



RERC: Accessible Pill Cutter/Dispenser

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Abstract

Currently, errors in medication administration and compliance are persistent problems in home medication. The goal of our project is to create a combined pill dispenser and cutter that is capable of administering set dosages of pills and half pills on a preprogrammed schedule. Over the course of a semester, we designed and built one module of our pill dispenser which will be used as a template for our final design.

Problem Statement

The goal of our project is to create a combined pill dispenser and cutter that is capable of administering set dosages of pills and half pills on a preprogrammed schedule. Our device must also alert the patient when a pill has been dispensed and off-site medical personnel if dosages have been missed.

Motivation

- Errors in medication administration & compliance (1)
- Polypharmacy is common for elderly and disabled population (3)
- Prescriptions are becoming increasingly expensive

Background

Current Pill Dispensers:

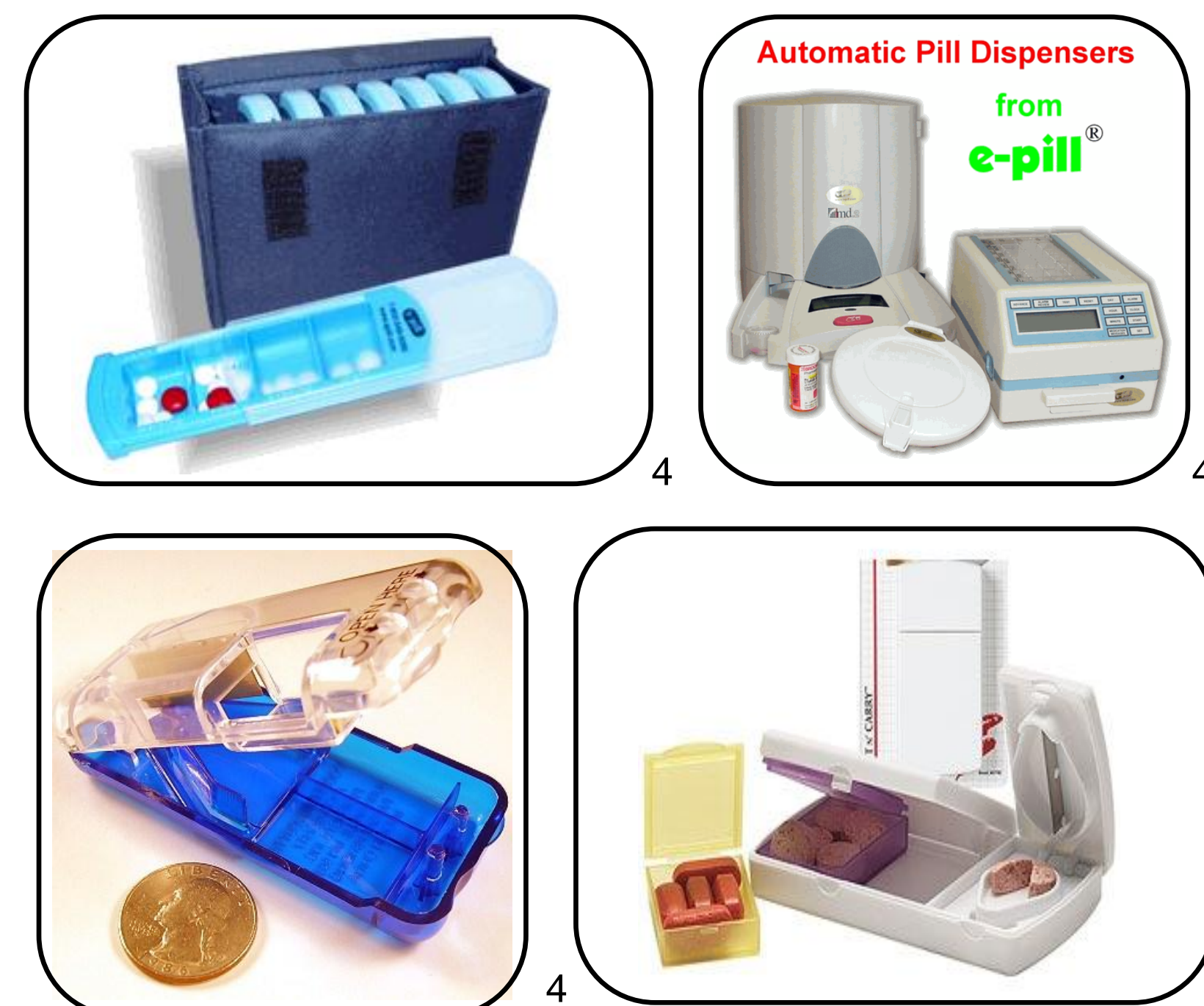
- Either expensive or inadequate
- No pill dispensers cut
- Not all can monitor ingestion or alert caregiver when dose is missed

Current Pill Cutters:

- Small, hand held devices
- Uniform cutting not guaranteed
- Work only for certain pill shapes/sizes/compositions
- Cost-effective

Accessibility:

- Must adhere to ADA specifications (2)
- Should be operable by persons with multiple, varying disabilities (sensory-motor, physical, & cognitive)
- Should eliminate disability-associated barriers



Design Criteria

- Accurately Dispense Multiple Medications
- Moderately Priced
- Dispense Varying Doses
- Precisely Cut Pills in Half
- Functional for Home or Clinical Environment
- Medication Alarm System
- Record Medication History
- Accessible Device

References

1. Osterberg, Lars, and Terrence Blaschke. "Adherence to Medication" *Drug Therapy* 353: 487-497.
2. "Americans with Disabilities Act Homepage". <<http://www.ada.gov/>>. Oct 2, 2007.
3. Salzman, C. "Medication Compliance in the Elderly." *J Clin Psychiatry* 56 (1995): 18-22.
4. "E-pill Medication Reminders". <<http://www.epill.com/>>. 2004.
5. Actuators-Solenoids <www.societyofrobots.com/images/actuators_solo...>. 2007

Special Thanks To...

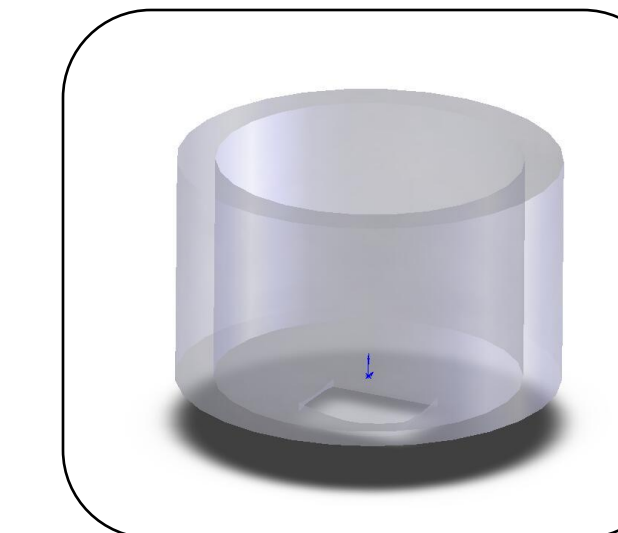
Professor Naomi Chesler, Professor Mitch Tyler, Professor Willis Tompkins, Andy Mulder, and Tom Yen

Final Design

Pill Dispensing

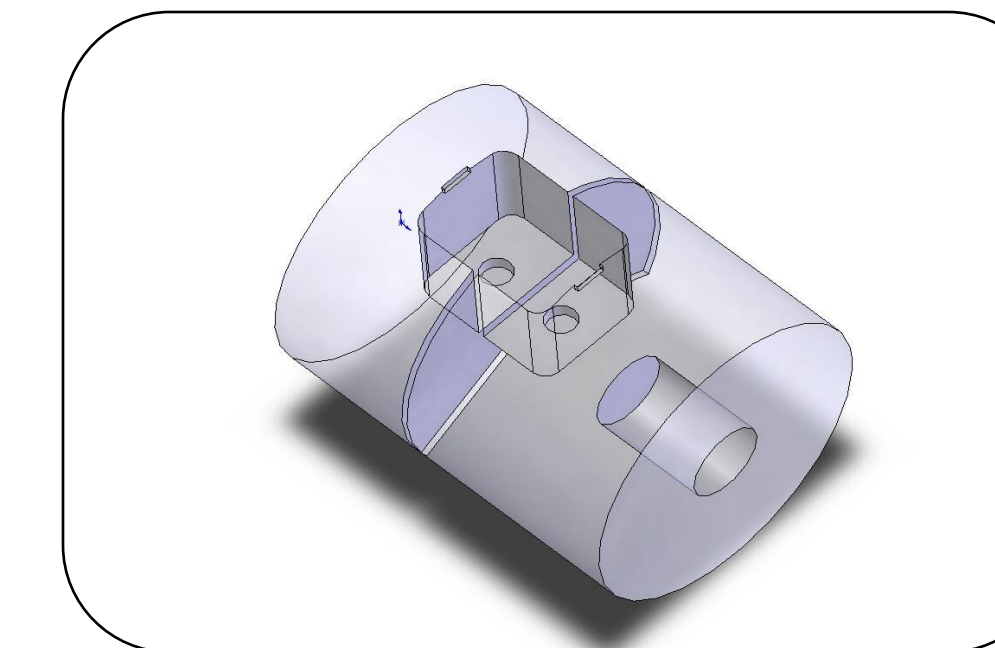
Pill Funnel

- Directs pills to pill drum



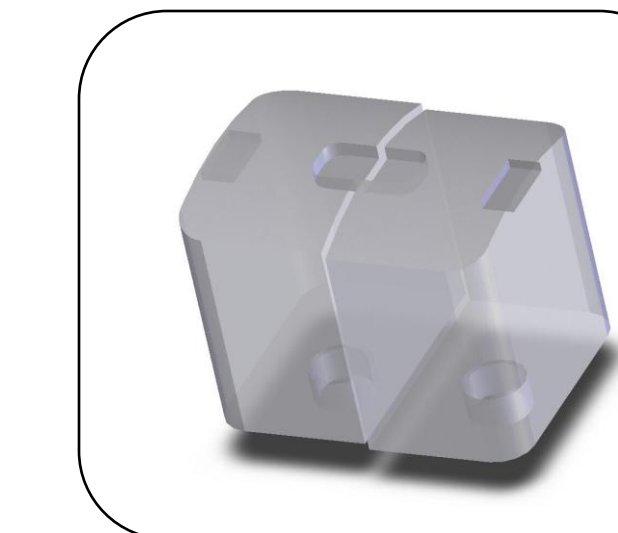
Pill Drum

- Slot for interchangeable inserts
- Slit for pill cutting
- Tapped inset to attach to motor



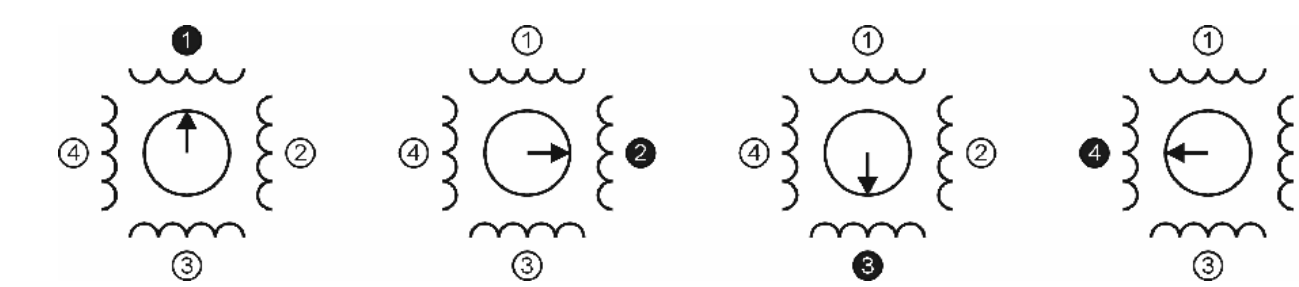
Pill inserts

- Accommodates different sizes & shapes
- Securely fastened to pill drum



Stepper Motor

- Used for rotation of the pill drum
- Hold any defined position
- Rotates either forward or in reverse
- Little input power required



Specs:

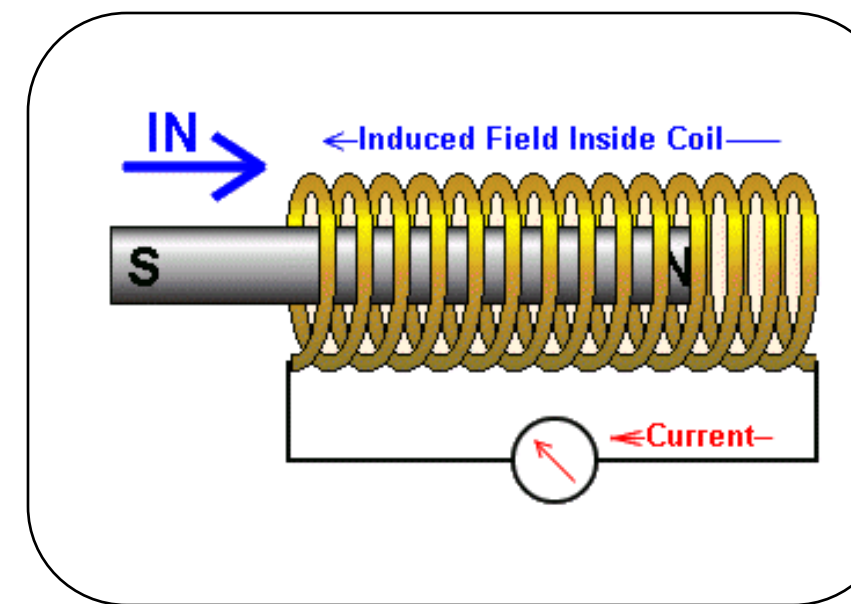
Rated Voltage: 12 VDC
 Rated Current/Phase: 259 mA
 No. of Phase: 4
 DC Coil Resistance: 50 Ω/ phase ±7% (100 Ω / coil)
 Step Angle: 7.5° / phase
 Excitation Method: 2-2 phase (unipolar)



Pill Cutting

Solenoid

Push style used to cut pill in drum
 Activated by a simple on or off switch



Specs:

Rated Voltage: 12V DC
 Max Force: 80 oz
 Rated Current: 1.2 A
 Max Stroke: 1 in
 10 Watts

Force Tests

	Shape	Pill Position	Applied Force (lbs.)	Resultant Force (lbs.)
Calcium Antacid Tablet	Circular	2	2.5	4.64
Glucosamine	Elliptical	2	5	9.29
Chondroitin				
Naproxen Sodium	Circular	1	2.5	5.41
SunVite	Elliptical	2	5	9.29
Calcium 500 + D	Elliptical	3	2.5	4.06
Advil (glossy coating)	Circular	1	5	10.8
Walgreens Multivitamin	Circular	1	1.25	2.71
Target Acetaminophen	Elliptical	2	5	9.29
Tylenol (ES)	Circular	1	5	10.8

Maximum force = 10.8lbs Average force = 7.37lbs

Parallax Basic Stamp 2 Microcontroller

- Control center
 - Contains processor, memory, clock, and interface
 - Directs actions of stepper motor, solenoid-blade apparatus, and eventual sensors
 - Programmable with Basic Stamp Editor using PBASIC language
- Specs:** Uses 5 – 15 Volt DC Source, 20 MHz processor speed (~4000 instructions/second) , 20mA source/ 25mA sink per I/O pin

