COLLISION AVOIDANCE AND TRAFFIC SAFETY ON ANDROID

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Bachelor of Engineering with Honours in Electronics (Computer) 2015
DECLARATION OF ORIGINAL WORK

This declaration is made on the 17th day of June 2015.

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17th June 2015
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I, Dr. SHAFRIDA SAHRANI hereby certifies that the work entitled COLLISION AVOIDANCE AND TRAFFIC SAFETY ON ANDROID was prepared by the above named student, and was submitted to the “FACULTY” as a partial/full fulfillment for the conferment of BACHELOR OF ENGINEERING with HONORS, and the aforementioned work, to the best of my knowledge, is the said student's work.

Received for examination by: Dr. SHAFRIDA SAHRANI
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COLLISION AVOIDANCE AND TRAFFIC SAFETY ON ANDROID
This Thesis is dedicated to my dearest family and lovely friends.
ACKNOWLEDGEMENT

I would like to express my very great appreciation to supervisor Dr. Shafrida Sahrani whose contribution in guiding and giving encouragement helped me in the effort to completing this project and writing this report. Her willingness to give her time so generously has been very much appreciated.

I wish to express my sincere thanks to Hj. Khairilzamrie Ros and Mohd. Roffizal Romali, staff of UNIMAS Centre for Information & Communication Technology Services (CICTS). I am extremely thankful and indebted to them for sharing expertise, and sincere and valuable guidance and encouragement extended to me.

I would like to offer special thanks to my friends especially fellow classmate Hii Sin Wei who have been a lot of help in providing moral support and guidance throughout my effort in completing this project.

Finally, I wish to thank my parents and my beloved family for their love and endless support throughout my studies.

Thank You!
ABSTRACT

Nowadays, road has become a very dangerous place with traffic fatalities becoming one of the leading causes of death in the modern world. Traffic control system like the traffic lights and warning signs alone is sometimes just not enough to prevent traffic fatalities from happening. A more relevant and handy solution is needed in order to aid road users in raising awareness to road surroundings. Considering the technological advancement in mobile computerized devices nowadays, a mobile application can be made to become a tool to aid increase awareness to road users that mostly acquire a smartphone. A warning system based mobile app can be developed to warn or notify the road user in the event of entering an accident prone area. A mobile application is software program to be used on small, wireless devices to perform specific tasks to aid people in daily life. A mobile application can be developed using different kinds of programming language to operate on different types of mobile platform such as Android. Android is now the most used mobile platform which runs on 43% of the entire world’s smartphone. Being open source, Android draws mobile phone companies to produce phones that run Android Operating System. Collision Avoidance and Traffic Safety mobile application which is an area awareness based application is proposed in this project to aid road users in increasing awareness towards hazardous road surroundings. Collision Avoidance and Traffic Safety mobile application which is to be developed on Android mobile platform, utilize the smartphone’s Global Positioning System (GPS) and also adopt the geofence concept in order to perform its task.
ABSTRAK

# TABLE OF CONTENTS

Declaration of Original Work

PROJECT TITLE

DEDICATION

ACKNOWLEDGEMENT

ABSTRACT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

## CHAPTER 1 INTRODUCTION

1.1 Traffic Fatalities

1.2 Problem Statements

1.3 Objectives

1.4 Expected Outcomes

1.5 Collision Avoidance and Traffic Safety Mobile Application

1.6 Scope of Project

1.7 Chapter Outline

## CHAPTER 2 LITERATURE REVIEW

2.1 Traffic Monitoring and Collision Avoidance System

2.2 Mobile Operating System (OS)

2.2.1 Apple’s iOS

2.2.2 Windows Mobile

2.2.3 Research in Motion’s (RIM) BlackBerry

2.2.4 Open Source Platforms

v
CHAPTER 3 METHODOLOGY

3.1 Project Overview 27
3.2 Collision Avoidance and Traffic Safety Application Development Process 27
3.2.1 Setting up Android Studio for 64 bit Computer 29
3.2.2 Collision Avoidance and Traffic Safety Application Development using Android Studio 35
3.3 Collision Avoidance and Traffic Safety Application Flow Chart 40
3.3.1 Region of Interest (R.O.I) Definition 42

CHAPTER 4 RESULTS & DISCUSSION

4.1 Results for Collision Avoidance and Traffic Safety Application 45
4.2 Collision Avoidance and Traffic Safety Application Respond Time Analysis 63

CHAPTER 5 CONCLUSION AND RECOMMENDATION

5.1 Conclusion 69
5.2 Recommendation

REFERENCES
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table No.</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Android Platform Version and its API Level.</td>
<td>16</td>
</tr>
<tr>
<td>2.2</td>
<td>Current Features and Specifications of Android.</td>
<td>17</td>
</tr>
<tr>
<td>2.3</td>
<td>Android Studio vs. Eclipse ADT Comparison.</td>
<td>21</td>
</tr>
<tr>
<td>2.4</td>
<td>Modern Geofencing Uses</td>
<td>26</td>
</tr>
<tr>
<td>4.1</td>
<td>App Respond Time Results.</td>
<td>66</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure No.</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Percentage Share of Various Causes of Accidental Deaths during 2013 in India.</td>
<td>2</td>
</tr>
<tr>
<td>1.2</td>
<td>Estimated Road Traffic Death Rate per 100 000 Population for South-East Asia Region Countries, 2011.</td>
<td>3</td>
</tr>
<tr>
<td>2.1</td>
<td>Anti-Car Collision System Model.</td>
<td>8</td>
</tr>
<tr>
<td>2.2</td>
<td>Vehicular Collision Avoidance Support System (VCASS).</td>
<td>9</td>
</tr>
<tr>
<td>2.3</td>
<td>Principle of Anti-Collision Warning System based on Fuzzy Control.</td>
<td>11</td>
</tr>
<tr>
<td>2.4</td>
<td>Example of iOS User Interface.</td>
<td>13</td>
</tr>
<tr>
<td>2.5</td>
<td>Example of Windows Mobile User Interface.</td>
<td>13</td>
</tr>
<tr>
<td>2.6</td>
<td>Example of a Blackberry Traditional User Interface.</td>
<td>14</td>
</tr>
<tr>
<td>2.7</td>
<td>The Timeline of Android Versions Evolution.</td>
<td>15</td>
</tr>
<tr>
<td>2.8</td>
<td>Java Conceptual Diagram.</td>
<td>19</td>
</tr>
<tr>
<td>2.9</td>
<td>GPS Satellites Constellation above the Earth’s Surface.</td>
<td>22</td>
</tr>
<tr>
<td>2.10</td>
<td>Example of GPS Receivers.</td>
<td>23</td>
</tr>
<tr>
<td>2.11</td>
<td>Schematic Representation of the Global Positioning System (GPS)</td>
<td>23</td>
</tr>
<tr>
<td>2.12</td>
<td>Geofence Concept Example.</td>
<td>24</td>
</tr>
<tr>
<td>2.13</td>
<td>Geofence Activity Example.</td>
<td>24</td>
</tr>
<tr>
<td>3.1</td>
<td>Project Process Flowchart.</td>
<td>29</td>
</tr>
<tr>
<td>3.2</td>
<td>Android Studio Download Button.</td>
<td>30</td>
</tr>
<tr>
<td>3.3</td>
<td>JDK Download Button.</td>
<td>30</td>
</tr>
<tr>
<td>3.4</td>
<td>Downloading JDK for the Used Device’s System.</td>
<td>31</td>
</tr>
<tr>
<td>3.5</td>
<td>Completion of JDK Installation.</td>
<td>32</td>
</tr>
<tr>
<td>3.6</td>
<td>Completion of Android Studio Installing.</td>
<td>32</td>
</tr>
<tr>
<td>3.7</td>
<td>The Computer’s System Window.</td>
<td>33</td>
</tr>
<tr>
<td>3.8</td>
<td>The Computer’s System Properties Window.</td>
<td>34</td>
</tr>
<tr>
<td>3.9</td>
<td>The Environment Variables Setting Window.</td>
<td>34</td>
</tr>
</tbody>
</table>
3.10 The New System Variable Window.
3.11 Android Studio Welcome Window.
3.12 Choosing Name of Project.
3.13 Configuring Form Factors the App will Run on.
3.15 Configuring Selected Activity.
3.17 Application Flow Chart.
3.18 Typical Stopping Distances for Speed Travelled.
3.19 Project’s Region of Interest (R.O.I).
3.20 Demonstration of a Vehicle Entering the R.O.I.
3.21 Rarely Used Road near the MASJA Building.
3.22 R.O.I Placement on Location.
4.2 Description of Buttons in the User Interface.
4.3 ID for ‘Find Coordinates’ Button.
4.4 ID for ‘Save Point’ Button.
4.5 ID for ‘Clear Point’ Button.
4.6 Defining Latitude Text Field in ‘activity_prox_alert.xml’
4.7 Defining Longitude Text Field in ‘activity_prox_alert.xml’
4.8 Declaration of Buttons and Text Fields in Main Activity.
4.9 Association of Declared Text Fields with their Definition by IDs.
4.10 Association of Declared Buttons with their Definition by IDs.
4.11 Saving Point of Interest
4.12 Implementation of ‘onClickListener()’ method for Save Button.
4.13 Saving Coordinates in Shared Preference.
4.14 Deleting Point of Interest.
4.15 Implementation of ‘onClickListener()’ method for Clear Button.
4.16 'clearProximityAlertPoint()' to Perform the Deleting of Saved Point.

4.17 Find Coordinate Button is Pressed.

4.18 Calling 'populateCoordinatesFromLastKnownLocation()' on Button Click.

4.19 Obtaining Current Coordinate from GPS.

4.20 Permission to Access Device's GPS.

4.21 Retrieving 'LocationManager' through 'Context.getSystemService(Content.Location_Service)'.

4.22 Registering 'LocationListener' with Location Manager Service.

4.23 Implementing 'LocationListener' to Perform Distance Calculation.

4.24 User's Distance to R.O.I Point Toast Message.

4.25 Setting Permission to Access Vibrator.

4.26 Contents that Make Up the Warning Notification Alert.

4.27 Notification Alert within Accident Prone Region.

4.28 User at Distance of 3 meters from R.O.I Point

4.29 Warning Toast Message

4.30 If-Else implementation to Create Geofence.

4.31 Notification Alert outside Accident Prone Region.

4.32 User at Distance of more than 3 meters from R.O.I Point

4.33 Outside Danger Zone Toast Message.

4.34 Creating Notification for more than 100 meters Distance Case.

4.35 Straight Road Testing Condition

4.36 Road for Testing Activity.


4.38 Demonstration of the Conducted Test.

4.39 Crooked Road Condition

4.40 T-Junction Condition

4.41 Roundabout Condition
# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADT</td>
<td>Android Development Tools</td>
</tr>
<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
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<td>API</td>
<td>Application Program Interface</td>
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<tr>
<td>DGPS</td>
<td>Differential Global Positioning System</td>
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<td>DoD</td>
<td>Department of Defense</td>
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<td>EDGE</td>
<td>Enhanced Data rates for Global Evolution</td>
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<td>EKF</td>
<td>Extended Kalman Filters</td>
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<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>GSM</td>
<td>Global System for Mobile</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
</tr>
<tr>
<td>IDE</td>
<td>Integrated Development Environment</td>
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<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
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<tr>
<td>ITS</td>
<td>Intelligent Transport Systems</td>
</tr>
<tr>
<td>IVC</td>
<td>Inter-Vehicle Communications</td>
</tr>
<tr>
<td>JDK</td>
<td>Java Development Kit</td>
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<tr>
<td>JRE</td>
<td>Java Runtime Environment</td>
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<tr>
<td>JVM</td>
<td>Java Virtual Machine</td>
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<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>NDK</td>
<td>Native Development Kit</td>
</tr>
<tr>
<td>OS</td>
<td>Operating System</td>
</tr>
<tr>
<td>PCs</td>
<td>Personal Computers</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>R.O.I</td>
<td>Region of Interest</td>
</tr>
<tr>
<td>SDK</td>
<td>Software Development Kit</td>
</tr>
<tr>
<td>SE</td>
<td>Standard Edition</td>
</tr>
<tr>
<td>U.S</td>
<td>United States</td>
</tr>
<tr>
<td>UI</td>
<td>User Interface</td>
</tr>
<tr>
<td>VCASS</td>
<td>Vehicular Collision Avoidance Support System</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>Wi-Fi</td>
<td>Wireless Fidelity, Wireless Internet</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

1.1 Traffic Fatalities

From the beginning of the era of mechanized vehicles, road safety issues have become a major concern [1]. Based on Global Status Report on Road Safety 2013, 1.24 million people died as the result of traffic fatalities in 2010 and there have been no overall reduction in the figure of deaths ever since which is roughly 1.24 million deaths per year [2][3]. In the near future, traffic fatalities will become the fifth leading cause of deaths in poor countries, beating HIV/AIDS, malaria and tuberculosis, according to the World Health Organization’s (WHO) latest Global Burden of Disease study [3]. Taking India in consideration which stands at second in terms of population count in the world, accidental death due to road fatalities is the most which is 34.3% in the year 2013 [4]. Figure 1.1 shows the percentage share of various causes of accidental deaths during 2013 for natural and un-natural cases in India.
According to the Road safety status in the WHO South-East Asia Region, 2013, there were 334,815 fatalities due to road accidents in the South-East Asia Region during 2010. In 2011, the average death rate is 18.5 per 100,000 populations which range from 1.9 per 100,000 populations in the Maldives to the highest which is in Thailand with 38.1 fatalities per a 100,000 population [5]. Figure 1.2 shows the estimated road traffic death rate per 100,000 population for South-East Asia region countries in 2011.
Thailand, being the country with the highest rate of road fatalities has the highest number of registered vehicles which is 412.1 vehicles per 1000 population, trailed by Indonesia which holds the number of 303.2 vehicles and 189.6 in Sri Lanka.

1.2 Problem Statements

Road intersections are where accidents or crashes usually occur. This is because these are the spot where two or more roads cross each other. At road intersections are also where activities such as turning left or right, making a ‘U’ turn and crossing over take place which have potential for conflicts [6]. The conflicts may cause accidents because sometimes confusion for example like “who should go first?” “should I go now?” and “Is the vehicle slowing down to let me pass through or not?” may arise among the road users at road intersections. These examples of assumptions that the road users make can lead to them making wrong decisions which will cause crashes.

This conflict can be made worse when the intersection is located at roads without street lights. This situation is often found at small road networks at villages and small townships. At night, this condition is extremely dangerous. Road users will not know if there is any vehicle coming. They need to see the incoming vehicle to make proper judgment whether to wait, or make turns or maneuver. Apart from that, obstacle issue can also add to the problem. Road intersections sometimes have trees, poles,
bushes or signs that may block the view of the road user at the intersection. This may cause unwanted collision if the drivers cannot properly see any incoming vehicle. Another situation that can contribute to crashes at intersection is the unavailability of traffic light or also during traffic light malfunction. In this condition, the situation is usually back to the conflict as mentioned earlier in first paragraph of section 1.2 when the road users simply just make turns and pass through based from their own assumptions about other road users. This is dangerous and not reliable.

Therefore, as in this project, Collision Avoidance and Traffic Safety application is proposed. This application is an Android based mobile application which aims to increase the awareness of the road user within the area of the target road intersection. This application act as a warning system that will aware the driver about other vehicle whether visible or invisible to the drivers’ eye that is at the intersection area.

1.3 Objectives

The objectives of this project are:

i. To develop an Android based mobile application namely Collision Avoidance and Traffic Safety using Android Studio development environment software.

ii. To implement Global positioning System (GPS) with the app.

iii. To introduce a modern and more relevant method of collision avoiding at road intersection with the involvement of smartphone.

1.4 Expected Outcomes

The expected outcomes of this project are:

i. Collision Avoidance and Traffic Safety mobile application is created using Android Studio development environment software.

ii. GPS is implemented with the Collision Avoidance and Traffic Safety app.

iii. A new and more relevant method of overcoming collision at road intersection is introduced.
1.5 Collision Avoidance and Traffic Safety Mobile Application

The Collision Avoidance and Traffic Safety mobile application is developed on Android 4.2.2 API 17 mobile platform. This application is a relevant method in today’s world as most individual acquires a smartphone. This application aids road users by making them to be aware of any other incoming or moving vehicle within the interested area around the intersection. Provided that all the road users at the area are using this application and activating it while driving, the app will inform the driver to just make maneuver or pass through.

This includes to warn the driver if there are other incoming vehicle within the targeted region. This warning feature is the main purpose of this application. Early awareness will help the driver to prepare earlier and thereby enable them to think more carefully before making decision.

The development of Collision Avoidance and Traffic Safety mobile app can help to aid in overcoming the factors that can lead to crashes. This include the main cause and also other related reasons stated such as turning with obstructed view, false assumption of another road user and also the mistake in judging other’s distance and speed.

By notifying the user/driver when entering a dangerous or accident prone intersection, the mobile app can help to aware the user/driver to become more alert to the surrounding. This app will make the user to be more careful by surveying around and to consider the aspects of his or her surrounding before accelerating out of the intersection. This can help to overcome the main factor which is the inadequate surveillance of the surrounding. The app also has another feature where it will also notify the user when there is another vehicle entering the interested area. This feature is useful for the identification of another vehicle incoming from the other road or the main road because sometimes the user’s vision may be obstructed by tress, sign boards or bushes for example.

1.6 Scope of Project

This project will cover the study of developing an Android mobile application by using the Android Studio development environment. The Collision Avoidance and Traffic Safety software application is to be developed using java programming language. The learning of Java programming language will be conducted in parallel
with the process of developing the Collision Avoidance and Traffic Safety application. The Android application will make use of the mobile GPS technology and hence, the method on how to integrate the application with the smartphone’s GPS in the programming part is also to be studied.

1.7 Chapter Outline

Chapter 1 discusses about traffic fatalities issues focusing mainly in the South East Asia region. Here, the Collision Avoidance and Traffic Safety mobile application is introduced as a new way of overcoming or at least reducing the risk of collision at road intersection. Apart from that, this chapter also includes the problem statement, project objectives to achieve as well as the expected outcomes when the project is finished, and also the project’s scope.

Chapter 2 discusses about the key components and considerations in developing the application and also summarizes them. Studies are conducted on all of the main components which include the Android mobile OS, GPS and Java programming language.

Chapter 3 explains about the methodology used in completing this project. Based on the flowcharts of the Collision Avoidance and Traffic Safety app and the project flow, how the steps are executed is summarized. The definition of Region of Interest (R.O.I) for this project is also described and explained in this chapter.

Chapter 4 presents the Collision Avoidance and Traffic Safety mobile application. The results are analyzed and how it is obtained is discussed in this chapter.

Chapter 5 is the conclusion of this project. This chapter will also present the future improvement and enhancement of Collision Avoidance and Traffic Safety mobile application
CHAPTER 2

LITERATURE REVIEW

2.1 Traffic Monitoring and Collision Avoidance System

According to Crash Factors in Intersection-Related Crashes: An On-Scene Perspective by the U.S Department of Transportation, there were roughly 2,188,969 road accidents that took place across the country from 2005 to 2007 and from this number, 36 percent (787,236) occur at intersections. Among all the 787,236 cases, an estimated 96 percent (756,570) had critical reasons attributed to drivers. Of the 96 percent, the distribution of the reasons which lead to the crash were inadequate surveillance (44.1%), trailed by false assumption of other’s action (8.4%), turned with obstructed view (7.8%), illegal maneuver (6.8%), internal distraction (5.7%), and misjudgment of gap or other’s speed (5.5%) [6]. From the data it is clear that the lack of surveillance or looking around before going out of the road intersection can mainly cause crashes to occur at road intersections.

An Anti-Car Collision System Using Global Positioning System (GPS) and 5.8Ghz Inter-Vehicle Communication at an Off-Sight Intersection has been introduced in 2000 [7]. This anti-collision system suggests an effective anti-collision system that combines the application of Differential Global Positioning System (DGPS) and Gyroscope. The idea is to identify the current position of the vehicle and then wirelessly trade the data with another vehicle using the same system via an inter-vehicle signal. High frequency such as 5.8 GHz is used for inter-vehicle due to its diffracting characteristics that will go through the surrounding obstacles like buildings and trees.
Figure 2.1: Anti-Car Collision System Model [7].

Figure 2.1 shows the model for the Anti-Car Collision System. This system works in three main steps. GPS satellite will obtain the positioning information which will then be referred to a navigation map. The vehicle will always emit the detection signal. From the Figure 2.1, step 1 shows that when the vehicle is approaching a junction with no signal emitted by the other incoming vehicle, nothing will occur as an exchange of information cannot take place. In step 2, both of the vehicle approaching the junction is emitting the detection wave. This detection wave emitted by both of the vehicles will make contact with each other and this is where step 3 will take place. Step 3 is where the exchange of information between the two vehicles occurs. This information exchanged between the two vehicles is what decides whether the condition is dangerous or not. If it is considered to be dangerous, an alert system in the form of an alarm will be activated to notify the driver.

The same idea of solution, the Development of Vehicular-Collision Avoidance Support System via Inter-Vehicle Communications (IVC) has also been suggested in 2004 [8]. The Intelligent Transport Systems (ITS) applies a state-of-the-art telecommunication technology to overcome traffic issues such as accident and congestion. An experiment was carried out to develop the Vehicular Collision Avoidance Support System (VCASS) which possess the functions as follows: