Air Hockey Game

A project report submitted in partial fulfillment of the requirements for the

Second Year of Computer Engineering

by

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Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Date: 7/12/2021

Abstract

Computer Graphics has been a part and parcel of our lives since the beginning and due to the current pandemic, it is extensively being used everywhere. Right from the morning weather reports to the educational resources and animations through which students are now being taught online. It has truly shaped the minds of students and has given a different perspective to all. We therefore decided to implement the computer graphics knowledge we gained to make an **"Air Hockey Game".**

This Air Hockey Game was inspired the actual air hockey game which required us to have the actual table and other parts. But now, anyone can play this game at their homes and wouldn't need to go to malls/places where the actual table is available. This is a free of cost, offline 2-player game for all. We used the pygame library of python to create this project.

Here there will be 2 pucks and a disc. The pucks are controlled by the user whereas the disc moves on its own. The users control the puck and try to hit the disc in the opponent's goals while they try to prevent this from happening. The score for each user is displayed on the screen and the player to score the first 5 goals win. To make this game a little more interesting and competitive we have added certain powerups like speed boost and variable goal-size once a player scores a goal.

Acknowledgments

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Introduction

1.1 Problem Statement

- To create a fun and easy to play air hockey video game, that supports a local 2-player mode along with smooth graphics.

1.2 Aim

- To successfully create an interactable graphics window with smooth animations and movements for the air hockey game using pygame module in python.
- To also add some innovative features to the game.

1.3 Scope

- A duel (two-player) game that can be played offline with your friends.
- The features added make it an interesting competitive game which is different from the ordinary air hockey game.

1.4 Motivation

The sole motivation behind undertaking game developments as our project is because games are a domain where computer graphics is used and needed the most. Right from Fifa to Pinball game, the computer graphics has been used multiple times. We wanted to experience the various challenges faced related to game development and also wanted to explore this domain by making a game with our own added special features.

Chapter 2
Literature Review

2.1 Existing System with its Limitations

Computer-game development is immensely popular with undergraduate computer-science and computer-engineering students. More importantly, the design and development of computer games is an excellent pedagogical opportunity.

Computer games are an important part of most children's leisure lives and increasingly an important part of our culture as a whole. We often, as adults, watch in amazement as children dedicate hours to acting as football coaches, designers of empires, controllers of robots, wizards and emperors in the virtual world.

The normal air hockey game can be pretty monotonous, which can get boring after a few rounds. It just involves 2 pucks with a constant velocity and the same goals.

Besides an abundant appearance of games in young students' lives, game development technology has matured and became more advanced than before. Based on various existing game development software, the whole duty of the game development process can be divided into several domains and roles such as

- game programmers
- 3D model creators
- game designers
- musicians
- animators
- play writers

Chapter 3
Analysis and Design

3.1 Analysis

3.1.1 User Requirement

- Basic knowledge of Python
- Basic knowledge about Pygame library

3.1.2 Software Requirement

- Python 2.7 or other latest version
- Modern Code Editor like Visual Studio Code, Sublime or even Notepad

3.1.3 Hardware Requirement

Windows or Linux or Mac:

- OS – Any Modern OS
- Processor – Single Core 1.1 Ghz
- Memory – 4GB RAM
- Graphics Card – 1GB

3.2 Design

First,using display function of pygame we create the main game window. Then we draw the center lines and goal markings to create our air hockey arena using the rectangle, line and circle functions. The puck is added using the blit function of pygame.

We then display and set the score counters for both the players and also create a function to pause the game and show the result once the game ends. We add our own power-ups like speed boost and variable goal-size.

Algorithm:

1. Start
2. We initialize pygame and create the window for the arena.
3. We mark the markings on the arena using the line, circle and rectangle functions.
4. Then we load and display the images of the pucks and the disc using the blit function.
5. We create the score counters to keep a track of each player's scores and display them on the screen.
6. We also declare individual speed variables for both players which we increment later during the game.
7. We give the disc a constant velocity and it starts moving.
8. If 'P' key is pressed, the game is paused. User can then enter 'C' to continue the game or 'Q' to quit.
9. Player 1 controls his puck using WASD keys and Player 2 controls his puck using the arrow keys.
10. When the disc touches the walls of the arena or a player's puck it rebounds from them.
11. When the disc touches a player's goal line, the opponent gets a point and powerups.
12. Once a point is scored, the player who scores it gets his puck speed increased and also his goal size increases. The disc returns to the center and starts moving again.
13. The player to score 5 goals first is the winner.
14. The winner is displayed on the screen.
15. Stop.

Chapter 4
Implementation

4.1 Technology Used

Python

- In this project we have used the Python language. In every emerging field in computer science, Python makes its presence actively. Python has vast libraries for various fields such as Machine Learning (Numpy, Pandas, Matplotlib), Artificial intelligence (Pytorch, TensorFlow), and Game development (Pygame,Pyglet). To create this air hockey game, we used the Pygame library of Python.

Pygame

- It consists of computer graphics and sound libraries designed to be used with the Python programming language. Pygame adds functionality on top of the excellent SDL library.
- Pygame is a cross-platform set of Python modules which is used to create video games.
- Multi core CPUs can be used easily. With dual core CPUs common, and 8 core CPUs cheaply available on desktop systems, making use of multi core CPUs allows you to do more in your game. Selected pygame functions release the dreaded python GIL, which is something you can do from C code.

Microsoft Visual Studio

- Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs, as well as websites, web apps, web services and mobile apps. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code.
- Visual Studio includes a code editor supporting IntelliSense (the code completion component) as well as code refactoring. The integrated debugger works both as a source-level debugger and a machine-level debugger. Other built-in tools include a code profiler, designer for building GUI applications, web designer, class designer, 20 and database schema designer. It accepts plug-ins that expand the functionality at almost every level—including adding support for source control systems (like Subversion and Git) and adding new toolsets like editors and visual designers for domain-specific languages or toolsets for other aspects of the software development lifecycle (like the Azure DevOps client: Team Explorer).

4.2 Code of important functions or routine

text_objects():

It takes the text, its color and the size as parameters. Then depending on the size, we create the textSurface variable using the render function of pygame. We then return the textSurface and textRect which we get using get_rect() function of pygame.

message_to_screen():

This function takes in a particular message, its color, size and the co-ordinates as parameters. We call the text_objects() function to get 2 values that is textSurf and textRect. We then specify the center of the textRect using the co-ordinates that we got. We then pass both the variables into the blit function of pygame and thus the message is displayed.

resetDisc():

Once a goal is scored, we call this function to reset the disc to its starting/default position. We take the players number who scored the goal as a parameter. Depending on this number we determine the direction in which the disc will move.

pause():

This function is called when the user presses the 'P' key. It doesn't take any parameter. It stops the disc and both the pucks. It displays the pause menu on the screen using the message_to_screen() function. Using the while loop the game will be paused until the user presses 'C' to continue or 'Q' to quit the game. If C is pressed then the game resumes, else if Q is pressed then the game exits.

winner():

This function is called when either of the two players score 5 goals. It takes the players number as a parameter. Now using the if-else condition we display the winner depending on the parameter passed using message_to_screen() function.

Power-up/Score validator:

Inside the while loop of the game, using the if-else condition and the co-ordinates of the goals, we check which goal's line the disc touched. If player 1's goal line is touched then the point goes to player 2 and vice-versa.

Now as far as the power-ups are concerned, the speed of the player whose score go incremented is increased. His goal size is also increased using the Rect function of pygame.

4.3 Screenshots

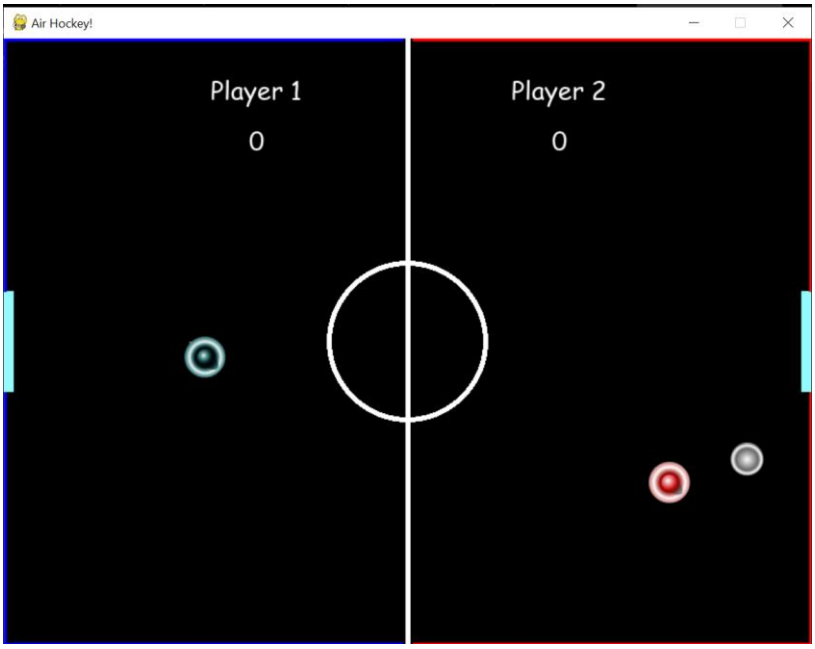

Figure 4.3.1 Game Arena

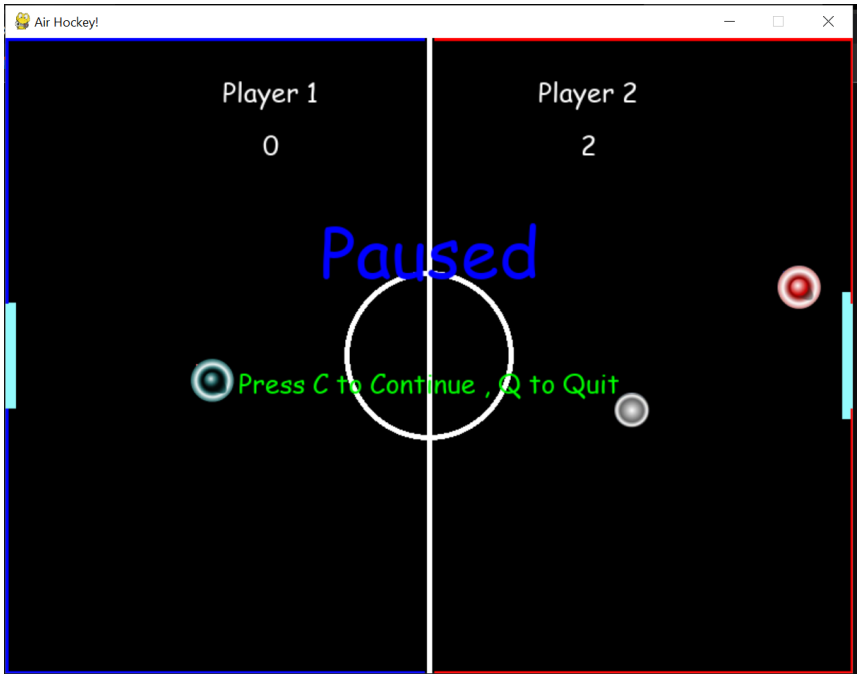

Figure 4.3.2 Pause Menu

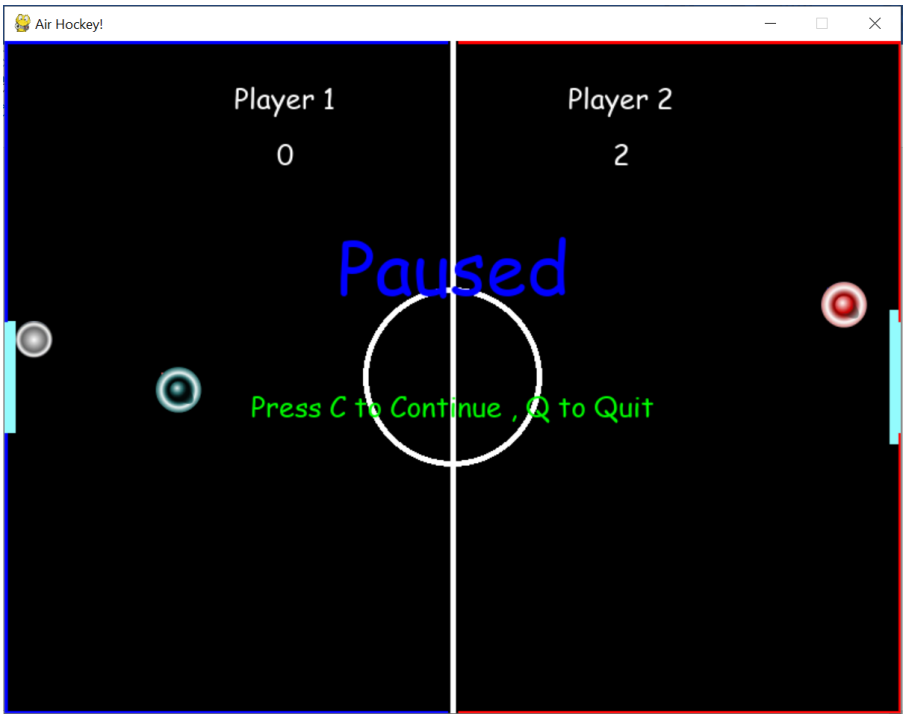

Figure 4.3.3 Disc Touching Goal Line

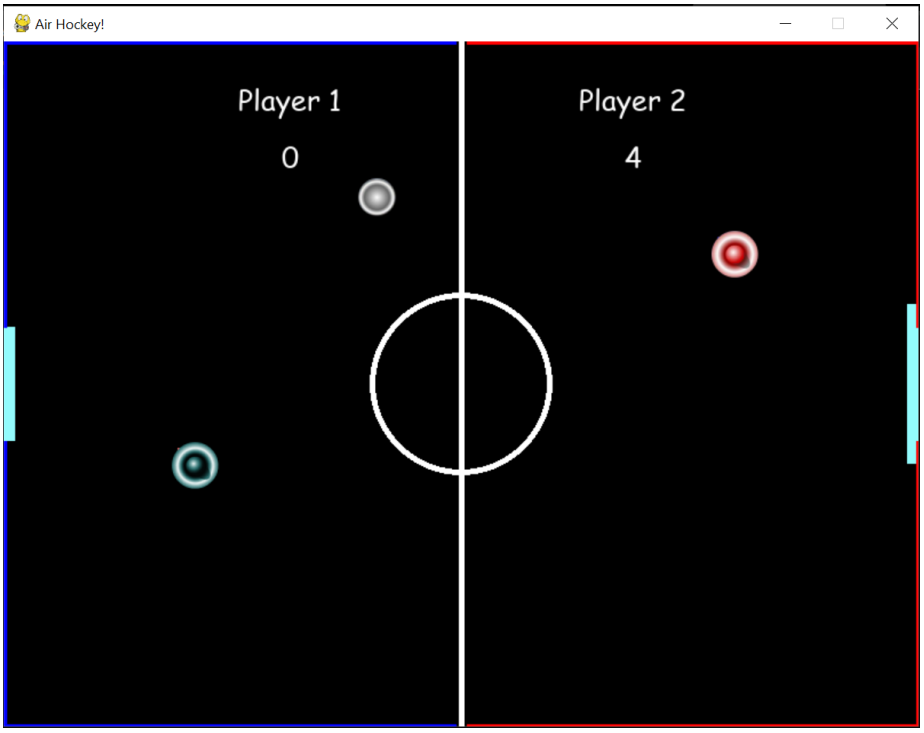

Figure 4.3.4 Player 2's Goal size greater than Player 1's Goal size

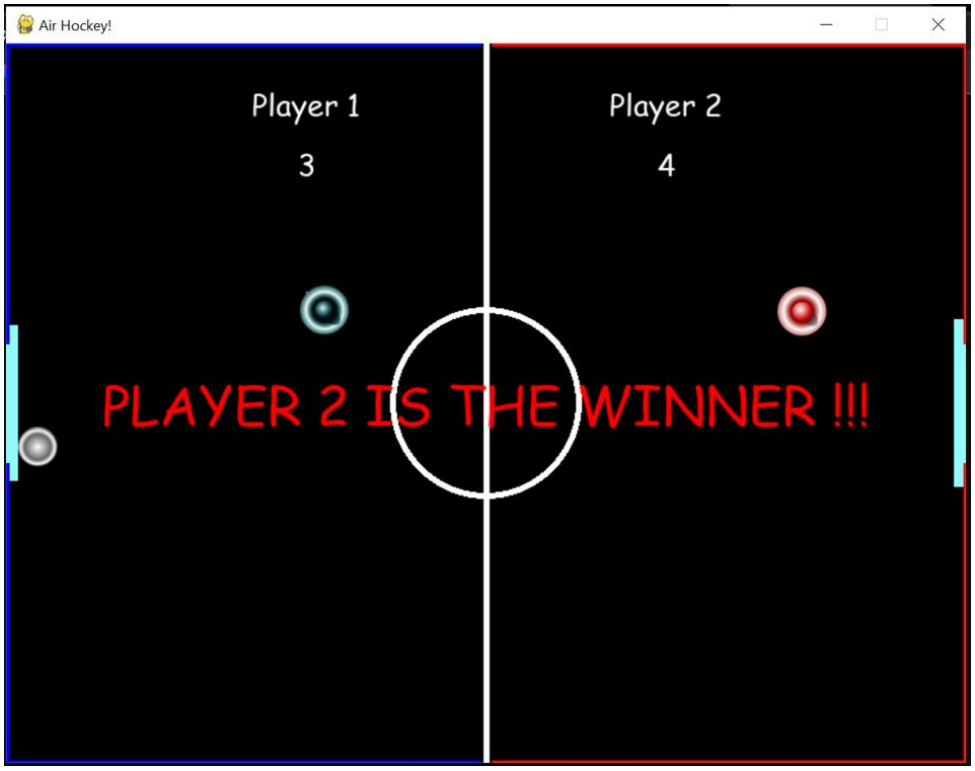

Figure 4.3.5 The moment Player 2 scores the 5th goal, he is declared the winner

Chapter 5

References

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- **https://docs.python.org/3/**

Pygame Documentation:

- **https://www.pygame.org/docs/**

Android Air Hockey Game:

- **https://play.google.com/store/apps/details?id=com.mobirix.airhockey&hl=en_IN&gl=US**

Online Air Hockey Game:

- **https://www.twoplayergames.org/game/air-hockey**