CHAPMAN UNIVERSITY

Reinventing the Pillbox

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GCI Grand Challenge - Alan Lu, Dominic Carosso, Thomas Ogawa, and Yuna Kim

Problem

Accidental poisonings occur when children access unsecured pillboxes and mistake medicattions for candy[1].

Traditional pillbox designs, such as "Monday-thru-Sunday" pillboxes, are too easy for children to open[2].

With a more secure pillbox design, access to medication can be more safely regulated.

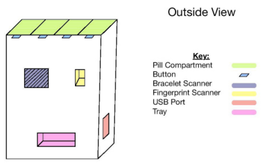
Solution

- Create a "smart" automated pill dispenser that communicates with a bracelet.
- It only dispenses pills when bracelet scans a RFID tag & it's right time
- RFID is a system that can read data without contact, using radio waves[3].
- It's easy to use dispenser with one scan, if caregiver sets up the dispenser

Why does it matter to patients:

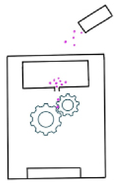
- Easier to manage medication
- Prevent potential accidents of child poisoning

Design



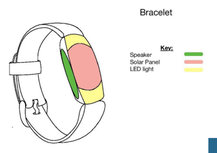
Pillbox Outside Design

- RFID scanner that checks for correct time for dispensing pills
- Pill compartment that stores different kinds of pills



Pillbox Inside Design

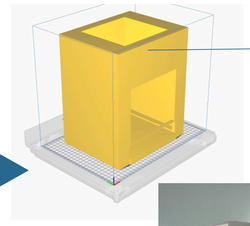
- Gears that allocate single pill. Only turns on the correct time.



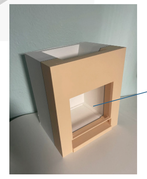
Bracelet Design

- Verifies user & time when scanned to dispenser

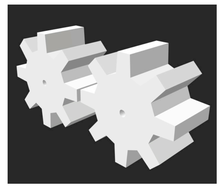
Prototype 1.0



Pyramidal funnel for pills to slide down

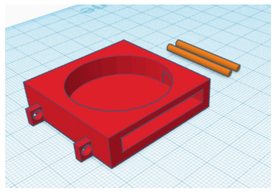


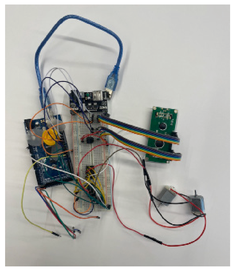
Hole for putting & taking out compartments while testing



- Printed out gears for dispensing individual pills
- Wired dc motors in Arduino
- Coded scheduler for dispensing pills

Prototype 2.0

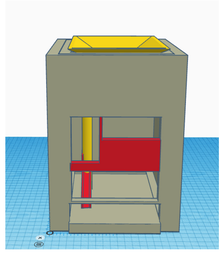


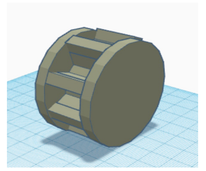


Improvements

- Designed RFID housing for bracelet.
- Designed chute to add supports for motors inside the dispenser, LED screen and RFID scanner in front of the dispenser.
- Added RFID scanners and LED screen in Arduino.
- Coded & tested each Arduino component separately.

Prototype 3.0





Improvements

- Added real time clock.
- New design for dispenser housing and gears.
- Changed from dc motor to stepper motor.
- Brought together separate codes for Arduino.

Product Comparisons

Wellness Pharmacy

Pros:
- Prepackaged & set up by medication manager
- Alarm
- Secure (Face recognition or PIN)

Cons:
- Inconvenient when patients are far away from the dispenser

Medikyu Single

Pros:
- Alarm
- Easy to carry

Cons:
- Can be lost
- Not secure
- Only one type of pills

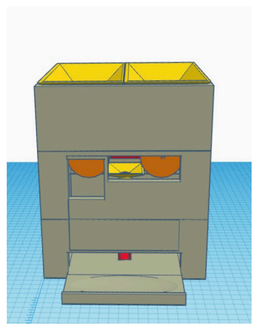
Hero Health

Pros:
- Prepackaged
- Alarm

Cons:
- Not secure (one button dispenses pills)

Results

We designed and built a smart pill dispenser that provides security using RFID scanner with a bracelet. We focused on how to maximize the security of the dispenser while making it simple enough for any user to easily use our product. This prototype design would thus enable households to regulate access to medication while significantly improving child safety.



Improvements

- Allow multiple kinds of pills
- Notify through bracelet
- More security with fingerprint or face recognition
- Pre-processing (setting up)/manager from pharmacy can add convenience to patients
- Smart phone apps and smart watch apps

Literature Cited

1. 5 Things to Know About Kids and Medicine. Safe Kids Worldwide. https://www.safekids.org/infographic/5-things-know-about-kids-and-medicine. 2. Budnitz DS, Lovegrove MC, Geller RJ. 2020. Prevention of Unintentional Medication Overdose Among Children: Time for the Promise of the Poison Prevention Packaging Act to Come to Fruition. JAMA. 324(6):550–551. doi:10.1001/ jama.2020.2152. 3. What is RFID?｜Technical Information of automatic identification｜DENSO WAVE. https://www.denso-wave.com/en/adcd/fundamental/rfid/rfid/index.html.

Acknowledgements

We would like to give a special shoutout to our wonderful Chapman Professors who helped us throughout our GCI Program: Dr. Shana Welles, Dr. Brenna Gormally, Dr. Bingjie Zhang, and Dr. Brian Hoover. We would like to thank Lisa Hisamura for her assistance with the poster graphic design. We would also like to thank program director Dr. Gregory Goldsmith. Additionally we want to thank our Sponsor Johnson & Johnson, especially Vice President of J&J Innovation Sanjay Mistry.