

# Automatic Medication Dispenser

Designed By: Nathan (Zibu) Yin

## The Problem and Inspiration

Many people around the world take medication every day, especially those with long-term or chronic illnesses who may need to take medicine for life.

Taking multiple medications presents several challenges. Counting pills manually is time-consuming and tedious, and mistakes can lead to overdosing or under-dosing. Most importantly, elderly people or those with reduced physical or cognitive abilities may struggle to manage their medication safely. For example, my grandmother, who lives alone, often forgets to take her medication on time, putting her health at serious risk.

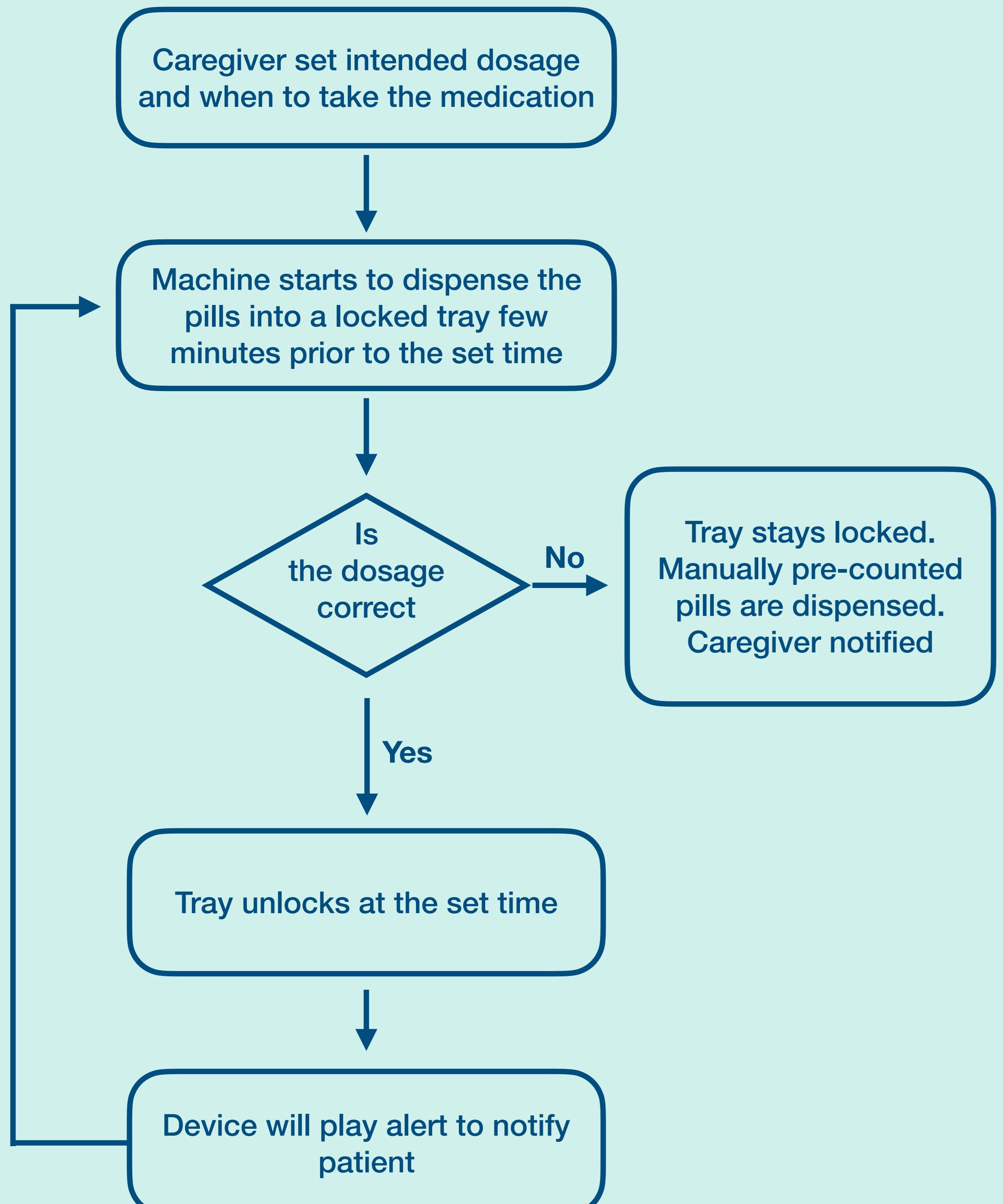
Existing products on the market are often expensive, making them inaccessible to many people who need them most.

## Project Aim

The aim of this project is to design an affordable automatic pill dispenser that counts and dispenses pills accurately at scheduled times. It will be safe and easy to use, and capable of remote monitoring, so caregivers can track medication intake and receive alerts for issues like low pill levels.

## Device Workflow

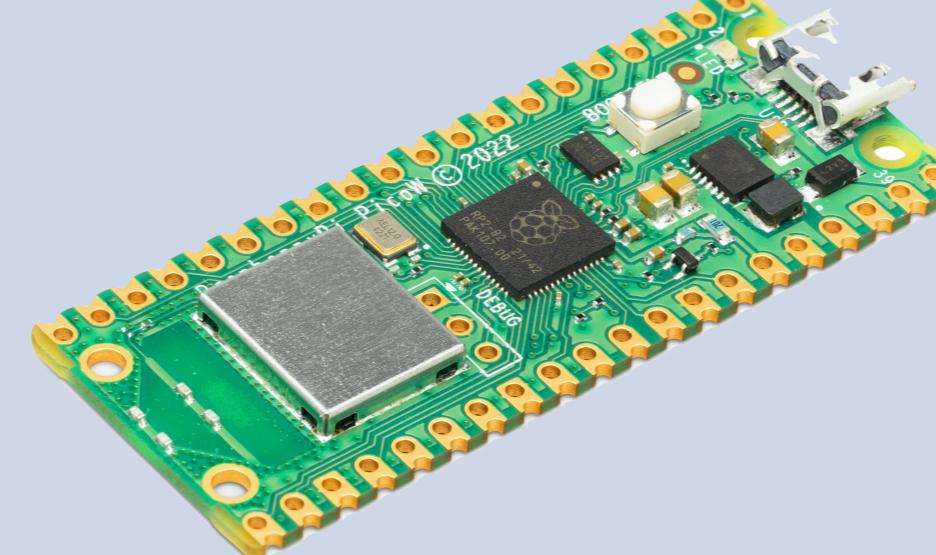
Below is a flowchart showing the basic process of how this device should function.



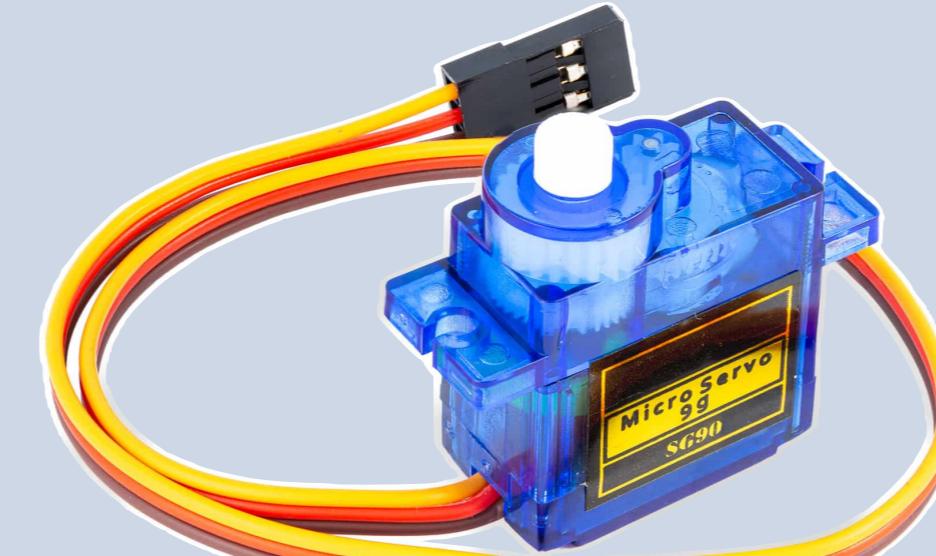
## Materials, Equipment and Software

### Materials:

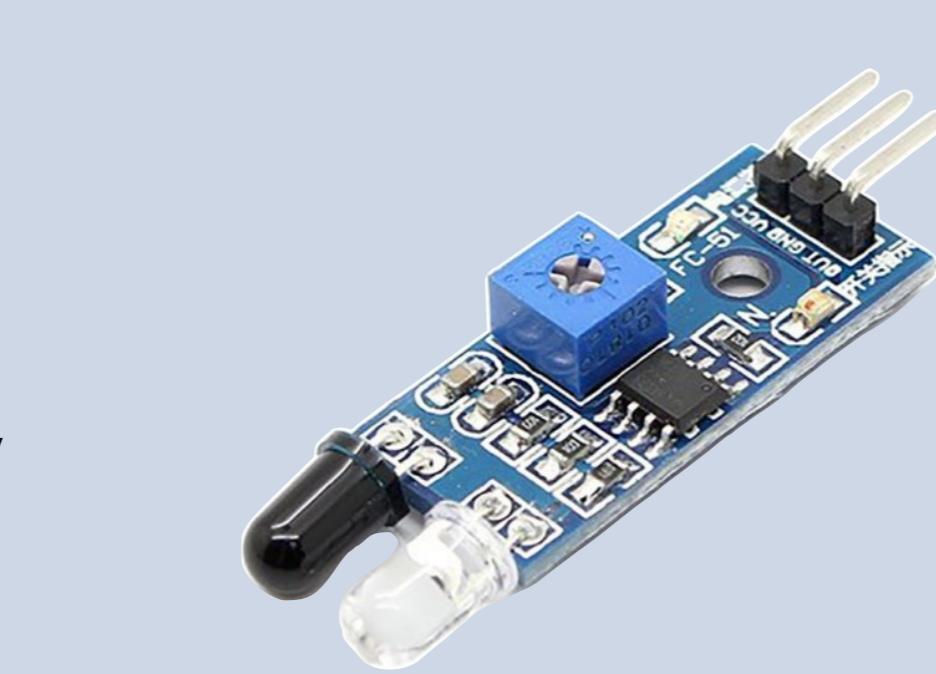
**Estimated Total Cost: £35**



**Main Controller Cost: £8.2 [1]**  
The Raspberry Pi Pico W is chosen for its low cost, low power use, and **wireless capability**, which most microcontrollers in this price range lack. It is also **widely available**, and the RP2040 chip can be embedded into custom PCBs for future versions.



**Actuators Cost: £1 each (X5) [2]**  
A TowerPro SG90 servo is used because it can run at 3.3 V, making it compatible with the Raspberry Pi Pico W. It also offers precise angle control, allowing the device to count and dispense pills accurately.



**Sensor Cost: £1.7 each (X4) [3]**  
An infrared sensor is used to detect when each pill is dispensed, enabling precise counting. When a pill passes through, it briefly reflects the IR LED's light back to the receiver, allowing the device to register each pill.

### Equipments & Software:



**3D Printer Filament Cost: ~£15**

A 3D printer is used to rapidly prototype and test different versions of the dispenser. I use a Bambu Lab X1C, which prints at high speed, allowing me to prototype efficiently.



**CAD Software**  
I used a cloud-based **CAD (Computer-Aided Design)** platform to design and test the pill dispenser, allowing me to evaluate small changes without physically rebuilding the device each time.

## Market Research

Many existing products on the market are expensive and not accessible to everyday users. This design offers a more affordable option that users can build themselves. The project can also be fully open-source, allowing anyone to view, modify, or recreate the device. In addition, the dispenser is more compact than most alternatives, making it easier to use in everyday settings.



Similar product online [4]

## Commercial Use

Currently, my plan is to keep this as a **DIY, open-source pill dispenser** that anyone can build themselves. If it were developed as a commercial medical device, it would need to go through strict regulatory approvals and certifications to ensure safety and reliability. These processes require significant time, money, and documentation, which is beyond the scope of this project.

## Potential Issues

- Servo could potentially get stuck if there is a large amount of pills in the container
- Pill tray could get stuck and unable to open due to too many pills dispensed
- Children or pets accidentally opening the container and consuming the medication

## Possible Solutions

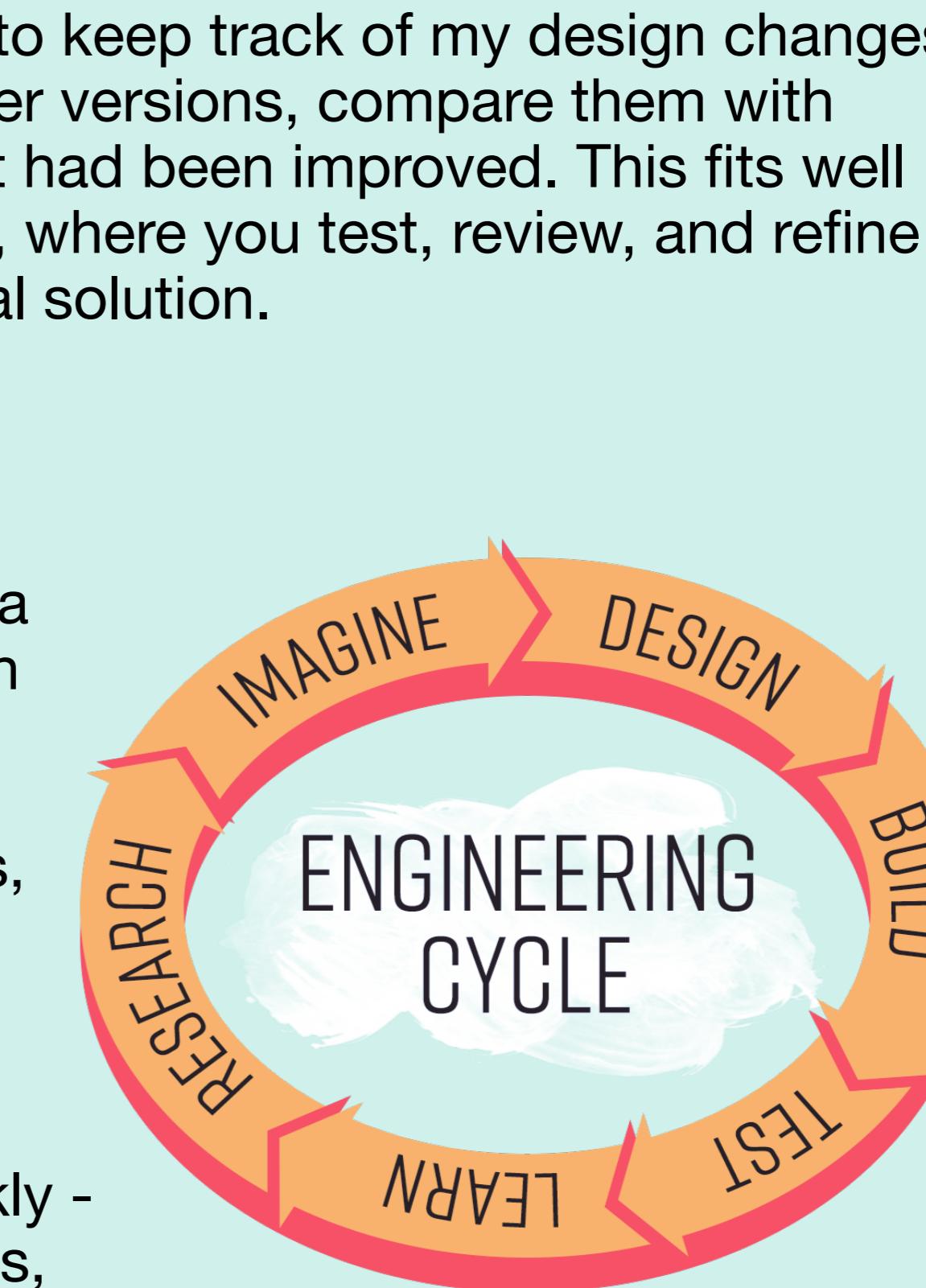
- Adjust the slope of the container to limit the amount of pills that presses on to the rotor
- Design a larger tray that the user could swap out if they require a large amount of pills each time
- Add childproof locks on the container lids to prevent children from opening it easily

## Engineering Lifecycle

I used Onshape's version control to keep track of my design changes. It made it easy to go back to earlier versions, compare them with newer ones, and see exactly what had been improved. This fits well with the engineering design cycle, where you test, review, and refine your ideas as you develop the final solution.

## Skills Gained

Through this project, I developed a wide range of engineering skills. In CAD modeling, I learned how to design precise mechanical parts, create assemblies, test tolerances, and adjust dimensions to ensure reliable pill flow and smooth mechanical movement. Rapid prototyping with a high-speed 3D printer allowed me to iterate quickly - printing, testing, identifying failures, and refining the design several times until the mechanism worked consistently.



Versions	
All branches	Active branch
Graph	Name
	Assembly improv...
	Main
Link mods	
Idea 1	
Angle Mods	
First attempt	
Version 1	
Start	

Onshape's Version Control

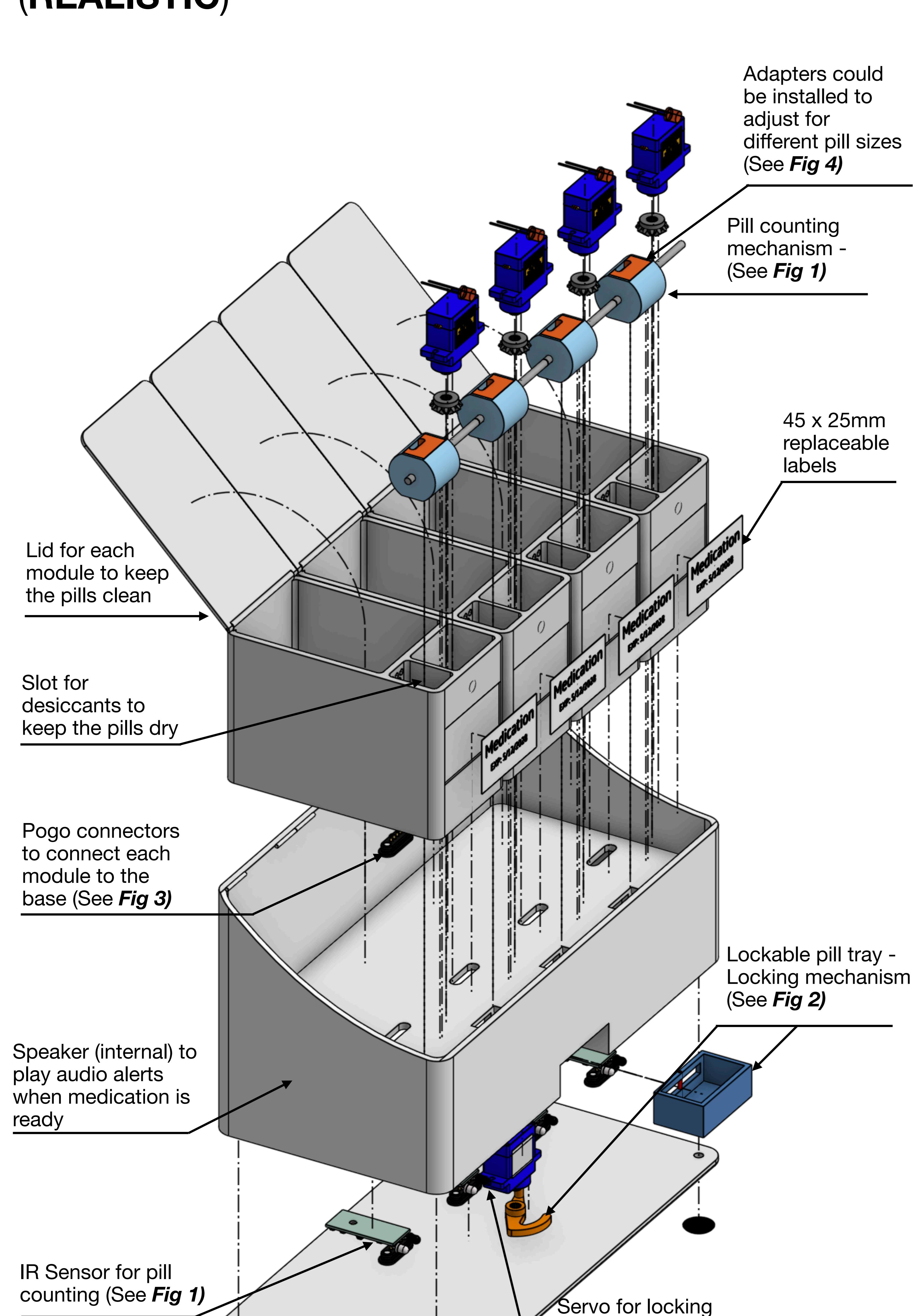
## Further Developing

- Make the modules freely expandable, removing the need for a base that all the modules connect to; therefore the user could choose how many modules to deploy based on the number of different kinds of pills that the user has
- Making a mobile web app to allow caregivers to easily monitor the pill dispenser
- Improve the reliability of the pill detection by using a suction cup to pick up the pills one by one, instead of a rotor wheel
- Add a simple LCD screen on the pill dispenser to directly display how many pills are left and to display other important information like when is the next dose
- Improve safety measures and accessibility, for example adding a button to alert the caretaker of any emergency, or improving the design of the tray to make it easier for people with reduced physical ability to handle

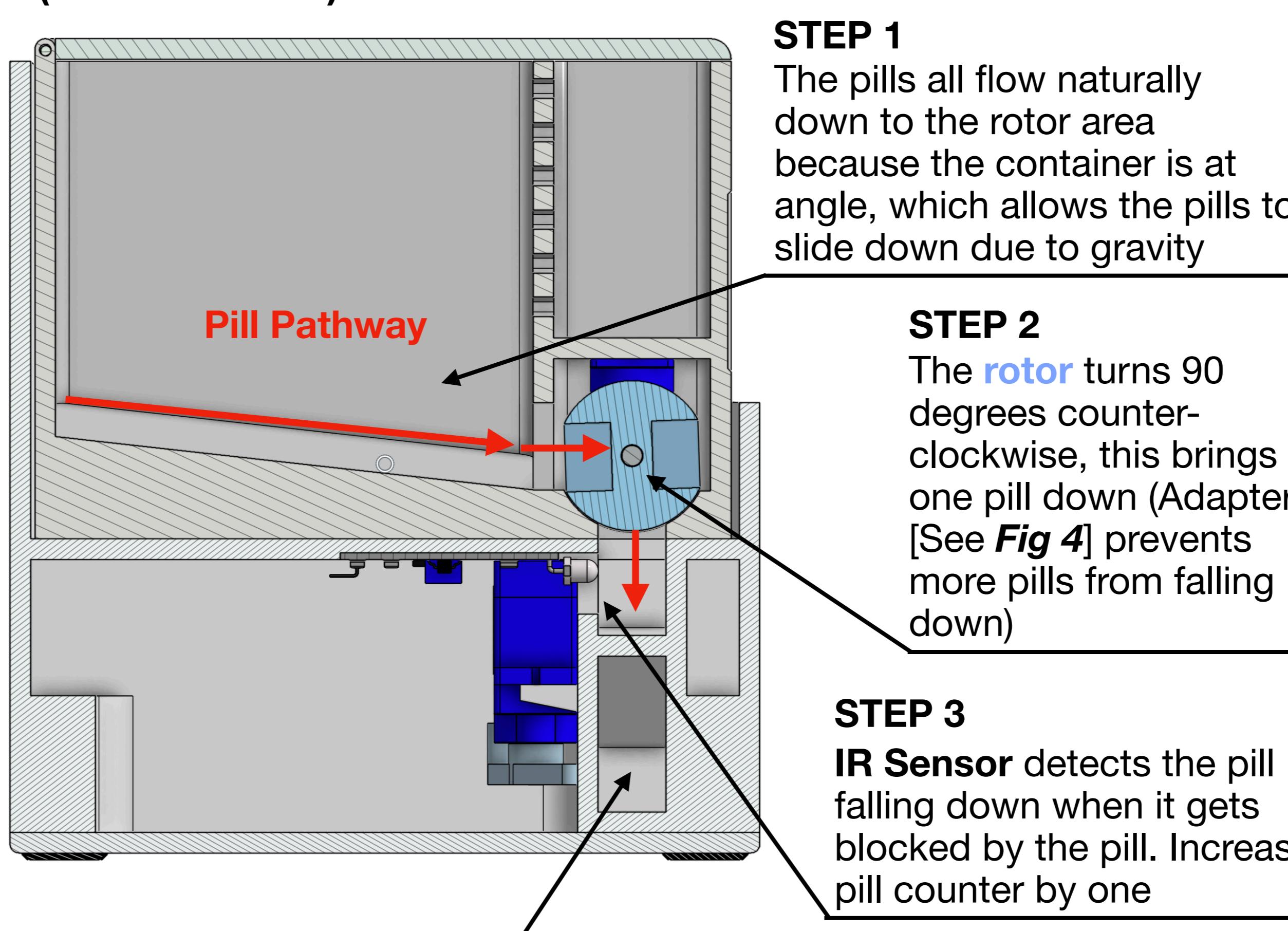
## References

- [1] <https://tinyurl.com/26yduew5>
- [2] <https://tinyurl.com/34eynpuf>
- [3] <https://tinyurl.com/5fhmf4r5>
- [4] <https://wellnessresourcesupport.com/tools/hero-pill-dispenser/>
- [5] <https://gomirraabkuserz14.web.core.windows.net/engineering-life-cycle-diagram.html>

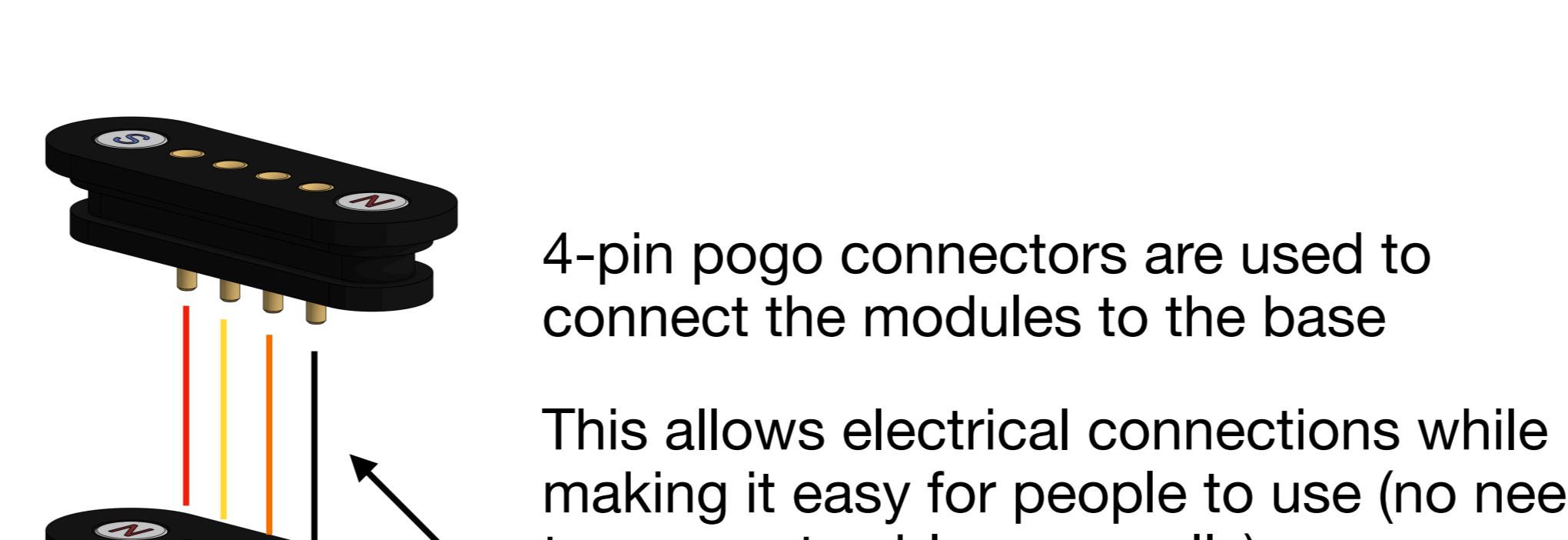
## EXPLODED VIEW (REALISTIC)



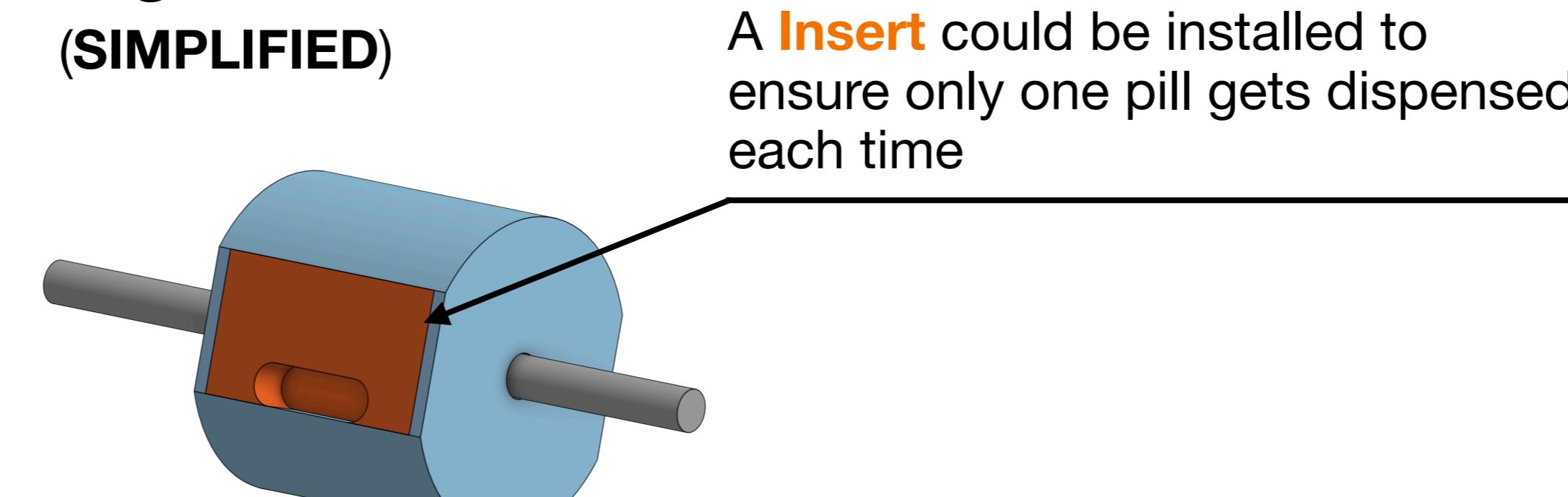
**Fig 1**  
(SECTION VIEW)



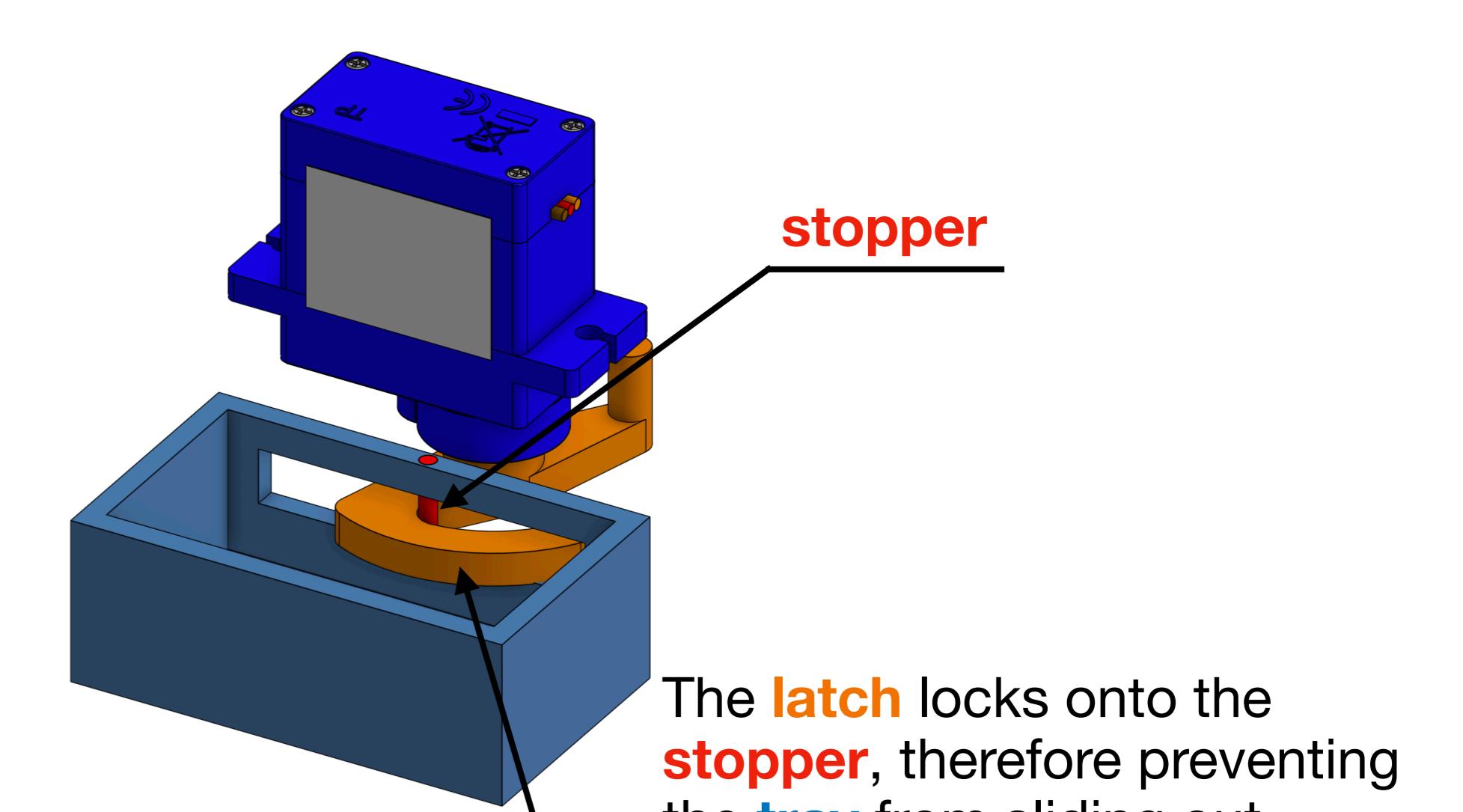
**Fig 3**  
(SIMPLIFIED)



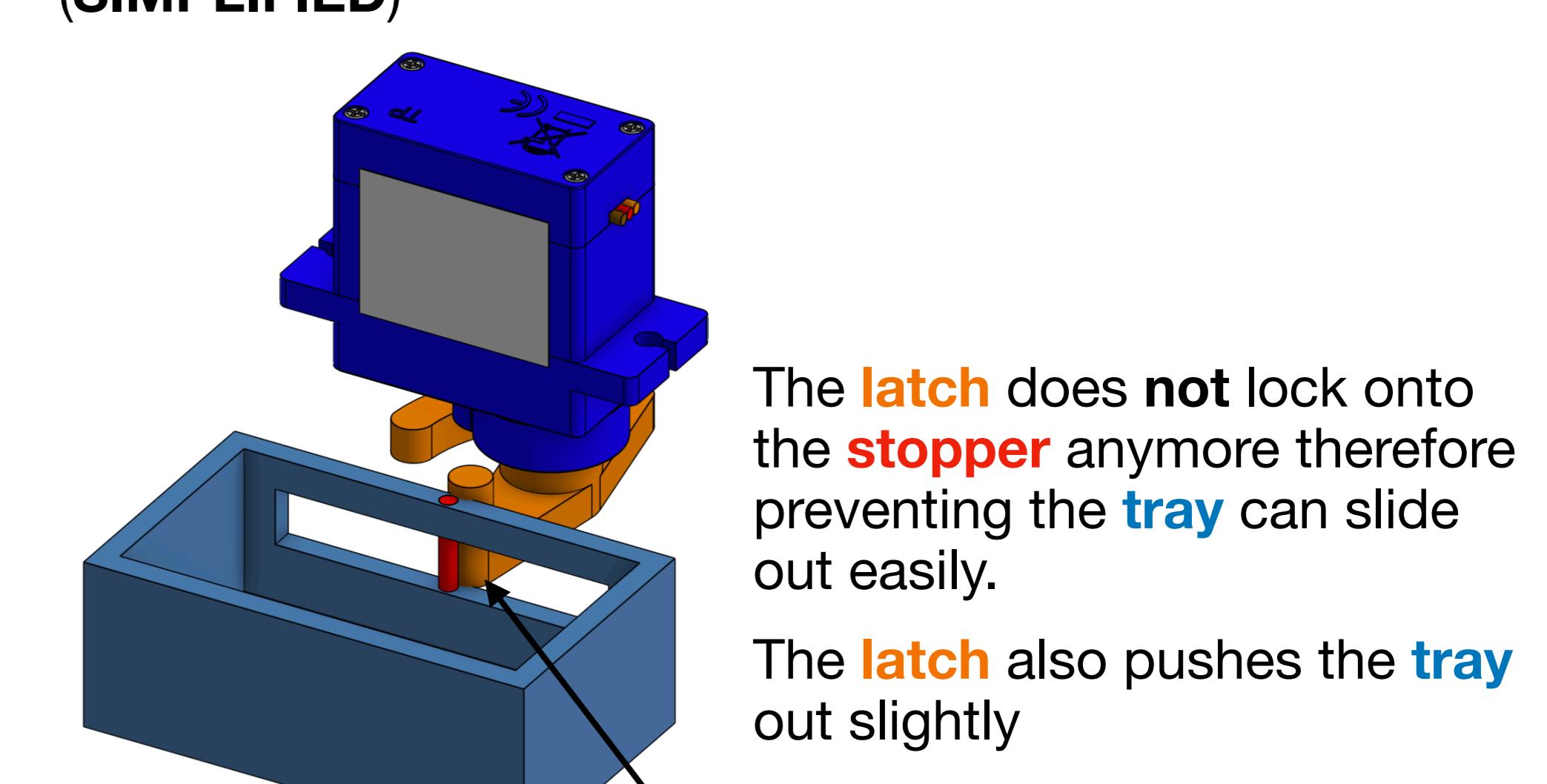
**Fig 4**  
(SIMPLIFIED)



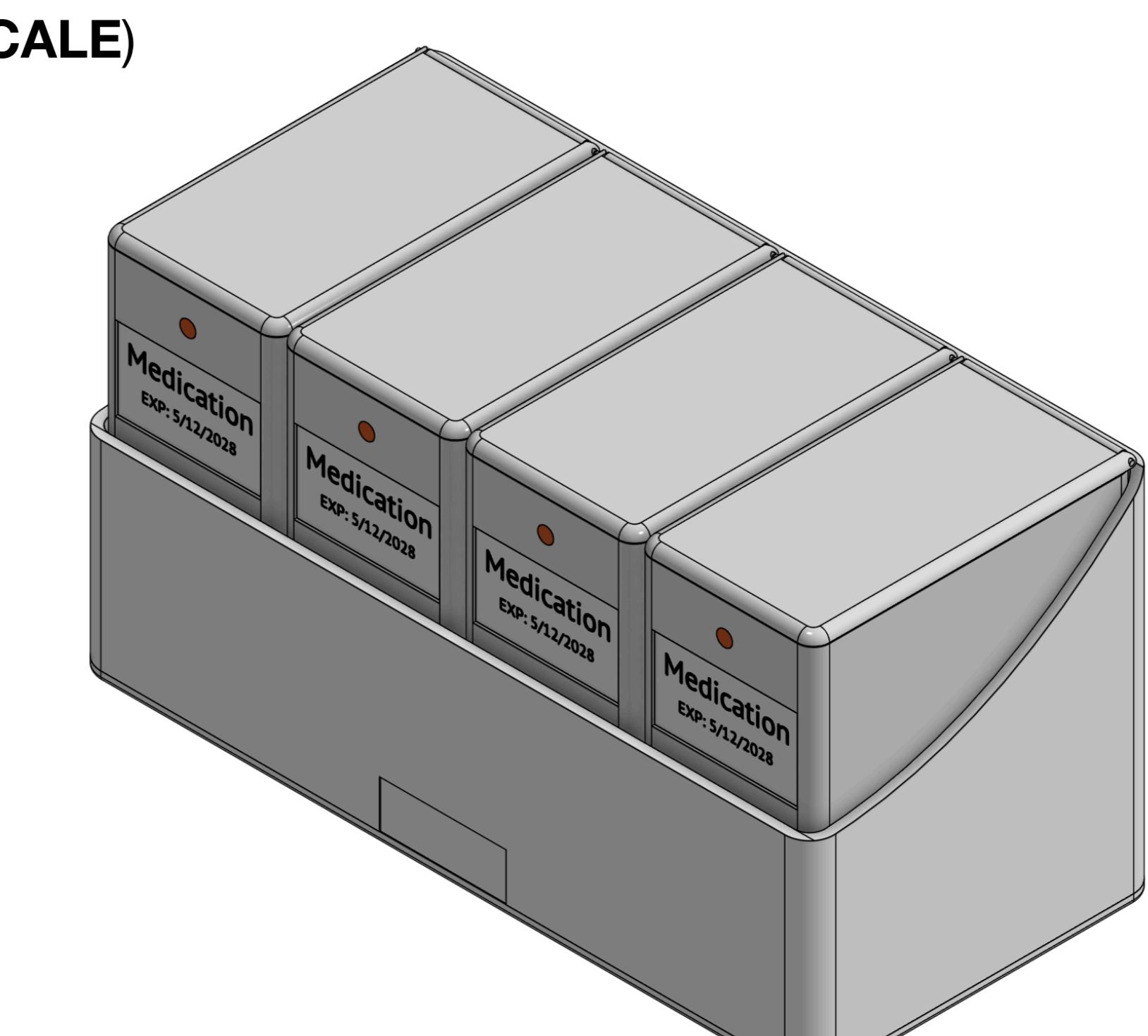
**Fig 2.1 - Lock Engaged**  
(SIMPLIFIED)



**Fig 2.2 - Disengaged**  
(SIMPLIFIED)



**ISOMETRIC VIEW**  
(NOT TO SCALE)



UNLESS OTHERWISE SPECIFIED,  
DIMENSIONS ARE IN MILLIMETERS

ANGULAR = ± 0.02°

SURFACE FINISH ✓

DO NOT SCALE DRAWING

BREAK ALL SHARP EDGES AND REMOVE BURRS

FIRST ANGLE PROJECTION

MATERIAL

FINISH

N/A

DRAWN

CHECKED

APPROVED

NAME

SIGNATURE

DATE

TITLE

SIZE

DWG NO.

REV

NATHAN Y

Nathan Yin

2025-12-10

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2025-12-11

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2025-12-11

Automatic Medication Dispenser

No. 0008

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1 of 1

WEIGHT

SHEET

1