Augmented Reality Project :
Bowling AR Game

Team:

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Youtube URL:
https://www.youtube.com/watch?v=a99fr1xVWIs

Aim:

To build a classic Bowling Game on the AR platform for iPhone users using the AR app building toolkit.

Introduction:

Bowling AR Game is an entertaining Augmented Reality Game where people can play the game on their phones. It will illustrate a classic bowling game environment over the real world, shown through the camera. Using the common physics fundaments used in the development of the game, such as Collision Detection and Plane Detection (3D Pattern Recognition), this certainly brings out a sense of realism to the game.

Theoretical Background:

For building this game, we have kept in mind the basic laws of Physics and demonstrated them in the game in such a way that it brings a sense of ‘realistic’

touch to the game. The concept of the classic bowling game is that the player rolls over a heavy bowling ball over the flat surface, aiming at a bunch of pins which are kept at a certain distance.

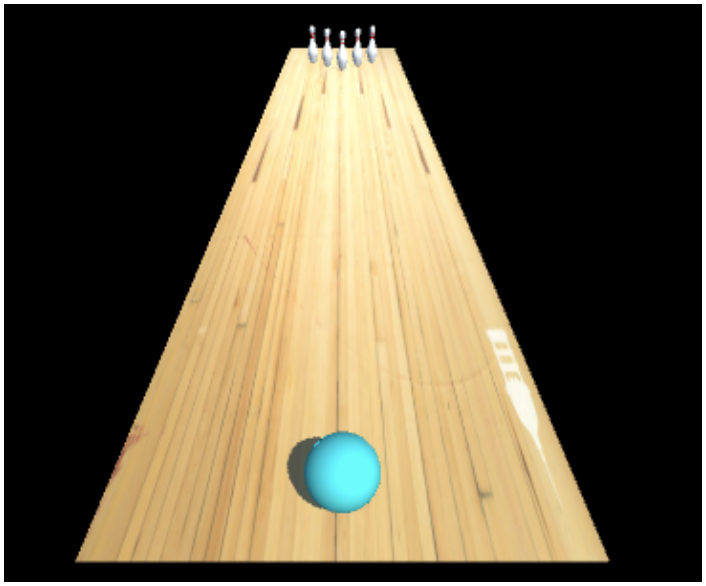
How the game works is that the user aims his/her phone over a horizontal flat surface and then a virtual bowling alley/environment is setup.

Once the environment is setup, the user gets to play the game by shooting the virtual ball towards the pins.

If ball hits the bottles, we experience collision detection and the score is displayed on the screen based on the number of pins dropped.

Implementation:

To build this game we have made use of Unity and ARKit as the major software tools. We developed the game in Unity and compiled it on ARKit, which was further used to push the code to the connected iPhone.



In order to keep the development simple & easy, we divided the project into two tasks:

- Plane Detection on the real world where our game will be setup and placed.
- Collision Detection in order to bring the physics of the game to life i.e. making the pins fall down when the bowling ball hits the pins.

Apart from this, we have also implemented the option for the user to move the ball on the horizontal x-axis based on his strategy of shooting the pins. Also, we have implemented a reset button basically to reset the game with all the pins standing, and a short score space which will display the score based on the number of pins dropped on collision.

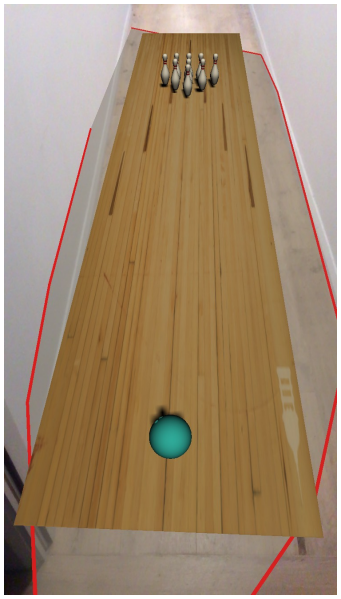
Experiments:

As mentioned earlier, we divided our primary objective into two - Plane Detection and Collision Detection. For each, we separately carried out different experiments and once completed, we merged both parts of our code to form the single game.

Plane Detection:

For plane detection we made use of certain properties of Unity, which helped in the scanning the real world using the phone's camera and detecting the horizontal surface from the input taken from the camera and outline it in the phone.

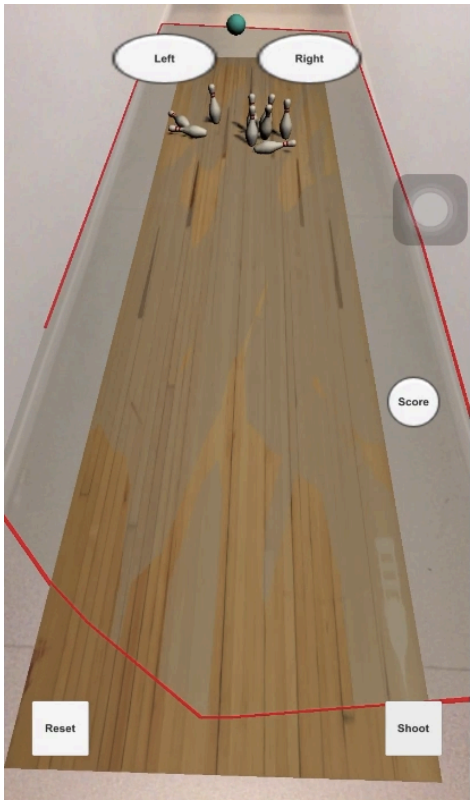
Once the horizontal plane is outlined, the user taps once on the screen and the game setup is then created on the outlined plane. To get the game setup on tap feature, we created the game prefab and wrote a C# script to have it function like that.



Collision Detection:

For collision detection we made the pins and the ball have physical features by providing it with Rigid body and Box Collider properties. Then, we gave an initial speed to the ball when the user presses the hit button. When the collider of ball touches the collider of pins the collision will happen and the pins which got hit by the ball with enough force would fall down.

To calculate the score of the game, we did this by checking the angle of each pin which have been changed after the game happens.



Other Basic Features:

- Bowling Ball Horizontal Movement Control - We have added two buttons (one for left and one for right) which controls the horizontal x-axis movement of the bowling ball. So the user can select the starting position of the bowling ball from where he wishes to shoot from.
- Scoreboard - A button with the title “Check Your Score” has been added to the game on click of which displays the score (number of pins that fell) for a particular game round.

- Reset Button - We have also added another button to reset the game. The user can use it once he has shoot the ball towards the pin, to get the game setup back to its original form.

Conclusion:

Through this project we got to learn how the mechanism behind Augmented Reality works and how to implement certain actions which require some laws of physics. From software perspective, we have gained a good chunk of knowledge on how to work on AR elements using Unity and ARKit for iPhone applications.

Future Work:

We can enhance the features of the game in many ways. The scoreboard can be given a similar look as it is seen on the real life bowling game. Use of finger dragging feature on the ball instead of the shoot button and horizontal x-axis movement buttons. Adding a curve ball throw feature to provide the users with the option of using advanced ball throwing techniques used by real life professional players. Upgrading the game from single player to multiplayer. Enhancements like these can be helpful to give the game a more realistic touch and can further act as a really good alternative for the real world physical bowling game.

References:

1. All Environmental models - https://www.turbosquid.com/
2. Shoot functionality - https://www.youtube.com/watch?v=RzmBnllRnh8
3. Plane Detection - https://www.youtube.com/watch?v=uWWiYfPTUtU
4. Tap to Place functionality - https://www.youtube.com/watch?v=xguiSueY1Lw