Project Deliverable E: Project Schedule and Cost

Faculty of Engineering – Engineering Design - GNG1103

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Abstract

This deliverable focuses on the project schedule and cost planning of the project given by Mines Action Canada covering the phase-by-phase development of the three prototypes. The team will start with finalizing a detailed design drawing of the chosen concept, complete with parts and materials essential to flesh out a full visual. A project plan in structure will then be formulated, stating every specific task estimated with the duration and responsibility assigned to each member involved for smooth and timely progress. The risk management strategy will be developed to counteract possible challenges of the project, along with contingency plans for the risks that are foreseen. A bill of materials will present the cost estimate to ensure everything falls within budget needs, while organizing procurement by team members is in line with project policies.

Each prototyping stage will be informed by a test plan that identifies objectives, metrics, and clear stop criteria in feasibility assessments with a view to reducing uncertainty. The plan shall target system integration and critical subsystems for effective refinement of the design in each iteration. This ensures the deliverables for alignment of project outcome and client needs for effective teamwork and on-time completion of a fully functional prototype by the end of the semester.

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1. Introduction

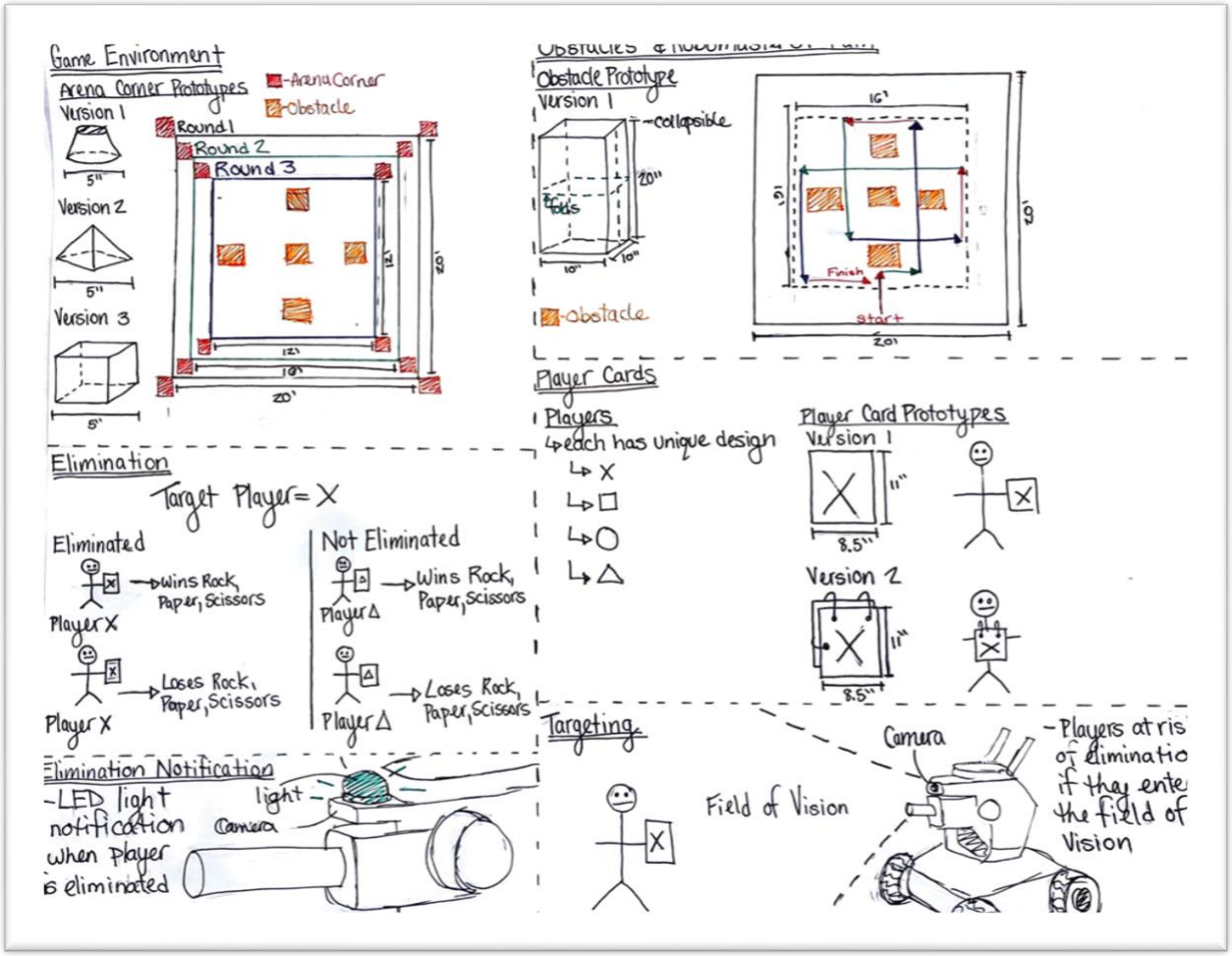
Based on the ideas shared, and the progress we made in the last deliverable in terms of designing a process for the experience to follow, we presented it in the client meeting on the 24th of October. We took the feedback from the clients and used to make a few tweaks to our concepts. Now for this deliverable, we have taken that finalized concept and developed it into further detail. At the beginning of this report, you will find a concept summary that walks you through the general process that the experience will follow. Beyond that, this deliverable consists of a design drawing that shows you in detail how the experience will look. Beyond that, you will find a Bill of Materials (BOM), a List of Software and Hardware that we need, the Project Schedule, Significant Project Risks and Contingency Plans, and the Prototyping Test Plan.

2.Concept Summary

This concept is an elimination game played in a closed environment relying on the deception of the players. Players are assigned player cards at the beginning of the game that will act as their identification throughout the game. Players are told they must avoid the Robomaster S1's field of vison while remaining in the game environment. If a player enters the field of vison of the Robomaster S1, they will have to participate in a game of rock, paper, scissors. Players are made to believe that the results of playing rock, paper, scissors will determine whether they are eliminated or not, however the true cause for elimination is based off their player card/identification. The Robomaster S1 will be assigned a target at the beginning of each round and must find the assigned target within the allotted round time. If the targeted player must participate in a game of rock, paper, scissors, no matter the outcome, this player will be eliminated. If a player who is not the target must participate in a game of rock, paper, scissors, no matter the outcome, they will not be eliminated. After each round, a new target will be selected by the Robomaster S1, as well as the game environment will become smaller.

The game environment will be marked out by 3D printed arena corners which will be moved throughout the game. The game environment will also contain 3D collapsible obstacles to make avoiding the Robomaster S1 more challenging for the players. While the obstacles and decreasing size of the game environment put the players at a disadvantage against the Robomaster S1, one advantage they have is that the robot will follow the same path each round to avoid the obstacles in the game environment. The last player remaining in the game is the winner. Once a winner has been determined, all players will be told the true cause of elimination and will be educated on the ethical concerns about Lethal Autonomous Weapon Systems (LAWS).

3.Design Drawing



4.Bill of Materials (BOM)

Item #	Description	Quantity	Source	Cost
1	Printing services for player cards	8	Staples	$5.06
2	Tape for Obstacles	1	Michaels	$6.77
3	Paper for printing	8	N/A (have at home)	$0
4	Cardboard for obstacle	5	N/A (have at home)	$0

5	3-D printing filament for arena corners	1	Makerspace	$0
TOTAL:				$11.83

5.List of Equipment

5.1. Software list

Category	Software	Description	Cost
Robot Programming - Behavior Simulation	DJI Robomaster Programming Platform	This platform allows programming of the Robomaster S1 using Python. You are allowed to create and test your movement patterns, the recognition of objects by using a vision algorithm, and interactions regarding the rock-paper-scissors game right on the robot.	$0
3D Modeling - Prototyping	SolidWorks	SolidWorks is an excellent tool for designing and modeling improvements in physical parts or changes to be implemented on the Robomaster S1. We plan to create detailed arena boundaries which gives us the ability to test different setups and make data-driven adjustments to get the best performance for our project.	$0
	Onshape	Onshape will be used to design and model an arena boundary shape precisely. In that way, there will be a virtual model shown clearly, which will guide the process of 3D printing. This method ensures accuracy in boundary size and shape, making it easy to move from design to physical prototyping.	$0
TOTAL:			$0

5.2. Hardware list

Hardware	Description	Cost
Computer/USB drive	The computer and USB drive will be used to put the implement the code into the Robomaster S1	$0

3D Printer	A 3D printer will be used to 3D print the Arena Corners	$0
Robomaster S1	The Robomaster is needed to play the game against the players	$0
TOTAL:		$0

6.Schedule

Category	Task	Duration	Person Responsible
Coding	Robomaster Arena Path Code	2 weeks	Ahmad
	Player Targeting Code	2 weeks	Thomas
	Rock, Paper, Scissors Code	3 weeks	Meg
	Elimination Code	2 weeks	Meg
Player Cards	Sketch Player Card Set Design	4 days	Samuel
	Make Player Card Design	1 week	Nithini
	Print and Laminate Player Cards	3 days	Thomas
Arena	Sketch corner designs (Onshape/Solidworks)	1 week	Ahmad
	3D print corners	2 days	Nithini
	Prototype obstacles	1.5 week	Meg
	Get/create obstacles	1 weeks	Thomas
Documents	Set-up Instructions Outline	1 week	Samuel
	Create Final Set-up Instructions	1 week	Nithini
	User Manual Outline	1 week	Ahmad
	Create Final User Manual	1 week	Samuel

	Player Instruction Presentation Outline	1 week	Meg
	Create Final Player Instruction Presentation	1 week	Nithini

7. Significant Project Risk and Contingency Plans

Various Tasks can lead to delaying the project development process. The risks are attributed a chance of occurring rating from Low to High, the impact of the risk, and a plan of contingency if the risk occurs. This list will be consulted if any of the risks occur, and contingency plans will be implemented accordingly.

Risks	Chance	Impact	Contingency
Cannot figure out how to create arena corners that are visible during the game	Low	Cannot mark out game environment/change game environment during the game	Figure out another method of marking out the game environment
Robomaster S1 doesn't not follow path	Low-moderate	Robomaster S1 cannot maneuver through game environment	Remove obstacles from game environment and rethink how to setup game environment
Coded version of rock, paper, scissors does not work	Low-moderate	Player elimination cannot occur	Make players play against themselves. Player selected to play rock, paper, scissors, will play against closest player near them. If either of the players are the target player, the target player will be eliminated. If neither of the players are the target player, both players will stay in the game.
Player elimination notification by Robomaster S1 does not work	Low-moderate	Player elimination cannot occur	Try various methods of notification (e.g sound, lights, verbal communication from person)
Team member in charge of coding aspect of project does not complete task	Low-moderate	Robomaster S1 movement; Player targeting; Rock, paper, scissors game; Player elimination	Other team members who can finish task takes over (e.g. Ahmad, Meg, Thomas)

Team member in charge of developing a tangible aspect of project does not complete task	Low-moderate	Cannot provide all materials needed to player the game	Other team members who can finish task takes over
Team member in charge of creating documentation of project does not complete task	Low-moderate	Instructions for users and players will not be available	Other team members who can finish task takes over
Team member in charge of creating presentation of project does not complete task	Low-moderate	Presentation of project cannot occur	Other team members who can finish task takes over
Robomaster S1 cannot recognize player cards	Moderate-high	Player elimination cannot occur	Try out different ways of presenting player cards (e.g. trying different paper, gluing paper onto cardboard)
Creation of obstacles is too expensive	Moderate-high	Cannot provide all materials needed to player the game	Brainstorm new ways of making the obstacles using cheaper materials or remove obstacles from the game environment

8.Prototyping Test Plan

Test #	Test Objective	What is being figured out	Testing Method	Attribute to Observe/Record	Duration
1	Test Arena code	If the Robomaster can travel around the arena/ what path the Robomaster will travel during the game	Using DJI Environment to simulate the Robomaster's path	Time and distance that Robomaster takes to travel around the arena	1 week
2	Test player targeting	If the Robomaster can Identify different symbols/which symbols the Robomaster can identify	Use DJI Environment to simulate player cards	Robomaster detection of chosen player symbols (Pass or Fail)	1 week

3	Test Elimination Code	Identify if the elimination code work	Use DJI environment to see if lights will flash during elimination	Observe Robomaster's reaction to different player cards	2 weeks
4	Test arena corners	Check if Arena boundaries are easily visible to players	Get user feedback	Arena boundary visibility	3 days
5	Test shrinking arena size	Check if Arena boundaries have enough space to move within	Get user feedback	Moveability in arena	3 days
6	Test Manual Documents	Check if the User, Player and Set-up manuals are easy to understand	Get User Feedback	Ask users if the manuals are easily understandable/ get users to explain to us what they read in the manual	5 days
7	Test for accessibility	Check to make sure that the arena with obstacles is still accessible to a variety of people	Analysis and User Feedback	Ask users in they are comfortable with the environment and ask if anything hinders their mobility, etc/ brainstorm ways that arena may not be accessible and find solutions to it	2 weeks

9.Conclusion

In conclusion, in relation to our bill of materials and list of equipment, we will design, build and test our prototype for the Robomaster S1 experience. We will use the created task and prototype schedule as a basis for how we will proceed in the creation of our project until design day, modifying and adding tasks as needed. We will be prototyping a game that will aim to cause frustration among its players and highlight the ethical concerns that stem from the usage of LAWs by using identification-based code and an arena space.