MAMBA'S MADNESS

A5-TEAM 4

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Overview

- Introduction
- Problem Understanding
- Conceptual Design
- Alternative Designs
- Design Overview
- Performance Results
- Conclusion

Introduction

- Theme: Space Jam!
- Challenges: Pass, jumpshot, and dunk
- Goal: Three rounds to maximize points
- Overall learning outcome: Diversify mechanism designs, think of individual systems and entire robot

Task	Max Point Value
Launch	1
Pass	3
Jumpshot	8
Dunk	30

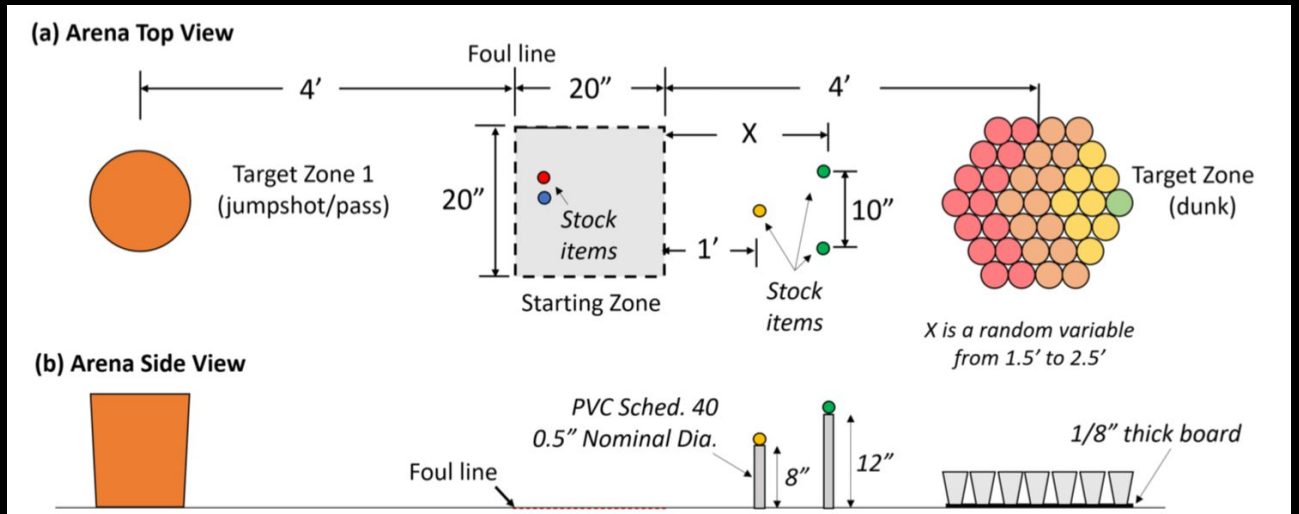
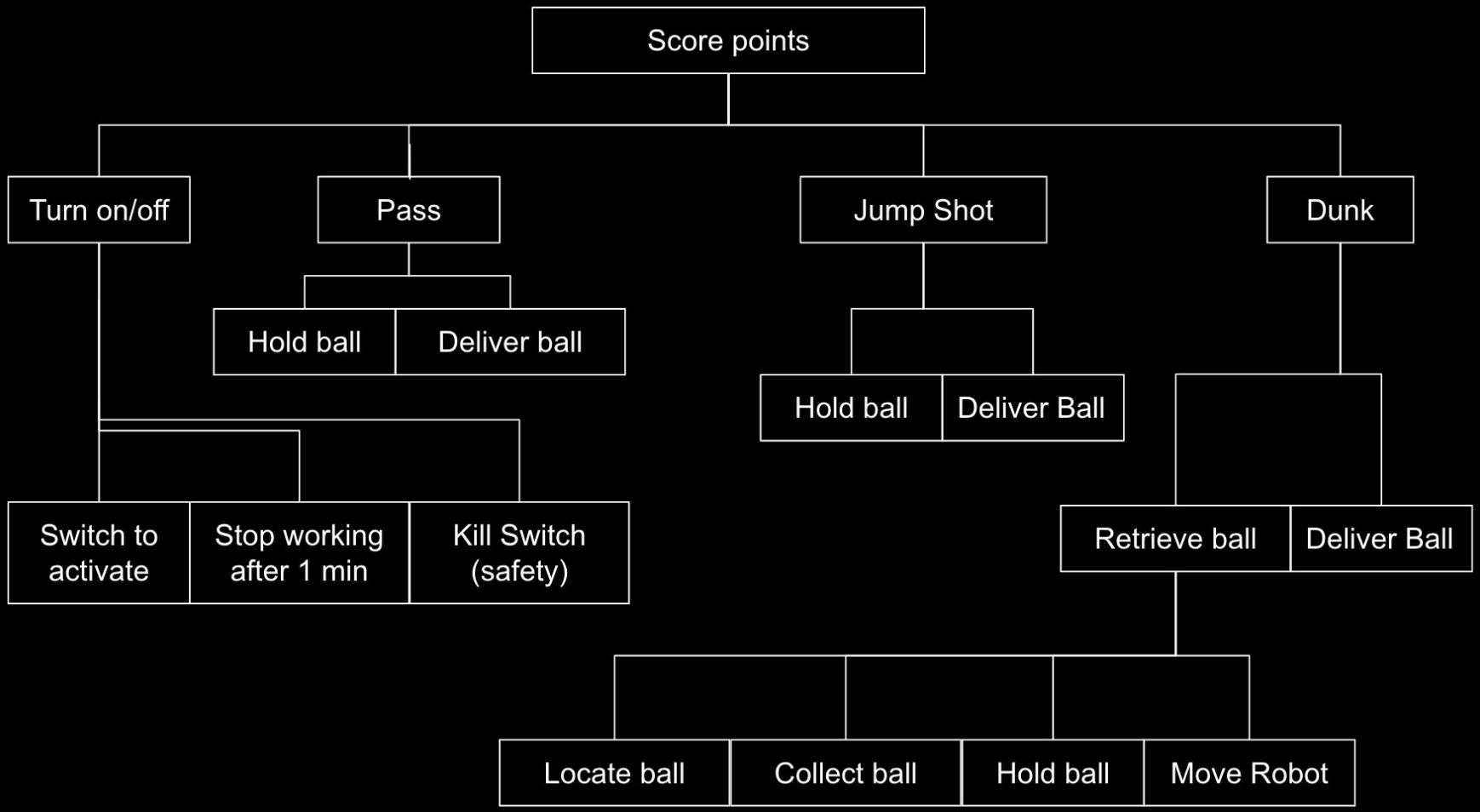


Figure 1. Layout of arena including top and side views. Red stock item is for the jumpshot task. Blue stock item is for the passing task. Yellow and green stock items are for the dunk task. Green stock items are moneyballs.

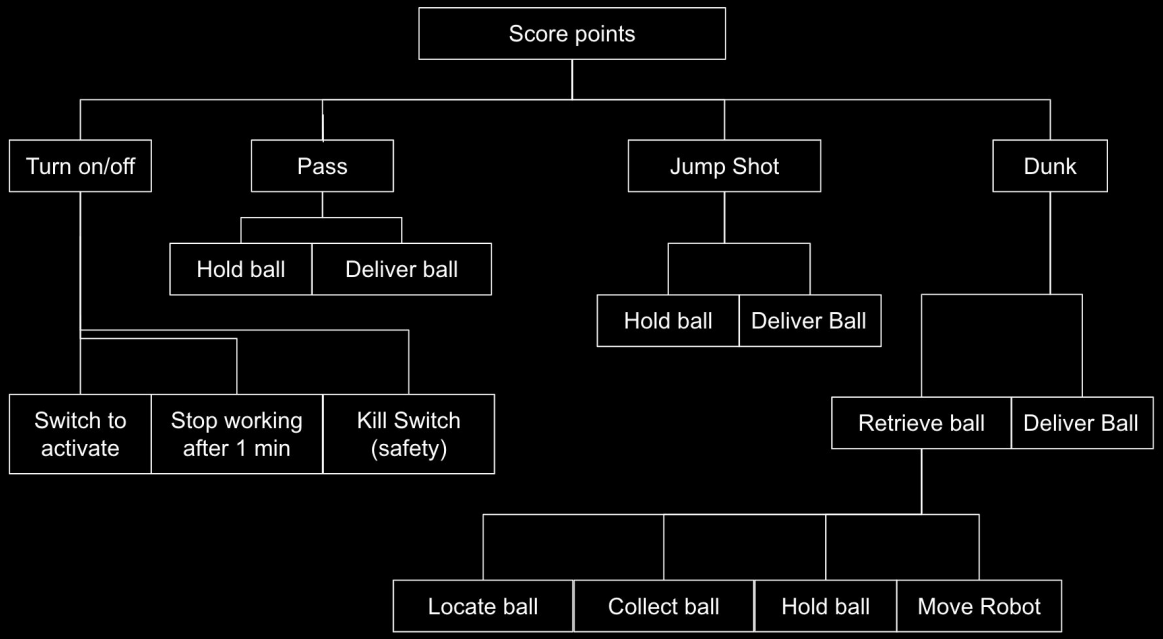
Problem Understanding

- Customer Requirements
  - Ease of use
  - Low budget
  - Legal
  - Reliable/Consistent
- Engineering Requirements
  - Set up in 3 minutes
  - Costs less than $100
  - Achieve JS/Pass 95% of time (wish)
  - Achieve Dunk 85% of time (wish)

Conceptual Design - Function Tree

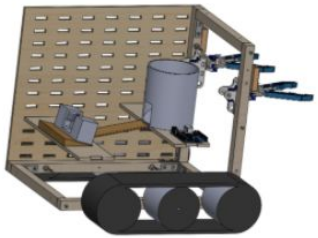


Conceptual Design - Possible Solutions



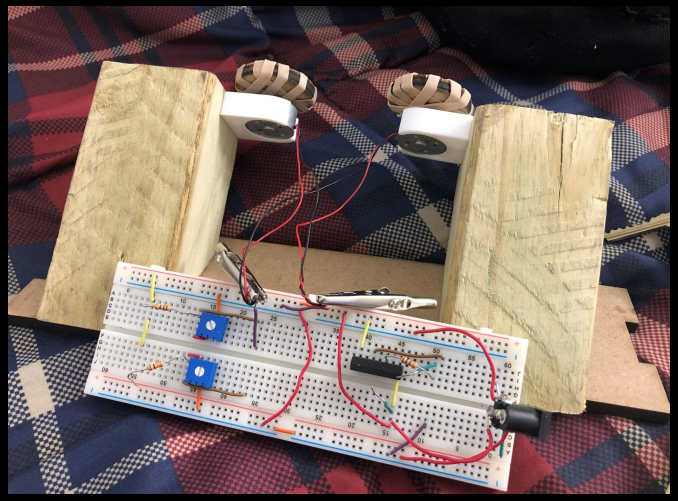
- Turn on/off: power switch, kill switch, code it to turn off
- Pass: catapult, striking mechanism, spinning wheel, rolling via gravity
- jumpshot: catapult, striking mechanism, spinning wheel
- Dunk
  - Locate ball: Sensor vs. Sensorless
  - Collection: Claws, tube collection, collection tray, scoop
  - Hold & Deliver balls: Dropping, projectiles, ramp
  - Move Robot: Motor with wheels, telescopic frame

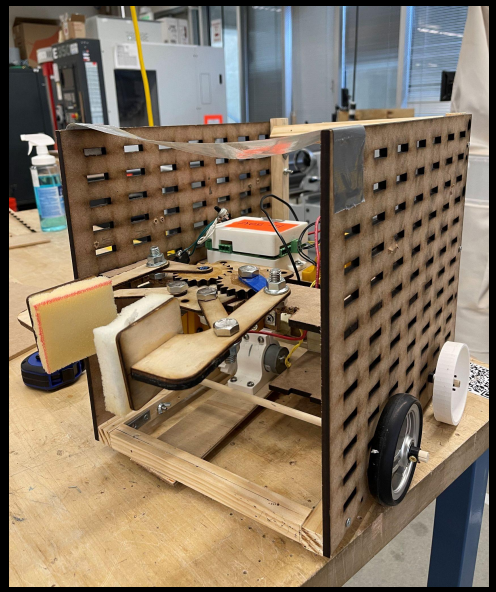
Alternative Designs

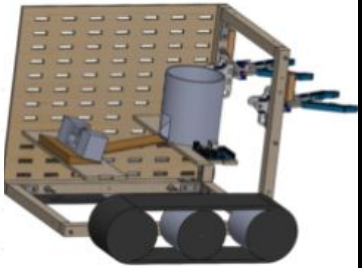


Criteria	Importance	Iteration 1		Iteration 2		Iteration 3		Iteration 4 (final design)	
		Rating	Weighted Total	Rating	Weighted Total	Rating	Weighted Total	Rating	Weighted Total
Makes Jump Shot	8	1	8	2	16	3	24	4	32
Make Pass	4	3	12	1	4	2	8	4	16
Retrive all three balls	5	1	5	1	5	3	15	4	20
Complete dunk challenge	9	1	9	1	9	2	18	4	36
Easily reparable	7	2	14	3	21	3	21	4	28
Inexpensive	5	2	10	4	20	3	15	3	15
Conforms to design constraints	10	0	0	4	40	4	40	4	40
Fabrication time	7	1	7	4	28	3	21	3	21
Total	55	10	65	12	143	16	162	23	208
Relative Total	220		0.295		0.650		0.736		0.945
Rank			4		3		2		1

Iteration 1

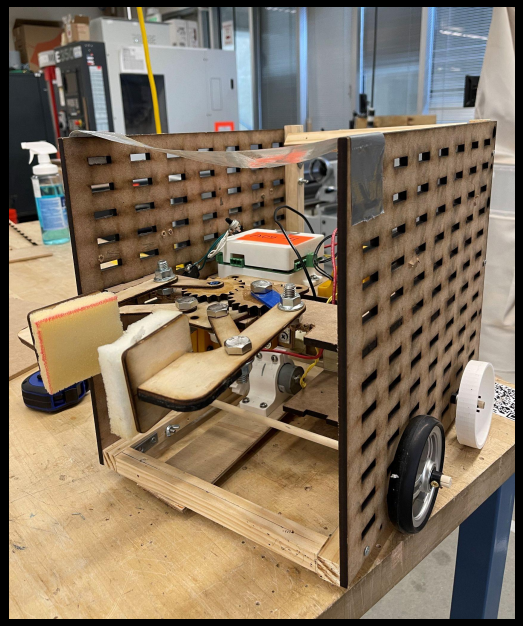






Criteria	Importance	Iteration 1	
		Rating	Weighted Total
Makes Jump Shot	8	1	8
Make Pass	4	3	12
Retrive all three balls	5	1	5
Complete dunk challenge	9	1	9
Easily reparable	7	2	14
Inexpensive	5	2	10
Conforms to design constraints	10	0	0
Fabrication time	7	1	7
Total	55	10	65
Relative Total	220		0.295
Rank			4

Iteration 2



Criteria	Importance	Iteration 2	
		Rating	Weighted Total
Makes Jump Shot	8	2	16
Make Pass	4	1	4
Retrive all three balls	5	1	5
Complete dunk challenge	9	1	9
Easily reparable	7	3	21
Inexpensive	5	4	20
Conforms to design constraints	10	4	40
Fabrication time	7	4	28
Total	55	12	143
Relative Total	220		0.650
Rank			3

Iteration 3

Iteration 4

Criteria	Importance	Iteration 3		Iteration 4 (final design)	
		Rating	Weighted Total	Rating	Weighted Total
Makes Jump Shot	8	3	24	4	32
Make Pass	4	2	8	4	16
Retrive all three balls	5	3	15	4	20
Complete dunk challenge	9	2	18	4	36
Easily reparable	7	3	21	4	28
Inexpensive	5	3	15	3	15
Conforms to design constraints	10	4	40	4	40
Fabrication time	7	3	21	3	21
Total	55	16	162	23	208
Relative Total	220		0.736		0.945
Rank			2		1

Final Design Overview

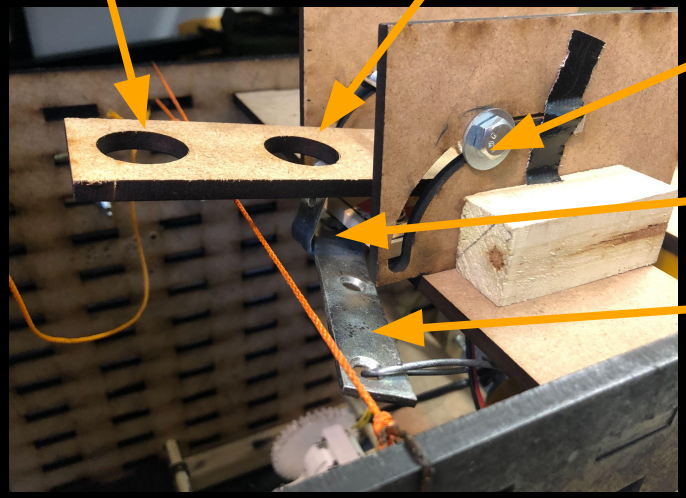
Pass/Jumpshot	Dunk

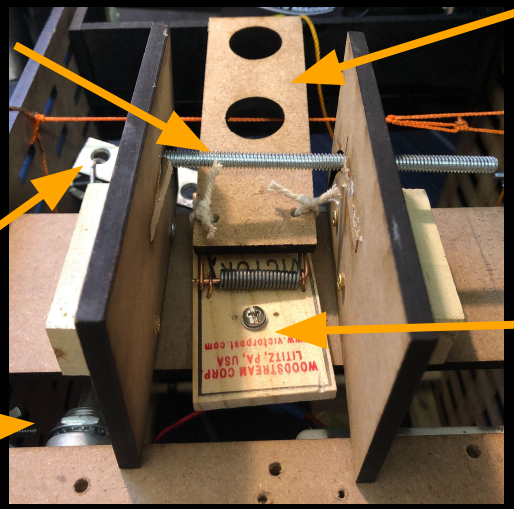
Design Principles

- Simple
- Cheap
- Reliable

Key Details	
Manufacturing Cost	$38
Manufacturing Time	19 mins
Assembly Time	< 1 Hour
Robot Reset Time	< 1 Min

Final Design Overview - Pass/Jumpshot in Detail





Key Details	
Manufacturing Cost	$2.69
Manufacturing Time	4 mins
Variable Launch Angle	
Score Max Points in 95% of Pass/Jumpshot Trials	

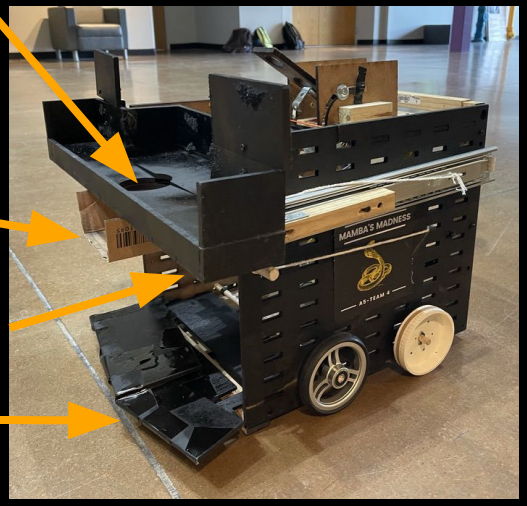
Final Design Overview - Dunk in Detail

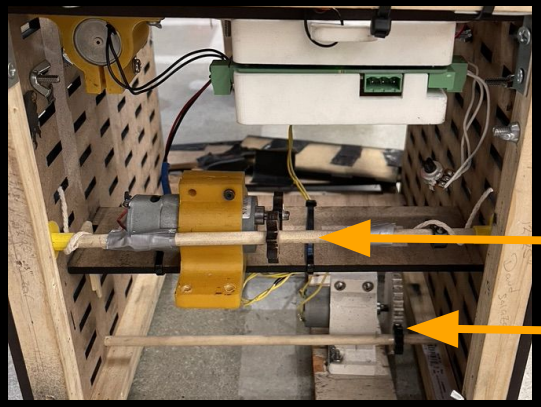
Ball Release

Chute

Tray

Ram

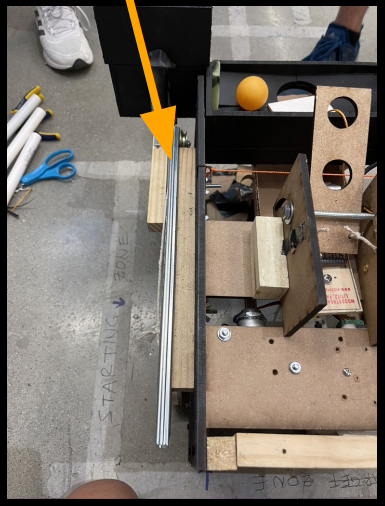




Pulley, Dowel, & String

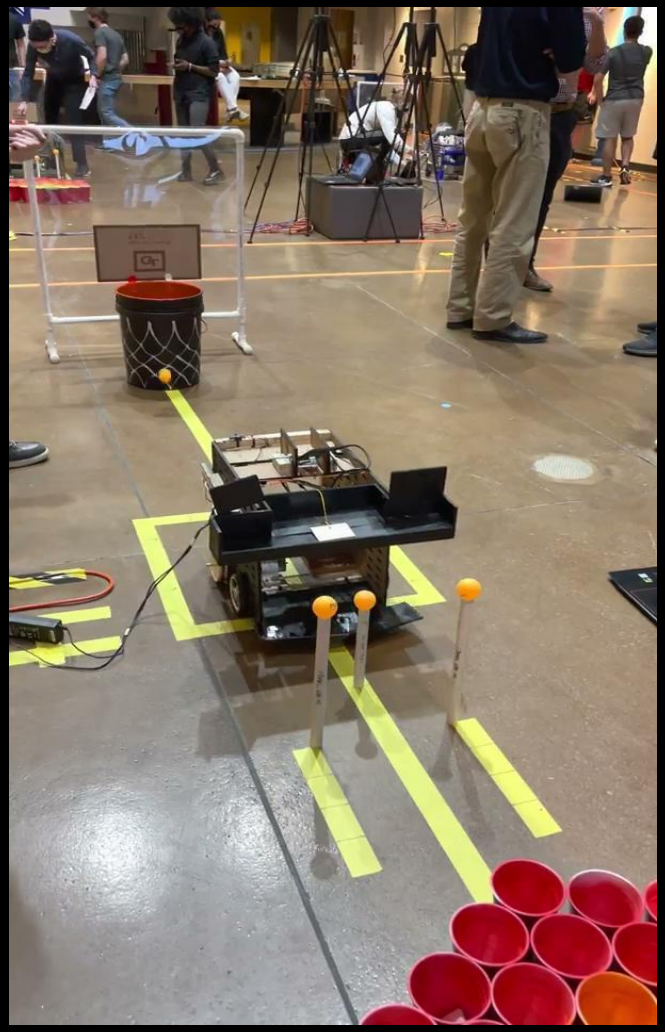
Drive-train

Tray Extension System (Slides)

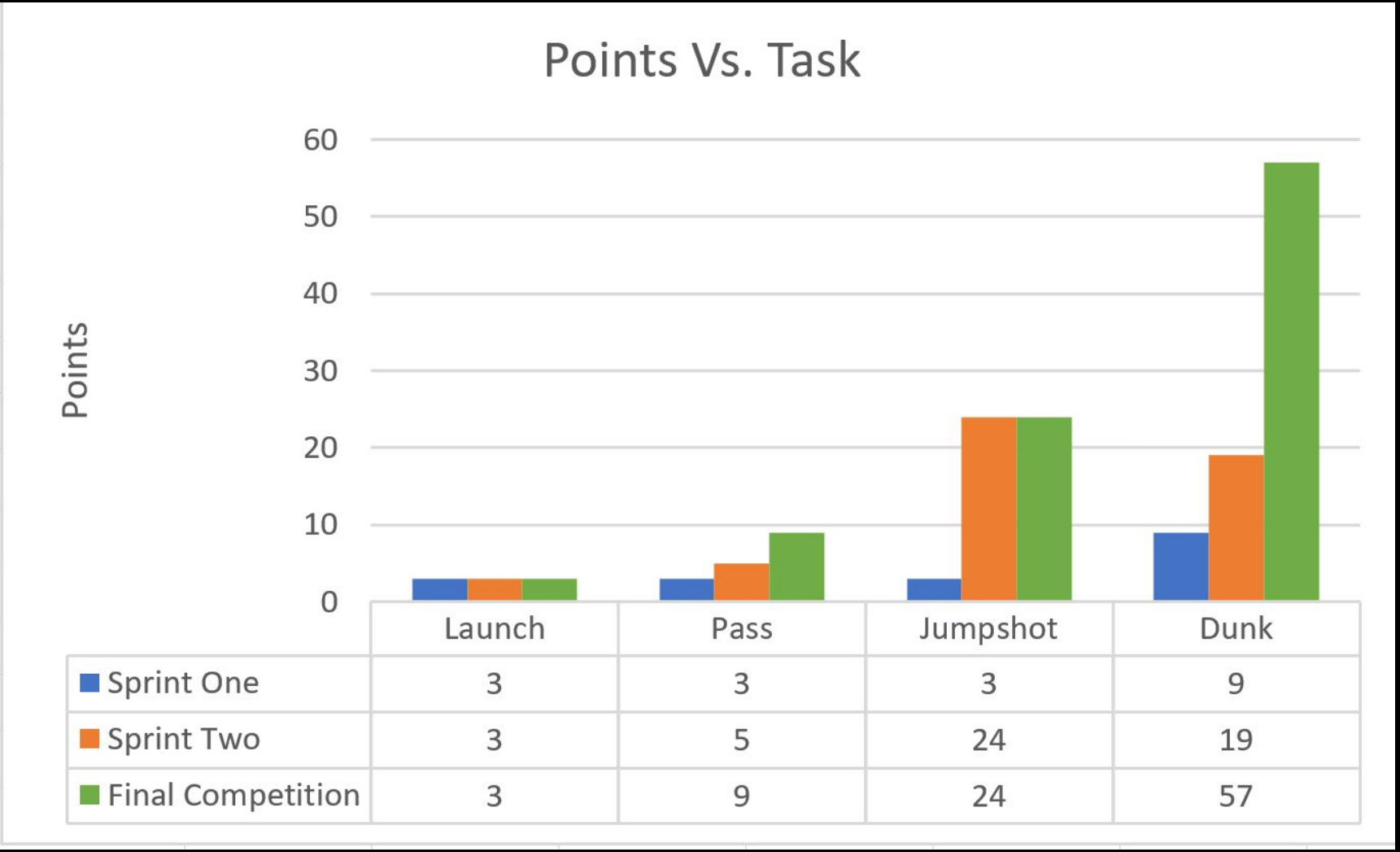


Key Details	
Manufacturing Cost	$26.35
Manufacturing Time	15 mins
Chute System	
Score 19 Points in each Dunk trial (2x Moneyballs -> Orange, Regular -> Red)	

Final Design Overview



Performance Results



	Launch	Pass	Jumpshot	Dunk
Sprint One	3	3	3	9
Sprint Two	3	5	24	19
Final Competition	3	9	24	57

Conclusion

- Lab Skills
  - Band saw, laser cutter, 3-D printer, etc.
  - Lab safety
- Design/Fabrication Skills
  - Tolerances
  - Material selection
- Became more agile with the engineering design process
- Developed quick thinking and problem solving
  - Main axle breaking
  - Balls not falling into tray

Questions