EZ MED:

Pill Dispensing Apparatus to Improve Medication Adherence Among Patients with Symptoms of Dementia

Emily N., Darren P., Paul Z., Derek N., Ori G., Mitchell U.

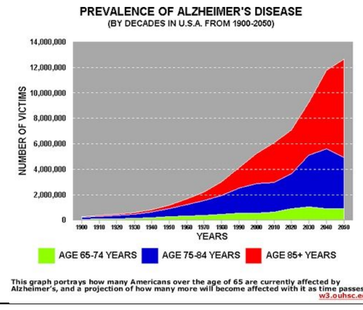
Grand Challenge:

The Grand Challenge our group chose to face this semester is to improve medication adherence among patients with cognitive impairment causing memory loss. Our solution to this grand challenge was to create a pill dispensing apparatus that will dispense medication on a fixed time interval. Our compact design allows the user to fill the dispenser with a weeks worth of medication and inform the user if their medication has already been administered. We believe our pill dispensing apparatus will improve the rate of daily medication adherence in patients with symptoms of dementia and potentially allow users to live independently without the need of a caretaker.

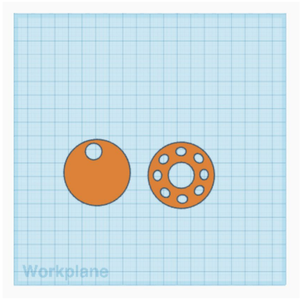
Introduction:

Hopefully, the idea exceeds standard expectations and expands towards other audiences, such as daily nutrition fields. Since our grand challenge requires medical knowledge as well as technical skills to create the physical design, our team has been able to code the machine program, design the dispenser model, and account for other medical measures.

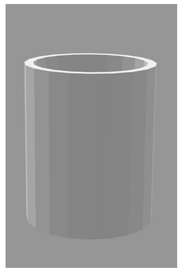
- Predicted 13.8 million Alzheimer's patients in 2050 [5]
- Study shows an increase in rate of diagnosis of Alzheimer's with age[4]
  - 10% of adults in their 40s
  - 30% of adults in their 50s
  - Varying rates for the elderly
- In adults of 65+ years, 50% adhere to medication regime properly[1]
- There is sufficient evidence to suggest that improper medication adherence can result in an increase in direct and indirect healthcare costs[2]
- Data Science, Computer Science, Biochem combined to create pill dispenser prototype
  - 3D printed casing
  - Used arduino board to prototype (hardware and software)



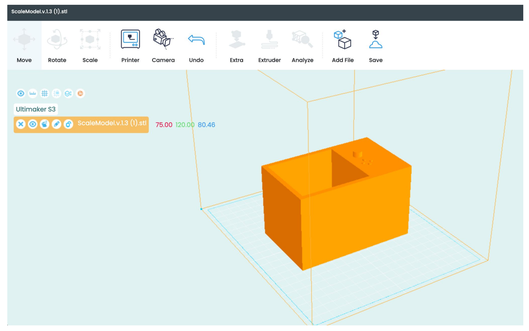
Design Process:



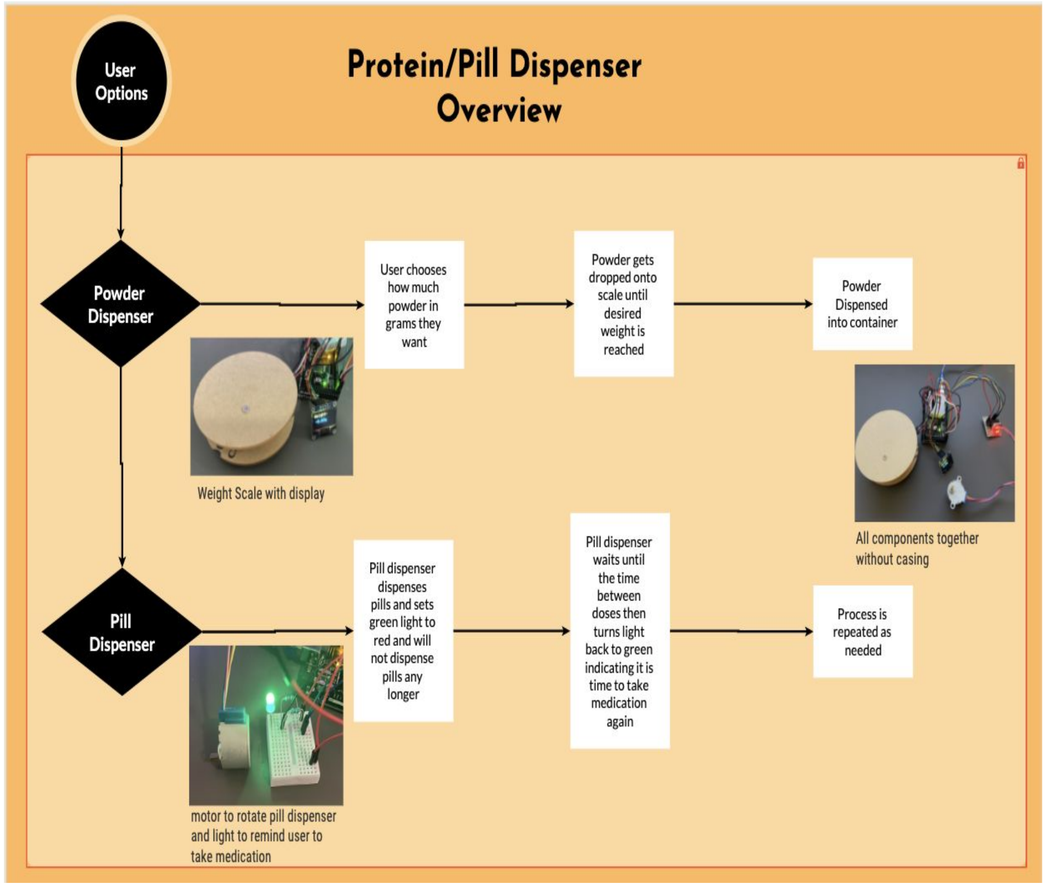
Pill Dispensing Wheel Design on TinkerCad



STL file of model cup



3D Printed Model of the box using 3DPrinterOS



Future Improvements

- Make a portable version for travel
- Increase the capacity of the dispenser
- Make an app that connects to the product and updates the user as necessary
- Improve the design by using higher quality material and making it more aesthetically pleasing
- Add specialized assistance for certain users

Acknowledgements:

- Maker Space: Allowed us to 3-D print models for dispenser
- Dr. Hoover: Ran oversight on project and gave insight when our group faced an obstacle
- Fund: Arduino kits for engineering aspect of grand challenge

Conclusion:

- Encourages users to hit daily nutritional goals
- Efficiently practices reliable medication ingestion
- Can target outside of Alzheimer's patients (anyone who struggle with nutrition/medication consumption)
- Simple designs translate to easy device management

Through our team's deep knowledge in medicine and engineering, we hope our passion for change will reach those who need it.

Work Cited:

(1) Hayes, T. L.; Larimer, N.; Adami, A.; Kaye, J. A. Medication Adherence in Healthy Elders: Small Cognitive Changes Make a Big Difference. *J Aging Health* **2009**, *21* (4), 567–580. https://doi.org/10.1177/0898264309333836.

(2) Malek, N.; Grosset, D. G. Medication Adherence in Patients with Parkinson's Disease. *CNS Drugs* **2015**, *29* (1), 47–53. https://doi.org/10.1007/s40263-014-0220-0.

(3) Ant, S.; Lindner, R.; Rösler, A.; von Renteln-Kruse, W. Adherence to Medication in Patients with Dementia. *Drugs Aging* **2008**, *25* (12), 1033–1047. https://doi.org/10.2165/0002512-200825120-00005.

(4) Strydom, A.; Shooshtari, S.; Lee, L.; Raykar, V.; Torr, J.; Tsiouris, J.; Jokinen, N.; Courtenay, K.; Bass, N.; Sinnema, M.; Maaskant, M. Dementia in Older Adults With Intellectual Disabilities—Epidemiology, Presentation, and Diagnosis. *Journal of Policy and Practice in Intellectual Disabilities* **2010**, *7* (2), 96–110. https://doi.org/10.1111/j.1741-1130.2010.00253.x.

(5) Hebert, L. E.; Weuve, J.; Scherr, P. A.; Evans, D. A. Alzheimer Disease in the United States (2010–2050) Estimated Using the 2010 Census. *Neurology* **2013**, *80* (19), 1778–1783. https://doi.org/10.1212/WNL.0b013e31828726f5.