Final Year Project Report

On

Driver drowsiness alarm system

Submitted By

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Chapter 1

Project Proposal

1.1 Abstract

When a driver drives an automobile in a sleepy state, it can cause a road accident. There are hundreds of accidents cases that are caused by the drowsiness state of the driver. It is necessary to control the number of such accidents by creating a system that can alert the driver when he is in a drowsy state.

The main objective of this project is to develop a Driver drowsiness alarm system by analyzing and monitoring the eyes of the person. The conditions of the drowsiness of drivers are detected by the system to avoid road accidents. This system works for safety because driver drowsiness is the main cause of commercial vehicles accidents. In the proposed system we will detect the face of the person and monitor the eyes of the driver continuously through an algorithm. The system manipulates the number of frames with open eyes and closed eyes and will determine the drowsiness of the person. The aim of this is to create a working prototype for driver drowsiness detection. It will decrease the accident ratio due to drowsiness.

1.2 Scope

Driver Drowsiness Alarm System will help us to minimize the accident ratio due to the drowsy condition of the driver. This system will check whether the driver is active or not? If the driver is sleeping. In this case, the system will alert the driver by the alarm. This will decrease the accidents due to the drowsiness of the driver.

Our system can be employed where detection of drowsiness is required. This system can also be implemented in other places not just in automobiles. Furthermore, used in any environment where it is useful to monitor the activeness of the person. It can be implemented for industrial employees, Staff of security officers, train operators, and airplane pilots. This system will provide the utmost benefit if it will be implemented in all newly produced vehicles and automobiles. It will increase the safety of the vehicle and driver.

1.3 Objective

This proposed system is the car safety technology that will help to save the life of the driver and the vehicle from an accident when the driver is getting drowsy. Our system will detect driver drowsiness by continuously monitoring the retina of the eye and it will alert the driver through a speaker or buzzer when drowsiness is detected.

1.4 Motivation and Justification

As we know that the major cause of accidents of vehicles is drowsiness. The 8.8 to 9.5 percent of overall accidents are due to drowsiness [1]. The driver can be in a drowsy state due to many reasons might be sleeping disorder, overwork. Furthermore, long periods of driving can make the driver drowsy so he is not able to pay his full attention to driving.

According to the U.S National Highway Traffic Safety Administration, Every year almost one lac (100,000) traffic accidents are due to drowsy driving which includes more than fifteen hundred deaths and seventy thousand plus injuries. [2] In the field of accident avoidance systems, the major challenge is to development of technologies to detect and prevent drowsiness at the wheel to avoid traffic crashes and accidents.

Due to this statistical information and reasons, there is a need for a driver drowsiness Alarm system. Whenever the driver goes in Dorsey state it will help to alert the driver during driving. Because the system will monitor the eye retina of the driver consistently and if he is in a drowsy state it will generate a signal and sound is created by a buzzer or speaker to make the driver attentive. This system will try to make traffic safe from accidents due to the drowsiness of the driver.

1.5 Project Methodology

We will use the agile approach for the development of this project. It is an iterative approach to the development of the software. Driver Drowsiness Alarm system will use a specially designed Python-based algorithm that points towards the driver's eyes

directly to detect drowsiness. After the detection of the drowsy state of the driver, a warning signal will be generated to alert the driver. The system will work with the information collected by the binary version of the image to find the edge of the face using an open CV, which will narrow the area where the eyes exist. When the face area is found the eyes will be found by computing the horizontal averages in the area. As we know the in-face eye region shows great intensity changes, the eyes are located by finding the significant intensity changes. After eye detection distances between intensity changes will show whether the eyes are closed are opened. The large distance represents the eye closure. If the eyes are detected closed beyond the limit the driver will be considered in a drowsy state and the alert will be generated to the driver.

1.6 Deployment platform

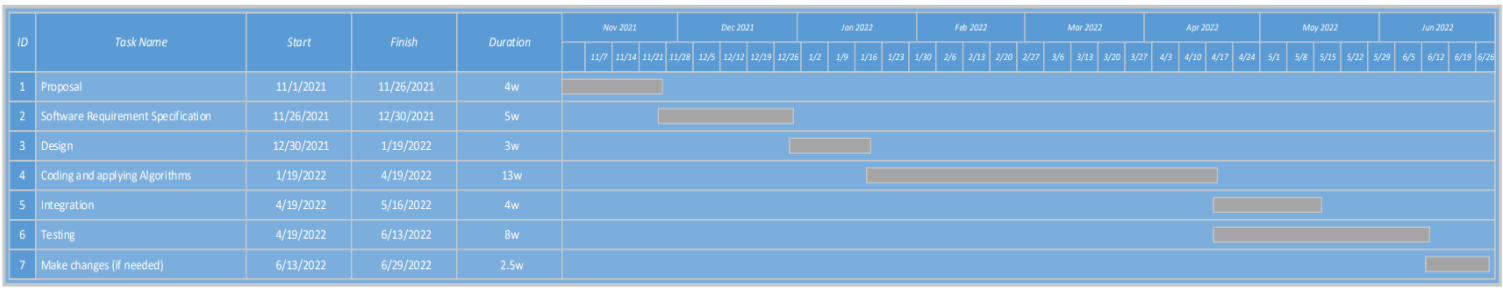
Raspberry pi 4

1.7 Tools and software

- Python 3
- Open CV
- Dlib

OpenCV and Dlib both are libraries used in machine learning for face detection and manipulation.

1.8 Project Gantt chart



ID	Task Name	Start	Finish	Duration
1	Proposal	11/1/2021	11/26/2021	4w
2	Software Requirement Specification	11/26/2021	12/30/2021	5w
3	Design	12/30/2021	1/19/2022	3w
4	Coding and applying Algorithms	1/19/2022	4/19/2022	13w
5	Integration	4/19/2022	5/16/2022	4w
6	Testing	4/19/2022	6/13/2022	8w
7	Make changes (if needed)	6/13/2022	6/29/2022	2.5w

1.9 References

- https://www.iii.org/fact-statistic/facts-statistics-drowsy-driving#:~:text=The%20study%20found%20that%20among,9.5%20percent%20of%20all%20crashes. [1]
- https://www.nsc.org/road/safety-topics/fatigued-driver. [2]

Chapter 2

Software Requirement Specification

2.1 Introduction

2.1.1 Purpose

This document lists the software requirement specification of the project named “Driver Drowsiness Alarm System”. This document represents the overall description of the system, interfaces, and functional and non-functional requirements. This document will also represent the classes and use cases of the system. The purpose of this document is to provide sufficient understanding to the reader about the system. Based on the requirements gathered in this document the team will go towards the production of the first version of the system.

2.1.2 Document conventions

The document holds content that contains both visual representation and description. The main headings are in “Calibri (body)” font and the font size is 18 and the style is bold. The subheadings are in “Calibri (body)” font and the font size is 16 and the style is bold. For the body text, the same Calibri (body) is used with font size 14.

2.1.3 Intended Audience and Reading suggestions

This document will help to understand the overall working of the Driver Drowsiness Alarm system. So the intended audience can be anyone who wants to understand the working of the system. These can include the stakeholders and some of the team members who recently joined the team and have to work with the team so it is necessary to have basic and important knowledge about the project.

2.1.4 Scope

The Driver Drowsiness Alarm system is designed to alert the driver if he is in a drowsy state. This system will surely minimize the number of accidents due to the drowsiness of the driver. Our system can be employed where detection of drowsiness is required. This system can also be implemented in other places not just in automobiles. Furthermore, used in any

environment where it is useful to monitor the activeness of the person. It can be implemented for industrial employees, Staff of security officers, train operators, and airplane pilots.

2.2 Overall Description

2.2.1 Product Prospective

This system is not only for the drivers of the vehicle it can also be implemented in almost all places where the activeness of the person is required. This system will check whether the specific person is in a drowsy state or not, if he is in a drowsy state the system will alert the user. Our system can work efficiently with persons having no glasses or having transparent glasses. It will not be able to work efficiently with the black or other glasses.

2.2.2 Product functions

Driver Drowsiness Alarm system will use a specially designed Python-based algorithm that points towards the driver's eyes directly to detect drowsiness. After the detection of the drowsy state of the driver, a warning signal will be generated to alert the driver. The system will work with the information collected by the binary version of the image to find the edge of the face using an open CV, which will narrow the area where the eyes exist. As we know the eye region shows great intensity changes, the eyes are located by finding the significant intensity changes. After eye detection distances between intensity changes will show whether the eyes are closed or opened. The large distance represents the eye closure. If the eyes are detected closed beyond the limit the driver will be considered in a drowsy state and the alert will be generated to the driver.

2.2.3 Classes

The designed system contains 3 main classes which are as follows

- Driver

- Vehicle
- Alarm

Some other classes are detection system, Analysis system, and Decision system.

2.2.4 Operating Environment

This system will be operated in the vehicle so the operating environment will contain the following:

- Vehicle
- Camera
- Raspberry Pi 4
- Alarm
- Driver

2.3 External Interface Requirements

2.3.1 User Interface

The user interface defines how the user will interact with the system. When the driver turns on the engine of the vehicle the system will automatically be working and the user interaction with the system will be through the camera. The camera will notice the movements and the eyes of the driver and this information will be passed to the system.

2.3.2 Hardware and software interfaces

The minimum hardware requirement is Raspberry Pi 4, Webcam, and Alarm system. As we know that Raspberry Pi is a small credit-card-sized computer so we can work on it by connecting it to the monitor. It also has different ports like USB ports and Ethernet ports.

2.4 Functional Requirements

2.4.1 Functional Requirement 1

Title: video capturing

Description: Video capturing is one of the functional requirements of the system. If the video is not captured completely the system will not be able to work properly.

2.4.2 Functional Requirement 2

Title: Face Recognition

Description: Face detection is also one of the functional requirements of the system. If the system will not detect face the system will not work properly. After capturing the video the first thing we do is to detect a face.

2.4.3 Functional Requirement 3

Title: Eye Detection

Description: Eye detection is also one of the functional requirements of the system. If the system will not detect the eyes of the driver the system will not work properly. After the recognition of the face, we will detect the eyes which is our region of interest.

2.4.4 Functional Requirement 4

Title: Drowsiness detection

Description: To check whether the driver is drowsy or not this is one of the main functional requirements. The system will evaluate the frames of the video. If the system is not able to detect the drowsiness we will not be able to alert the driver when he is in a drowsy state.

2.4.5 Functional Requirement 5

Title: Running Alarm

Description: To alert the driver when he is in a drowsy state is one of the major functional requirements. If the system does not alert the driver we can face accidents.

2.5 Non-Functional Requirements

2.5.1 Non-Functional Requirement

Title: Reliability Requirements

Description: The hardware system that is being used in the project is reliable and accurate. The chances of errors are least because we used reliable hardware.

2.5.2 Non Functional Requirement 2

Title: Security Requirements

Description: The proposed system consists of two things camera and a small casing of Raspberry Pi, These both can be securely mounted inside the vehicle with no threat of thief.

2.5.3 Non Functional Requirement 3

Title: Maintainability Requirements

Description: The maintainability of the system is very easy because the system is small and the user can easily understand how to arrange the system.

2.5.4 Non Functional Requirement 4

Title: Portability Requirements

Description: Portability specifies how easy it is to transport the system. Because our system is small and can be used in any vehicle so it is easy to transport it.

2.6 Feasibility Requirements

2.6.1 Technical Feasibility

The driver drowsiness alarm system comes in a complete package which will include a camera and a raspberry pi and alarm. The system will be easy to install the unit.

2.6.2 Operational Feasibility

This system can be installed on any kind of automotive vehicle. Even it can also be used in trains and the industrial environment.

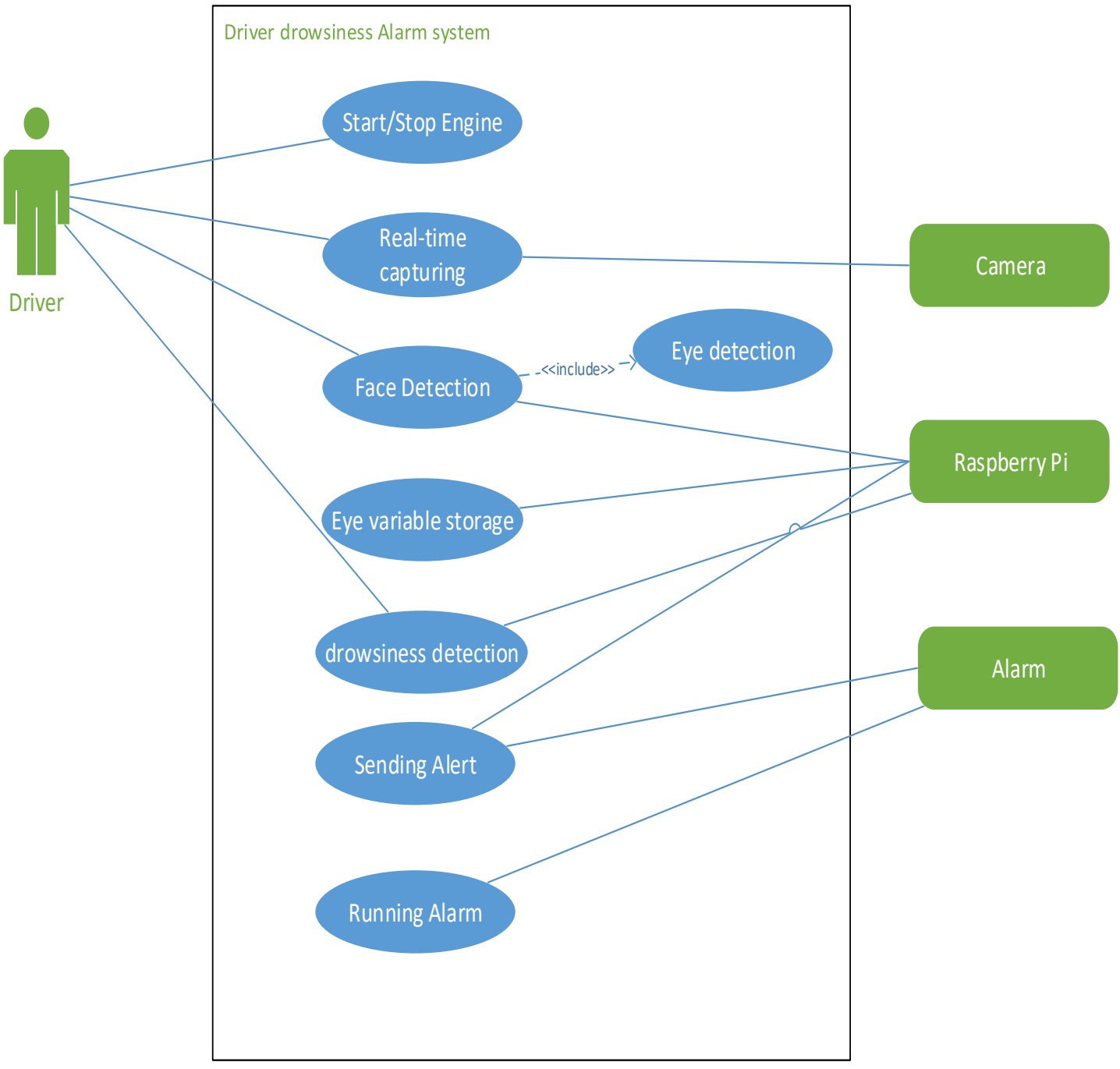
2.6.3 Legal and Ethical Feasibility

This system is developed while considering all the legal and ethical laws. The video feed of the customer will not be stored or uploaded to the internet. It is deleted after a certain period.

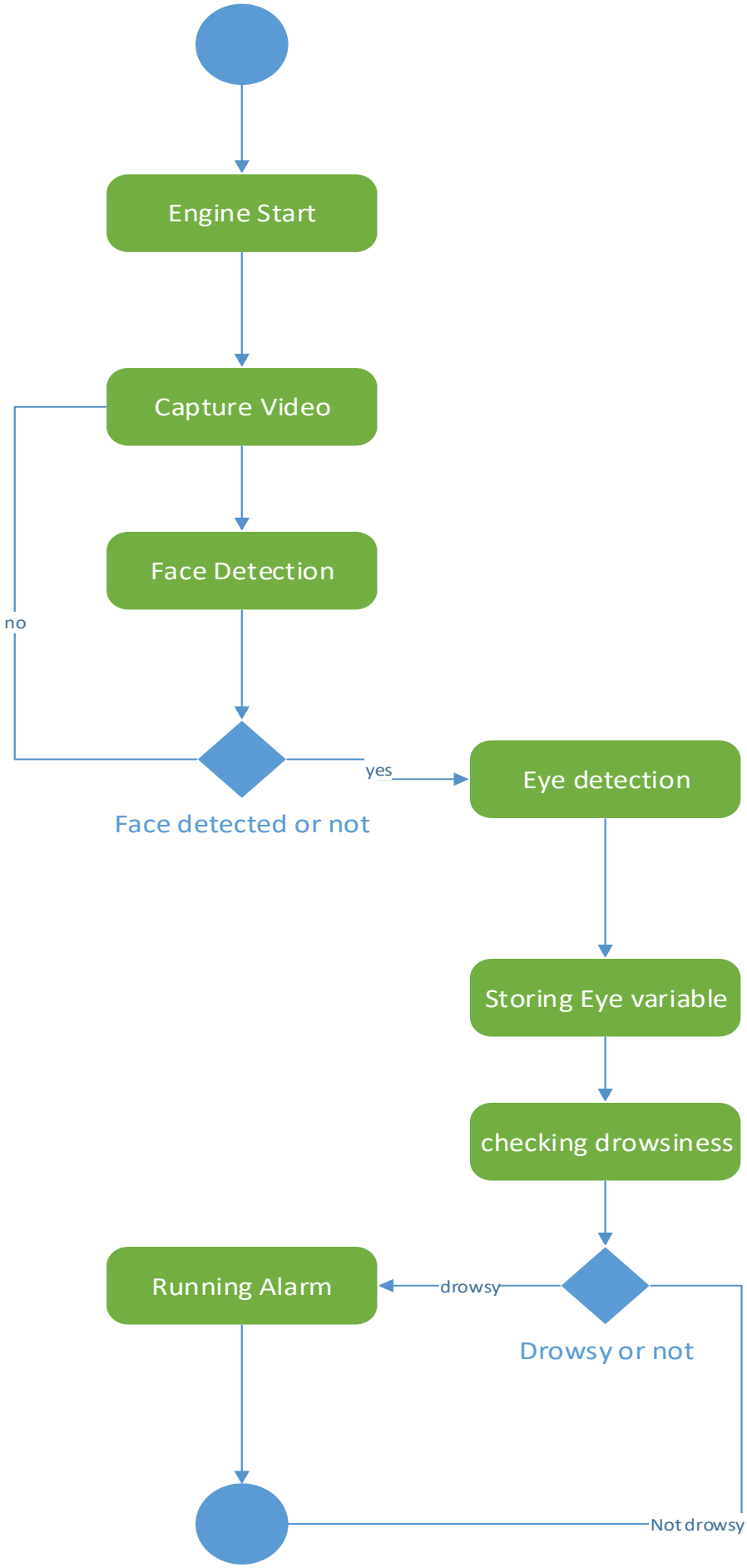
Chapter 3

Design Document

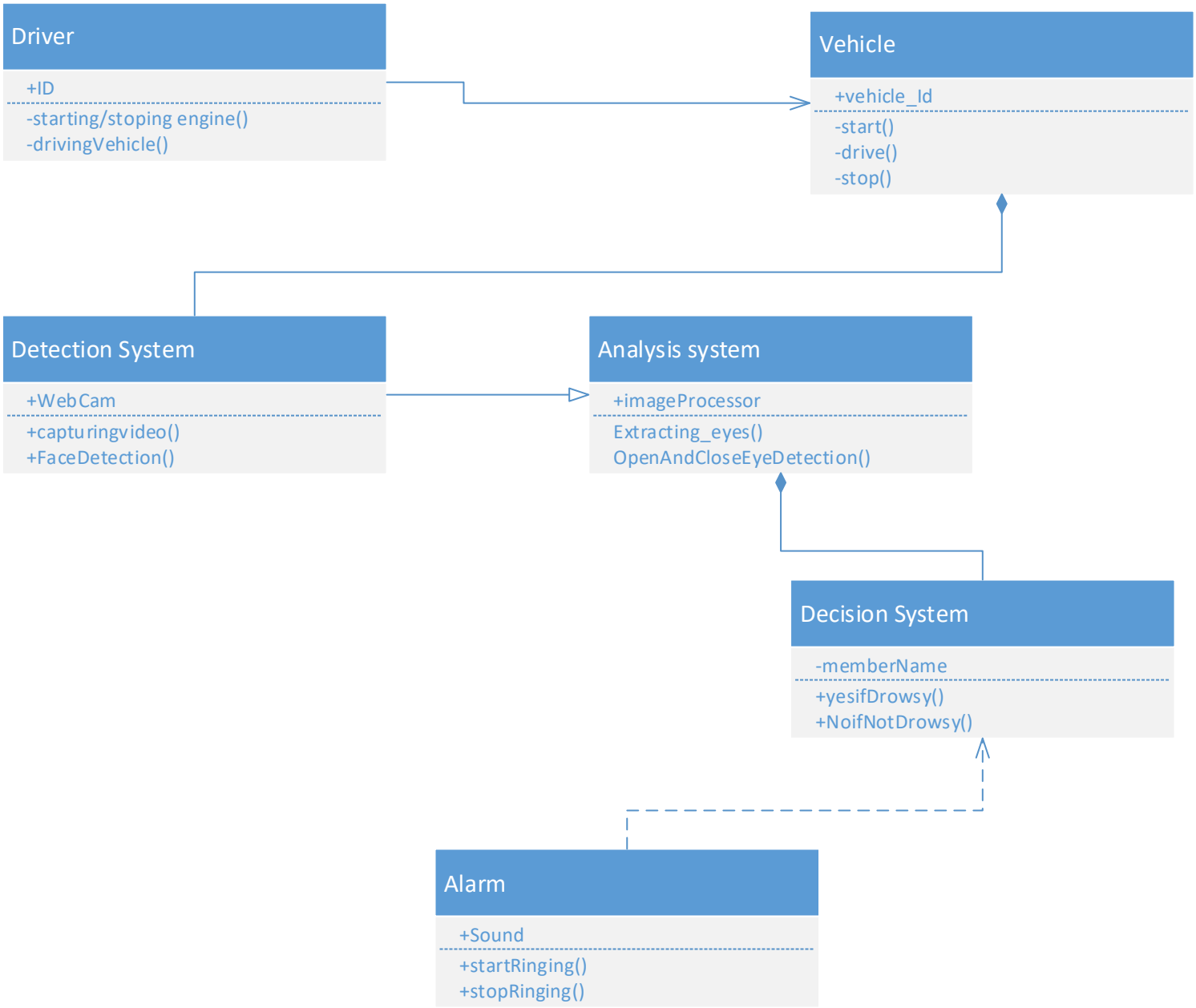
3.1 Use Case Diagram



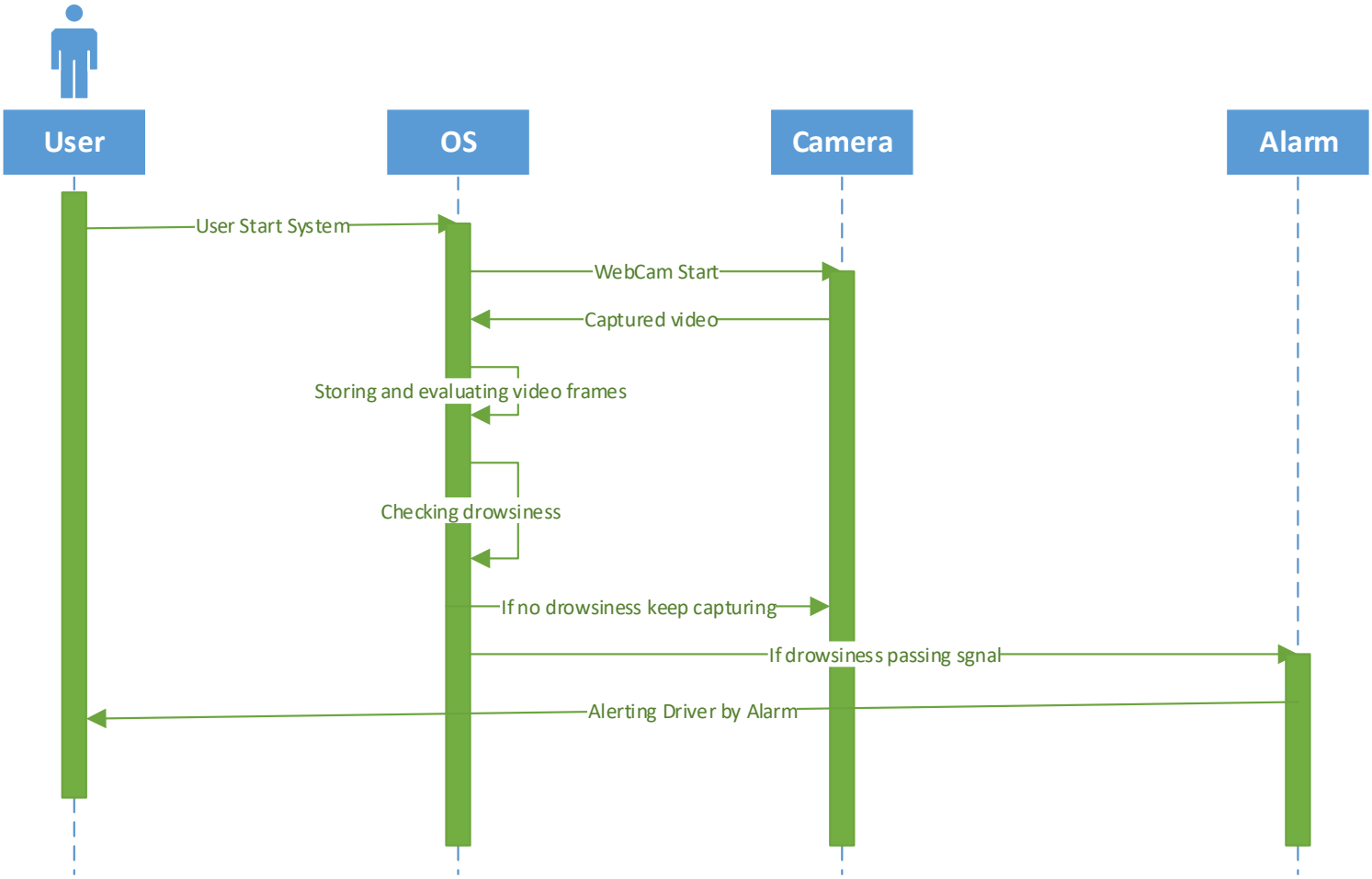
3.2 Activity


Engine Start
Capture Video
Face Detection
no
Face detected or not
yes
Eye detection
Storing Eye variable
checking drowsiness
Running Alarm
drowsy
Drowsy or not
Not drowsy

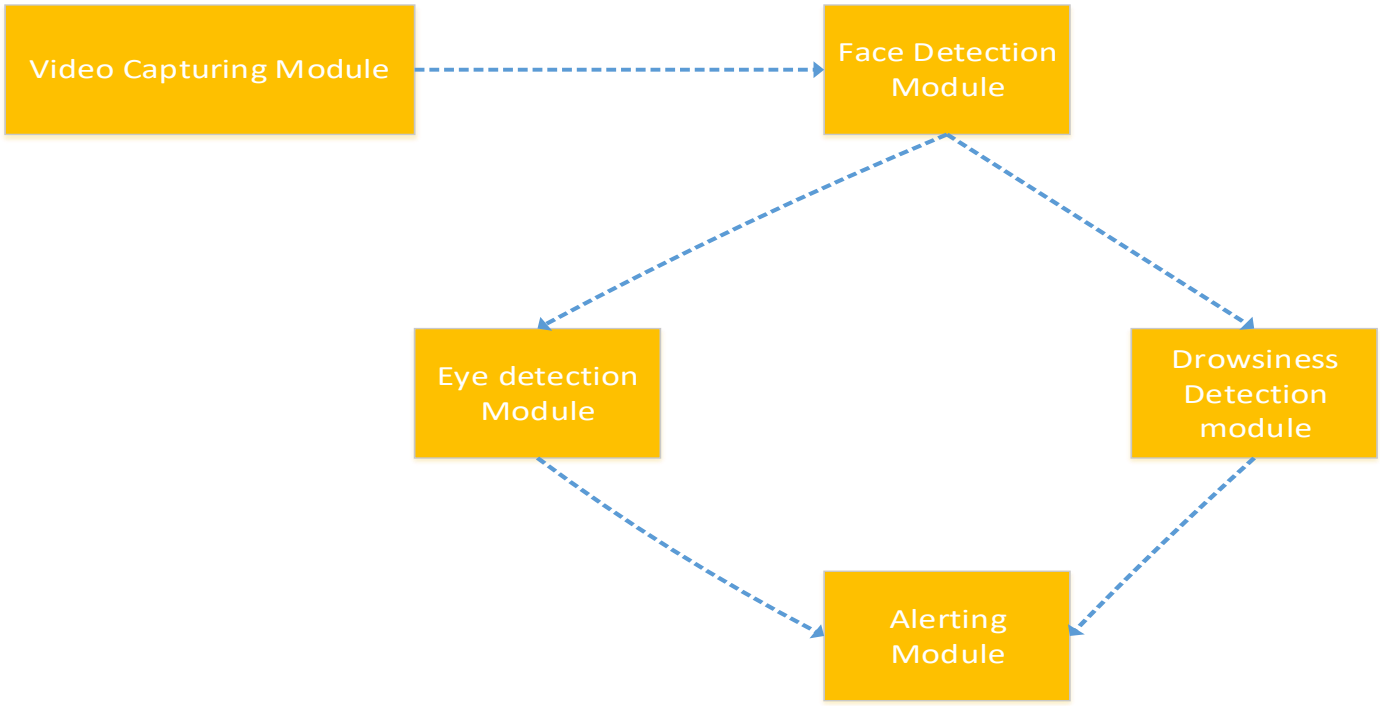
3.3 Class Diagram

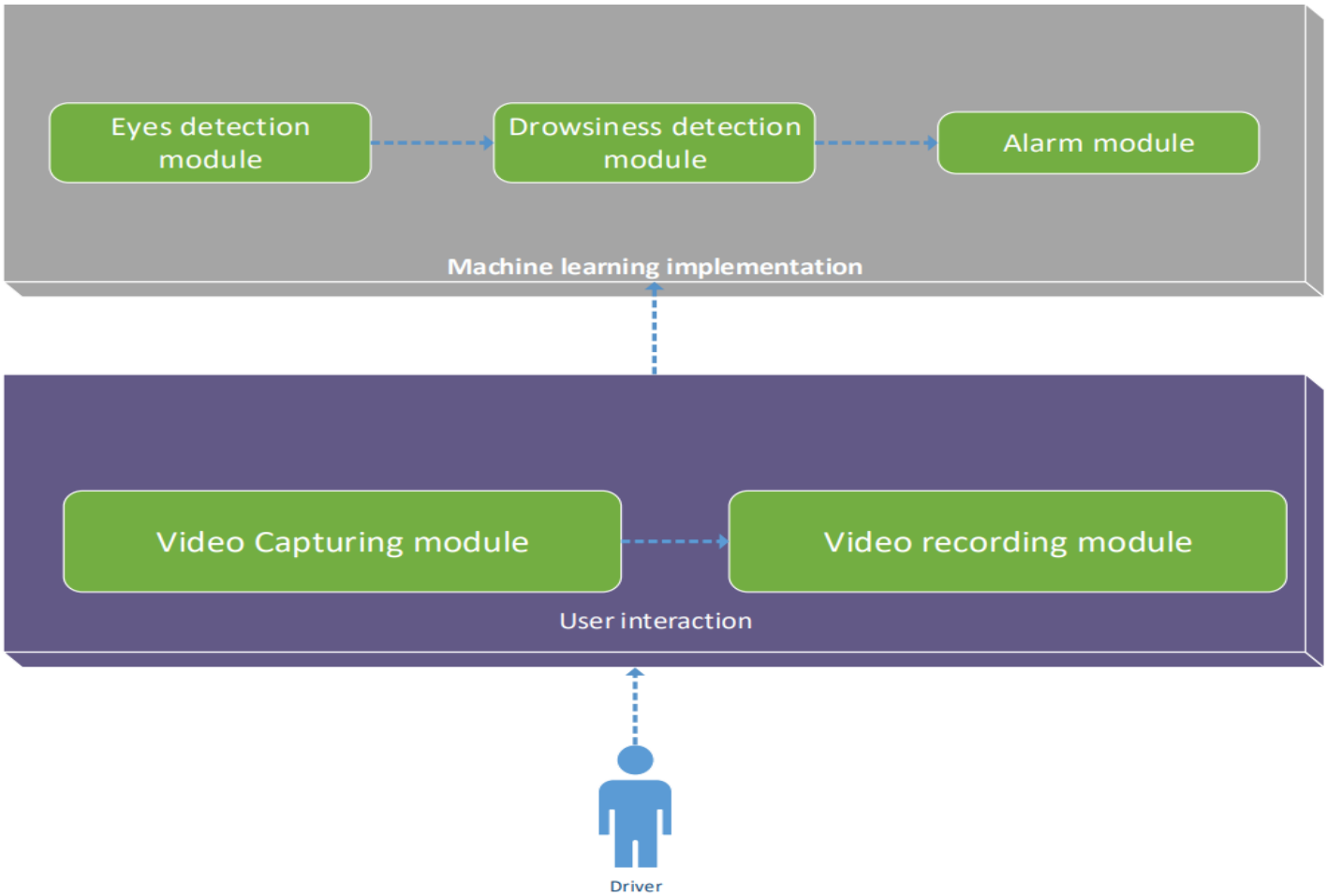


3.4 Sequence

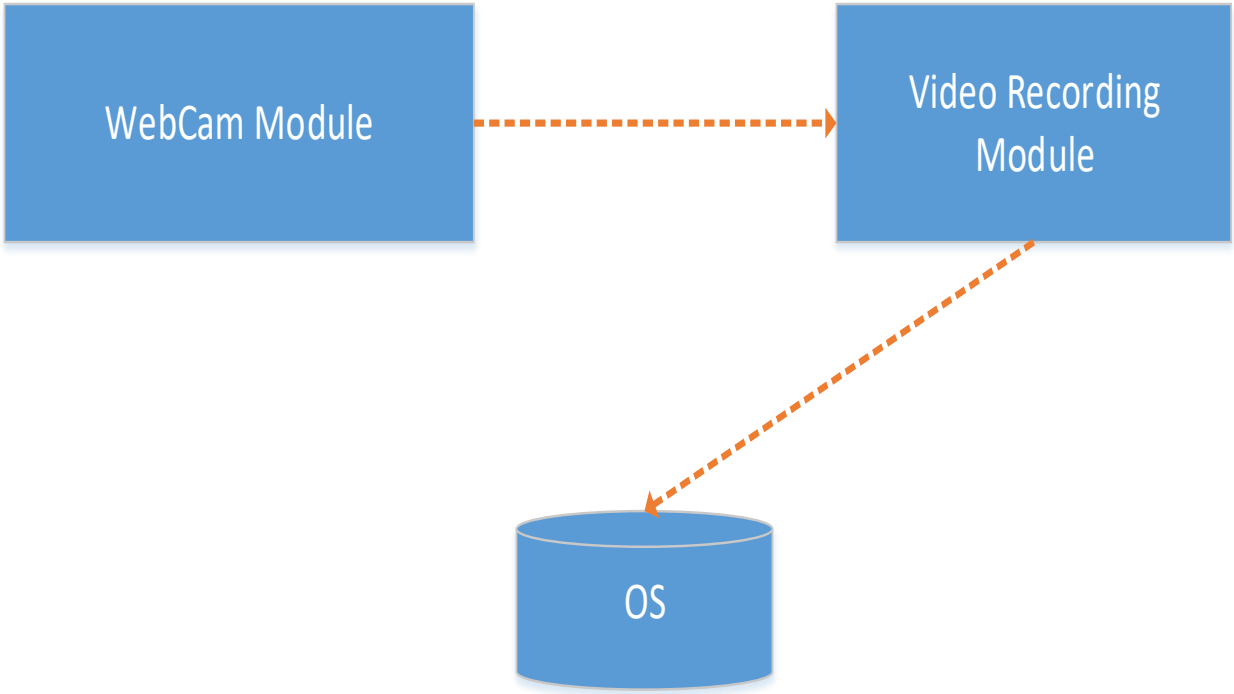

User
OS
Camera
Alarm
User Start System
WebCam Start
Captured video
Storing and evaluating video frames
Checking drowsiness
If no drowsiness keep capturing
If drowsiness passing sgnal
Alerting Driver by Alarm

3.5 Architecture

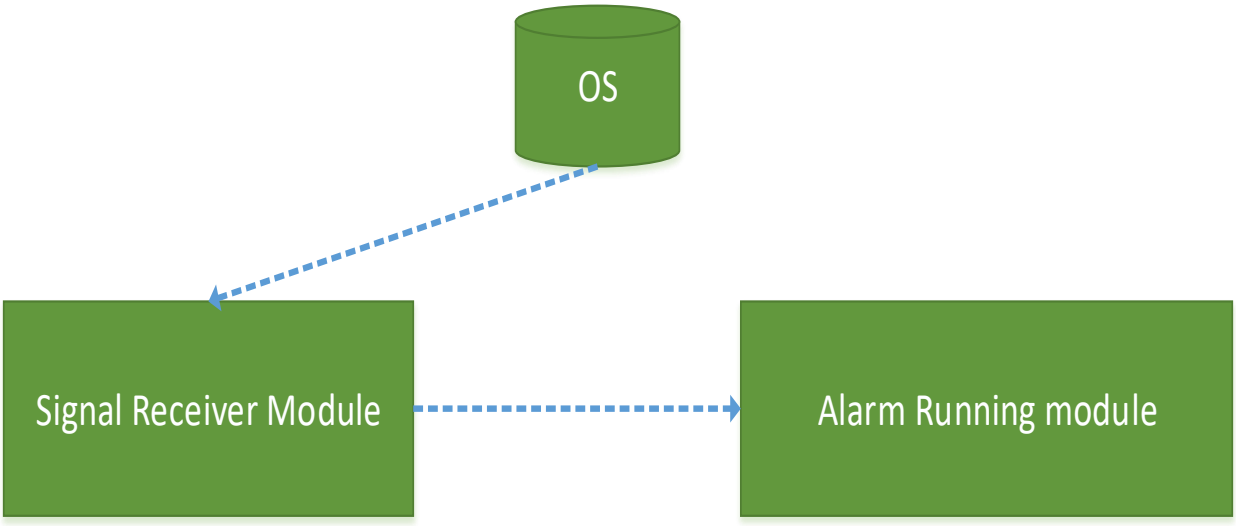




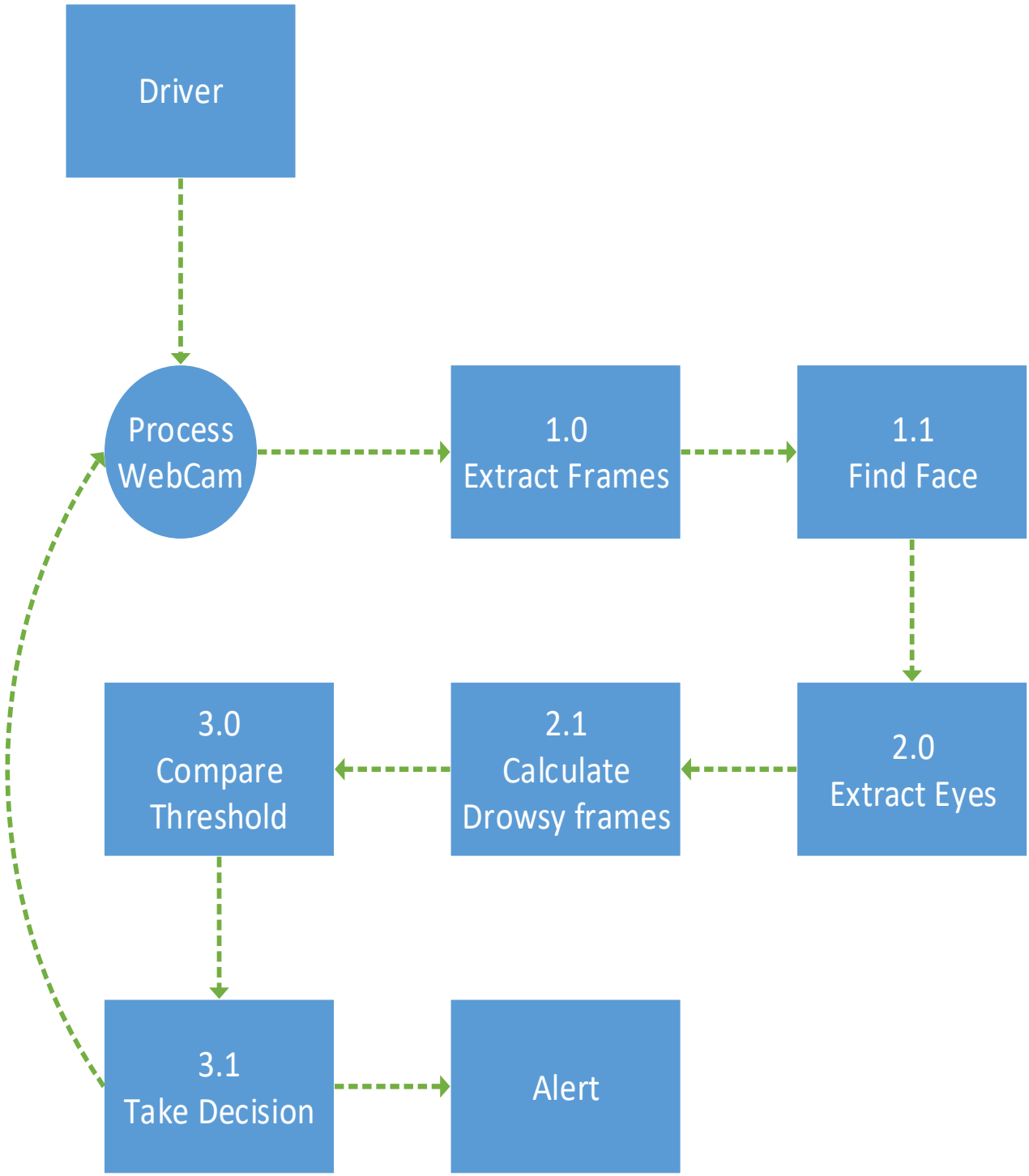
3.6 Architecture of Video capturing module



3.7 Architecture for Alerting module



3.8 Data Flow Diagram



3.9 Hardware Structure