VR Biking

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Abstract

Fitness is popular. But when people ride the bike, they just watch TV hanging on the ceiling, listen to music or look at themselves in the mirror at the meantime, which is kind of boring. The happiness for biking to some people has been decreased and that prevent them to do exercise. If we can make biking exercise funner, it can encourage people to engage sports and embrace the healthy life.

Our application aims at making fitness more satisfying. When the user put on this headset, the world will be totally different from the regular fitness room. And there is a chance that you can ride by the seaside. Equipping bike with Oculus Rift can turn the dry machine into the entertainment product.

Implementing a pure virtual world using Unity, we will create a seaside environment with runways, bonus and small barriers. By using the Wahoo Bluetooth Speed and Cadence Sensor, the VR game will reflect the speed that you ride. Specifically, the program and changing speed of the scene in Oculus Rift is adjust to the real spinning speed. The user will be asked to achieve a certain amount of score or finish certain distance.
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1. Introduction

1.1. Background

Fitness is popular. But when people ride the bike, they just watch TV hanging on the ceiling, listen to music or look at themselves in the mirror at the meantime, which is kind of boring. The happiness for biking to some people has been decreased and that prevent them to do exercise. If we can make biking exercise funner, it can encourage people to engage sports and embrace the healthy life.

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1.2. Devices to use

Oculus Rift -- 3D device
Oculus Touch -- Control the direction in the VR game while riding
PC -- Run the VR game program
Wahoo Bluetooth Speed and Cadence Sensor -- Measure the spinning speed of the bike and send the data to PC
Bike -- Fitness device
Server -- We ran the server on the same PC as the VR game program
1.3. FAQ

1.3.1. Minimum requirement of the PC to run

In order to fully run the VR game and the server at the same time, we would recommend:

1. 2 GHZ CPU with dual core;
2. 2 GB graphic card;
3. 8 GB memory;
4. Windows 10 / OSX 10.7 or later;

Our device is Macbook Air(early 2014) with 1.5 GHZ CPU, dual core, 1.5 GB graphic card, 4 GB memory, OSX 10.10; and our device cannot fully boost this VR game, and even if we use the preview mode, our Macbook gets very hot in a short time.

1.3.2. Version of Unity

Unity 5.0 or later

1.3.3. Can I turn left / right in the game?

No, this is a straight path running game. But we can move left / right to collect bonus or avoid obstacles; Also, we can jump to avoid obstacles.
2. METHODS / RESULTS / APPROACH

2.1. Methods

2.1.1. Game Design

As we can see above, in the game design part, we implemented a path, and set the environment as sea by putting a huge sea asset under the path in the game. Also, we made a person and set to first person view. In the path, we use random function to display the obstacles, which can kill the player, and some bonus, which can boost the score. For the speed in the scene, we wrote a function to read data from the localhost every .5 second, and update the speed as well.
2.1.2. System Design

As we can see above, we install the Wahoo Speed and Cadence Sensor on the bike, and through bluetooth the sensor can send the cadence data to the PC (here we use the same PC which runs the Unity program), and write to the Apache Server every .5 second. As we discuss above, the unity program read data from the server every .5 second to update the scene moving speed. And the Oculus touch makes it possible for the user to control the player.
in the game without hitting the left arrow key, right arrow key and up arrow key (which can let the player jump) on the keyboard.

2.2. Experiment / Product Results

Since this is a VR game, we just executed the program when we came up with new features. And we adjusted the moving speed of the scene according to the spinning speed of the real world bike to have everything looks real, not too fast and not too slow;

Product Results:

We implement:
1. First person running game
2. Auto-extended path & infinite sea
3. Character can move left and right to collect bonus point
4. Character can jump or move L/R to avoid collision

This is the scene when the user look forward
Challenges:

1. More reality: Only the seaside is not enough for users. If we can use Google Map Street View API and use the Oculus Rift to render the street view, the product will be much more awesome and competitive!
2. Minor bug: if the user keep jumping in the VR game, then the path has a possibility to not extend, in this case the player will dive into the sea and die.

3. COST AND SUSTAINABILITY ANALYSIS

Cost:

- Mini Displayport for Mac $13.99 * 2 = $27.98
  Reason: the Oculus Rift has a HDMI port while our Macbook Air cannot adapt, so we need extra adaptor cable
- Wahoo Bluetooth Speed and Cadence Sensor $40
  Reason: we need to measure the spinning speed of the bike and tell the Unity Program so that the scene will move faster or slower; hence a Cadence sensor with bluetooth is satisfiable
- Oculus Touch $100
  Reason: Control to move left / right in the game while riding in the real world

Oculus Rift : free, borrowed from Charles
4. CONCLUSIONS / SUMMARY

From February to March, we learnt how to program on Unity, and we designed how
the system should look like; we set up the Oculus Rift on our Macbook so that it can
render programs.

From March to April, we made a decision about what kind of game to implement,
designed the rule of the game, and built the VR game program on Macbook in Unity
Environment. In the game, the virtual environment consists of the auto-extended
running path, bonus, obstacles and ocean view.

By the end of April we figured out which sensor to use and then we were able to
measure the spinning speed. After that we posted the speed data on a apache server
and let the program to read speed data from the server.

During the Capstone project, we came across many problems and difficulties,
which we probably will meet in our career. And at the end we either avoid the problem
by using a substituted method or overcome the problem. By doing this design project,
we practised our problem solving skills and better prepare us for the future. In the same
time we realize how important a team is and how important the communications
between the members are.
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