TRACI TRUMEDICINES SMART PILL PACK DISPENSER

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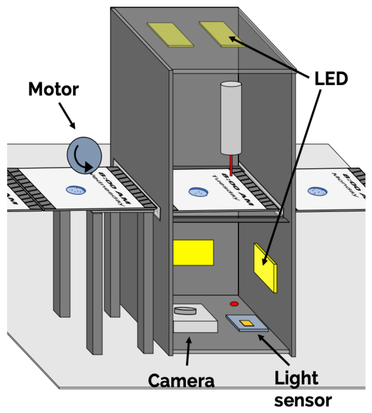
Introduction

Project:

- Create a pill pack dispenser to improve medication adherence and verify pill authenticity
- Track medication on individual pill level
- Track medication using machine learning and unique pill speckle patterns

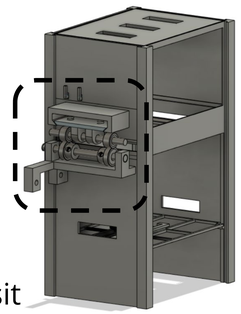


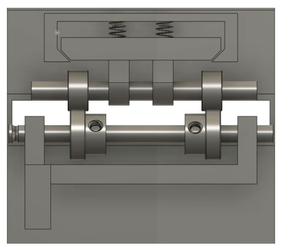
Goals:

1. Reliably move pill packs
2. Detect perforations between pill packets
3. Segment pills
4. Identify pills

1. Moving Pill Packets

- Pill packets are pinched between drive rollers and passive rollers
- Passive rollers are on is spring loaded shaft to keep pressure on pill packets between the drive and passive rollers

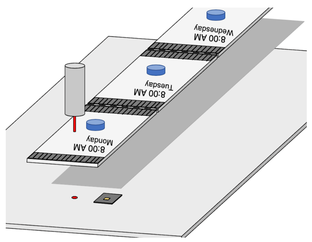


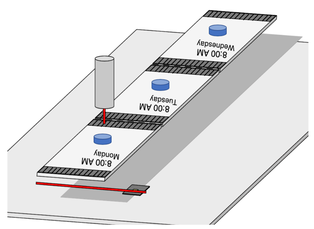


- Drive rollers sit on a shaft that is spun by a stepper motor to provide consistent movement to pill packets

2. Perforation Detection

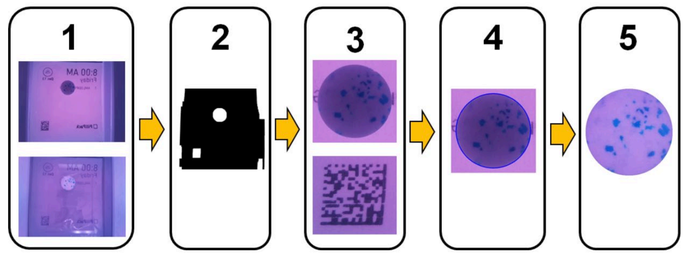
- Uses laser beam and light sensor to detect changes in light
- Laser beam creates a distorted horizontal line as it approaches the perforation
- Detecting an increased brightness allows us to identify perforations





3. Pill Pack Segmentation

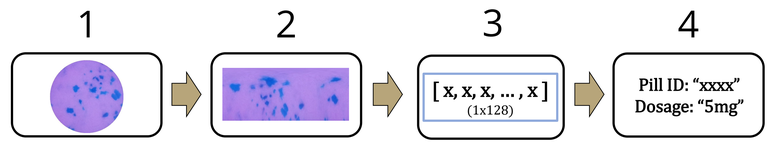
1. Take dark (backlit) and bright (front lit) photos
2. Find extents of pill and QR code using computer vision algorithms
3. Crop out pill and QR code
4. Find circles in pill image
5. Crop out pill face from bright image



4. Pill Identification

Pills are identified using several methods:

- QR code scanning
- Brute force comparison of pixel values
- Encoder-decoder neural network (depicted below)



1. Original pill image
2. Flatten image by converting to cartesian coordinates to polar coordinates
3. Pass through trained encoder model to produce compressed (1 X 128) representation
4. Compare encoded number against those in the pill database to find closest match

Conclusion

Our pill pack dispenser shows a reliable method for medication dispensing and pill tracking. This product can be used in healthcare facilities to free up extra staff or in elderly homes to maintain medication adherence.

Future Recommendations:

1. Improve movement of pill packs
2. Improve recognition
   a. Gather more training data for machine learning model
3. Improve quality of images
   a. Decrease glare with filters
   b. Flatten pill pack

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