
BY ANYELA~/LIAM<\NIKITA=/MICHAEL
NATURAL SELECTOR
MARBLE SORTER
04/03/24
POE_MEDCALF_4A

PROJECT SUMMARY

Problem and Constraints

Our project aims to provide a timely, accurate method of sorting marbles (wood, clear, and red) randomly into different bins based on color/type; The system should be able to incorporate controls for user interaction and real-time feedback. The sorting process should be automated, cost-effective, and display biomimicry in its design.

OUR SOLUTION

The Natural Selector takes inspiration from the different sections of a cow’s stomach to sort marbles based on color. When our solution tracks the color of the marble in question, a motor turns to display its corresponding bin. Our control, the system’s brain, displays the color detected by the marble and is equipped with a pause, reset, and detect button to allow for user interaction. While detection is not wholly automated, the sorting process is.

GANTT CHART

Project Name	Team members	Project Duration	Project Start Date	Project End Date	
3.1.7 Machine Control Design - V5	Liam // Michael Nikita //Anyela	9 Days	2/29/2024	04/03/2024	THE MACHINE MUST INCLUDE AN ELEMENT OF BIOMIMICRY THAT ONE WOULD FIND IN NATURE.

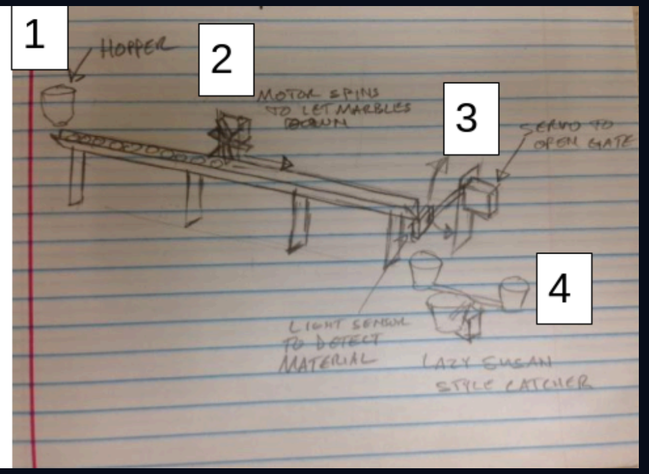
		DONE	DONE	DONE	coming work	coming work	coming work	coming work	coming work	coming work	coming work		
		Thurday	Monday	Thurday	Spring Break	Monday	Wednesday	Friday	Tuesday	Thurday	Wednesday		
Task ID	Task	02/29/2024	03/04/2024	03/07/2024	03/11-15/2024	03/18/2024	03/20/2024	03/22/2024	03/26/2024	03/28/2024	04/03/2024	Completion	*description*
1	activity choices	Liam // Michael Nikita //Anyela (DUE)										☑	~Marble Sorter
2	define roles	Liam // Michael Nikita //Anyela (DUE)										☑	*SYSTEMS *COMMUNICATION *INDUSTRIAL *CONTROL LOGIC ENGINEER
3	roles discussion	Liam // Michael Nikita //Anyela Liam // Michael (DUE- Nikita //AnyelaNikita //Anyelaclass)		end of								☑	Discuss the definition of each role and the responsibilities of each member. How do you intend to divide the work to accomplish your goals effectively and efficiently? (at least 4 each)
4	Design Brief	Nikita (DUE- NikitaNikitaend of class)										☑	Client, End User, Team, Problem Statement (1-2 sentences), Design Statement (steps required for successful design process)
5	Project Management Sheet	divide divide divide assignments-- assignments--assignments-->Liam // >Liam // >Liam // Michael Nikita Michael Nikita Michael Nikita //Anyela //Anyela //Anyela (Group) (DUE- (Group)(Group)end of class)										☑	includes detailed list of activities with team member assignments
6	Gantt Chart	Anyela (DUE- AnyelaAnyelaend of class)										☑	complete with heading and column with team member assignments
7	Brainstorming Sketches _ two potential physical sketches (hand drawn)	Pick 2 from the //Anyela //Anyela (Group) (Group)	Pick 2 from the group-->Liam // Michael Nikita	group-->Liam // Michael Nikita		Pick 2 from the group-->Liam // Michael Nikita //Anyela (Group)						☐	Produces accurate sketches that meet the required design concepts. Is properly detailed for effective communication, including labels, descriptions, signatures, and dates.
8	Machine Control Design Research (INDIVIDUAL)	Liam // Michael Nikita //Anyela (individual)				Liam // Michael Nikita //Anyela (individual) (individual)	Liam // Michael Nikita //Anyela					☐	
9	images of two potential program sketches (written pseudo code and/or flow chart)	Pick 2 from the //Anyela (Group)		group-->Liam // Michael Nikita		Pick 2 from the group-->Liam // Michael Nikita //Anyela (Group)						☐	Produces accurate program solutions. Is properly detailed for effective communication, including labels, descriptions, signatures, and dates.
10	Decision matrix (individual)	Liam // Michael Nikita //Anyela (individual)				Liam // Michael Nikita //Anyela (individual)						☐	
11	Top program sketch (individual)	Liam // Michael Nikita //Anyela (individual)				Liam // Michael Nikita //Anyela (individual)						☐	
12	Top Iso-sketch (individual)	Liam // Michael Nikita //Anyela (individual)				Liam // Michael Nikita //Anyela (individual)						☐	
13	Decision matrix 2	Liam // Michael Nikita //Anyela (Group)				Liam // Michael Nikita //Anyela (Group) (Group)	Liam // Michael Nikita //Anyela					☐	
14	Final physical sketch (hand drawn on isometric paper)					depends on the final choice, the depends on the final choice, the one who one who designed it designed it does it-> liam// does it-> liam// michael// Nikita michael// Nikita //Anyela //Anyela liam--> if liam--> if liam--> if needed needed needed						☐	* Solution is accurate and includes a high-quality sketch. 3D model. Meets the ired design concepts * Includes details for effective communication, including criptions, signatures, and dates. ***fully annotated isometric sketch.
15	Final program sketch (written pseudo code)					michael// Nikita michael// Nikita michael// Nikita //Anyela //Anyela //Anyela liam--> if liam--> if liam--> if needed needed needed						☐	
16	Final program with description image screenshots from VEXcode)					michael// Nikita michael// Nikita michael// Nikita //Anyela //Anyela //Anyela						☐	
17	Final Physical Solution Concept Written Communication 1) Personal reflection, 2) learning target, 3) project objective								Anyela	Anyela	Anyela	☐	Includes details for effective communication, including labels, descriptions, signatures, and dates.
18	project summary								Nikita Nikita Nikita			☐	
19	Presentation								Liam // Michael Liam // Michael Nikita //Anyela Nikita //AnyelaNikita //Anyela (DUE)			☐	
20	Building Prototype (take photos)							Michael--> if needed liam// Nikita //Anyela	Michael--> if needed liam// Nikita //AnyelaNikita //Anyela			☐	
21	Code testing								liam--> if liam--> if needed needed michael// Nikita michael// Nikita //Anyela //Anyela			☐	
22	Prototype testing							Michael--> if needed liam// Nikita //Anyela	Michael--> if needed liam// Nikita //AnyelaNikita //Anyela			☐	
23	Prototype Testing DAY (take photos)									Liam // Michael Nikita //Anyela (DUE- Start)		☐	**Physical Solution Quality and Functionality** Did your solution solve the problem? -->Mechanism functions correctly, consistently, and the chosen parts are appropriate. **Program Solution Design Requirements** solution satisfy all design requirements? **Program Solution Quality and Functionality** From a programming standpoint, did your programming solve the problem?--->Works correctly, consistently, and function blocks are well chosen.

FINAL SOLUTION

---IMAGES----

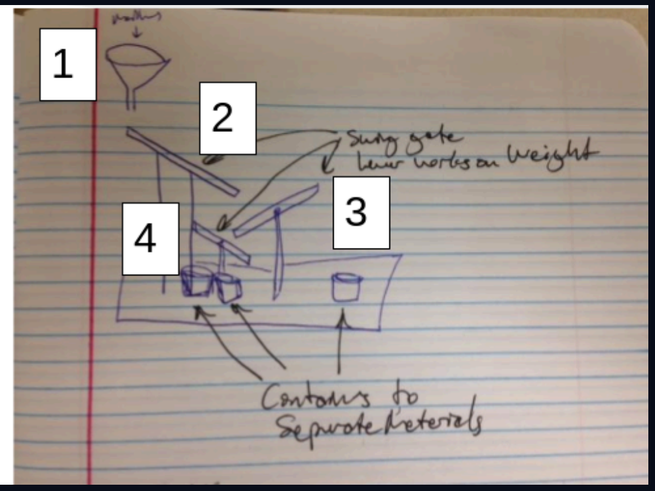
POTENTIAL PHYSICAL SKETCHES

1. The hopper drops the balls onto the rail.
2. The balls roll to a rotating wheel that will release them individually.
3. Each marble will roll to a light sensor which will decide what the material is.
4. The lazy suzan is powered by a motor that will spin the correct cup under the end of the ramp and the ball gets dropped into the cup.



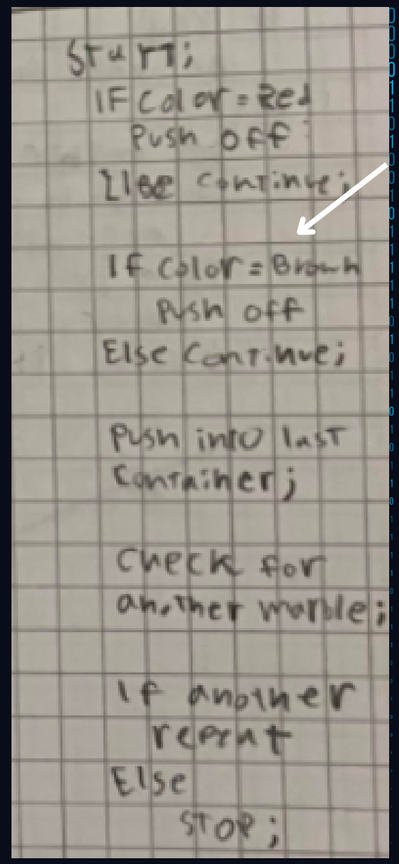
BUILD 1

1. Funnel hopper.
2. Swing gate allowing one ball at a time.
3. Heavier ball will deflect lever and fall to cup.
4. Difference in weight will deflect lever into one cup or another.



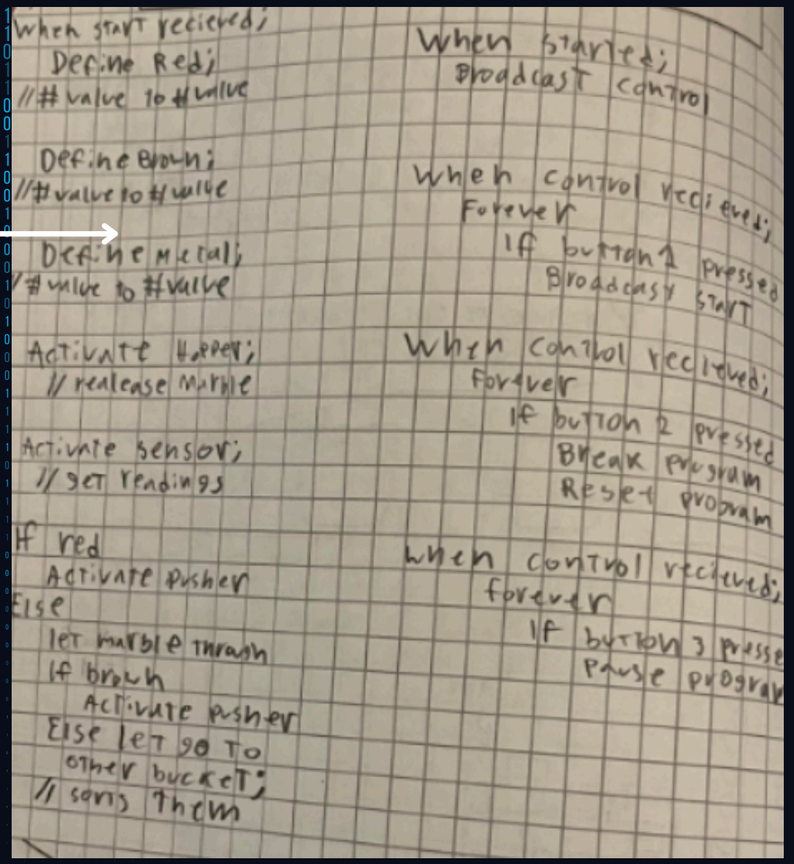
BUILD 2

POTENTIAL PROGRAM SKETCHES



PSEUDOCODE 1

For our pseudo-code, I made a pseudo-code that told what the machine had to do. This is what I had in my pseudo code: The machine had to have a motor turn a big gear and separate each marble to its correct location depending on the color that the sensor detected. The flashlight turns on and the light sensor reads the marble. The servo motor rotates to face the correct storage bin until the marble is deposited. And keeps count of everything the brain, while you have button to select (pause,start, reset)



PSEUDOCODE 2

DECISION MATRIX

	1-10	1-10	1-10 (higher = less error)	
Sketch	meets criteria?	design difficultly	room for error	totals
Build 1	8	5	9	**22**
Build 2	7	7	6	20
Psuedocode 1	7	7	6	20
Psuedocode 2	8	5	9	**22**

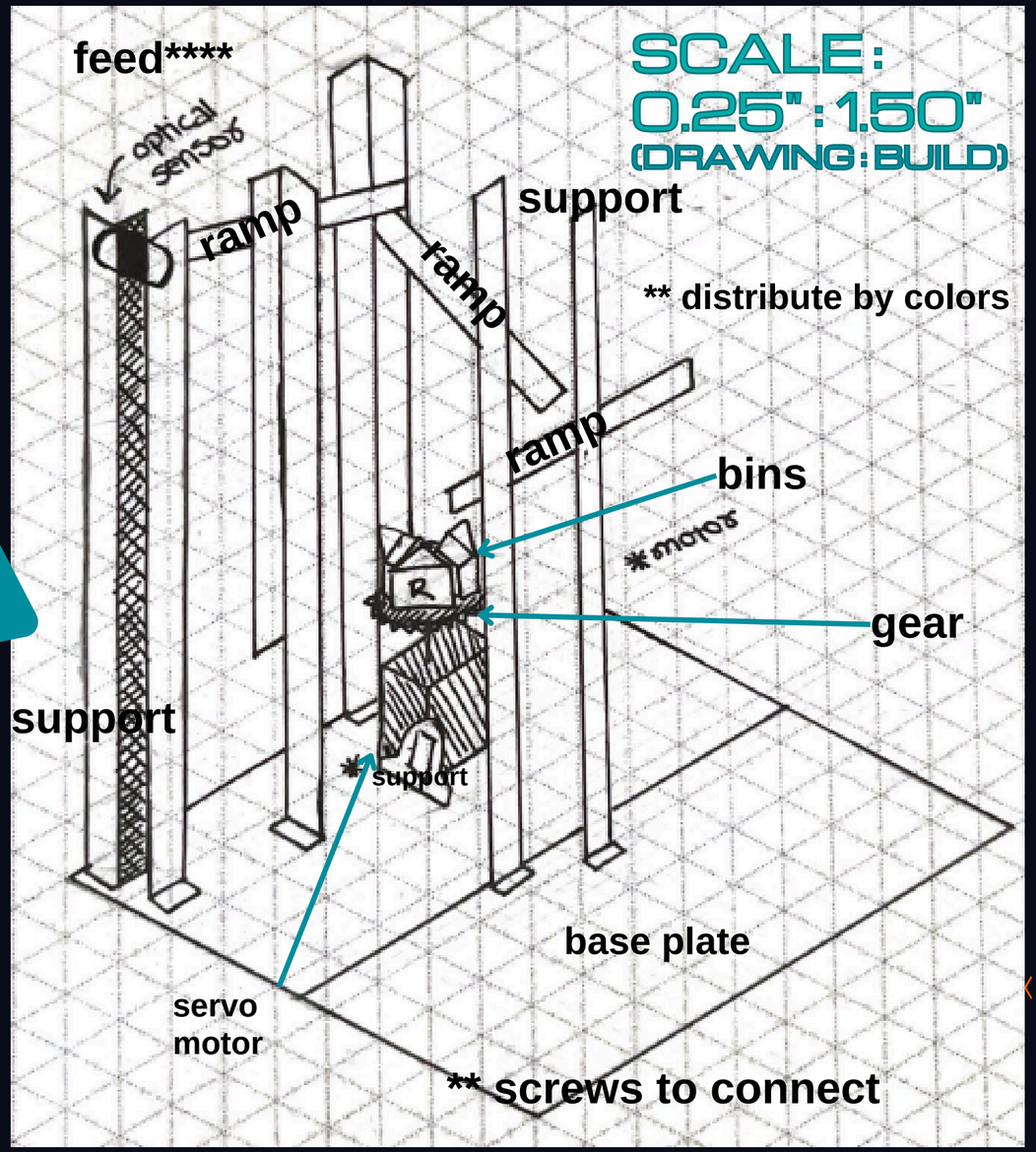
1-10 : higer scores represent easier designs to build or those with less error

Chosen Designs & Justification : Build 1 and Psuedocode 2

Build 1 was chosen because it best meets the criteria. Because the system is reliant on the ramp to sort the marbles into buckets, it is also more prescise than just sorting by ramp. As such, the build mimimizes error. While the design in question may be difficult to build and achieve, it has the most potential. In a similar vein, Psudeocode 2 is more precise and minimizes error with more detail around it's achiveablitiy. While defining colors will prove to be difficult, it allows us to best sort the marbles accurately.

FINAL PHYSICAL SKETCH

After many revisions of our design, we finally decided on a final design that we would use to build our machine. We decided to use the light sensor to determine the difference between the marbles. We incorporated a new way to place the marbles into the storage bins using the servo motor. We used a motor to turn a big gear that had each bin, and hand feed each marble. We found that our final design was much better than our previous designs.



FINAL PROGRAM

https://drive.google.com/file/d/1q7HP6u9LbN-5IDF4IEhBY0x9-g-R-83U/view?usp=sharing

Blockly >
< Python

https://drive.google.com/file/d/1VRjOkUXtNjjKC80H1IlihJhJ6oSWHyeU/view?usp=sharing

```
#region VEXcode Generated Robot Configuration
from vex import *
import urandom

# Brain should be defined by default
brain=Brain()

# Robot configuration code
startButton = Bumper(brain.three_wire_port.a)
stopButton = Bumper(brain.three_wire_port.b)
resetButton = Bumper(brain.three_wire_port.c)
FirstColorSensor = Optical(Ports.PORT1)
servo_h = Servo(brain.three_wire_port.h)
motor_11 = Motor(Ports.PORT11, GearSetting.RATIO_18_1, False)


# wait for rotation sensor to fully initialize
wait(30, MSEC)


def play_vexcode_sound(sound_name):
    # Helper to make playing sounds from the V5 in VEXcode easier and
    # keeps the code cleaner by making it clear what is happening.
    print("VEXPlaySound:" + sound_name)
    wait(5, MSEC)

# add a small delay to make sure we don't print in the middle of the REPL header
wait(200, MSEC)
# clear the console to make sure we don't have the REPL in the console
print("\033[2J")

#endregion VEXcode Generated Robot Configuration
vexcode_brain_precision = 0
vexcode_console_precision = 0
beginSorting = Event()
programStart = Event()
messageI = Event()
stopProgram = Event()
```

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The coding for this project was fairly difficult to make. Writing the actual code was not too difficult but after the code was written the difficult part was making all of the values correct and just simply troubleshooting the problems that we had. We had to program the servo motor to turn to the correct distance. We also had to experiment and see what readings the light sensor got for various types of marbles and use that data to choose which marbles we wanted to use and then enter the correct values back into the light sensor on our code.

Discussion of Roles -

Define the role of each team member (definition) and list at least four activities that each member will be responsible for doing. How do you intend to divide the work to accomplish your goals effectively and efficiently?

To divide the work effectively and efficiently, the team can put tasks based on each member's skills and strengths. Regular communication and collaboration sessions should be scheduled to ensure alignment and progress tracking. Additionally, establishing clear deadlines can help prioritize tasks and keep the project on track. Each team member shouldbe responsable on their assigned tasks while also providing support and feedback to one another as needed.

Systems Engineer: Anyela

Definition: The systems engineer is responsible for overseeing the overall functionality and integration of components within the marble sorter system.

Activities:

- Designingtheoverallarchitectureandlayoutofthemarble sorter.
- Coordinatingcommunicationbetweendifferentsubsystems, such as the sorting mechanism, control system, and feedback display.
- Conductingsystemtestingandtroubleshootingtoensure operation.
- Optimizingthesystemforefficiency,reliability,andscalability.
- GanttChart
- FinalPhysicalSolutionConceptWrittenCommunication1) Personal reflection, 2) learning target, 3) project objective

Industrial Engineer: Michael

Definition: The industrial engineer focuses on optimizing the manufacturing and production processes involved in building the marble sorter.

Activities:

- Designingthephysicalstructureandmechanismsofthemarble sorter for efficient assembly and operation.
- Selectingappropriatematerialsandmanufacturingtechniques to achieve performance.
- identifypotentialmanufacturingchallengesandstrategies.
- Prototypetesting
- PrototypeTesting(takephotos)

Communication Engineer: Nikita

Definition: The communication engineer is responsible for designing and implementing the communication protocols and interfaces within the marble sorter system.

Activities:

- communication
- dataexchangeandcontrol.
- Testingandvalidatingcommunicationtoensurereliability
- Providingdocumentation
- DesignBrief
- ProjectSummary

Control Logic Engineer: Liam

Definition: The control logic engineer focuses on designing the algorithms and control logic for the marble sorter's sorting mechanism and feedback system.

Activities:

- Developingalgorithmstoanalyzemarblecharacteristicsand determine sorting criteria based on color/type.
- Implementingcontrollogic
- Integratingsensorsandfeedbackmechanismstoprovide real-time data on sorting performance.
- controlparametersandalgorithmstooptimizesorting accuracy and speed.
- Codetesting
- Finalprogramwithdescriptionsimage(screenshotsfrom VEXcode)
- Finalprogramsketch(writtenpseudocode)

Machine Control Design Research (INDIVIDUAL)
Decision matrix 1 (individual)
Decision matrix 2 (group)
Presentation (group)
Images of two potential program sketches (written pseudo code and/or flow chart) (group)
Final physical sketch (hand drawn on isometric paper) (group)
Top Iso-sketch (individual)
Top program sketch (individual)

Project Management Sheet (group)
Brainstorming Sketches _ two potential physical sketches

(hand drawn) (group)
activity choices (group)
define roles (group)
roles discussion (group)

Discussion of Roles and Responsibilities

Systems Engineer - Anyela
The systems engineer is responsible for facilitating conversations and keeping up with the project schedule.
1. GanttChart
2. Brainstormingsketches
3. Topiso-sketch
4. Presentation

Communications Engineer - Nikita
The communications engineer manages the production and assembly of all deliverables.
1. DesignBrief
2. Brainstormingsketches
3. Topiso-sketch
4. Presentation

Industrial Engineer - Micheal
The industrial engineer manages the construction of the product prototype.
1. Brainstormingsketches
2. PotentialPrograming
3. Topiso-sketch
4. PrototypeTesting

Control Logic Engineer - Liam
The control logic engineer keeps track of the logic and programming part of the product.
1. Brainstormingsketches
2. PotentialProgramming
3. Topiso-sketch
4. FinalProgram

Design Brief

Created by: Liam, Michael, Anyela, Nikita

Uploaded final design brief into shared folder

Machine Control Design

CLIENT NAME: Marble Mania

END USER: Kids

TIMELINE: February 28 – April 2

DESIGNERS: Liam, Michael, Anyela, Nikita

PROBLEM STATEMENT	Kids who use the facilities often clean up and organize the marbles wrong. This makes it hard for employees and kids alike to look for the marble of their dreams. As such, we need a machine that can sort different types of marbles efficiently and neatly.
DESIGN STATEMENT	The machine needs to sort 3 kinds of marbles from a random group and incorporate an element of bio-mimicry to attract children. (See deliverables for more on the manufacture process)
CRITEETIA AND CONTSTRAINTS	1. Sort 3 types of marbles into bins by color and or type 2. It needs to be able to sort 20 marbles in a continuous stream 3. It should know the final total of marbles sorted and what color they were 4. Should have controls that can start, stop, pause, and reset the machine.
DELIVERABLES	1. Design Brief 2. Gantt Chart 3. Brainstorming Designs 4. Machine Control Design Research 5. Design Matrix 6. Top Design Sketch 7. Final Program 8. Final Machine Design 9. Project Summary 10. Prototype and Code Testing (For more, see Gantt chart)

Design Brief

Created by: Liam, Michael, Anyela, Nikita

Client:	Marble Mania
Target	Kids, young people.
Consumer/Market End User:	The end user of this marble sorter is someone or an organization involved in manufacturing processes where marbles of various types are used, such as toy manufacturing, art studios, or educational institutions.
Designer(s):	Liam, Michael, Anyela, Nikita
Problem Statement:	The current manual sorting process for marbles is time-consuming, have errors, and inefficient. There is a need for an automated solution to accurately and efficiently sort marbles based of their color/type.
Design Statement:	Design and develop a prototype marble sorter that can automatically sort a batch of 20 random marbles into three different bins based on their color/type. The sorter should incorporate controls for user interaction and display to provide real-time feedback on the sorting process.
Criteria & Constraints:	● Thesortermustaccuratelyidentifyandsort3outof types of marbles: clear glass, red glass, multicolor glass, steel, plastic, and wood. ● Theprototypemustbeabletohandleabatchof20 random marbles at a time. ● Thesortingprocessshouldbeautomatedand efficient, with minimal manual intervention required. ● Thesortershouldhavecontrolsforuserinteraction, such as start/stop buttons and mode selection. ● Real-timefeedbackonthesortingprocess,including a tally of the sorted marbles, should be displayed. ● Theprototypeshouldbecost-effective,easyto assemble, and maintainable. ● Thedesignmustadheretobiomimicryconstraints, drawing inspiration from natural systems and

	processes.
deliverables	Presentation Deliverables: ● Title,date,class,andteammembernames ● ProjectSummary ● GanttChart ● Imageofthefinalsolution ● Imagesoftwopotentialphysicalsketches (hand-drawn) ● Imagesoftwopotentialprogramsketches (pseudo-codeand/orflowchart) ● Finalphysicalsketchimage(hand-drawnon isometric paper) ● Finalprogramsketchimage(written pseudo-code) ● Finalprogramwithdescriptionsimage (screenshots from VEXcode) ● Personalreflection,learningtarget,project objective ● Prototypedemonstrationshowcasingthe sortingprocess. ● Explanationofthedesignprocess,including biomimicry-inspired elements. ● Finishedprototype

Project Management Sheet

Group Members: Anyela, Nikita, Liam, Michael

Task	Steps to Completion	Responsibility	Due Date
activity choices	Choose an activity	Liam // Michael // Nikita //Anyela	Done! 2/29
define roles	Find a definition for each of the roles. Assign specific roles to each team member based on their skills such as system engineer.	Liam // Michael // Nikita //Anyela	March 7
roles discussion	Talk about the roles and their purposes. Discuss and clarify individual roles, responsibilities, and expectations.	Liam // Michael // Nikita //Anyela	March 7
Design Brief	Complete a design brief (criteria, constraints, ect.) Develop a design brief outlining the end user, problem statement, design statement, criteria, constraints, and deliverables.	Nikita	March 7
Project Management Sheet	THIS. Create a project management sheet to track tasks, deadlines, and progress throughout the project duration.	divide assignments-->Liam // Michael Nikita //Anyela (Group)	March 7
Brainstorming Sketches _ two potential physical sketches (hand drawn)	Brainstorming Code Flow Chart.Generate two potential physical sketches (hand-drawn) based on brainstorming sessions and design concepts.	Pick 2 from the group-->Liam // Michael Nikita //Anyela (Group) Anyela	March 7
Gantt Chart	Finish Project Management Sheet. Develop a Gantt chart outlining the timeline for each task and milestone from project initiation to completion		March 7
Top program sketch (individual)	Sketch out the program. Each team member creates an initial program sketch (pseudo-code or flow chart) outlining the logic and functionality of the marble sorter.	Liam // Michael Nikita //Anyela (individual)	Planning (2/29-3/26)
Project Summary	Write a paragraph about how the project works, and what the criteria for sorting each marble is. Summarize the project objectives, scope, and approach in a concise project summary document.	Nikita	Planning (2/29-3/26)
Machine Control Design Research (INDIVIDUAL)	Research 5 machine control designs and codes in EN. Conduct research on machine control design principles and techniques to inform the development of the marble sorter's control system.	Liam // Michael Nikita //Anyela (individual)	Planning (2/29-3/26)
Decision matrix 1 (individual)	We need multiple brainstorming sketches/ideas.Each team member creates a decision matrix to evaluate potential design options or solutions for specific aspects of the marble sorter.	Liam // Michael Nikita //Anyela (individual)	Planning (2/29-3/26)
Decision matrix 2	Filter out some ideas. Collaboratively evaluate and refine the decision matrix to select the best design option or solutions.	Liam // Michael Nikita //Anyela (Group)	Planning (2/29-3/26)
Presentation	Google slide presentation on canvas requirements.Prepare a comprehensive presentation covering all aspects of the project, including design process, decision-making, prototype demonstration, and future considerations	Liam // Michael Nikita //Anyela	april 4
Code testing	See if the code works, and if not reiterate it to get it working. Test the code for the marble sorter to ensure functionality, accuracy, and reliability.	liam--> if needed michael// Nikita //Anyela	Planning (2/29-3/26)
Prototype testing	See if the program works, and if not reiterate it to get it working.Conduct physical prototype testing to see the sorting mechanism, user controls, and feedback system	Michael--> if needed liam// Nikita //Anyela	Testing day (3/28)
Prototype Testing (take photos)	Machine control design needs to be finished. Document the prototype testing process through photos to capture key moments and outcomes.	Michael--> if needed liam// Nikita //Anyela	Planning (2/29-3/26)
Images of two potential program sketches (written pseudo code and/or flow chart)	We need to think about how variables will be stored, and how potential data will be counted. Create two potential program sketches (pseudo-code or flow chart) illustrating different approaches to programming the marble sorter.	Pick 2 from the group-->Liam // Michael Nikita //Anyela (Group)	Planning (2/29-3/26)
Final program with descriptions image (screenshots from VEXcode)	Clean up the code, and add comments to explain it.take screenshots from VEXcode and descriptions explaining the functionality of the final program.	liam--> if needed michael// Nikita //Anyela	Planning (2/29-3/26)
Final program sketch (written pseudo code)	Write out how the program works in plain english. Document the final program logic and functionality using written pseudo-code.	liam--> if needed michael// Nikita //Anyela	Planning (2/29-3/26)
Top Iso-sketch (individual)	Draw the sketch.Each team member creates an isometric sketch of the final physical solution concept to see the design thats the winner	Liam // Michael Nikita //Anyela (individual)	Planning (2/29-3/26)
Final physical sketch (hand drawn on isometric paper)	Draw a sketch using isometric principles.Develop a detailed hand-drawn sketch of the final physical solution concept on isometric paper to accurately represent the design.	depends on the final choice, the one who designed it does it-> Liam//Michael// Nikita //Anyela	Planning (2/29-3/26)
Final Physical Solution Concept Written Communication 1) Personal reflection, 2) learning target, 3) project objective	Write about the different questions. Provide a written communication including the personal reflections, learning targets achieved, and project objectives met during the development of the final physical solution.	Anyela	Planning (2/29-3/26)

PERSONAL REFLECTION

a device that sorts recycled material, and as a prototype we created a machine that sorts marbles.We used this to be an example of what the recycled machine sorter would mimic. As a group we accomplished our objective very successfully because we solved the problem while following all of the constraints. We came up with an initial design, but struggled to follow it since we could not account for some factors. We also had to change our design a lot to account for stuff we couldn't predict when planning, such as needing to add walls to stop bouncing marbles. Some other problems we faced throughout the project were learning how to be efficient by dividing the tasks amongst each other and being responsible for getting it done. We created a Gantt chart to create a schedule for each person's tasks everyday, but couldn't always follow it. Some of the challenges of working in a design group are expressing ideas we have, and explaining why we feel it would enhance the project.

This is because it's hard to understand others ideas without any physical demonstration and understand if it would be better than our own. As a group we accomplished our objective very successfully because we solved the problem while following all of the constraints. We were able to complete our machine on time despite our setbacks, and our final product was able to sort marbles.Looking back on these challenges there are some areas we would improve. The feed motor worked rather inconsistently. We would desire to find a means to make the rotation more consistent with the size of one ball at the distance we set it at. The light sensor seemed to work with great success, but is limited to a certain level of ambient light. It would be helpful to have a contained chamber with its own light source to produce more reliable data. Finally, we would design more space for the marbles to sit while they are being distributed and we would make like an arm to stop the marbles from rolling while the sensor its detecting the color

LEARNING TARGET

Throughout this project, our team aims not only to build a marble sorter but also to an understanding of how machines function and how to make them perform specific tasks. Individually, we aspire to develop new skills in mechanical engineering, electrical engineering, and programming. We learned how to collaborate effectively, communicate ideas, and problem-solve as a team. We learned a great deal about cooperation and problem solving. As a team we had to troubleshoot multiple challenging issues while maintaining good communication. Each team member was able to work on their part of the project, make alterations, and give feedback without causing any concerns. By having a mindful and team oriented approach to this difficult problem, we were able to successfully produce the sorter with all members having a hand in the process.

PROJECT OBJECTIVE

The objective of the Marble Sorter VX 5 project is to create a functional prototype capable of sorting a batch of 20 random marbles into three different bins based on their color/type. The sorter should address the inefficiencies of the current manual sorting process by providing accuracy, speed, and real-time feedback. This project aims to enhance user experience in manufacturing processes involving marbles, such as toy manufacturing, art studios, or educational institutions.

1. Look at other machines that sort things and figure out how they do it. 2. Think up ideas for our marble sorter, making sure it's fast, accurate, and easy to use. 3. Draw plans for how the sorter will be put together, including the parts that move the marbles around. 4. Make a plan for the electrical parts, like the sensors that tell what color the marbles are. 5. Figure out how to tell the machine what to do and write the instructions for it. 6. Decide how users will tell the machine what to do and see what it's doing while it works. 7. Build a first version of the marble sorter and test it to see if it works right. 8. Fix any problems we find and make the machine better if we can. 9. Finish everything up and write down how to make more machines like this if people want them.

*note: ***1 paragraph each_individual*

ANYELA

PERSONAL REFLECTION

This project showed me that nature is an engineer who has been at work for eons. Biomimicary is a way for engineers to take inspiration from nature. The project also offered me insight on how valuable the research stage of planning is, allowing the solution to be guaranteed

LEARNING TARGET

The learning target of the project was to use real world constraints and scenarios to simulate the engineering process and the development of solutions to solve said problems.

PROJECT OBJECTIVE

The projects objective was to automatically sort 20 marbles while keeping in mind aspects that mimic nature.

MICHAEL

PERSONAL REFLECTION

From the project, I learned more about biomimicry and the importance of its application. Additionally, I learned a lot more about time management. Because we sacrificed so much time in planning and building our product, we didn't have enough time to improve our solution, leaving our final product relatively bare. Despite this, though, our team continued to persevere; we stayed relatively organized, getting our deliverables complete and making sure to meet as many constraints as possible despite the setback.

LEARNING TARGET

The learning target of the project was to use real world constraints and scenarios to simulate the engineering process and the development of solutions to solve said problems.

PROJECT OBJECTIVE

The objective of the project was to construct a machine to sort marbles with an element of biomimicry. The machine should also have elements of user input and interaction.

Nikita Srinivas

LIAM

PERSONAL REFLECTION

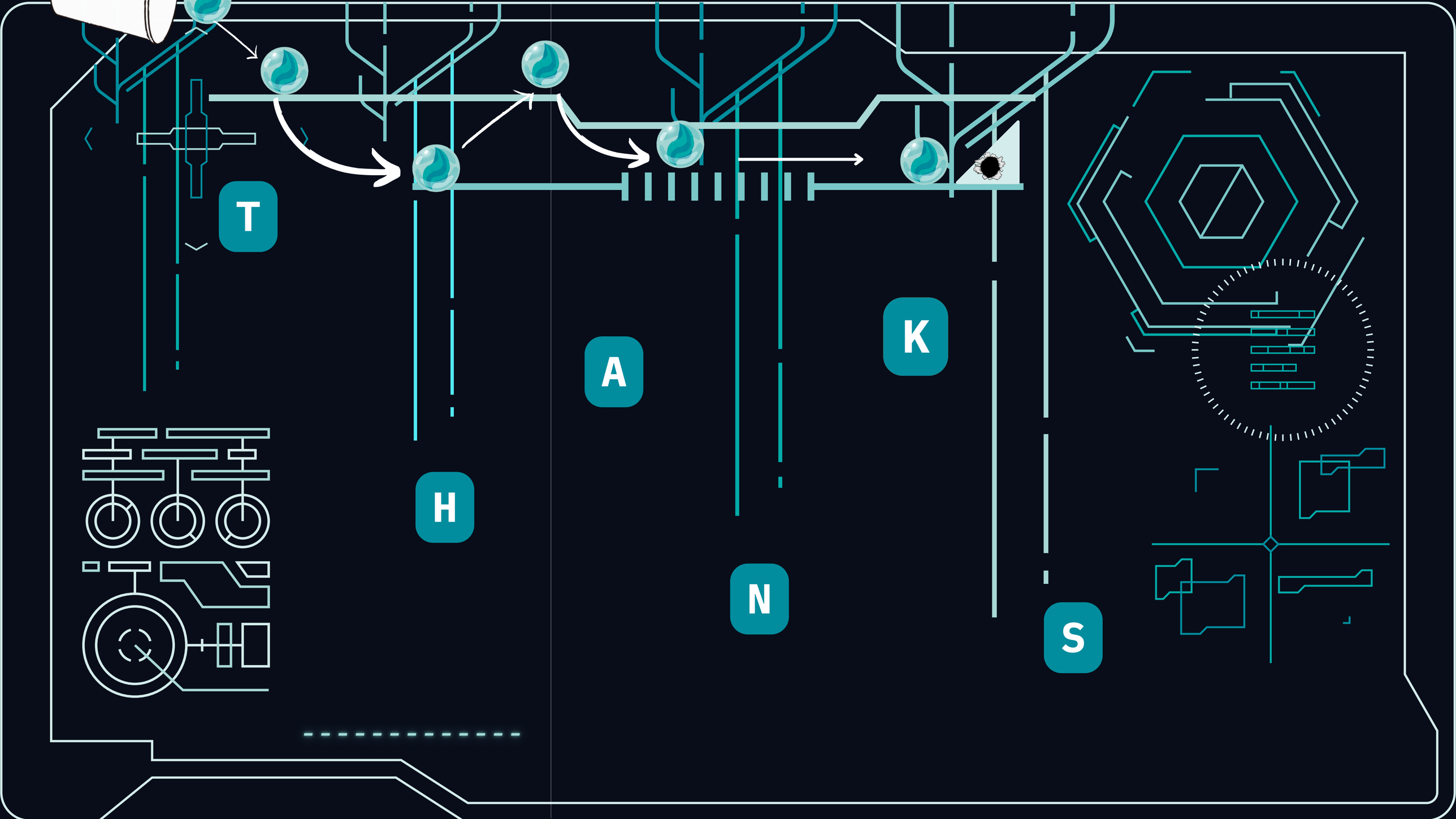
I think that our team did very good. There were a few times when we struggled some with communication, but overall, we were able to finish any issues or bugs we had with the code. It was a good lesson because we were able to designate the work out, using the systems engineering method, which was very useful. Overall I would definitely do this project again, but I would make more use of my time, as well as starting to bug test faster, since I was the programmer for the code.

LEARNING TARGET

For this project the learning target was to create a system that is capable of performing a few set tasks using constraints. The other main point of the project was to display out knowledge about coding that we had learned into a project that is able to showcase a real world trait or thing. So, if we complete this project

PROJECT OBJECTIVE

For this project our goal was to create a machine that can sort three types of marbles into buckets, based off of their weight, color, or size. The machine had to be coded using vex, and would have to be made with vex parts.In addition to this, we only had eight days, and it would be tested on the last day. It should also be able to hold 20 marbles in a hopper, that dispenses them into the osrting mechanism.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