

Team “ACES”

Deliverable G

GNG 1103

Group G01-1

Team members

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Abstract

This week, we had the opportunity to present our Prototype I to our client and receive more feedback. We showed him a video of our current prototype as well as some extra information such as the features and failures of our first prototype and some preliminary results. We will now use our prototype I successes and improve them, further develop them, and correct the flaws present to create an improved prototype II.

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1. Introduction

This deliverable will focus on the Prototype II as well as a plan for prototype III. To develop our Prototype II, we will use the feedback received from our client during our presentation and correct the errors present in our first prototype. We will aim to improve the accuracy of our testing, as our last tests were accurate however still required more precision. We will also focus on coding the User Interface as well as making it aesthetically pleasing.

2. Client feedback

Ultimately the client was uninterested in our first prototype as they were on their phone during the presentation and only said good job when we concluded the presentation. The 4-minute window was also not enough time to convey all necessary aspects of the prototype. The client mentioned to all groups not to use physics engines and to consider camera distortion going forward. We have no intention of using a physics engine and camera distortion was researched and found to be very minimal. The client's concerns from our presentation were less on the function of our code and the efficiency, and more on the problems that can occur after the test. Now that the code works properly, the client wants us to be able to accurately show that a camera can be placed at a distance and show the size difference of the ball when it is closer or further from the camera.

3. Plan for prototype 3

Since the tracking capabilities of the software have been confirmed prototype 3 will build on the current prototype by creating a final clean and polished user interface in unity that uses the socket extension to communicate with python code. We will also look at ways to reduce jitter and make the balls motion smoother. The goal of this prototype is to integrate the balls motion into the Padel Ball court on unity.

Test items:

Since we don't always have access to Padel ball courts, we will be using a Ping Pong table (or a substitute) with ping pong balls and ping pong racquets to depict the idea of using a Padel Ball court in real time. Currently, we have a Lenovo IdeaPad Flex 5, with Microsoft Windows 11 Home operating system. We will be using OpenCV, unity, IV cam to capture this project. Associates of group members will also be asked to navigate and use the menus to see if the user interface is clear and concise.

Features to be tested:

- Speed of ball
- Position of ball
- Where the ball will be situated in the space at a given time
- Full analysis of the game

Approach:

Use the listed test items, generated codes and download specific software's to compile a program that will test a ping pong balls location, speed, and position in the final product. The generated code will be more user friendly. There will be no need to call methods and function

manually. Users will be able to follow a more convenient set of directions to operate the final product.

To test the accuracy of software a ball will be moved around a ping pong table in a predictable manner and the output of the software will be compared to the true known position.

To test menus and interfaces random people will be asked to use the software and navigate to different features.

Item pass/fail criteria:

PASS:

The software will be able to track the ball on the computer and depict the position as it is in real life. The movement of the ball should be clean and reasonable rather than jumpy and illogical. The ball's calculated position should be no more than 10% different than the true value.

90% of people tested will be able to navigate menus and find features in a short amount of time. As well as say the software is understandable and easy to use.

FAIL:

The software fails to track the ball on the computer and depict the position as it is in real life

Users are unable to navigate menus and provide feedback that software is complicated or difficult to use.

4. Prototype 2

Considering client feedback and test results from prototype 1, prototype 2 used the methods and class structures from prototype one to create a basic user interface and unity environment. The user begins by inputting their computer setup by providing the location and rotation of the camera. They then use the left and right arrow key to adjust the hsv values so that only the ball is detected. They can also choose to load a saved camera setup from a previous use. Once a camera setup is selected the game is recorded to a .txt file. The new unity portion reads the .txt file and moves the ball accordingly. This user interface and unity environment will be the basis of our UI for the final product. The unity environment also helped us visualize prototype 2 test results.

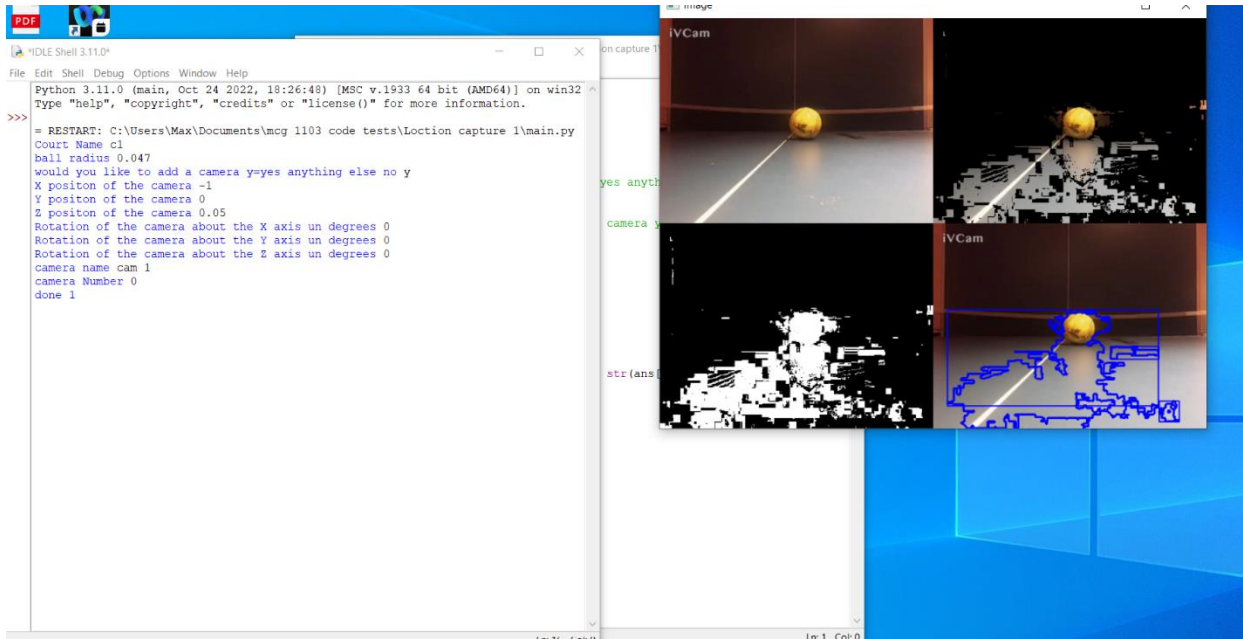


Figure 1: what the users sees as they calibrate a camera setup

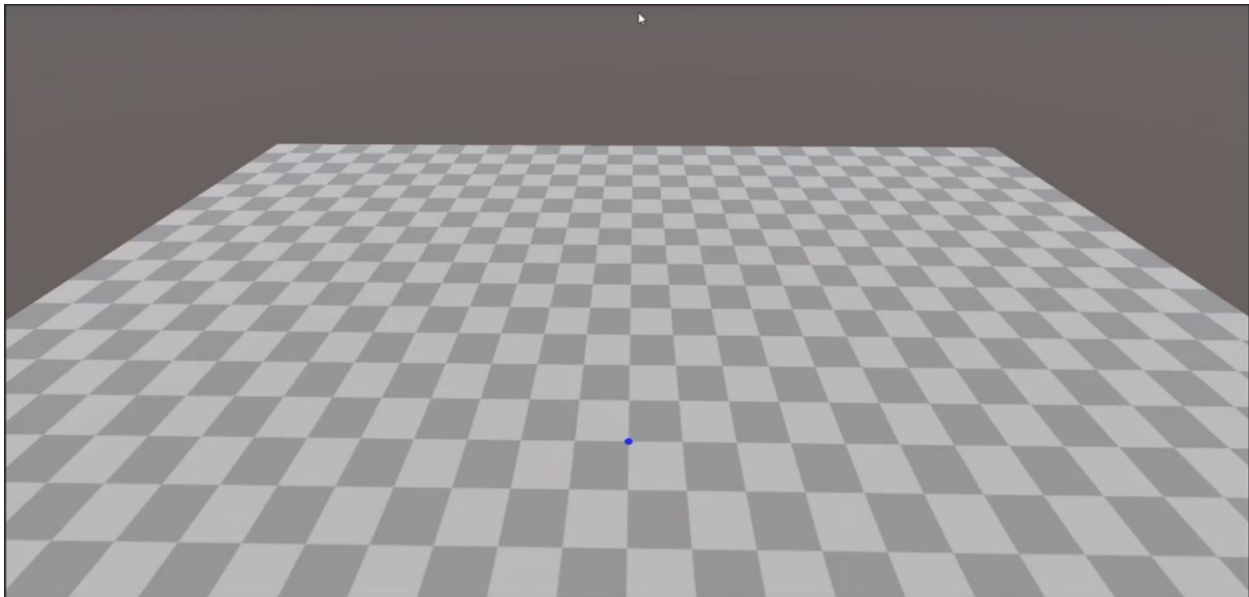


Figure 2: Unity environment where user is free to move around and look in any direction.

5. Prototype 2 testing results

Of the 5 people asked to input camera coordinates and focus the camera so it only sees the ball 80% understood and navigated the software successfully. The people asked were associates who had some knowledge of this project. To further improve UI better graphics and instructions will be added to better communicate with users what input the software is expecting. In terms of accuracy recording with the camera 1m from a ball that had a radius of approximately 0.047m and was not moving and centered in

relative to the camera the results were very accurate with the results fluctuating no more than 1cm in any direction. This test was done with the camera in a variety of different positions. This confirms that the feature to place cameras wherever functions and provides reasonable accurate results. In moving trials, the videos played back in unity very similarly resembled how the ball was moved. There was no way to quantify this finding as we had no way of knowing the true position of the ball and had to base this conclusion strictly on a qualitative observation. In both cases due to small inaccuracies the ball appeared to jitter in unity and appeared to vibrate as it moved or stayed still.

6. Target specifications, design and bill of materials

After testing our prototype and the client feedback, it was decided that our current target specifications and BOM will remain the same. For the detailed design, our choice to purchase a texture for our application has changed. We have learned that it may not be necessary for our project to have this; However, if we do still choose to purchase a texture, it must first be cleared with a PM (Project Manager) or TA (Teacher Assistant).

7. Potential Client feedback/comments

After testing the camera setup and game viewing on various people it was found that the 4-picture display while calibrating the cameras helped users understand the process and will be carried over to the final design. Some users were confused about what different variables meant so to better help the users understand we will include more diagrams and detailed instructions in the final product. They were also concerned about the way their body would affect the camera sending the information virtually, but with more cameras or different angles, this won't be an issue.

8. Wrike

Permalink

<https://www.wrike.com/workspace.htm?acc=4975842#/folder/968841774/timeline3?viewId=109685302>

Snapshot

<https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=VxsW4zYIqldDSDmWGYR327nucc5h5jHI%7CIE2DSNZVHA2DELSTGIYA>

9. Conclusion

Reflecting on the client's feedback, our second prototype was a success. The client did not provide much constructive criticism to build from, though we will focus on incorporating the unity environment with the features of OpenCV to allow the projection on the ball into the Padel ball court we have acquired in the software currently. The following prototype will include the insertion of the input (from the moving ball) into the 3D environment into Unity. We will also develop a real graphical outline for our app and

check in with the program manager of this project whether we will need to purchase more features to make our app look good.