Home Opioid Patient-Controlled Analgesia (PCA) Box

Team 11 Recovery Improvement Interactive Technologies (RIIT)
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Sponsor Seattle Children's Hospital & The University of Washington
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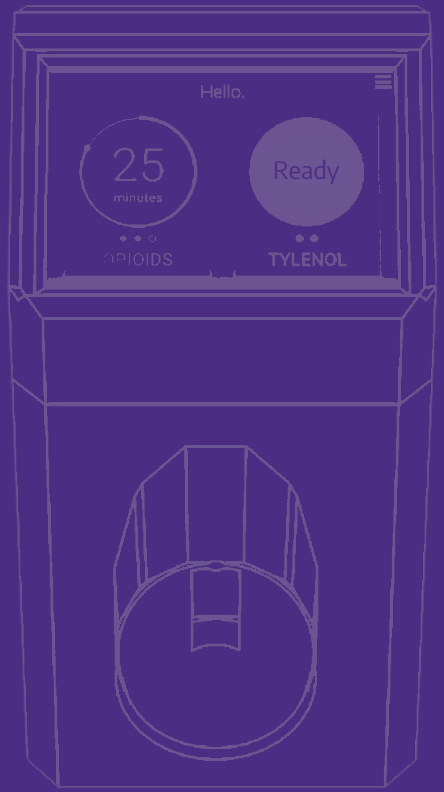


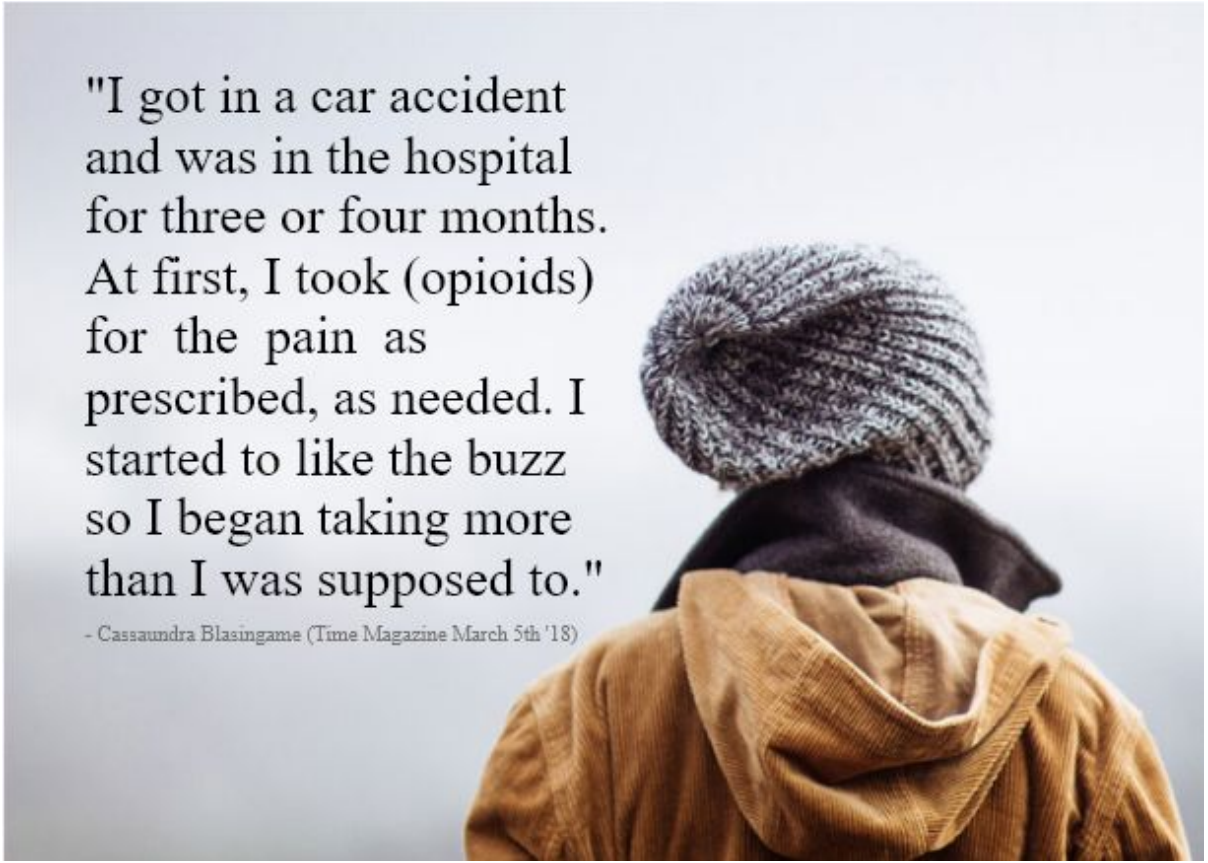
Milestone 4 **Iterate** (May 21)

HUMAN CENTERED DESIGN & ENGINEERING
UNIVERSITY of WASHINGTON

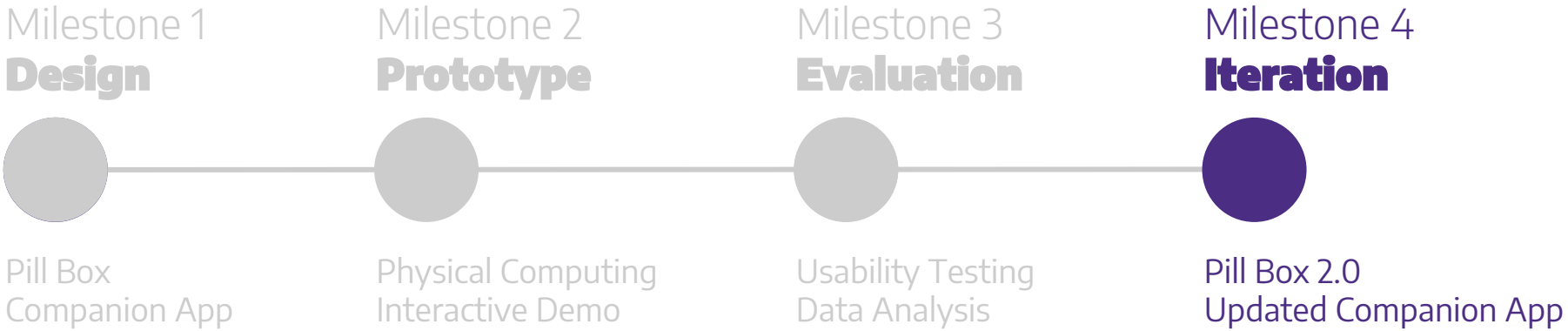
Project Overview

Opioids provide necessary pain relief to postoperative patients. However, opioids can be addictive, dangerous, and are often subject to misuse. Our project, an in-home oral Patient-Controlled Analgesia (PCA) box, will address these issues by providing patients with the guidance they need to manage their pain effectively during their postoperative recovery.

Our team will be researching, designing, prototyping, evaluating, and iterating a Patient-Controlled Analgesia (PCA) device and companion app that monitors and manages opioid prescriptions while connecting patients to doctors throughout the postoperative recovery phase.



Design Process



Milestone 4
Iteration

Project Manager: Ali Morgan

Milestone 4 Overview

The iteration phase is the final step in our process where we refined our design based on the work we completed in previous milestones. In this phase, we used Milestone 3's design recommendations, as well as information from our own observations to make improvements to the initial prototype. Milestone 4 consisted of creating and adjusting new models, using new microcontroller instruments and creating introductory documentation.

- Quick Start Guide
- Device 2.0
  - New & Improved Features
  - Pain Question
  - Raspberry Pi
- Companion App 2.0
  - Updated Aesthetic
  - Improved Progress/Wean Graph
- Thank You

RIIT PCA 2.0

Quick Start Guide

Features

- Device overview
- Start-up instructions
- Wean Chart explanation
- Companion App introduction
- Frequently asked questions

Quick Start Guide for First-Time Users

Quick Start Guide: Panel 1

The new Quick Start Guide helps clarify the device's affordances and use to first-time users. This guide will be supplied to the post-operative patient when they receive the device from a pharmacy or hospital. A nurse or pharmacist can explain the use of the device to patients before they leave the hospital using this Quick Start Guide.

Panel 1 (left), Panel 2 (below, next slide).

Quick Start Guide: Panel 2

Quick Start Guide for First-Time Users

How It Works

Everyday you will be asked to rate how your pain is being managed overall. You will also be asked to rate your current pain level every time you request medication. This data will help us understand how we are doing with your wean prediction.

The Wean Chart

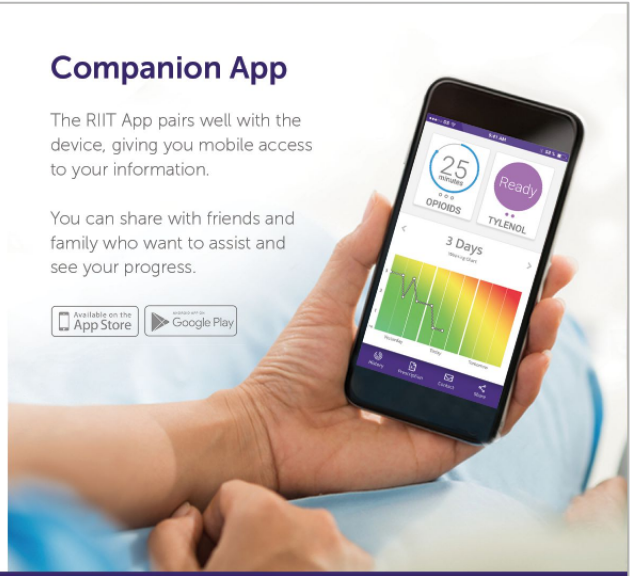
The wean chart will help you stay on track and monitor your recovery progress. Each dot represents a dose. Everytime you take a dose, a new dot appears. If you stay within the green, you are on track to weaning successfully.

Companion App

The RIIT App pairs well with the device, giving you mobile access to your information.

You can share with friends and family who want to assist and see your progress.

Available on the App Store Google Play



Frequently Asked Questions

Will I ever be locked out from medication?
No, you will never be locked out from your medication, no matter how you respond to the pain questions.

What do the dots under the medication buttons mean?
The dots represent the max number of pills you can have for the prescription. When they are filled in, it means enough time has passed and a pill is ready for consumption.

Quick Start Guide: Panel 2

What's new in Device 2.0

New and Improved Features

- Redesigned pill cup for easier retrieval
- Increased device stability
- Faster pill dispensing
- Dispensing mechanism w/ larger capacity
- Reduced pain question frequency
- Newly worded pain question
- New pain question response option
- Audio feedback and backlight control
- WiFi connectivity for recording dose data

New and Improved Device Features

The new RIIT PCA device 2.0 implements design recommendations from Milestone 3.

Faster Pill Dispensing
We increased the pill dispensing speed for less waiting time.

Redesigned Pill Cup for Easier Retrieval
We redesigned the pill cup to be larger and smoother for easier pill retrieval.

RIIT PCA Device 2.0

Dispensing Mechanism w/ Larger Capacity
We redesigned the pill chamber mechanism to increase the pill capacity from 12 to 90.

Increased Device Stability
We redesigned the base and added weight to the device to reduce risk of tilting and tipping.

Updated Pain Question Frequency and Wording

Pain Question Frequency

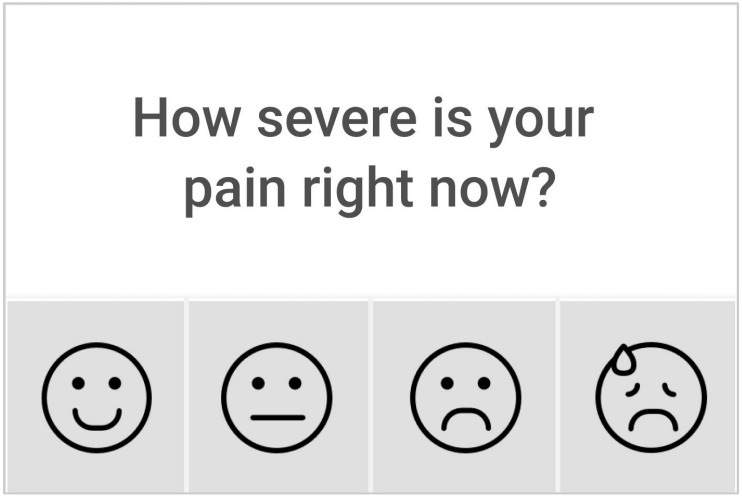
We adjusted the software to display the current pain question at most once every 10 minutes. While this recommendation will result in less data being collected, we believe this change is valuable for fostering a better user experience.

Newly Worded Pain Question

We adjusted the wording of the pain question from “How tolerable is your pain right now” to “How severe is your pain right now?”

Added Face to Pain Question

We added a fourth face to response options. This new face adds an additional negative response, as our sponsors pointed out that users will be more likely in pain than not.



The pain question asked every time a patient requests medication.

Replaced Arduino with Raspberry Pi

Benefits

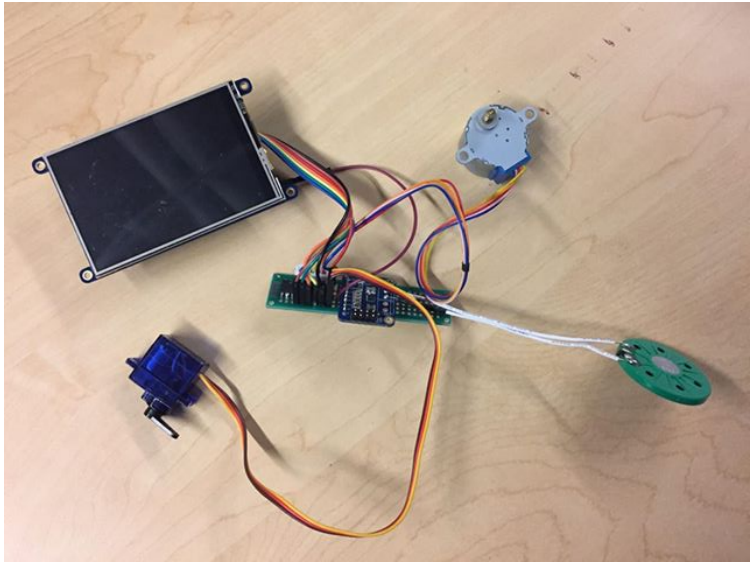
We used a Raspberry Pi Zero W, providing us with several benefits:

- Quick, responsive screen
- Better graphical libraries
- WiFi connectivity for uploading data

Changes

- Rebuilt in Python
- Audio feedback
- Setting controls
- Maintainable code
- Communicating dose readiness with screen instead of LEDs

Full code, which is still a work in progress as we implement customizable settings and finishing touches, can be found at: https://github.com/FThompson/SmartPCA-Capstone-v2



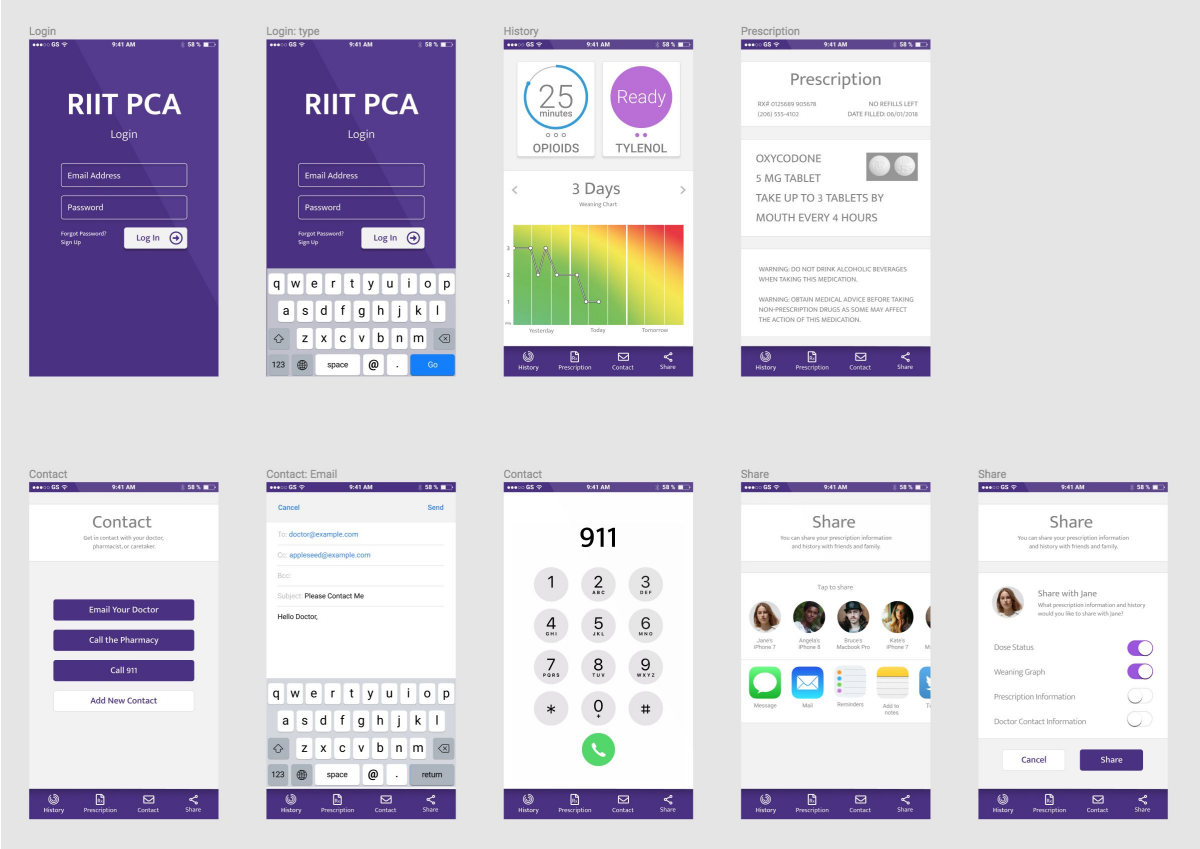
The screen, servo motor, stepper motor, speaker, and soldered prototyping board containing an integrated circuit and an amplifier.

What's new in Companion App 2.0

New and Improved Features

- Cleaner app aesthetic
- Customizable contact page
- Customizable share options
- Progress / Weaning Graph improved

Updated App Aesthetic and Customizability



Clarified App Hierarchy

We updated the aesthetic of the Companion App to provide more a defined visual hierarchy.

Customizable contact page

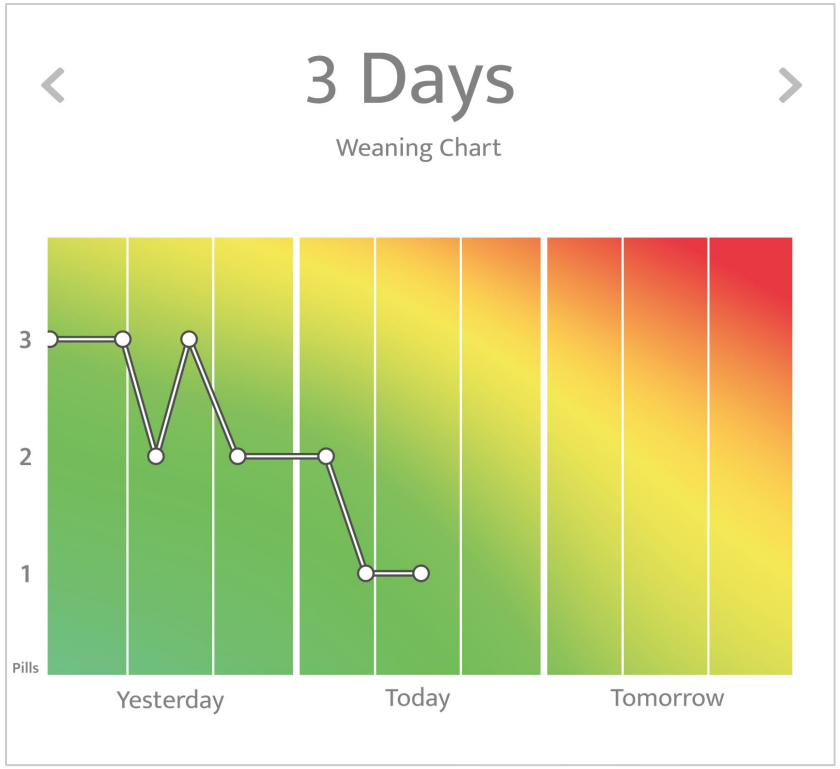
We updated the contact page to provide options for adding new contacts.

Customizable share page

We updated the share page to include more control over sharing options.

Companion App 2.0 Screens

Improved Progress / Weaning Chart



Weaning Chart 2.0

Updates

We updated the weaning chart to have more context and clear labels for the y-axis and colors.

Wean Chart

The wean chart will help you stay on track and monitor your recovery progress. Each dot represents a dose. Everytime you take a dose, a new dot appears. If you stay within the green, you are on track to weaning successfully.

Thank You