

**LAKBAY: A THREE-DIMENSIONAL GAME ABOUT DRIVING FUNDAMENTALS
AND ROAD COURTESY AND SAFETY OF GEAR-1 DRIVING SCHOOL**

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CHAPTER 1

INTRODUCTION

Background of the Study

Road accidents happen anywhere, anytime, with anyone. It is an inevitable circumstance that may or may not take or change our lives. It is important that we (both the pedestrians and drivers), as law-abiding citizens must be aware of the road's safety precautions and must strictly follow the rules and regulations. As for the drivers, they are the masters of the road and must be responsible for their actions especially in avoiding road accidents and taking into account the safety of the pedestrians.

The government implemented laws and regulations in order for us to have a safe and sound driving experience. The Filipino Driver's Manual of 2018 is a manual that guides motorists and all driver's license applicants in understanding the process of availing a driver's license as well as the importance and the responsibility of having it (Caguete, Sabela, Menis, & Garcia, 2018). The manual itself is in accordance with the Republic Act No. 4136 also known as the Land Transportation and Traffic Code of the Philippines which enumerates the traffic laws that all motorists (motorcycles, cars, and bike drivers) must follow on the road. Compilation of articles and chapters relative to land transportation and traffic rules to promote good driving practices not only applicable to the drivers but also to the pedestrians and law enforcers (Republic Act No. 4136 | GOVPH, 1964).

Along with this law is Chapter 2 of the Registration of Motor Vehicles which is composed of rules and regulations that an applicant is obliged to observe with regards to the issuance of a Drivers' License. Other sections of the law incorporate the preliminary provisions, responsibility for the registration and operation of the motor vehicles, and traffic rules which include the licensing and other operations related to this matter. Last August 02, 2017, President Rodrigo Duterte signed the extension of

the validity of the driver's license from three (3) years to five (5) years under the same law.

But sometimes all we need is to take the initiative and apply the following ideas: alertness while driving, avoiding aggressive driving, vehicle speed and distance, and special driving situations (Safe driving essays, n.d.). Reaching your destination safely requires attention, stay away from any distractions while driving, put down your phone, stay alert, and focus on the road. Self-control is one basic rule as a driver, there will be a lot of times that he/she will encounter unexpected confrontations on the road and one way to settle things around is having self-control (Safe driving essays, n.d.).

In concerned with this issue, the researchers proposed a study that will help the aspiring drivers and even the non-driver citizens by creating a three-dimensional game to better learn and understand the road (rules and regulations, signs, lights, and precautions).

Overview of the Current State of the Technology

Over the past few decades, Bacoor City earned its name as one of the most renowned cities in the province of Cavite. The city was known as "Bakood" during the Spaniards era and later became "Bacoor" which is now an official city in Cavite. As stated in (PhilAtlas, n.d.), Bacoor has an area of 46.17 square kilometers or 17.83 square miles which constitutes 2.93% of Cavite's total land area. Moreover, it is a coastal component city of Cavite consisting of 73 barangays and a population of 600,609 (Philippine Statistics Authority, 2016). The said figures represent 16.33% of the total population of the province making it the 14th most populous city in the country. Like any other city, Bacoor is also facing problems and issues with regard to governing the municipality. One of the said problems is vehicular road accidents which happen quite often.

Jeepneys, Buses, and Tamaraw FX Taxis are the common form of transportation for Bacooreños. Furthermore, Tricycles and pedicabs ply the different

roads in the said city. With that being said, commuters often take Jeepneys and the likes as their mode of transportation within different routes in and out of the city (About Cavite Province, n.d.). Based on Wikipedia Contributors (2021), Bacoor is described as a bedroom community with most of its citizens commuting to and from Metro Manila to work. The city is connected to Metro Manila by different expressways like the Cavite Expressway or CAVITEX and Muntinlupa, Aguinaldo Highway and Quirino Avenue, and other major thoroughfares. Considering the congestion of population of the city and its thoroughfares, it is most likely to say that Bacoor experiences daily heavy traffic frequently.

The following lists are the number of registered Vehicles in Region IV-A as of the year 2020 that falls under the category of cars with a total number of 200,845, UV with a total number of 291,874, SUV with a total number of 87,225, TRUCKS with a total number of 24,637, and BUS with a total number of 1, 481 for a grand total of 606,062. On the other hand, this is the number of registered motor vehicles, MOTORCYCLE: without Sidecar with a total of 771,461, with Sidecar with a total number of 238,635, Non-Conventional with a total number of 1,162, the Total number of Motorcycles/TCs/NCs with a total number of 1,011,258, TRAILERS with a total number of 2,687 for a grand total of 1,620,006 (eFOI - Electronic Freedom of Information - Request, 2021).

Road accidents ranked 8th as one of the main causes of death around the globe. As World Health Organizations (WHO) stated last 2018 in a global report, there were about 1.34 million deaths yearly from road accidents, and is the number 1 cause of deaths of people from ages 5-29 years old (Pino, 2019). The Philippine Statistics Authority (PSA) data, states that there were 194 deaths of young adults from ages 20-29 years old within 11,360 road-crash last 2017 (Pino, 2019). According to Center for Health Development Calabarzon (2019), last October 2019, CALABARZON (Cavite, Laguna, Batangas, Rizal, and Quezon) registered the highest transport vehicle crashes and road injury occurrences in the country with over 2,386 (16.5%) followed

by Central Visayas (Region VII) with 2,125 (14.7%) and the National Capital Region (NCR) with 1,556 (10.8%) as reported to the DOH.

According to Bacoar Traffic Management Department (2017), the main agencies reinforced by the government and is liable for maintaining peace and order are the Bacoar Traffic Management Department (BTMD) and the Bacoar Public and Safety Unit. Whilst BTMD as the highest local bureaucracy (department's status) has given the authority administer to the citywide implementation of ordinance especially about the implementation of traffic rules and regulations on the road. Additionally, securing a quality service in receiving and releasing Licenses, plate numbers, and traffic ordinance violation receipts are the goals of BTMD. They are also in charge to protect and secure the safety of motorists, pedestrians, and the public as a whole. Furthermore, the said department opts to constitute an equal ground of rights and duty with everyone (including Traffic Enforcers, Motorists, and Pedestrians) who are involved in the road in terms of rules and regulations implementation.

Statement of the Problem

General Problem

In particular, the study focuses on developing a Three-Dimensional Game Application about Driving Fundamentals and Road Courtesy and Safety of Gear-1 Driving School.

Specific Problem

In conjunction with the main problem, the following problems are expected to be given light throughout the study:

1. Learning in the current generation requires a new approach for the people to focus on, because of this, many people began to lose interest in the traditional way of learning and seeks an innovative platform to use.

In our current generation, people are learning in a more "techy" and innovative style of learning. They are attracted to things that are

appealing to the eyes, in which they find themselves engaged. Learning by reading tons of manuals and scripts might increase the boredom of the reader which can result in their loss of interest in the subject and poor absorption of the lessons.

2. The way of learning Traffic Rules and Regulations is through reading manuals and because of this, people get easily bored and tend to not absorb what they were reading.

Nowadays, technology plays a big part in the education of the people. They seek a new approach to educate themselves using different devices or platforms. They prefer an innovative platform that will both educate and entertain them at the same time.

3. There is no existing game application in Gear-1 Driving School that promotes awareness to the people about Road Courtesy and Safety and Driving Fundamentals.

Currently, Gear-1 Driving School has no existing platform or a game application that will educate people about Road Courtesy and Safety and Driving Fundamentals, because of this, their means of promoting awareness about Road Safety in a game will be enclosed to a narrow audience hence, people who are in-to-games are being left out the chance to learn in a gaming platform.

4. The lack of understanding of both Driver's and Pedestrian's Obligation on the Road causes misleading actions that result in unexpected risks or danger to them. Because of this, vehicular crashes happen frequently and endangers both the lives of drivers and pedestrians.

Lack of understanding about Road Safety for the Drivers and Pedestrians will cause danger in their lives also, unawareness of traffic rules might result in frequent road crashes.

Objective of the Study

The overall objective of the study is to be able to develop a Three-Dimensional Game Application that will educate the citizens about Driving Fundamentals and Road Courtesy and Safety of Gear-1 Driving School.

The specific objectives of the system are listed as follows:

1. To develop a game application that will both entertain and educate the people in the current generation.

The proponents created a game that is a visually appealing, educational yet entertaining platform that will challenge and gain the user's attention.

2. To develop a game application with Information Module that will convey Traffic Rules and Regulations effectively.

This module will help the users to learn more about basic Traffic Rules and Regulations. The said module contains sets of Information about Rules and Regulations on the road.

3. To develop a game application for Gear-1 Driving School that will raise awareness about Road Courtesy and Safety and Driving Fundamentals.

The proponents will develop a game application for Gear-1 Driving School that will help them to educate the people about Road Safety and Driving. Also, the application will help to broaden the range of audience for it will be a game application.

4. To identify possible reasons on how a game innovates the style of teaching Road Safety and Driving.

This module will help the users to learn Road Safety and Driving and enjoy the application at the same time. The said module contains games that cover lessons about Road Courtesy and Safety and Driving Fundamentals that are both entertaining and educational.

Scope and Limitation

The Lakbay: A Three-Dimensional Game Application About Driving Fundamentals and Courtesy and Safety of Municipality of Gear-1 Driving School aims to provide a knowledgeable and useful application that can help and guide ordinary people of Bacoor about Road Safety and Driving.

Scope

The scope of the study revolves around the following:

Access Levels

User. The user is the one who controls the player in the game. The main goal of the game is for the player to complete every stage by meeting two conditions, the player must reach the target destination and meet the passing score of that level. Failing to do so, the player will have to redo the level. Upon finishing the stages, a Driver's License will be issued to the player as a prize for completing the game. Moreover, now that the stages are all unlocked, the player can choose freely on what stage he wants to play.

Functionalities

Below are the general functionalities that the system can offer. These enable the system to operate in different ways and communicate well with the users involved in the system.

Familiarization of Equipment. This refers to the review and familiarization of gears and accessories of the vehicle consisting of images with descriptions of certain equipment.

Introduction of Essentials. This refers to the presentation of the skills and tips on how to survive the game. Skills are assets possessed by the player that will help him/her in completing the game.

Tutorial Phase. This is intended for the new users of the game for them to be familiar with the flow. It is a simple instructional video tutorial on how to navigate and learn the basics of the game.

Scoring and Rating System. It is the numerical and graphical representation of the player's accomplishments in the game. The player will be rated and scored based on their score's percentage, number of correct answers, and how fast the questions are answered.

Leaderboard. This refers to the display of scores and rating of the player in every completion of a level from the late top scores to the recent ones. Each user has the ability to have their own playthrough in a game. The users' top scores will be displayed on the leaderboard in descending order.

Timer Per Question. This is a set timer per question of the game. It is another opportunity for the player to gain a higher score and ratings depending on how fast the question will be answered correctly. Additional coins as a reward will be sponsored to the player in every correct answer within the time limit. Failing to answer within the time frame will affect the score of the player if the questions will be answered correctly but not within the time frame.

Puzzle Fragments. This is a puzzle piece that will serve as a reward that the player will obtain after completing every mission. At the end part of the game, the collected pieces will assemble and portray a digital representation of a Driver's License template.

Driver's License. Upon finishing the phases, a Driver's License will be issued to the player as a prize for completing the game. It is a graphical representation of the player's license and reflects the information based on the user's inputted data at the last part of the game.

Linear Play. This is a standard gameplay phase consisting of levels wherein, the player must drive on the road and will need to answer every question that will pop up along the way.

Free-Roam Play. Is a new phase that will automatically unlock after finishing all the levels in Linear Play. In this phase, the player has the ability to roam on the map. It also includes the implementation of driving and parking simulation.

Head-Up Display. The User Interface elements are displayed on the screen. It includes the navigation and control buttons as well as other elements such as icons, indicators, main menu, etc.

Limitation

Putting aside the functionalities offered by the system, the following are the known limitations:

1. Lakbay is a free-to-play game application that can be used by anyone as long as they have installed the application on their mobile devices. This game has no age limit but is advised to be used by 18 years old and above.
2. The android application is strictly for only playing games. The hotline numbers of the national local government offices are provided in the game but it does not mean that it will call the agency directly. Gear-1 Driving School can not send notifications information to android users. Moreover, some part of the application needs an internet connection specifically to the social media accounts and official website of Gear-1 Driving School.
3. The application will only run on phones with an ARMv7 CPU with the minimum requirements: Android 5.1 Lollipop and higher versions, minimum memory(RAM) storage of 1GB, and storage of 300MB.

Methodology of the Study

RAD (Rapid Application Development) is a type of Agile software development model published in the 1980s. Its development was prompted by the shortcomings of regressive traditional development models such as the Waterfall Software Development Model. One major flaw in the waterfall model was that once the software

entered the testing phase, changing its core functions and features became extremely difficult (Deshpande, 2018).

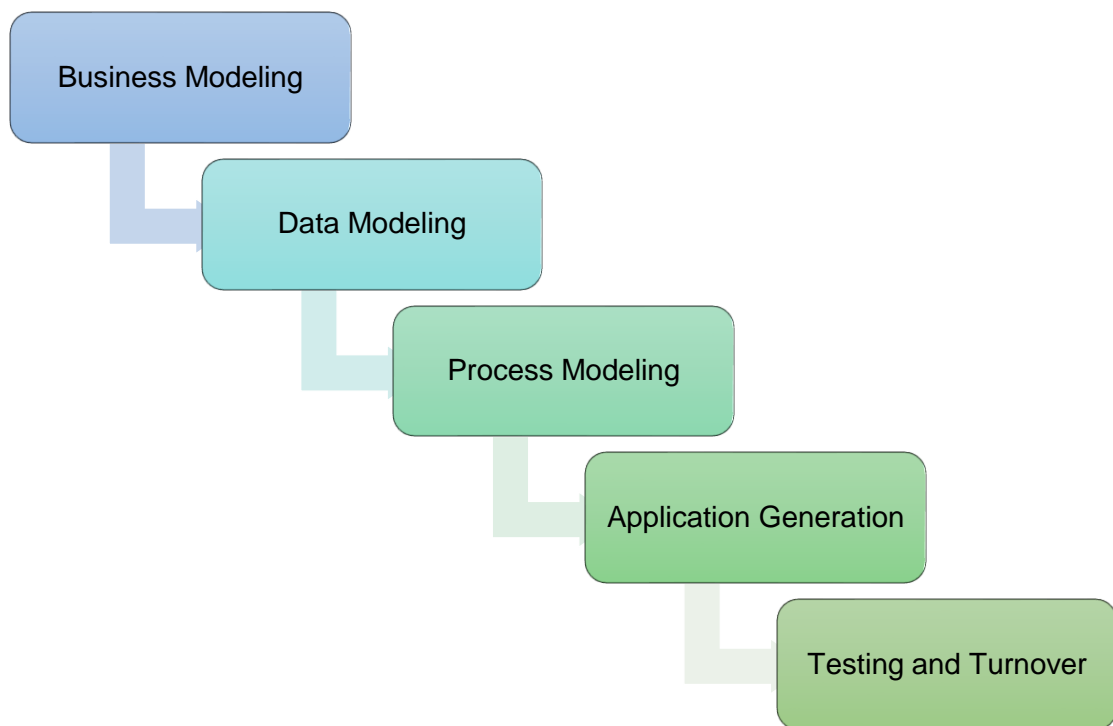


Figure 1: The RAD Model (Rungta, 2021)

The developers have chosen this methodology considering the evolving requirements of the software being developed. RAD or Rapid Application Development is the best solution to this issue, through rapidly developing prototypes for the testing of functions and features without affecting the result and providing functionalities such as change of design, adding/removing functionality, and cleaning by eliminating things you don't want to be included while keeping the result safe. It is an advanced developing model that provides more significance to rapid prototyping and quick feedback despite the length of its developing and testing cycle allowing the developer to create a quick software update and multiple iterations. RAD enables low-code rapid application development and yields a more convenient environment both in the competitive marketplace of technology and the lives of the developers.

This methodology will aid the developers to identify the possible problems that may arise in the development process of the system. RAD is focused on prototyping

and is acting as a substitute to design specifications, this implies that RAD modeling is best at User interface programs because RAD includes the Agile method and Spiral model (The Economic Times, n.d.).

Below phases are in the Rapid Application Development (RAD) model:

Business Modeling. The information flow is identified between different business functions. On basis of the flow of information and distribution between various business channels, the product is designed.

Data Modeling. Information collected from business modeling is used to define data objects that are required for the business. The information collected from business modeling is refined into a set of data objects that are significant for the business.

Process Modeling. Data objects defined in data modeling are converted to establish the business information flow to achieve some specific business objective process descriptions for adding, deleting, modifying data objects that are given. The data object that is declared in the data modeling phase is transformed to achieve the information flow necessary to implement a business function.

Application Generation. The actual system is created and coding is done by using automation tools. This converts the overall concept, process, and related information into an actual desired output. This output is called a prototype as it's still half-baked. Automated tools are used for the construction of the software, to convert process and data models into prototypes.

Testing and Turnover. The overall testing cycle time is reduced in the RAD model as the prototypes are independently tested during every cycle. As prototypes are individually tested during every iteration, the overall testing time is reduced in RAD.

Significance of the Study

The development of a Three-Dimensional Game Application about Driving Fundamentals and Courtesy and Safety of Gear-1 Driving School is believed to be beneficial to a certain individual, group of individuals, or organizations.

Gear-1 Driving School. This study is significant to Gear-1 Driving School as they are the client of the study and they will be able to utilize the game application in teaching effective road safety practices and protocols to the students of their school that aspires to drive.

Drivers. This study is significant for aspiring drivers for them to have a portable, useful yet entertaining source of knowledge about Road Safety and Driving. Furthermore, it will help them to familiarize themselves with Traffic Rules and Regulations.

Cavite State University – Bacoar City Campus. This study is significant to the university as it will be recognized to be a part of the development of having an application for Road Safety and Driving.

Driving Schools. This study is significant to schools that educate aspiring drivers. It can help them in introducing basic Traffic Rules to driving applicants with the use of an easy and entertaining platform.

Local Government Institutions. This study is also significant to other Local Government Units as an inspiration to develop their own application pertaining to Road Safety and Driving or the likes

Researchers. This study is important to the researchers as they will gain more knowledge about developing an android application and about Road Safety and Driving. Moreover, it will help them to enhance their skills in developing a game application and aid them in their professional career in the future.

Future Researchers. The study is also important to future researchers and developers as it can be of help to become a groundwork in developing a new application relevant to the concepts of the system or serve as a related study for their manuscript.

CHAPTER 3

THEORETICAL FRAMEWORK

The theoretical framework of the study contains information about the existing theories and ideas that are used within the development of the study. It explains and gives elaboration to these concepts in order to facilitate a better understanding of the core concepts that build the game application.

Road Safety

Road crashes play a quite large percentage in injury and death tolls globally. For injuries, road crashes cause 20 to 50 million injuries every year. While the fatality that it inflicts reaches up to 1.3 million per year. These numbers alone are already daunting on many levels, but to simplify things, road crashes are the major cause of death among all age groups and are said to be the leading cause for the death of children and young adults from age brackets of 5 to 29 years old. Additionally, when it comes to economic status, countries with low-income have a higher risk of death rate when it comes to road crashes. Almost three times larger than high-income countries.

The number of people that can be affected by road crashes can be greatly alleviated by implementing road safety protocols and guidelines. Protocols that will mostly focus on aspects that are vital in roads such as drinking, driving, use of seatbelts, child restraints, and motorcycle helmets. On the other hand, for the government, plotting of right road signs, improvement in vehicle standards, as well as serving better emergency response can also save many lives (World Health Organization, 2018).

Driving Simulation

The prevailing technologies nowadays help in different endeavors and researches. One thing to consider as part of this is the advent of the development of

driving simulators. Driving simulators can be considered a sophisticated application since they can be used in different disciplines. Advanced driving simulators are used by engineers and experts in improving vehicle design. One of the other perks that a driving simulation can give is the ability to provide a safe testing environment that the user can interact. This prepares the drivers themselves before engaging in real-life driving. Thus, reducing the chance of causing accidents and road violations (Chang, 2015).

C# Programming Language

The C# programming language is what powers the development of the game. C# is a modern, type-safe, and object-oriented programming language. Modern because even though its roots came from the C language itself, the syntaxes that it incorporates are comparable to the known and popular programming languages nowadays, such as Java. The language allows developers to build applications that are robust and secure. This is because the language runs on the .NET ecosystem. The .NET ecosystem is the framework and runtime where the C# programming language is built. It contains several languages as well, and C# is one of them.

Another features why the C# programming language is considered an ideal language because of its Garbage Collection. This alone can make the application run efficiently while saving tons of resources. Lastly, the language is compiled first before it gets run. This ensures that applications built around C# are less prone to errors (Microsoft, 2021).

Adobe Photoshop

Assets and resources were used in making the game. Things such as images and icons and other graphic assets were made possible by using a multimedia application such as Adobe Photoshop.

Adobe Photoshop is a very popular raster image editing software application. It enables users and enthusiasts to complexly edit or manipulate images through the use of layers and numerous tools that are essential in the editing process. It was created by brothers Thomas and John Knoll in 1988. Later on, it was sold to Adobe Systems and was named "Photoshop." Adobe Photoshop now became the defacto standard when it comes to image manipulation and raster-based editing of images as it is packed with different comprehensive tools that can make anything possible through editing (Techopedia, 2017).

Visual Studio Code

Visual Studio Code or also known as VSC served as the game's Integrated Development Environment (IDE). Although VSC is not entirely an IDE it is capable of operating under such conditions.

Visual Studio Code source code editor or text editor that comes with developer tools such as IntelliSense code completion and debugging. It is a lightweight and fast cross-platform editor that allows developers to quickly edit and amend their codes. It supports various languages from plain text files to the known programming languages. It offers syntax highlighting, bracket-matching, auto-indentation, and more. It is also fully customizable aesthetically and operationally. Keyboard shortcuts can be utilized for faster workflow and development (Microsoft, 2016).

Android Operating System

The Android OS is a popular operating system that is mainly used in smartphone devices. It was written using the Java programming language and is based on Linux operating system, thus making it an open-source operating system that is contributed by different developers all over the world. It is now acquired and maintained by Google. The Android OS allows users to run different applications on their smartphone devices. This includes games as well since the operating system can

support both 2D and 3D rendering of graphics. Which makes the operating system suitable for running portable games on the fly (Techopedia, 2018).

Android Software Development Kit

The Unity Game Engine is integrated with Android SDK which is used for developing android applications.

Android SDK allows developers to develop and run applications on android devices. Android development now supports different programming languages in developing applications that can run under the Android operating system. Nevertheless, despite the preferred language, Android SDK is a prerequisite that is necessary for developing any kind of Android application. The Android SDK also provides tools that are required to emulate Android applications on other devices such as personal computers and laptops (Vaishnavi, 2019).

Unity

Unity is a game engine used by developers globally. It is a game engine that supports both 2D and 3D game development across different platforms. With Unity, one can develop a single code-based game using the C# programming language then run and build it into different platforms such as Android, iOS, Windows, Mac, Linux, and more. Unity comes with comprehensive tools that are necessary for developing games, so it also acts as an Integrated Development Environment. Additionally, Unity also allows quick prototyping through its built-in tools and free assets that can be downloaded from Unity's official Assets Store (Sinicki, 2021).

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