoring devices capable of continuously assessing a driver's state of alertness through the analysis of various physiological and behavioral indicators, such as eye movements, steering behavior, and heart rate. When signs of drowsiness are detected, the system employs a multi-tiered approach to intervention. This includes audible alarms, tactile feedback through seat vibrations, and automated adjustments to the vehicle's internal environment, such as subtle changes in temperature and lighting, to awaken the driver. The system also records and stores data related to driver behavior and fatigue patterns for later analysis and reporting, contributing to long-term safety improvements. Furthermore, it offers seamless integration options for vehicle manufacturers, allowing them to incorporate this life-saving technology into their vehicles. Overall, the product scope of the Drowsy Driver Vigilance Enhancement System is a comprehensive and intelligent solution for mitigating the risks associated with drowsy driving, ultimately fostering safer roads for everyone.

# **2. Overall Description**

## **2.1 Product Perspective**

The System represents a paradigm shift in the automotive industry, placing safety and proactive accident prevention at the forefront of technological innovation. This system is engineered as an integrated solution, seamlessly blending cutting-edge sensors, artificial intelligence algorithms, and real-time data analysis capabilities. It serves as an autonomous, non-intrusive guardian within the vehicle, continuously monitoring the driver's facial expression. By employing advanced technologies like eye-tracking, the system can accurately detect signs of drowsiness or diminished alertness.

One of the system's key strengths is its adaptability and responsiveness. It doesn't merely identify the problem; it actively intervenes to prevent potential accidents. When signs of driver fatigue are detected, the system deploys a range of customized alerts. These alerts can include auditory warnings, seat vibrations, and subtle adjustments in the vehicle’s environment. This nuanced approach ensures that the driver is gently but effectively roused from their drowsy state, allowing them to regain full control of the vehicle.

The system is designed with scalability and compatibility in mind, making it suitable for integration across various types of vehicles, from compact cars to heavy-duty trucks. Its user-friendly interface and seamless integration capabilities mean that both automakers and end-users can implement it without significant modifications or disruptions to the driving experience.

## **2.2 Product Functions**

The primary function of a Drowsy Driver Vigilance Enhancement System is to enhance driver alertness and prevent accidents due to drowsiness. Here are some key product functions:

* The system continuously monitors the driver’s eye movement, facial expression and drowsiness.
* It detects signs of driver fatigue or drowsiness, including drooping eyelids and erratic driving behavior, and promptly alerts the driver.
* When drowsiness is detected, the system generates immediate alerts, typically through audible alarms, vibrations in the seat, or visual cues on the dashboard, effectively jolting the driver back to alertness.
* The system can adapt its alerts based on the severity of drowsiness, ensuring the most appropriate level of intervention.
* It records data on driver behavior and fatigue events, which can be later accessed for analysis or used as evidence in case of accidents.
* Users can often customize alert preferences to suit their preferences and sensitivities.

The Drowsy Driver Vigilance Enhancement System effectively serves as an intelligent co-pilot, actively working to keep drivers alert and prevent accidents caused by drowsy driving.

## **2.3 User Classes and Characteristics**

Drowsy Driver Vigilance Enhancement system to use by all personals.

## **2.4 Operating Environment**

The operating environment of a Drowsy Driver Vigilance Enhancement System is a dynamic and complex space that revolves around the vehicle and its driver. This system functions within the confines of the vehicle cabin, relying on a network of sensors and advanced technologies to monitor and respond to the driver's state of alertness. Its primary arena is the interior of the vehicle, where it tracks various eye movements, and vital signs. The system is also interconnected with the vehicle's electrical and electronic architecture. In essence, the operating environment of a Drowsy Driver Vigilance Enhancement System is a comprehensive and integrated space, contributing to the safety and well-being of drivers and other road users.

## **2.5 Design and Implementation Constraints**

Design and implementation constraints for a Drowsy Driver Vigilance Enhancement System are essential to consider to ensure its effectiveness and feasibility. Here are some common constraints:

* The cost of hardware components and sensors must be reasonable to make the system affordable for a wide range of vehicles
* The system should be energy-efficient to avoid draining the vehicle's battery and should not interfere with other essential vehicle functions.
* The system's sensors and algorithms must provide highly accurate drowsiness detection to prevent false alarms
* Developing a user-friendly interface for customization is important.
* Collaboration with automakers and ensuring compatibility with different vehicle architectures can be complex.
* User training and education about the system's functions and benefits are necessary.
* The system should be scalable, suitable for use in a variety of vehicle types, from personal cars to commercial fleets.
* Ensuring that the system can be adapted to different vehicle sizes and types is important for wider adoption.

## **2.6 User Documentation**

The user documentation is not mainly provide by if some want the documentation so we print the documentation and give to our user. Where you can read and use our product because our product is mainly based on the hardware.

## **2.7 Assumptions and Dependencies**

* They should know how to operate.
* It is dependent on NVIDIA JETSON Nano kit.
* It is dependent on availability of electric power Web camera and Buzzer.

# **3. External Interface Requirements**

## **3.1 User Interfaces**

The user interface of a System is designed to provide drivers with real-time information and alerts regarding their level of alertness while driving. Typically integrated into the vehicle's dashboard or heads-up display, the interface includes features such as: The system may display visual cues, like an eye icon or a drowsiness meter, on the dashboard. These indicators change in response to the driver's alertness level. In situations of heightened drowsiness, the system can emit audible alerts, such as alarms or spoken warnings, to jolt the driver's attention.

## **3.2 Hardware Interfaces**

* NVIDIA Jetson Nano kit(GPU)
* Buzzer
* Webcam
* USB link usb4.0 adapter

## **3.3 Software Interfaces**

* VS Code
* Python Language
* pytorch,
* OpenCV,
* Google Colab
* YOLOv5s
* Numpy
* Play sound/multiprocessing/VLC

## **3.4 Communications Interfaces**

* Webcam in front of vehicle’s dashboard, such as cameras, provide real-time data on the driver's behavior which are essential for detecting drowsiness.
* When drowsiness is detected, the system uses the communication interface to generate alerts, which may include visual cues on the dashboard, audible alarms.

# **4. System Features**

## **The project consists of features**

**First,** real-time image input is given to the jetson Nano kit through a webcam. **Second,** the input image is divide into frames by default as we know that a video is a combination of frames these frames are passed into the model which performs convolution on each frames. **Third** after performing CNN the model then classifies image into authentic /unauthentic and awake/drowsy. **Fourth,** if 10 continuous frames are classified as unauthentic, signal is passed to the buzzer and alarm turns on the indicating the person on the drivers not on the owner rather than the alarm will turn on until the driver is awake.

## **4.1 Description and Priority**

The Drowsy Driver Vigilance Enhancement System is an advanced safety technology designed to address the pressing issue of drowsy driving, a major cause of accidents on our roads. Its primary function is to monitor a driver's alertness in real-time, employing various sensors and algorithms to detect signs of fatigue, and subsequently alert the driver through visual, auditory, or haptic cues, thereby preventing potential accidents. Given the significant human and economic costs associated with drowsy driving incidents, the priority of this system is exceptionally high. It plays a crucial role in enhancing road safety, reducing accidents, and potentially saving lives, making its development and implementation a paramount concern for both automotive manufacturers and road safety authorities.

## **4.2 Stimulus/Response Sequences**

The stimulus/response sequences of a System are designed to actively monitor a driver's level of alertness and react swiftly to mitigate the risks associated with drowsy driving. Stimuli primarily involve the continuous analysis of driver behavior through sensors, tracking eye movements and facial expression. In response to identified drowsiness indicators, which can include visual alerts on the dashboard, audible alarms to awaken the driver. The system can also adapt its response based on the severity of drowsiness. This seamless interaction between stimuli and responses is instrumental in preventing accidents and promoting road safety by keeping drivers vigilant and engaged while on the road.

## **4.3 Functional Requirements**

* Real-Time Analysis

It should provide real-time analysis of the driver's alertness levels a respond promptly to any detected drowsiness.

* Drowsiness Detection:

The system must continuously monitor the driver's facial indicators to detect signs of drowsiness, such as drooping eyelids and erratic driving behavior.

* Alert Generation

The system should generate immediate and effective alerts, including visual cues on the dashboard, audible alarms, and seat vibrations to awaken the drive.

* Adaptive Alerts

The system should be capable of adjusting the intensity and type of alert based on the severity of the driver's drowsiness, avoiding unnecessary distractions.

* Scalability

The system should be adaptable to various vehicle types and sizes, from personal cars to commercial trucks, for widespread implementation.

* Privacy and Security

Data privacy and security measures must be in place to protect sensitive driver information and prevent unauthorized access.

# **5. Other Nonfunctional Requirements**

## **5.1 Performance Requirements**

Performance is of very high value in this project as mentioned earlier the performance parameters of the product are accuracy, speed, efficiency, learnability and autonomy. These parameters are of high importance as one cannot compromise on it not even a bit, the product would be working in a real environment and as well as is a real-time system along would be handling a sensitive portion as health so we cannot expect any glitch or even a slight mistake. The performance requirement is highly entertained.

## **5.2 Safety Requirements**

Safety requirements for a System are paramount to ensure its role in enhancing road safety. These requirements encompass stringent criteria to protect both the driver and other road users. The system must consistently operate without causing any interference with the vehicle's core functions, ensuring that it never compromises vehicle control. It should also prioritize the prevention of false alarms to prevent driver distraction, while maintaining a high degree of sensitivity to accurately detect drowsiness. Meeting these safety requirements is essential to creating a Drowsy Driver Vigilance Enhancement System that minimizes risks and actively contributes to a safer driving environment.

## **5.3 Security Requirements**

Ensuring the security of a Drowsy Driver Vigilance Enhancement System is paramount to protect sensitive driver data and prevent potential misuse. The system should comply with relevant data protection regulations, providing drivers with transparency regarding the collection and use of their data and obtaining explicit consent.

## **5.4 Software Quality Attributes**

Vigilance Enhancement system is designed to be highly easy to use for the personals as the other individual utilizes. The system must prioritize real-time responsiveness, swiftly detecting and responding to drowsiness cues to prevent accidents. While maintaining a user-friendly interface that minimizes distractions. Scalability and compatibility ensure the system's seamless integration into various vehicles, while ongoing maintenance and updates guarantee its long-term effectiveness. Striking the right balance between sensitivity and specificity is critical for accurate drowsiness detection and avoiding false alarms.

## **5.5 Business Rules**

The companies engaging in the brand's supply would sign on the contract to ensure the typical user's privacy rights. The deals would accordingly change and further modified to provide the better implication of its security and no record keeping of activities the user with the intent for selling to a third party. The business rules of a System encompass a range of policies and guidelines aimed at ensuring the system's functionality, effectiveness, and ethical operation. These rules dictate strict adherence to data privacy and security regulations, safeguarding sensitive driver information. The system must be designed for affordability, aligning with cost-effective pricing to cater to a broad market

# References

* Bhargava R, Panchal R, Verma P, Sharma S. Drowsiness Detection While Driving Using Eye Tracking. *Int Res J Eng Technol*. 2020;(June):6485-6491. www.irjet.net
* 2.Xu J, Min J, Hu J. Real-time eye tracking for the assessment of driver fatigue. *Healthc Technol Lett*. 2018;5(2):54-58. doi:10.1049/htl.2017.0020