

Chapter V. Design Alternatives Creation and Evaluation

Ideas were brainstormed for each of the subsystems of the robot. These design options were then evaluated and compared to one another based on how they would perform in different areas of that system's function. A simple point scale was used which ranges from -2 to 2, where 0 shows that a design does not stand out in any meaningful way, 1 or -1 indicated that the design filled that criteria well or poorly, and 2 or -2 showed that the design especially stood out in that regard, either positively or negatively. 2 and -2 scores are also highlighted in green and red respectively as an additional visual indicator.

Drive and Steering

Drive System	Maneuverability	Ease of Implementation	Durability	Cost	Total Points
Live Axel	-1	0	1	2	2
Dead Axel	X	X	X	X	X
Wheels	1	2	2	1	6
Tank Treads	1	1	0	0	2
Omni Wheels	2	-1	-1	0	0

Should be 'axle'.
Axel is a figure
skating jump.

The live axel design is driven by a main motor and steered by changing the angle of wheels, much like how a car drives. This uses the least motors, reducing cost, but is the only option that cannot turn in place.

The dead axel design has a left and right side that are independently controlled and turns by the difference in speed between the two. This can be done with traditional wheels, or tank treads. Tank treads would be more complicated to set up and leave themselves vulnerable if the track is removed.

The omni wheels design uses four angled omni wheels to allow complete freedom of movement. It can turn in place and even drive sideways or at an angle, however it requires more motors and more involved programming to function.

Electronics

Electronic Control System	Ease of Implementation	Reliability of Control	Versatility	Cost	Total Points
Off the Shelf RC Parts	2	2	-2	1	3
Arduino	X	X	X	X	X
Bluetooth	1	1	2	1	5
Wi-Fi	0	1	1	1	3
Radio	-1	2	2	1	4

Using off the shelf RC parts such as from an RC car or plane would provide a proven transmitter, receiver and some motors and servos, but would be difficult to modify for a robot with more things to control or which drives differently.

Using an Arduino microcontroller would require the design and programming of the electronics needed but would have inputs and outputs that could be easily modified to fit the needs of the robot. An Arduino could be controlled in a few different ways. Radio would have the longest range and clearest signal but may be difficult to decode on the Arduino's end. Bluetooth protocols are well documented and components for it are readily available for Arduino. Bluetooth is also used by off the shelf PlayStation 4 controllers.

Weapon

Weapon System	Damage	Ease of Implementation	Ease of Use	Cost	Total Points
Hammer	2	1	1	0	4
Roller	2	1	2	0	5
Hydraulic Wedge	0	0	1	-1	0
"Hermit Crab"	1	1	-1	1	2
Spatula	1	0	0	-1	0

Hammers are mechanically simple and capable of a lot of destruction but are heavy which will affect the available weight for the rest of the robot.

Rollers use a studded cylinder that rotates at high speed on the front of the robot which can cause damage both by throwing opponents, and by tearing at them with studs. They are versatile and do their job as long as the robot drives forward into the opponent.

A hydraulic wedge design uses a wedge-shaped vehicle with a sloped face that can be tilted forward by hydraulic piston. It would attempt to drive into opponents and flip them over.

The "hermit crab" idea involves making a robot that other bots can easily drive onto and baiting them into doing so. One on top, a set of powerful magnets would trap them in place. They are then the "shell" of the hermit crab as it fights the other robot.

Spatula weapons use a flat implement which they attempt to slide under the opponent, which is then rapidly raised to flip the opponent over.

Armor

Armor	Strength	Ease of Implementation	Weight	Cost	Total Points
Aluminum	0	2	1	0	3
1018 Steel	1	1	0	0	2
UHMWPE	2	-1	1	-1	1
AR400 Steel	2	-2	0	0	0

Aluminum armor would be relatively easy to machine and is a light option as metal armors go.

Steel is more difficult to work with than aluminum and heavier, but also stronger.

UHMWPE (Ultra-High-Molecular-Weight Polyethylene) is a plastic which will make it harder to work with than metal with the available facilities but can have much lower density than aluminum and is notoriously durable, even being used in body armor.

Design Ideas

Design	Drive System	Electrical System	Weapon	Armor	Total Points
Design 1	Dead Axel: Wheels	Arduino: Bluetooth	Roller	Aluminum	
	6	5	5	3	19
Design 2	Omni Wheels	Arduino: Radio	Hammer	UHMWPE	
	0	4	4	1	9
Design 3	Dead Axel: Wheels	Arduino: Bluetooth	Hydraulic Wedge	1018 Steel	
	6	5	0	2	13

Design 1 combines the highest scoring systems of each category.

Design 2 is an extremely maneuverable hammer bot which uses plastic armor to reserve weight for the hammer.

Design 3 is a hard steel ramming wedge.

Overall Feedback:

In several places, you use the word "axel". This is a jump performed in figure skating.

Proofread.

Describing what an alternative is, is not sufficient. Discuss the benefits and drawbacks more.

Pugh charts should have weighting factors.

The chosen solutions/alternatives should be indicated.