Object Oriented Tutorial Using Open User Model in Adaptive Augmented

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ABSTRACT

In the project of Object-Oriented Tutorial Using Open User Model in Adaptive Augmented, we have focused on implementing an Open User Model and User Adaptation, that helps user learn Object Oriented Concepts through a game by integrating with Augmented Reality. The project is based on the concept of integrating User adaptation, Data Visualization, with Unity 3D and Augmented Reality.

Keywords

Unity 3D, Augmented Reality, Object Oriented Concepts, Data Visualization, Adaptation.

1. INTRODUCTION

The project demonstrates how data visualization and adaptation are implemented in a 3D gaming environment using Unity 3D as the core technology. It is implementation of various concepts like User Adaptation, Data Visualization through Unity 3D and Augmented Reality. There is a significant learning as well involved in the project which helps user in learning Object Oriented Concepts through an interesting game. Projection is implemented through Augmented Reality. The concept of Open User Model is achieved through various Data Visualization as implemented in the Project. The User adapts through the speed of the game, on a cube and a ball.

2. MOTIVATION

Most of the real-world technologies are based on User Model in order to increase User Interactions and User Recommendations. Hence, in this project we help the user to visualize his actions through persistent action logging so that the user understands his performance and adapts to it. The implementation of Augmented Reality through Projection is a way of enhancing the User experience.

3. METHODOLOGIES

Unity 3D provides a huge set of assets which includes varieties of 2D and 3D objects, images as well as widgets. All game objects are provisioned to inherit the physical attributes. It also provides different ways to manage the life cycle of objects and scenes.

4. IMPLEMENTATION

This game expects the user to score certain number of hits by colliding the ball with surrounding cubes. If the ball crosses the ground boundary at any time, the game ends. The game also terminates after crossing the maximum hits. As soon as the game ends, the user is taken to a visualization page displaying the graphical representation of the average speed and hit count performance of the user. At any time, maximum latest 10 records are displayed in the form of line graphs. In the play page, a dynamic graph depicting the acceleration across X, Y and Z axes is displayed. As the user changes the orientation of the device, the same is reflected in the acceleration graph. The change happens every 200ms. This game also features augmented reality. To be specific, the ground is mimicked with the help of a printed picture from Vuforia database. The changes in the surface of the paper translates the same in the ground surface shown in the device. This gives a live AR experience. There is another learning aspect of the project, where every hit of the ball with any of the cubes, triggers displaying an OOPs concept in the footer.

4.1 Open User Model

In our effort to implement an Open User Model in the project, we have displayed bar graphs and line graphs to help user understand his/her performance while playing the game. The bar graph helps the user to understand the acceleration across x, y, z axes caused due to change of orientation. As the game comes to an end, the user can even get an overall idea of his performance through two-line graphs showing speed of the ball and number of hit count throughout the game.

4.2 Data Visualization

The data visualization is represented with the help of both line graph and bar graph displaying the average speed, hit count and live acceleration respectively. The game has the provision to change the ball shape from spherical to cubical. This is how the game implements adaptation. Ideally, in both the situations, the ball follows the law of physics irrespective of the shape.

4.3. User Adaptation

User Adaptation is implemented in the project through change of ball shape and reduction in speed, such that if a player is unable to play with the ball the speed of the ball decreases to almost 50%. Even after that if the player is unable to get hands on of the game the ball changes to cube thereby making it easier for the player.

4.4. Augmented Reality

The Augmented Reality is an interesting part to implement. The playing scene is primarily focused on the ground, ball, cubes and wall. This is the movable part in the scene. The scene as a whole gets augmented on top of a real world printed paper.

5. CONTRIBUTION

5.1. *Data Visualization and Adaptation*

My contribution in this project is primarily implementing Data Visualization and Augmented Reality. There are two types of graphs present in the gaming project such as bar graph and line graph. The bar graph shows the acceleration across all the axes. The three axes are represented across length, breadth and thickness of the device. As and when the device changes its orientation, acceleration across the X, Y, Z axis are updated and same is being displayed in the graph. There are 3 bars which are rectangular images, and anchored with the parent graph holder. They are anchored in the middle center. The changes in the scale, translates the height of the bars. Positive scaling lets the bar go up and negative scaling does the same in reverse direction. And this event is called every 200 milli seconds. So, we can see the graph changing lively 5 times every second.

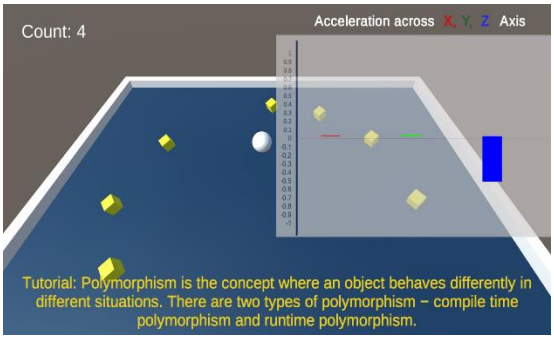

Fig 1: Game Scene showing ball, cube, ground and wall

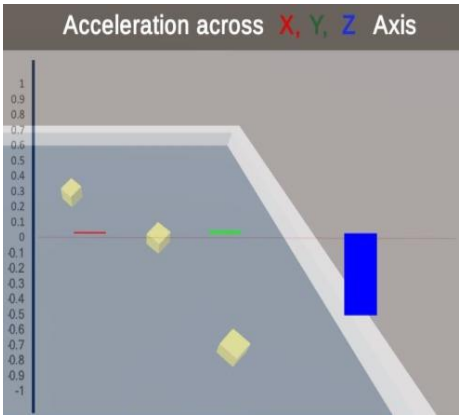

Fig 2: Bar graph showing x, y, z acceleration

The line graphs showing average speed, hit counts are implemented with the help of sprite. The sprite is of circular shape object with white color. There are maximum 10 sprites representing the 10 recent hit count/ avg speed. The data corresponding to these records are stored in a queue. The queue is expected to hold latest 10 records, which are supplied to the graph builder 5 times every second. But the queue and indirectly graph changes only when the game ends. The change is reflected with the help of update () function which calls itself every 200 milliseconds. This can be customized based on user's preference. The sprites are retranslated as per the new values (avg speed/ hit count) and at the same time the connecting lines adjusts themselves between enclosing sprites where either of the same changes.

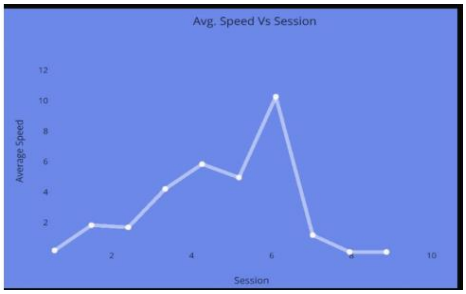

Fig 3: Line graph showing average speed per game session

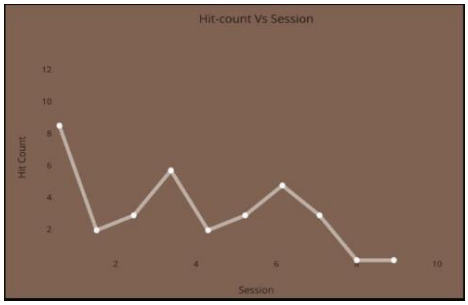

Fig 3: Line graph showing hit count per game session

5.1.2. AR Implementation

To implement AR, I had to upload a picture to Vuforia database and then download the database from the account holder's Vuforia developer page. The database is imported in the Unity project. The AR implementation needs an AR camera in the scene. The AR camera has a target image (represented by the picture uploaded and to be printed later) of which all the components like wall, ball, ground, cubes are part of. As the picture printed on the paper changes its surface, the same is reflected in the ground scene. The device camera acts as AR camera.

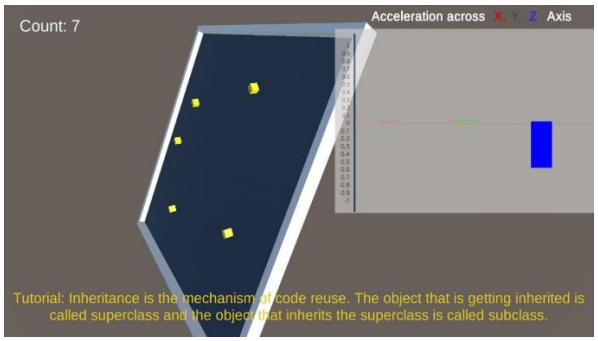

Fig 4: Augmented Reality reflecting the paper orientation

6. CONCLUSION

The project is an effort to capture important aspect for an end user including User Adaptation, an Open User Model, Data Visualization and Augmented Reality. The project is not only essentially a game but also illustrates the facts to be considered to increase User interactions with the game. The graphs shown in the project helps the end user to analyze the performance which is an important aspect.

On the other hand, there has been integration of many trending technologies like Unity 3D, Augmented Reality and Graph based Visualization.

7. ACKNOWLEDGMENTS

I would like to thank Professor to Ihan Hsiao for giving us a chance to explore different aspects in Unity 3D, Augmented Reality to integrate with Open User Model and User Adaptation. I would also like to express my gratitude to her for helping us understand the concepts that have been implemented. I would also like to thank Cheng-Yu Chung for helping us to get hands on Unity and Augmented Reality.

8. REFERENCES

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