Design Document: MediMate

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Needs Assessment

Client/Customer Definition

Senior Canadians of all incomes/economic classes are the most dependent on prescription medication in Canada. In 2021, one in four seniors relied on over ten drug classes, and out of these seniors, one in four of this group aged 85+ have also been diagnosed with dementia [1]. Thus, in addition to their heavy reliance on medication, seniors with impaired cognition also struggle with tracking and medication management, and studies have shown that this interferes with proper medication [2]. If medication intake is not proper, it decreases the effectiveness of prescriptions, increases costs of healthcare, and shortens life [3].

Competitive Landscape

<u>Caretaking Systems (Social/Economic)</u>

Caretakers provide human interaction in a healthcare role which is human interaction and companion [4]. Not only do their responsibilities provide the necessary medication, health, and lifestyle maintenance, they also address the common loneliness that seniors face [5]. Though effective, caretaker systems are expensive and in high-demand, often resulting in caretaker shortages and instances of lower-income seniors being left without care [6].

<u>Mailed and Sorted Medication Systems (Social/Economic)</u>

Pharmacies often have an implemented mailing system that sends patients their prescriptions weekly, bi-weekly, or monthly [7]. This system is usually more affordable, and oftentimes, these systems can have patient prescriptions sorted by day and time to ensure proper medication intake [8]. Though effective in theory, mailing risks delivery lateness and lost/missing/stolen goods, and though prescriptions are sorted by day and time, it is not guaranteed that patients will actively remember when to take them [9].

<u>Pill Boxes (Economic/Technological)</u>

A common solution to medication management is pill boxes. It is affordable, easy-to-understand, and portable, resulting in optimal convenience for most patients [10]. A more technologically advanced alteration of the pill box are those with timers and locks to ensure additional safety and proper medication intake [11]. Though effective for many individuals with prescriptions, pill boxes are not designed for senior patients. Oftentimes, they are too small to handle, easily misplaced, and must be refilled frequently by either a caretaker or healthcare provider [12].

Requirement Specification

Accurate Sorting/Dispensing:

- Precision in sorting and dispensing of patient prescriptions will be achieved through servo motors, ramps, and a controlled pill-dispensing mechanism (see design diagrams) [13]. The final design will dispense prescriptions within thirty seconds.

Responsive Intake Verification:

- A light-sensing module will verify timely medication intake. The sensor will be implemented to sense the presence of the cup. If the patient picks up the cup to consume the prescriptions, the cup will be absent from the sensor, enabling light reception and indicating that the patient has properly taken their medication. If the cup remains in the range of the light sensor, blocking light reception, caretakers will be notified of the intake failure within three minutes.

Safe Reminder Alarm/Light:

- Studies have shown that lights flashing between 3-30Hz trigger photosensitive epilepsy seizures, and frequent exposure to sounds over 120 decibels (dB) can lead to hearing loss [14]. Thus, LEDs flashing below 3Hz and an alarm below 70dB will alert visually and auditorily impaired consumers without risk of triggering photosensitive epilepsy and preserve hearing health [15].

Accurate Light Sensing:

- To toggle between Day and Night Mode, MediMate will utilize light-sensing modules to manage electrical current and trigger Day and Night features [16]. Light-sensing module will facilitate an automatic transition to Night Mode that deactivates LEDs and mutes alarms for undisturbed sleep. The purpose of toggling between modes is to improve user experience and ensure that MediMate is a helpful appliance to improve quality of life, not hinder it. These modes will alternate within three minutes of changing light.

Effective Shock-Prevention:

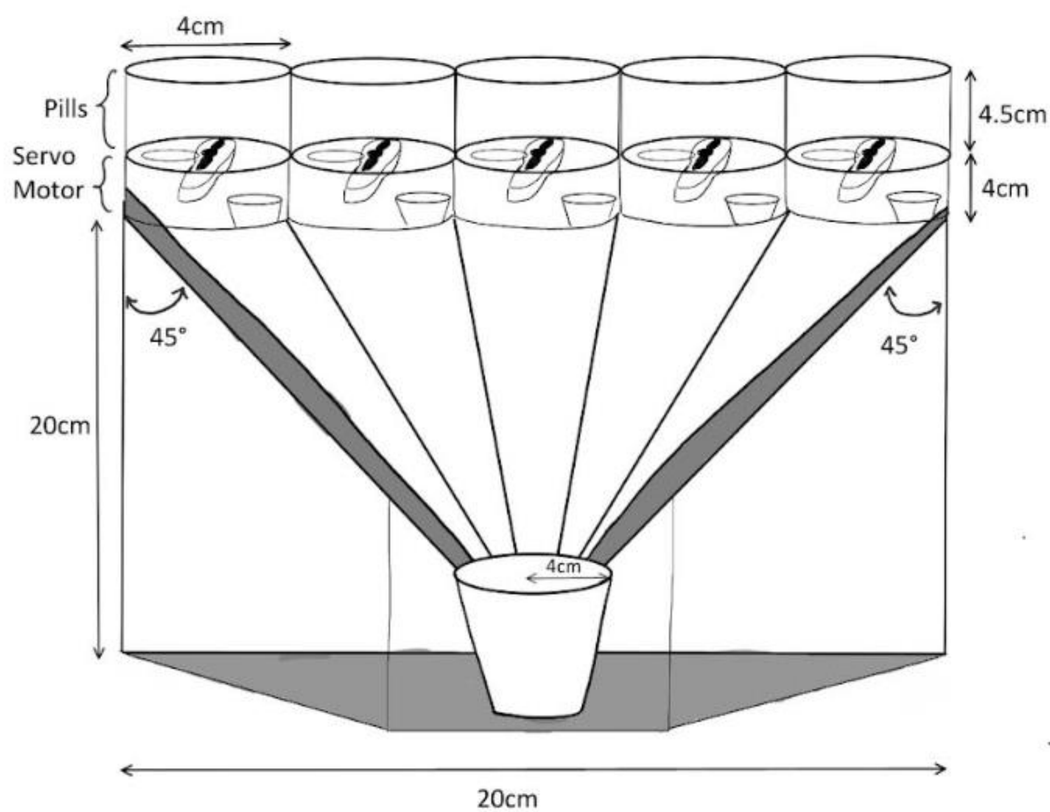
- A waterproof chassis will be constructed to prevent shock related hazards. A 250mL quantity of water will be poured over the chassis to test its waterproof effectiveness.

Analysis

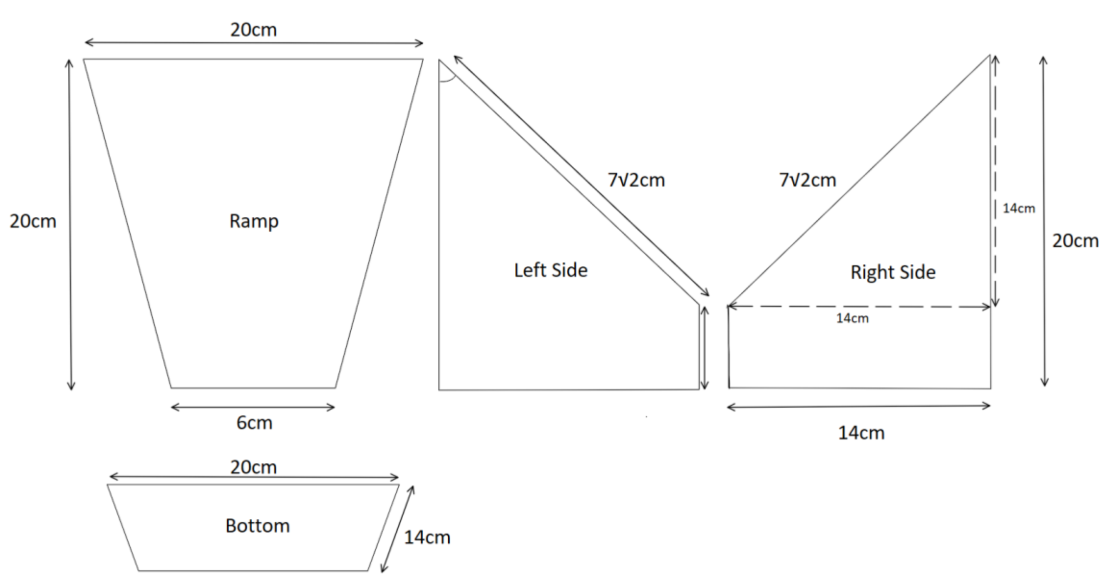
Design

The **Installation Manual** and **User Guide** are included in the ***Implementation Costs* section** of the Design Document. Please refer to the diagrams below and two manuals/guides during the construction, implementation, and operation of a MediMate.

<u>Overall Design Diagram:</u>

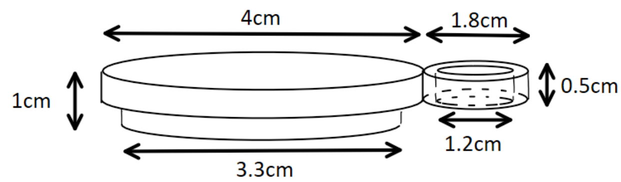


<u>Chassis Design Diagram:</u>

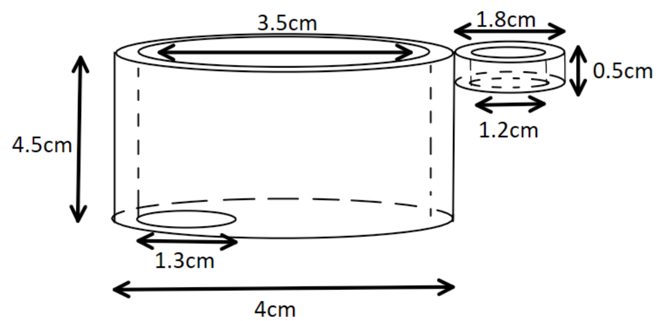


<u>Pill Box Design Diagrams:</u>

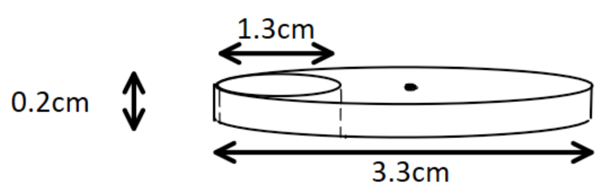
- Pill Box Lid
  - Prevents unauthorized access to prescriptions (includes lock hole).
  - Preserves quality of prescriptions by reducing exposure to air, and preventing exposure to dust.



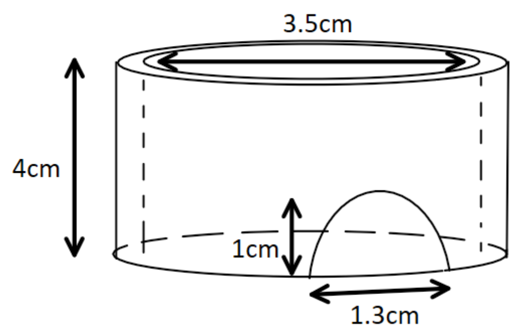
- Pill Box
  - Preserves prescriptions in a waterproof container.
  - Features a dispensing hole (that enables the dispensing design of the MediMate).
  - Prevents unauthorized access to prescriptions (includes lock hole).



- Distribution Disk
  - Servo-motor controlled disk that rotates to dispense prescriptions from the pill box.
  - Exact motor movements to optimize accuracy and precision.

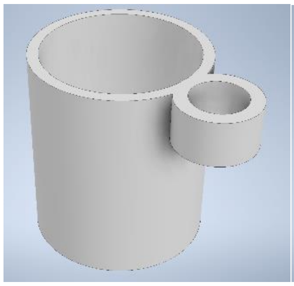


- Distribution Bottom
  - Guides prescriptions from pill box to ramp.

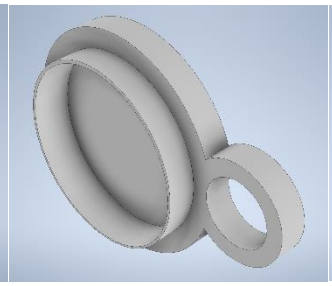


Inventor Software (3D Printing) Design Diagram:

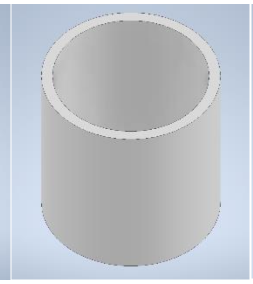
- Designed on Inventor, 3D Modelling Software by AutoCAD
- 3D-Printing Files only available by TA's request
- Includes exact dimensions; design is to-scale



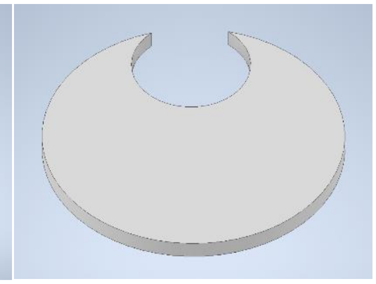
Pill Box Container



Pill Box Lid

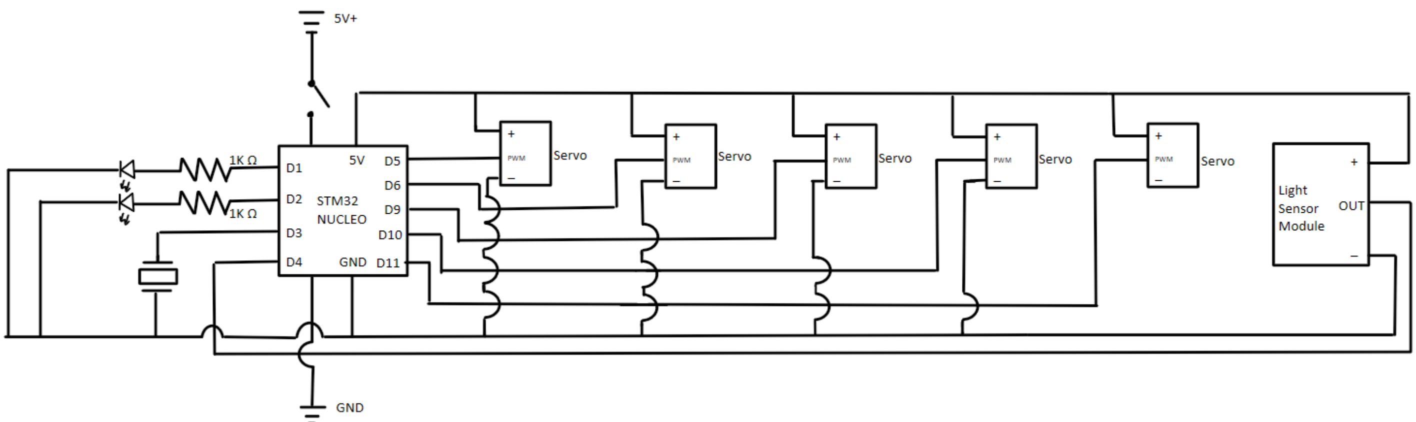


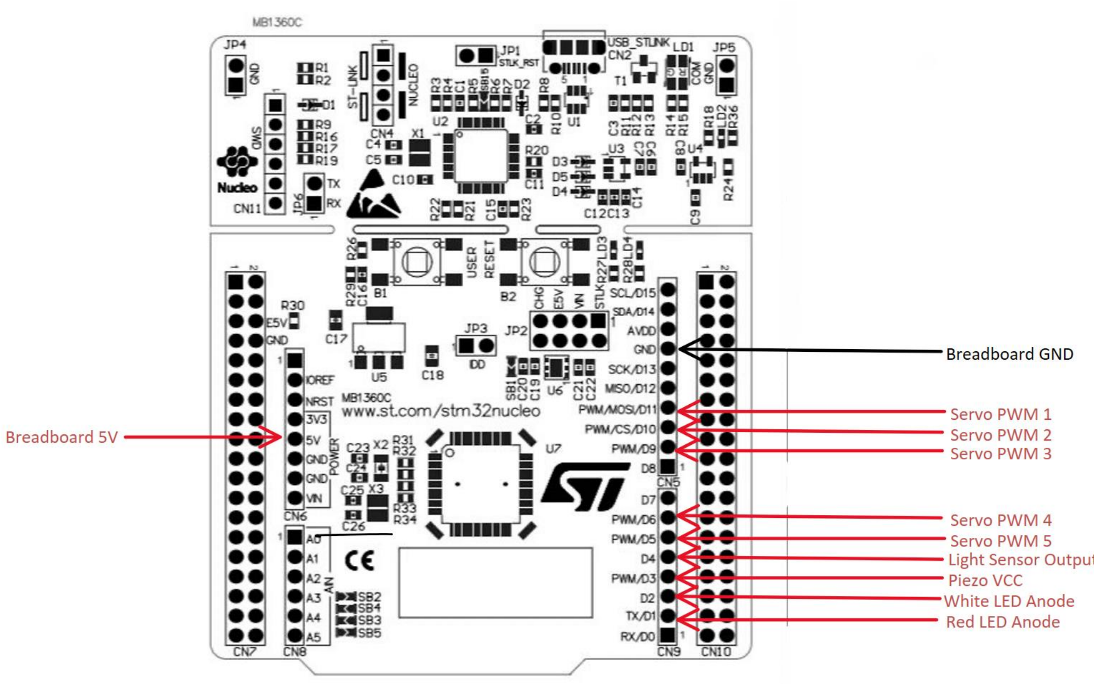
Distribution Bottom



Pill Box Distribution Disk

Circuit Schematic Design Diagram:





Design Explanation:

Medimate consists of 5 pill boxes, each storing a specific prescription that is dispensed based on client schedules. Each pill box will be constructed as follows:

To contruct the pill boxes (see Pill Box Design Diagrams):

1) 3D print all four components of the provided pill box design (downloaded from Inventor files).
2) Glue the top of the distribution bottom component to the base of the pill box container.
3) Drill a screw into the distribution disk, attaching it to its corresponding servo motor.
4) Repeat four more times for all five pill boxes.

To construct the chassis of the pill dispenser, cut or 3D print 4 sides as shown (see Chassis Design Diagram).

1) Mark dimensions on a sheet of plastic or cardboard.
2) Cut each side out with precision.
3) Melt together (using heat gun) or glue together (with any industrial adhesive), following the Overall Design Diagram.

After constructing the chassis, implement hardware components as follows:

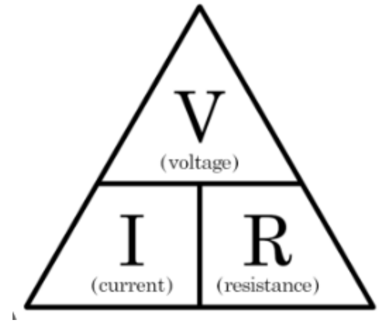
1) Follow the provided Circuit Schematic Design Diagram using listed components from the *Cost* section of the Design Document. Excluding the five servo motors that will be contained in the distribution bottom component of the MediMate, all components will be connected with a breadboard and jumper wires.

Following this implementation, the MediMate components will be programmed to dispense, remind, and alert users of medication schedules with the implementation of the following intentions:

1) Modular functions that increase and are customized for every scheduled dose.
    a. Servo motors rotate 360 degrees to dispense 1 pill from the pill box.
    b. LEDs turn on to indicate schedule during Night Mode.
    c. Speaker module triggers audio reminder during Day Mode.
2) Internal clock tracks provided schedule and triggers customized functions as programmed.
3) The Day/Night Mode function is triggered using the constant readings of the light-sensing module.

Scientific or Mathematical Principles

- **Ohm's Law**
    - V=IR (V = Voltage, I = Current, R = Resistance)
    - Ohm's Law is a fundamental equation in the electrical field used to express the relationships between voltage, current, and resistance in a circuit. This law will be utilized for the prototyping of the circuits to determine proper resistor values to sensors, LEDs, and other hardware components [17].



Ohm's Law

$V = IR$

IDEAL CURRENT for LED= 10mA

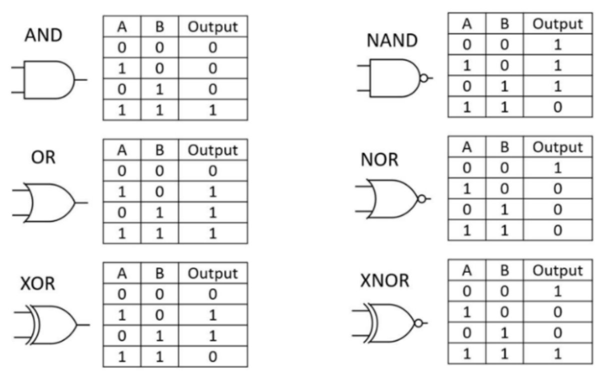
$5V = (10\ mA)R$

$5V = (0.01\ A)R$

$R = \frac{5\ V}{0.01\ A}$

$R = 500\Omega$

    - In our design, we will be using Ohm's Law to calculate the appropriate voltage and current required to power our design. It will be used to calculate the current running through the electrical wires to ensure the safety of the electrical compartments to prevent any damages to the internal components of the design from occurring. For example, in our design, we used Ohm's law to calculate the ideal current for the LEDs that we will be implementing into our design. Based on our calculation, the LED needs a resistance of 500 ohms such that the power of the LED will not fuse. This ensures that our design will operate and consume to appropriate amount of energy, optimizing its battery life. Ohm's Law is also important to ensure the safety of the user such that it does not pose any threat or harm towards them. Therefore, by using Ohm's Law, it helps with voltage regulations and ensures electrical safety.
- **Logic Gates**
    - AND, OR, NOR, NOT, XOR, NAND.
    - Logic gates are utilized in programming and circuitry to assist in decision-making and the determination of how data/electricity is handled. Logic gate theory will be implemented in conditional statements within the code of the STM32 and with the light-sensing modules utilized for the Night Mode feature of MediMate [18].



AND

A	B	Output
0	0	0
1	0	0
0	1	0
1	1	1

NAND

A	B	Output
0	0	1
1	0	1
0	1	1
1	1	0

OR

A	B	Output
0	0	0
1	0	1
0	1	1
1	1	1

NOR

A	B	Output
0	0	1
1	0	0
0	1	0
1	1	0

XOR

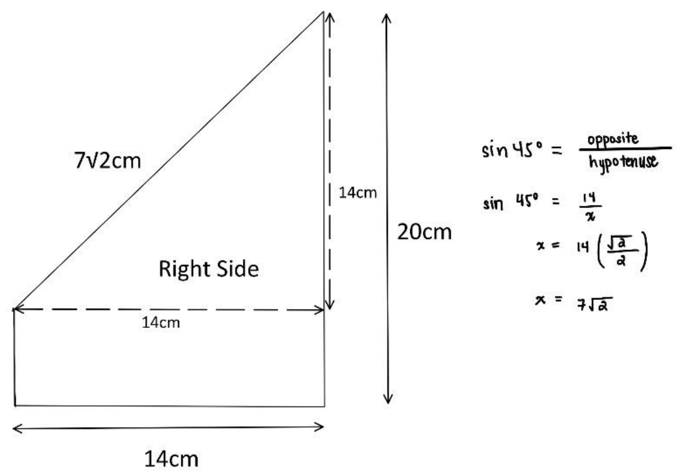
A	B	Output
0	0	0
1	0	1
0	1	1
1	1	0

XNOR

A	B	Output
0	0	1
1	0	0
0	1	0
1	1	1

    - In our design, logic gates will be used to operate the light-sensing modules. The light-sensing module is a light sensor device which detects the presence or absence of light in its environment. The purpose of the light-sensing module in our design is that when light is detected, the light-sensing modules will conduct and activate the reminder, informing the user to take their medication. When light is detected by the light-sensing module, the AND gate will output 1 which is true. As a result, it will output 5 volts to the STM which it will read as high voltage and will trigger the daytime feature of MediMate. Whereas, if there is no light, this will indicate that it is dark and is nighttime. As a result, the light-sensing module will output 0, thus, the AND gate result in false and will activate the nighttime feature instead of the daytime feature [18].

- **Kirchoff's Current Law / Kirchoff's Voltage Law**
  - $I1 - I2 - I3 = 0$ $(I = \text{Current})$
  - Kirchoff's Current Law will be utilized to calculate the current entering and exiting the circuit in which will the sum be zero. In [19], it educates and informs the reader on how the theorem works in parallel circuits [19].
  - $V1 + V2 + V3 = 0$ $(V = \text{Voltage})$
  - Kirchoff's Voltage Law allows us to calculate and analysis the voltage throughout the circuit in which the sum of all the voltages will equal to zero [20].
- **Arithmetic**
  - Fundamental Theorem of Arithmetic
  - In calculating our mathematical design, various arithmetic operations will be utilized to compute mathematical operations (e.g. multiplication, division, addition, subtraction) [21].
- **Geometry**
  - Trigonometry
    - Sine = Opposite/ Hypotenuse
    - Cosine = Adjacent/ Hypotenuse
    - Tan=Opposite/Adjacent
  - Trigonometry ratios is a powerful tool used to solve mathematical and geometric problems such as measuring for heights, angles, distances, and dimensions. Trigonometry has three special angles which are 30°, 45°, and 60° in which when analyzing geometric problems, if given only 2 measurements, by using the special angles, it allows us to efficiently calculate the other unknown values [22].



  - Trigonometry will be utilized to help us calculate the best-optimized angle and length/distance in which our chassis will be designed. In our project, we used trigonometry to calculate optimal dimensions of our ramp. By using the special sine angle, we knew that sin45° equals to √2/2 and from this, we were able to determine the hypotenuse of the ramp's side length given that the desired angle at the top of the ramp's side is 45 degrees and the opposite side of the angle was 14cm, according to special angle rule, the hypotenuse of the ramp should be approximately 9.89cm ($7\sqrt{2}$ cm) in length.

Costs

Manufacturing Costs

Component	Manufacturer	Distributor	Quantity	Cost
STM32 Nucleo	ST Electronics	UW Store	1	$26.95
White PC Filament	Filaments.ca	Rapid Prototyping Centre	300 g	$6.00
Battery Case	Keystone Electronics	KW Surplus	1	$0.39
LEDs (red and white)	Kingbright	KW Surplus	2	$0.65
Switch	E-Switch	KW Surplus	1	$1.19
Breadboard	Haraqi	Amazon	1	$3.33
Jumper Wires	Haraqi	Amazon	40	$3.00
Audio Piezo	TDK Corporation	RigidWare	1	$0.80
Servo Motors	DFRobot	Amazon	5	$16.99
Cardboard (20cmx20cm)	Staples	UW WEEF	4	$0.00
Light Sensor Module	Sparkfun	RigidWare	2	$0.60
Resistors	Stackpole Electronics	RigidWare	3	$0.30
Cup	ULine	EngSoc C&D	1	$0.00
				Total: $60.20

Locations:

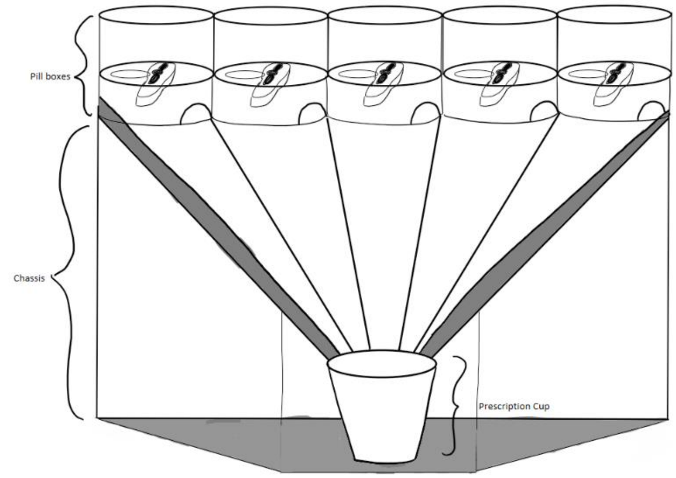
- Filaments.ca: 7195 Tranmere Dr. Unit 3 Mississauga, ON L5S 1N4, CA
- ST Electronics: 350 Burnhamthorpe Rd W, Mississauga, ON L5B 3J1, CA
- Keystone Electronics: 55 S Denton Ave, New Hyde Park, NY 11040, USA
- Kingbright: 225 Brea Canyon Road, City of Industry, CA 91789, USA
- E-Switch: 7153 Northland Drive Minneapolis, MN 55428 USA
- Haraqi: N/A
- DFRobot: 498 Guoshoujin Road, Pudong, Shanghai, China
- Staples: 6 Staples Avenue, Richmond Hill, Ontario, L4B 4W3, CA
- TDK Corporation: 3000 Technology Drive Suite 100, Plano, TX 75074, USA
- KW Surplus: 666 Victoria St. N, Kitchener, ON N2H 5G1, CA
- Amazon: 125 Maple Grove Rd. Cambridge, ON N3H 4R7, CA
- UW WEEF: 200 University Ave W, Waterloo, ON N2L 3G1, CA
- RigidWare: 200 University Ave W, Waterloo, ON N2L 3G1, CA
- EngSoc C&D: 200 University Ave W, Waterloo, ON N2L 3G1, CA
- Rapid Prototyping Centre: 200 University Ave W, Waterloo, ON N2L 3G1, CA
- SparkFun: Boulder, Colorado, USA (exact address N/A)
- Stackpole Electronics: 3110 Edwards Mill Road Suite 207 Raleigh, NC 27612, USA

Implementation Costs

Installation Manual:

Assuming that the chassis, hardware, and software have been implemented and manufactured prior to the purchase from a consumer, MediMate will arrive to the patient with the following components:

- 1 Chassis (pre-constructed and waterproof)
- 5 Removable and Refillable Pill Boxes
- 1 Prescription Cup (to store dispensed prescriptions
- 1 Power Cord (to power the STM32 Nucleo board)
- 1 Battery Case for 2 AA Batteries (to power the STM32 Nucleo board)



For the Caretaker:

To initialize MediMate:

1) Fill each pill box with a specific prescription of the same kind (e.g. a full bottle of Vitamin K pills). Place them in the slots on the top of the MediMate body.
2) If the MediMate was not already pre-programmed with the patient's exact prescription intake schedule, a MediMate technician will arrive to program the schedule to dispense medication as needed.
3) Plug in the Medimate into a power outlet with the provided Power Cord, or into the Battery Case (batteries not included).
4) Refill pill boxes as needed, and contact MediMate to update or alter prescription dispensing schedules.

User Guide:

For the Patient:

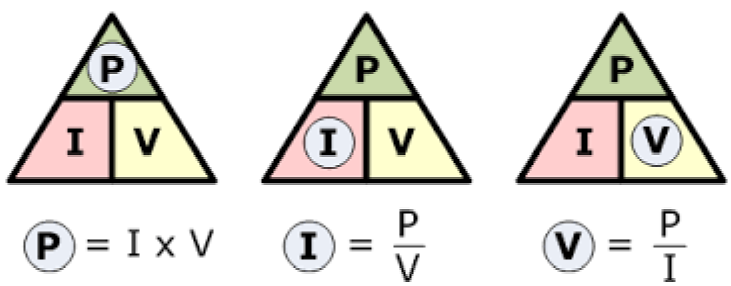
To use MediMate:

1) When LEDs are flashing and/or when an alarm sounds, please take the provided prescriptions dispensed in the cup. Not picking up the cup will trigger an alert that will be sent to your caretaker of an unsuccessful medication intake. Thus, when consuming the medication, please pick up the cup, and only place the cup back after you are finished with the intake.
2) Please do not attempt to open the pill boxes. They are sealed to promote safety and preserve the quality of the medication. Attempts to open the pill boxes will result in physical damage to the MediMate that will prevent the longevity of the appliance.

Risks

Energy Analysis

- **STM32F401RE**
  - Standard Baseline Power Levels Consumption (according to the STM32 Nucleo Data Sheet)
    - The maximum amount of energy required to power the STM32F401RE is 3.3 volts.
    - Run Mode (fully on) Power Supply: 146 µA/MHz
    - Standby Mode Power Supply: 2.4 µA @25 °C @1.7 V; 12 µA @85 °C @1.7 V
    - Since the clock-cycle of the STM32 Nucleo is 16MHz, the power consumption during run times, according to the Power formula [23]:



I = (146 µA/MHz)(16 MHz)
= 0.002336 A
V = 3.3 V

→

P = IV
= (0.002336 A)(3.3 V)
P = 0.0077088 W

The maximum power consumption during run times is 0.0077088 W. Since the maximum power consumption, as outlined in the Project Outline, is 30 W, and all power supply for external hardware components will be from the STM32 Nucleo, MediMate passes the power consumption requirements.

Risk Analysis

Negative consequences not using the design as intended:

The possible negative consequences regarding the environment of MediMate is that it is highly reliant on the medical professionals, caregivers or designated family members. To ensure the privacy and safety of the senior, a combination lock with a three-number sequence passcode is used which is managed by the caretaker. Due to this, the caretake is highly responsible and reliable for the senior's prescriptions. For example, if the caretaker were to forget to add new prescriptions into MediMate each week, because of their actions, the negative consequence is that the seniors would have no prescription to take on that day which would directly affect their health and lead to further health complications. Therefore, the caretaker must be very responsible as they must refill the pills weekly as intended.

Negative consequences of using the design incorrectly:

If the user mechanically misuses MediMate such as trying to pry open the lock or forcing the pill dispenser to open, it could damage the locks and latches of the design. The negative consequence from using the design incorrectly is it could lead to damaging the design, in which the components of the design will wear down faster. As a result, the negative consequence is that the lifespan of MediMate will significantly decrease than its expected usage lifespan.

Negative consequences of misusing the design:

A possible way the design could malfunction is if the caretaker were to add too many pills into pill compartments than what is recommended. By overloading the pill dispenser, this would result in the lack of space in which would restrict the pills from flowing out properly. The consequence of this action is that it could jam the design, preventing the pills from properly dispensing. The negative affect of misusing the design in a manner that was not intended is that the user would not be able to take their daily pills. This has a significantly consequence as it would worsen the health conditions of the cognitive senior's which will reduce their life span and could result in future hospitalizations to future treat their chronic conditions. Furthermore, if the pill dispenser is overloaded with too many pills, it could damage or break the internal mechanisms. As a result, this would have a negative impact on the environment as lots of energy will be required to decompose the plastic and components of the design.

What are possible ways that the design could malfunction:

Some possible ways the design could malfunction is if the rotating mechanism of the dispenser fails to align with the hole where the pill come out and releases the pills into the container. This malfunction could result in jamming of the internal mechanism which will make it difficult for the pills to dispense or in worse case seniors, the pill does not come out at all, resulting in the user not intaking their prescription. Another possible way the design could malfunction is if the alignment of the pill dispenser is not perfectly aligned. This could result in incorrectly dispensing of certain pills, in which could lead to mis-dosage of pills or overdosing if the dispenser does not function properly.

Consequences on safety or the environment for failure mechanisms:

The failure of the internal mechanism from jamming and misalignment could result in waste of pills. If the alignment of the pill dispenser is not accurately aligned it could result in pills being over dispensed or certain pills being dispensed when it would not be. As a result, the pills will become contaminated and will no longer be usable. The consequence of this failure mechanism is medication waste which directly affect the environment as addition electrical energy will be required to dispose and decompose the pills. Furthermore, if the code glitches in the design, it could also lead to incorrect dispensing of medications or no pills at all. This directly affects patients' safety as they would either be overdosing or not taking their pills at all which neglects the safety of the user.

Testing and Validation

Test Plan

Below are the following test plans for the following test conditions:

1. Accurate Sorting/Dispensing:

    a. Test Setup:

    To setup the pill dispenser, the caretaker of the senior must first collect all prescribed pills that the senior must take for the week. After retrieving them, the caretake must then pour each of the user's prescribed pills into separate pill container where each type of pills (e.g. vitamin A, B, C) will have its own designated container.

    b. Environmental Parameters:

    MediMate must be used on a flat and stable horizontal surface. MediMate is designed to be placed on a horizontal surface as a flat surface it will ensure that pills are dispensed accurately in a controlled and precise manner, ensuring that the user takes the correct dosage as prescribed. When using MediMate, a flat surface ensures stability which plays a crucial role as placing it on an uneven/tilted surface could result in the dispenser tipping over or pills spilling out, thus, could potentially cause medication errors.

    c. Test Inputs

    To test the accuracy of our dispensing mechanism, we can use assorted candies of assorted shapes that will mimic the physical properties of the different types of pills. For example, we will be using the pill-shaped candy, Mike and Ike. Thus, with similar physical attributes to actual pills, this can will aid in determining whether our design will successfully dispense the prescriptions out. We power the design and pour the candy into pill container and see if the candy can come of the dispenser successfully and fall into the cup for the user.

d. Quantifiable Measurement Standards:

When testing the accuracy of the dispenser, it must be able to dispense at least 1 pill per container. The design must be able to dispense the prescriptions within thirty seconds. As a result, there should be at least 3 pills dispensed into the cup.

e. Pass Criteria:

The design will pass the testing criteria if and only if the candy successfully comes out of the pill container and into the cup which will be located at the base to catch the pills.

2. Responsive Intake Verification:

a. Test Setup:

A light-sensing module will verify timely medication intake. The sensor will be implemented to sense the presence of the cup. If the patient picks up the cup to consume the prescriptions, the cup will be absent from the sensor, enabling light reception and indicating that the patient has properly taken their medication. If the cup remains in the range of the light sensor, blocking light reception, caretakers will be notified of the intake failure within three minutes.

b. Environmental Parameters:

MediMate should be placed within an environment with adequate light variation as the light sensor relies on the light condition. It must have adjustable sensitivity settings to accommodate different light levels. The device should be designed to work effectively in various lighting conditions, from low light or darkness to well-lit environments.

c. Test Inputs:

The test input required is that MediMate will be placed within a room with sufficient sunlight. Furthermore, we can also test both gradual transitions from darkness to light and vice versa, to determine the sensor's ability in different light conditions.

d. Quantifiable Measurement Standards:

With a timer of three minutes, the design must flag and alert a caretaker of a failed medication intake. When the sensor detects light within the three minutes, it should not alert the caretaker.

e. Pass Criteria:

If the design detects and alerts a caretaker of a failed medication intake within 3 minutes, the design satisfies the required criteria.

3. Safe Reminder Alarm/Light:

a. Test Setup:

Studies have shown that lights flashing between 3-30Hz trigger photosensitive epilepsy seizures, and frequent exposure to sounds over 120 decibels (dB) can lead to hearing loss [24]. Thus, LEDs flashing below 3Hz and an alarm below 70dB will alert visually and auditorily impaired consumers without risk of triggering photosensitive epilepsy and preserve hearing health.

b. Environmental Parameters:

MediMate must be placed in a dim-enough environment to observe the light-flashing with ease. It should also be in a quiet space to hear alarms with minimal effort.

c. Test Inputs:

To test the alarm device in MediMate, it requires voltage from a power source. Therefore, MediMate will be plugged outlet for voltage source to power MediMate.

d. Quantifiable Measurement Standards:

Frequency and audio-level testing softwares will be utilized to test whether the LEDs flash below 3Hz or create sound below 70dB.

e. Pass Criteria:

The design will fulfill the criteria if the LEDs flash below 3Hz and create sound below 70dB.

4. Accurate Light Sensing:

a. Test Setup:

To toggle between Day and Night Mode, MediMate will utilize light-sensing modules to manage electrical current and trigger Day and Night features [12]. Light-sensing module will facilitate an automatic transition to Night Mode that deactivates LEDs and mutes alarms for undisturbed sleep. The purpose of toggling between modes is to improve user experience and ensure that MediMate is a helpful appliance to improve quality of life, not hinder it. These modes will alternate within three minutes of changing light.

b. Environmental Parameters:

MediMate should be placed within an environment with adequate light variation as the light sensor relies on the light condition. It must have adjustable sensitivity settings to accommodate different light levels. The device should be designed to work effectively in various lighting conditions, from low light or darkness to well-lit environments.

c. Test Inputs:

The test input required is that MediMate will be placed within a room with sufficient sunlight. Furthermore, we can also test both gradual transitions from darkness to light and vice versa, to determine the sensor's ability in different light conditions.

d. Quantifiable Measurement Standards:

The design must alternate between Day and Night Mode within 3 minutes of changing light. This change in modes will be represented through the silencing/increasing volume of the alarm and the toggling between flashing LED alerts and dimmed LED alerts.

e. Pass Criteria:

When the design alternates between Day and Night mode within 3 minutes of changing external light, the design will pass the pre-determined testing scenario.

5. Effective Shock-Prevention:

a. Test Setup:

A waterproof chassis will be constructed to prevent shock related hazards. The test setup requires the user to retrieve 250ml quantity of water which can be water from the faucet, or a 250ml bottle of water could also be used for this test setup.

b. Environmental Parameters:

This requirement will be tested in a dry environment to prevent external factors (e.g. humidity, rain, etc.) from affecting the results from the actual, controlled testing quantity.

c. Test Inputs:

The test input to determine Mediate's waterproof capabilities involves exposing it to water under a controlled condition (250ml of water). A quantity of 250mL of water will be poured onto the design to test the shock-proof characteristics of the chassis.

d. Quantifiable Measurement Standards:

Each hardware component will be inspected for traces of water 15 seconds after the 250mL quantity is poured. Each component should be dry.

e. Pass Criteria:

If the design can withstand and preserve inner hardware from the 250mL quantity of water, MediMate will satisfy the necessary shock-prevention requirements.

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