GNG 1103 [G]

Engineering Design

Deliverable F: Prototype I and Customer Feedback

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Introduction

The deliverable F will outline our prototype and the feedback that we received on our main concept designs by the client. We will also establish a test plan for the first prototype using the suggestions received. Finally, we will discuss the results obtained from our prototype and elaborate on new objectives for the next prototype.

Customer Feedback

At the first client meeting, we discussed about our main concept ideas and, the customers told us that it was a great one and that we should continue working on it. However, he told us that we needed to make sure that we will use more than one camera. He suggested that we start by recording with one camera and figure out the logistics to later, add the other cameras. We also talked about how we were going to add the 3D virtual aspect in our project via Unity and OpenCV. We were contemplating about the position of the ball in the virtual court and, how we were going to dimension the court from a 2D point of view to 3D point of view on Unity. The client said that there was multiples website or project online that you could guide us, and he also gave us the choice to choose the (0,0,0) position in our interface on Unity.

First prototype

The prototype had two objectives for us to work on the basics before adding new features to the second prototype. Firstly, we wanted to find a way to detect the padel ball on OpenCV and Unity. We were able to detect the ball using its colour. For the next step, we want to detect the ball based on its colour and shape and find its position. Secondly, we wanted to detect the players using OpenCV and reproduce their movement on Unity. We were able to do the detection from a 2D point of view. However, the customers deemed that we did not need to detect the player because there is a module on Unity that could identify the players for us to some extent. He advises us to focus more on the ball's detection and its position.

Table 1 - Test Plan and Results for Prototype I

Test	Objectives (Why)	Description of the prototype (What)	Expected Results (How)	Estimated Test Duration (When)	Analysis / Customer Feedback
1	Ball detection	Write a code on OpenCV to detect the padel ball based on its colour and its movement.	The ball should appear on Unity, and it should follow the ball movement and reciprocate the same movement.	October 24-October 29	The team was able to do the ball detection using the ball colour, however it will also be safer to do it based on the shape of the ball. Next step is to find the position of the ball using a reference point.
2	Players' detection	Write a code on OpenCV to detect the players and follow its movement.	Unity should detect the players and follow its movement.	October 24-October 29	The team was able to only detect one player and follow its movement. Next step would see if we can find others alternative to do so to detect the two players effectively and accurately.
3	Record 3D video	Find an application or a software that could help us directly film a padel ball game from a 3D point of view.	Record a 3D video via an iPhone and Android to later, add on Unity.	October 24-October 29	The team was not able to record a 3D video because the tools and the software used to film the video was over the budget hence, it did not respect our design criteria.

Image 1 - Code for the ball detection for Prototype I

```
import cvzone
from cvzone.ColorModule import ColorFinder
import cv2
import socket

cap = cv2.VideoCapture('test copy.mov')
cap.set(3, 1280)
cap.set(4, 720)
success, img = cap.read()
h, w, _ = img.shape

myColorFinder = ColorFinder(False)
hsvVals = {'hmin': 19, 'smin': 79, 'vmin': 83, 'hmax': 90, 'smax': 255,
'vmax': 255}

sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
serverAddressPort = ("127.0.0.1", 5056)

while True:
    success, img = cap.read()
    imgColor, mask = myColorFinder.update(img, hsvVals)
    imgContour, contours = cvzone.findContours(img, mask)

    imgStack = cvzone.stackImages([img, imgColor, mask, imgContour], 2, 0.5)

    if contours:
        data = contours[0]['center'][0],\
               h-contours[0]['center'][1], \
               int(contours[0]['area'])
        print(data)
        sock.sendto(str.encode(str(data)), serverAddressPort)

    cv2.imshow("Image", imgStack)
    cv2.waitKey(1)
```

In this code, we were able to detect and track the padel ball with its colour. As we can see from line 11-12, we have entered the values of the colour that we wanted to track and detect and from line 5, we were able to download a video on Unity. We took a video of a moving tennis ball and this code allowed to track the padel ball on Unity via the video.

Table 2 - Test Plan for Prototype II

Test	Objectives (Why)	Description of the prototype (What)	Expected Results (How)	Estimated Test Duration (When)
1	Ball Position	Write a code on OpenCV to detect the padel ball and find its position from a reference point.	The ball should appear on Unity, and it should follow the ball movement more accurately than the first prototype and reciprocate the same movement. It should also tell the (x,y,z) position from a reference point at all times.	November 8-November 18
2	Interface on Unity	Recreate a padel ball court on Unity and simulate a game for accuracy.	The simulation should accurately represent a padel game and the position of the ball should be always known. The measurement of the padel ball court on Unity should be like the real-life court on smaller scale.	November 8-November 18

Conclusion

In summary, we presented our test plan and our results for the prototype I. Overall, we accomplish 2 out of the 3 tests that we wanted to do. We were able to do an analysis of our overall project to with client and we made the necessary change to achieve our desired results. We were also able to showcase one example of our codes for the ball detection. For the next step, we were able to formulate the test plan for the second prototype and explain our expected results. Finally, we were able to schedule and prepare our team for the next prototype on Wrike.