|  |
| --- |
| Name: Udugama Nuwanthika |
| Student Reference Number: 10749139 |



|  |  |
| --- | --- |
| Module Code: PUSL2023 | Module Name: Mobile App Development |
| Coursework Title: Final Report | |
| Deadline Date:17th of May 2022 | Member of staff responsible for coursework:  Mr. Iman Ashly |
| Programme: BSc (Hons) Software Engineering | |
| Please note that University Academic Regulations are available under Rules and Regulations on the University website [www.plymouth.ac.uk/studenthandbook](http://www.plymouth.ac.uk/studenthandbook). | |
| Group work: please list all names of all participants formally associated with this work and state whether the work was undertaken alone or as part of a team. Please note you may be required to identify individual responsibility for component parts.  Udugama Nuwanthika 10749139  Rajapaksha Rajapaksha 10749121  Merenna Amarasinghe 10749150  Sakaladhipathige Fernando 10749110  Bopage Muthumala 10749145  Randeera Withanage 10749185  ***We confirm that we have read and understood the Plymouth University regulations relating to Assessment Offences and that we are aware of the possible penalties for any breach of these regulations. We confirm that this is the independent work of the group.***  A black and white photo of a handwritten note  Description automatically generated with low confidence  Signed on behalf of the group: | |
| Individual assignment: ***I confirm that I have read and understood the Plymouth University regulations relating to Assessment Offences and that I am aware of the possible penalties for any breach of these regulations. I confirm that this is my own independent work.***  Signed: | |
| Use of translation software: failure to declare that translation software or a similar writing aid has been used will be treated as an assessment offence.  I \*have used/not used translation software.  If used, please state name of software………………………………………………………………… | |
| **Overall mark \_\_\_\_\_% Assessors Initials \_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_** | |

\*Please delete as appropriateSci/ps/d:/students/cwkfrontcover/2013/14

***A picture containing diagram

Description automatically generated***

# Acknowledgement

Without the collaboration and support from many people who contributed to this Mobile Application Development project, it would not have been feasible to complete it. However, we want to convey our gratitude and indebtedness to our module leader, Mr. Iman Ashly for their continuing support, compassion, and understanding throughout the project. Thank you so much for your continuous support and presence at all times. Our gratitude also goes to our university for providing us with the resources we needed to complete the project. Thank you to everyone who has generously offered their expertise and recommendations to assist us improve our project.

**Table of Contents**

[Acknowledgement 1](#_Toc103675291)

[Table of Figures 3](#_Toc103675292)

[Chapter 1 – Introduction 4](#_Toc103675293)

[1.1 Introduction 4](#_Toc103675294)

[1.2 Requirements 5](#_Toc103675295)

[1.2.1 Functional Requirements 5](#_Toc103675296)

[1.2.2 Non – Functional Requirements 8](#_Toc103675297)

[1.3 Scope of the Project 8](#_Toc103675298)

[Chapter 2 – System Overview 9](#_Toc103675299)

[2.1 High Level Architecture Diagram 9](#_Toc103675300)

[2.2 APIs and Technologies Used 10](#_Toc103675301)

[2.3 Challenges and the Actions Taken to Overcome 11](#_Toc103675302)

[Chapter 3 – Real-World Applications and Future Enhancement 12](#_Toc103675303)

[3.1 Usefulness in the Real-World Applications 12](#_Toc103675304)

[3.2 Future Enhancements 13](#_Toc103675305)

[Chapter 4 – Conclusion 14](#_Toc103675306)

[Team Plan & Responsibility Matrix 15](#_Toc103675307)

[References 16](#_Toc103675308)

# Table of Figures

# Chapter 1 – Introduction

## 1.1 Introduction

The Head-Up Display (HUD) is a technology that projects an essential information about directly the driver's line of sight onto the vehicle's windscreen without restricting it. HUDs have become more popular in automobiles in recent years. HUDs, which are common in both real and simulated airplanes, convey information to the driver (or pilot) without requiring them to adjust their line of sight. HUDs are not a new concept in cars; they were first seen in 1988. In the last 20 years, technological advancements have enabled more information to be displayed in higher quality. Several car manufactures, like BMW, Lexus, and General Motors, have HUDs incorporated into their vehicles nowadays. The driver's concentration remains on the road ahead, which not only improves safety but also reduces eye fatigue by decreasing the need to move focus between the road and the instruments. Because of that they don’t have to struggle looking for information inside the car and Eyes tend to re-focus faster on the road when you take your eyes off the it.HUD technology has advanced significantly over time. For instance, now it can react to ambient light, so the displays are just as clear whether you're driving at night or during the day.

**Graphical user interface, application, Teams

Description automatically generated**This in-built HUD technology is only available at new luxury vehicles. There are some third-party systems can be purchased and installed to serve comparable functions. However, it is a very expensive task. Therefore, as a solution for that we launched our Head-Up Display Widgets for vehicle drivers who are lacking built-in HUDs.To achieve this, we use android device to projects a transparent image on to the windscreen. Driver can see the compass, vehicle speed, pitching of the vehicle, rolling of the vehicle, live location of the vehicle and trip info. Drivers will get all the information that you need while driving at single place.

## 1.2 Requirements

### 1.2.1 Functional Requirements

* Check the Speed

To display the accurate speed of the vehicle, at least vehicle speed should have 4kmph

A picture containing text, device, meter, control panel

Description automatically generatedspeed.

* Check the Pitching

We get X axis value by using android device acetometer sensor, we decide the pitching of the vehicle.

* Check the Rolling

Diagram

Description automatically generatedBy using the android device acetometer sensor, we get Y axis value and decide the rolling of the vehicle

* Compass

By using the magnetic sensor of the android device, we display all the 8 directions.

A screenshot of a computer screen

Description automatically generated with medium confidence

* Live Location Tracking

We use Google Maps API (Night Mode) for live location tracking.

Chart

Description automatically generated with medium confidence

* Check Trip Info

In here, users can click the ‘’Start’’ button in the beginning of a new journey and click the ‘’End’’ button in the end of the journey. After the end of the journey, user can see the mileage, max speed, average speed, and the duration of the journey.

A screenshot of a computer screen

Description automatically generated with medium confidence

### 1.2.2 Non – Functional Requirements

* Performance

The system should perform fast and respond to user interactions within less time. The accuracy of the location might change depending on the GPS signal strength. Since we’ll be using an android device, the accuracy of the directions depends on the compass.

Android version should be 7.0 or higher.

* Usability

The user should be able to easily understand how to use the app. So, the UI design should be simple to avoid any confusion. Therefore, we use green, red, white, and black as colors. We will be using black as our mobile app background color.

* Scalability

Since we’re developing this app for the vehicles, we can assume that the scale won’t change much over time. So, we can identify the required resources and performance quantity wise from the beginning.

## 1.3 Scope of the Project

This is a Head-Up Display Widget for vehicle drivers who are lacking built-in HUDs.To achieve this, we use android device to projects a transparent image on to the windscreen. Driver can see the compass, vehicle speed, pitching of the vehicle, rolling of the vehicle, live location of the vehicle and trip info. In trip info driver can see mileage, max speed, average speed, and the duration of the journey. Using this widget drivers will get all the information that you need while driving at single place.

Using this HUD Widgets mobile application users can mainly check information of their vehicle. There are 6 types of widgets,

* Speedometer
* Rolling
* Pitching
* Compass
* Live Location Tracking
* Trip Info

# Chapter 2 – System Overview

## 2.1 High Level Architecture Diagram

## 2.2 APIs and Technologies Used

### **2.2.1 Used APIs**

Google Map API is being used for tracking the live location of the user. Dark theme of the google map is being used because it

### **2.2.2 Used Technologies**

Firebase is being used to save driver details and Trip Info.

Sensor Library

## 2.3 Challenges and the Actions Taken to Overcome

# Chapter 3 – Real-World Applications and Future Enhancement

## 3.1 Usefulness in the Real-World Applications

The 1988 Oldsmobile Cutlass Supreme Indianapolis 500 Pace Automobile Parade Convertible was the first car to include a Head-Up Display. While the range of content offered has expanded from vehicle status (such as speed or fuel) to road and trip details (such as collision warnings or navigation) since then, most standard or add-on HUDs on the road continue to reproduce the information accessible in existing displays. HUDs have become more popular in automobiles in recent years. HUDs, which are common in both real and simulated airplanes, convey information to the driver (or pilot) without requiring them to adjust their line of sight. HUDs are not a new concept in cars because HUD technology has advanced significantly over time. In the last 20 years, technological advancements have enabled more information to be displayed in higher quality. Several car manufactures, like BMW, Lexus, and General Motors, have HUDs incorporated into their vehicles nowadays. By using this HUDs, driver will get all the information that you need while driving at single place. They don’t have to struggle looking for information inside the car and Eyes tend to re-focus faster on the road when you take your eyes off the it.

A person driving a car

Description automatically generated with low confidence

## 3.2 Future Enhancements

The presented Head-Up Display Widget in this study, is developed using mobile phone capabilities, making the entire system less cost effective when compared to other HUDs on the market. It needs to be integrated with voice recognition, voice control, and gesture control in the future, allowing the HUD to execute functions without touching the touch screen of the android device while driving. The HUD on display can display instructions and turn by turn guidance, making driving safer and more comfortable. A car's heads-up display can be utilized to provide a variety of functions and help to the driver. With the enhancement of technology, the mass population has adopted to use GPS. The use of mobile phones and applications such as Google Maps has revolutionized navigation technology. Today, anyone with a GPS-enabled phone can travel routes with ease using Google Maps. Users can also navigate routes for driving or walking. The route's traffic condition, navigation instructions for each turn, and the anticipated time to reach the destination are only a few of the elements featured in Google Map. In addition to navigation, the HUD may be used for answering calls, messaging, playing music, controlling music volume, regulating car headlights, windows, and roof, and many other things. HUD with integrated sensors can be utilized to create an Ad-hoc network for traffic management. HUD is a platform, and it is the way of the future. With advancements in augmented reality, HUDs will be able to sense objects in the future and can be connected with automatic driving systems to provide the greatest possible experience for the user.

**A picture containing text, car, outdoor, street

Description automatically generated**

# Chapter 4 – Conclusion

Head Up Display (HUD) will show various forms of information in a predetermined area, allowing the driver to see it without having to shift their focus to a display console or GPS screen that is out of their field of vision. It will completely immerse the driver in their vehicle, displaying speed, rolling, pitching, and other information on any accessible windshield. A-HUD develops a network of cars using a high-bandwidth wireless network and powerful servers to gather crucial pieces of information that can better inform drivers of their journey. By tracking the driver's line of sight, it provides substantially more info than any current navigation system or HUD while keeping a simplistic display technique. Traffic monitoring and navigation is seen as the primary application, however the increased amount of data combined with the augmented reality display of information will support many other uses.

# Team Plan & Responsibility Matrix

|  |  |  |
| --- | --- | --- |
| Plymouth ID | Name | Tasks Carried Out |
| 10749139 | Udugama Nuwanthika | * Development of Speedometer |
| 10749121 | Rajapaksha Rajapaksha | * Firebase Authentication and User Profile |
| 10749150 | Merenna Amarasinghe | * UI & UX Design |
| 10749110 | Sakaladhipathige Fernando | * Development of Compass |
| 10749145 | Bopage Muthumala | * Development of Rolling & Pitching |
| 10749185 | Randeera Withanage | * Development of Navigation System |

# References

Chu, K.-H., Brewer, R.S. and Joseph, S. (2008). Traffic and Navigation Support through an Automobile Heads Up Display (A-HUD). *undefined*. [online] Available at: [https://www.semanticscholar.org/paper/Traffic-and-Navigation-Support-through-an-Heads-Up-Chu-Brewer/3ba82361f8d09fe711b620b356934d1c64cf6cc3](https://www.semanticscholar.org/paper/Traffic-and-Navigation-Support-through-an-Heads-Up-Chu-Brewer/3ba82361f8d09fe711b620b356934d1c64cf6cc3%20) [Accessed 16 May 2022]

S. Chouksey and S. Sirsikar, "A prototype of low cost heads up display for automobiles navigation system," 2016 International Conference on Computing, Analytics and Security Trends (CAST), 2016, pp. 205-210, doi[: 10.1109/CAST.2016.7914967‌](https://scholarspace.manoa.hawaii.edu/server/api/core/bitstreams/a24b3871-b6fe-4d6e-bfa9-66396c231425/content)

Currano, R. & Park, So Yeon & Moore, Dylan & Lyons, Kent & Sirkin, David. (2021). Little Road Driving HUD: Heads-Up Display Complexity Influences Drivers’ Perceptions of Automated Vehicles. 1-15. [10.1145/3411764.3445575](https://dl.acm.org/doi/10.1145/3411764.3445575)

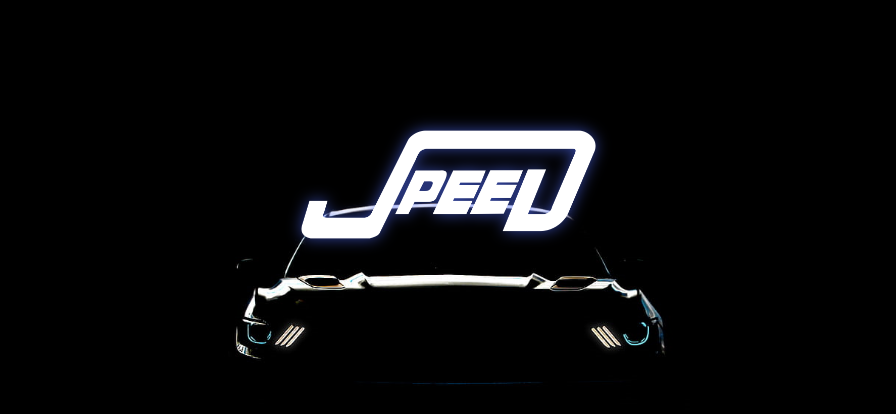
Steinfeld, A. and Green, P. (1995). *Driver Response Times to Full-Windshield, Head-Up Displays for Navigation and Vision Enhancement*. [online] Available at: <https://www.cs.cmu.edu/~astein/pub/UMTRI-1995-29.pdf> [Accessed 16 May 2022]

Burnett, G. (2000). USABLE VEHICLE NAVIGATION SYSTEMS: ARE WE THERE YET? *undefined*. [online] Available at: [https://www.semanticscholar.org/paper/USABLE-VEHICLE-NAVIGATION-SYSTEMS-%3A-ARE-WE-THERE-Burnett/2a3fe1df4fb8094fc145bb433472c858149f5c37?sort=relevance&pdf=true](https://www.semanticscholar.org/paper/USABLE-VEHICLE-NAVIGATION-SYSTEMS-%3A-ARE-WE-THERE-Burnett/2a3fe1df4fb8094fc145bb433472c858149f5c37?sort=relevance&pdf=true%20) [Accessed 16 May 2022]

‌

‌

‌

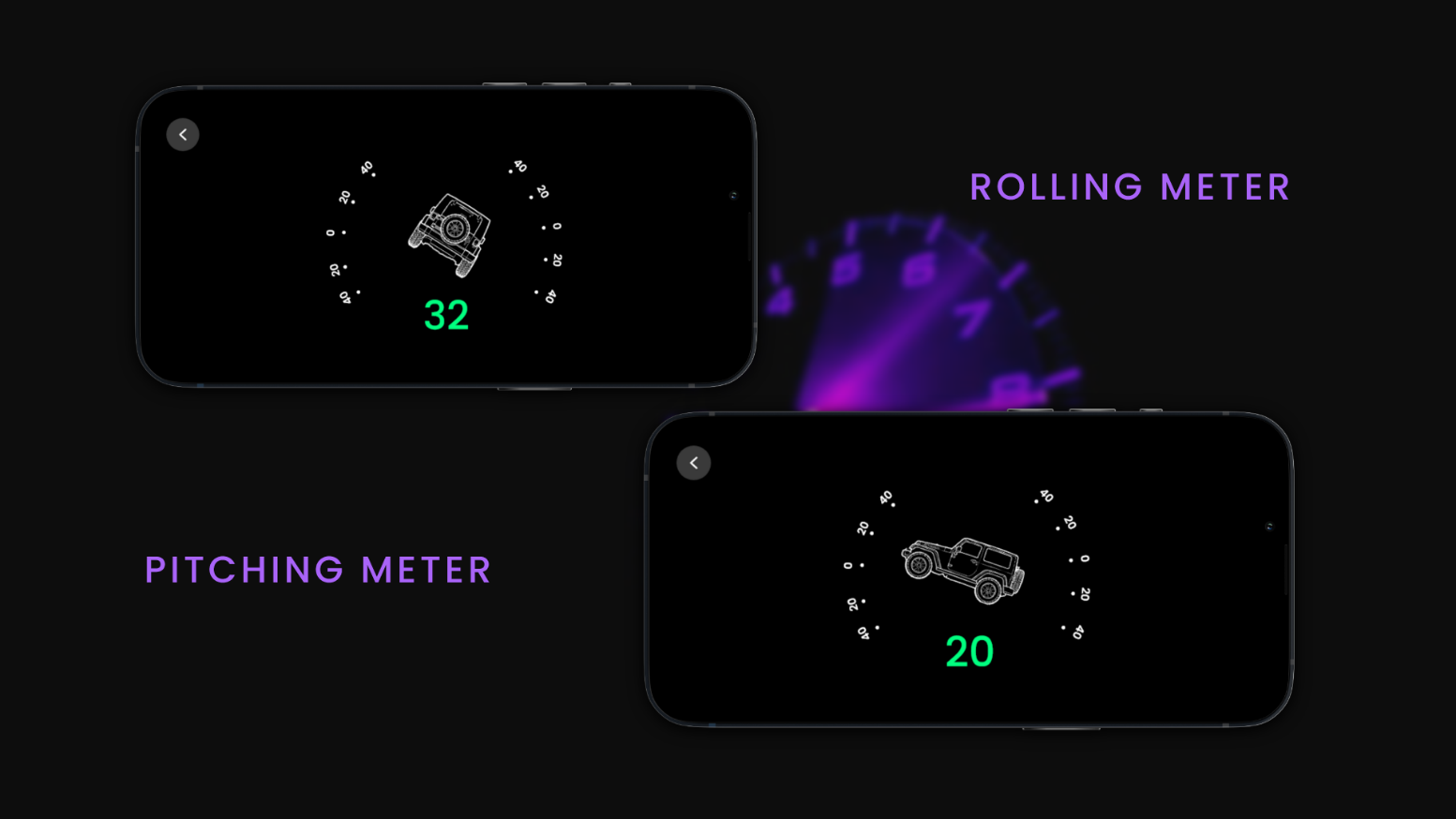


***Splash Screen***

**Mock-ups**







A screenshot of a computer

Description automatically generated with low confidence