The Development of Motorbike Riding Application Simulation Using User-Centered Design Method

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Abstract. A vehicle simulator is a tool that allows users to drive a moving vehicle in a controlled, simulated environment. Simulators like this are often used to improve driving skills and reduce the effects of vehicle accidents. According to initial research conducted by the company, almost 50 percent of accidents that occur in Batam are road accidents. This accident will certainly have an impact on the company's productivity because employees have to rest for quite a long time and leave their work. This Motorbike Riding Simulator is a simulator that can teach users to understand the conditions and situation of the roads in a city. Based on the existing problems, researchers tried to develop a large system in the form of a motorbike riding simulator system, where one of the parts in this simulator is a simulation application. In this research, we focused on creating a simulation application that can be used as a training tool before facing real-life conditions with real vehicles. The simulator was developed by applying visualizations such as public road conditions that are usually used by most workers in the company and several settings for road conditions that make it possible for users to feel as if they are driving from their residence to their place of work.

Keywords: motorbike, riding, simulator.

1 Introduction

Accidents involving motorbike riders currently have an adverse effect on both the rider and his or her workplace because when a rider is injured, the company also loses people who could perform the tasks and obligations assigned to them [1]. According to the survey results, because employers are also impacted by employee accidents, they also want to lower the risk of car accidents for employees when they wish to travel to work. In addition, road accidents currently account for roughly 50% of accidents in Batam [2]. According to work accident report data issued by the UPT for Labor Inspection of the Riau Islands Province Manpower and

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Transmigration Service, the biggest contributor to accidents in Batam is still road accidents. According to the Riau Islands Labor Inspector for the Batam City working area, Sudianto, in 2021, there were 3,735 accidents recorded in 2021 alone, which is an average of road accidents.

The use of driving simulators as a tool for assessing the effectiveness of safety and emergency systems in transportation studies has been used routinely for more than three decades [3]. Simulators can be set up to use a number of qualities that allow them to accurately simulate the real world, despite the fact that they cannot accurately simulate every scenario that could occur in the real world [4]. Based on the problems, initial research results and also the literacy obtained, the researcher tried to design a Motorbike Riding Simulator application as part of his research. Where this application is a simulator that can teach users to understand road conditions and situations which are created by considering the needs of the user and with a display that matches what the user has seen so far. It is hoped that this simulation application can be used asa training tool before facing real conditions with real vehicles.

2 Research Method

In conducting this study, we used the user-centered design methodology [5]. We work with a company in Batam City that wants to train and learn how to make sure that its staff can drive safely. We go through a number of stages, including locating context specifications and user needs, figuring out business requirement specifications, developing design solutions from initial concepts to final designs, assessing designs with usability testing, implementing, developing, and releasing products, deploying, and the end result is evaluate against requirement, as follow in figure 1.

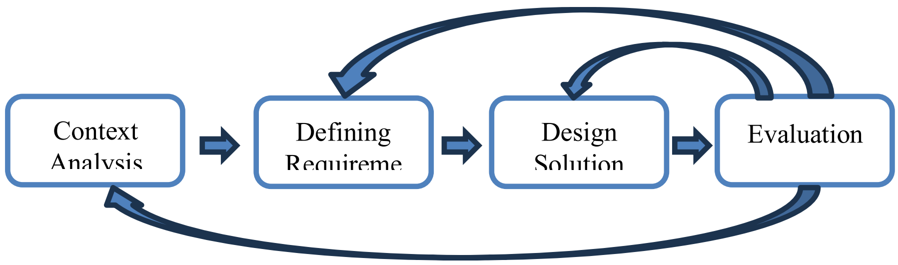

Fig. 1. User Centered Design Process

2.1 Context specification and user needs

In this stage, we discuss with the company concerned to find out what problems have been occurring, especially related to vehicle accidents experienced by workers, the impact felt by workers and the company, the company's actions in preventing accidents that have been carried out so far and the needs related to making motorbike riding simulators and applications. We then use the results obtained as initial evaluation material to map user needs such as application appearance, routes and features in the application according to the problems that have been experienced by users.

2.2 Business requirements specifications

In this stage, we continue to gather information and conduct analyses pertaining to business requirements[6], such as how this application and simulator will operate and be used, how employees can use this application, and how the business can track the outcomes of employee trials and training, so that in the future the business can obtain a lot of data and information about what challenges employees have faced thus far that they frequently experience traffic accidents.

2.3 Build design solutions from basic concept to final design

From the initial concept through the finished design, we construct design solutions using the findings from phases one and two. Starting with the fundamental idea, we developed a concept design, chose the hardware requirements, developed the software, tested it, and maintained it. When developing the fundamental idea, we decided that a PC equipped with a simulator that looked like a human playing a game would be the platform. The simulator's appearance was

then created to resemble the general route that employees take the most, in order to give users the impression that it fits their regular driving activity. We talked with the organization about the routes that employees frequently take and carried out a survey to get a better understandingof these routes. Then we also determine the functionality of the simulator and how the simulatorcan be connected to the application we are developing.

2.4 Design evaluation with Usability Testing

The designs we produce are then put through usability testing to make sure they satisfy user needs. The company conducts testing on possible consumers, and the outcomes will serve as our standard for gauging how well the design will work with the new application.

2.5 Implementation, developing and releasing products

We next go on to the stage of creating the application. We develop applications using unity. We use our design to develop the look and feel of the program that will be used on a PCbecause the focus of this research is on applications. A different research team will beresponsible for creating the simulator's tools, foundation, and electronic components. In this implementation, we first make sure that the program's appearance and functionality can be met,and then we merge the application with specially planned and made tools to build a single integrated simulator.

2.6 Deployment, the final product is evaluated againts requirements.

To confirm that the functional requirements of the application can be met, the development team will test the outcomes acquired during the implementation stage using the black box testing methodology. The study team will make a note and use it as evaluation material if the test findings are inadequate in any way.

3 Implementation

Implementation of making motorbike riding simulation using Blender and Unity applications can create realistic and interactive experiences[7] [8]. There are also several partsthat the author will explain below.

3.1 Modeling Motorbike.

Motor vehicle modeling is the main object to be studied used in this Motorbike Simulator. A motorbike model is an exact model made with Blender's 3D modeling tools [9]. includes all important components such as frame, wheels, exhaust and other parts.

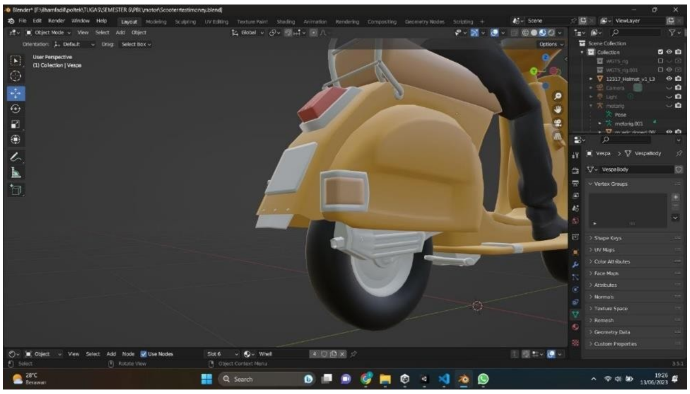

Fig. 2. Motorcycle Rear Side Modeling

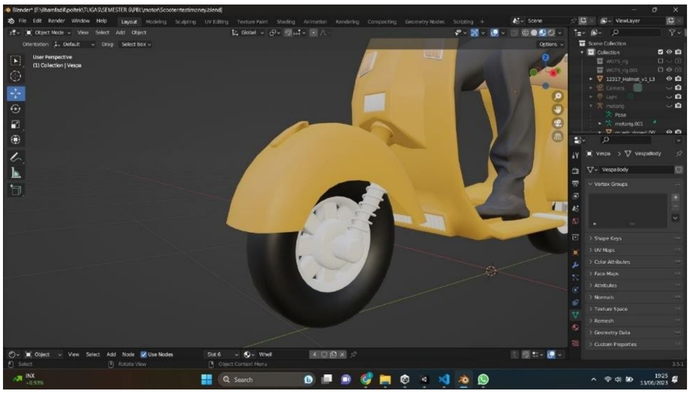

Fig. 3. Motorcycle Front Side Modeling.

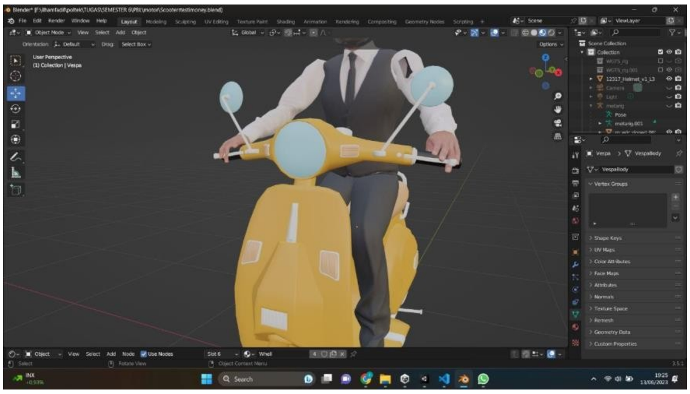

Fig. 4. Motorcycle Handlebar Modeling.

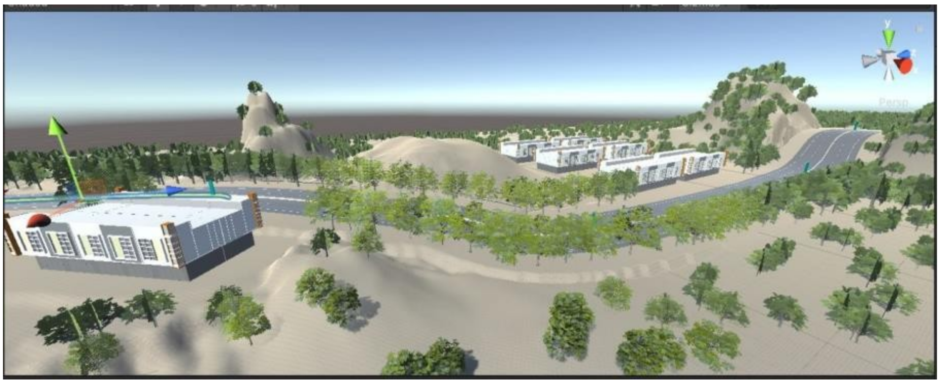

Fig. 5. Simulation Environment

3.2 Simulation Environment.

The virtual environment was created in Blender and integrated into Unity to run the simulation [10].This environment includes roads, surrounding scenery, and other elements such as trees, buildings, and other objects that fill the simulation background according to the roads that exist along the road to the company.

3.3 Buildings Modeling Environment.

The building model created was used as part of the existing buildings on the side of the road leading to the company. The buildings made include houses, shop houses, warehouses and gas stations, all of which are based on survey activities carried out by the team by reviewing the location of the road used as a reference.

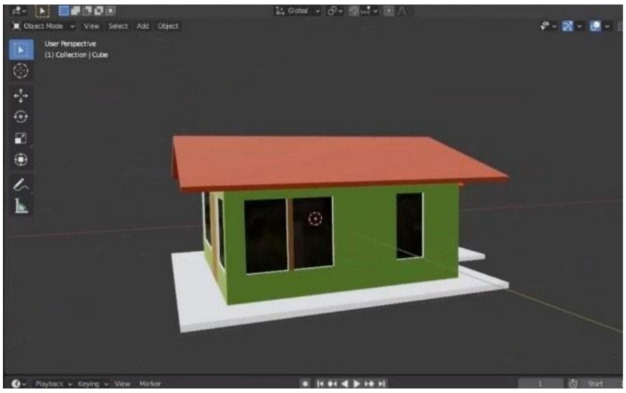

Fig. 6. House Modeling.

Fig. 7. Shophouse Modeling.

Fig. 8. Gas Station Modeling.

Fig. 9. Warehouse Modeling

3.4 Aplication Coding.

We code the controller, values, crash situations, checkpoints, and the game's completion at this point. Initially, the user follows a predefined course in this simulation flow. Along the way, there are a number of obstacles the user must avoid. Users will be assigned a starting point value, which will drop if they encounter issues like getting caught in a speed trap or running red lights or traffic signs. The user will ultimately come to a stop in front of the business to ascertain its ultimate worth and any errors that have been made.

The first challenge is that there is a simulated layout in the shape of a roundabout in the middle of the highway, so the driver has to avoid other cars coming from that direction or from another direction at different speeds. After passing the roundabout there will be a hilly road that requires drivers to be able to pass it because the lane rises and turns slightly. After that, the road will be a straight road that is quite long for 500 meters and continues with a trap in the form of a red light that will be activated if the driver passes the checkpoint line that is 200 meters before the red light and the red light will start counting down. This will give the driver a choice whether to stop in front of the red light until it turns green or slow down the vehicle until the light turns green, which will give an idea of how the driver has behaved so far. The next trap is the speed limit if the driver has entered an industrial area which cannot exceed 40 kilometers per hour . If the value is exceeded, it will be reduced for the time the driver exceeds the speed limit

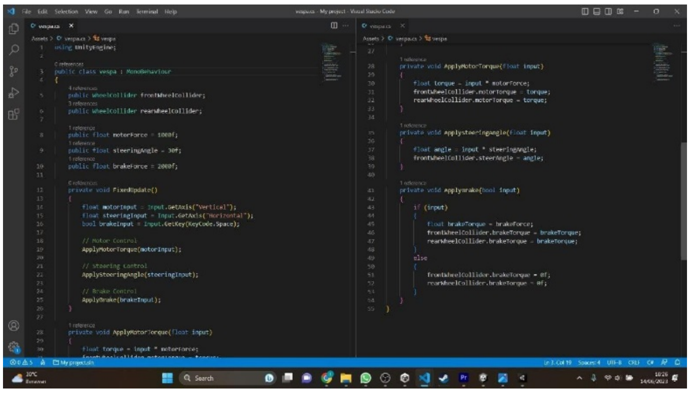

Fig. 10. Coding Controller.

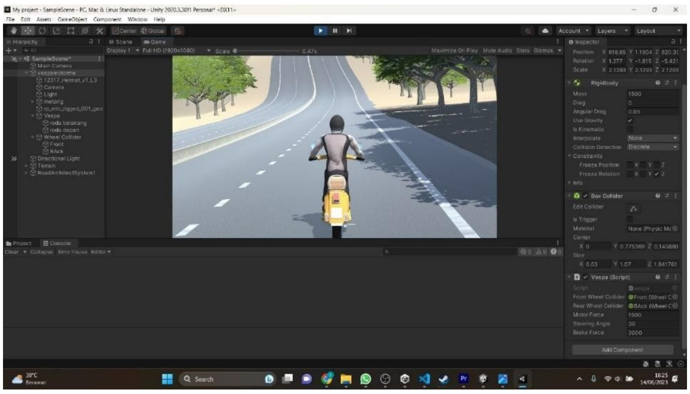

Fig. 11. Coding for running motor.

4 Testing

4.1 Usability Testing

Usability testing was used to conduct the initial test during the design evaluation phase. where we question businesses and potential customers about disability testing. We provided details about the application being developed, the functionality it offered, and the program's mockup design before we started tested. The user was then given a usability questionnaire to complete. We evaluated application mockups on potential users used the SUS (System Usability Scale) approach, a questionnaire that may be used to gauge a computer system's usability based on the user's subjective point of view. Ten questions in total were asked to respondents.

Table 1. System Usability Scale Question.

Code	Question
Q1	I think that I would like to usethis system frequently.
Q2	I found the system unnecessarily complex.
Q3	I thought the system was easy to use.
Q4	I think that I would need thesupport of a technical person to be able to use this system.
Q5	I found the various functions inthis system were well integrated.
Q6	I thought there was too much inconsistency in this system.
Q7	I would imagine that mostpeople would learn to use this system very quickly.
Q8	I found the system verycumbersome to use.
Q9	I felt very confident using the system.
Q10	I needed to learn a lot of thingsbefore I could get going with this system.

From the distributed SUS questionnaire, respondents are required to fill in the assessment column for each question item according to what they felt when experimenting with the system. Furthermore, the results of the questionnaires that have been filled out by respondents are recapitulated and each answer is calculated with the following conditions:

a. For every odd numbered question, the score for each question obtained from the user's score will be reduced by 1.

b. For every even numbered question, the final score is obtained from 5 points minus the question score obtained from the user.

c. The SUS score is obtained from the sum of the scores for each question which is then multiplied by 2.5.

We obtain an average score from the SUS score recapitulation data, from which we will then make inferences. Finding out the SUS assessment's findings is the next step. Net Promoter Score (NPS) is used to ascertain the outcomes of the SUS assessment.

The level of user happiness can be managed and measured effectively using NPS. Each user group exhibits a variety of patterns and responses, including:

1. Promoter - for respondents who give a score between 77.2 and 100, typically characterized as utilizing it frequently;
2. Passive - users who give the product/app a score between 62.7 and 77.1;
3. Detractor - users who provide a score between 0 and 62.6.

Their results show that either the product or app is used or that the consumer reaction has decreased. And the final average SUS score from respondents was 76.00.

Following is a detailed explanation of the SUS score scale based on the results of the scale usedto determine the outcomes of the SUS such as the SUS score in this study when compared to the application grade scale indicating that the score is fairly high. Users may also accept the developed application.

4.2 Fungsionality Testing

At this stage, we test the functionality of the application that has been created. Testing is carried out after the application is completed and administered to users. The functionality requirements of this application can be seen in the following table:

Table 2. Functionality Requirement.

Code	Fungsionality
F001	Users can start the vehicleusing the gas button
F002	Users can use brake button
F003	Users can steer the vehicle right and left
F004	Users can see other vehicles and obstacles
F005	Users can see the values
F006	Users can set the driving speed

Testing was carried out using the black box testing method, and the results obtained were

Table 3. Functionality Test Results.

No	Proces	Scenario	Target	Result
F001	Users can start the vehicle using the gas button	Press the gas buttonand make sure the vehicle is running	Successfully started the vehicle	Succeed
F002	User can usebrake button	Press the brake button and ensurethe vehicle stops	Successfully reduced speed	Succeed
F003	Users can steer the vehicle right and left	Press the right andleft buttons and ensure the vehicle turns	Successfully determined the direction of the vehicle	Succeed
F004	Users can see other vehicles andobstacles	See the position ofthe vehicle and other obstacles	Managed to saw the position of other vehicles and obstacles	Succeed
F005	Users can see thescore	See the valueobtained	Managed to saw the value	Succeed
F006	Users can set the driving speed	Press and release the gas button to determine vehicle speed	Successfully regulated vehicle speed	Succeed

It is clear from the test results above that all functional requirements have been satisfied in accordance with the scenario that has been developed.

5 Conclusion

The author has finished creating the programming and assets for this motorcycle riding simulator. Additionally, the author has been successful in creating and operating a motorcycle as well as various other essential simulator elements, such as cars, buildings, and roads. These resources have been utilized in a motorcycle riding simulation environment to give the user a realistic riding experience. The outcomes of the tests also demonstrate that the user requirements, which served as the research's benchmark, were tested and executed with very positive outcomes. The functionality testing results were successful and the usability testing results received a score of 76.00. A procedure will be implemented in the future to guarantee that the function may be used with the simulator, which is also now undergoing manufacturing.

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