PaddlePals

Team G01-2

Deliverable C: Design Criteria

Engineering Design GNG1101

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ABSTRACT

The purpose of the project is to develop a digital replica of a paddle-ball game which is accessible through a computer application. The client specified that the application is to be used by coaches and players of paddle ball to review technique. The problem statement was identified as such: to design a user-friendly app for the client, Manit Ginoya, to measure the precise position of the ball in Paddle ball matches at any given time on the court and translate this information into a 3D, real-time representation that is saved for post-match analysis.

1. Introduction

The previous deliverable (deliverable B) introduced the purpose of the Paddle Pals application. This application will be used to aid paddle ball coaches and players by providing post game analysis of a player's paddle ball game. The application will be capable of measuring the precise position of the paddle ball on the court.

The purpose of this document is to clearly define and prioritize the design criteria and target specifications needed to begin development of the Paddle Pals prototype application. The criteria are based on the client's requirements identified the last deliverable, as well as technical benchmarking of similar applications currently in the public domain. The design criteria will then be organized into a list of functional and non-functional requirements, including technical specifications, and followed by constraints.

Table 1. Revision of Client Requirements and Categorization of Importance

Need	Importance
Game data can be collected in real time from the match.	5
Software can accurately calculate the mechanics of the ball with each hit (trajectory, angle of hit, force of hit).	5
Object recognition software can identify the ball on the court.	5
Game footage can be recorded with data for later viewing.	4
Player statistics are recorded and organized.	4
Instruction Manual is included.	3
Users can be shown what an ideal shot would look like	2
Aesthetically pleasing.	1
Works indoors and outdoors	1

2. Design Criteria

Table 2: Needs translated into Design Criteria

Number	Needs	Design Criteria
1	Software can accurately calculate the mechanics of the ball with each hit (trajectory, angle of hit, force of hit).	Shot tracking Kinematic Functions
2	Game data can be collected in real time from the match.	Online
3	Object recognition software can identify the ball on the court.	Shot tracking
4	Game footage can be recorded with data for later viewing.	Computer disk storage Cloud storage
5	Player statistics are recorded and organized.	Computer disk storage Cloud storage Organization program
6	Instruction Manual is included.	In-app manual section
7	Users can be shown what an ideal shot would look like.	Ball trajectory simulation program
8	Aesthetically pleasing.	Good looking Accessible User-friendly
9	Works indoors and outdoors.	Camera protection and support Operation in rain and snow Offline version for outdoors

Functional Criteria	Non-Functional Criteria	Constraints
Shot Tracking Storage of Information Kinematic Functions Simulation Program Online and Offline	Aesthetically Pleasing User Friendly Camera Protection and Support In-app Manual Section	Low-cost Operation in Rain and Snow Operation in low temperature Operation on impact with ball

3. Benchmarking

After researching applications like our project, we found 3 different applications that involve ball tracking for sports like paddle ball (tennis and squash). These 3 applications seemed to be the most used applications after research. They all have video analysis, gameplay advice and shot tracking. But the three applications differ in terms of price and access to how-to application tutorials. Post-benchmarking, we have concluded that the Swing Vision application is the best

application out of the three compared. Therefore, this will be the application we choose to reference when we build our own design.

Table 3: Analyzing similar products based on Design Criteria [1]-[3]

Company	Swing Vision	Top Tennis Tracker	Squash Track
Subscription Cost	$269.98 (per year)	$40.32 (per year)	$215.85 (per year)
Video Analysis	Yes	Yes	Yes
Shot Tracking	Spin, speed, placement, rally length, stroke.	Momentum, serve, rally, scores	Ball position, detailed analysis
Instruction Manual/Tutorials	Yes, many video instructions	Yes, some video instructions	Yes, but very few.
Aesthetically Pleasing	Yes	Yes	No
Outdoor use ability on rainy days	No	No	No
Gameplay Advice	Yes	Yes	Yes
Cloud Storage	Unlimited storage, accessible on any device, lifetime backups	Yes	Unlimited Storage on match or training records

Table 4: Benchmarking system based on Design Criteria [1]-[3]

Company	Importance	Swing Vision	Top Tennis Tracker	Squash Track
Subscription Cost	1	1	3	2
Video Analysis	5	3	3	3
Shot Tracking	5	3	2	1
Instruction Manual/Tutorials	3	3	2	1
Aesthetically Pleasing	1	3	2	1
Outdoor use ability on rainy days	1	1	1	1
Gameplay Advice	4	3	3	3
Cloud Storage	3	3	1	3
Total		65	52	48

4. Target Specifications

4.1 Functional Criteria

	Design Specifications	Relation (=, < or >)	Value	Units	Verification Method
1	Shot Tracking	>	15	Frames per second	Test
2	Storage of Information	>	5	Gigabytes	Analysis, Test
3	Kinematic Functions	=	yes	Meters Seconds Newtons Degrees	Analysis, Test
4	Simulation Program	=	yes	N/A	Test
5	Online and Offline	=	yes	N/A	Test

4.2 Non-Functional Criteria

	Design Specifications	Relation (=, < or >)	Value	Units	Verification Method
1	Aesthetically pleasing	=	Yes.	N/A	Test
2	User Friendly	=	Yes.	N/A	Test
3	Camera Protection and Support	=	Yes.	N/A	Analysis, Test
5	In-app Manual Section	=	Yes.	N/A	Analysis, Test

4.3 Constraints

	Design Specifications	Relation (=, < or >)	Value	Units	Verification Method
1	Cost	≤	50	$ (CAD)	Estimate, Final Check
3	Camera operation in varying temperature	=	-40 - 30	˚C	Test
4	Camara operation on impact with ball	=	Yes.	N/A	Test

5. Conclusion

This document outlined the technical specifications and design criteria needed to produce a prototype of the Paddle Pals application. Criteria were organized into functional and non-functional requirements, as well as important constraints. Technical benchmarking was used to compare current products that follow these criteria, such as: Swing Vision, Top Tennis Tracker, and Squash Track. To conclude, Swing Vision best met the criteria and will be used as inspiration for the prototype application.

6. References

[1] *SwingVision: A.I. scoring, Stats & Line calling for tennis*. SwingVision: A.I. Scoring, Stats & Line Calling for Tennis. (2022). https://swing.tennis/c/cracked20

[2] Kolonic, A. (2020). *Top tennis tracker - pro stats for serious players*. Top Tennis Tracker - Pro stats for serious players. https://www.toptennistracker.com/

[3] *All About Squash Track App*. SquashTrack. (2019, March 3). https://www.squashtrack.com/

7. Wrike Progress

Wrike update