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Pocket Skate: Prototype of a Mobile Projection-Based Game

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ABSTRACT

Exergaming is the activity in which this kind of videogame relies on the technology from the body's movement or reaction. However, some commercial devices that provides these engaging activities, such as XBOX Kinect and Nintendo Wii Fit, are quite expensive and considered luxury for many. What we propose here that is by using a typical mobile phone as the censor/controller and combined it with a display device such as a smart TV or a laptop.

By using accelerometer, gyroscope and magnetometer on a typical mobile phone we can build a prototype of a game that attached on players' body and have it mirrored on a Smart TV.

The researcher was able to construct a proof of concept prototype of the app. First, the user will control a skateboard on smart TV or other wireless projection where it will receive mirror feeds from the smartphone. The smartphone itself was placed on the player hips or inside his or her pocket. To control the skateboard, user must make a small jump to make it jump or face side to side to make the skateboard change direction to avoid obstacles. While the app is still a prototype, yet it was able to show how a game can use a projected-based interface and mixed it the use of gyroscope and accelerometer censors. Future recommendation would be integrating it with calories counters for it to be fully "exergaming".

Keywords: Accelerometer, Gyroscope, video game, Unity 3D, exergaming.

INTRODUCTION

Videogame is a game using digital screen to show video or animation. In videogame, the player can get failed in doing the goal of the game. However, the player can also get another chance to try to finish the problem until the end of the game and find a solution to the problem (Bahar, 2014; Wahyudi, 2017). Today, the activity that is too monotonous can lead to boredom due to the repetition without any variations. Playing video game doesn't require too many moves but some recent development show some game can supports exercise, namely "fitness game", that relies on the technology that "follows" the player's movement and reaction. Fitness game is

classified into game genre named exergaming. Exergaming is the activity in which this kind of videogame relies on the technology from the body's movement or reaction (Oh & Yang, 2010; Wijaya, Honggowidjaja, & Suprobo, 2018).

There are several existing commercial devices that has been used as user interface for an exergaming activity such XBOX Kinnect, Nintendo Wii Fit and other arcade games such as the popular Dance Dance Revolution. However, these games platform are quite expensive and considered as luxury as they are a dedicated device only for games.

What we propose here is a different kind of exergaming that is by using a typical mobile phone as the censor/controller and combined it with a display device such as a smart TV or a laptop, thus it is a prototype of a mobile projection-based game. The game is similar to the typical endless runners game on mobile such as Subway Surfers and Temple Run but with several main differences. First, the player will not holding a smartphone on but instead he or she will look at a laptop, smart TV or other wireless projection, where it will get the screen feed from the player smartphone. The smartphone itself will be placed on the player hips or inside his or her pants or jeans' pocket and to control the skateboard and user has to make a little jump to make the skater jump or move side to side to make the skater change direction. This app will serve as a prototype which show how a game can use a projected-based interface and mixed it the use of gyroscope and accelerometer censors. The app will also count how many jumps which user may count is as exercise indicator.

LITERATURE REVIEW

We utilized accelerometer and gyroscope for controlling the object and it is not something new, yet the following are a compiled comparison of this app and other published research. On research by Finklestein, Nickel and Barnes (2010), the researcher uses a wide screen, projector, electromagnetic tracker, and VR so it is a bit costly. While on a research by Shaw et al (2015) the researcher only identified the VR design, so it will not use compass, accelerometer and gyroscope. Furthermore, the research by Colombo et al (2012) and another one A. Colley, J. Väyrynen, and J. Häkkilä, (2015) used compass, accelerometer and gyroscope on their researches, which is very similar to this research. However, the purpose of the former research is to improve human's brain capability who has dementia. The equipment used on this research is only TV and censored camera. Meanwhile, the later research was only held the research on

the ski area and didn't held anywhere else. On the other hand, this research will make an exergaming application prototype that may be more affordable and aimed for fun or casual use.

METHODS

Research Design & Data Collection

In this research, the researcher follows the prototyping model. In this model, there is a stage started with communication, quick plan, modeling quick design, construction of prototype, deployment delivery and feedback as seen on Figure 1.

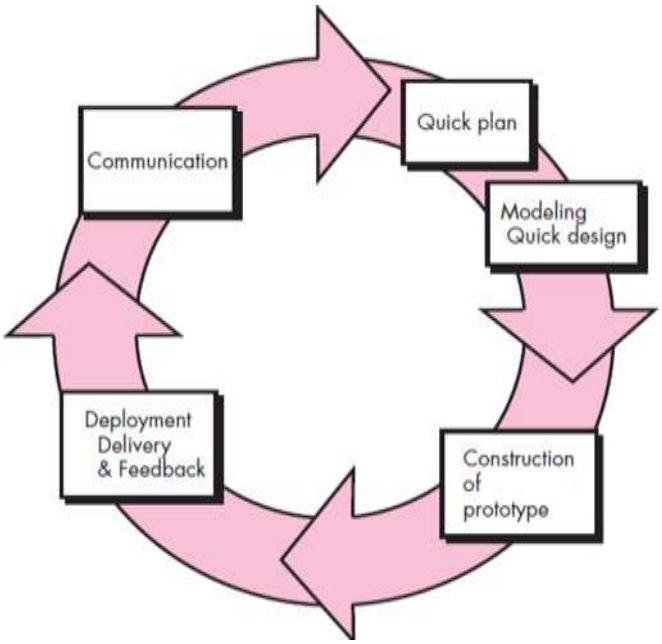

Figure 1. Prototyping Model (R. S. Pressman, 2010)

The data needed in the research and how to collect data. The data needed in this research is secondary data and for the data collecting is using study literature. The data used in this research is secondary data. The researcher obtained the data through another research object based on journals, books, articles, and other sources related to this research. The data collecting technique used in this research is study literature towards journals, books, and articles related virtual reality gaming.

Conceptual Framework

Conceptual framework is made to explain the research concept. Below, the researcher divides the conceptual framework into 2 parts, namely: Research Conceptual Framework and App Conceptual Framework

1. Research Conceptual Framework

This research conceptual framework will discuss how the research process is conducted. From the conceptual framework above the steps can be explained as follows:

a. Collecting Information

This is the first stage of the research, in which the collected information is data that will be used later as the app making reference.

b. The App Making and the Interface Design

This is the second stage of the research; the researcher will make an app based on the interface design which is the base design of the app. The app making the app coding as well as the 3D are made using Unity 3D that is used as 3D model making from the cross object and each score taken.

c. Testing

This is the last stage of the research, the trial process towards the app made is conducted and if the app isn't accordance with what the researcher wants, it will return to the initial process, if it is accordance with what the researcher wants the trial will be conducted.

2. The App Conceptual Framework

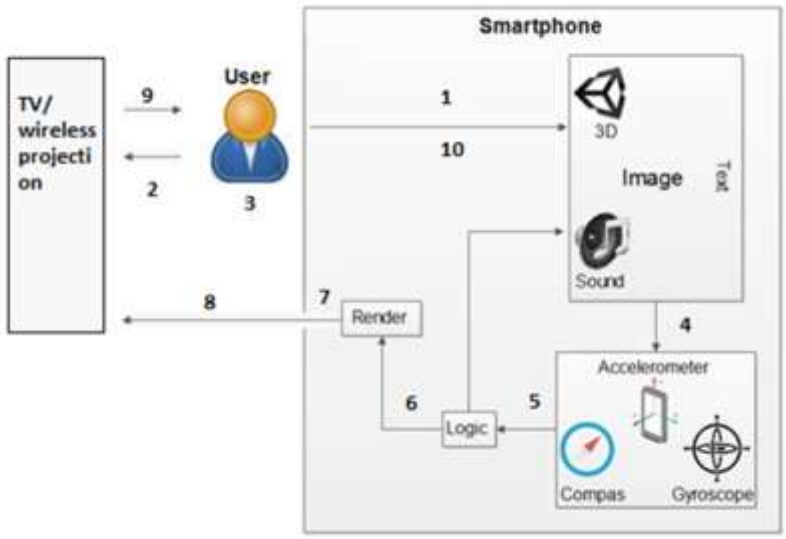

Figure 2. Application Conceptual Framework Insert

Figure 2 explains about the app conceptual framework, as follows:

1. User uses smartphone to open the app.
2. User will connect the smartphone to an external display such as a smart TV, chromecast or a wireless projection feature in Windows 10.
3. User placed the smartphone on his/her hips (probably with a holder such as a waist bag)
4. The app starts to run, and it will be started from the integration of 3D, sound, text.
5. Sensor process, accelerometer, gyroscope, and compass.
6. The app will proceed compile from the app.
7. Rendering frame per frame process.
8. The process shows the result from rendering to smartphone and the sent to the TV or wireless projection.
9. The projection will be seen by users
10. User will send input in the form of a movements.

App Development

In this research, the researcher uses tools such as hardware and software. We will use a typical PC running AMD FX 9800p with 8GB RAM and a combo 1 TB & 128 SSD storage. We will use Real Me 2 Pro as the smartphone running Android Oreo 8.1

For application development we use Unity 3D that aimed to build an Android app as the end product which can be installed on an Android based smartphone. The application will utilize the smartphone censors such as the accelerometer, gyroscope & compass. The accelerometer will be utilized to detect shakes which will be translated by the app to "jump" while the gyroscope and compass will detect when the smartphone is tilted or face left or right which will be control the player in avoiding the obstacles in the game.

RESULTS

The final application was built and installed on the smartphone with interface shown on Figure 3. On the interface, there is jump, distance and coins counter. The jump and coins won't reset unless the player quit the game while the distance will reset when player collided with the obstacles.

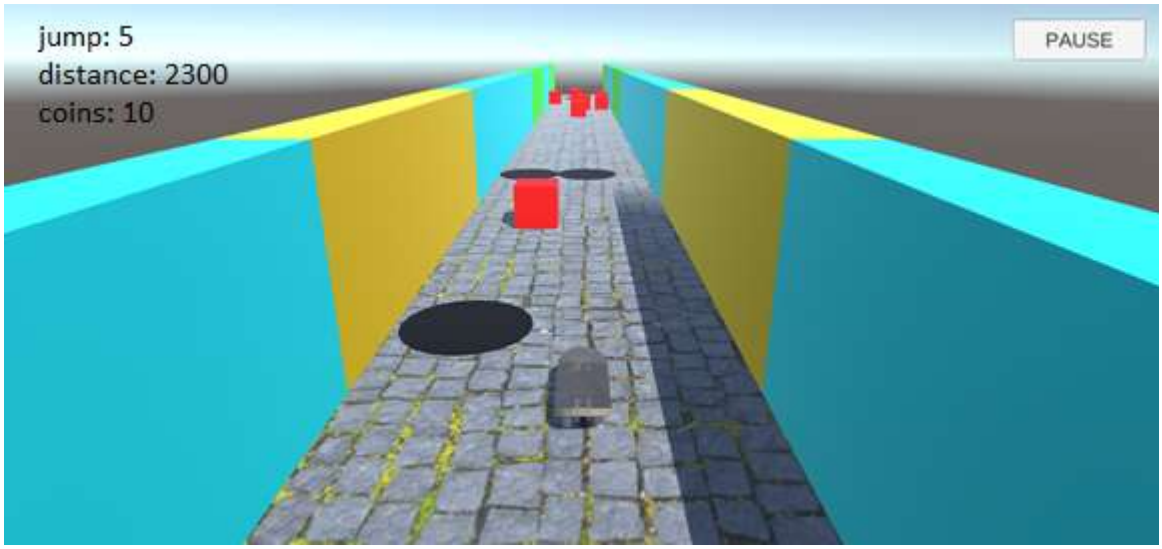

Figure 3. The Game Interface

As seen on Figure 4, to play user can start the application and place the smartphone inside his or her pants or jeans front pocket of before starting the game. User will control the skateboard by mimicking a skateboarder (twisting the feet to face left to turn left and face right to turn right). User can also jump to avoid a hole obstacle.

While on Figure 4 laptop is being used to mirror the app, we can also use Smart TV or Projector for bigger screen. To mirror the phone screen to laptop or Smart TV we need to turn on "Project to This Screen" feature on Windows 10 and turn on mirror feature on the Android smartphone. On a projector we may use Chromecast or another Wi-Fi based HDMI dongle.

Another requirement to have a good mirror the smartphone and laptop, Smart TV or HDMI dongle needs to be on the same Wi-Fi network. While it is noticeable that there's lag caused by the Wi-Fi mirroring, yet the lag is less than 1 second thus the game is still very much playable.

Figure 4. How to Play the Game

DISCUSSION

Conclusion

The researcher was able to construct a proof of concept prototype of the app. First, the player will look the hero, a skater, on laptop, smart TV or other wireless projection where will be receive mirror feeds from the smartphone. While the app is still a prototype, yet it was able to show how a game can use a projected-based interface and mixed it the use of gyroscope, accelerometer and compass censors.

Future recommendation would be integrating it with calories counters for it to be fully "exergaming" and have it available on other platform such as iOS and Windows Smartphone.

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