FAMU-FSU Engineering
Senior Design 301
2021-2022
Testing and Validation

Test Writer: Melissa Emery						
Test Case Name		LCD Test			Test ID #:	1
Description		Functionality Test			Type:	Unit
Tester Information						
Name of Tester		Melissa Emery			Date	1/7/22
Hardware/Software Ver.		1.5			Time	5:33 PM
Setup		Run developer graphics test and modify to include FAMU-FSU Logo				
Step	**Actions**	**Expected Results**	**Pass**	**Fail**	**N/A**	**Comments**
1	Run Graphics Test	Display will run test successfully and to completion to verify functionality of the LCD Screen	x			Screen functions as it should.
2	Run Example code	Example code with example image from SD-Card breakout displays successfully	x			SD-Card Breakout works and communication with Arduino is well-established.
3	Replace example image with school logo	School Logo displays correctly	x			Logo displays reliably on power up.
Overall Test Result			x			LCD working properly

Team: 301

Test Writer: Raymond Martinez						
Test Case Name		Launcher Testing			Test ID #:	2
Description		Launcher design revisions in order to improve capability to launch beads.			Type	Unit
Tester Information:						
Name of Tester		Raymond Martinez			Date	1/14/22
Hardware/Software Ver.		3.0			Time	6:00pm
Setup		Treadmill design: 3d printed holding case for four bearings for two cylinders, placed two belts on the cylinder and tension, and then drill in the holding cases on a wooden boards and insert a motor into one of the cylinders to spin it and the belts. Catapult design: 3d print a catapult arm with bucket and base, then place it within the base, put a screw in the arm to hold a spring and attach the other end to a servo motor that will tension the spring and cause a launch.				
Step	**Actions**	**Expected Results**	**Pass**	**Fail**	**N/A**	**Comments**
1	Assembled a treadmill with wood, belt, and DC motors	Launch beads a foot distance at minimum		x		Did not launch the required distance due to lack of friction with beads
2	3d printed catapult with spring and servo motor	Launch beads a foot distance at minimum	x			Launched the required distance but was not large enough to carry many beads
3	3d printed larger catapult with spring and servo motor	Launch beads a foot distance at minimum and hold many beads	x			Launched the required distance but was not large enough to carry many beads
Overall Test Result			x			Can launch and carry beads without issue!

Team: 301

Test Writer: Melissa Emery						
Test Case Name		Marshmallow Test			Test ID #:	3
Description		Test for different pushing mechanisms			Type	Unit
Tester Information						
Name of Tester		Kelvin Hamilton			Date	1/20/22
Hardware/Software Ver.		2.0			Time	4:00 PM
Setup		3D Print two prototypes including an accordion/scissor arm and a rounded bumper				
Step	**Actions**	**Expected Results**	**Pass**	**Fail**	**N/A**	**Comments**
1	Attach a motor to one side of the scissor arm and rotating pin to the other. Connect the pin and motor.	When the motor is turned on, the rotating pin will push and pull the scissor arm open and closed.	x			Although functional, high accuracy of pin-pointing the marshmallow would be required.
2	Attach the rounded bumper to the front of the robot and drive forward into the marshmallow.	The marshmallow will be pushed off to the side out of the way of the robot.		x		Marshmallow gets pushed most of the way but occasionally gets caught on the wheels.
3	Add cardboard panels to the ends of the bumper to shield the tires from the marshmallow.	The marshmallow will be pushed off to the side out of the way of the robot.	x			A cost-effective solution to the problem mentioned in step 2.
Overall Test Result			x			Success

Team: 301

Test Writer: Destiny Law						
Test Case Name		Collector Testing			Test ID #:	4
Description		Revisions to collector mechanism to ensure collection of beads			Type	Unit
Tester Information						
Name of Tester		Kelvin Hamilton			Date	3/11/22
Hardware/Software Ver.		5.0			Time	11:00AM
Setup		3D print an arm and attach the claw horizontally and vertically. Attach the servo motors to the top base Arduino MEGA and attach it to the arm.				
Step	**Actions**	**Expected Results**	**Pass**	**Fail**	**N/A**	**Comments**
1	Mechanical arm with vertical claw	Arm will be able to pick up at least 3 beads		X		Due to the claw angle and the line tracking, the arm misses the tree and beads entirely. The arm drops heavily to the top base because the claw is too heavy.
2	Connect a spring to the top and bottom part of the arm to counteract the weight of the arm after bead collection	The arm will not fall heavily onto the top base of the robot	X			The arm does not drop onto the top base, but the claw only grabs 1-2 beads.
3	Mechanical arm with spring & horizontal claw	Arm is projected to pick up 3 or more beads.	X			
Overall Test Result			X			The arm successfully collected 3 or more beads and did not drop down onto the top base.

Team: 301

Test Writer: Raymond Martinez						
Test Case Name		Line Tracking Sensors Placement			Test ID #:	5
Description		Testing line sensor placement for optimal line tracking			Type	Debugging
Tester Information						
Name of Tester		Raymond Martinez			Date	3/11/22
Hardware/Software Ver.		3.0			Time	1:15pm
Setup		Line tracking sensors placed horizontally under the robot and connected by the analog pins to the analog pins on the Arduino MEGA 2560 on the bottom base				
Step	**Actions**	**Expected Results**	**Pass**	**Fail**	**N/A**	**Comments**
1	Placed in a straight line in between motors and front caster	See the line without issue	x			Followed the line well without much issue
2	Placed along front of bumper, spaced out in a V shape	See and follow line without issue		x		Large gaps between sensors would cause large inaccuracies
3	Placed in a straight line under the front bumper with a custom mount	See and follow line without issue	x			Followed the line without much issue and turned smoother due to larger lookahead distance
Overall Test Result			x			

Team: 301

Test Writer: Allison Rosenbaum						
Test Case Name		PixyCam			Test ID #:	6
Description		Image Recognition Test			Type	Unit
Tester Information						
Name of Tester		Melissa Emery			Date	3/18/22
Hardware/Software Ver.		2.0			Time	4:00
Setup		Run the PixyCam test code and implement to communicate with the top arduino when to execute the bead launcher sequence				
Step	**Actions**	**Expected Results**	**Pass**	**Fail**	**N/A**	**Comments**
1	Download the PixyCam Test code and train it to recognize the cups	It will show the red solo cup with a box labeling it			x	Although it recognized the cup, it would label anything with red undertones
2	Test with the white background	It will only have the label on the red solo cup	x			As long as the PixyCam is angled down, it won't mistake something red for the cup
3	Implement for the test run to only shoot when there isn't a cup in fixed locations	The robot will only launch the beads when there isn't a cup at locations that are hard coded into the robot	x			Worked very well recognizing when and when not to shoot
Overall Test Result			x			Overall successful

Team: 301

Test Writer: Raymond Martinez						
Test Case Name		Line tracking algorithm			Test ID #:	7
Description		Forming the best line tracking algorithm for the robots navigation			Type	Debugging
Tester Information:						
Name of Tester		Raymond Martinez and Kelvin Hamilton			Date	4/1/22
Hardware/Software Ver.		4.0			Time	11:40pm
Setup		Line tracking code testing and implementation on the Arduino MEGA 2560				
Step	**Actions**	**Expected Results**	**Pass**	**Fail**	**N/A**	**Comments**
1	Wrote navigation algorithm based on case statements with color thresholds	Track line and adjust the robot position for turns		x		While it worked on a floor with flat colors, the reflectivity of the paint made this method ineffective
2	Wrote navigation algorithm based on case statements with the color smallest value under the threshold	Track line and adjust the robot position for turns		x		While it did line track, the algorithm would fail on the initial all white start point
3	Previously written algorithm with an initial set distance moved to leave start point and also an automatic turnaround hardcoded into the end of the track	Track line, track positions, and adjust the robot position for turns	x			Works as intended, with few expected inaccuracies
4	Added objective locations for the robot to perform actions	Track line, track positions, adjust the robot position for turns	x			Works as intended, with few expected inaccuracies
Overall Test Result			x			

Team: 301

Test Writer: Raymond Martinez						
Test Case Name		Arm and catapult algorithm			Test ID #:	8
Description		Forming the best line tracking algorithm for the robots navigation			Type	Debugging
Tester Information:						
Name of Tester		Kelvin Hamilton			Date	4/2/22
Hardware/Software Ver.		2.0			Time	9:00am
Setup		Arm movement and catapult launching code testing and implementation on the Arduino MEGA 2560				
Step	**Actions**	**Expected Results**	**Pass**	**Fail**	**N/A**	**Comments**
1	Programmed the arm to grab, deposit, and hold down the catapult, and launched the catapult	Picked up the beads from tree locations, placed them into the catapult, held down the catapult, and launch	x			Worked well but would keep launching when catapult was empty
2	Added a check for launch prevention once catapult was empty	Picked up the beads from tree locations, placed them into the catapult, held down the catapult, and launched. Checks the catapult for beads before launching	x			Works as intended
Overall Test Result			x			

Team: 301

Test Writer: Allison Rosenbaum						
Test Case Name		Integrated Test			Test ID #:	9
Description		Full test runs on practice game board			Type	Integration
Tester Information						
Name of Tester		Team 301			Date	4/2/22
Hardware/Software Ver.		12.0			Time	9:00AM
Setup		Once each module is finished and working together, test on the completed practice board				
Step	**Actions**	**Expected Results**	**Pass**	**Fail**	**N/A**	**Comments**
1	Complete Practice run 1	Able to effectively complete each obstacle		x		The robot has power issues where different modules cannot work effectively together
2	Add a voltage regulator	The robot is able to complete the course without any modules failing due to power	x			Power was stabilized. Has an issue delivering power to the motor driver.
3	Soldered the voltage and ground directly to the motor driver	The robot consistent is able to complete the course without power issues for the motors	x			Fixed the power issue. The hard coded locations are now off.
4	Update the location for all the trees and net/cup placements	The robot is able to stop at accurate locations to collect or launch the beads	x			Stops at accurate locations. After the turnaround, it won't end back on the line.
5	Edit the code for the spin to make it more accurate	Is able to identify the line again more consistently	x			Found the line again more accurately.
6	Edit the code to grab multiple times to get more beads or	The robot is able to grab more beads			x	Although it worked, we could not implement it with the time constraint
7	Edit the code to only shoot for the first net after a tree	It will ignore a net if it's the second one after a tree, will reset after each tree	x			Worked Effectively
Overall Test Result			x			Robot was able to complete each obstacle