CEDARVILLE UNIVERSITY

Project Definition

A remotely-accessible network of devices that work together to passively monitor the environment of an elderly individual or individuals living alone and send emergency alerts if needed.

Abstract

The Internet of Things (IoT) home monitoring system (CU HomeCare) is an in-home care solution providing independence to the observed and peace of mind to the observer. A cloud platform makes data about the environment available to the observer as well as provides SMS notifications in case of emergencies. The system connects a network of non-intrusive devices which gather information from the environment. The devices use various sensors to collect data and send it to a cloud server via a router.

Requirements

- This project will be composed of a network of devices and a server
- The system will be specifically designed with a non-technical user in mind
- System must able to be set up by a technical user in less than an hour
- System must be able to alert the user or client about out of bounds conditions in a timely manner

- System must be able to be disabled by a nontechnical user
- System must be able to timestamp relevant data to be displayed or acted upon by the server
- Devices must be able to broadcast data wirelessly
- Devices must be able to have a minimum “battery life” of 6 months or be able to plug into a standard wall plug of a home
- Devices must be capable of interfacing with multiple types of sensors including temperature, proximity, and light
- Devices must be capable of collecting and storing data from sensors at variable collection rates
- Device must be able to be wirelessly configured All
- Server must be capable of receiving and storing data from device wirelessly
- Server must be capable of meaningfully displaying stored data to user from an internet connected device
- Server must be accessible by user or client on a different network
- Server must be reference-able easily by nontechnical user

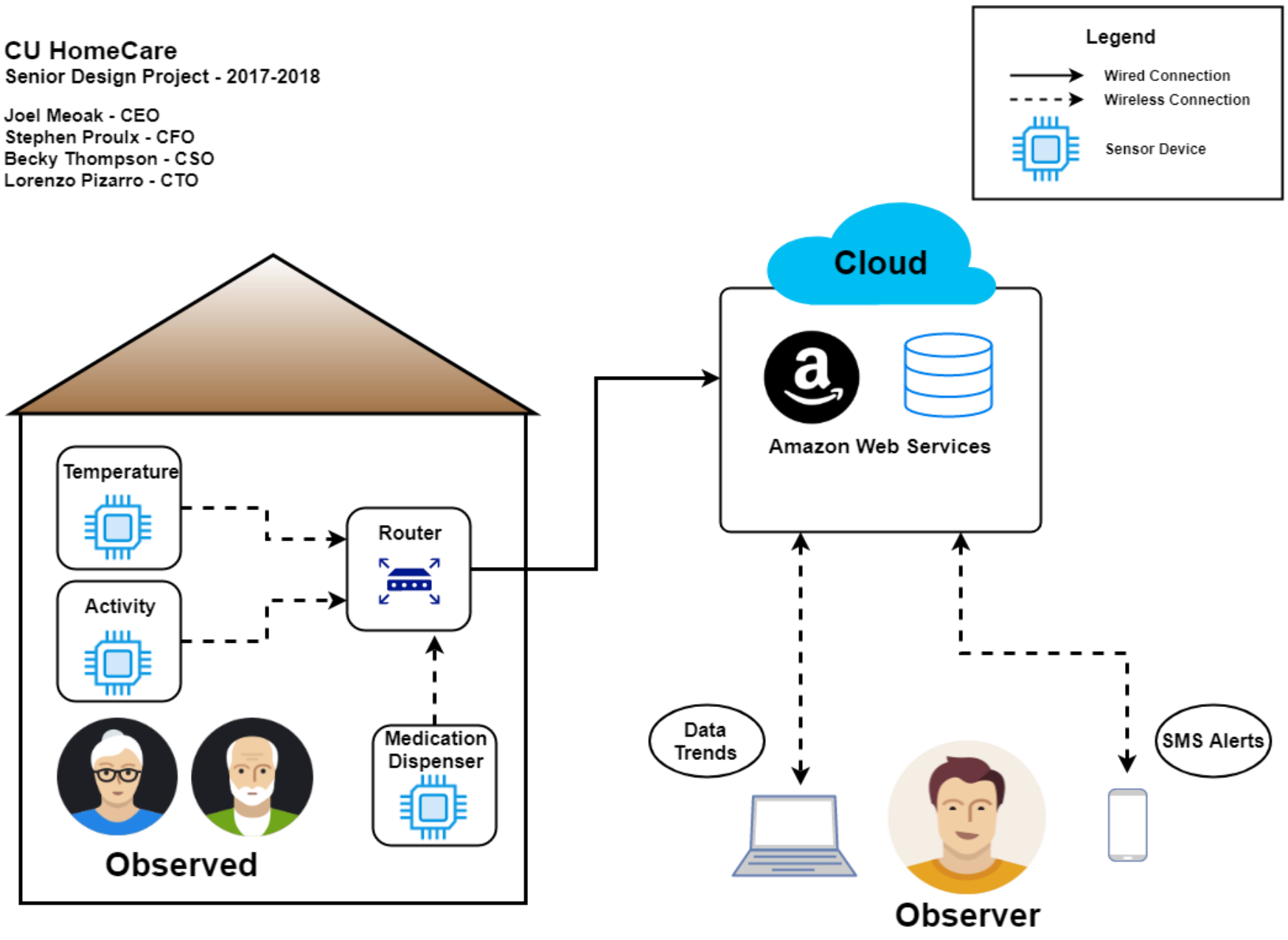
Background

There are many situations where the elderly that we know cannot be checked on due to time or distance. Many elderly want to continue living on their own, but traditional in-home care can be very expensive.

CU HomeCare allows an elderly person to maintain their independence while giving the observer the peace of mind that their loved one is safe. This system gives both emergency notifications and general environmental data to reduce the need for daily check-ups from a loved one. The setup is relatively quick for a technical user and the total cost for setup and monthly subscription is far less than in home care.

Internet of Things

Joel Meoak, Stephen Proulx,

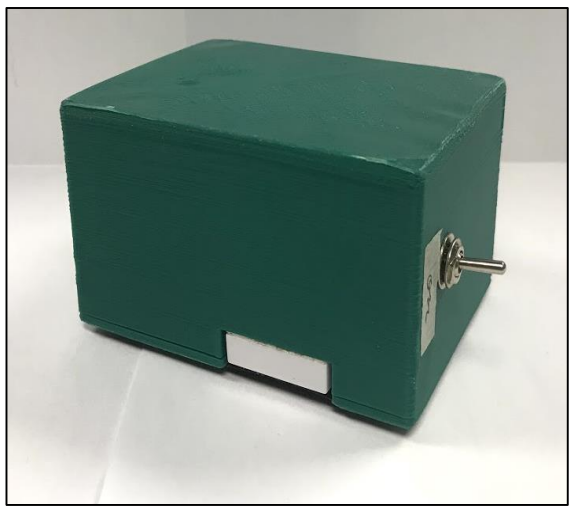


Summary

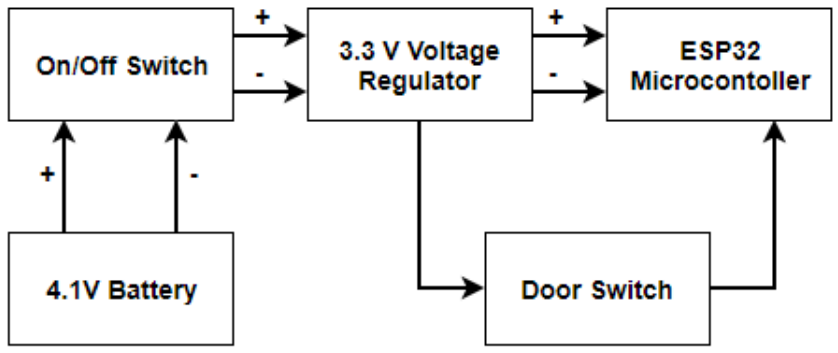
The purpose of CU HomeCare was to create an in-home care system capable of passively monitoring the environment of an elderly individual or individuals living alone and send emergency alerts when needed. The final product fulfills this description as well as adds more functionality by adding the additional medication dispenser, more SMS capabilities, and a cleaner interface. The system uses the Espressif ESP32 Wifi capable microcontrollers as the main devices, Mongoose OS as the development environment, Amazon Web Services as the server backend, and a React.js as the frontend. The system as a whole runs as expected and can provide peace of mind when distance separates loved ones.

Devices

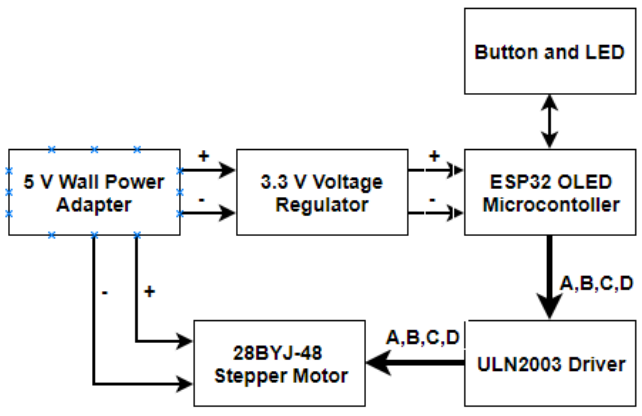
Door Sensor



- Magnetic Switch Sensor
- Battery Powered
- Uses the PCB
- Low Power

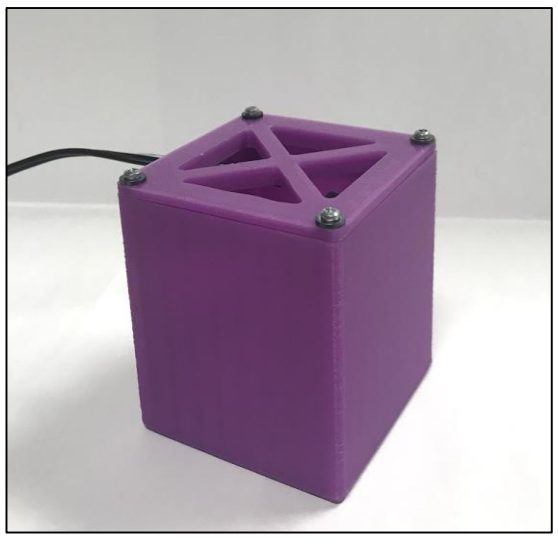


Medication Dispenser

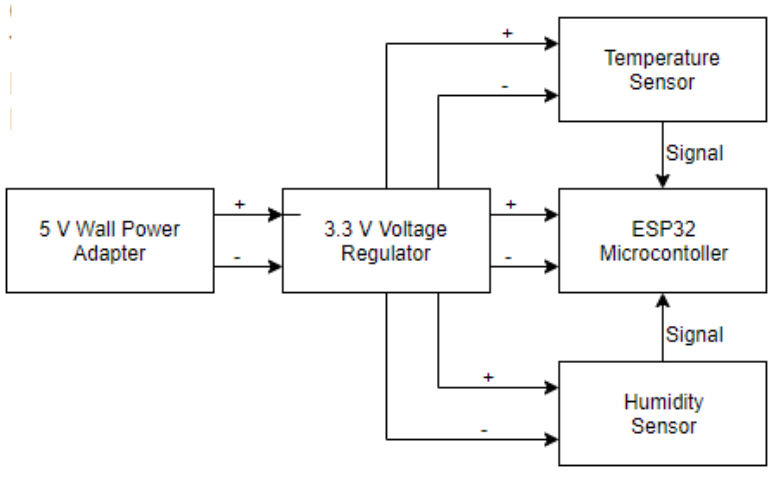


- Stepper Motor
- Two Buttons
- Beam Break Sensor

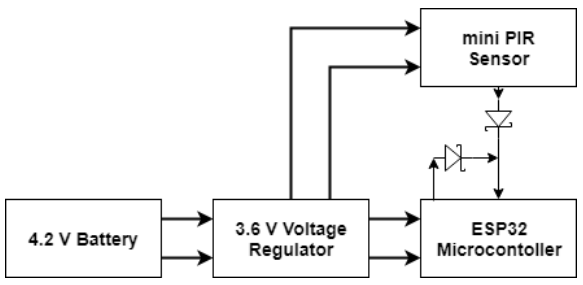
Air Hub



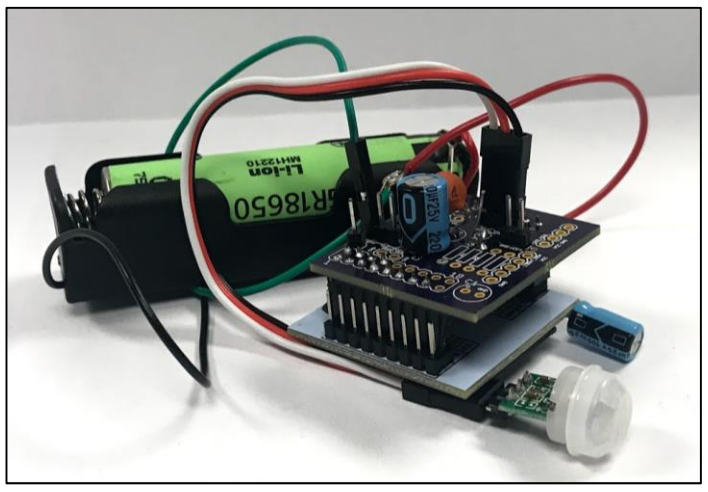
- Temperature Sensor
- Humidity Sensor
- Uses the PCB



Mini PIR

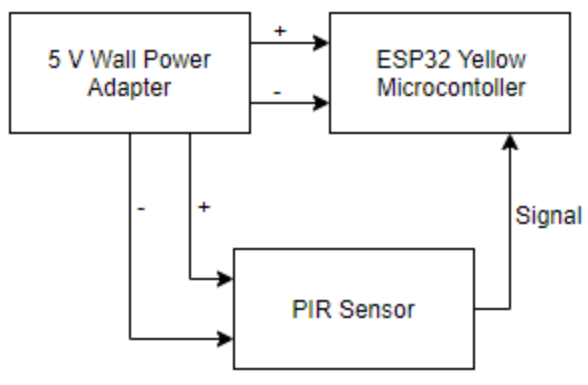


- PIR Sensor
- Low Power
- Uses the PCB
- For Small Area or Hallway



Main PIR

- PIR Sensor
- For Large Area
- Wall Power



CU HomeCare

Becky Thompson, Lorenzo Pizarro

CU HomeCare

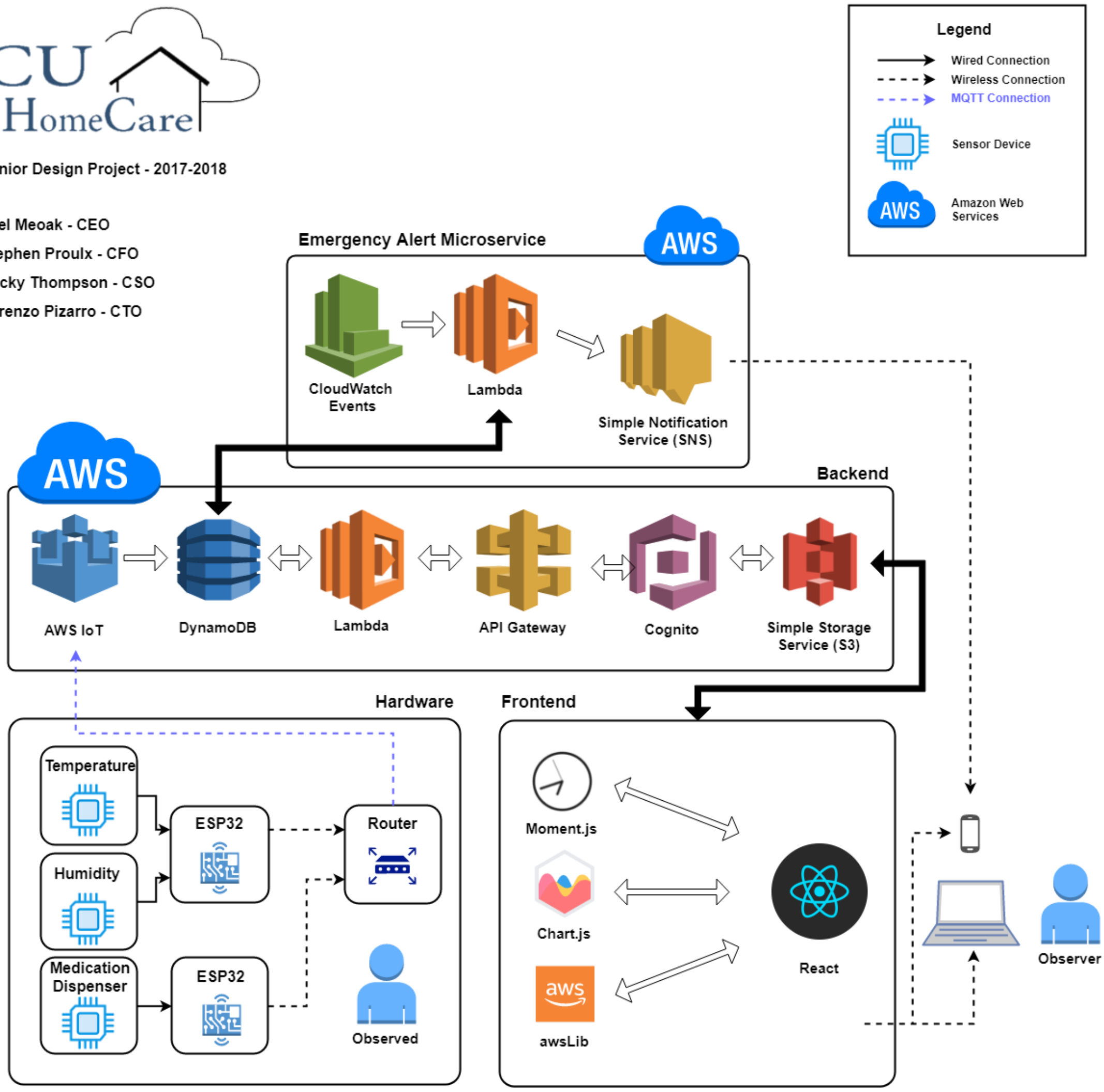
Senior Design Project - 2017-2018

Joel Meoak - CEO

Stephen Proulx - CFO

Becky Thompson - CSO

Lorenzo Pizarro - CTO



Mongoose OS

- AWS integration
- Clean IDE
- C/C++
- Mongoose Javascript (mJS)
- Apps
- Large Ecosystem

Batter Power

Door Monitor

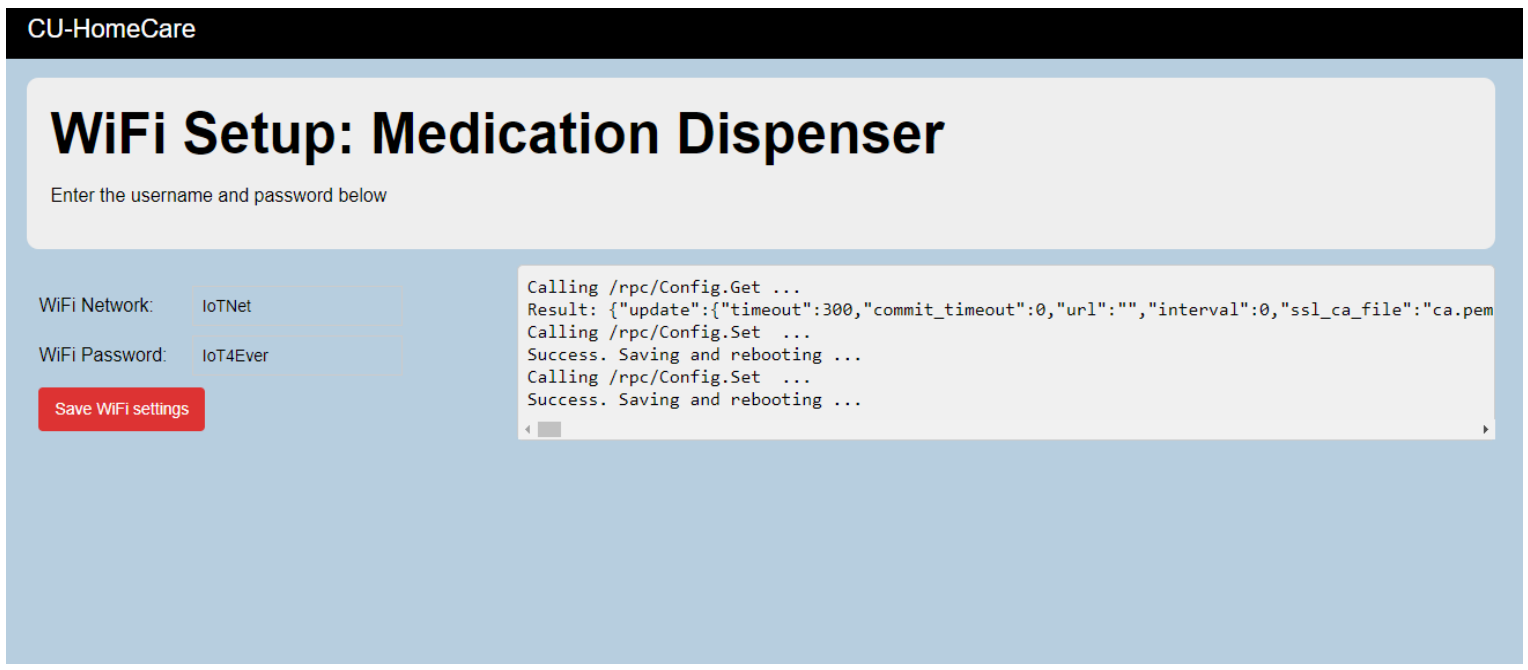
Time Active per Trigger (s)	Idle Power mA	Active Power mA	Activations Per Day	Runtime: Days	Runtime: Months
10	0.018	119	20	355	11.7
10	0.018	119	40	183	6
10	0.018	119	100	75	2.5

Mini PIR Sensor

Time Active per Trigger (s)	Idle Power mA	Active Power mA	Activations Per Day	Runtime: Days	Runtime: Months
15	0.075	120	10	368	12
15	0.075	120	20	212	7
15	0.075	120	40	115	4

Wireless Configuration

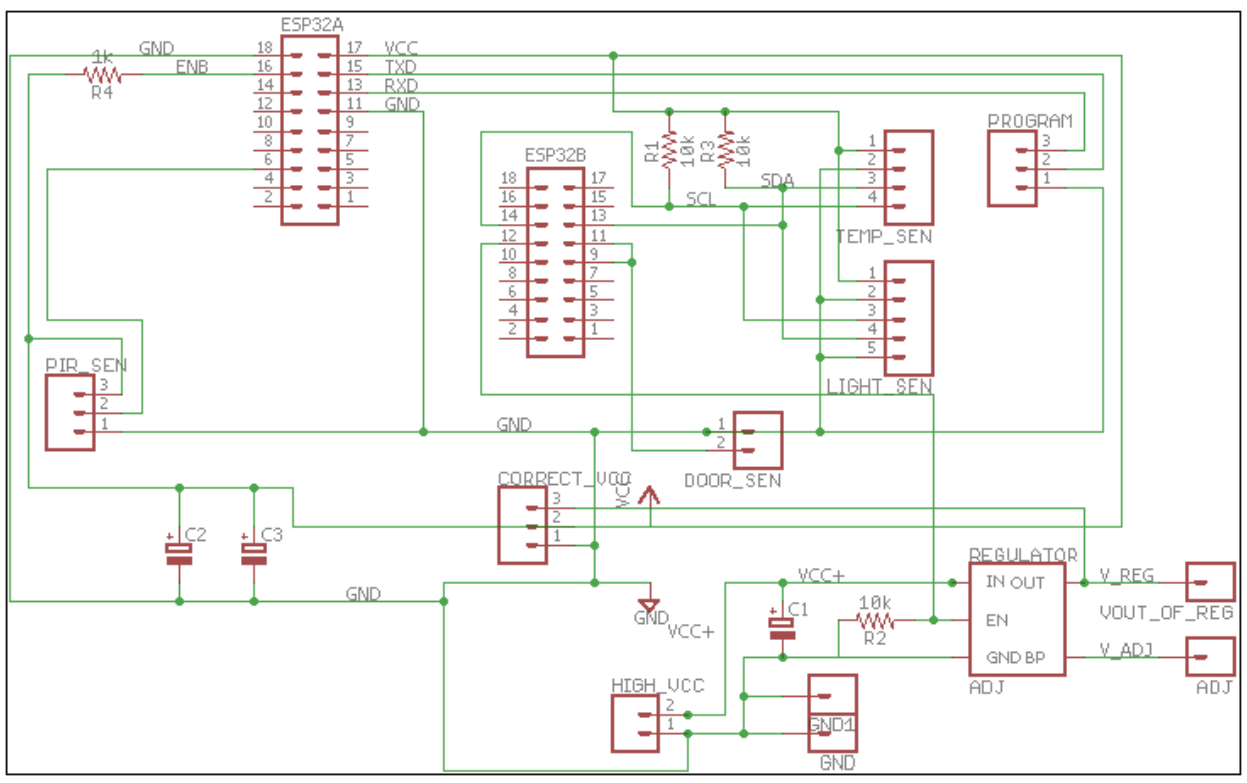
- Easy to use
- Accessible from smartphone or laptop
- Configuration in less than 1 min



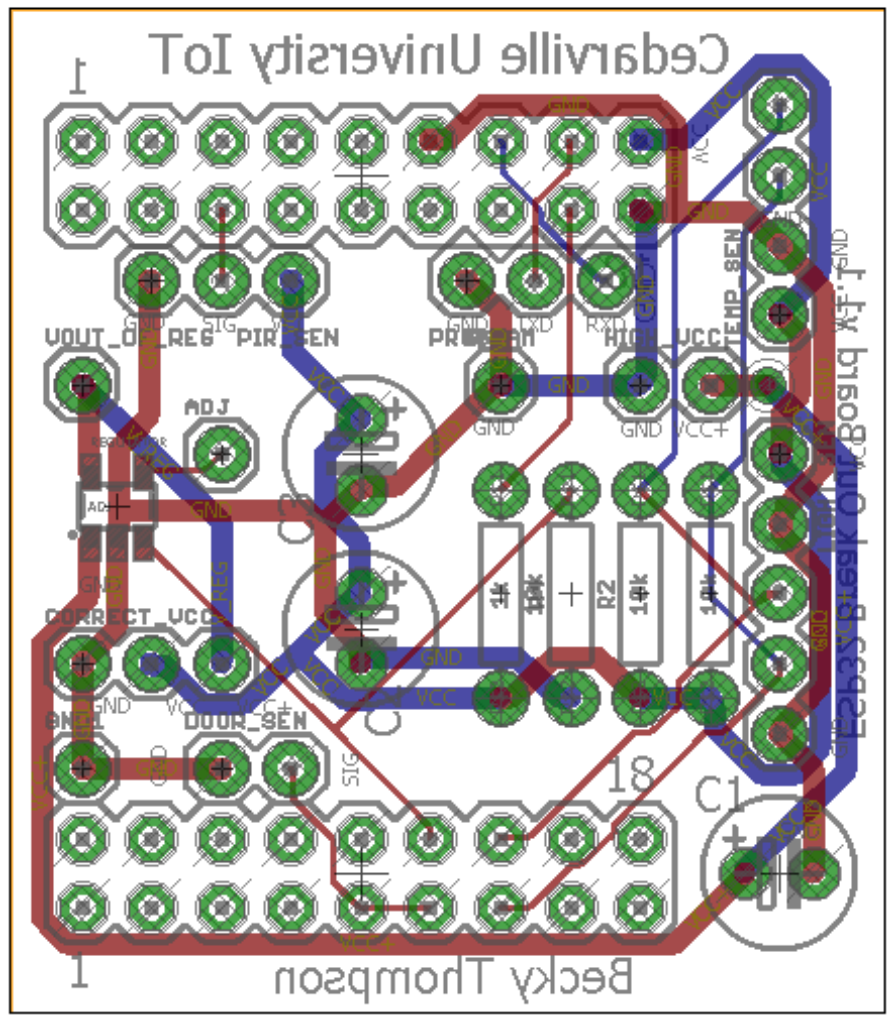
Printed Circuit Board (PCB) Design

- Lower Power Consumption
- Modular design for three devices

EAGLE Schematic



EAGLE Board



CU HomeCare

Amazon Web Services - AWS

Cloud Based Services

Easily Scalable

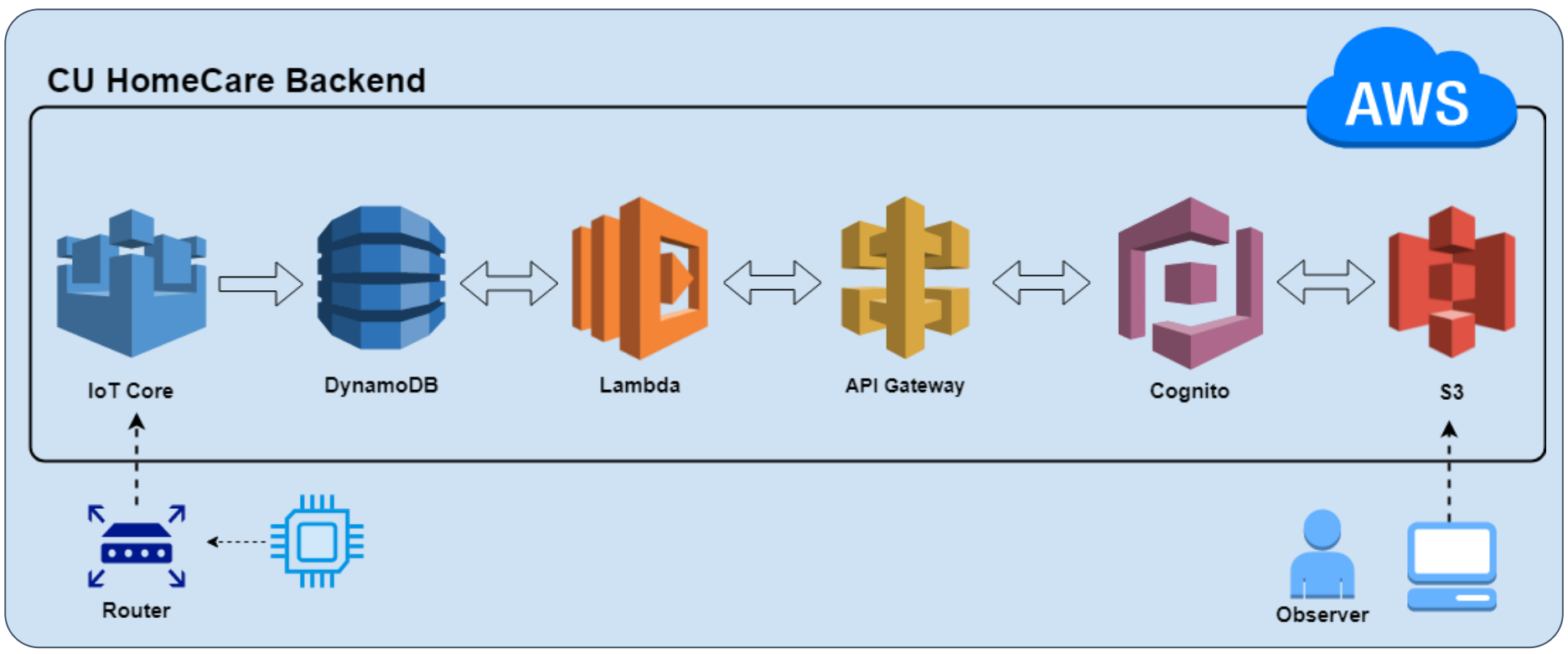
Data Redundancy

Pay-By-Use

Programmed to interact and pass information securely

Allow us to service Things and support the website

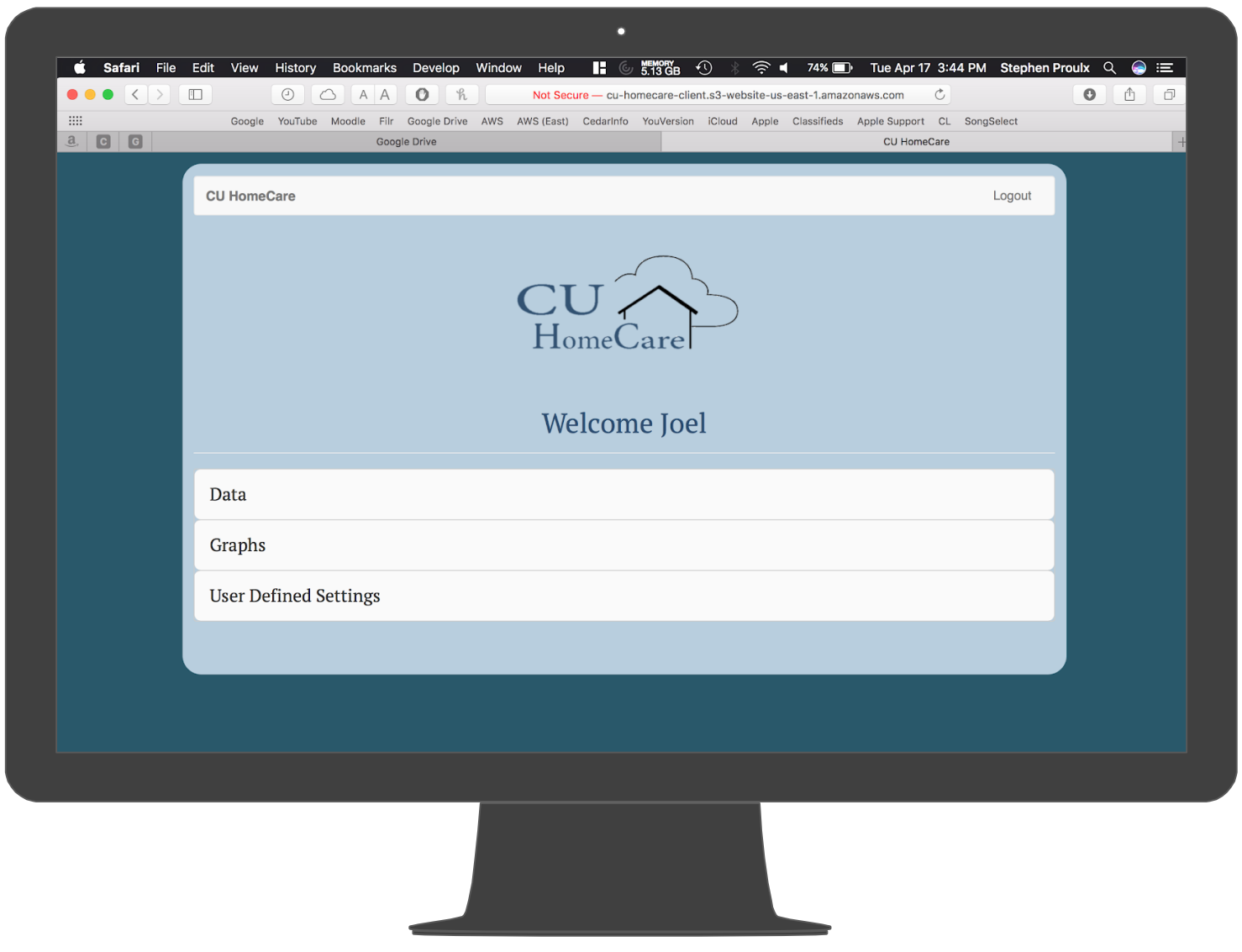
Backend

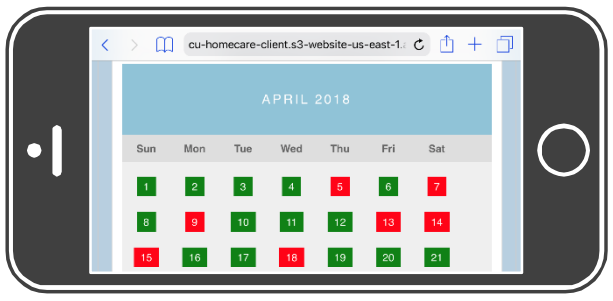


Frontend Website

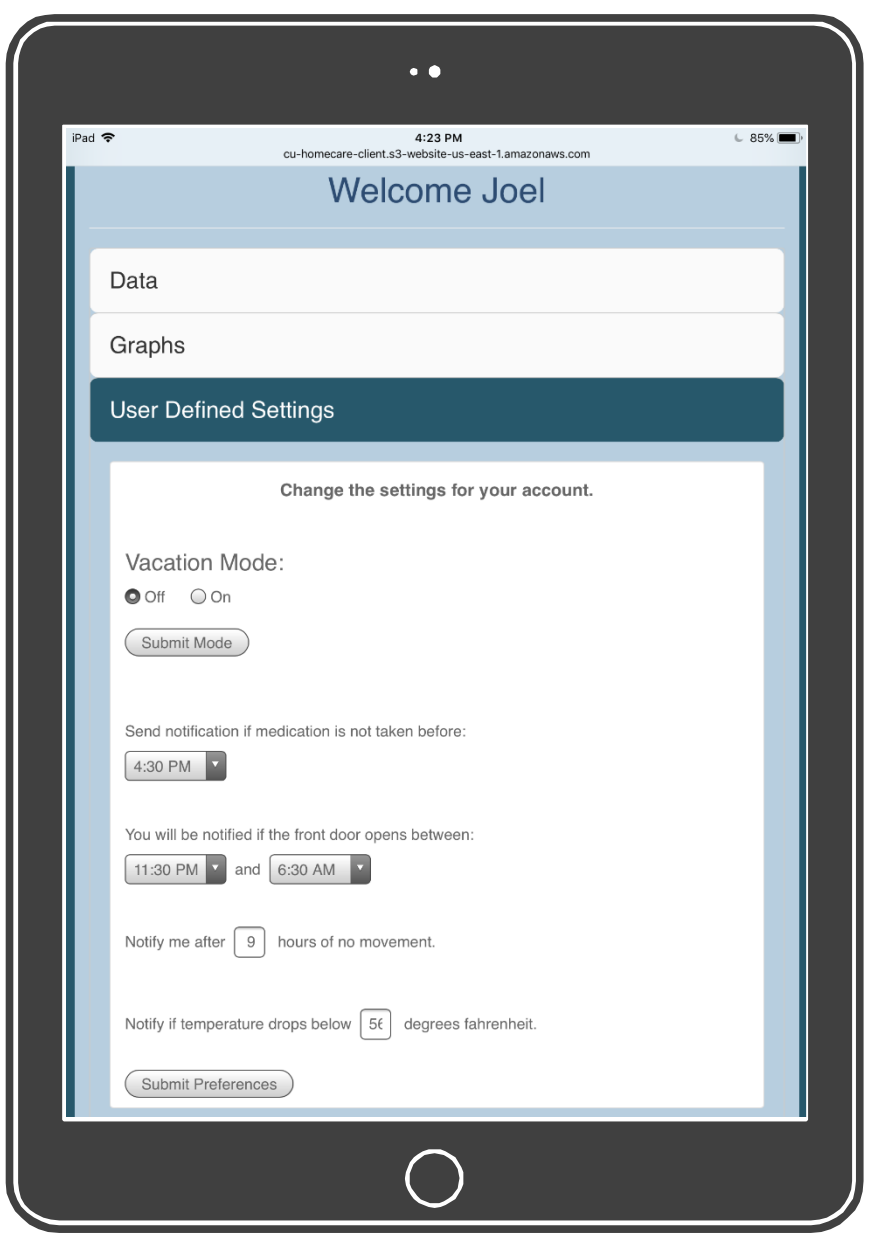
Constructed in React
Programmed in JSX
Mobile Friendly

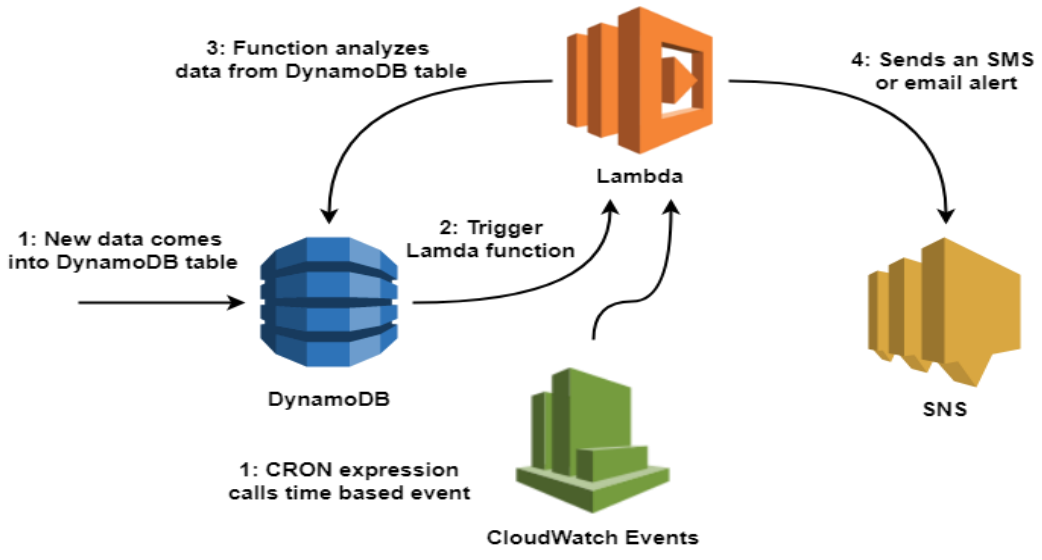
Secure User Authentication
Fetches Relevant Data
Dynamically built





Emergency Alert Microservice





Caretaker defines out-of-bounds conditions

System checks incoming data for concerning values

Emergency notifications are sent out as emails or SMS