

# Pill Pal

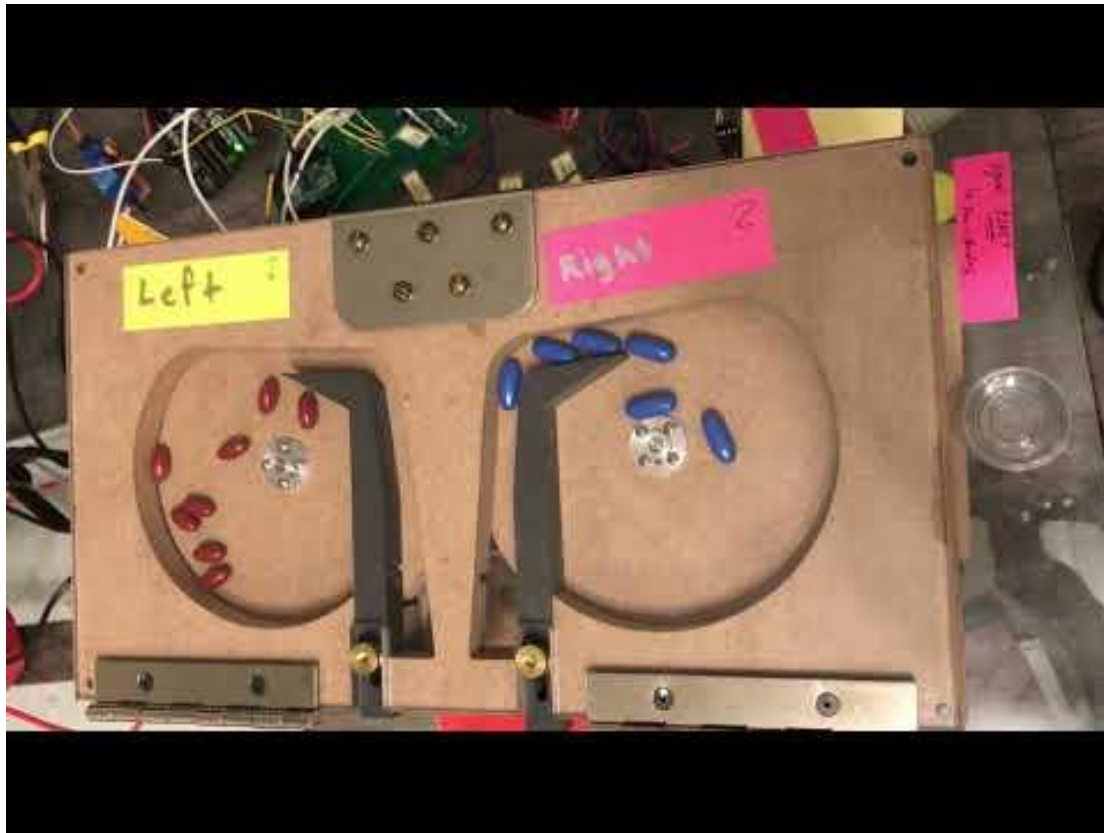
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# Introduction

- Remotely controlled Pill dispenser
- 2-person system:
  - Caretaker
  - Patient
- Pill dispenser unit and remote care web server

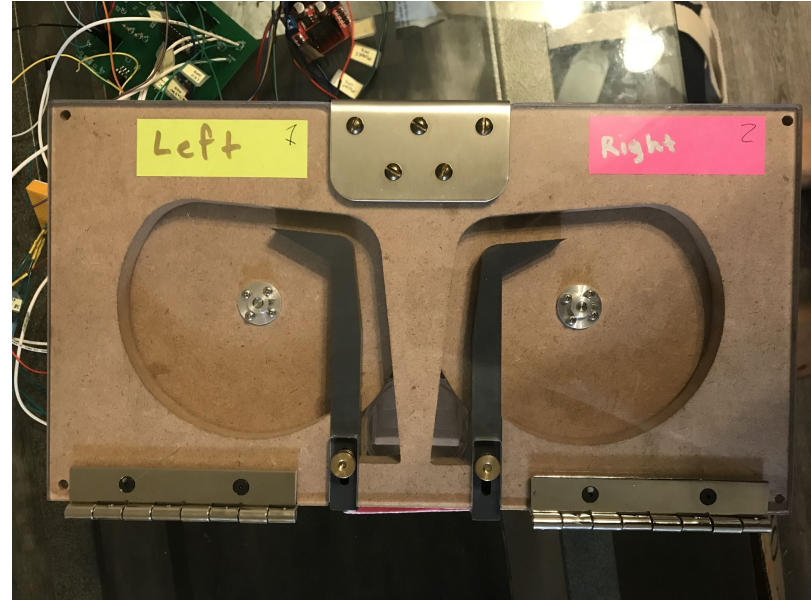
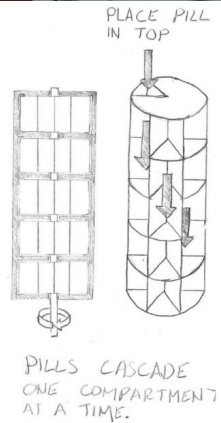
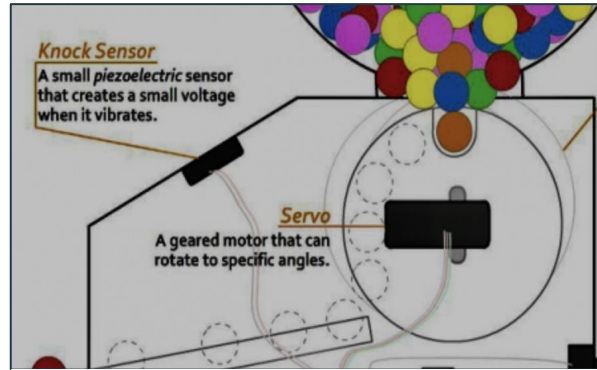
# Objective

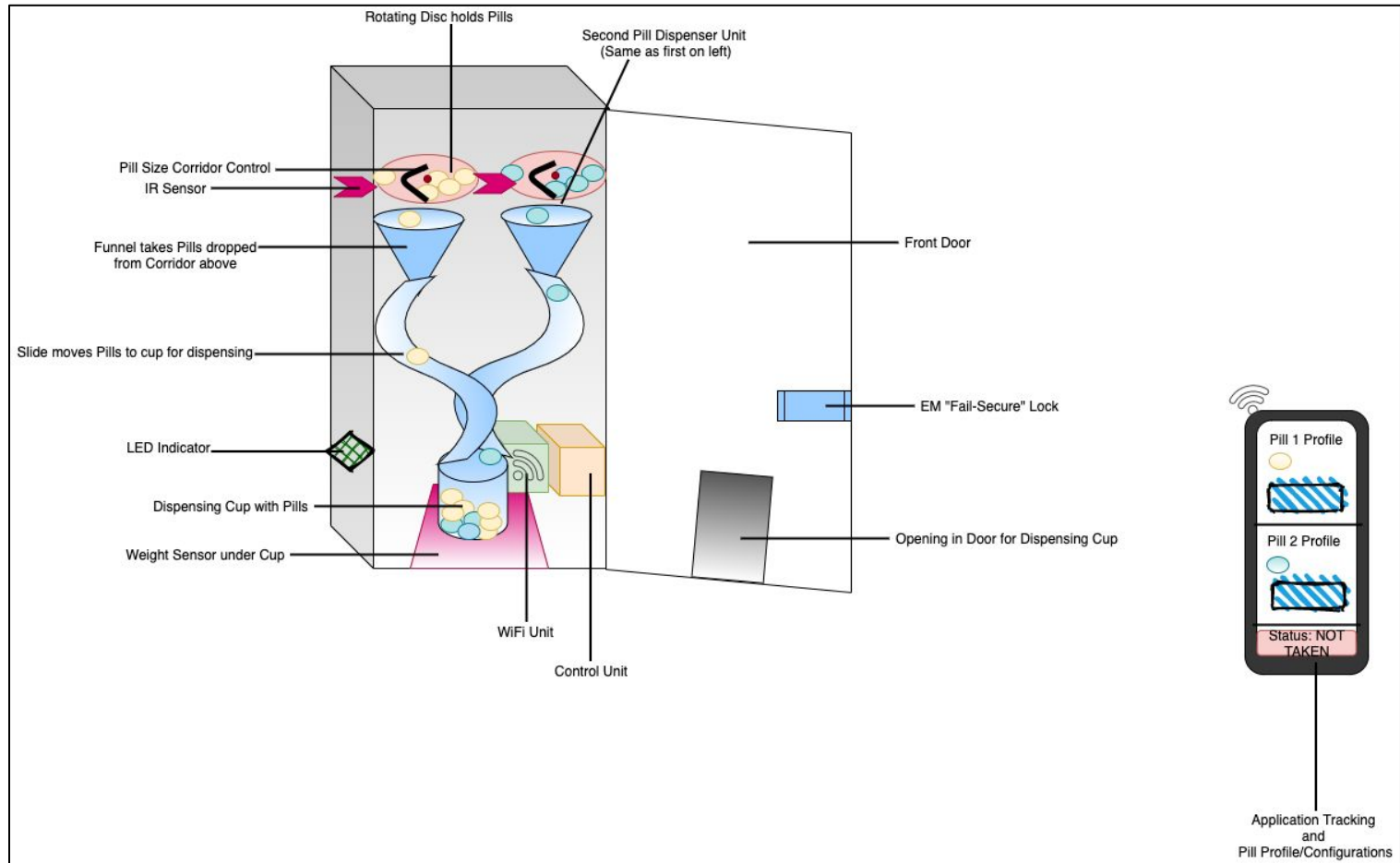
- Control of medication taken by schedule
- Track whether pills have been taken
- Dispense at least two types of pills at various times



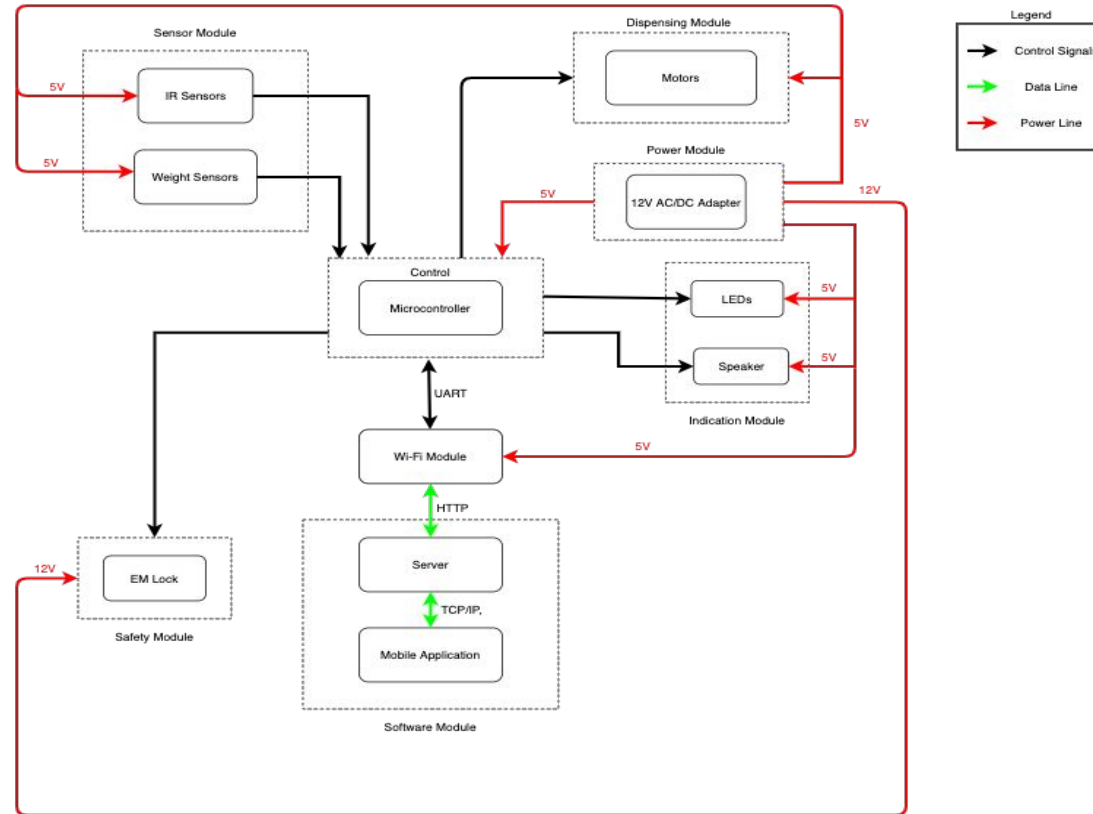
Video Demonstration of Pill Pal

# Iterations of Mechanical Design

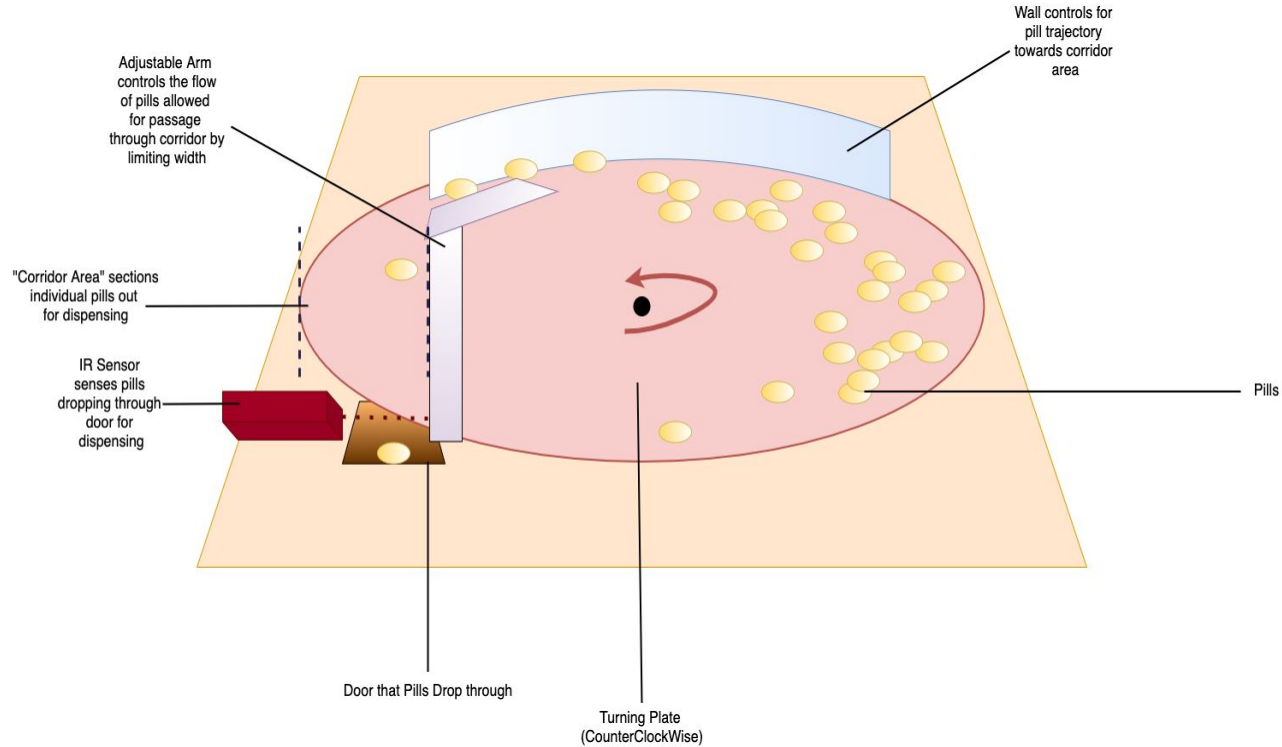




# Block Diagram



# Physical Design: Motor & Disc



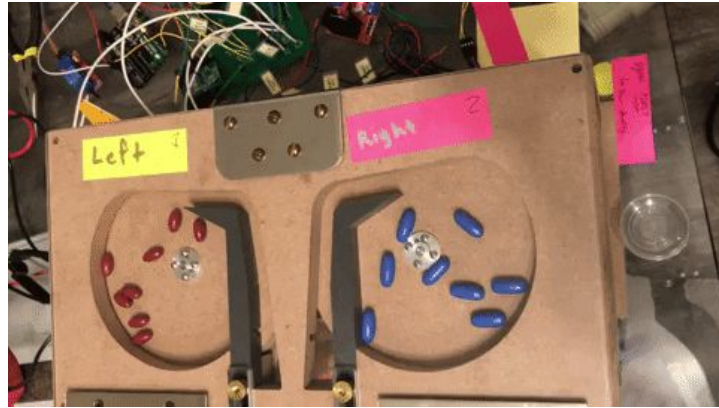
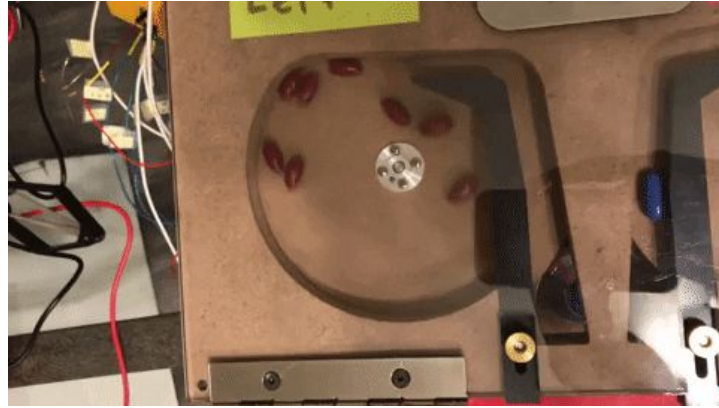




Physical Design of Disc, Arm, and Location of IR sensors

# Motors

- Stepper over DC
- Rotation precision
- Pushes pills outward
- Immediate stop
- Works well with IR sensors



# IR Sensor and Emitter

- Tested many types
- Break beam with larger bulbs are the most accurate
- 0.7V to 0V change
- Single digital output to microcontroller

IR Sensor	Low	High
TSL237S-LF	-	No output in DC and AC
TSOP34438	-	0.7
SEN-0042	3.4	3.7
Adafruit 3mm Break Beam	0	1

Table 1: IR Sensor Testing



# Motor + IR Sensors Testing

- Motor code is “blocking”
  - Small steps
- Motor has capability to step in both directions, clockwise and counterclockwise
- IR sensor accurate with small steps (4 >= incremental movements)

```
if (PILLCOUNT_1 != 0x00 || PILLCOUNT_2 != 0x00){  
    if (PILLCOUNT_2 > 0) {  
        sensorState2 = digitalRead(SENSORPIN_2);  
        if (sensorState2 == LOW) {  
            PILLCOUNT_2 -= 1;  
            delay(500);  
  
            if (PILLCOUNT_2 <= 0) {  
                Serial.println("Waiting for next motor");  
                delay(2000);  
            }  
  
        } else {  
            if (PILLCOUNT_2 <= 0) {  
                motor2.step(0);  
            } else {  
                motor2.step(2);  
            }  
        }  
    }  
}
```



Graph 1: Percentage Success of Specified Pills Dispensed Based on Motor Step

# WiFi Chip + Web Server

- ESP8266-01
- Capabilities:
  - Web Server
  - Time Retrieval
  - Read and Write User Input on SPIFFS
  - Write data to Web Server
  - UART Serial Communication with Microcontroller





# Load Cell

- CZL639HD load cell
  - 0g - 100g
- HX711 load cell amplifier
- Change in weight values
- Accurate
  - Tare
  - Amplification factor
  - Threshold value

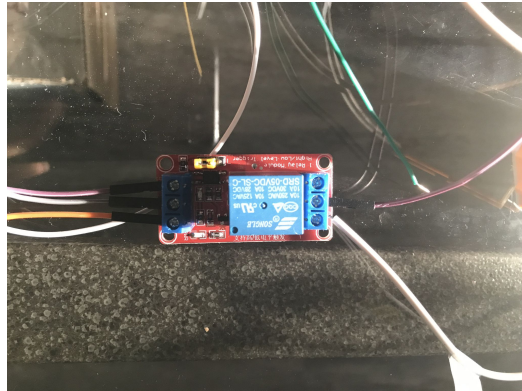


Blue Pill	Weight	Red Pill	Weight
1	6.40	1	3.51
2	6.41	2	3.50
3	6.39	3	3.51
4	6.42	4	3.45
5	6.38	5	3.48
6	6.38	6	3.48

Table 2: Pill Weight on Load Cell

# Lock

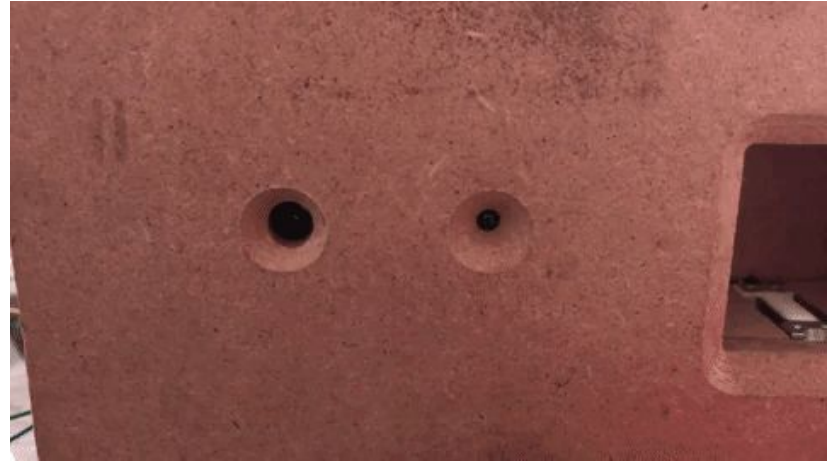
- EM Solenoid Lock
  - Solenoid retracts when 9-12v are applied
- “Fail-Secure”





# Indications - Buzzer + LED

- Indicate when pills dispensed
- Also when pill cup removed from box
- Piezo buzzer and Green LED



# Challenges

- UART Serial connection difficulties
- Testing and reordering components
- PCB designing and testing
- Physical issues with motor

# Strength & Weaknesses

- Accuracy is about 75%
- Pill dispensing at specified times
- Easy input for dosage and schedule information
- Dispenser opens only by command of caretaker
- Sometimes extra pills dropped or failed to drop, skewing ir readings
- Oblong pills worked best with IR
- Motors don't work simultaneously

# Conclusion

- Successfully tested modules, integrated modules
- Both motors are functional with I/O control
- Future work:
  - More robust mobile application for caretaker interface
  - Integrate more dispensing units
  - Tighter control for different size and shape pills



Thank You