User and Product Manual Instructions

GNG2101

Design Project User and Product

Manual SNACK ARM

Submitted by:

ScrewU - B1.4

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Table 1. Acronyms

Acronym	Definition
Snack arm/conveyor belt	“Snack arm” and “conveyor belt” are used interchangeably in this document because though the original project proposal was for a snack arm, the product evolved into a conveyor belt

Table 2. Glossary

Term	Definition
Acrylic Frame	Type of transparent thermoplastic material
Arduino	Programmable circuit board
Conveyor Belt	Device used to move goods or materials from one place to another
Motor	Device that converts electrical energy into mechanical energy
Soldering	Fundamental technique used to join two or more pieces of metal together by melting a filler metal, called solder, into the joint

Sprocket	Toothed wheel designed to mesh with conveyor belt

1. Introduction

This User and Product Manual (UPM) provides the information necessary for those at Bethany Children's Hospital to effectively use the Snack Arm and for prototype documentation.

The user manual is formatted such that a reader will have full context of the snack arm's purpose and features before delving into the use. From there, the reader will be informed of common errors and troubleshooting for use of the snack arm. After, documentation on the various subsystems is provided, followed by testing and validation of these subsystems and the product as a whole. Lastly, the conclusion and appendices are available for the reader to view.

The User and Product Manual includes detailed safety instructions for setting up, operating, and maintaining the conveyor belt system. This includes guidelines to prevent injury during operation, and troubleshooting. Clear instructions are provided on emergency stop protocols to ensure immediate halting of the system in case of safety hazards or critical failures. Users are advised to operate the system in a safe environment, free from obstructions, liquids, or any other potential hazards that could get in the way of the system's functionality or pose risks to users.

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2. Overview

For context, this project was requested by the Bethany Children's Hospital. Their initial request was to create a snack arm that, with the push of a button, would move a snack. This snack would be moved from some loading station at the base of a counter to an unloading station at the top of a counter (there is a difference in height between these two countertops). The goal of this request was to provide a way for children - residents at Bethany Children's hospital are aged 0-19 - to achieve a greater sense of independence in day-to-day tasks. Since children at the hospital have varying levels of dexterity, the snack arm must be operational through the push of a button.

Considering that the intended users of this product are children, the product needed to have a focus on three criteria; adaptability, simplicity, and safety. This is because - out of all the customer needs pulled from both the initial project proposal and the client meets - these criteria

were a recurring factor in their requirements.
One major feature that differentiates our snack arm from others on the market - apart from the obvious difference in that ours is a conveyor belt - is a safety feature implemented in our product. It was mentioned that safety is one of the three central criteria for our product; we implemented a feature to accommodate children playing with the buttons on the conveyor belt. If a user were to click the button on the conveyor belt, it would run for 5 seconds, which is enough time to move an object from the base to the top of the conveyor belt. However, if a user were to continuously click on the button during that 5 second period, there would be no risk of throwing objects off of the conveyor belt due to sudden stops and starts of the motor.

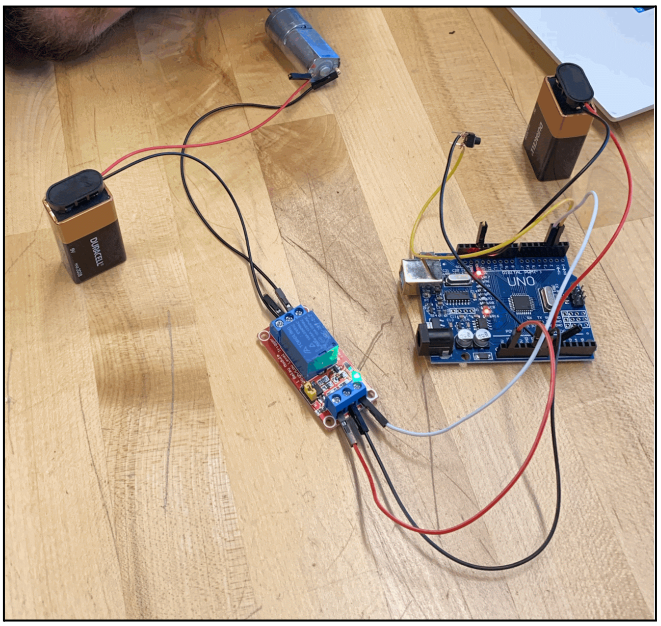

Figure 1: electrical subsystem of final prototype

Figure 2: front view of mechanical portion of the final prototype

Figure 3: side view of mechanical portion of the final prototype

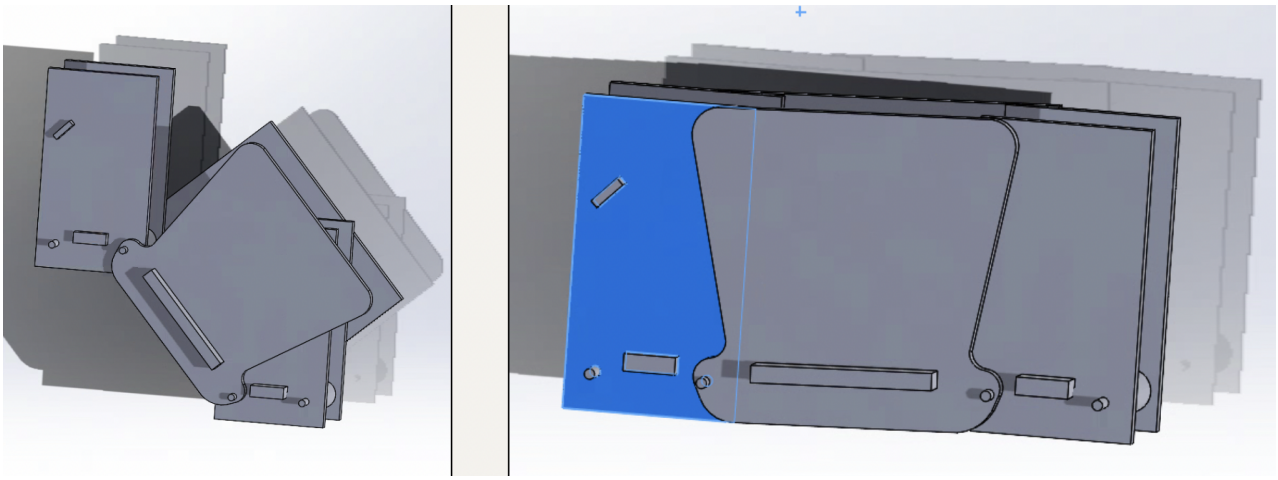

Figure 4: the adjustability of the acrylic frame

The key features of the conveyor belt are its button (as can be seen in *Figure 1)*, the emergency stop button on the side of the body (*Figure 3*), the belt (*Figure 2)*, and adjustable body (*Figure*

2).

The system is composed of an acrylic frame, which supports all other subsystems. This acrylic frame is adjustable in order to accommodate different height differences between the loading and unloading areas (*Figure 4*).

The user accesses this system via the push of two buttons. The first button - the emergency stop switch on the side of the frame (*Figure 3*) controls the system as a whole; unless the switch is on, the conveyor belt will not run, and if the switch is flipped, the system will immediately stop. Assuming the first switch is on, the second button allows the user to control the movement of the belt. If the user presses this second button, the conveyor belt will roll for five seconds before stopping.

The above instructions for the user are also illustrated in the block diagram below (*Figure 5*)

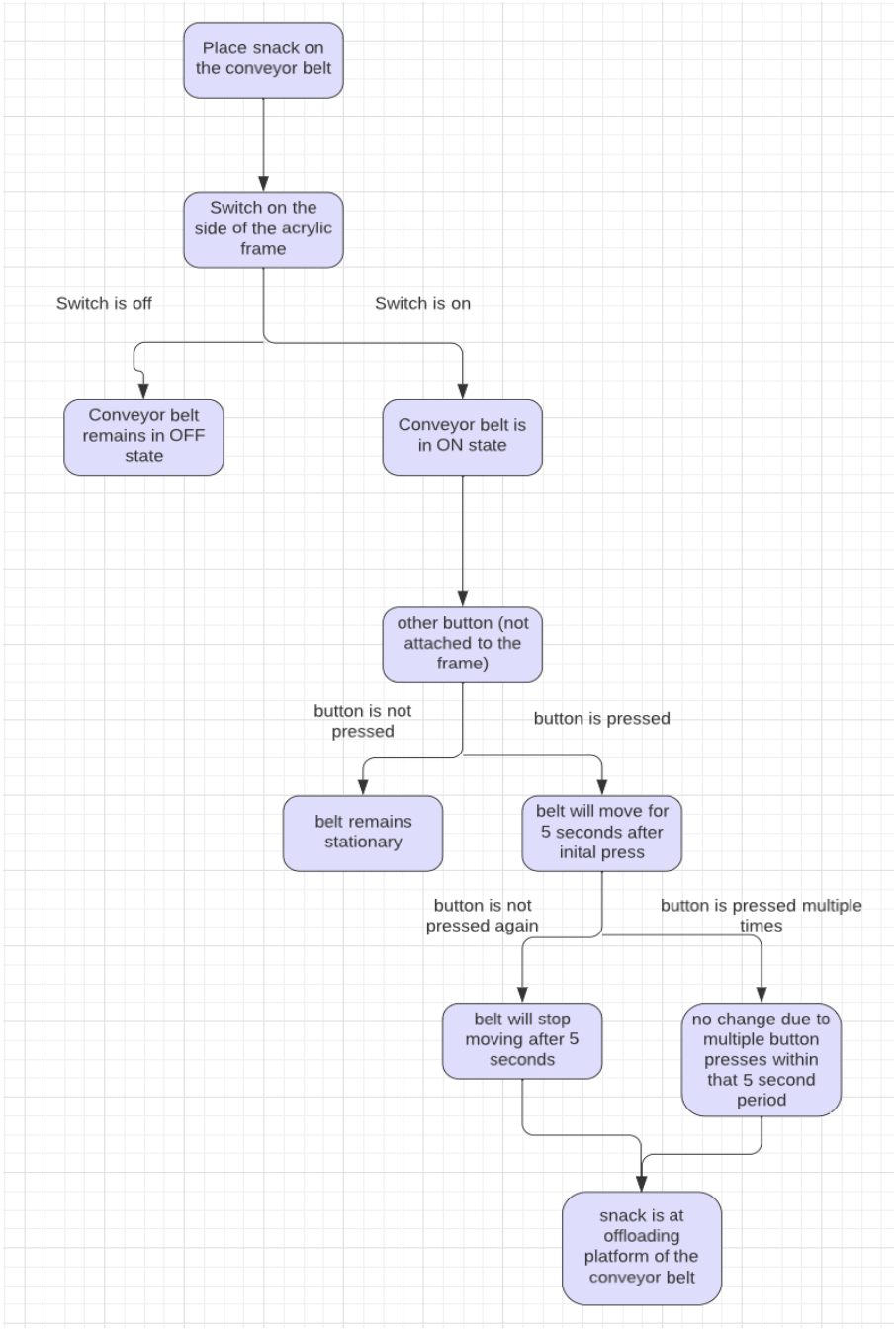

Figure 5: block diagram representation of user instructions

2.1. Cautions & Warnings

First and foremost, the user should store the conveyor belt in a cool, dry space, so as to not damage any of the electrical components. Exposure to elements such as water or excessive heat may damage the individual components of the conveyor belt.

Another major warning is that this conveyor belt is meant to transport sealed and packaged goods only. No sticky, crumbly, or otherwise “messy” products should be transported on the conveyor belt for both the health of the user and that of the snack arm.

It must also be noted that the conveyor belt is made of many small components. Since young children will be using it, it must be ensured that the pieces are not consumed, as they could cause serious bodily harm.

Further, the user should be cautious of fingers, hair, and any other things that may be caught in the conveyor belt treads; if possible, tie back any hair or dangly jewelry before operating the conveyor belt.

Lastly, the user should never attempt to touch the conveyor belt while it is in motion. If an item must be retrieved from the conveyor belt mid-usage, the user should flip the emergency stop switch located on the acrylic body and then wait for the conveyor belt to come to a stop.

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3. Getting started

The first step in the setup of the conveyor belt is to place it on the counter. It should be placed in the following orientation; the half containing the emergency stop button should be closest to your surface from which the snacks will be loaded, while the other half of the conveyor belt should be touching the surface on which you wish to offload the snacks.

Figure 6: the conveyor belt is oriented such that emergency stop button is nearest to the loading station

To ensure the correct orientation for your conveyor belt, ensure that there is a surface underneath the offloading station for your conveyor belt, so that any snacks being offloaded do not fall to the ground.

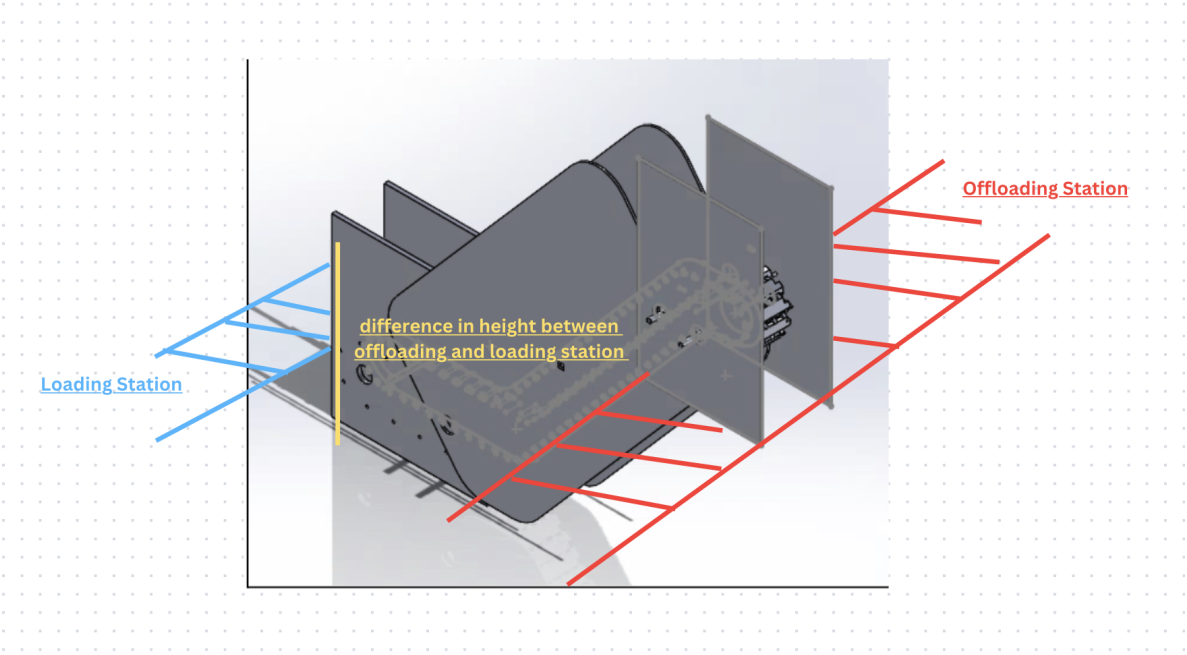

Figure 7: diagram displaying different loading phases of conveyor belt

Once the above instructions have been completed, the body will have been properly set up for use.

To begin using the snack arm, the user should place the snack on the tracks at the base of the snack arm; the loading station.

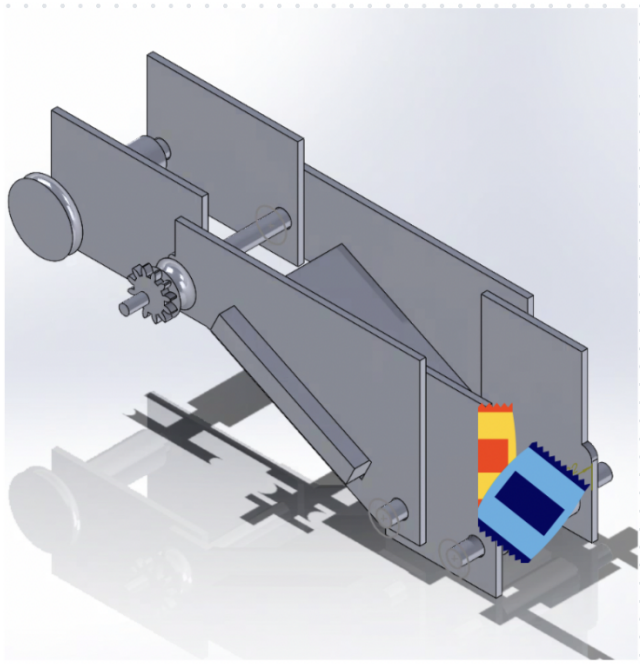

Figure 8: diagram displaying loading phase of snacks

If the user is now ready to transport the snacks, they may press the switch on the side of the acrylic body, to turn on the conveyor belt

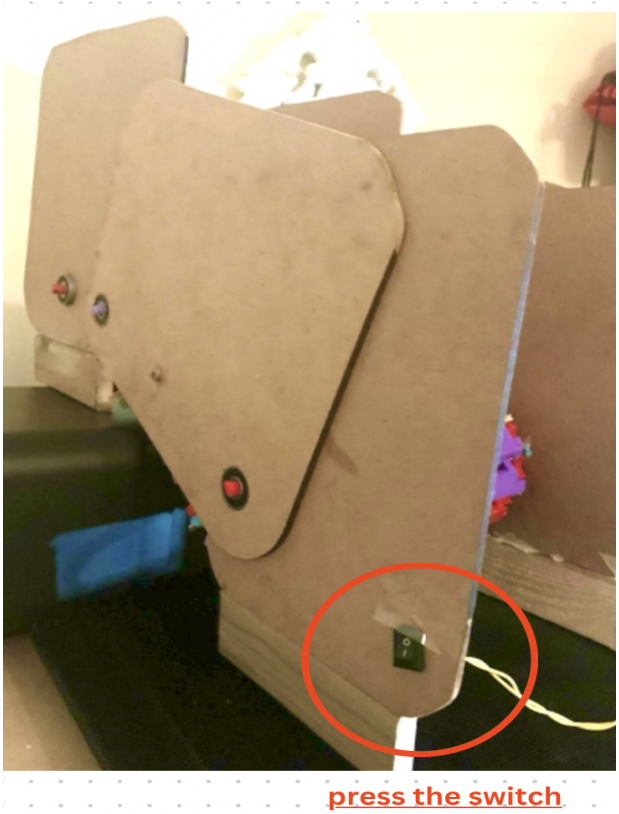

Figure 9: display of switch function

With the snacks on the treads of the belt and the switch pressed, the user may now press the button to transport the snacks across the conveyor belt. By pressing this button, the belt will move for 5 seconds, transporting the snacks from the loading station to the offloading station.

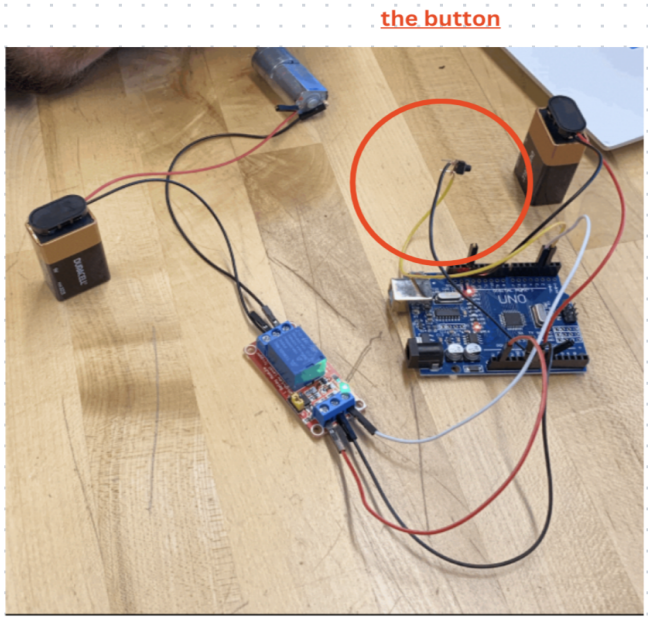

Figure 10:display of electrical component of belt with the ON button circled

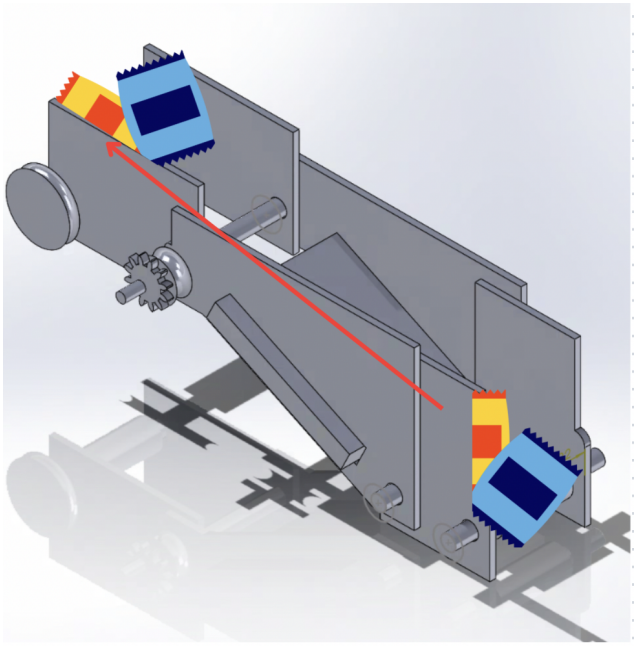

Figure 11: diagram displaying movement of snack along conveyor belt

After the 5 seconds have passed, the user should turn off the switch on the side of the conveyor belt.

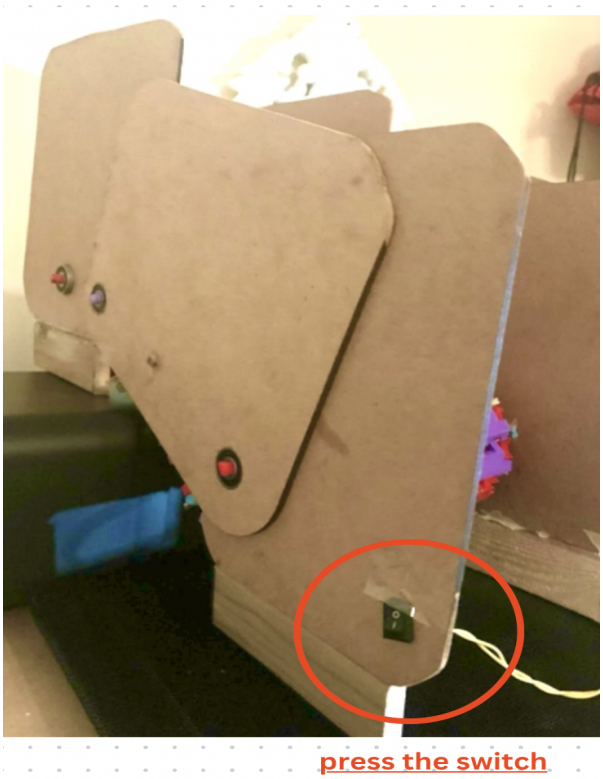

Figure 12: display of switch function

With the conveyor belt turned off, the user may retrieve the snack from the offloading station.

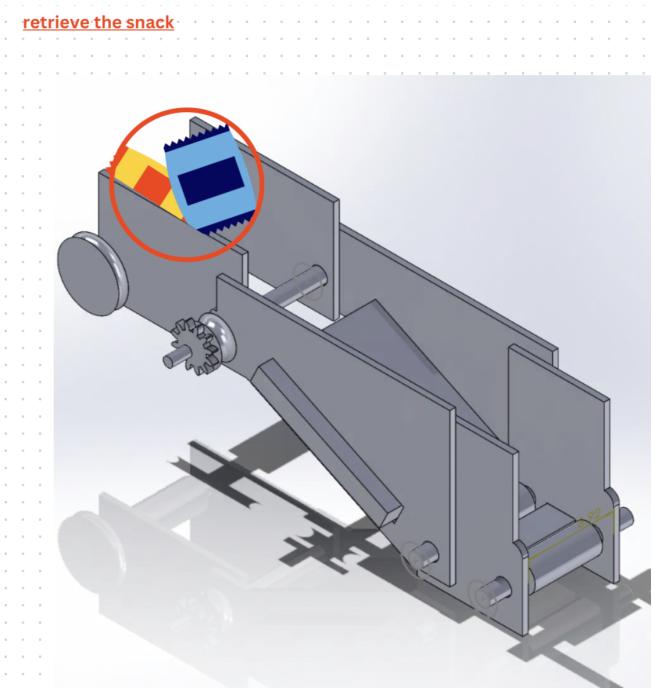

Figure 13: diagram displaying offloading phase

At this point, the entire process may be repeated to transport more snacks.

3.1. Configuration Considerations

Our conveyor belt design consists mainly of our conveyor belt itself as well as the supports around. The conveyor belt was constructed through 3D printing with many pieces connecting to each other. This is the part of the device that moves the snack from one point to another.

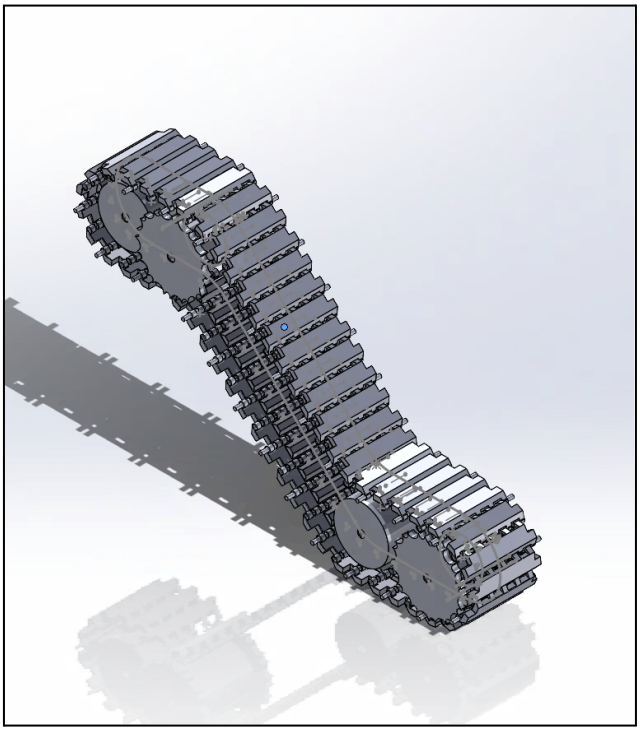

Figure 14: diagram displaying belt and sprocket structure

The conveyor belt activates once the button is pressed and it will begin moving upwards.

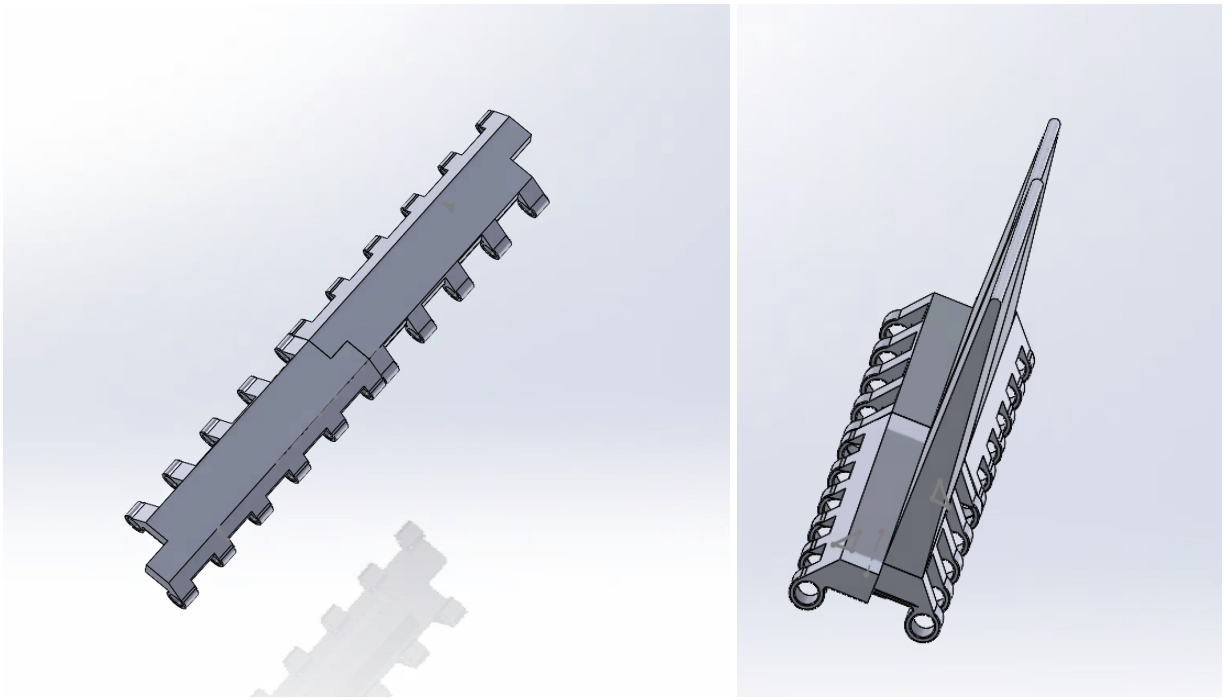

Figure 15: diagram displaying separate pieces of conveyor belt

The two different types of pieces required for the belt itself are the regular pieces on the left as well as the special pieces on the right which keep snacks from sliding backwards when being transported upwards by the belt. There are a few sets of these special pieces placed throughout the entire conveyor belt.

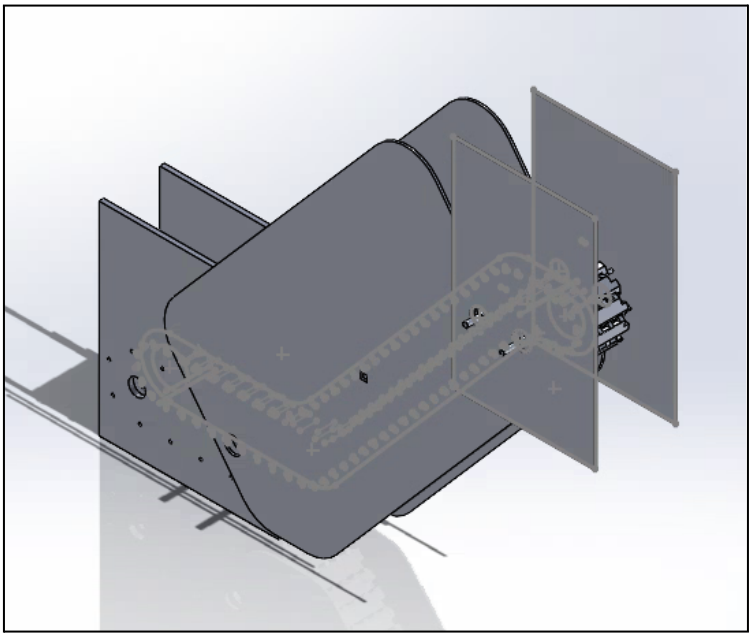

Figure 16: diagram displaying supports of conveyor belt as well as conveyor belt on the inside

The structure that holds the belt was made from an acrylic body. It was designed in three main segments: the bottom (loading phase), middle (transporting phase), and the top segment (final delivering phase). When a snack is placed on the bottom segment and the button is pressed, the

snack will be transported from the bottom of the conveyor belt to the top.

3.2. User Access Considerations

The first user group - which is also the group that is expected to be the primary user - is those patients at the Bethany Children's Hospital. Some possible restrictions related to accessibility for those patients are related to the height at which the conveyor belt is placed. For example, if a patient's eye level is below the line of the counter on which the conveyor belt is placed, it would pose an issue with reaching the arm. Further, though the button controlling the motion of the belt is not attached to the body of the arm, the emergency switch is. For these reasons, it is recommended that - when using the snack arm - the patient has someone around who is able to reach the snack arm's body.

Another user could be employees at the hospital. More particularly, those employees that work directly with the children who will be using this device. An issue that could arise with accessibility is if there is limited counter space for the arm to operate on. Though the arm is adjustable to fit different counter spaces, it still requires adequate counter space to support the base (the loading area) and top (offloading area) of the conveyor belt. For these reasons, limited space would make the conveyor belt less accessible to employees at the hospital.

Further, those receiving the snack are the third and final group of users. Similarly to those patients using the snack arm, if the person receiving the snack is not able to reach the surface on which it is dropped off, this poses an accessibility issue. For this reason, it is recommended that the hospital employee that is with the patient who is operating the machine act as an in-between if needed; if any height-accessibility issues arise between the recipient of the snack and the counter, the hospital employee may retrieve the snack from the offloading station and pass it to the recipient.

3.3. Accessing/setting up the System

The conveyor belt comes as one unit so to begin using it would be setting it in place where the lower end is the starting point and the higher end of the device is placed where the user would like the snack to be moved towards.

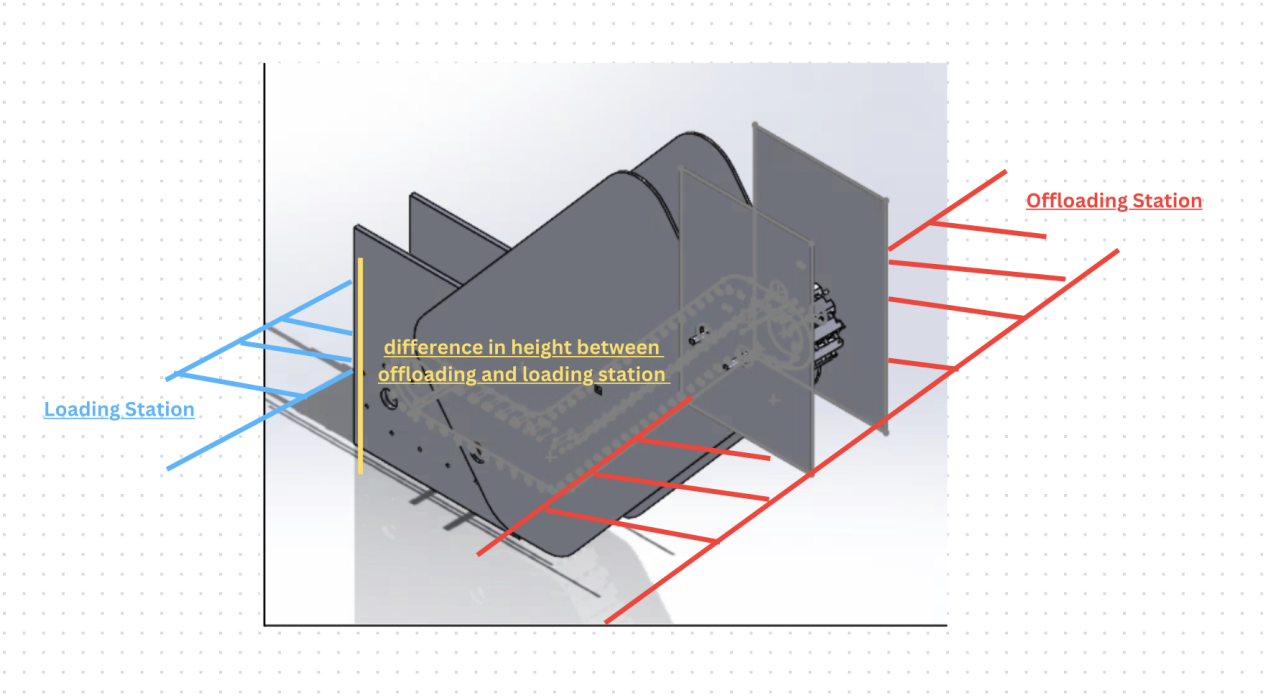

Figure 17: diagram displaying different loading phases of conveyor belt

Adjusting the angle at which the conveyor belt is placed is accomplished simply by placing the conveyor belt in the desired configuration. This is because the bearings allow for the different components of the acrylic body to move with enough freedom that the angle of the body with respect to the ground may go from 180° to 270°

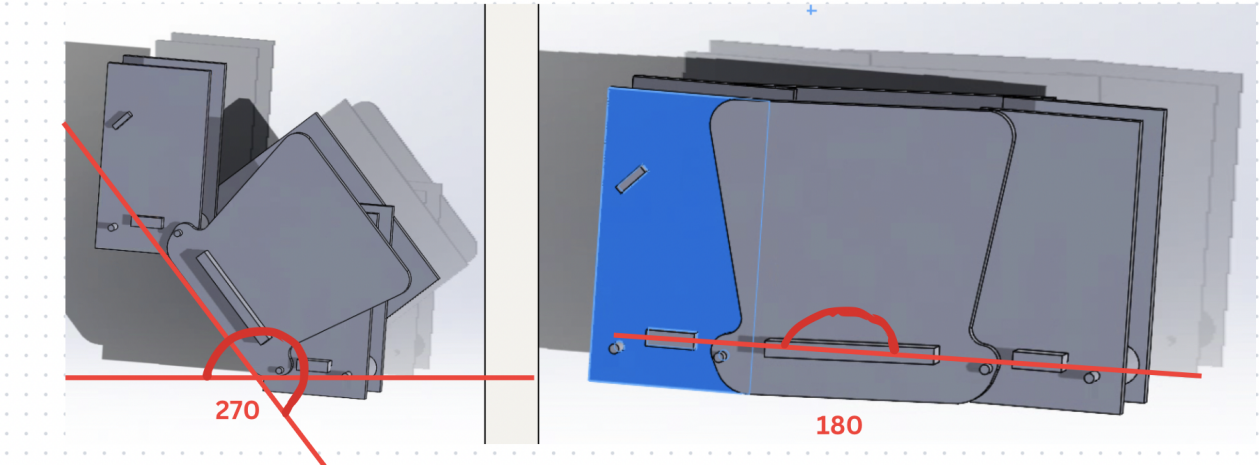

Figure 18: diagram displaying foldable feature of conveyor belt

It is also important that this surface on which the conveyor belt is placed is sturdy. If the conveyor belt were to fall, many of the mechanical and electrical components would be at risk. Further, though the conveyor belt is relatively light, it is composed of rigid materials, such as the acrylic body and the 3D printed treads, which may cause harm to those they hit.

3.4. System Organization & Navigation

Conveyor Belt:

The conveyor belt is in the middle of the device and is connected along the supports so it will move along the intended path. The belt wraps around the sprockets so that when the motor is activated the belt will run accordingly.

Supports:

The supports are along the side of the conveyor belt and have three main sections that hold it together. The bottom segment, middle segment, and top segment.

Sprockets:

The sprockets work like gears for the belt and are powered by the motor. Once the motor is activated the sprockets will turn and in turn the belt will begin to move.

Button:

Once the button is pressed it will activate the motor which turns the sprockets which turns the conveyor belt.

Emergency Button:

Once the emergency switch is flipped the motor will be forced to stop which will stop the sprockets from turning which will stop the belt from turning.

3.5. Exiting the System

Though this product is one unit, and does not necessarily need to be put away in a different configuration, it is recommended that the loading and unloading stations be placed at the same level; the product should be at a 180° angle. This is so that no extra stress be placed on the system - particularly the belt - while it is not in use.

Further, the emergency stop switch should be activated (see *4.3. Emergency Stop*) while the conveyor belt is not in use

Lastly, it must be stressed that optimal storage conditions for the conveyor belt are: a room temperature, dry space, with enough space that the conveyor belt is not squished.

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4. Using the System

The following subsections provide detailed, step-by-step instructions on how to use the various functions or features of the Snack Arm.

4.1. Starting Conveyor Belt

Pressing the start button activates the motor which will begin turning the sprockets which will commence the movement of the conveyor belt for 5 seconds. Once the button is pressed a cooldown timer of 5 seconds will activate where any further presses of the button will not be registered.

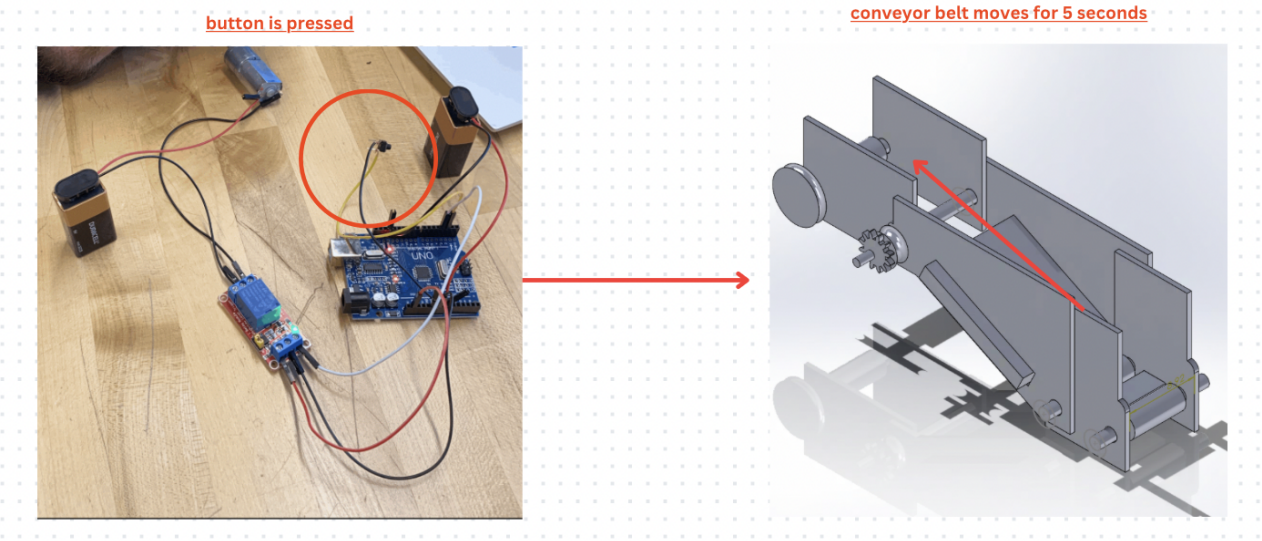

Figure 19: display of button pressed on left resulting in conveyor belt moving for 5 seconds

4.2. Stopping Conveyor Belt

There are two ways that the conveyor belt will stop. The first is that, five seconds after the button is pressed and the motor begins moving, the conveyor belt will automatically stop. The second way the conveyor belt may be stopped is by flipping the emergency stop switch, as is illustrated in the below section; *4.3. Emergency Stop.*

4.3. Emergency Stop

The emergency stop button is a switch located on the exterior of the acrylic body, near the base, as can be seen in the figure below.

Figure 20: display of switch function

Flipping this switch so that the side with “0” is pressed down will trigger the emergency stop and halt all movement of the conveyor belt. This state is illustrated in the below graphic.

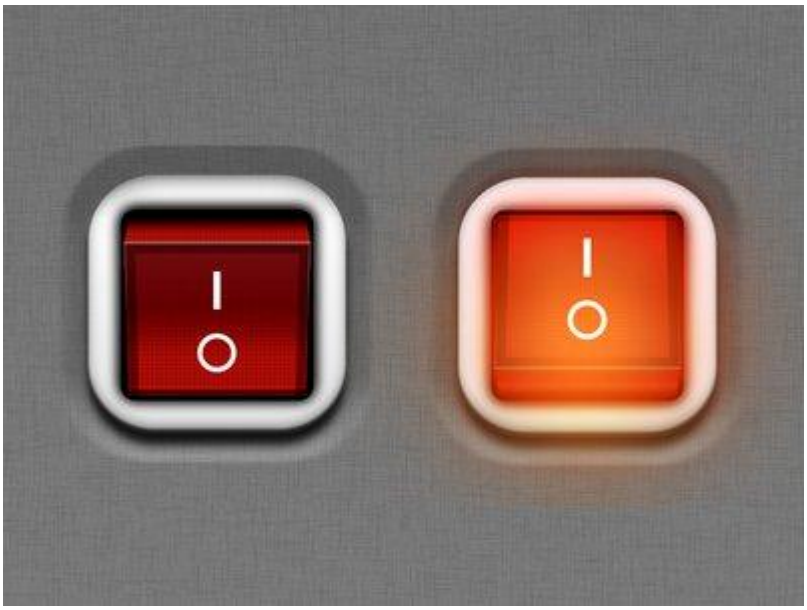

Figure 21: switch to the left is in OFF state, with "0" pressed down. Switch to the right is in ON state, with "1" pressed down

While this "0" is down, regardless of any other presses of the button, the conveyor belt will remain motionless.

To exit this emergency stop state, the user can flick the switch in the other direction, such that "1" is down. This can be seen in *Figure 21* on the switch to the right.

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5. Troubleshooting & Support

5.1. Error Messages or Behaviors

If snacks are getting stuck often, the belt movement becomes irregular, or any strange noises are heard, do *not* attempt to open up the conveyor belt. There are many small mechanical components inside of the conveyor belt that could scratch and harm the user or cause greater damage to the conveyor belt. Instead, immediately discontinue all use of the conveyor belt and contact support in section 5.4 on how to proceed and if the device needs any maintenance.

5.2. Special Considerations

The device should be kept in a dry, room-temperature room to preserve all mechanical and electrical components. The device should be stored away from any liquids (not including canned or bottled liquids) and non-covered foods to prevent the growth of mold and bacteria. However, should any such specimen be found on the conveyor belt, it is recommended that use of the conveyor belt be discontinued; the conveyor belt will be in direct contact with the wrapping of consumable products and the consumption of mold and bacteria may be harmful. Should the user want to discuss alternatives such as replacing the contaminated components, they may contact the support person found in section *5.4.*

Another common scenario may be that the conveyor belt does not start when the button is pressed. The first thing to check in this instance is that the emergency stop is not activated. The switch on the side of the acrylic body should be in the ON state ("1" is down) when trying to use the conveyor belt (a more detailed description of this may be found in *4.3. Emergency Stop*).

If this solution does not work, the user should ensure that the orientation of the snack arm is not inhibiting its motion; check that there are no objects beneath the snack arm or snagged on it that are stopping the belt from moving.

If this does not solve the problem, the user should try switching out the battery. The battery required for this system is a 9V battery, as shown below.

Figure 22: 9V DURACELL battery

To switch out this battery, the old battery must be removed from the battery cap (the black cap attached to the battery in the above graphic). This can be done by gently tugging it off of the battery. Then, the new battery must be attached to the battery cap in the same orientation as the previous battery was in. To attach the battery to the battery cap, it can simply be clicked in place.

If all else fails, the user should contact the person listed in section *5.4* to receive further guidance.

5.3. Maintenance

For smooth use of the device for a long period of time it is recommended to dust the device and remove any debris every now and then. Though the device is meant to transport sealed goods only, it should be ensured that no crumbs or spills have gotten on the device, as these can bring about the production of mold and bacteria, as well as damage the ability of the belt to roll smoothly.
It is also recommended to perform a visual inspection quickly before using the device to ensure that it is in working order to ensure safety of the user.

5.4. Support

For any help or support regarding the conveyor belt system, users can contact:

Support Contact:

- Name: Kylan Thurairajah
- Email: kylanthurairajah@gmail.com
- Phone: 613-619-0915

To report problems or issues with the system:

- Users experiencing any problems should email or call Kylan Thurairajah with details about the issue.
- Describe the problem, when it occurred, and any important observations.

Please use the provided contact information for any system-related issues or emergencies.

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6. Product Documentation

6.1.1. BOM (Bill of Materials)

Name	**Place of purchase**	**Site**	**Amount**	**Cost (tax included)**
Arduino Uno(Clone)	MakerSpace Shop	https://makerstore.ca/shop/ols/products/arduino-uno-r3/v/A001-WTH-USB	1	N/A
DC motor	Amazon	https://www.amazon.ca/Torque-Motor-3000RPM-Permanent-Magnet/dp/B078F7M8R8/ref=asc_df_B078F7M8R8/?tag=googleshopc0c-20&linkCode=df0&hvadid=578829734382&hvpos=&hvnetw=g&hvrand=15466660979480158186&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-578736573083&psc=1	1	16.84
Jumper cables	MakerSpace Shop	https://makerstore.ca/shop/ols/produc	1 (10 pieces)	N/A

		ts/jumper-cables-per-10/v/JMP-CBL-10C-MLFML		
Female jack (3mm)	amazon	https://www.amazon.ca/Female-Stereo-Replacement-Headphone-Repair/dp/B09V15J2MH/ref=sr_1_13?crid=284JQ5BRN56SC&keywords=female+jack&qid=1698727483&sprefix=female+jack+%2Caps%2C97&sr=8-13	2	12.42
Ball bearings	Amazon	https://www.amazon.ca/%EF%BC%BB10-Pack%EF%BC%BD-608-Ball-Bearings/dp/B08XVFSZTF/ref=asc_df_B08XVFSZTF/?tag=googleshopc0c-20&linkCode=df0&hvadid=580633643990&hvpos=&hvnetw=g&hvrand=5222406078902610010&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000668&hvtargid=pla-1334327078771&th=1	1	11.27
Transistor	MakerSpace	https://makerstore.ca/shop/ols/products/transistor-npn-40v-02a	3	N/A
Fasteners	MakerSpace		Unknown	N/A
Roller	3D printer		3	N/A
Battery case	3D printer		1	N/A

Conveyor belt + sprocket	3D printer		1 + 6	N/A
Bearings	Amazon	https://www.amazon.ca/uxcell%C2%AE-628-2RS-Groove-Bearing-Bearings/dp/B07FMQM37G?th=1	8	22.58
Channel relays	Amazon	https://www.amazon.ca/gp/product/B07WQH63FB/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&th=1	10	24.86
Buttons	Amazon	https://www.amazon.ca/gp/product/B06XT3FLVM/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1	10	12.31
PVC filament	Recycled		N/A (pieces were not full sized)	N/A
Total				$100.28

6.1.2. Equipment list

In terms of materials used, the list is fairly small. This is because the vast majority of the assembly required for this project is in printing the treads of the tank and soldering the electrical components.

- 0.8 mm 3D Printer
- Sander
- Solder
- Pliers
- Scissors

6.1.3. Instructions

Mechanical

1. 3D print the materials required for conveyor belt using a 0.8 mm 3D printer and the CAD files found in the makerepo. Note that this will take many hours to accomplish; for context, each individual tread of the conveyor belt took around a half hour to print.
2. Using the pliers, gently pick apart all excess plastic from the 3D printing, making sure to place all "cleaned" pieces in one spot so that they do not get misplaced
3. Decide if you will require a "double"(*Figure 15)* or "single" width conveyor belt. A double belt can fit the width of a can of chips, whereas a single belt will fit exactly half of that width. Note that a double belt requires twice as many treads as a single belt to create a conveyor belt of the same length.
4. Assemble acrylic body in required structure (Refer to *Figure 23*). If using the double width structure, align the holes of the treads of two pieces together as is shown in *Figure 23*. If going for the single arrangement, simply thread the pvc filament through the holes of the treads and cut with scissors to the length of the tread. The same process of threading the filament through the holes and then snipping may be done with the double arrangement
5. Now that the belt of interlocked treads has been created, the belt may be fit around the sprockets (*Figure 14*). There are two sets of sprockets included with the snack arm; a smaller set and a larger set. The larger set is configured so that it can fit the double arranged belt, while the smaller set may fit the single arrangement. So, with the belt looped over the sprockets in the configuration (double or single) of the client's choice, the belt will fit snugly over the sprockets.
6. Further, all sprockets are created so that they fit into the circular holes on the sides of the acrylic body (*Figure 3*). So, all
7. Add in sprockets into the acrylic body
8. Connect sprockets in required area between acrylic body's
9. Connect motor to sprocket as well as buttons to acrylic body
10. Attach conveyor belt around sprockets (refer to *Figure 23 and 24*)

Figure 23: front view of mechanical portion of the final prototype

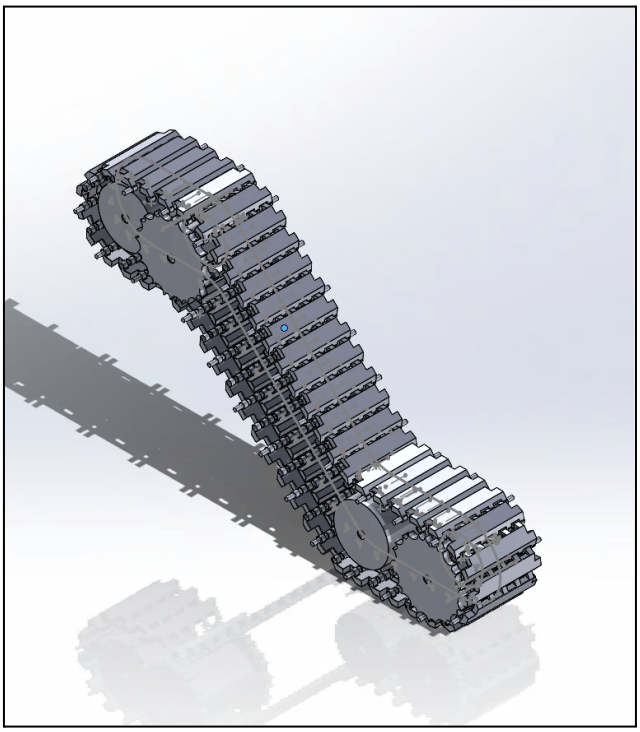

Figure 24: diagram displaying supports of conveyor belt as well as conveyor belt on the inside

Electrical (complete circuit can be seen below in *Figure 25.5*)

1. Place the battery cap on the 9V battery
2. Connect the black wire (negative)from the battery into the COM terminal of the relay
3. Connect the red wire (positive)from the battery into the positive terminal of the motor
4. Connect the negative terminal of the motor into the relay at the NC terminal (steps 2-4 are illustrated in figure 25.1)
5. Using a - preferably non-black or red (to avoid confusion)- male-male wire, connect the IN terminal of the channel relay to 3 on the arduino uno
6. Using a black male-male wire connect the GND terminal of the channel relay to GND on the arduino uno
7. Using a red male-male wire, connect the VCC terminal of the channel relay to the IOREF on the arduino uno
8. Using a second 9V battery, place a battery cap on it. Using the black wire on the cap - which is connected to the negative terminal of the battery - attach the other end to the GND on the Arduino.
9. The positive terminal of the battery and its corresponding red wire should be attached to the arduino uno via its Vin terminal
10. To attach the button to the arduino, the negative terminal of the button as well as the positive terminal must have black and red wires, respectively. These may be attached to the button by soldering them.
11. The black wire of the button should be attached to the GND of the arduino uno, while the red button should be attached to the 2 terminal
12. The source code to control the Arduino may be found under *9. APPENDIX I: Design Files* . This code uses the Arduino IDE so that the button will run for exactly 5 seconds after an initial click, regardless of any additional clicks within that 5 second frame

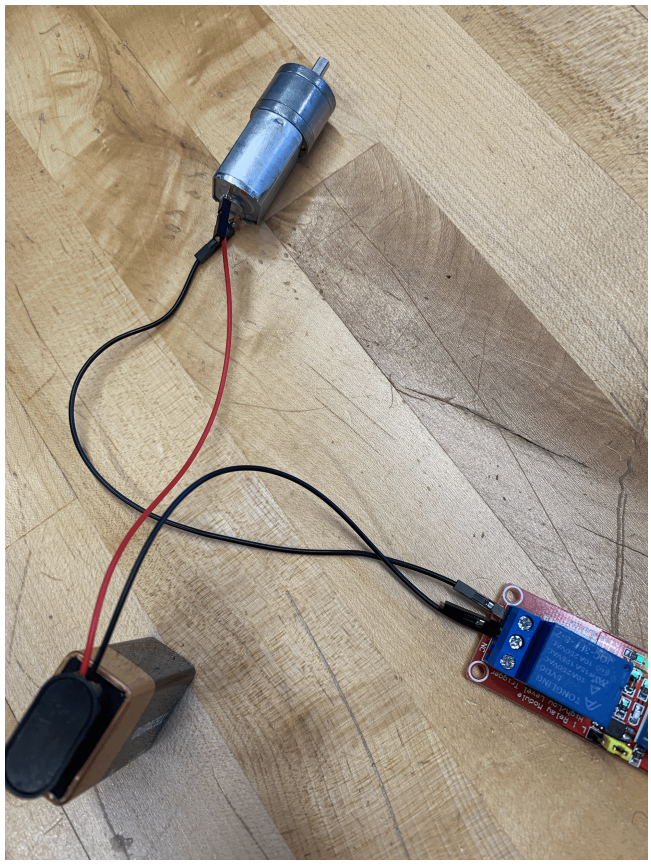

Figure 25.1: steps 2-4 of electrical assembly

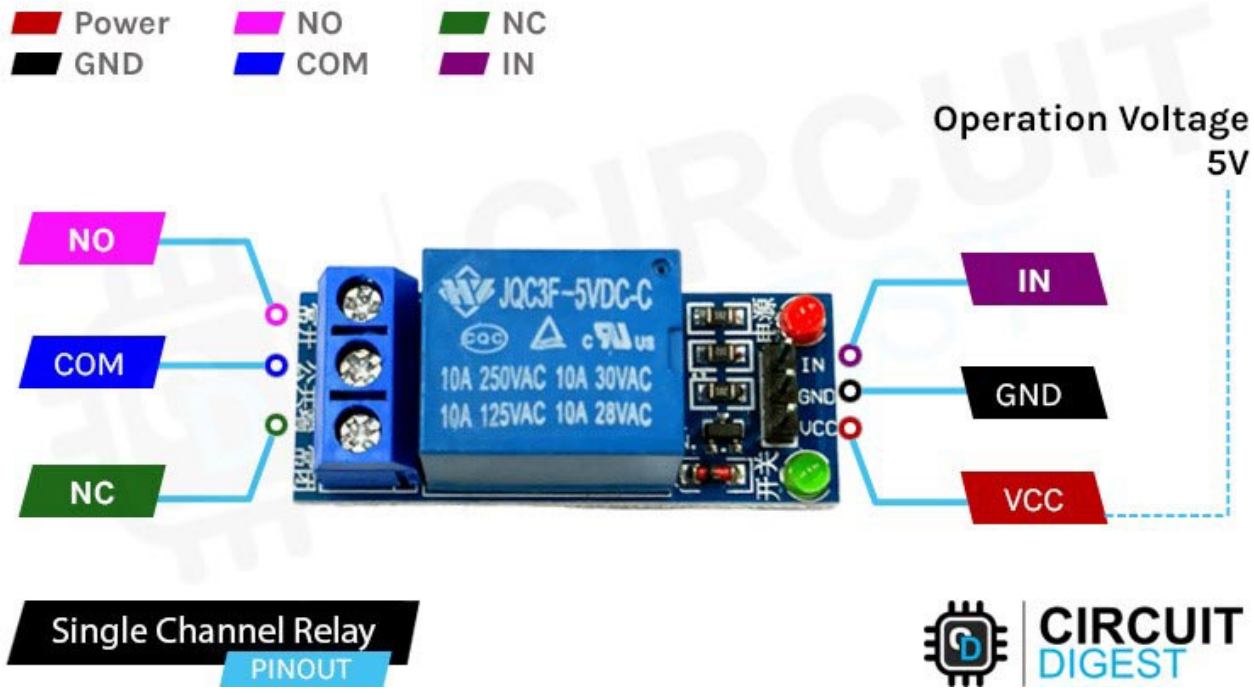

Figure 25.2: steps 2-4 of electrical assembly (Prathamesh, 2023)

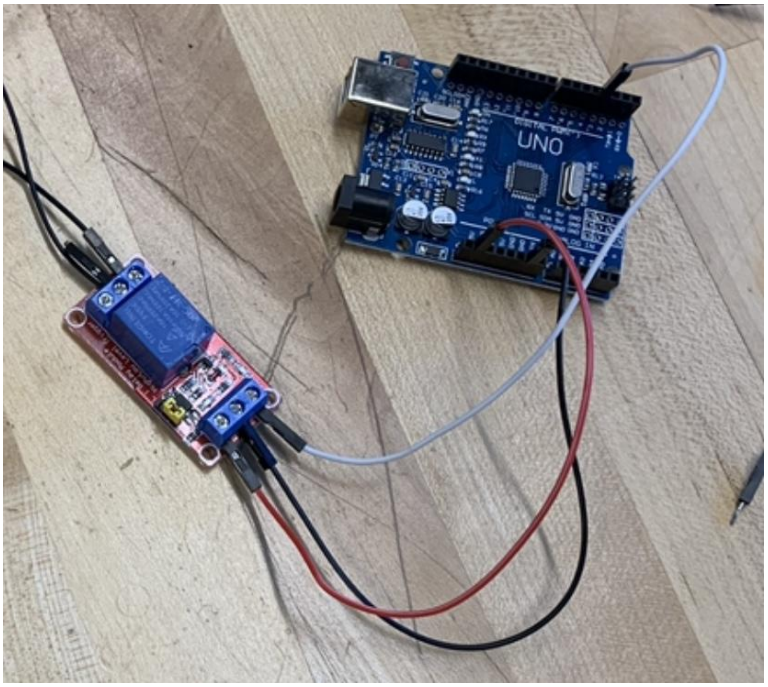

Figure 25.3: steps 5-7 of electrical assembly

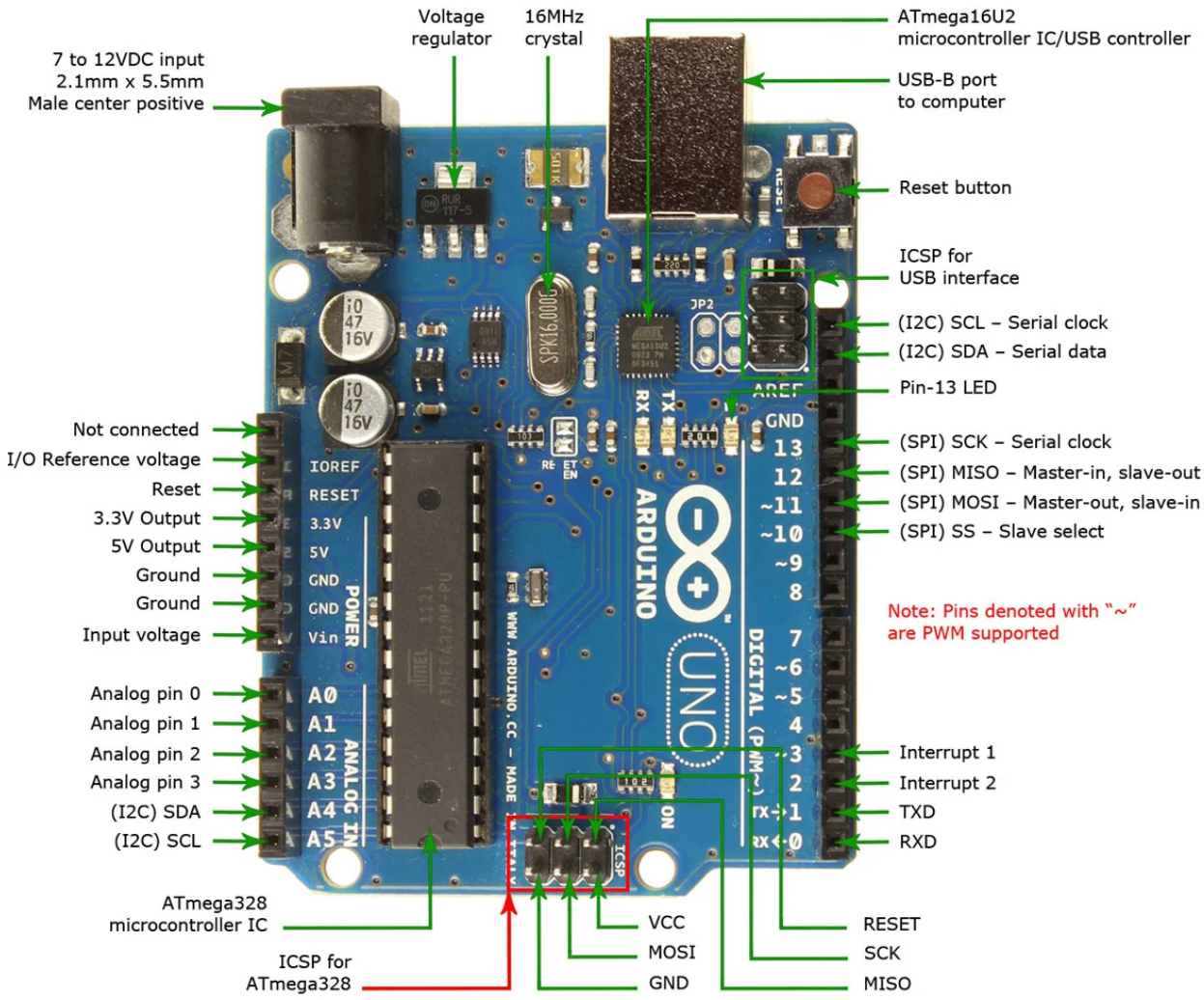

Figure 25.4: Arduino Uno Labelled diagram (Jameco Electronics, 2023)

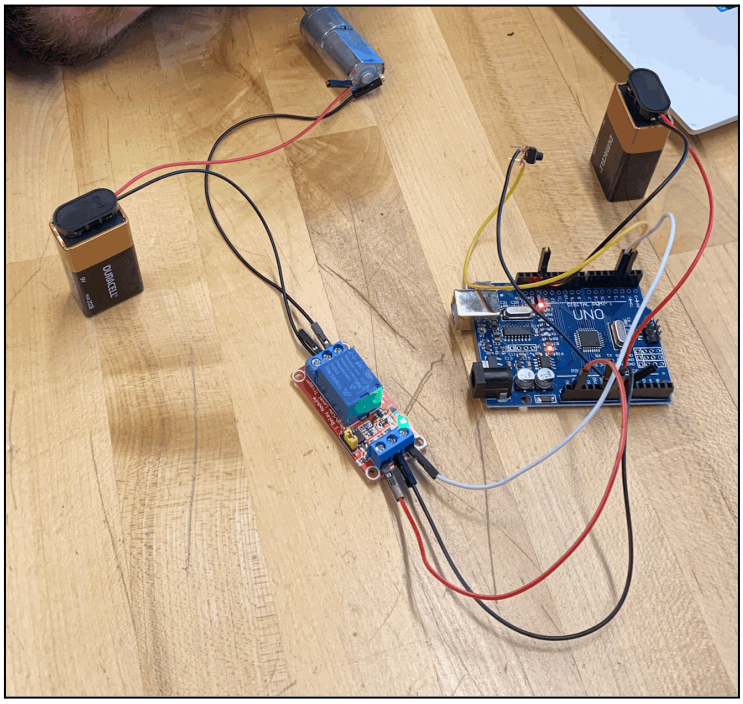

Figure 25.5: electrical subsystem of final prototype

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6.2. Testing & Validation

We performed some load testing to ensure the conveyor belt could tolerate the weight of the snacks. Overall, the system passed the testing for different weights and sizes of snacks. A test was performed to see if fingers getting stuck in the conveyor belt would be dangerous. When we did the test, we found that the force of the belt was negligible and found it wouldn't cause harm. A test was run on the emergency stop button in which 10 times it was flipped while the conveyor belt ran which it passed all 10 times.

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7. Conclusions and Recommendations for Future Work

Lessons Learned and Future Recommendations:

A big issue we faced with this project was figuring out how to divide our budget among the materials we needed. This was because many of the materials we purchased were unavailable at the makerspace and could only be purchased in bulk packs. The problem with this is that though we needed these components, in most cases we only required one or two pieces from those larger packs but still had to pay for the bulk price.

Another issue faced was time management. Though we had set lab times and weekly meetings where we could work together, it was difficult to account for variables such as getting to the makerspace early enough to get a 3D printer, or waiting for a part we ordered to be delivered. These issues popped up a lot in the last portion of our product design because we had made a dramatic shift in our product design, and had to completely redesign our bom.

This brings us to another lesson learned; the importance of communication within a group. As we quickly learned, this project has many components and is a huge time commitment. Without constant communication and progress check-ups, we realized we would've quickly fallen behind. To avoid this situation, we took the initiative to organize group meetings every Thursday, where we go over what has to be done in the next week, as well as the division of tasks. With this we've managed to stay on track with this project.

Further, another major lesson we learned throughout this process was the importance of knowing each other's strengths and playing to them. For example, Gaby already had extensive experience with 3D printing, so she led that portion of the project. As another example, Robin had extensive experience working with circuits, so he led that one. However, that's not to say that new skills weren't learned throughout this process.

Future Work Recommendations:

- Refining Conveyor Belt Design:
    - Given more time, we'd enhance the conveyor belt design further to optimize its efficiency and reliability for snack transportation.
- Motor strength:
    - We would implement our design with a stronger motor as our original motor lacked the strength to power our conveyor belt as we originally desired
- Enhanced Time Planning:
    - Implement better contingency plans for unforeseen delays, ensuring smoother project execution.
- Continued Communication and Task Division:
    - Maintain regular meetings and task delegation, ensuring continued progress and avoiding potential setbacks.

Our journey in creating the snack arm not only improved our technical skills but also honed our teamwork, communication, and time-management abilities. While we have ideas for improvements, we are proud of the final product, which is the proof of our dedication and effort invested by all of us.

8. Bibliography

Images:

- Robson, John. 2020. https://www.google.com/url?q=https://www.google.com/url?sa%3Di%26url%3Dhttps%253A%252F%252Fwww.quora.com%252FWhat-does-the-O-and-I-mean-on-a-switch-2%26psig%3DAOvVaw2fLbYtXe7RN-hiFNwgisnR%26ust%3D1701982051036000%26source%3Dimages%26cd%3Dvfe%26opi%3D89978449%26ved%3D0CBIQjRxqFwoTCOiH77DX-4IDFQAAAAAdAAAAABAD&sa=D&source=docs&ust=1701913644640185&usg=AOvVaw3AAuy6cUirGW2Mbx6nKeYt
- Jameco Electronics. 2023. *Arduino Uno Pinout Diagram.* *https://www.jameco.com/Jameco/workshop/CircuitNotes/CN-Arduino-uno.html*
- Barik, Prathamesh. 2023. *Understanding How a Single Channel Relay Module Works and How to Use it with Arduino to Control AC Loads.* *https://circuitdigest.com/microcontroller-projects/interface-single-channel-relay-module-with-arduino*

APPENDICES

9. APPENDIX I: Design Files

The Arduino code file which can be found in our makerepo displays our code behind the logic regarding the electrical component of the conveyor belt. The CAD files which can be found in our makerepo contain all of our main designs of our prototype conveyor belt as well as designs of its specific components.

Link to MakerRepo: https://makerepo.com/mmoya064/1761

Table 3. Referenced Documents

Document Name	Document Location and/or URL	Issuance Date
Arduino code	https://makerepo.com/mmoya064/1761 (under project files - **Snack_arm.ino**)	Dec 7, 2023

CAD files	https://makerepo.com/mmoya064/1761 (under project files)	Dec 7, 2023

10. APPENDIX II: Other Appendices

No other information was deemed crucial for the product, though if the reader has any further questions, they are encouraged to explore the makerrepo (*9. APPENDIX 1: Design Files*) or contact the support (*5.4 Support*).