

GNG 2101

Design Project User and Product Manual

Submitted by:

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List of Acronyms and Glossary

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Table 1. Acronyms

Acronym	Definition
UPM	User and Product Manual
MPD	Menstrual Product Dispenser
BOM	Bill of Materials
ADA	American Disability Association

1 Introduction

This User and Product Manual (UPM) provides the information necessary for consumers to effectively use the Menstrual Product dispenser (MPD) and for prototype documentation. This document is structured into different sections all containing various sorts of information pertaining to the MPD. Section 2 and its subsections provides a general overview of the product along with the various warnings and cautions in regards to operating the MPD. Sections 3, 4 and 5 provide instructions on how to set up the product, how to operate it, as well as information regarding maintenance, product errors and other special considerations. Sections 6 and 7 provide in-depth details into the production document (BOM, materials, equipment, instruction), the various subsystems of the MPD, as well as recommendations and further improvements that could be made in the future. The purpose of this document is to give the consumer an overview of the MPD as a whole, in regards to its purpose, operation and troubleshooting, as well as information that pertains to the development of the product and its subsystems. This document is intended to be read by consumers who are looking to install the MPD in womens'/gender-neutral washrooms on their property.

2 Overview

A representative from the University of Ottawa's Office of Campus Sustainability stated that two main tampon dispensers being used on campus currently are riddled with issues, those being the "Joni" and "Aunt Flow" dispensers respectively. This is important because due to these issues, the uOttawa Office of Campus Sustainability has had difficulties in repairing and maintaining these dispensers, as well as issues pertaining to reliable dispensing, product capacity and ease of restocking said product; therefore,

The fundamental needs derived from the interpreted needs are as follows: the design of the MPD should be durable, have a large capacity, easy to restock, meet ADA guidelines, easy to install, dispense reliably and at a controlled rate to prevent hoarding.

In comparison to the Joni and Aunt Flow dispensers, our MPD dispensing mechanism relies largely on gravity for its dispensing mechanism, whereas the Joni's dispensing mechanism is fully electronic and the Aunt Flow's is fully mechanical, using a series of gears in conjunction to dispense products. Unlike the other two dispensers, our MPD is much lighter and therefore much easier to install in comparison. Thanks to its simplistic design and ease of operation, our product also meets ADA guidelines, which cannot be said for the other two dispensers. Our product capacity is much higher compared to our competitors, as it is able to hold 50 products at a time compared to 20-30 products.



The key feature of this product is the dispensing mechanism. Our MPD uses two gears, one of them having an arm attached to a sliding tray. When activated, the gears turn and the arm

moves, which then moves the sliding tray, allowing a tampon to be dispensed from the storage casing. The sliding tray is designed in such a manner where it only allows for one tampon to be dispensed at a time, with the margins of error being extremely minimal as proven during testing of the dispenser. The storage casing allows for gravity to be the main and only force that allows for the tampons to be dropped out of the casing. The sliding tray is moved electronically by a press of a button that is easily accessible to the user, being located on the front-side of the dispenser.

The construction of the dispenser is relatively simple; aluminum is used for the outer casing, as well as the storage casing inside that stores the tampons themselves. Aluminum allows for the product to be durable while being relatively lightweight, allowing it to be easy to install and uninstall. The sliding tray and gears are made from plastic, and there is a battery-powered motor within the casing that is responsible for moving the gears, which move the sliding tray back and forth and allow for tampons to be dispensed. The dispensing mechanism has a delay, and this delay is set using a programmed microcontroller. There are rails within the casing that are used to hold the sliding tray in place, while also allowing it to slide back and forth freely; these rails are made of aluminum.

2.1 Cautions & Warnings

Before using, ensure tampons are properly loaded within the storage casing. Do not attempt to use improperly sized tampons and or any other incompatible products. Do not attempt to fill the dispenser with more products than what is recommended. For your safety, ensure the outer casing is properly closed prior to using the dispenser. Do not attempt to handle the internal dispenser mechanisms without disconnecting the batteries/power source from the dispenser.

3 Getting started

3.1 Configuration Considerations

The dispenser should be set up on an easily accessible area (i.e. a wall) between 35” to 40” off the ground. The mounting rails should be drilled into place using screws and a power drill; these mounting hooks should be tightly drilled into place. Once that is done, the dispenser can be hung up on the hooks that are drilled into the wall. Ensure that the dispenser is rigid and moves very little when on the hooks.

3.2 User Access Considerations

This system will be primarily used by both transgender and biological women, those that identify as gender-neutral or non-binary, and those with physical disabilities and or mental disabilities. For those with physical and or mental disabilities, the dispenser must be at a reasonable height, and the method for dispensing the tampon itself must be convenient and easy for anyone to do regardless of their incapacities.

3.3 Accessing/setting up the System

The mounting rails should be drilled into place using screws and a power drill on a wall 35” to 40” off the ground; these mounting hooks should be tightly drilled into place. Once that is done, the dispenser can be hung up on the hooks that are drilled into the wall. Ensure that the dispenser is rigid and moves very little when on the hooks.

3.4 System Organization & Navigation

The system only has one moving part: the dispensing tray. It is moved back and forth via a motor which rides in a groove in the bottom of the tray. The motor is connected to a microcontroller which activates the motor when the button is pressed. The button is the main user interface: it controls the dispensing of products via the microcontroller via the motor via the dispensing tray. The product storage is also placed relative to the dispensing tray: the storage sits right above the resting position of the dispensing tray. The whole dispenser is organized and built around this dispensing tray.

3.5 Exiting the System

Start by emptying the dispenser of any remaining tampons and empty the battery pack and or any remaining in the storage compartment. Then, carefully lift the dispenser off the mounting hooks. Afterwards, you can uninstall the mounting hooks themselves.

4 Using the System

4.1 Pushing the button

In order to dispense a product, the user input required is a push of a button. The motor will then run and dispense one product which will be obtainable by the user (product will fall onto a tray for the user to take).

4.2 Stocking the dispenser

To restock the dispensers, the user must first unlock the dispenser to access the storage inside. Afterwards, the user can simply drop the products into the product storage compartment and restock the dispenser until the storage is full.

5 Troubleshooting & Support

5.1 Error Messages or Behaviors

There are no error messages. The dispenser will either stop dispensing if it is empty or if there is a blockage. As it is recommended to restock the dispensers every day, the error behavior will never persist for long periods of time without attention.

5.2 Special Considerations

If the motor is not working, consider changing the battery as the battery emptying should not be an error behavior given proper maintenance.

5.3 Maintenance

When restocking, always make sure products fall correctly and in a column. Always make sure nothing is in the way of the sliding tray and keep all moving parts clear of obstacles.

Make sure the components are clean. Change the battery every 3 months (2 months for higher traffic dispensers).

5.4 Support

For support, contact TeamTampons at fmadh090@uottawa.ca.

6 Product Documentation

6.1 Dispensing mechanism and electronics

This is the system responsible for dispensing the menstrual product after user input (button).

It consists of an arduino circuit, a motor and a sliding tray which together dispense on demand. The sliding tray is the physical element that dispenses and blocks the tampons (from all falling out). It is moved forwards and backwards by the motor as it slides on rails (secured to the casing detailed later).

6.1.1 BOM (Bill of Materials)

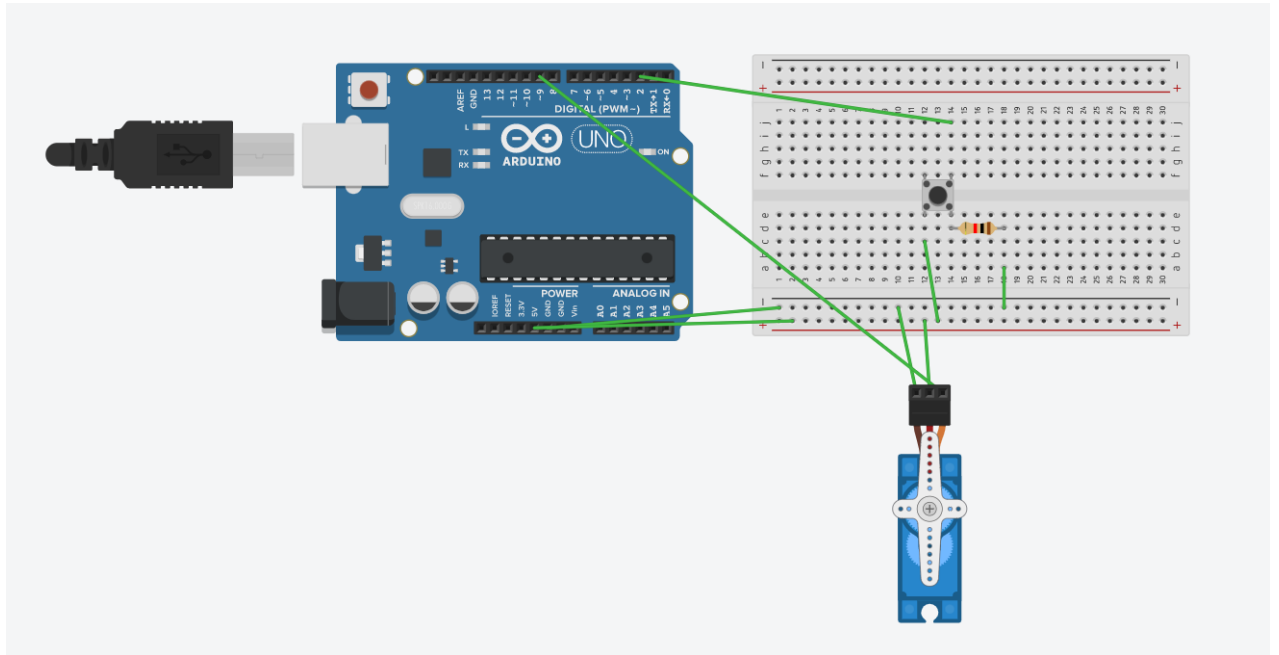
Name	Price
Arduino Uno	17
1000 Ohm resistor	0
wire	0
breadboard	4
button	0.25
servo motor	22 https://www.amazon.ca/Miuzei-Torque-Digital-Waterproof-Control/dp/B07MDM1C3M/ref=sr_1_10?keywords=Servo+Motor&qid=1681074308&sr=8-10
3d printing filament	0
arduino servo.h library	0
arduino ide	0
toothpick	0

6.1.2 Equipment list

3d printer, soldering iron (and solder)

6.1.3 Instructions

3d print parts (rails and tray), wire the circuit below and upload the code below into the arduino. Option to solder wires to button so that the button is mobile and not constrained to the breadboard.

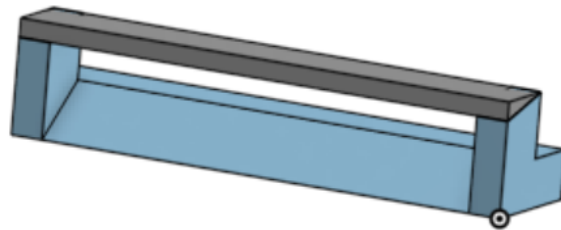
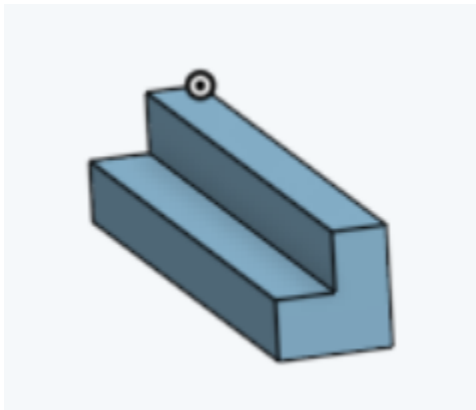


```

1 #include <Servo.h>
2 Servo myservo; // create servo object to control a servo
3 int buttonPin = 2; // the number of the pushbutton pin
4 int buttonState = 0; // variable for reading the pushbutton status
5 int buttonPressed = 0; // flag for checking if the button was pressed
6 int count = 0;
7 void setup() {
8   myservo.attach(9); // attaches the servo on pin 9 to the servo object
9   pinMode(buttonPin, INPUT_PULLUP); // initialize the pushbutton pin as an input
10  Serial.begin(9600);
11  Serial.print(count);
12 }
13 void loop() {
14   buttonState = digitalRead(buttonPin); // read the state of the pushbutton
15   if (buttonState == HIGH) { // check if button was pressed and released
16     myservo.write(180); // set servo position to 90 degrees
17     delay(3000); // wait
18     myservo.write(0); // set servo position back to 0 degrees
19     count=count+1;
20     Serial.print(count); }
21   if (buttonState == LOW) {
22     myservo.write(0);
23   }
24 }

```

Circuit and control code



rails and sliding tray (see files railsbetter.stl and Part Studio 1 - Part 1.stl and Part Studio 1 - Part 2.stl)

6.2 Product storage

This is the subsystem responsible for storing the menstrual products to be dispensed. The products would be stacked vertically in a column.

6.2.1 BOM

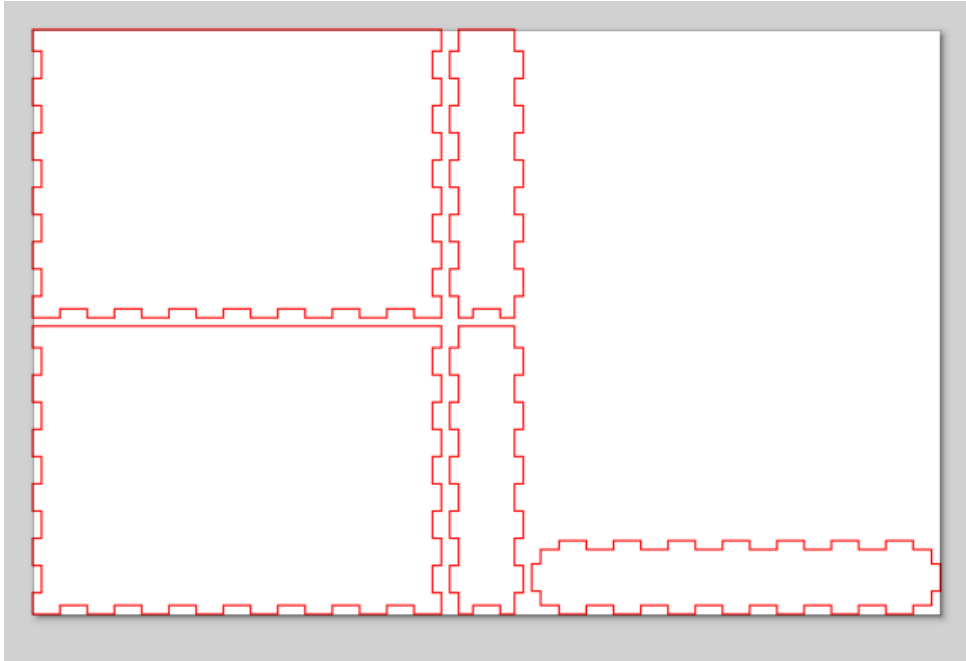
Name	Price
MDF ($\frac{1}{8}$ in thick) x2	6 total
superglue	11.5

6.2.2 Equipment list

laser cutter

6.2.3 Instruction

3d cut the mdf box, the glue the sides together without glueing the top/bottom.



laser cutting file for product storage (see file storage.svg)

6.3 Outer casing

This is the subsystem responsible for protecting all other subsystems and ensuring that the dispensing can occur uninterrupted. It also makes the mechanical and storage subsystems inaccessible to regular users (outside of maintenance)

6.3.1 BOM

Name	Price
mdf $\frac{1}{4}$ in	3
superglue	11.5
2x4 wood	0
mdf $\frac{1}{8}$ in	6

6.3.2 Equipment list

laser cutter, clamp

6.3.3 Instructions

Assembly of all subsystems: Glue the rails to the correct height (approx 15 cm from base) of the box. Cut a 2x4 to the length of 3 cm thick and glue it to the product storage box.

Then glue the 2x4 piece such that the product storage is approx 10 cm from the top of the box. Place the sliding tray on the rails and place the toothpick in the motor arm. Position the motor under the sliding tray such that the tray is right under the storage compartment. Secure the motor in place and place the toothpick in its slot. Place electronics behind the motor and drill a hole to pass the arduino power cable as well as the button through the side of the casing. Glue the casing together leaving the front panel off for demonstration purposes. Cut bottom of front panel off to let product slide out for box when it is on, and cut mdf to size of the box to act like a slide for the product to be dispensed. Finally, cut mdf with spare pieces to make a tray for the dispensed products.



outer casing of final prototype (see box.svg)

6.4 Testing & Validation

This prototype tested the dispensing mechanism. To see its reliability, we dispensed the product 100 times. Out of those 100, only 7 failed to work properly.

7 Conclusions and Recommendations for Future Work

Our biggest lesson learned is to keep things simple. Our dispenser operates on a very simple idea and the most complicated thing is the dispensing tray, as it is meant to only dispense one product at a time. Simplicity means easier to fix and easier to produce.

If we had more time, we would make the dispenser casing and storage out of more durable materials, inching us closer to the final design.

APPENDICES

8 APPENDIX I: Design Files

Table 3. Referenced Documents

Document Name	Document Location and/or URL	Issuance Date
railsbetter.stl	railsbetter.stl	2023-04-09
Part Studio 1 - Part 1.stl	Part Studio 1 - Part 1.stl	2023-04-09
Part Studio 1 - Part 2.stl	Part Studio 1 - Part 2.stl	2023-04-09
storage.svg	storage.svg	2023-04-09
box.svg	box.svg	2023-04-09
motor casing.stl	motor casing.stl	2023-04-09