



# **Lavallee Industries Presents InSync**

**Lab Section 1 – Group 4**

**Deliverable D – Design Criteria**

**Engineering Design - GNG1103**

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## **Abstract**

In this lab, a collection of three conceptual designs were created based on the design criteria and target specifications from the last deliverable, which were determined by interpreting needs and benchmarking. This lab's goal is to describe and clarify each of the three conceptual designs, as well as benchmark the conceptual design with other software available.

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## Introduction

We are aiming to create an application that has the ability to capture the trajectory of a ball in real time using cameras to create a 3D coordinate system. Within this report, we will examine the conceptualizations of our team members for the application. These concepts will allow us to form 3 applicable solutions to our main project goal by integrating the ideas and concepts of our group members to make a conclusive decision on the best possible design.

The following are the three conceptual designs covered within this report.

- Concept 1) Daniel's Camera Set-up Design
- Concept 2) Robert's User Interface Design
- Concept 3) Shazan's Menu & Settings Design

### Concept 1, Dan's Camera Set-up Design Concept

We have decided this camera placement seen in Figure 1 would be the most optimal to get what we are looking for, whilst using a reasonable number of cameras. As can be seen in the picture, having 4 cameras in that manner would result in a complete view of all that occurs inside the court, without any blind spots where the ball cannot be seen. Other camera positionings have higher chances of having issues occur, as there may be a chance where the cameras do not give full court coverage, like this camera setup does, or there could be blind spots where the player is in between the vision of the camera and the ball. Another example would be when the ball is traveling straight at the camera, and while this makes it hard to calculate the positioning of the ball based off the footage from the camera which the ball is travelling to, there will always be at least 1 camera that will have a good angle on the trajectory of the ball.

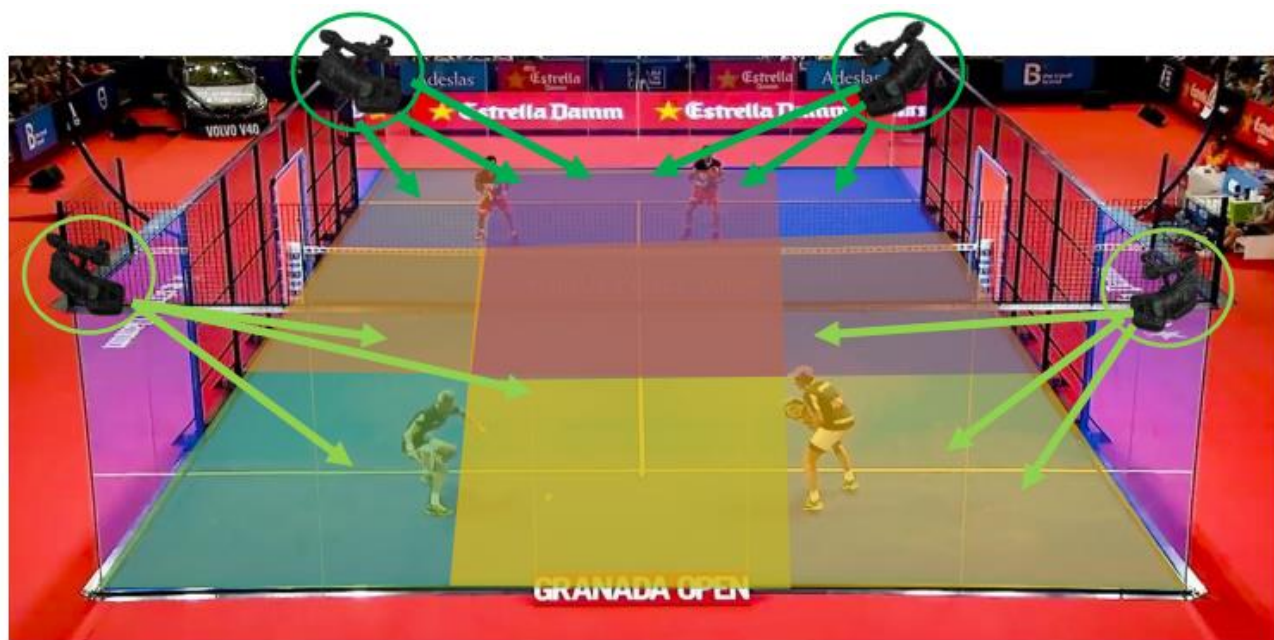


Figure 1 Optimal Camera Placement, Dan B

Besides having full court coverage, and no blind spots for the ball, this camera setup can also be used to determine the exact coordinates of the ball relative to the court, as the cameras are all placed in each corner of the court, which takes the shape of a rectangle. While making the software, we can create codes that calculate where the ball is inside the court by comparing the footage of each different camera and evaluating the difference in the positioning of the ball in each footage. This can be done by determining how far each camera is placed from the center of the court and using a form of measurement inside of code that determines how many pixels the balls is distanced relative to the lines in the court, and using that information from the other cameras we can use the intersection of the pixelated positioning in each camera, and calculate the Realtime positioning of the ball.

In terms of cost, while having 3 cameras would be cheaper, it would leave us with certain blind spots, and we wouldn't have full court coverage, as having 1 camera on the ceiling will not cover the entire court, nor is it easy to get the camera attached at the top of the court. Using 5 cameras would be excessive and would be a waste of money, as 4 cameras give us the full coverage of the court, and all the information we need to calculate the necessary data required for the client.

## Concept 2, Robert's User Interface Design Concept

Robert oversaw the design of the user interface for the software. He mainly focused on the user's perspective and keeping it clean, with lots of functionality and options for the user to have whatever they needed on the screen.

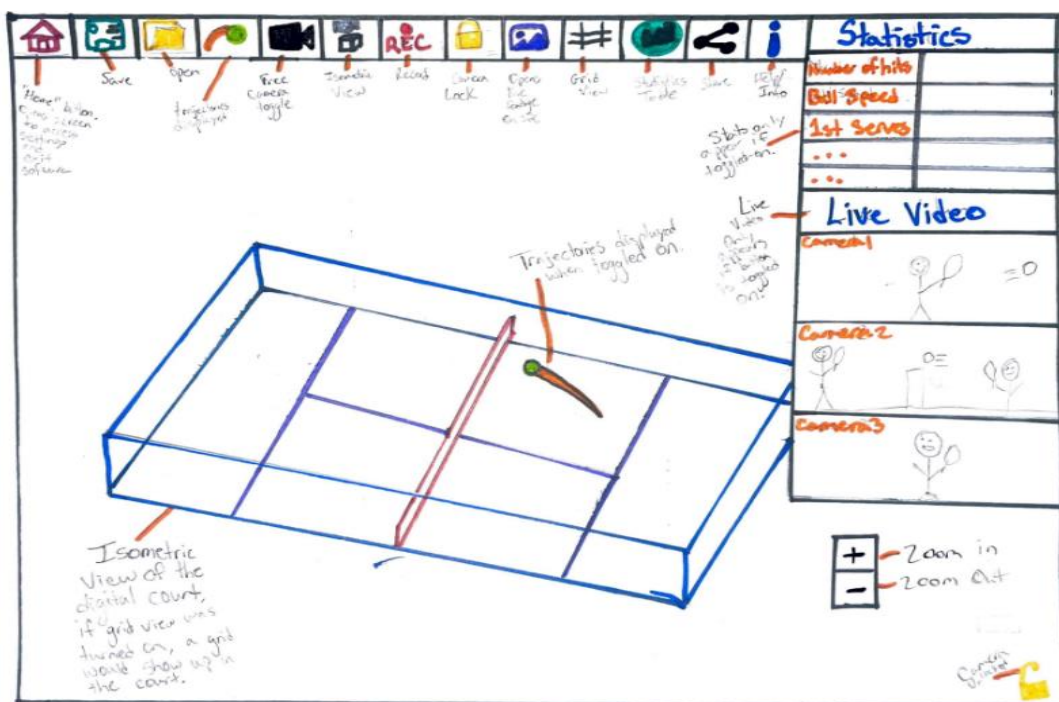


Figure 2 User Interface View 1, Isometric View with Grid Off, Robert L

In Figure 2, the interface has a main tool bar at the top that includes several buttons to control what the software does. The first button is the “Home” button that grants the user access to the settings and menu screen. The second button is the “Save” button to save a file. The next button to the right is the “Open File” button to open existing files. Following the open button is the “Display Trajectories” button, this button toggles the balls trajectory lines on and off. The next button is the “Free Camera” button, this button allows the user to move the camera to whatever position they would like. The next button is the “Isometric View” button, this button situates the user’s camera perspective to an isometric view. Proceeding after the “Isometric View” button is the “Recording” button. The “Recording” button gives the user the ability to record the displayed information in the software. The next button is the “Camera Lock” button, this works by locking the camera in whatever position the user wants it to be in. Beside the “Camera Lock” button is the “Display Live Footage” button, when this button is selected an overlay will appear on the side of the screen of the live footage of the cameras. The next is the “Grid View” button, this button will allow the user to have a grid view of the digital court. After the “Grid View” button there is the “Display Statistics Table” button, this button when toggled on will display a table with statistics on the right side of the screen. The next button is the “Share” button where the user can share the recording to others. Lastly, the final button on the top tool bar is the “Help/ Information” button, clicking this button will give the user information on all the buttons in the tool bar and the buttons in the display.

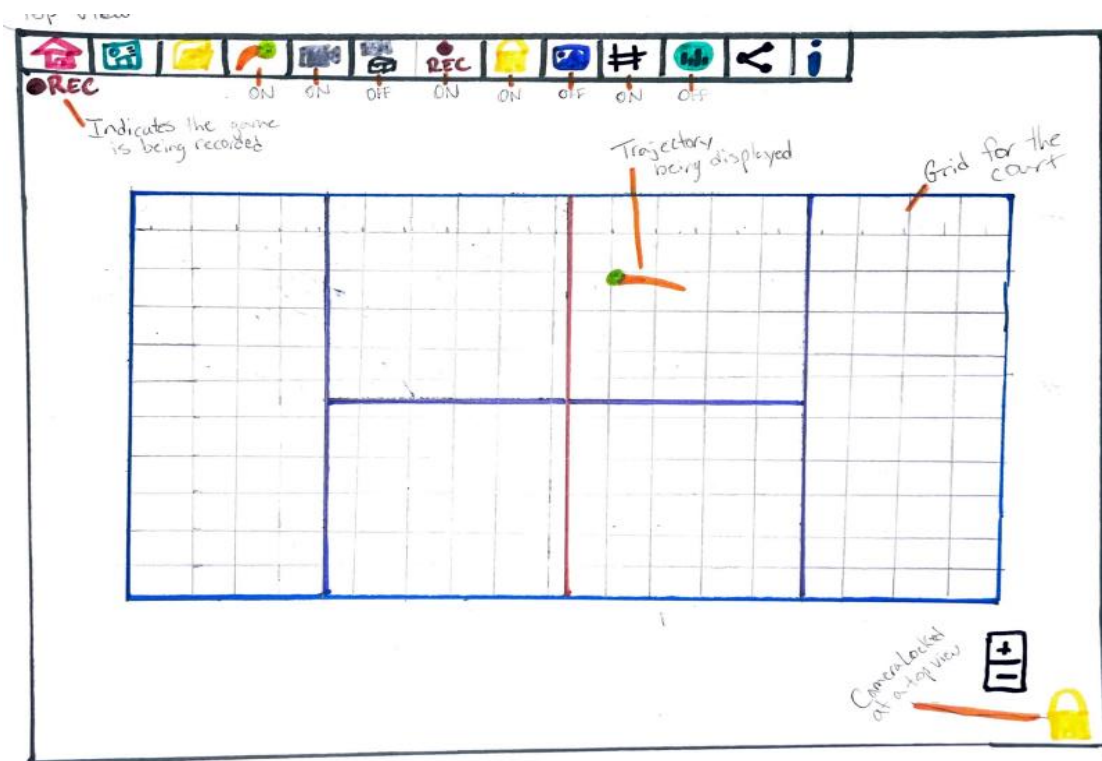


Figure 3 User Interface View 2, Top View with Grid On, Robert L

Aside from the main toolbar there is only two other buttons. It is the “Zoom in” and “Zoom out” buttons in the bottom right corner. There is also an overlay in the bottom right that indicates whether the camera is unlocked or locked.

The most important buttons would be the “Display Statistics” and the “Display Trajectories” buttons. These are the most useful and important buttons for the user as they display the main goal and main functionality of our software.

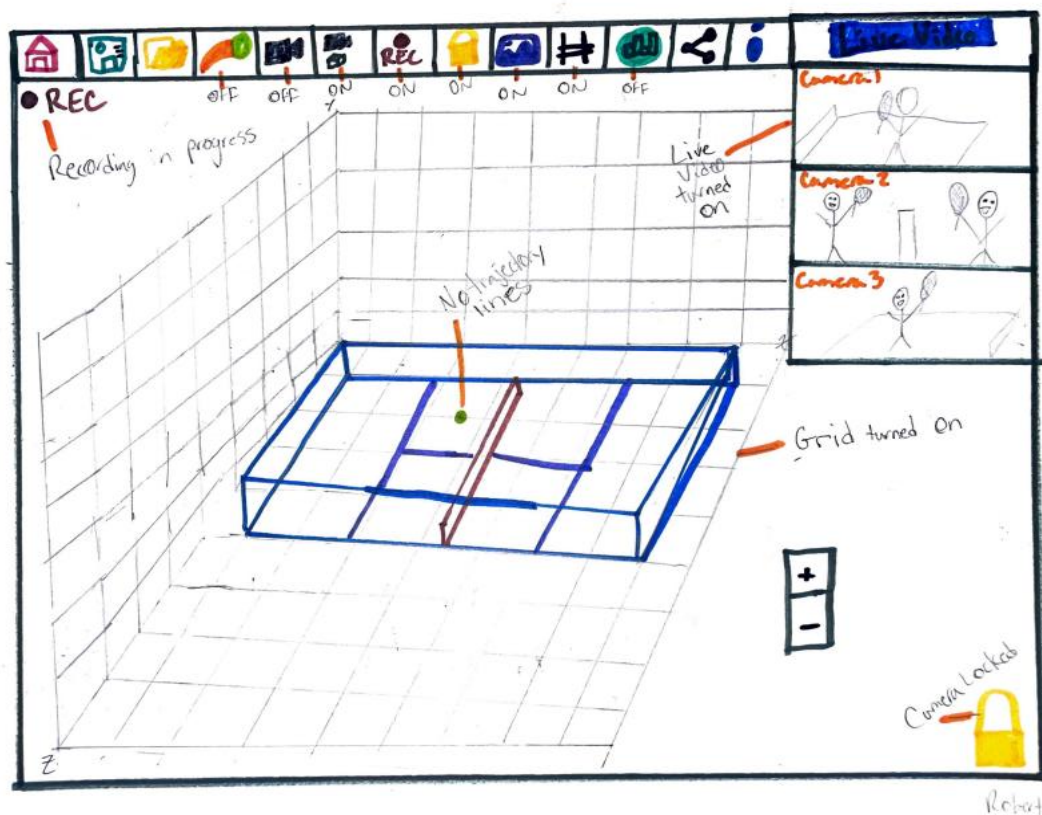


Figure 4 User Interface View 3, Isometric View with Grid On, Robert L

### Concept 3, Shazan’s Menu and Settings Design Concept

The menu is the users first introduction to the application, keeping it simple is integral. The goal of my menu design was to have simple interface without overwhelming the user and easy access to help. The layout is starts with “Live”, which is the start button to start tracking the ball. Past games will be an option to view the recorded games. Settings will have basic options to change font, aspect ratio and the volume. Help will show the user manual with a link to the InSync website.



Figure 5 Home Screen, Shazan A



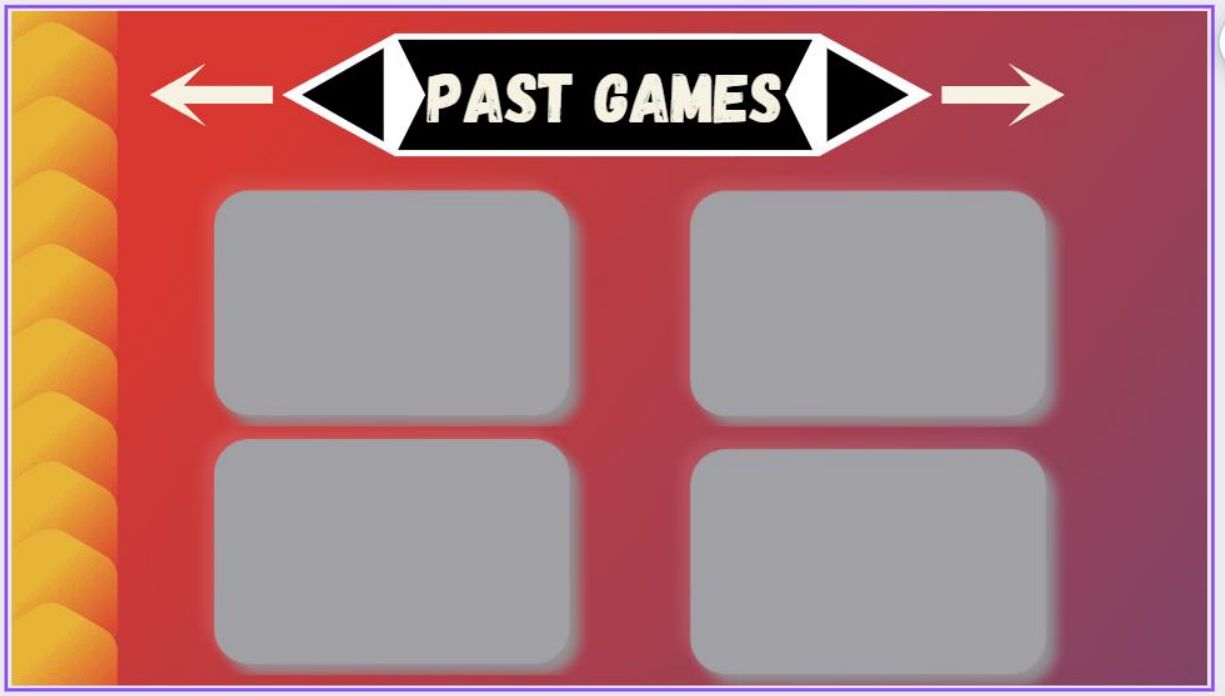


Figure 6 Past Games Menu, Shazan A

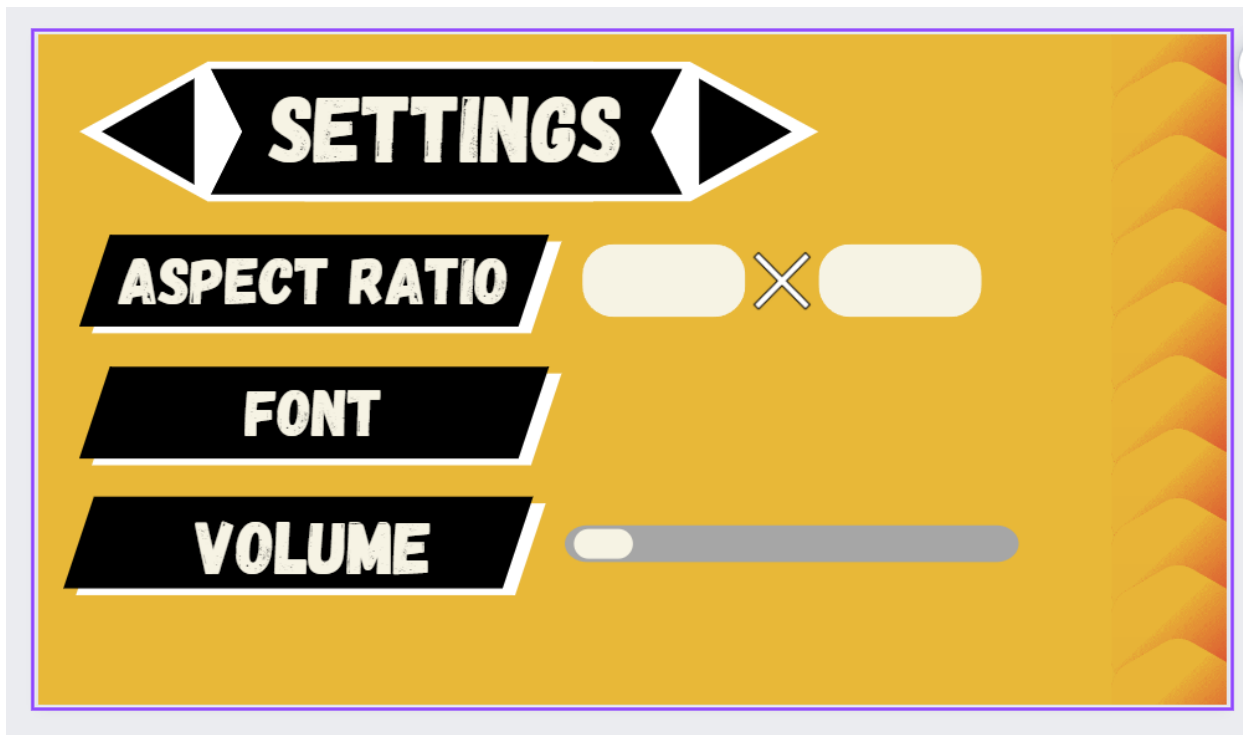


Figure 7 Settings Menu, Shazan A

## Benchmarking and Verdict

Here, the concept design is compared with other software applications available. The benchmarking was used to measure how well the specifications from deliverable C matched up with the proposed design.

Specifications	Competition Video and Data Analysis Software			
	Dartfish	Quintic Sports	Kinovea	InSync
Cost	104\$/Month	7500\$ (Price includes full kit, not just software)	Free	Free
Velocity and Acceleration Measurements	No	Yes	Yes	Yes
Time and Position Markers	No	Yes	Yes	Yes
Tagging Moments	Yes	Yes	Yes	Yes
Multi-Platform	iOS AND Android, Windows and MacOS	No phone Application, Windows and MacOS	No Phone Application, Windows Only	iOS AND Android, Windows and MacOS
Data Sheet	Yes	Yes	Yes	Yes
Memo	Yes	Yes	No	Yes
Video Editing	No	Yes	No	Yes
Overlay Comparison	No	Yes	Yes	Yes

Table 1 (Table 1, Benchmarking the values from Design Criteria of similar products [1]–[3])

Specifications	Competition Video and Data Analysis Software				
	Importance	Dartfish	Quintic Sports	Kinovea	InSync
Cost	4	2	1	3	3
Velocity and Acceleration Measurements	5	1	3	3	3
Time and Position Markers	5	1	3	3	3
Tagging Moments	4	3	3	3	3
Multi-Platform	3	3	2	1	3
Data Sheet	4	3	3	3	3
Memo	3	3	3	1	3
Video Editing	3	1	3	1	3
Overlay Comparison	4	1	3	3	3
<b>Total</b>		67	94	87	105

Table 2 (Table 2, Benchmarking of similar products using Design Criteria [1]-[3])

## Conclusion and Recommendations

The client will see the final design and provide comments regarding any adjustments that need to be made.

## Bibliography

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