Gyroscope Implementation in Arcade Shooter Game "Full Metal Parabellum"

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Abstract— **"Full Metal Parabellum" is a three-dimensional rail shooter game for smartphone with an Android Operating System. This game was created using Unity 3D game engine for Android platform. In this game, player will have to defeat all enemies in every stages. Player can move the in-game camera and aim by moving the smartphone around. This game is tested by black box testing for functionality test. And also, this game tested by respondent with a survey using alpha testing method and beta testing method. The survey distributed to 30 respondents. The survey shows that Full Metal Parabellum is a fun game that easy to play, and the gyroscope feature that was implemented in this game is working as planned.**

Keywords: Gyroscope, Arcade, Rail, Shooter, Unity, Android

I. INTRODUCTION

As time passed videogame has become one of the entertainment people can enjoy. Videogame is a game that use electronic device to interact with people. The game itself is an interactive activity carried out by one or more people by following the rules that limit the activities that can be done by players, creating and resolving conflicts to have measurable results [1]. Rail shooter is a genre of videogame which put player in a situation to shoot targets or enemies. Rail shooter usually can be found in arcade machine which is a type of videogame that operated by coins and can be found in a family restaurants or entertainment center.

One of popular rail shooter title is "Time Crisis". That we can found this game in almost arcade machine provider [2]. Time Crisis arcade machine can be seen in **Figure 1**. But as we know, arcade machine is huge. So, this game considered not a portable one. To play 'Time Crisis" we must come to arcade machine shop. Even though, nowadays many people already have portable gaming machine. Such as Nintendo Switch, Steam Deck and even Smartphones. Gaming trend already become on the go gaming [3]. Therefore, the idea creating portable rail shooting machine become main reason of this "Full Metal Parabellum". For simulating gun controller on arcade machine, this game will be using Gyroscope on Smartphone.

Figure 1 Time Crisis, an example of Rail Shooter Game

The title of the game is "Full Metal Parabellum" which is a combination of two words, that is full metal jacket and 9mm

parabellum, a type of bullet that is used in this game. In this game player will act as a kidnapping victim and has to shoot all the robots that prevent the player to escape. Example of a rail shooter game is Hide Mission developed by Januar Pangestu from Tarumanagara University, Faculty of Information Technology. The gameplay shown in **Figure 2** [4].

Figure 2 Hide Mission Gameplay

II.   METHODOLOGY

A. Game Design

In order to create a game, a design method is needed to make sure that the game is made as the creator vision. These are the structure from Jesse Schell, as follows: [5]

1.   High Concept
     "Full Metal Parabellum" is a three-dimensional rail shooter game developed for Android-based smartphones. This game has a gyroscope feature that is used to control the in-game camera.

2.   Gameplay
     Gameplay is a set of mechanics or rules and features that is possessed by a game. In Full Metal Parabellum player control their character to defeat robots and escape. In more detailed structure can be listed as follows:

   a.   Control Design
        "Full Metal Parabellum" use touch screen on the smartphone to interact with buttons and gyroscope to control the in-game camera. Some illustration regarding control can be seen in **Figure 3.**
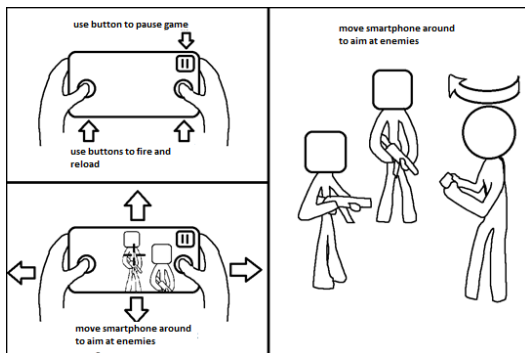

Figure 3 Control Illustration

   b.   Character Design
        There are 3 mob enemies and bosses that player encounter in "Full Metal Parabellum". Character Design can be seen in **Figure 4.**
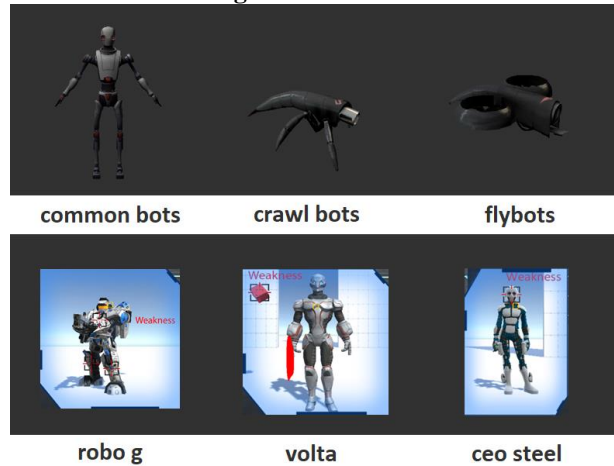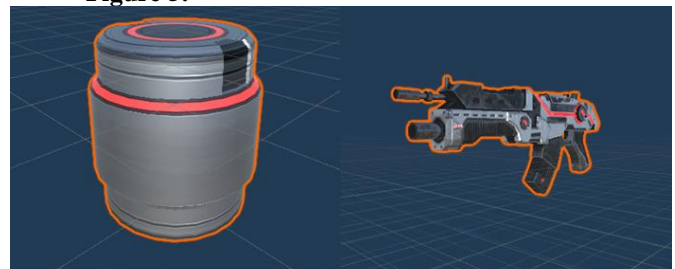

Figure 4 Character Design

   c.   Object Design
        There are 2 items that can be interact with by player in "Full Metal Parabellum". These Objects can be seen in **Figure 5.**

Figure 5 Object Design

   d.   Level Design
        "Full Metal Parabellum" has 5 stages and 3 boss fights in each odd numbered stage. Stage Design can be seen in **Figure 6-10.**
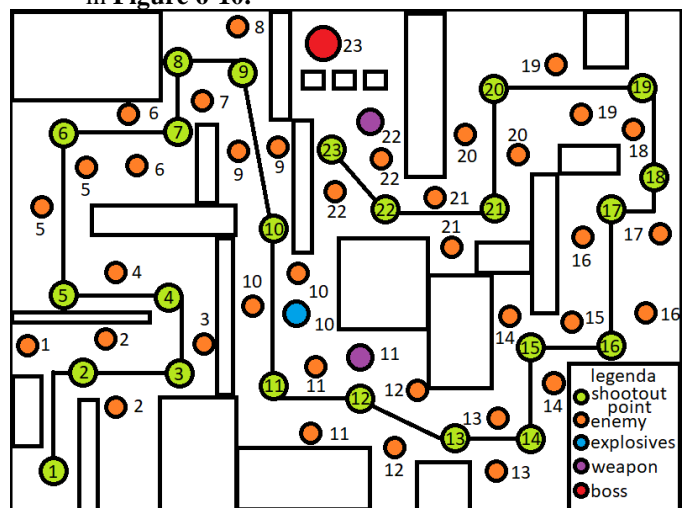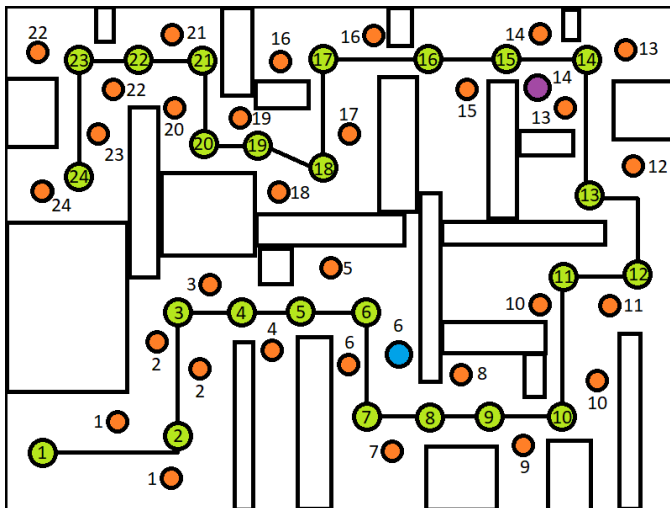

Figure 6 Stage 1 Design
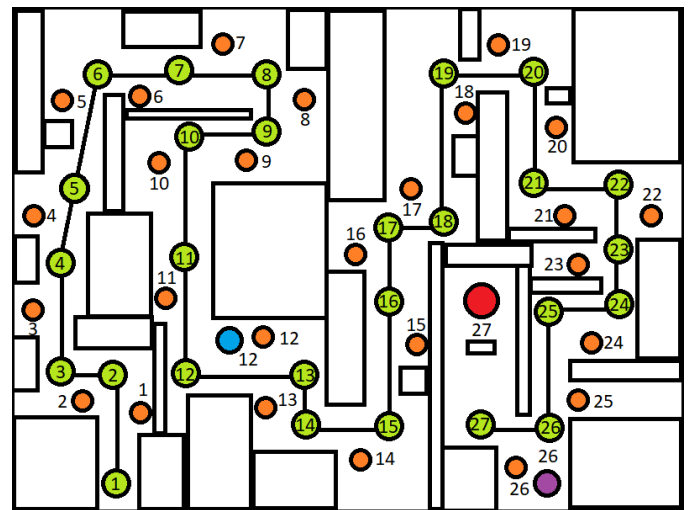
Figure 7 Stage 2 Design
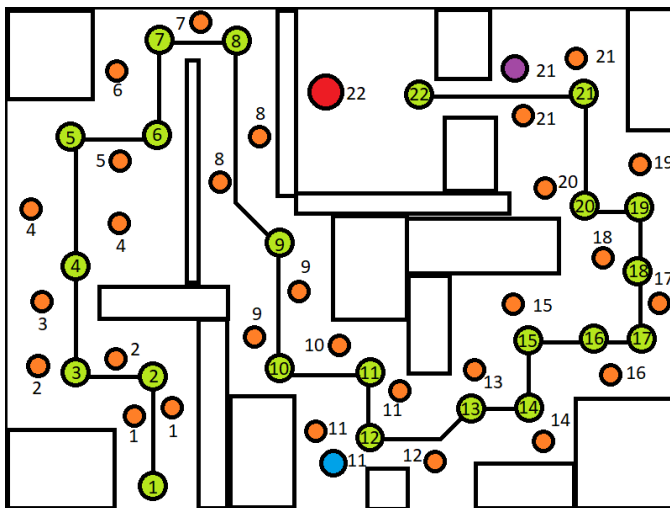

Figure 8 Stage 3 Design
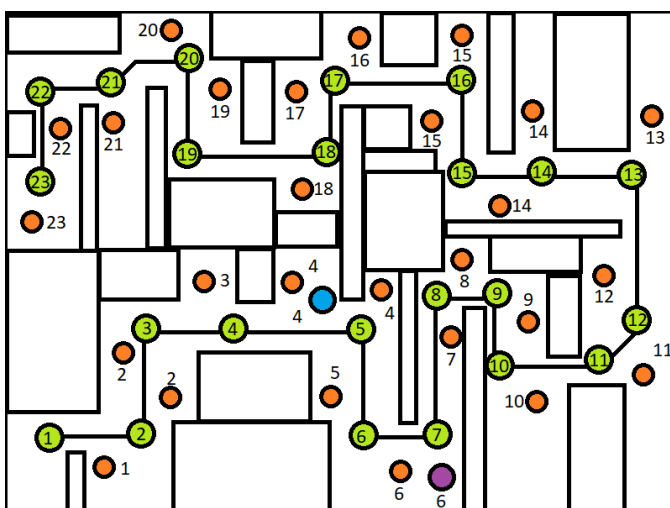

Figure 9 Stage 4 Design

Figure 10 Stage 5 Design

e. Sound Design

Each stage and menus in "Full Metal Parabellum" feature a different background music and sound effects to support the atmosphere of the game.

3. Story

The player will act as a kidnapping victim by evil robots and has to find a way to escape the building.

4. Hardware

Full Metal Parabellum platform is targeted for Android Smartphone that has gyroscope sensor.

5. Testing

There are 3 testing phases in "Full Metal Parabellum", which are black box testing, alpha testing, and beta testing.

B. Game Genre

Games genres is used to identify and group games based on similar characteristics. "Full Metal Parabellum" is categorized as a rail shooter. Rail shooter is a shooter type of game where player control is limited to directing where to fire around a screen. The player does not take control of which path their character will take.

C. Gyroscope

Accelerometers in mobile phones are used to detect the orientation of the phone. The gyroscope, or gyro for short, adds an additional dimension to the information supplied by the accelerometer by tracking rotation or twist [6]. Smartphone uses gyroscope in form of a sensor to sense rotation and determine the device's orientation like shown in **Figure 11**.

Using Gyroscope for shooting game can provide better aiming for moving the crosshair faster rather than using gamepad or virtual joystick controller that usually used in mobile first-person shooter game [7].
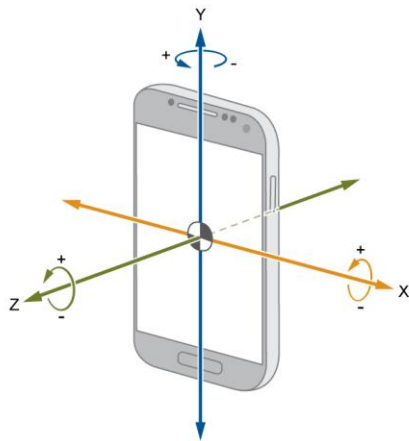
Figure 11. Gyroscope System on Smartphone

There are already some games using this feature in their gameplay such as popular shooting games PUBG using it for additional aiming system like shown in **Figure 12** [8].

Figure 12. Aiming in PUBG shooting games using Gyroscope

There is relevance of genre from PUBG and "Full Metal Parabellum" in term of using gyroscope for aiming system. Therefore, this game will make use of gyroscope sensor in Android smartphone to control the in-game camera. Player will be aiming their crosshair using gyroscope trying to shoot every enemies that appear in screen. But because this is rail shooter game, player don't have to move their character in term of translation space. Because it is already done with the game system. Player just need to rotate the camera aiming.

III. TESTING AND DISCUSSION

"Full Metal Parabellum" is developed using Unity Game Engine with gyro class properties to use gyroscope feature. This game is developed for smartphone with Android Operating System. The testing of "Full Metal Parabellum" has been done using 3 testing methods, black box testing, alpha testing, and beta testing.

A. Blackbox Testing

Blackbox testing is done by running every module in the game on several devices to check whether the game has running properly according to the design or if there is any bug in the game. After being checked, all the module was working properly. Some of the gameplay interface that has been checked can be seen in **Figure 13.**
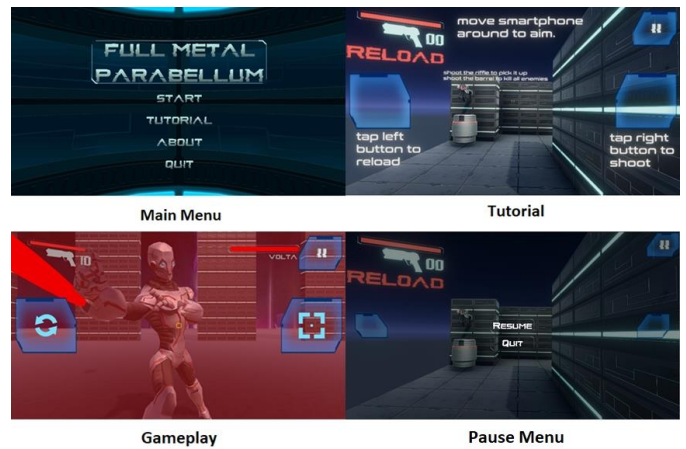

Figure 13 Gameplay Interface

B. Gyroscope Testing

Gyroscope is testing with playing games several times in seated position and standing position. This will test stability in gyroscope that can affect performance in gaming. The gyroscope feature is working as planned in seated position or standing position, all of the interaction between objects and character are working as planned. Testing process can be seen in **Figure 14.**
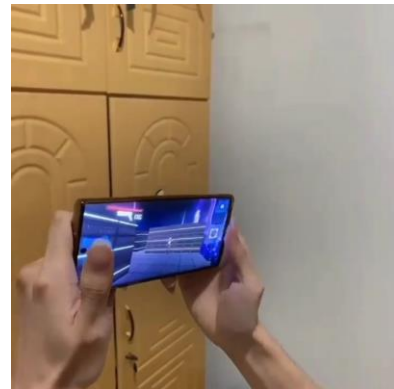

Figure 14 Testing the Gyroscope

C. Alpha Testing

This testing is done with people who have experience and knowledge in the field of games. Alpha testers for "Full Metal Parabellum" are the thesis supervisors. Based on the alpha testing that has been done, there are some feedbacks from alpha tester then it will be reviewed and changed the gameplay of "Full Metal Parabellum" such as:
1. Add a transition animation when stage is restarting
2. Add more information on about module
3. Add a skybox for tutorial stage

D. Beta Testing

Beta testing is done using an online system. where game files are placed on Google Drive which are then distributed randomly. After playing the game, respondents were asked to fill out a questionnaire with Google Form. There are 30 respondents who tried the game and filled the survey. Some of the beta testing results can be seen from **Figure 15** to **Figure 17**.
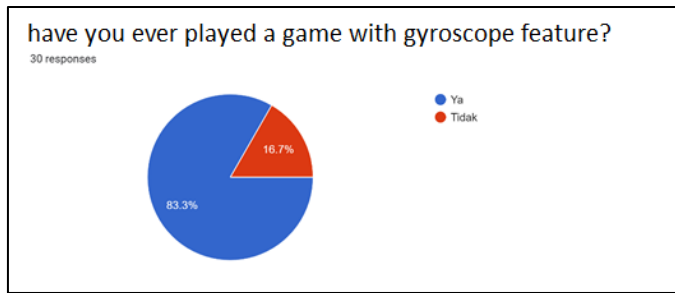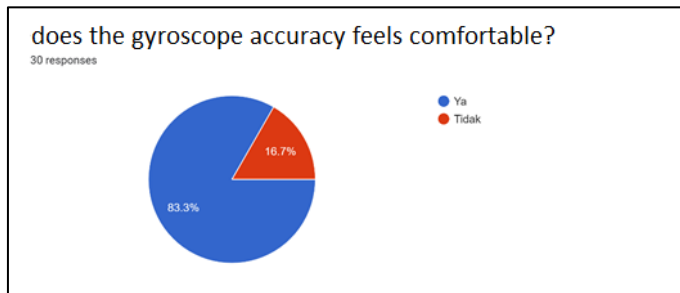
Figure 15 Game with gyroscope feature

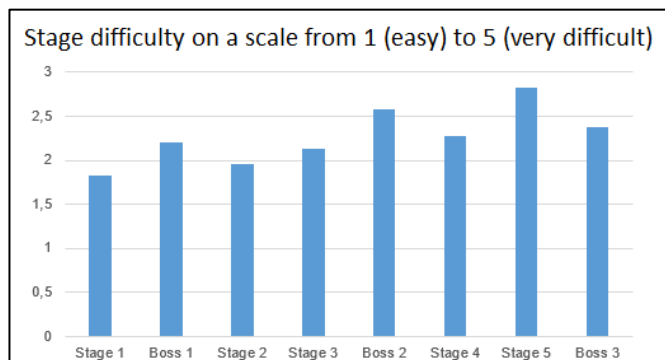**Figure 16** Gyroscope accuracy Full Metal Parabellum

Figure 17 Full Metal Parabellum difficulty average

Survey result analyzed as follows:

1. Around 90% of respondents answered that they have played a rail shooter game before, so it can be concluded Full Metal Parabellum's genre is popular.
2. As many as 83,3% of respondents answered that they have played a game with gyroscope feature, so it can be concluded that there are many mobile games that use smartphone's gyroscope sensor.
3. As many as 83,3% of respondents feels that the gyroscope accuracy is already adequate.
4. "Full Metal Parabellum" difficulty gradually rises as player move to higher stage.
5. As many as 80% of respondents finds "Full Metal Parabellum" entertaining and wants to play it again.

IV. CONCLUSION

"Full Metal Parabellum" has finished developed then it is tested with several methods that can be concluded that Gyroscope feature that has been used in this game can be found in many mobile games, but these unique features become main attractive point so there are many respondents want to play this game again. And rail shooter genre like "Full Metal Parabellum" are very popular. Also, the precision of gyroscope in "Full Metal Parabellum" is already tested as adequate. Lastly, this game considered has balance difficulty.

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