DRIVING ASSIST AND SAFETY SYSTEM

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ABSTRACT

Driving Assist and Safety System

Automobiles have deeply impacted the way in which we travel but they have also contributed to many deaths and injury due to crashes. A number of reasons for these crashes have been pointed out by researchers. Inexperience has been identified as a contributing factor to road crashes. Drivers driving abilities also play a vital role in judging the road environment and reacting in-time to avoid any possible collision. Our failure to understand what is really important for learners, in terms of competent driving, is one of the many challenges for building better safety program for drivers. Driving Assist and Safety System is one of the intervention aimed at decreasing the number of crashes that involve drivers. Currently, there is a need to develop comprehensive driver evaluation system that benefits from the advances in Driving Assist and Safety System. A multidisciplinary approach is necessary to explain how driving abilities evolves with on-road driving experience.

The aim and novelty of this document is to develop and evaluate Driving Assist and Safety System, an automated system for the safety of drivers. Sleep creeps up on drivers almost unnotices , at that time most of the people risk falling asleep for a few seconds unintentionally.That is one of the worst scenario when the Driving Assist and Safety System can help, but there are many more circumstance which can bring a car close to intentional leaving of the lane without having the proper knowledge about what is behind their own vehicle. Also overspeeding and loosing the control at the critical moments. Blind spot is the region on the both side of car which is outside the vision angle of driver and side mirrors combined. System shall detect the object (vehicle) presence, determine if it is in the blind spot region and then alarming the driver.

The system receives the instruction from the user through User interface, which consists of buttons for enabling/disabling the system or to override any settings. Driving Assist and Safety System have 3 modules; Driver Alertness, Blind Spot Detections and Safe Distance keeping.

CERTIFICATE OF CORRECTNESS AND APPROVAL

Certified that work contained in this thesis "Driving Assist and Safety System" carried out by Khaqan Ahmed Bhatti, Arusa Kanwal and Abdullah Hafeez, under the supervision of Asst. Prof Athar Mohsin Zaidi for partial fulfillment of Degree of Bachelor of Computer Software Engineering is correct and approved.

Approved by

____

(Supervisor Name)

_____ Department

MCS

Dated: _______________

DECLARATION

We declare that the work presented herewith is the result of sole effort of our group, comprising of Khaqan Ahmed Bhatti, Arusa Kanwal and Muhammad Abdullah Hafeez and is free of any kind of plagiarism in part or whole. We also declare that the dissertation has never been submitted previously in part or whole in support of another award or qualification either at this institution or elsewhere.

DEDICATION

In the name of Allah, the Most Merciful, the Most Beneficent

To our respected teachers whose kind guidance and unfailing support made this mammoth task easy for us and to our very dear parents whose unceasing prayers gave us strength and courage to complete the work of this magnitude.

ACKNOWLEDGEMENT

We are very humbly, grateful to Almighty Allah for bestowing us with the strength and resolve to undertake and complete the project**.**

We owe a special debt of gratitude to our supervisor, Asst. Prof Athar Mohsin Zaidi for putting us on right track and guiding us in understanding the Safety system for vehicle using latest techniques and for the continuous supervision, motivation and support provided to us right through the project. Without his supervision we would not have been able to complete this successfully. We would like to thank all our other teachers for guiding us in solving our problems related to our project.

We are also thankful to our class mates and our family members for their support throughout the project in every possible way.

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CHAPTER 1

INTRODUCTION

1. Introduction:

The purpose of this document is to present a detailed description of the requirements, functionalities and testing of our project, Driving Assist and safety system. This document shall cover each of the system's intended features, what the system shall do, the constraints under which it must operate, how the system shall behave when operated by user, as well as offer a preliminary glimpse of the software application's User Interface (UI). The document should also cover hardware, software, and various other technical dependencies along implementation and testing details.

1.1 Document Conventions:

The format of this document is simple, divided up into sections detailing different aspects of the system. Bold face and indentation is used on general topics and on specific points of interest. The remainder of the document should be written by using the standard font, New Times Roman. Every requirement statement is assumed to have its own priority as to define in most appropriate way the system behavior. In addition there are various figures that represent the described system, where it is needed, and serve only for better understanding of the deployment.

1.2 Background:

There are certain problems the drivers face while driving a car like Blind Spot problem, drivers' lack of attention while driving the car (eye contact) and distance from the car in front. To cater for these problems, the project development team propose a system also consisting some safety measures. The system shall be able to inform and alert the driver about any vehicle in his blind spot at the time of steering, vibrate the steer ring when the drivers' eye contact is not with what it should be after 3 seconds and the distance from the next car according to his own speed (safe/unsafe).

Sleep creeps up on drivers almost unnotices , at the end of long drive back from holiday or after a stressfull, tiring day at work, at that time most of the people at the risk of falling asleep for a few seconds. Tiredness is also a factor for the accident. That is one of the worst scenario when the Driving Assist System can help, but there are many more circumstance which can bring a car close to unintentional leaving of the lane- at the end this could be as dangerous as falling asleep.

It is the region on the both side of car which is outside the vision angle of driver and side mirrors combined. System shall detect the object (vehicle) presence in the blind spot region The system receives the instruction from the user through User interface, which consists of buttons for enabling/disabling the system and a touch screen. Also there is an alert component to the User interface through which it buzz the alarm when danger is detected.

1.3 Product scope:

The document only covers the requirements, functionalities and testing for the Driving Assist and Safety System. All the external interfaces and the dependencies are also identified in this document.

1.3.1 Project vision:

Project vison detail of our project is given below in table 1-1

Table 1- 1 Project Vision

For	Vehicle Drivers
What	**Safe Distance keeping:** If the car with the installed system has the approaching time of minimum 3 sec to the next car. If the time is less or equal to 3 sec then the system should alert the driver **Blind Spot:**

	It is the region on the both side of car which is outside the vision angle of driver and side mirrors combined. System shall detect the object(vehicle) presence in the blind spot region **Driver Alertness:** To alert the driver when the drivers not concentrate on his/her driving then they use a vibrator that is attached with steering to vibrate and alert the driver.
The	Driving Assist & safety system
Is	Integrated modular system
That	Provides efficient ,convenient , free of prejudice ,flexible , reliable safety system for the driver.

1.4 Goal and objective:

Academic objectives and goals of the project that are achieved are given below:

1.4.1 Academic Objective:

To practice all aspects of Software Engineering i.e. Software Requirement Engineering, Software Design and Architecture, Software Project Management, Software Quality Assurance and Testing.

1.4.2 End Goal:

To provide information to the driver about his surroundings and to keep him attentive while driving.

1.5 Deliverables:

These are the application and document level deliverables prepared during project. Deliverables of project shown below in table 1- 2 Deliverables

Table 1- 2 Deliverables

1	Project Synopsis.
2	Software Requirement Specification.
3	Architecture and Design Document.
4	Project Documentation and Code.
5	Testing Document.
6	User Manual.
7	Embedded system that include 3 modules.

1.6 Organization:

The first part of thesis is the abstract which describes the main details of the project, followed by the introduction section which specifies the problem statement, approach, scope and objectives. The literature review section state the various resources read online before the commencement of the project. The design and development part illustrate the diagrams which describe the detailed design of the system, its components, interfaces and data necessary for the implementation phase. The analysis and evaluation part give details of the unit testing and system integration testing; actual results against expected results.

CHAPTER 2

LITERATURE REVIEW

2. Literature Review:

2.1 Introduction:

Traffic injuries are the ninth leading cause of death worldwide. Public health experts say that without intervention, traffic related deaths shall rise to fifth leading cause of death within 20 years. It is estimated that 1.2 million persons are killed each year, with up to 50 million injured around the world. Road traffic crashes cost an estimated US$518 billion globally in material, health and other expenditure. The burden of crashes is counted not only in lives and permanent injuries but also as a cost to the society. Enhanced road safety is a highly priority objective not only for the government agencies such as the National transportation Administration but also for most automobile manufactures and research centers.

2.2 Safe Distance Keeping:

If the car with the installed system has the approaching time of minimum 3 sec to the next car. If the time is less or equal to 3 sec then the system shall alert the driver.

2.2.1 Pre-Sense Plus by AUDI:

It's a safety system introduced by Audi motors in the 2010 model of their flagship sedan **A8**, this system works in four stages. In the first phase, the system provides warning of an impending accident, while the hazard warning lights are activated, the side windows and sunroof are closed and the front seat belts are tensioned. In the second phase, the warning is followed by light braking, strong enough to win the driver's attention. The third phase initiates autonomous partial braking at a rate of 3 m/s^2 (9.8 ft/s^2). The fourth phase decelerates the car at 5 m/s^2 (16.4 ft/s^2) followed by automatic deceleration at full braking power, roughly half a second before projected impact. Now the system is also offered in A4, A5, A6 and A7 in upper trim levels.

When the pre sense front system detects a potential accident the Audi braking guard warns the driver and increases braking force if necessary. Pre sense plus is triggered when a collision is unavoidable and activates the Audi braking guard in order to reduce the impact as much as possible.

2.2.1.1 Pros and Cons:

2.2.1.1.1 Pros

Supercar performance; hatchback versatility; sublime interior; surprisingly good fuel economy.

2.2.1.1.2 Cons

Tight rear headroom for taller passengers.

2.2.2 Pre Safe System by MERCEDES-BENZ:

It was unveiled in the fall of 2002 at the Paris Motor Show on the 2003 **S-Class**. Pre-Safe can tighten the seat belts, adjust seat positions including rear seats (if installed), raise folded rear headrests (if installed) and close the sunroof if it detects a possible collision (including rollover).

PRE-SAFE operates at speeds above 30km/h and is focused at providing protection in accidents which are more severe than those typical of urban driving. The anticipated benefit is biased towards severe and fatal injuries. It is estimated that nearly five percent of all casualties in accidents involving a passenger vehicle could be addressed by PRE-SAFE®. If all cars were equipped with PRE-SAFE®, this would be equivalent to the system being activated, and providing some measure of protection, in some 55,000 injuries in EU 27 each year.

2.2.2.1 Pros and cons:

PRE-SAFE does not work autonomously; it depends on some action by the driver in order to identify when an accident is likely. In this regard, the system offers no benefit in accidents which the driver has not himself predicted. The system has to achieve a balance between sensitive triggering, offering a high safety benefit, and the irritation caused to drivers if e.g. seatbelts were regularly tightened, when there was no real danger. Daimler has optimized the system to achieve this balance.

2.2.3 Driving Assistant Plus by BMW:

The system comprises not only Collision Warning and Lane departure warning but also Active Cruise Control with Stop & Go function. In this way, your BMW supports you in critical and monotonous driving situations on the motorway.

2.3 Driver Alertness

To alert the driver when the drivers not concentrate on his/her driving then they use a vibrator that is attached with steering to vibrate and alert the driver.

2.3.1 Attention Assist by MERCEDES-BENZ:

In 2009, Mercedes-Benz unveiled a system called Attention Assist which monitors the driver's fatigue level and drowsiness based on his/her driving inputs. System creates an individual driver profile, based on 70 parameters and when the driver deviates from the predicted graph its prompts for the rest or brake.

An industry first, ATTENTION ASSIST takes note of over 70 parameters in the first minutes of a drive to get to know your unique driving style. With the passage of time as the journey continues, it can detect certain steering corrections that suggest the onset of drowsiness. It then considers a wide array of other factors, from crosswinds and road smoothness to how often you are interacting with the vehicle’s controls and switches. If it all adds up to driver fatigue, Attention Assist sounds an alert encouraging you to stop for a rest.

2.3.1.1 Pros and cons:

The most savings in terms of cost, time, and lives is going to come from when more people "opt in" to the service. If self-driving cars are not adopted widely, accidents can and will still happen.

If other technology fails, such as traffic signals that the cars rely on, there's no accounting for human traffic signals. In the event of an accident, for example, where a police officer is directing traffic, the cars cannot interpret human signals

2.3.2 Driver Alert Control by VOLVO:

World's first Driver Drowsiness Detection system “Driver Alert Control” was introduced in 2007. The system monitors the car's movements and assesses whether the vehicle is being driven in a controlled or uncontrolled way.

Volvo's Driver Alert Control "monitors the progress of the car on the road and assesses whether it's being driven in a controlled, consistent manner." The DAC system assesses the impact that fatigue or distraction has on the car's movements through a camera, a number of sensors and a control unit. The camera, located between the windscreen and the interior rear view mirror, measures the distance between road lane markings and the car, while sensors monitor the car's movements. If the control unit assesses the risk as high, the system should make an audible signal and a coffee cup symbol shall appear in the car's information display between the dials.

2.3.2.1 Pros and Cons:

In some cases the system may issue a warning despite driving ability not deteriorating, for example: in strong side winds, on rutted road surfaces, System is not intended for city traffic.

2.4 Blind Spot:

It is the region on the both side of car which is outside the vision angle of driver and side mirrors combined. System shall detect the object (vehicle) presence in the blind spot region

2.4.1 BLIS by VOLVO:

This system was first introduced in the **Volvo S80** sedan and produced a visible alert when a car entered the blind spot while a driver was switching lanes, using two door mounted lenses to check the blind spot area for an impending collision. The system's software is programmed to identify cars as well as motorcycles, in daylight and at night. Since BLIS is camera-based, it has the same limitations as the human eye does.

The new BLIS shall be offered as an option on XC70 wagon, S60 sedan and V70 wagon available in Australia in 2005. When another vehicle (motorcycle, car or truck) enters this zone - an area of 9.5 meters by 3.0 meters - a yellow warning light comes on beside the appropriate door mirror in the driver's peripheral view. A digital camera is installed on each door mirror. This small camera captures 25 images per second, and by comparing each frame taken, the system is able to recognize that a vehicle is within the BLIS zone.

2.4.1.1 Pros and Cons:

Other traffic cannot see the driver through the reflection if the driver can see them. The heater needs more time to heat the bigger window surface. The flat windshield angle does not let snow slide off easily. The driver cannot reach the whole flat window to clean it easily.

2.5 Shortcoming/Issues:

Analysis of the potential Risks associated with the project are given below in table 2-1.

Table 1- 1 Shortcoming/Issues

No	Type of Risk	Probability of Occurrence	Impact of Occurrence
1	Financial	Medium	Project incompleteness
2	Delay in hardware and software procurement	Medium	Project exceeds in projected time of deliverance
3	Project exceeds its schedule	High	Project delivery delayed
4	Team members absence when required on field	Low	Momentum of the work affected. Discipline within the team is disturbed
5	Choosing faulty or incompatible hardware or the hardware not able to sustain the load of processing required of it	Medium	Waste of finances, time and effort eventually resulting in either the failure or incompleteness of the project in time.
6	First time assignment for the project management	Medium	Common mistakes might occur during the development of the project leading to some difficult situations
7	Unavailability of additional skilled personal for assistance	Low	Work on the project halts with the team doing

			nothing and precious time being wasted
8	Decision ambiguity	Low	Decisions specially from an inexperienced manager may lead the project and the team into difficult situations
9	Operational safety	High	Since a prototype is intended to be built, so relying on it entirely is not recommended
10	Commercial	Medium	This type of product might fail in the market resulting in the loss of investment

Financial: Finances play an important part in the respective project. It has to be identified carefully that the requested funds should suffice. Budget upsets shall affect the whole project resulting its incompleteness.

Delay in hardware and software procurement: If a specific piece of hardware (e.g., an ultrasonic sensor) and /or software (e.g., a testing tool) is/are needed to develop or implement the project and there is either a supply problem on the manufacturer's end or the procurement process takes a long time. This might result in the project to exceed its schedule.

Project exceeds its schedule: Any upset in the development of the project e.g. unavailability of hardware or funds unavailability may lead to the project to halt and to exceed its time of deliverance.

Team members' absence when required on field: Not having the required people in place to complete the project would include things like not having a Visual Basic programmer in place to code the Graphical User Interface portions of the application. Which will eventually result in delays in module building and their integration.

Choosing faulty or incompatible hardware or the hardware not able to sustain the load of processing required of it: If the hardware and software products are prone to bugs and are “slow”, they may be inappropriate for developing a system. This can affect development, especially during the coding and testing stages.

First time assignment for the project management: First time project management is a risk because some of the learning about project management only comes through time and experience.

Unavailability of additional skilled personal for assistance: If additional help is required desperately and no acknowledgments are received then this might result in time wastage of the team with the project hitting an unexpected halt.

Decision ambiguity: Slow, low quality or ambiguous decisions are common with an inexperienced project manager in charge.

Operational safety: Since the project under discussion is to be used by people in their daily lives during driving none less, also it is an intended prototype and not a commercial product. So complete reliance over it is not recommended.

Commercial: Although this type of the systems are already available in the market and are successful but still driving is possible without it. So it contains the element of risk that it can fail commercially.

2.6 Conclusion:

Driving Training is one of the interventions aimed at decreasing the number of crashes involving young drivers. So the aim is to present the motivation and need to access driving competencies, using Driving Assist and Safety System.

CHAPTER 3

SOFTWARE REQUIREMENT SPECIFICATION

3. Software Requirement Specification:

3.1 Introduction:

The purpose of this document is to present a detailed description of the requirements of our project, Driving Assist and Safety System. This document should cover each of the system's intended features, what the system should do, the constraints under which it must operate, how the system should behave when operated by user, as well as offer a preliminary glimpse of the software application's User Interface (UI). The document should also cover hardware, software, and various other technical dependencies along implementation and testing details.

3.2 Product Perspective:

There are certain problems the drivers face while driving a car like Blind Spot problem, drivers' lack of attention while driving the car (eye contact) and distance from the car in front. To cater for these problems, the project development team propose a system also consisting some safety measures. The system will be able to inform and alert the driver about any vehicle in his blind spot at the time of steering, vibrate the steer ring when the drivers' eye contact is not with what it should be after 2 seconds and the distance from the next car according to his own speed (safe/unsafe).

Sleep creeps up on drivers almost unnotices , at the end of long drive back from holiday or after a stressfull, tiring day at work, at that time most of the people at the risk of falling asleep for a few seconds. Tiredness is also a factor for the accident. That is one of the worst scenario when the Driving Assist System can help, but there are many more circumstance which can bring a car close to unintentional leaving of the lane- at the end this could be as dangerous as falling asleep. It is the region on the both side of car which is outside the vision angle of driver and side mirrors combined. System shall detect the object (vehicle) presence in the blind spot region.

The system receives the instruction from the user through User interface, which consists of buttons for enabling/disabling the system and a touch screen. Also there is an alert component to the User interface through which it buzz the alarm when danger is detected.

3.3 Product Functions:

The driving assist and safety system will include these features: Safe distance keeping, Blind spot, and Driver alertness.

3.4 Operating Environment:

The product shall be operating in Linux environment. It shall be compatible with Debian Linux environment.

3.5 Design and implementation Constraint:

Detail of design and implementation constraint of the project shown below in table 3- 1.

Table 3- 1 Design and Implementation Constraint

No.	Design and Implementation Constraint
1	The Driving assist and safety system relies on outside information provided by radar/ultrasonic sensors and cameras
2	The system must be able to be overridden at any time by the drivers
3	The system will be able to detect and find the distance of the object that is directly (define specific area by developer) in front of the car (Laser Range Finder sensor).
4	Designed for humans.
5	The system under consideration will work for the people whose iris is clearly visible.
6	Have specified contact area for eye and it will work in daylight.
7	Have specified area/range for ultrasonic sensor.

8	Specified maximum and minimum range for safe distance keeping module.
9	Specified maximum and minimum speed for safe distance keeping module.
10	Specified lag time for safe distance keeping is up to 2 second
11	Minimum required RAM is 512Mb
12	Minimum CPU required is 1GHz
13	System will not work in dense traffic

3.6 User Documentation:

The user documentation components that will be delivered with the software include:

3.6.1 The users will be provided with a hard copy of the user manual, the whole instruction should be provided in the user manual, so that the user first read those instructions then use the system.

3.6.2 PDF-Archive format user manuals, since PDF-A is a standard for using PDF as an archival format in development by AIIM [Association for Information and Image Management].PDF-A includes standard methodology for embedding metadata in documents, the XMP Standard (Extensible Metadata Platform) that seeks compatibility with web technologies

3.6.3 A CD containing all the information about the system shall also be delivered along with the product.

3.7 Assumptions and dependencies:

Driving assist and safety system will communicate with safe distance keeping, blind spot and driver alertness modules in order to use the information provided via its subsystems to manage their functions.

Driving assist and safety system gathers information via user interface, cameras and sensors.

3.7.1 User Related:

Assumptions and Dependencies related to user shown below in table 3- 2.

Table 3- 2 User Related Assumptions and Dependencies

No	User Related Assumptions and Dependencies.
1	The user has sufficient knowledge of driving.
2	User possesses a valid driving license.
3	The users must know the English language, as the user interface will be provided in English.

3.7.2 Bandwidth Related:

(Not Required)

3.7.3 Time Dependencies:

Day time with good light exposure

3.7.4 Hardware Dependencies:

Assumption and dependencies related to hardware shown below in table 3 -3

Table 3- 3 Hardware Dependencies

No	Hardware Dependencies
1	Minimum required RAM is 512Mb.
2	Minimum CPU required is 1GHz.
3	System performance relies on the data received from the radar, ultrasonic and camera sensors
4	Sensors must be compatible with the main single board computer being used.

3.7.5 Software Dependencies:

Operating system: Debian Linux.

3.8 External Interface Requirement:

3.8.1 User Interface:

User Interface shown below in table 3 -4

Table 3- 4 User Interface

No	User Interface
1	Application start icon is user interface of the app.
2	Camera setting so the user adjust the eye to the specified area of the screen (directly in front of the driver)
3	Power source: Cigarette lighter plug.
4	System shall have on/off button.
5	System have Touch screen.
6	Set the camera in front of the driver.
7	Vibrator is attached with the steering wheel.
8	System have two LEDs, each at the side view mirror.
9	Board and LCD is placed at the center of the dashboard (almost one arm distance).
10	System have buzzer.

3.8.2 Hardware Interface:

3.8.2.1 Ultrasonic distance finder:

Key Features:

Provides precise, non-contact distance measurements within a 2 cm to 3 m range. Ultrasonic measurements work in any lighting condition, making this a good choice to supplement infrared object detectors. Simple pulse in/pulse out communication requires just one I/O pin. Burst indicator LED shows measurement in progress. 3-pin header makes it easy to connect to a development board, directly or with an extension cable, no soldering required.

3.8.2.2 Laser Range Finder:

Key Features:

Laser accurately detects surfaces and measures distance up to 40 meters (130 feet) where ultrasonic and infrared distance sensing are inadequate. Outputs 12 readings per second for quick data refresh. Supports USB, analog and digital interfaces for a variety of applications. No calibration required – ready to use right out of the box. Configurable voltage output and ground/object proximity alarm settings

3.8.2.3 MMA7455 3-Axis Accelerometer Module:

Key Features:

Works with 3.3 and 5 volt devices. I2C and SPI interfaces for compatibility with virtually any microcontroller. On-board voltage regulators and I/O level shifters for compatibility with 3.3 and 5 volt systems. Low current consumption for long life in battery powered applications. Compact, breadboard-friendly package.

3.8.2.4 Raspberry Pi b+:

Key Features:

512MB DDR3 RAM. 4GB 8-bit eMMC on-board flash storage. 3D graphics accelerator. NEON floating-point accelerator. 2x PRU 32-bit microcontrollers. Dual step-down power supply for 3.3 v and 1.8 v. 5V supply has polarity protection, 2A fuse and hot-swap protection (so you can plug/unplug USB without resetting the board). Micro SD card socket instead of full size SD. Four mounting holes in rectangular layout. Many connectors moved around. Basic Size, 85mm x 56mm.

3.8.2.5 Vibrator Capsule:

Key Features:

Mechanical Noise of 50 dB (A) Max so you can get the feedback you desire without a lot of extra noise. Rotation can be CW or CCW, giving you more applicable capabilities. Rated at 3 VDC, giving you a low-power solution for user and application feedback.

3.8.2.6 Buzzer:

Key Features:

Officially supported in the ELEV-8 V2 Assembly Guide. Connects directly to the batteries balancing lead – no extra connectors or wires necessary. Twin piezoelectric buzzers may be heard from over a hundred feet away. Easy to program – just press the micro switch (under the buzzers) until your desired alarm voltage level is displayed. They recommend to use 3.5 volts for LiPo batteries.

3.8.2.7 Raspberry Pi Camera:

Key Features:

The Raspberry Pi Camera Module is a custom designed add-on for Raspberry Pi. It attaches to Raspberry Pi by way of one of the two small sockets on the board upper surface. This interface uses the dedicated CSI interface, which was designed especially for interfacing to cameras. The board itself is tiny, at around 25mm x 20mm x 9mm. In terms of still images, the camera is capable of 2592 x 1944 pixel static images, and also supports 1080p30, 720p60 and 640x480p60/90 video. The camera is supported in the latest version of Raspbian, Raspberry Pi's preferred operating system.

3.8.3 Software Interface:

OS: debian Linux.

Language: Python, Java

3.8.4 Communication Interface:

Communication Interface of our project Driving Assist and Safety System shown below in table 3- 5.

Table 3- 5 Communication Interface

No	Communication Interface
1	The modules of the system will be interconnected using wires.
2	No internet or any external assistance required to connect the modules.

3.9 System Features:

3.9.1 Driver alertness Functional Requirements:

Priority: Medium

RE-1: System shall be able to alarm the driver when he is eluded with drowsiness.

RE-2: System shall be able to alarm the driver when his eye contact is not with the specified part of the road for 3 seconds.

3.9.2 Blind Spot Functional Requirements:

Priority: Low

RE-1: System shall be able to detect any object (vehicle) in the "Blind Spot Region(s)" of the driver.

RE-2: System shall notify the Driver about the object(s) in the "Blind Spot Region(s)".

Blind Spot Functional Requirement shown below in table 3- 6.

Table 3- 6 Blind Spot Functional Requirement

1	System shall be able to produce "beep sounds" when some object happens to be in the blind spot region
2	System shall be able to light the left/right LEDs depending on the presence of the object in the driver's Left/Right Blind spot region.

3.9.3 Safe Distance Keeping Functional Requirements:

Priority: High

RE-1: System shall be able to alarm the driver about its safe driving distance to be kept from the object in the front of his car.

Safe Distance keeping functional requirement shown below in table 3- 7.

Table 3- 7 Safe Distance Keeping Functional Requirement

1	System shall be able to identify the object in the front of his car.
2	System shall calculate the speed of the car in which it is installed.
3	System shall know the distance of the abject ahead.
4	System shall calculate the time in which it is expected to reach that identified object.
5	System shall alarm the driver if the expected time drops from three seconds

3.9.4 Main Menu Functional Requirements:

Priority: High

RE-1: System shall provide a menu for the driver to customize the system extensions.

RE-2: Driver shall be able to change the default settings of the system that are:

Main Menu Functional Requirement shown below in Table 3- 8.

Table 3- 8 Main Menu Functional Requirement

1	Adjusting the camera.
2	Adjusting the side mirrors.
3	Adjusting the distance threshold.

3.9.5 System Display Functional Requirements:

Priority: Low

RE-1: User shall get the simulated feedback of the blind spot recognition module.

RE-2: System shall simulate the objects recognized and display them on the LCD.

RE-3: User shall get the numeric feedback of distance from the object in front of it.

RE-4: User shall get the numeric feedback of “time of approach” to the object in front it.

RE-5: User shall get the numeric feedback of the relative speed of the user’s car with respect to the object ahead.

3.10 Nonfunctional Requirement:

3.10.1 Performance Requirement:

3.10.1.1 System Capacity:

The system shall be capable of handle one user (vehicle driver himself) at a time.

3.10.1.2 System Throughput:

In standard workload, the CPU usage shall be less than 65%, leaving the rest for background jobs or other back end activities.

3.10.2 Safety Requirement:

The system shall ensure all sorts of safety to the environment and user, i.e. it shall not causing any danger to the environment with any sorts of pollution, it shall not be harmful to the user mentally or physically.

3.10.3 Security Requirement:

Security signatures will be embedded in “apk” file of the application i.e. the end product. No security certificates are required other than the default ones.

3.10.4 Software Quality Attributes:

3.10.4.1 Availability:

The system shall be available at all times as it does not depend on any sort of connectivity, outside assistances.

It shall only be needing a power source from inside the car.

3.10.4.2 Maintainability:

The system software will be upgraded for the fixation of bugs (expected as prototype) reported by the users after every specific period of time.

3.10.4.3 Design Quality:

3.10.4.3.1 Evolution:

The System shall have the capability to evolve according to the changing needs/environment. It shall be able to incorporate new requirements in the individual modules. Therefore, system shall be checked for evolutionary changes every year.

3.10.4.4 Usability:

Checking that the system shall be easy to understand and use, and navigates in the most expected way with no delays. In that case the system program reacts accordingly and transverses quickly between its states.

3.10.4.4.1 Learnability:

The system is fairly easy to use with clearly labeling. A new user will require at maximum 1 day understanding how the entire system is to be operated. The system will provide user manual that describes the functionality and options available to the user.

3.10.4.4.2 Efficiency:

The system shall be able to handle all the data inputs from the three specified modules and use it effectively for the required results.

3.10.4.4.3 User Satisfaction:

At least 70% of candidates shall rate their satisfaction with the system after using it at 7 or more on a scale of 1 to 10.

3.10.4.4.4 Flexibility:

The design and architecture of the application shall be flexible enough for catering any new requirements, if any at some later stage or for the application enhancement.

The system shall be flexible enough to evolve with the operating system as it upgrades.

3.10.4.5 Reliability:

This system should be reliable and provide accurate data without errors. It should use all input data wisely to create better output.

3.10.4.6 Robustness:

After the failure occurs, the system will be able to recover within 2 hours after restart the system.

3.11 Conclusion:

So in the end, the purpose of this document is to present a detailed description of the requirements of our project, Driving Assist and Safety System is fully complete. In that we highlight the functional requirements and non-functional requirements of our project. And also give the detail description of hardware, software and user interface requirements for that project.

CHAPTER 4

SOFTWARE DESIGN SPECIFICATION

4. Software Design Specification:

4.1 Introduction:

The document presents the architecture and system design details for Driving assist and safety system, a system shall be able to inform and alert the driver about any vehicle in his blind spot at the time of steering, lane, sound an alarm when the drivers' eye contact is not with what it should be after a certain period of time and the distance from the next car according to his own speed (safe/unsafe). It is intended to inform stakeholders of the details of the design and the design process. This document will help the developer(s) in implementation and maintenance of the Application.

4.2 System Architecture:

This section provides a detailed and comprehensive architectural overview of the system.

4.3 Observe And React Architectural Pattern:

Use the **observer and react** pattern in Driving Assist and Safety System project. The system use the sensor for the working and react as an actuator control (buzzer, vibrator and LED). The input values of a set of sensors of the same types are collected and analyzed. These values are displayed in some way. If the sensor values indicate that some exceptional condition has arisen, then actions are initiated to draw the operator attention to that value and in certain cases, to take actions in response to the exceptional value. And Observe and react pattern related to our project diagram shown below

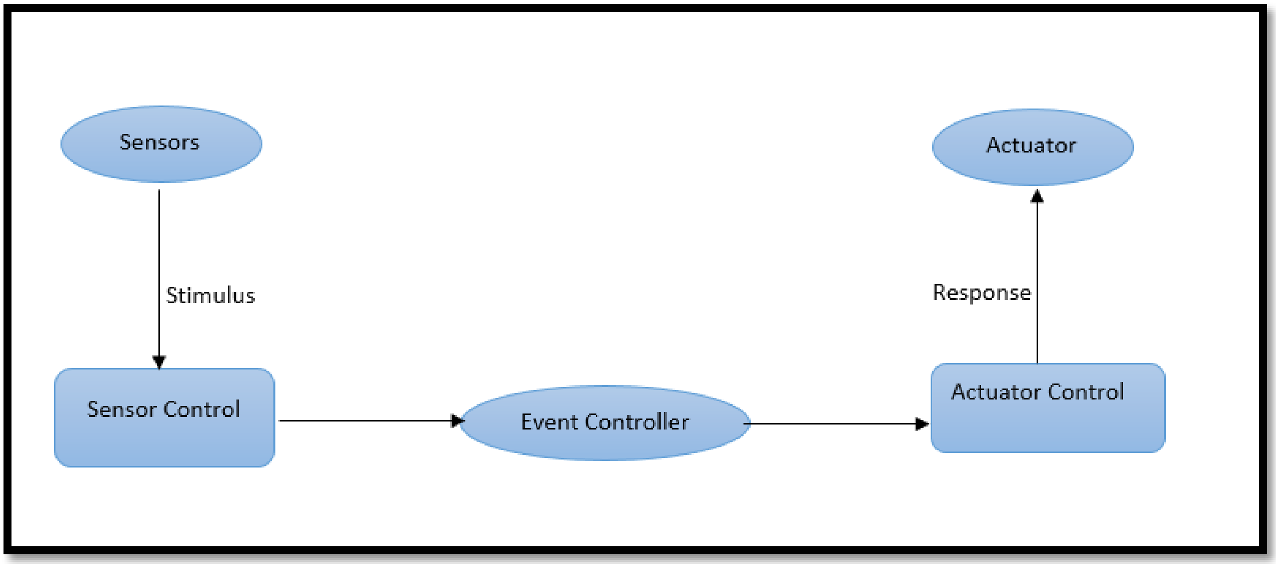


Figure 4-1 System Architectural Diagram

4.4 Module Identification:

Our system have 3 modules

4.4.1 Safe distance keeping

If the car with the installed system has the approaching time of minimum 3 sec to the next car. If the time is less or equal to 3 sec then the system will alert the driver by using buzzer.

4.4.2 Driver alertness

To alert the driver when the drivers not concentrate on his/her driving then they use a vibrator that is attached with steering to vibrate and alert the driver by using vibrator that is attached to the steering wheel of the system.

4.4.3 Blind spot

It is the region on the both side of car which is outside the vision angle of driver and side mirrors combined. System will detect the object (vehicle) present in the blind spot region and alert the driver by using LED.

In given below Figure 4-2, it shown that our project divided into 3 modules and how the further components use in those modules.

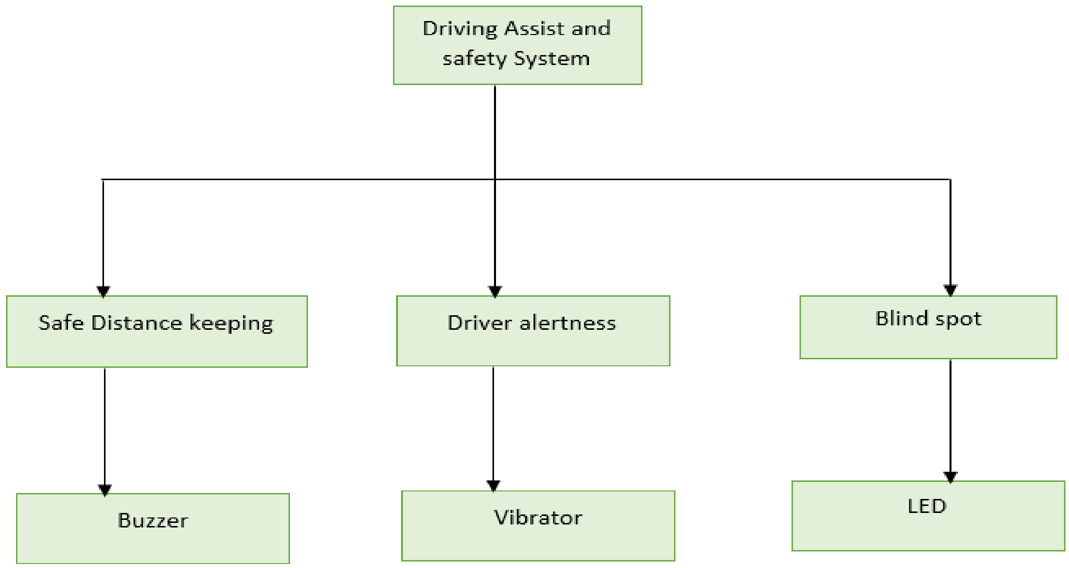


Figure 4-2 Module Identification Diagram

4.5 Component Diagram:

In driving assist and safety system, they should use different components according to our need. They should use the sensors, actuators, event handler.

In sensor they should use the camera for taking images, ultrasonic sensor for providing analogue signals, accelerometer for calculating the speed and range finder for calculating the distance. In event handler, they should use the frame analyzer to extract frames from the image for driver alertness, then activate the vibrator. In time calculator, they should calculate the time by using distance and speed for safe distance keeping and alert the driver by buzz the alarm. In object sensor, they should detect the objects in blind spot region and alert the driver by using LED.

Given below figure 4-3 show the component diagram of our project.

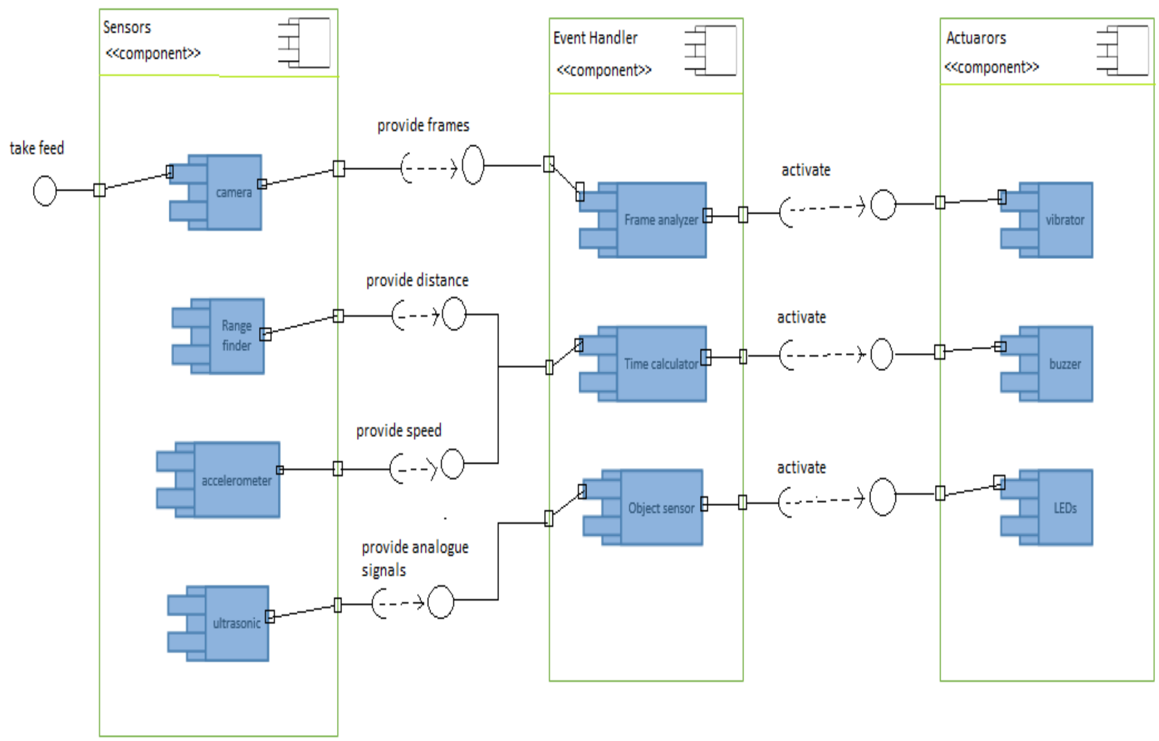


Figure 4-3 Component Diagram

4.6 Deployment Diagram:

Deployment diagram shown below in figure 4-4

4.6.1 Safe distance keeping

If the car with the installed system has the approaching time of minimum 3 (default) sec or less than the set threshold to the next car, then the system will alert the driver. Radar sensor shall detect the object, range finder shall find the distance, and the accelerometer shall find the speed, by using speed and the distance they find the time. If time is less than the 3 sec form the next vehicle then the system alerts the driver by using alarm.

4.6.2 Driver alertness

To alert the driver when the drivers not concentrate on his/her driving then they use a vibrator that is attached with steering to vibrate and alert the driver. Camera shall be used to take the images, system shall extract frames from these images, and if the frames are same in the sequence within 2 sec of time then system alerts the driver by using vibrator that is attached to the steering wheel.

4.6.3 Blind spot:

Ultrasonic sensor are used to detect the object, ultrasonic sensor have some range if anything appear in that range, the signals are forwarded to the control unit where it is determined whether the object is in the blind spot region of the driver or not. If it is, it alerts the driver by using LED.

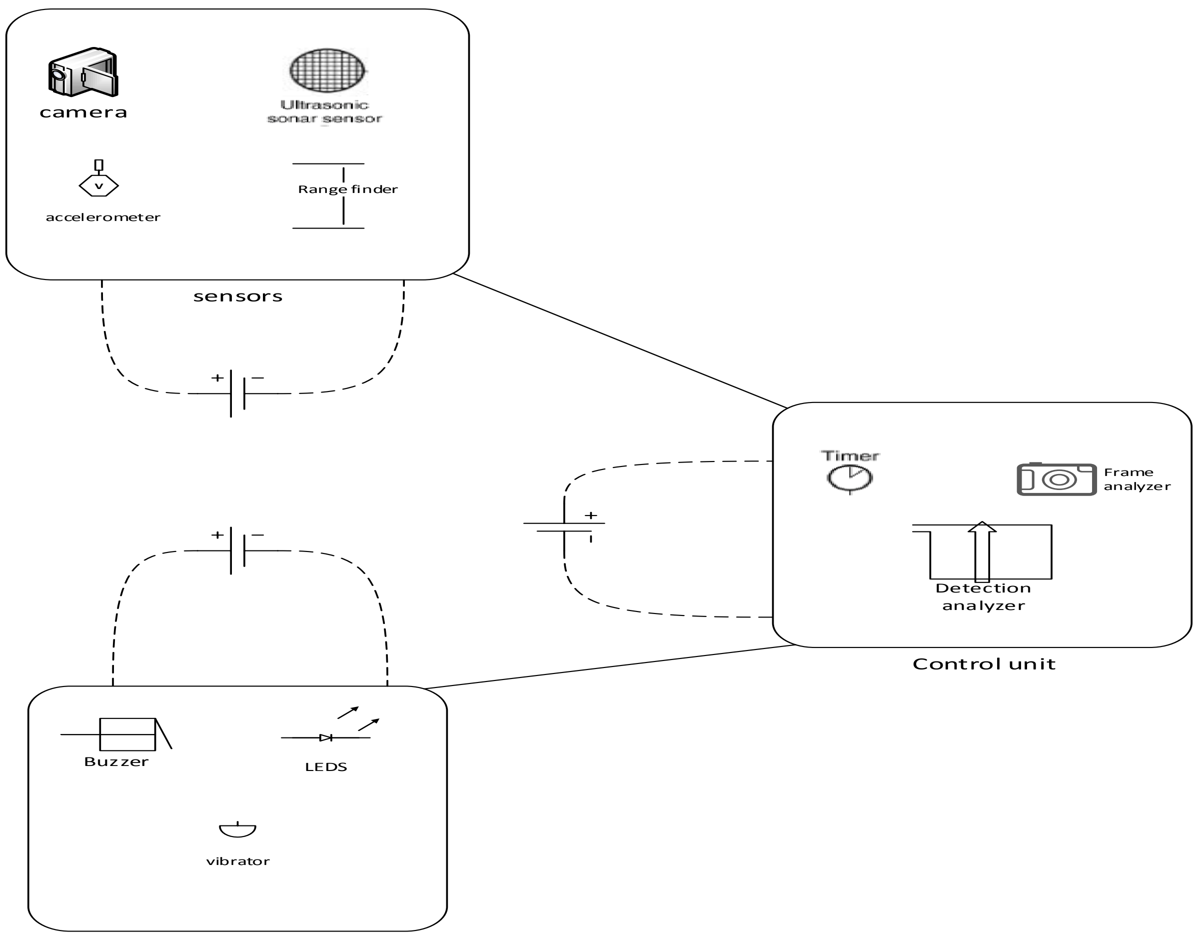


Figure 4-4 Deployment Diagram

4.7 Class Diagram:

The whole system consists of several different classes. Given below figure show the classes and the relationships between different classes used by the Vehicle Controller. Here they use the sensor for the system and they react as to alert the driver by using vibrator, buzzer and LED. Class Diagram shown below in figure 4-5

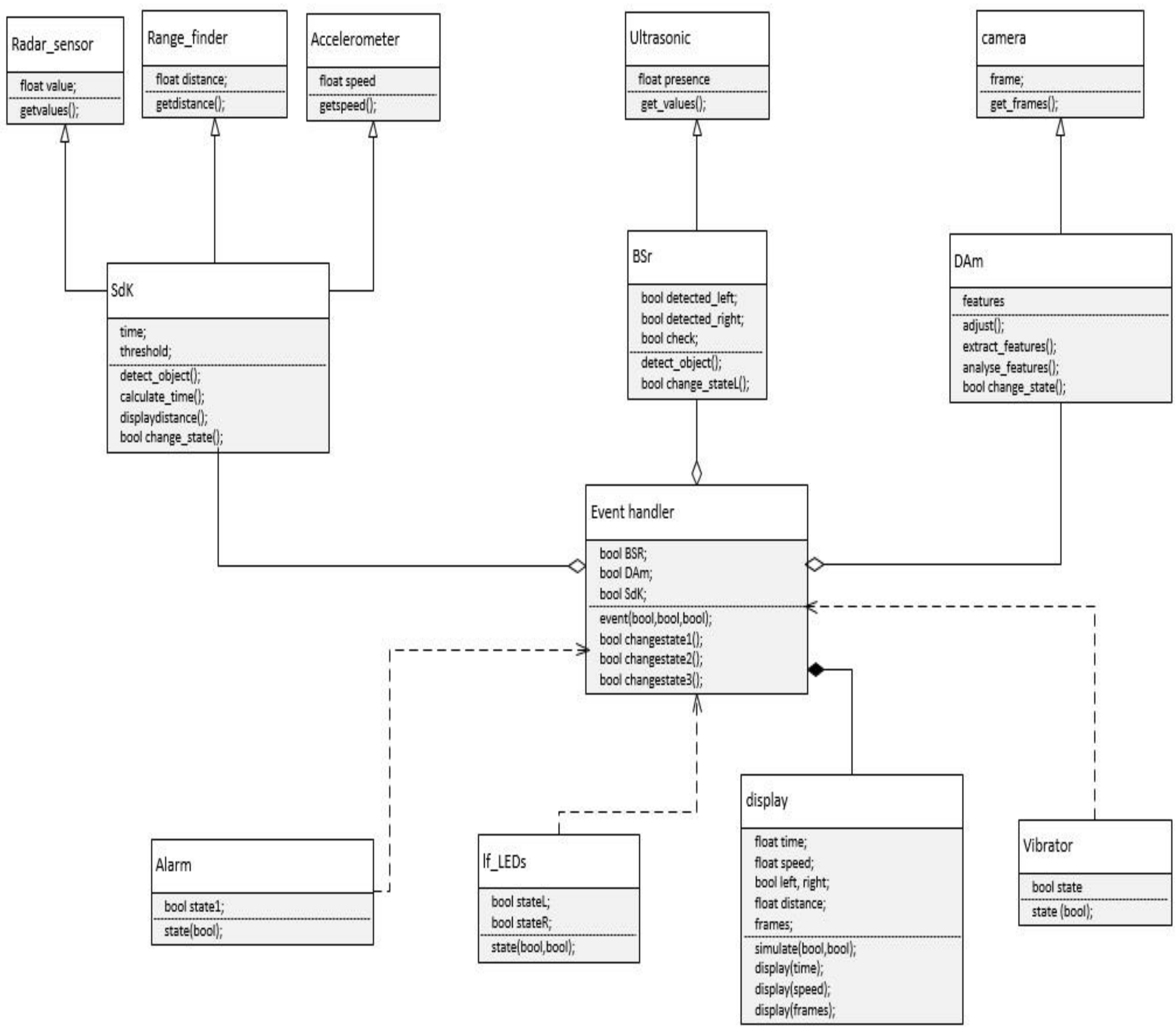


Figure 4-5 Class Diagram

4.8 Sequence diagram:

Each of the actions performed by the user are shown here using Sequence Diagrams. All the actions are supposed to be triggered by the user only.

4.8.1 Sequence diagram for safe distance keeping:

Sequence diagram for safe distance keeping shown below in figure 4-6

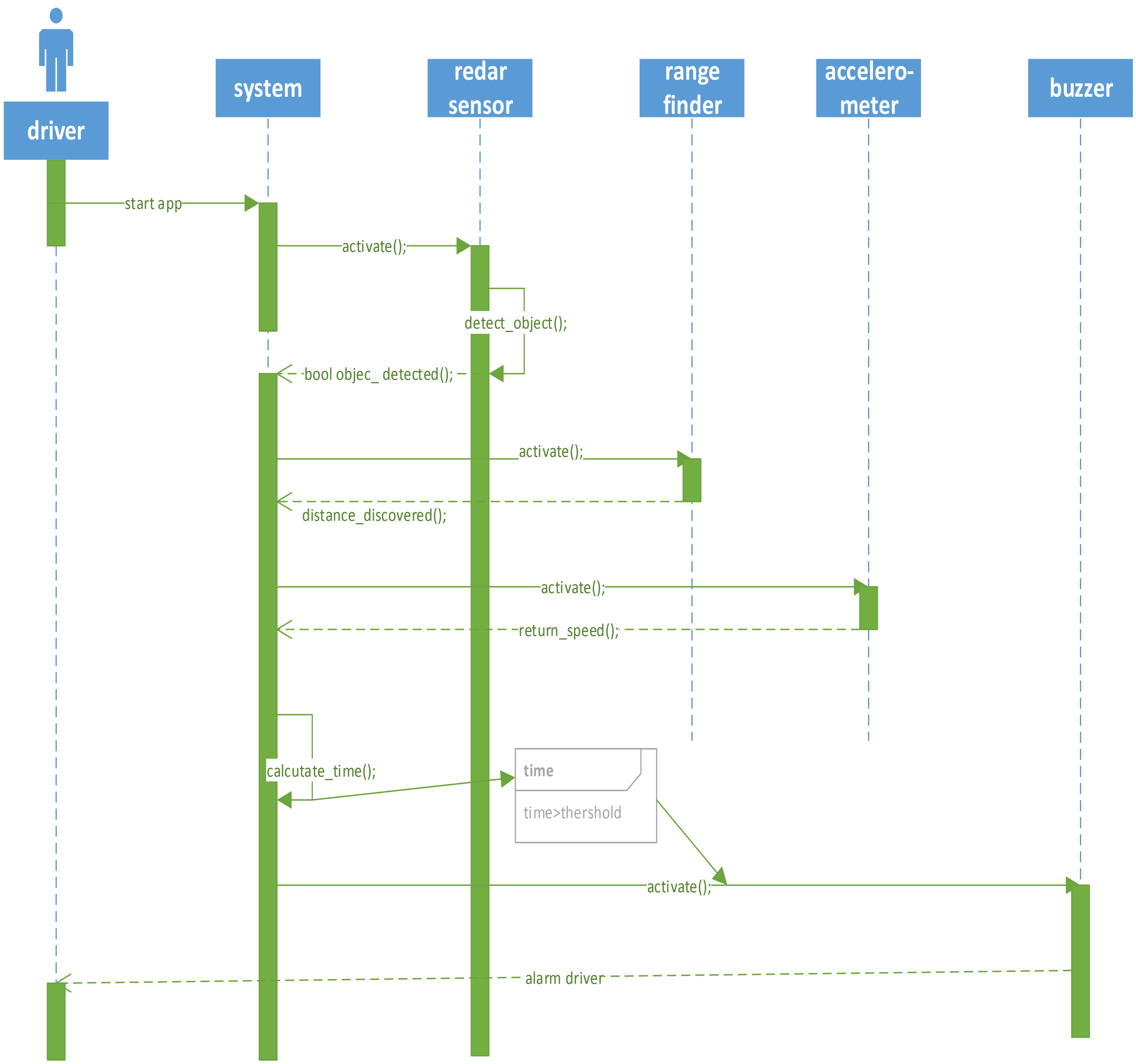


Figure 4-6 Sequence Diagram for Safe Distance Keeping

4.8.2 Sequence diagram for Driver alertness:

Sequence Diagram for Driver Alertness shown below in figure 4-7

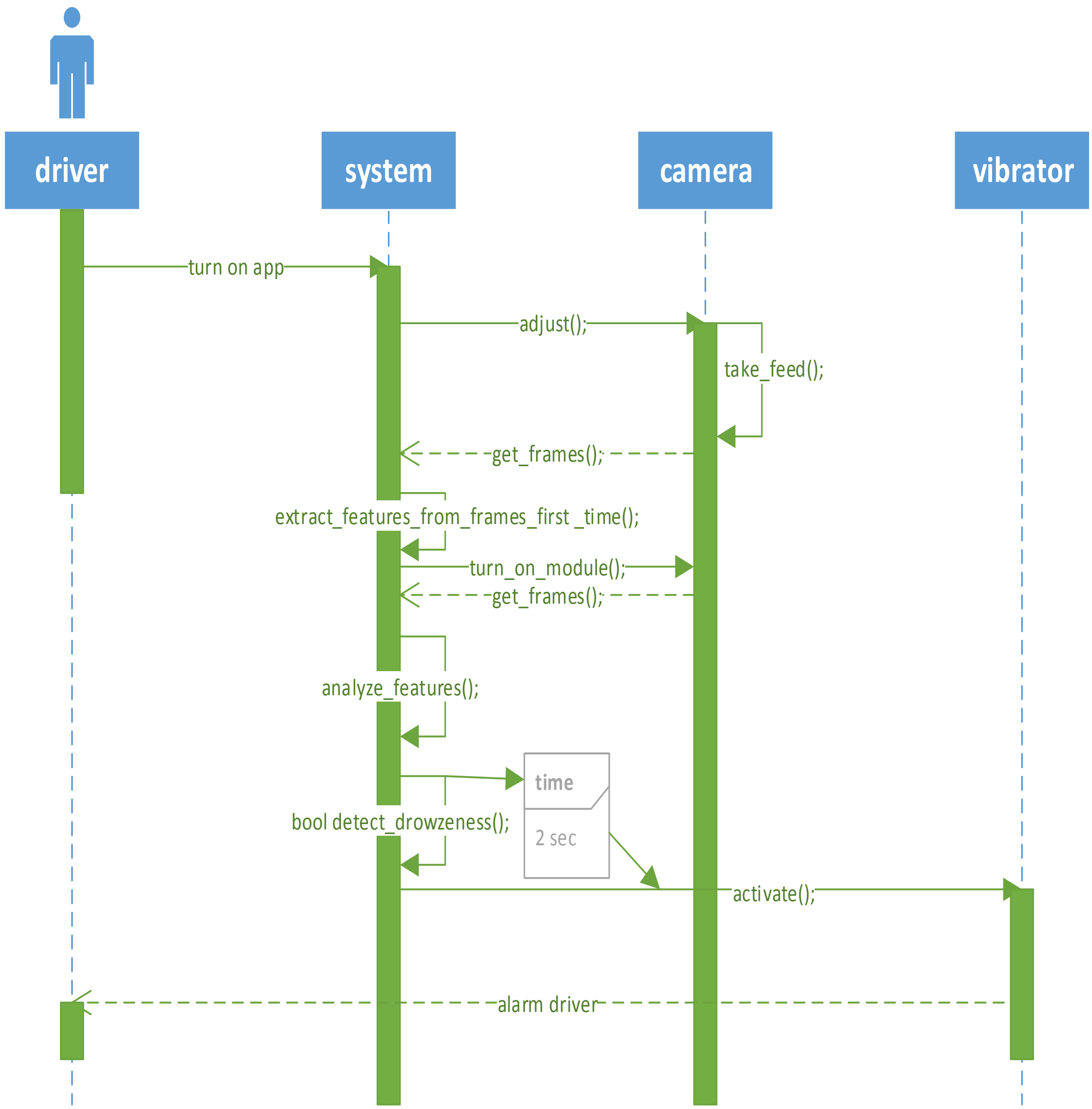


Figure 4-7 Sequence Diagram for Driver Alertness

4.8.3 Sequence diagram for blind spot:

Sequence Diagram for Blind Spot shown below in figure 4-8

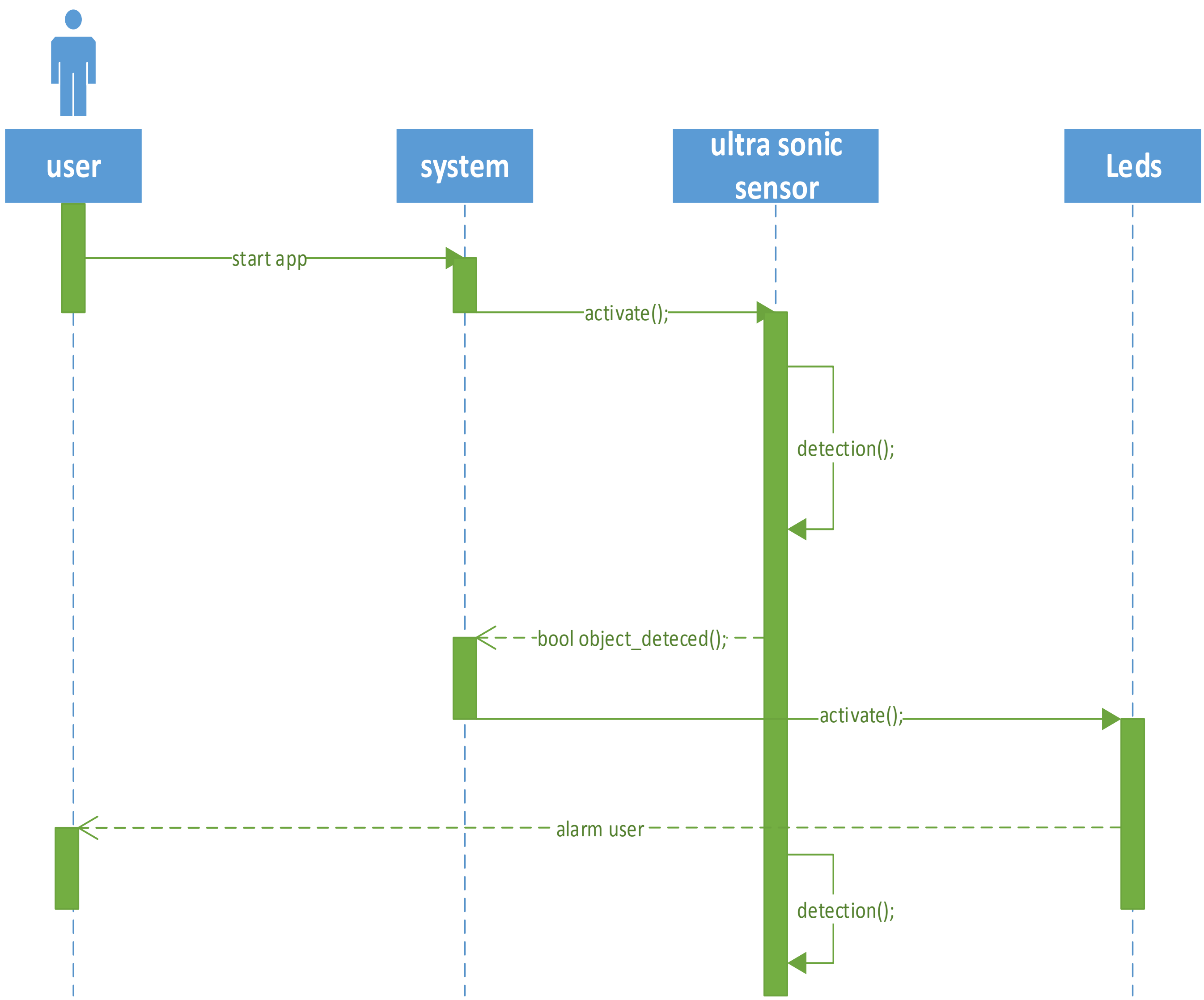


Figure 4-8 Sequence Diagram for Blind Spot

4.9 Activity Diagram:

Activity Diagram for Driver Assist and Safety System shown below in figure 4-9

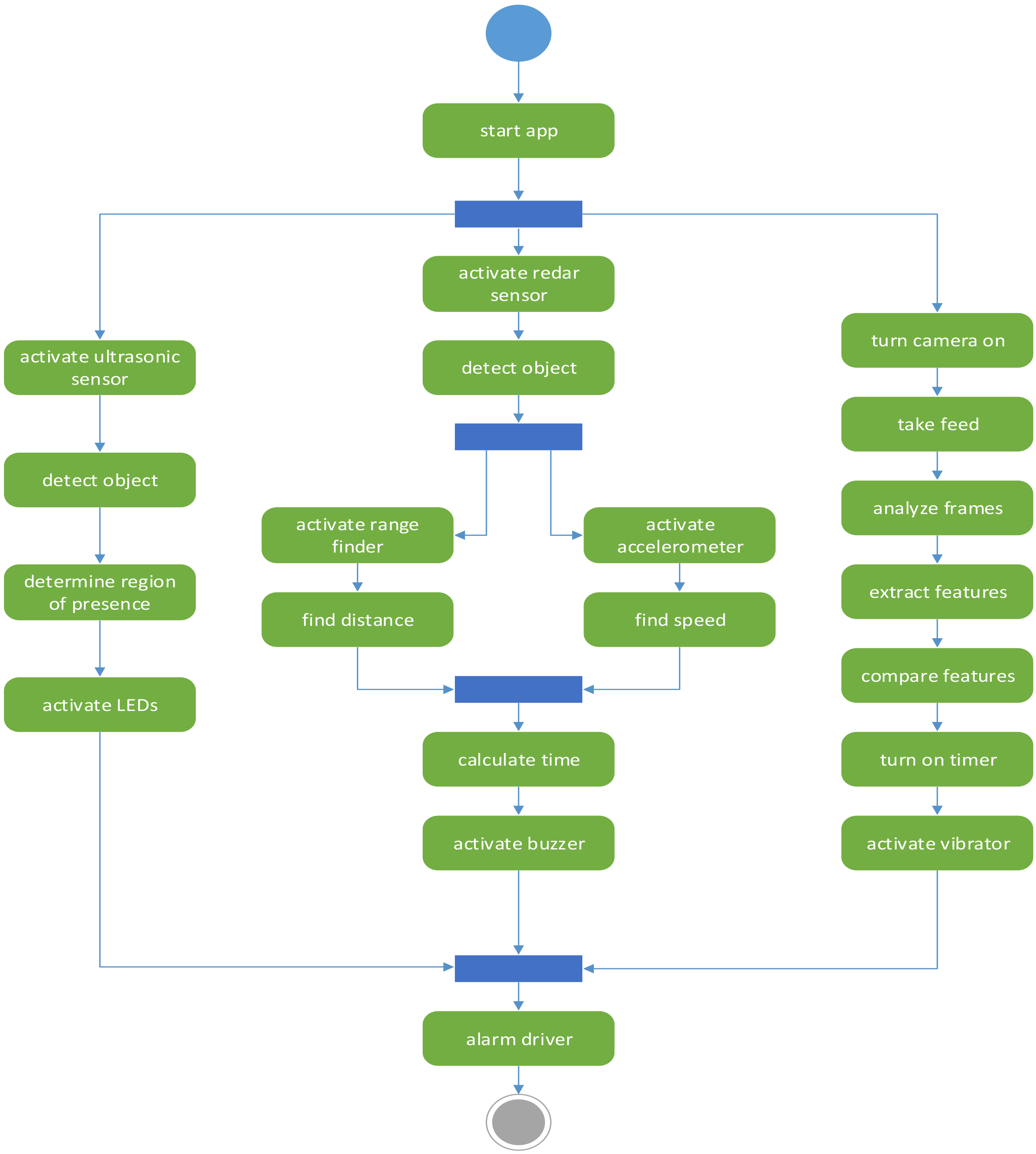


Figure 4-9 Activity Diagram for Driving Assist and Safety System

4.10 State Machine Diagram:

State Machine Diagram for Driver Assist and Safety System shown below in figure 4-10

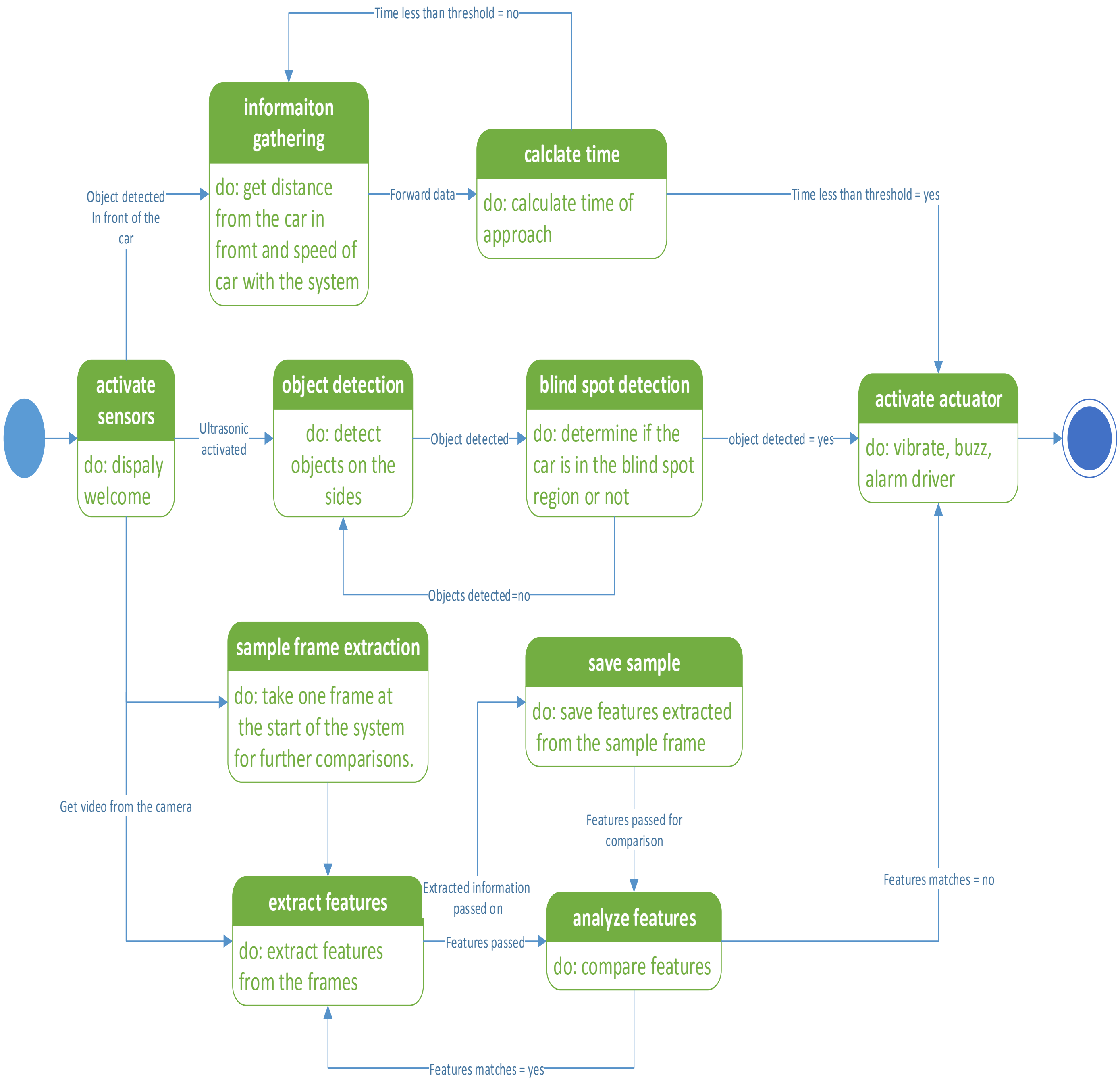


Figure 4-10 State Machine Diagram for Driving Assist and Safety System

4.11 Use Case Diagrams:

As the system is embedded in nature therefore it has a very limited interaction with the user. The given below use case diagram encompasses all the user interactions with the system.

4.11.1 Use case diagram for Driving Assist and Safety System:

Use Case Diagram of Driver Assist and Safety System shown below in figure 4-11

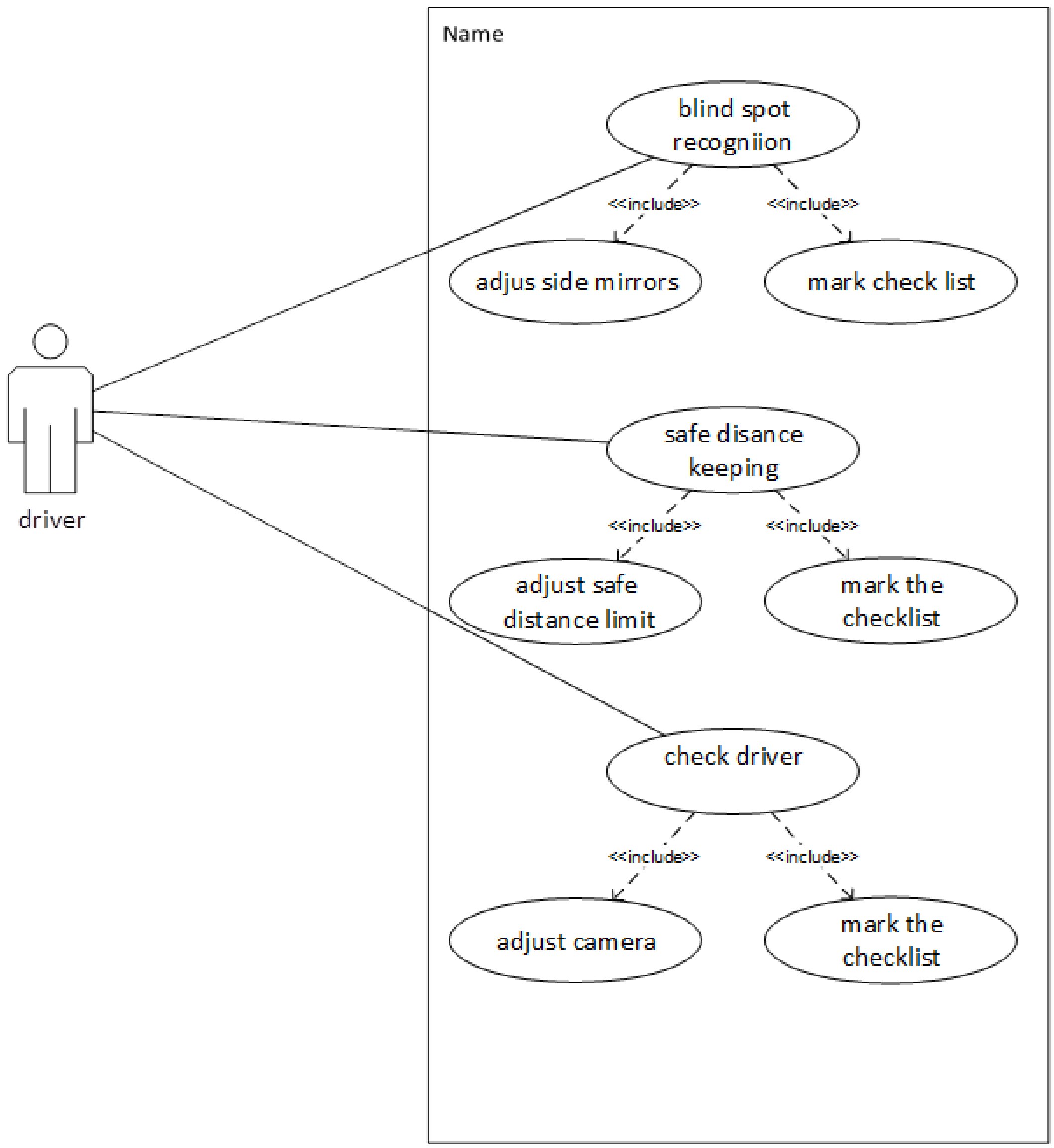


Figure 4-11 Use Case Diagram for Driving Assist And Safety System

4.11.1.1 Use Case Scenario for Driving Assist and Safety System:

Use Case Scenario for Driver Assist and Safety System shown below in table 4-1

Table 4- 1 Use Case Scenario for Diving Assist and Safety System

Use Case ID:	1.0		
Use Case Name:	Driver assistance and safety		
Created By:		**Last Updated By:**	-
Date Created:	17-12-2014	**Last Revision Date:**	-
Actors:	Primary Actor: Driver		
Description:	User (driver) will access the main menu where he will have to mark a checklist after performing certain actions with the modules. User will mark the check list after adjusting the threshold for distance, setting the camera and the side mirrors.		
Trigger:	System is turned on.		
Preconditions:	System shall be turned on.		
Post conditions:	The system will generate alarms to assist driver whenever he is not alert or an object is present in its blind spot region or when the time to approach the object in front of the car is less than the set threshold.		
Normal Flow:	1. User turns system on. 2. System provides the user with a GUI checklist to mark. 3. User sets the threshold of distance. 4. User sets his side mirrors. 5. User sets his camera.		

	6. User marks the checklist. 7. System activates the sensors.
Alternative Flows: **[Alternative Flow 1 – Not in Network]**	1. None
Exceptions:	1. Driver shall not be wearing glasses.
Includes:	Adjust side mirrors, adjust camera, set threshold, mark checklist
Frequency of Use:	Every time the system is turned on. It activates camera which will keep taking video feed and pass it on until an event occurs.
Special Requirements:	System shall be independent of any assistance in connections like internet and Wi-Fi. System shall be available at all times.
Assumptions:	System will be used in daylight. System will only work for the people whose iris are clearly visible. System will not be used in the dense traffic.
Notes and Issues:	None.

4.11.2 Use case diagram for Blind Spot:

Use case Diagram for Blind Spot shown below in figure 4-12

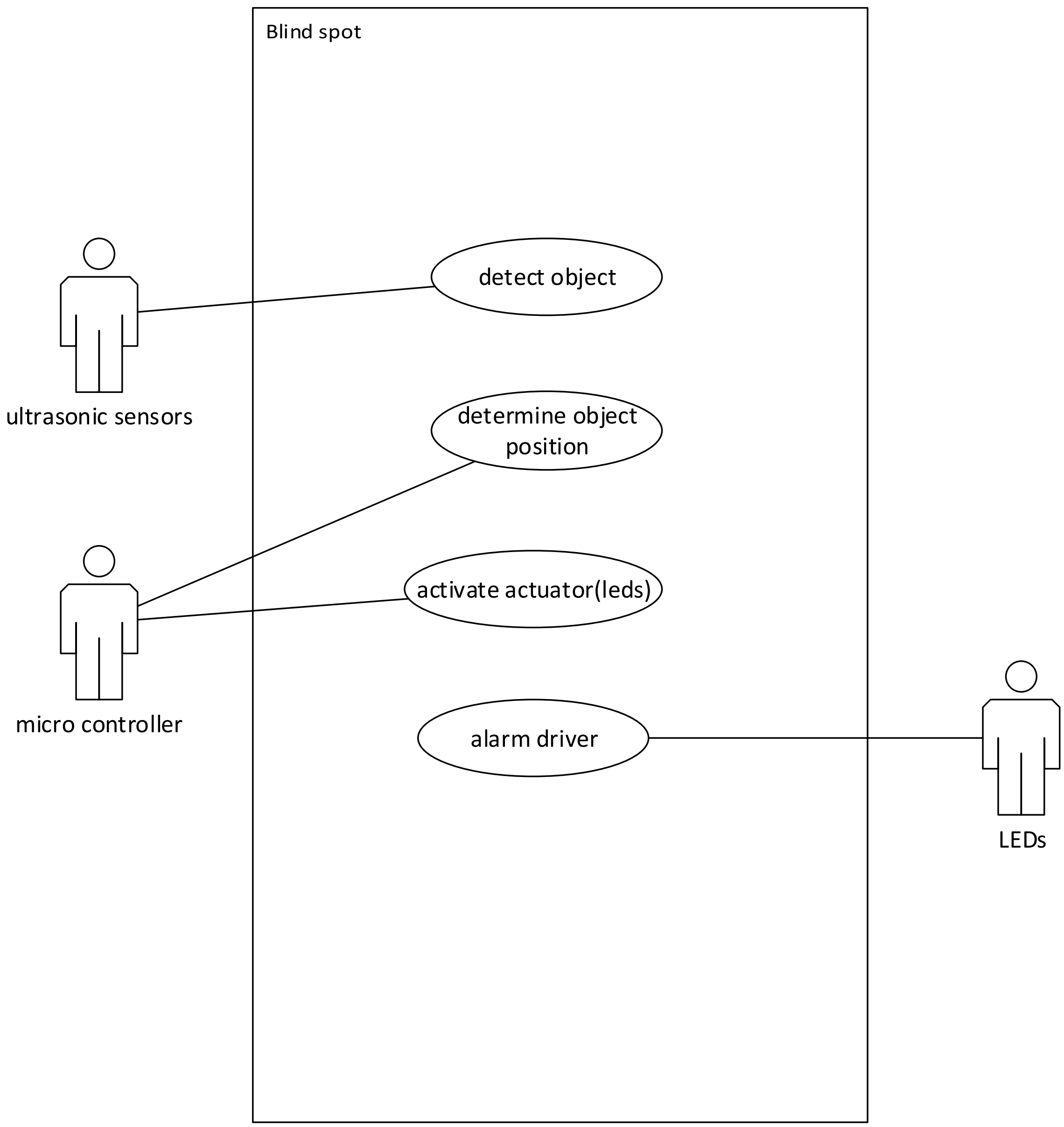


Figure 4-12 Use Case Diagram for Blind Spot

4.11.2.1 Use Case Scenario for Blind Spot:

Use Case Scenario for Blind Spot shown below in Table 4-2

Table 4- 2 Use Case Scenario for Blind Spot

Use Case ID:	1.1		
Use Case Name:	Blind spot recognition		
Created By:		**Last Updated By:**	-
Date Created:	17-12-2014	**Last Revision Date:**	-
Actors:	Primary users: Ultrasonic sensor, Micro controller Secondary user: LEDs		
Description:	Ultrasonic sensor observes the environment to detect object in the blind spot region of the driver. If the object is detected then the microcontroller activates the actuator to alarm the driver.		
Trigger:	System turned on.		
Preconditions:	1. System must be turned on. 2. User must have adjusted the side mirrors and marked the checklist on GUI.		
Post conditions:	1. After the driver is alarmed and the object gets out of the range of ultrasonic sensor (blind spot region), it will stop the actuator.		
Normal Flow:	1. Ultrasonic sensor detects an object in its range (blind spot region). 2. Microcontroller activates actuator. 3. Actuators alarm driver.		
Alternative Flows:	1. Ultra sonic sensor detects an object. 2. System determines it is not in the blind spot region of the driver.		

[Alternative Flow 1 – Not in Network]	3. Actuators are not activated.
Exceptions:	1. Have specified area/range for ultrasonic sensor.
Includes:	None
Frequency of Use:	Whenever system is working, ultrasonic sensor will keep observing until an event is detected.
Special Requirements:	System shall be independent of any assistance in connections like internet and wifi. System shall be available at all times.
Assumptions:	System will not be used in the dense traffic.
Notes and Issues:	1. Every time an object is detected in the blind spot region, it will alarm the user whether he wants to turn or not.

4.11.3 Use case diagram for Safe Distance Keeping:

Use Case Diagram for Safe Distance keeping shown below in figure 4-13

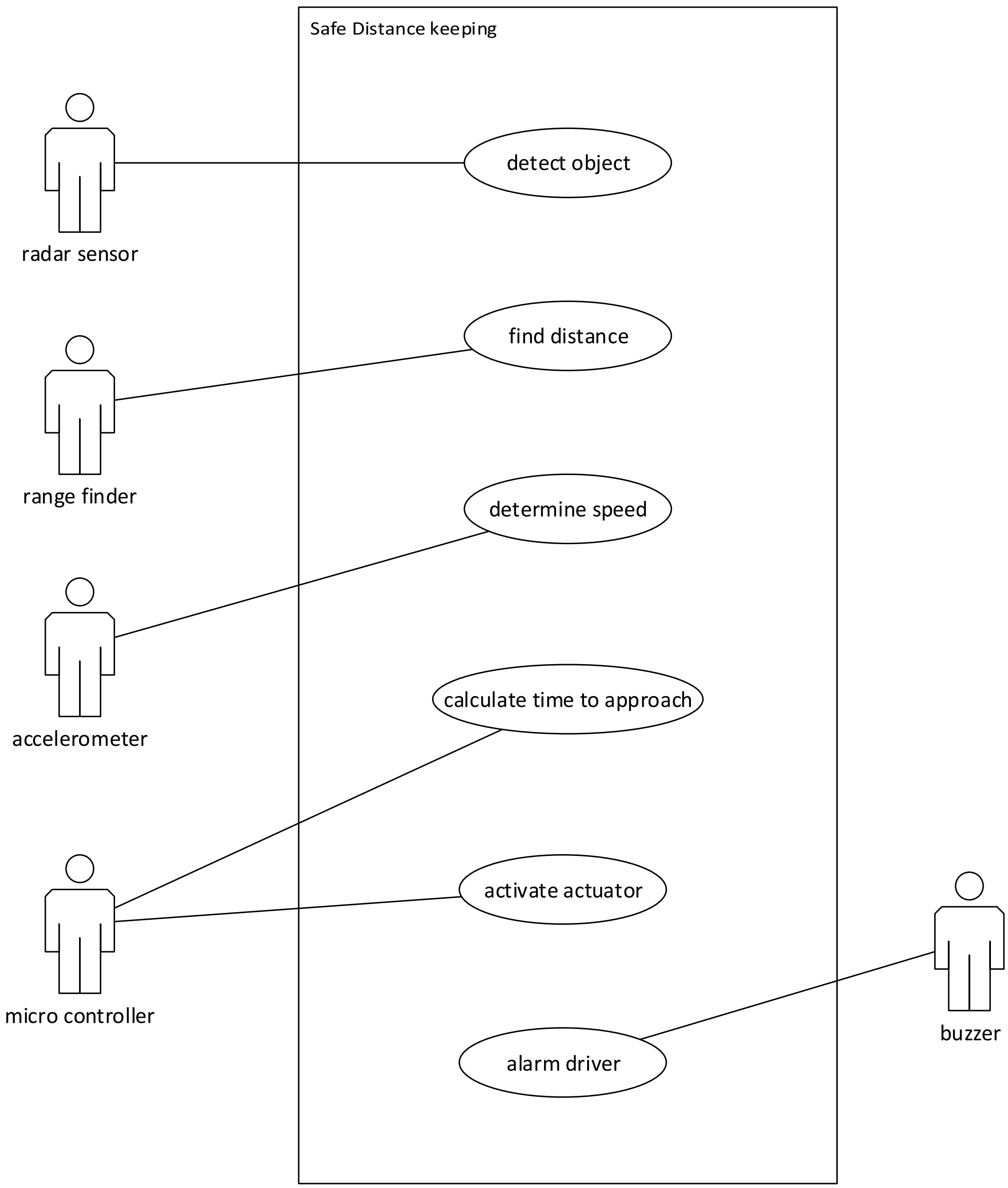


Figure 4-13 Use Case Diagram for Safe Distance Keeping

4.11.3.1 Use Case Scenario for Safe Distance Keeping:

Use Case Scenario for Safe Distance keeping shown below in Table 4-3

Table 4- 3 Use Case Scenario for Safe Distance Keeping

<table>
<tr><td>Use Case ID:</td><td colspan="3">1.2</td></tr>
<tr><td>Use Case Name:</td><td colspan="3">Safe distance keeping</td></tr>
<tr><td>Created By:</td><td></td><td>Last Updated By:</td><td>-</td></tr>
<tr><td>Date Created:</td><td>17-12-2014</td><td>Last Revision Date:</td><td>-</td></tr>
<tr><td>Actors:</td><td colspan="3">Primary Actor: Radar sensor, Range finder, Accelerometer, Microcontroller
Secondary User: Buzzer</td></tr>
<tr><td>Description:</td><td colspan="3">Radar sensor will detect an object in front of the car and notify microcontroller. It will then activate range finder and accelerometer
Which will provide speed and distance. Microcontroller will then calculate time to approach the next object. If the time is less than the set threshold, it will activate the actuator. Actuator will alarm the driver.</td></tr>
<tr><td>Trigger:</td><td colspan="3">System is turned on.</td></tr>
<tr><td>Preconditions:</td><td colspan="3">1. System shall be turned on.
2. User must have set a threshold and marked the checklist.</td></tr>
<tr><td>Post conditions:</td><td colspan="3">1. After the object is out of range of range finder (distance = infinite), it will deactivate the actuator.</td></tr>
<tr><td>Normal Flow:</td><td colspan="3">1. Radar sensor senses an object in front of it.
2. Microcontroller activates range finder and accelerometer.</td></tr>
</table>

	3. Microcontroller gets distance and speed. 4. Microcontroller calculates time to approach the next object. 5. If the time is less than the set threshold, it will activate the actuator.
Alternative Flows: **[Alternative Flow 1 – Not in Network]**	1. Radar sensor senses an object in front of it and notifies controller. 2. Microcontroller activates radar sensor and accelerometer. 3. Object gets out of the range of radar sensor. 4. Microcontroller gets distance = infinite. 5. It will de activate accelerometer and range finder.
Exceptions:	1. Fixed maximum and minimum range for radar sensor and range finder.
Includes:	None
Frequency of Use:	Every time the system is turned on. It activates radar sensor which will keep observing the environment until an event occurs.
Special Requirements:	System shall be independent of any assistance in connections like internet and Wi-Fi. System shall be available at all times.
Assumptions:	The system will detect and find distance of the object directly in front of it. System will not be used in dense traffic.
Notes and Issues:	None.

4.11.4 Use case diagram for Driver Alertness:

Use Case Diagram for Driver Alertness shown below in figure 4-14

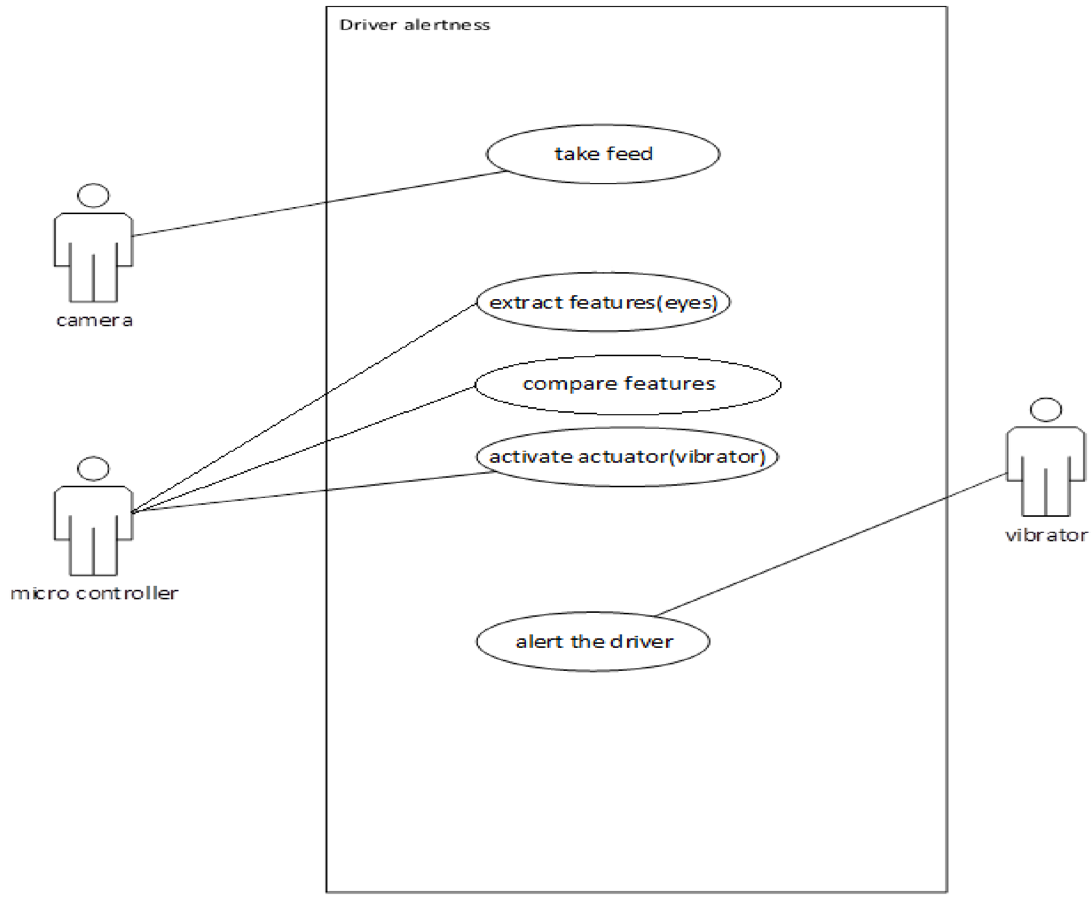


Figure 4-14 Use Case Diagram for Driver Alertness

4.11.4.1 Use Case Scenario for Driver Alertness:

Use Case Scenario for Driver Alertness shown below in Table 4-4

Table 4- 4 Use Case Scenario for Driver Alertness

Use Case ID:	1.3
Use Case Name:	Check Driver Alertness

Created By:		**Last Updated By:**	-
Date Created:	17-12-2014	**Last Revision Date:**	-
Actors:	Primary Actor: Camera, Microcontroller Secondary User: Vibrator		
Description:	Camera will take the feed and pass it on the control unit. It is then used to get frames, extract features from those frames. These features are then compared. If the features are not equal, then microcontroller will activate the actuator.		
Trigger:	System is turned on.		
Preconditions:	1. System shall be turned on. 2. User must have adjusted the camera and marked the checklist.		
Post conditions:	After the driver's features again come equal after the comparison, it will deactivate the actuator.		
Normal Flow:	1. Camera takes feed. 2. The frames are sent to the data processing unit. 3. Features are extracted from these frames. 4. Features are compared. 5. If the comparison results in negative, microcontroller will activate the actuator.		
Alternative Flows: **[Alternative Flow 1 – Not in Network]**	1. Camera takes feed. 2. The frames are sent to the data processing unit. 3. Features are extracted from these frames. 4. Features are compared. 5. If the comparison results in negative and then suddenly changes to positive during the time, then the actuator will not be activated.		

Exceptions:	Driver shall not be wearing glasses.
Includes:	None
Frequency of Use:	Every time the system is turned on. It activates camera which will keep taking video feed and pass it on until an event occurs.
Special Requirements:	System shall be independent of any assistance in connections like internet and Wi-Fi. System shall be available at all times.
Assumptions:	System will be used in daylight. System will only work for the people whose iris are clearly visible.
Notes and Issues:	None.

4.12 Event Response diagram:

Event Response Diagram of our project Driving Assist and Safety System shown below in table 4-5

Table 4- 5 Event Response Diagram

Event	System State	Response
Radar sensor detects an object in front of the car	Car is moving or stationary	System activates the range finder
Laser range finder finds the distance of the car from the object in front (detected by radar sensor)	System now has distance from the object in front	System activates the accelerometer

Accelerometer calculates the speed (velocity) of the car	System now has velocity of its own	System will calculate the time to approach to the object in front
CPU detects that the time to approach to the next car is less than the specified minimum safe approach time	System has the time to approach	1. System activates the buzzer 2. Buzzer buzzes to alarm the driver
Ultrasonic sensors detect any object (car) in the blind spot regions	System has the information about the presence of the object in blind spot regions	System makes LEDs to blink to alarm the driver
Camera takes feed of the driver's eyes	System finds that driver's eye contact is not in a specified area	1. System activates the vibrator on the steer ring 2. Vibrator vibrates to make the driver attentive

4.13 Work Breakdown Structure:

Work Breakdown structure diagram for Driving Assist and Safety System shown below in figure 4-15

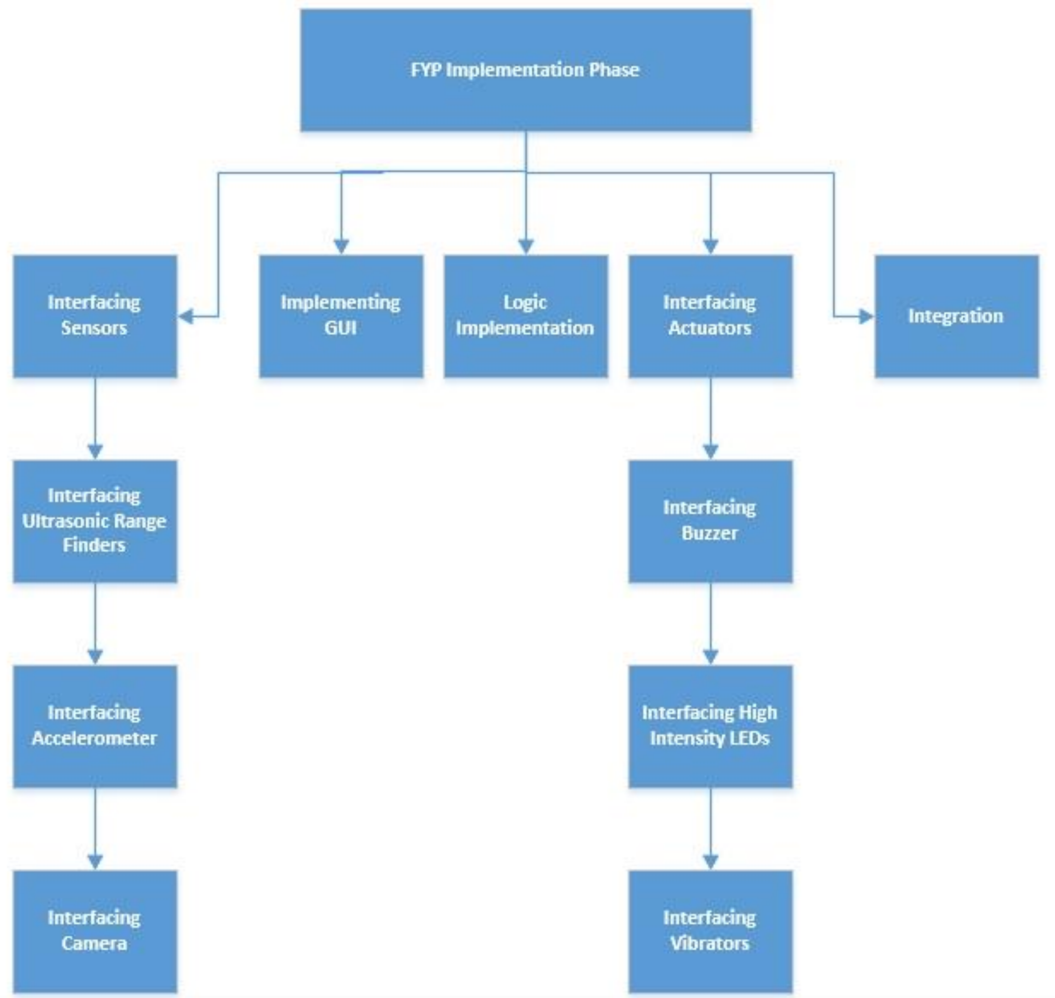


Figure 4-15 Work Breakdown Structure

4.14 Interface Specification:

Interface Specification Diagram shown below in figure 4-16

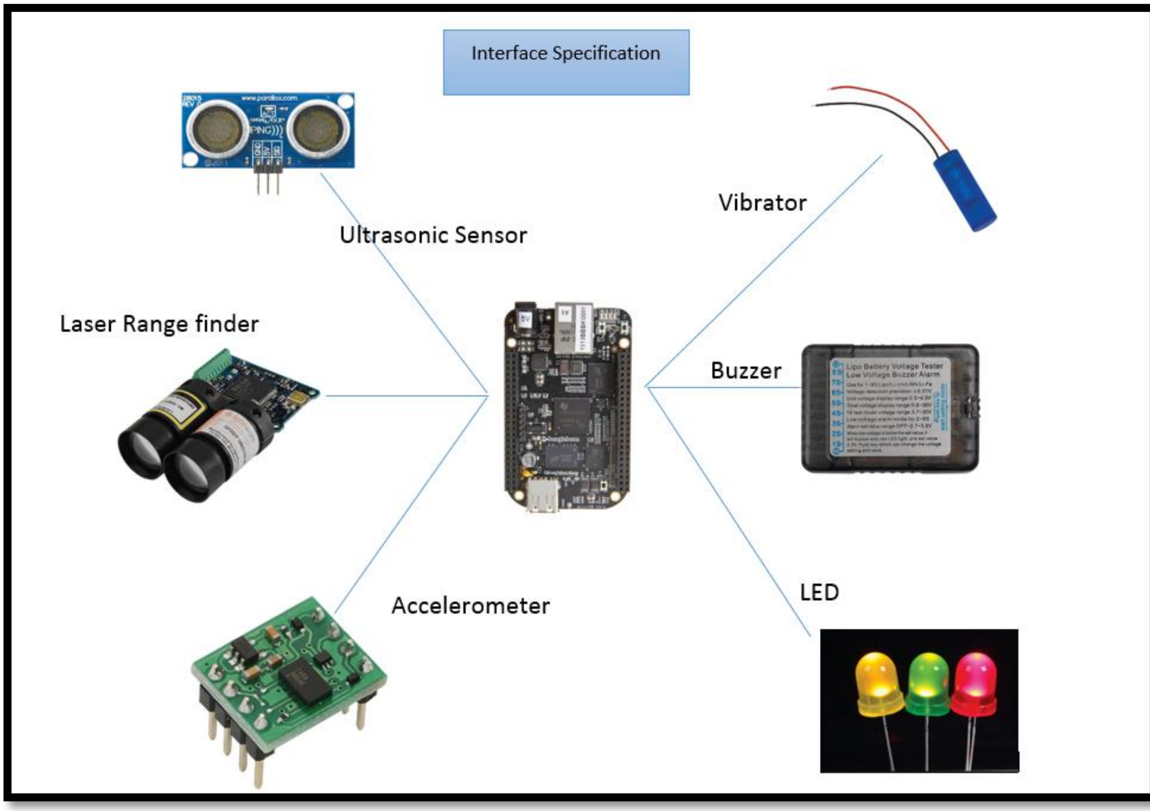


Figure 4-16 Interface Specification Diagram

This sections contains all the details about different interfaces i.e. Hardware, Software as well as communication interfaces to be implemented on the system. The design of the interfaces has been presented with a clear insight into the working of different components has been provided. This application should run on the microcontroller and shall require minimum hardware interaction. A brief description of these components is as follows:

Raspberry pi b+

This is the brain of the vehicle. All the components will be connected to it. It will have enough number of ports to allow communication with different devices mentioned below.

Ultrasonic distance finder

Provides precise, non-contact distance measurements within a 2 cm to 3 m range. Ultrasonic measurements work in any lighting condition, making this a good choice to supplement infrared object detectors. Simple pulse in/pulse out communication requires just one I/O pin.

Laser range finder

Laser accurately detects surfaces and measures distance up to 40 meters (130 feet) where ultrasonic and infrared distance sensing are inadequate. Outputs 12 readings per second for quick data refresh.

Accelerometer

Works with 3.3 and 5 volt devices.I2C and SPI interfaces for compatibility with virtually any microcontroller. On-board voltage regulators and I/O level shifters for compatibility with 3.3 and 5 volt systems. Low current consumption for long life in battery powered applications. Compact, breadboard-friendly package.

Vibrator

Mechanical Noise of 50 dB(A) Max so you can get the feedback you desire without a lot of extra noise. Rotation can be CW or CCW, giving you more applicable capabilities. Rated at 3 VDC, giving you a low-power solution for user and application feedback.

Buzzer

Officially supported in the ELEV-8 V2 Assembly Guide. Connects directly to the batteries balancing lead – no extra connectors or wires necessary. Twin piezoelectric buzzers may be heard from over a hundred feet away. Easy to program – just press the micro switch (under the buzzers) until your desired alarm voltage level is displayed. They recommend to use 3.5 volts for LiPo batteries.

Pi Camera

The Raspberry Pi Camera Module is a custom designed add-on for Raspberry Pi. It attaches to Raspberry Pi by way of one of the two small sockets on the board upper surface. The board itself is tiny, at around 25mm x 20mm x 9mm. It also weighs just over 3g, making it perfect for mobile or other applications where size and weight are important. It connects to Raspberry Pi by way of a short ribbon cable. The sensor itself has a native resolution of 5 megapixel, and has a fixed focus lens onboard. In terms of still images, the camera is capable of 2592 x 1944 pixel static images, and also supports 1080p30, 720p60 and 640x480p60/90 video.

4.14.1 Start Screen Interface:

Start Screen of our project shown below in figure 4-17

Figure 4-17 Interface for Start Screen

4.14.2 Safe Distance Keeping Screen Interface:

Safe Distance keeping module screen shown below in figure 4-18

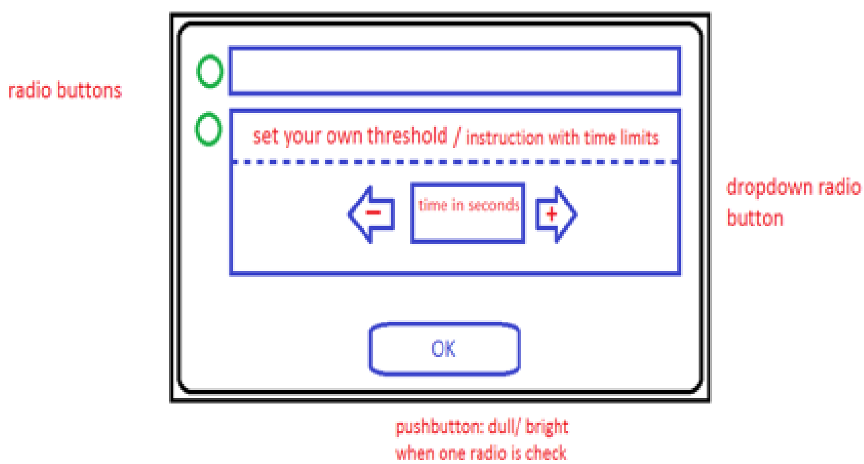


Figure 4-18 Interface for Safe Distance Keeping

4.14.3 Driver Alertness Screen Interface:

Driver Alertness module screen shown below in figure 4-19

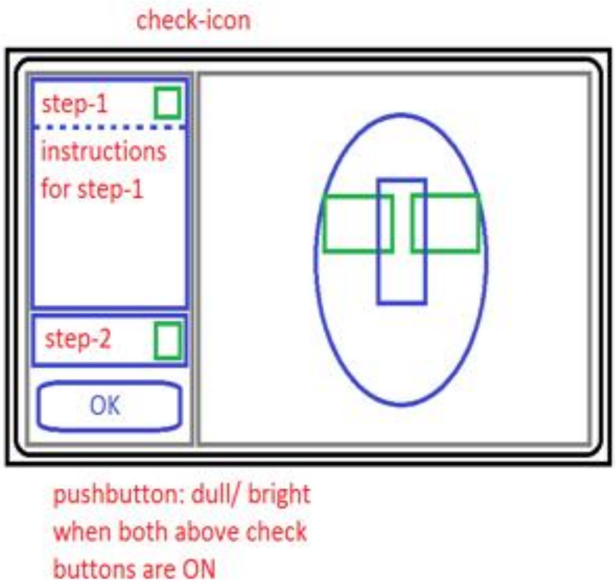


Figure 4-19 Interface for Driver Alertness

4.14.4 Blind spot Response Screen Interface:

Blind Spot Detection module screen shown below in figure 4-20

Figure 4-20 Interface for Blind Spot Response

4.14.5 Main Screen Interface:

Main Screen interface of our project shown below in figure 4-21

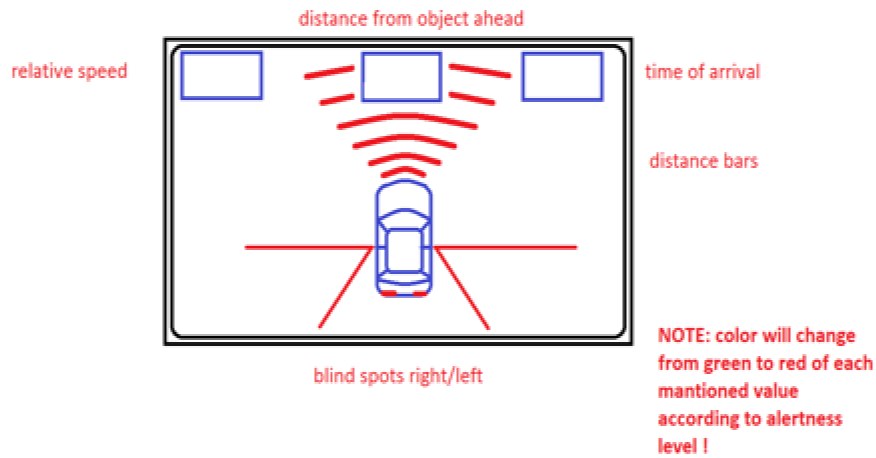


Figure 4-21 Main Screen Interface

4.15 Conclusion:

So in the end, the purpose of this document is to presents the architecture and system design details for driving assist and safety system is fully complete. In that they intended to inform stakeholders of the details of the design and the design process. So it shall help the developer in implementation and maintenance of the system.

CHAPTER 5

IMPLEMENTATION

5. Implementation:

5.1 Introduction:

The purpose of this document is to present a detailed description of the implementation of our project, Driving Assist and Safety System. In this document, they should discuss the source code and the component use in implementation.

5.2 Detailed Description of Components:

Table 5- 1 Detailed Description of Component

Identification	The unique name for the component and the location of the component in the system.
Type	A module, a subprogram, a form, a data file, a control procedure, a class, etc
Purpose	Function and performance requirements implemented by the design component, including derived requirements. Derived requirements are not explicitly stated in the SRS - but are implied or adjunct to formally stated SDS requirements.
Subordinates	The internal structure of the component, the constituents of the component, and the functional requirements satisfied by each part.
Dependencies	How the component's function and performance relate to other components. How this component is used by other components. The other components that use this component. Interaction

	details such as timing, interaction conditions (such as order of execution and data sharing), and responsibility for creation, duplication, use, storage, and elimination of components.
Interfaces	Detailed description of all external or internal interfaces as well as of any mechanism for communicating through messages, parameters, or common data areas. All error messages and error codes should be identified. All screen formats, interactive messages, and other user interface components (originally defined in the SRS) should be given here.
Resources	A complete description of all resources (hardware or software) external to the component but required to carry out its functions.
Processing	A full description of the functions presented in the Function subsection. Pseudo code can be used to document algorithms, equations, and logic.
Data	For the data internal to the component, describes the representation method, initial values, use, semantics, and format.

5.2.1 Sensors

Sensors description shown below in table 5-2

Table 5- 2 Sensors

Identification	**Sensors**
Type	Class/Form
Purpose	Sensor shall be used to detect events or changes in quantities and provides a corresponding output, generally as an electrical or optical signal. In our system the sensors shall be used to detect object when any object appear in the blind spot area. Sensors that are used in

	rangefinder is to measure the distance between our vehicle and next vehicle. And it shall also return the speed of our vehicle.
Function	Sometime the driver lack of attention while driving the car (eye contact) or distance from the car in front or presence of an object in the blind spot region of the driver. To cater for these problems, the sensors shall be able to inform and alert the driver about any vehicle in his blind spot at the time of driving, vibrate the steer ring when the drivers' eye contact is not where it should be after 2 seconds and the distance from the next car according to car's own speed (safe/unsafe).
Subordinates	The sensors contains link to the system only. System through which the driver interact and they use the sensors on the system.
Dependencies	They put the sensors on the front screen of vehicle and on the side mirrors. The sensors shall detect the events, and alert the driver.
Interfaces	The links are contained in the bottom half of the screen. This should be designed to easy to view using the resolution standard on the PDA.
Resources	They should registers the hardware, and check it before the using that whether that sensor is working correctly or not.
Processing	None.
Data	The data that is used in it is related to the vehicle. By using sensors on vehicle they should detect the object and measure the distance from the next vehicle, that's only the data to whom that sensor is related.

5.2.2 Camera

Camera description shown below in table 5-3

Table 5- 3 Camera

Identification	**Camera**
Type	Sensor

Purpose	Camera shall be used in driver alertness module in which the camera shall provide the frames to the frame analyzer for drowsiness detection.
Function	When the driver does not concentrate on his/her driving, the camera shall provide the frames to the frame analyzer , frame analyzer detect that driver concentration time on one point is greater than 2 sec then buzz the alarm.
Subordinates	The camera contains link to the system, system can turn on and the camera shall take the feed and return to the system.
Dependencies	They should attach the camera to the system (vehicle, facing the driver), system gets the frames and extract features.
Interfaces	The links are contained in the bottom half of the screen. This should be designed for user to easy to view using the resolution standard on the PDA.
Resources	They should check it before using that whether that sensor is working correctly or not. Access to the system and detect the drowsiness.
Processing	Digital image sensor, using as few as 6144 bytes of Propeller RAM for an image (4-bit pixels). 3.6mm focal-length lens. Fast real-time imaging and individual snapshots, with shutter speeds down to 200 microseconds. Direct connection to Propeller chip: no intermediate controller required.
Data	The data that is used in it is related to the vehicle. By using camera on vehicle they should detect the frames and detect the drowsiness.

5.2.3 Range Finder

Range Finder description shown below in table 5-4

Table 5- 4 Range Finder

Identification	**Range Finder**
Type	Sensor

Purpose	Range finder shall be used to provide the distance to the time calculator. Through range finder and accelerometer, they calculate the time of our vehicle from next vehicle.
Function	Range finder is used in safe distance keeping, through range finder wo find the distance of our vehicle from next vehicle. After that they calculate the time by interacting with speed.
Subordinates	The range finder contain link to the time calculator. Time calculator shall calculate the time through distance and speed.
Dependencies	It is dependent on the radar sensor. When the radar sensor detects an object, it notifies the controller which, as a result, activates range finder.
Interfaces	The links are contained in the bottom half of the screen. This should be designed to easy to calculate the time through distance.
Resources	They should registers the hardware, and check it before the using that whether that sensor is working correctly or not.
Processing	Range finder accurately detects surfaces and measures distance up to 40 meters (130 feet) where ultrasonic and infrared distance sensing are inadequate. Outputs 12 readings per second for quick data refresh.
Data	The data that is used in it is related to the vehicle. By using rangefinder on vehicle they should measure the distance that shall use in finding the time.

5.2.4 Accelerometer

Accelerometer description shown below in table 5-5

Table 5- 5 Accelerometer

Identification	**Accelerometer**
Type	Sensor

Purpose	Accelerometer shall be used to provide the speed to the time calculator. Through range finder and accelerometer, they calculate the time of our vehicle from next vehicle.
Function	Accelerometer is used in safe distance keeping, through accelerometer they should find the speed of our vehicle. After that they should calculate the time by interacting with distance.
Subordinates	The accelerometer contains link to the time calculator. Time calculator shall calculate the time through distance and speed.
Dependencies	It is dependent on the radar sensor. When the radar sensor detects an object, it notifies the controller which, as a result, activates accelerometer.
Interfaces	The links are contained in the bottom half of the screen. This should be designed to easy to calculate the time through speed.
Resources	They should registers the hardware, and check it before the using that whether that sensor is working correctly or not.
Processing	Works with 3.3 and 5 volt devices. I2C and SPI interfaces for compatibility with virtually any microcontroller. On-board voltage regulators and I/O level shifters for compatibility with 3.3 and 5 volt systems. Low current consumption for long life in battery powered applications.
Data	The data that is used in it is related to the vehicle. By using accelerometer on vehicle they should measure the speed that shall use in finding the time.

5.2.5 Ultrasonic

Ultrasonic description shown below in table 5-6

Table 5- 6 Ultrasonic

Identification	**Ultrasonic**
Type	Sensor

Purpose	Ultrasonic sensor is used in blind spot module. Ultrasonic is used to detect the objects.
Function	Ultrasonic is used in blind spot recognition module. The system activate the ultrasonic sensor and return the system as the object detection. Blind spot is the region on the both side of car which is outside the vision angle of driver and side mirrors combined.
Subordinates	The ultrasonic contain link to the object sensor by providing analogue signal.
Dependencies	It should not depend on anyone.
Interfaces	The links are contained in the bottom half of the screen. This should be designed to easy to provide analogue signals to the object sensor.
Resources	They should registers the hardware, and check it before the using that whether that sensor is working correctly or not.
Processing	Provides precise, non-contact distance measurements within a 2 cm to 3 m range. Simple pulse in/pulse out communication requires just one I/O pin.3-pin header makes it easy to connect to a development board, directly or with an extension cable, no soldering required.
Data	The data that is used in it is related to the vehicle. By using ultrasonic on vehicle they should detect the object in the blind spot region. Ultrasonic measurements work in any lighting condition, making this a good choice to supplement infrared object detectors.

5.2.6 Frame Analyzer

Frame Analyzer description shown below in table 5-7

Table 5- 7 Frame Analyzer

Identification	**Frame analyzer**
Type	Class/Form
Purpose	Frame analyzer shall be used to get frames from the camera. After getting the frames it compare new frame with previous frame if both

	the frames are same in next 2 sec then it detect that driver not concentrate on driving.
Function	Frame analyzer used in driver alertness. When camera provide frames to the frame analyzer and frame analyzer check each frame, if frames are same in sequence for 2 sec then it detect the problem and have some next action.
Subordinates	The frame analyzer contains link to the vibrator through event handler. When frame analyzer detect any event, they activate the vibrator.
Dependencies	The frame analyzer depends on the camera. System turns on the camera. Camera shall take the feed, then system get the frames from the camera and extract features from the frames for further processing.
Interfaces	The links are contained in the bottom half of the screen. This should be designed to provide frames and activate the vibrator.
Resources	They should registers the hardware, and check it before the using that whether that frame analyzer is working correctly or not, it correctly capture the frames or not.
Processing	Direct connection to Propeller chip: no intermediate controller required. Uses Kodak KAC9360 sensor, whose full datasheet is readily available without a non-disclosure agreement, permitting user modification of open-source driver firmware
Data	The data that is used in it is related to the camera. Camera shall provide the frames and frame analyzer capture those frames and used that frames for further processing.

5.2.7 Time Calculator

Time Calculator description shown below in table 5-8

Table 5- 8 Time Calculator

Identification	**Time Calculator**
Type	Class/Form
Purpose	Time calculator shall be used to calculate the time in safe distance keeping by using the distance and speed.
Function	Time calculator shall be used in safe distance keeping module. Time calculator gets the distance from the range finder and gets the speed from the accelerometer. After that by using distance and speed, they should calculate the time.
Subordinates	Time calculator contains link to the buzzer. After calculating the time to approach of our vehicle to the next vehicle, if that time is less than the set threshold then it shall buzz the alarm and alert the driver.
Dependencies	This shall depend on the range finder and accelerometer. Through range finder it shall give the distance and through accelerometer it shall give us speed to calculate the time.
Interfaces	The links are contained in the bottom half of the screen. This should be designed to get the distance and speed and then buzz the alarm for the driver.
Resources	They should define before using the system that how to calculate the time by using distance and speed.
Processing	Time shall be calculate by using distance and speed and the formula is; Time = distance/speed.
Data	The data that is used in it is related to the range finder and the accelerometer. Range finder and accelerometer provide the distance and speed respectively to that component.

5.2.8 Object sensor

Object sensor description shown below in table 5-9

Table 5- 9 Object Sensor

Identification	**Object Sensor**
Type	Class/Form
Purpose	Object sensor shall be used to take the analogue signals from the ultrasonic sensor, then detect the object in blind spot region.
Function	Object sensor shall be used in blind spot recognition module. The system activates the ultrasonic sensor, it should detect the object and return that signal to the system. Ultrasonic sensor has some range (limit), if anything appear in that region it should detect that object and activate the low frequency LEDs to alarm the user.
Subordinates	The sensors contains link to the low frequency LED only. If they detect anything in that blind spot region, object sensor detect that object is in the blind spot region of the driver, it shall activate the low frequency LED.
Dependencies	It depends on the ultrasonic, ultrasonic sensor have some range, ultrasonic sensor provide analogue signal to the object sensor to detect the object.
Interfaces	The links are contained in the bottom half of the screen. It designed to detect the objects in the given range.
Resources	They should check that whether sensor is detecting and object or not.
Processing	Within the range of 2-3 cm, if it shall detect and object then alert the system.
Data	The data that is used in it is related to the ultrasonic sensor. Ultrasonic sensor have measure within 2-3 cm range. 3-pin header makes it easy to connect to a development board, directly or with an extension cable, no soldering required

5.2.9 Actuators

Actuators description shown below in table 5-10

Table 5- 10 Actuators

Identification	**Actuators**
Type	Class/Form
Purpose	Actuator shall be used to control the system or responsible for controlling. Actuator is a mechanism by which a control system acts upon the environment.
Function	Actuators are be used to alert the system by using different methods. When Safe distance keeping problem is detected then it buzzes the alarm. When anything appears in blind spot region, it alerts the driver by using low frequency LED's. For driver alertness module they should use the vibrator to alert the driver, vibrator that is attached with the steering of the car with the system.
Subordinates	Buzzer, vibrator and low frequency LED that are used in actuator shall interact with the system.
Dependencies	The actuator shall depend on the event handler, after the processing of frame analyzer, time calculator and object sensor, they should come on actuator point. For frame analyzer, it activates the vibrator. For Time calculation, it activates the buzzer and for object sensor, it activates the low frequency LEDs.
Interfaces	The links are contained in the bottom half of the screen. This should be designed to alert the driver by using vibrator, buzzer and LED. Because there's no other solution to alert the driver if they detect any problem in the system.
Resources	Before using the actuator, they should check the internal components for working.
Processing	Vibrator have the mechanical Noise of 50 dB(A) Max so you can get the feedback you desire without a lot of extra noise. Rated at 3 VDC, giving you a low-power solution for user and application feedback.

	Buzzer shall support in the ELEV-8 V2 Assembly Guide. Connects directly to the batteries balancing lead – no extra connectors or wires necessary. They should use 3.5 volts for LiPo batteries.
Data	The data that is used in it is the frames, time calculation and the object detection in the blind spot region of the driver. After extracting the frames if any event appears, then alert the driver through vibrator that is attached to the system steering. After calculating the time through speed and distance, if time is less than the threshold, it buzzes the alarm. If any object appears in the blind spot range, it alerts the driver by using low frequency LEDs.

5.2.10 Vibrator

Vibrator description shown below in table 5-11

Table 5- 11 Vibrator

Identification	**Vibrator**
Type	Actuator
Purpose	Vibrator shall be used to alert the system in driver alertness module.
Function	Our app runs on the micro controller, firstly turn on the app, then the system turns on, takes feed and captures the frames form the camera. Features are extracted from these frames and compared. If any event is detected and gives the same response for 2 seconds, the vibrator is activated to alarm the driver.
Subordinates	The vibrator not link to further any other component, it only alert the driver through vibration.
Dependencies	The vibrator depends on the frame analyzer. Camera provide the frames to the frame analyzer, frame analyzer extracts the frames and detects events. If any problem appears then frame analyzer activates the vibrator and alerts the driver.

Interfaces	The links are contained in the bottom half of the screen. This should be designed to alert the driver. Because there's no other solution, if it detects any problem in the system.
Resources	Before using it, they check the sound of it. They should take the vibrator of low sound because high sound vibrator disturb the driver and irritate them.
Processing	Vibrator have the mechanical Noise of 50 dB(A) Max so you can get the feedback you desire without a lot of extra noise. Rated at 3 VDC, giving you a low-power solution for user and application feedback.
Data	The data that is used in it is the frames, after extracting the frames if any problem appear then buzz alert the driver through vibrator that is attached to the system steering wheel.

5.2.11 Buzzer

Buzzer description shown below in table 5-12

Table 5- 12 Buzzer

Identification	**Buzzer**
Type	Actuator
Purpose	Vibrator shall be used to buzz the alarm and alert the system in safe distance keeping module.
Function	Our app executes on the micro controller, firstly turn on the app, then the radar sensor detects the object, range finder measures the distance and accelerometer calculates the speed, time is calculated by using distance and speed. If the time is less than the threshold value then the system shall activate the buzzer and alert the driver.
Subordinates	The buzzer is not linked further to any other component, it only alert the driver through alarm the buzzer.
Dependencies	The vibrator shall depend on the time calculator. Time calculator is used to get the distance from the range finder and get the speed from

	the accelerometer. Through the formula it calculates time, if time is less than threshold than it shall buzz the alarm.
Interfaces	The links are contained in the bottom half of the screen. This should be designed to alert the driver by the buzzer. Because there's no other solution if they detect any problem in the system.
Resources	Before using it, they should check the sound of it. They should take the buzzer of low sound because high sound buzzer disturb the driver and irritate them.
Processing	Buzzer shall support in the ELEV-8 V2 Assembly Guide. Connects directly to the batteries balancing lead – no extra connectors or wires necessary. Twin piezoelectric buzzers may be heard from over a hundred feet away. They should use 3.5 volts for LiPo batteries.
Data	The data that is used in it is the time calculator. After calculating the time, if they detect any problem then buzz the alarm and alert the driver.

5.2.12 LED

LED description shown below in table 5-13

Table 5- 13 LED

Identification	**LED**
Type	Class/Form
Purpose	Vibrator will be used to alert the system in blind spot recognition module.
Function	Firstly start the app, the system activates the ultrasonic sensor, ultrasonic sensor have range of 2 to 3 cm if they detect some object in that range then it shall return that to the system, the system activate the LEDs and to alert the user they turn on the low frequency LEDs.

Subordinates	The low frequency LEDs is not linked further to any other component, it only alerts the driver through turning on the actuator.
Dependencies	The low frequency LEDs is dependent on the object sensor. Ultrasonic sensor have some range. Object sensor shall detect the object in that range, determine if it is in the blind spot region of the driver, and then activate the low frequency LEDs.
Interfaces	The links are contained in the bottom half of the screen. This should be designed to alert the driver by using low frequency LEDs. Because there's no other solution if they detect any problem in the system.
Resources	Before using it, they check that whether LEDs work correctly or not. They take the low frequency LEDs of high intensity.
Processing	None.
Data	The data that is used in it is the object, the objects that they should detect through object sensor and then pass it to the LED and activate it.

5.3 Pseudo code for components

activate ultrasonic(); % activates three sensors at the start of the system%

activate camera(); % activates three sensors at the start of the system%

activate rangefinder(); % activates three sensors at the start of the system%

set camera(); % user sets camera with the assistance of the system%

float threshold; (global var)

set threshold(); %user sets manually, the threshold, to override default settings%

mark checklist(); %after customizing the settings, user marks the checklist provided with a GUI%

do parallel %this module runs parallel to the other two%

do

{observe environment();}

while(object detection = false); %ultrasonic observes the environment for an event%

do

{activate LEDs}

while(object detection = true); %system activates the LEDs until the object disappears from the blind spot region of the driver%

do parallel   %this module runs parallel to the other two%

do

{take video feed();}

while(true); %system takes the video feed of the driver at all times after the system is turned on%

do

{process frames();

compare frames();

}

while(comparison = true) %frames are processed and compared until an event occurs%

do

{activate vibrator();

compare frames() = false;}while(comparison = false); %if the features(iris) of the driver are found different(greatly e.g closed or not where they are supposed to be) then the actuator is turned on%

do parallel   %this module runs parallel to the other two%

bool a=false, float time;

do

{observe environment();}while(object detection = false); %environment is observed(directly in front of the car) until an event occurs%

do

{activate rangefinder();

activate accelerometer();

}

while(object detection = true); % if an object is found in front of the car, system activates range finder and accelerometer%

x = get distance;

y = get speed;   %distance and speed are observed by the sensors%

calculate time()

{ time = x/y;   %time to approach the next vehicle is calculated%

a = true;

```
 }
If (time<=threshold)
Do
{activate buzzer();
If(object detection = false)
a=false;
}
while(a = true);  %if the time if found less than the set threshold, it activates actuator%
```

5.4 Conclusion:

In that chapter, the purpose of this document is to present a detailed description of the implementation of our project, Driving Assist and Safety System is complete. In this document, they should discuss the source code used for the system and the component use in implementation of the system.

CHAPTER 6

ANALYSIS AND EVALUATION

6. Analysis and Evaluation:

(Testing and validation)

6.1 Introduction:

Testing of the software projects involve different levels of testing to make sure that the software which is being developed is error and fault free. Driving Assist and Safety System has different modules which were developed separately depending up on the functionalities. Therefore testing of all the modules has to be done and testing while integrating all the modules. To ensure quality of the product, testing is conducted. Accuracy and efficiency of tasks performed by our system had to be tested to analyze the system and verify and validate it. Software testing techniques and results obtained are discussed in the coming sections.

6.2 Testing Levels:

Separate modules were developed to provide different functionalities of the system. All of these modules were tested at different levels during development and after integration. Different levels of testing and results have been described here:

6.2.1 Unit Testing:

Unit testing involves the testing of each module at the completion and sometimes during the development of the module. Each module was designed, developed and tested individually. Each functionality was also tested separately. Detailed procedure of each test along with the expected and received results are presented below:

6.2.1.1 Integral Time Calculator

Integral Time Calculator test description shown below in table 6-1

Table 6 - 1 Integral Time Calculator

Test Case ID	1
Unit to Test	Integral Time Calculator
Assumptions	1. Range Finder is placed in the module circuit. 2. Accelerometer is placed in the module circuit. 3. Sonar and Accelerometer are working properly. 4. Buzzer (Actuator) is working in module circuit.
Test Date	1. During Distance values. 2. During Speed values.
Steps to be Executed	1. Functions receives values from range finder and accelerometer. 2. Functions calculate time. 3. Time is checked against the threshold. 4. Actuators activates.
Expected Result	Actuators activated when required.
Actual Result	As Expected.
Pass/Fail	Pass.

6.2.1.2 Object Detection

Object detection test description shown below in table 6-2

Table 6 - 2 Object Detection

Test Case ID	2
Unit to Test	Object Detection.

Assumptions	1. Sonar is placed at required angle in the module circuit. 2. Sonar is working properly. 3. Actuators are placed in module circuit.
Test Date	1. Dummy Sonar values.
Steps to be Executed	1. Functions receive values from Sonar. 2. Object is detected by the Sonar. 3. Actuator activated.
Expected Result	Actuators activated when required.
Actual Result	As Expected.
Pass/Fail	Pass.

6.2.1.3 Eye Detection

Eye detection test description shown below in table 6-3

Table 6 - 3 Eye Detection

Test Case ID	3
Unit to Test	Eye Detection.
Assumptions	1. Camera is integrated with the processing unit. 2. Camera is placed in the right angle for the driver. 3. Camera is working in daylight. 4. Actuator is placed in the module circuit. 5. Camera and actuators are working properly.
Test Date	1. Video
Steps to be Executed	1. Function receives the camera feed in real time. 2. Features are detected from the human face. 3. Eyes are detected and monitored. 4. Closed eyes are detected for a certain period of time. 5. Actuator activates.
Expected Result	Actuators activated when required.

Actual Result	As Expected.
Pass/Fail	Pass.

6.2.1.4 Simulation

Simulation test description shown below in table 6-4

Table 6 - 4 Simulation

Test Case ID	4
Unit to Test	Simulation
Assumptions	1. Screen is placed correctly in the system circuit. 2. Screen is working properly. 3. Values are being received from accelerometer, range finder and the time of approach to the next vehicle.
Test Date	Dummy Sonar data, Distance in meters, Speed, Time.
Steps to be Executed	1. Sonar data is received by the application. 2. Distance, Speed is received by the application. 3. Time is calculated by the application. 4. Time is displayed. 5. Distance is displayed. 6. Speed is displayed. 7. Alerts generated from the simulation upon object detection by the sonar.
Expected Result	Time, Distance, Speed, Alerts are generated by the simulation.
Actual Result	As Expected.
Pass/Fail	Pass.

6.2.2 Integration Testing:

Integration testing steps shown below in table 6- 5.

Table 6- 5 Integration Testing

1	All the sub controllers created for unit testing were replaced with actual applications and modules
2	All the expected results were confirmed with real testing and the results were successful
3	In the next step, Vehicle controller functionality was successfully tested

6.2.3 System Testing:

System testing is the level of testing which comes when the whole system has been developed and integrated. The complete system was tested in different inputs with different conditions to verify that those conditions do not disrupt the performance of the system. There were no significant findings that need to be documented. All the functional requirements were verified and whole system was analyzed for performance and other attributes (failures, response delays, connection losses etc.).

6.3 Analysis:

The results were very encouraging and reported errors were well within acceptable range. DASS is an idea under development therefore there is a room for further improvements and updates to the system. As a whole, the system is fully functional and reliable.

6.4 Conclusion:

In that chapter, the purpose of this document is to present a detailed description of the different testing case involved in our project, Driving Assist and Safety System is complete. In this document, they should discuss unit testing, integration testing and system testing of the system.

CHAPTER 7

FUTURE WORK

7. Future Work:

This Document is concerned with the development of a model bases framework and its associated tool for the design and evaluation of driver's competence, such that the dependability of the assessment can be guaranteed. This document opens up a realm of possibilities where future researchers can produce more powerful, user friendly software that can analyze all the possible performance factors with all the variables involved in driving, producing reliable results.

As mentioned previously, that the driving experiment for this document was conducted on open roads using raspberry pi. Further experimentation with advancement can produce more finding related to the difference in novice and experienced drivers. Along with this, different types of vehicles can be used to verify the driving performance of both novice and experienced drivers.

Secondly, more complex moves can be incorporated into this system to make it more comprehensive. Along with this, additional sensors monitoring more variables related to driver, vehicle and environment shall definitely increase the robustness and effectiveness of this system. Furthermore, a GPS receiver that shall have a sub-meter precision can improve spatial resolution of the data collected during experiment. Future work shall include the use of a differential GPS receiver for improved accuracy of the results that are computed using GPS data.

There is a strong need for sponsored funding for such research oriented projects as the cost involved in working with real cars is very high. DASS suffered from lack of sufficient budget therefore it was developed on small scale car. In future, such sponsorships shall provide a Launchpad for development of DASS on more than one car at a time which require a high level of accuracy and reliability. They believe that Military College of Signals shall carry this project further in the coming years and it should be refined and implemented on real cars.

CHAPTER 8

CONCLUSION

8. Conclusion:

The goal of this project was to give a proof of concept which is revolutionary in nature. Technology is advancing at a very rapid pace and robots are taking over many of the laborious tasks which were once performed by human beings. Modern cars are now controlled by computer i.e. Electronic Control Unit(ECU) and provide great relief to drivers by taking over few of the control parameters for example “Cruise Control” where the onboard controller maintains the car at a specific speed.

The Driving Assist and Safety System has three modules and they implemented all the modules namely Safe distance keeping, Driver alertness and Blind Spot detection.

There are certain problems the drivers face while driving a car like Blind Spot problem, drivers’ lack of attention while driving the car (eye contact) and distance from the car in front. To cater for these problems, they should propose a system also consisting some safety measures. The system shall be able to inform and alert the driver about any vehicle in his/her blind spot at the time of steering, sound an alarm when the drivers’ eye contact is not with what it should be after a certain period of time and the distance from the next car accoring to his own speed (safe/unsafe).

APPENDIX

GENERAL INFORMATION

General Information section explains in general terms the system and the purpose for which it is intended.

1.1. Organization of the Manual

The user's manual consists of five sections: General Information, System Summary, Getting Started, Using the System, and Reporting.

General Information section explains in general terms the system and the purpose for which it is intended.

System Summary section provides a general overview of the system. The summary outlines the uses of the system's hardware and software requirements, system's configuration, user access levels and system's behavior in case of any contingencies.

Getting Started section explains how to get Driving Assist and Safety System and install it on the device. The section presents briefly system menu.

Using The System section provides a detailed description of system functions.

Reporting section describes in what way information collected by the application are presented and how to access the information.

1.2. Acronyms and Abbreviations

DASS	Driving Assist and safety system.
FAQ	Frequently Asked Question
UI	User Interface
SRS	Software Requirements Specification
OS	Operating System
RAM	Random Access Memory
Mb	Megabytes.
GHz	Gigahertz.

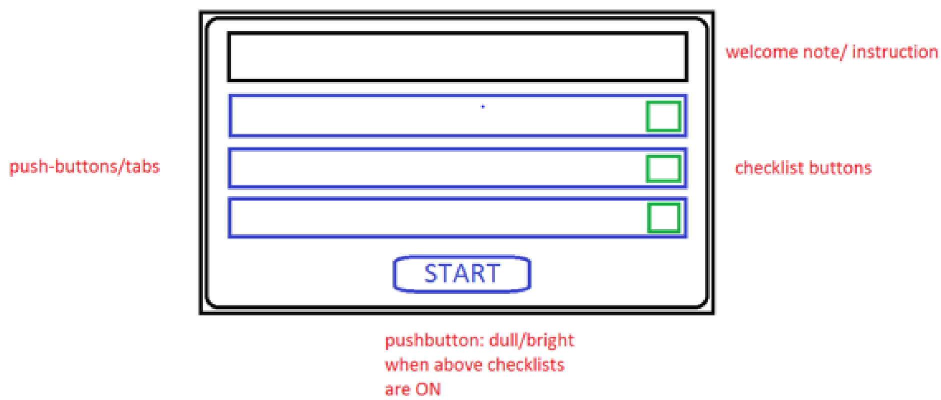
GETTING STARTED

Getting Started section explains how to get Driving Assist and Safety System and install it on the device. The section presents briefly system menu.

2.1 Logging On

The installation version currently available and it should be installed on debian Linux environment. For specific instruction on how to install application on Linux environment refer to specific device manual

2.2 System Menu

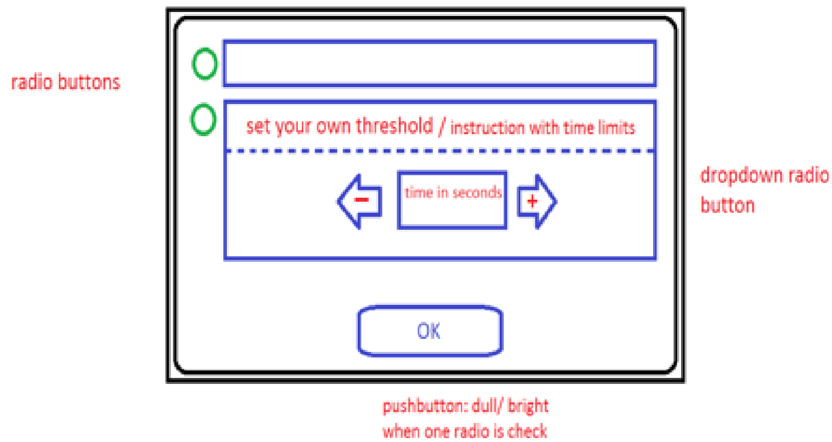


DASS is embedded system, which consists of 3 tabs/push buttons (Figure 1).

Each tab consist of one module each. If you want to choose safe distance keeping module then check the button of 1st tab. If you want to choose blind spot module then check the button of 2nd tab. If you want to choose driver alertness module then check the button of 3rd tab. All the tabs have icon and, additionally, name at the bottom to allow distinguishing them easily.

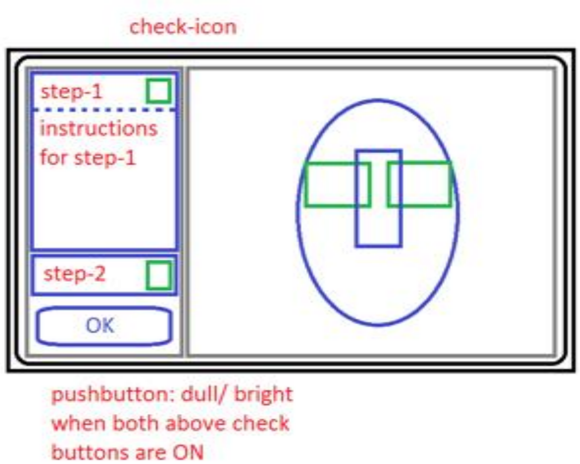
2.2.1 Safe Distance keeping

Safe distance keeping module tab consist of threshold one tab in which driver first set the threshold value that is mostly 3 sec. After setting the threshold value driver check the box and move on. If the car with the installed system has the approaching time of minimum 3 sec to the next car. If the time is less or equal to 3 sec then the system will alert the driver by using buzzer.



2.2.2 Driver Alertness

Driver alertness module tab consist of 2 tab. In 1st tab user first see the instruction if using that module and in 2nd tab before start driving capture the image because after starting driving frames of images before and after driving compare. To alert the driver when the drivers not concentrate on his/her driving then they use a vibrator that is attached with steering to vibrate and alert the driver by using vibrator that is attached to the steering wheel of the system.



2.2.3. Blind Spot Detection

Blind spot detection tab show the reminder for driver to set the mirror according to his/her own priority where the sensor of blind spot detection attached. It is the region on the both side of car which is outside the vision angle of driver and side mirrors combined. System will detect the object (vehicle) present in the blind spot region and alert the driver by using LED.

2.3 Exit System

Driving Assist and Safety System can be closed by selecting back button and at the end choosing exit button from the start menu

USING THE SYSTEM

This section provides a detailed description of system functions.

3.1.1 System Menu

DASS is embedded system, its system menu screen consists of 3 tabs/push buttons (Figure 1).

Each tab consist of one module each. If you want to choose safe distance keeping module then check the button of 1st tab. If you want to choose blind spot module then check the button of 2nd tab. If you want to choose driver alertness module then check the button of 3rd tab. All the tabs have icon and, additionally, name at the bottom to allow distinguishing them easily.

3.1.2 Safe Distance Keeping

Safe distance keeping module tab consist of threshold one tab in which driver first set the threshold value that is mostly 3 sec.

To determine the right distance, first select a fixed object on the road ahead such as a sign, tree or overpass. When the vehicle ahead of you passes the object, slowly count "one thousand, two one thousand, three one thousand." Making sure there are three seconds between you and the car ahead gives you time and distance to respond to problems in the lane ahead of you.

Inclement Weather, Heavy Traffic, or Night-Time Driving - In heavy traffic, at night, or when weather conditions are not ideal (eg. light rain, light fog, light snow), double the three second rule to six seconds, for added safety.

Poor Weather **-** If the weather conditions are very poor, eg. heavy rain, heavy fog, or heavy snow, start by tripling the three second rule to nine seconds to determine a safe distance.

Tailgating – To move behind a vehicle too closely is called 'tailgating'. Tailgating is an aggressive driving behavior that is easily mistaken for **road rage**. Use the three-second rule to avoid tailgating. Most rear end collisions are caused by the vehicle in back too closely. If someone is tailgating you, move to another lane or turn off the road as soon as possible and allow the tailgating vehicle to pass

Three-Second Rule		**Safe Interval Should Be >**	**3 seconds**	**6 seconds**
Speed	Distance Traveled	For These Conditions >	Good	Marginal
25 m.p.h.	37 ft. per second		111 ft.	222 ft.
35 m.p.h.	52 ft. per second		166 ft.	312 ft.
45 m.p.h.	66 ft. per second		198 ft.	396 ft.

55 m.p.h.	81 ft. per second	243ft.	486 ft.
65 m.p.h.	96 ft. per second	288 ft.	576 ft.
75 m.p.h.	111 ft. per second	333 ft.	666 ft.
		Safe Distance in Feet	

Those that drive family & economy cars tailgate less than those who drive sportscars and SUVs by a ratio of 2 to 1.

The results for the 10 states in this sample for which I had enough respondents to make statistical comparisons, show the worst five States with a mean of 21% dangerous tailgating: Colorado (25%), Georgia (20%), Pennsylvania (20%), Michigan (19%), Texas (19%). The lowest tailgating States are: Illinois (8%), New York (10%), Florida (14%), Ohio (15%), California (18%).

There are as you might expect, age differences as well as gender differences. Among young drivers, 19% admit to tailgating dangerously, which is about one in five. This is more than middle aged drivers (15%) and senior drivers (6%). This age pattern recurs in many aggressive driving behaviors: as they get older, they drive less aggressively. Women admit to as much tailgating as men (15%), in general, but once again there are significant influences attributable to the type of car they drive, as show in this table:

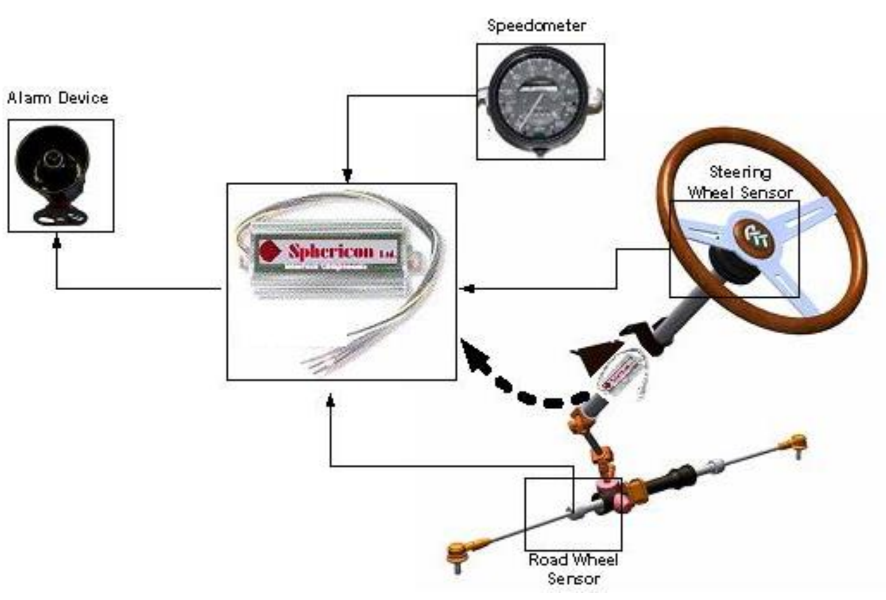
Tailgating	**Type Of Vehicle**		
Sex Of Driver	Family / Economy Cars	Sports Cars	SUVs
Male	13%	23%	18%
Female	13%	20%	25%

You can see that those drive the "soft" cars (family and economy) tailgate less than those who drive the "hard" cars (sports and SUV) with a ratio of two to one. This holds true for both men and women. However, with SUV drivers they see a reversal between the genders: more female SUV drivers tailgate dangerously, by their own admission, than male drivers of SUVs.

3.1.3 Driver Alertness

Driver alertness module tab consist of 2 tab. In 1st tab user first see the instruction if using that module and in 2nd tab before start driving capture the image because after starting driving frames of images before and after driving compare. To alert the driver when the drivers not concentrate on his/her driving then they use a vibrator that is attached with steering to vibrate and alert the driver by using vibrator that is attached to the steering wheel of the system.

Driver Alertness System will receive information on the steering system dynamics from two sensors located, respectively, at the steering wheel side and at the road wheel side of the steering system and from the vehicle speedometer. Driver Alertness System will communicate with the vehicle computer and will send it a signal when the warning of the driver is necessary.



Driver Alertness system is presently being developed for installation in new vehicles during production. The possibility of its expansion into the after-market will be explored, in particular for heavy vehicles where installation and interfacing with existing vehicle is likely to be considerably easier.

The first users of Driver Alertness system are expected to be the long-haul trucking and motor coaches, large fleet companies. Their operations are typified by long driving hours, and they suffer the most when a company vehicle gets involved in a fatigued and drowsy driver related crashes. Moreover, the decision to use a driver monitoring and alarm system is made by management, not by an individual driver who might not be keen on putting a safety device high on his or her priority list. Other commercial vehicle companies are expected to follow suit, motivated by the apparent performance of the system.

The penetration of Driver Alertness system into the passenger car market is expected to start at the high-end, car models. This is the market segment where new features are usually tested first due to the relatively large profit margins which give the car manufacturer the freedom to try new features and because the typical luxury car users are inclined to try new technologies in their cars.

3.1.3. Blind Spot

Blind spot detection tab show the reminder for driver to set the mirror according to his/her own priority where the sensor of blind spot detection attached. It is the region on the both side of car which is outside the vision angle of driver and side mirrors combined. System will detect the object (vehicle) present in the blind spot region and alert the driver by using LED.

Blind spot monitoring systems utilize radar based technology that is either mounted below side mirrors or in the rear bumper of the vehicle. The radar sensors emit and receive electromagnetic waves that are tuned to a specific frequency and distance by the system suppliers. When an approaching vehicle is within the range of the electromagnetic wave, it is reflected off of the approaching vehicle and sent back to the primary vehicle. This information is then processed by the Blind Spot Detection (BSD) controller to determine whether or not an alert condition exists. If an alert condition exists, the warning lights in the A-pillar or side mirror will be illuminated.

Most radar based blind spot monitoring systems utilize a short range pulse that has a potential range of approximately 100ft. While the sensors have the ability to measure up to the maximum distance their detection range is tuned by the manufacturer to a distance that is determined to provide adequate response yet not too far to create an annoying alert when vehicles are driven in typical traffic conditions.

AUDIO / VISUAL DISPLAY:

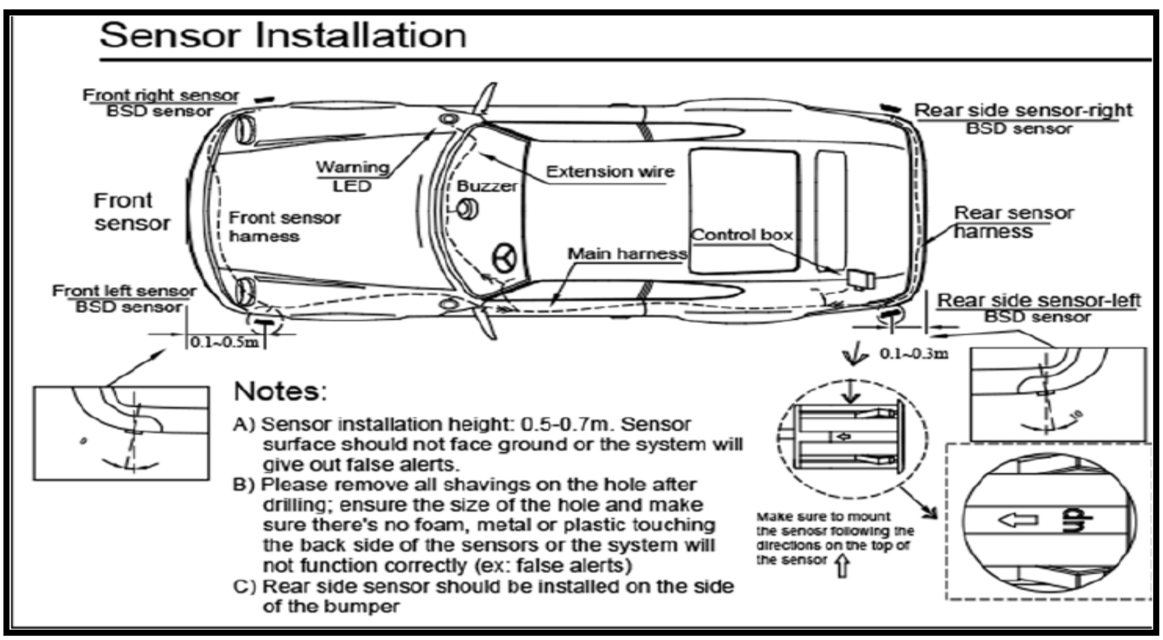
The BSD systems typically notify the driver with a visual alert in either in the A-pillar of the car or in the side view mirror as shown below. Most manufacturers do not use an audible alert for blind spot warning systems due to the annoyance potential of an audible alarm in traffic conditions. If a driver attempts to make a lane change towards a vehicle in their blind spot, the system may issue an audible alarm or flash the BSD warning light to indicate a potential collision.

BLIND SPOT DETECTION TESTS

The target vehicles were driven according to the test plan in the lane adjacent to the vehicle-under-test. In certain test scenarios, the target vehicle will approach the subject vehicle in the same lane to simulate a last minute passing maneuver by the target vehicle. The detection distance and response time for the data table within the *results section* is an average of the five test runs.

				Target Vehicle	
Blind Spot Monitoring Test Scenarios	Vehicle Side	Subject Vehicle	Target Vehicle	Full-size Sedan	Motorcycle
Minimum Activation Speeds	Right	Slow Accel	Slow Accel	X	
Lateral Activation Distance	Right	40	40	X	
Longitudinal Activation Distance	Right	40	40	X	
Small Speed Differential	Left	55	70	X	X
Large Speed Differential	Left	25	75	X	X
Pass from Behind	Left	60	75	X	X
Small Speed Differential	Right	55	70	X	X
Large Speed Differential	Right	25	75	X	X
Pass from Behind	Right	60	75	X	X
Two Vehicle Passing	Both	55	70	X	

Blind Spot Sensor Installation:



3.2 Special Instructions for Error Correction

The system shall ensure all sorts of safety to the environment and user, i.e. it shall not causing any danger to the environment with any sorts of pollution, it shall not be harmful to the user mentally or physically. The system software will be upgraded for the fixation of bugs (expected as prototype) reported by the users after every specific period of time. The System shall have the capability to evolve according to the changing needs/environment. It shall be able to incorporate new requirements in the individual modules. Therefore, system shall be checked for evolutionary changes every year.

3.3 Caveats and Exceptions

Security signatures will be embedded in "apk" file of the application i.e. the end product. No security certificates are required other than the default ones

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