



Smart Coffee Maker

Senior Design Project Technical Presentation

Group Members

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Team Members



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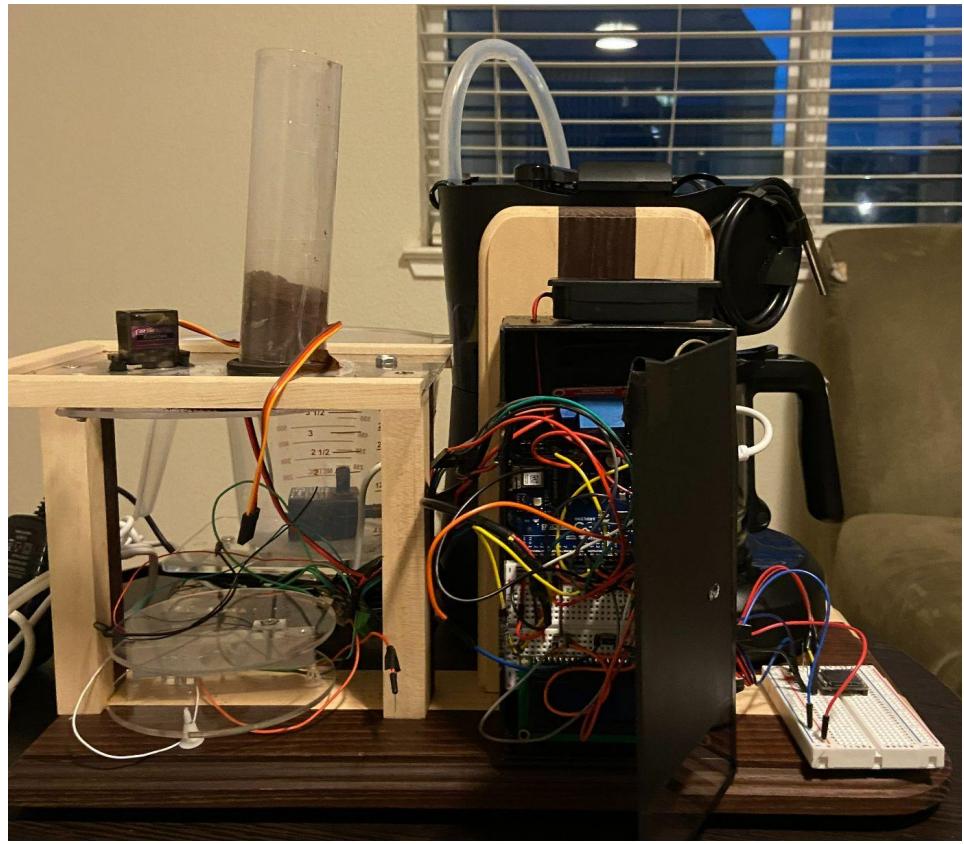
Project Description

The Smart Coffee Maker is a IoT device that makes the “ideal 8 oz cup of coffee” perfectly every time. We will accomplish this by providing 42 unique options to reach a user’s desired taste based on the brew ratio, the total dissolved solids, the temperature, extraction time, etc.

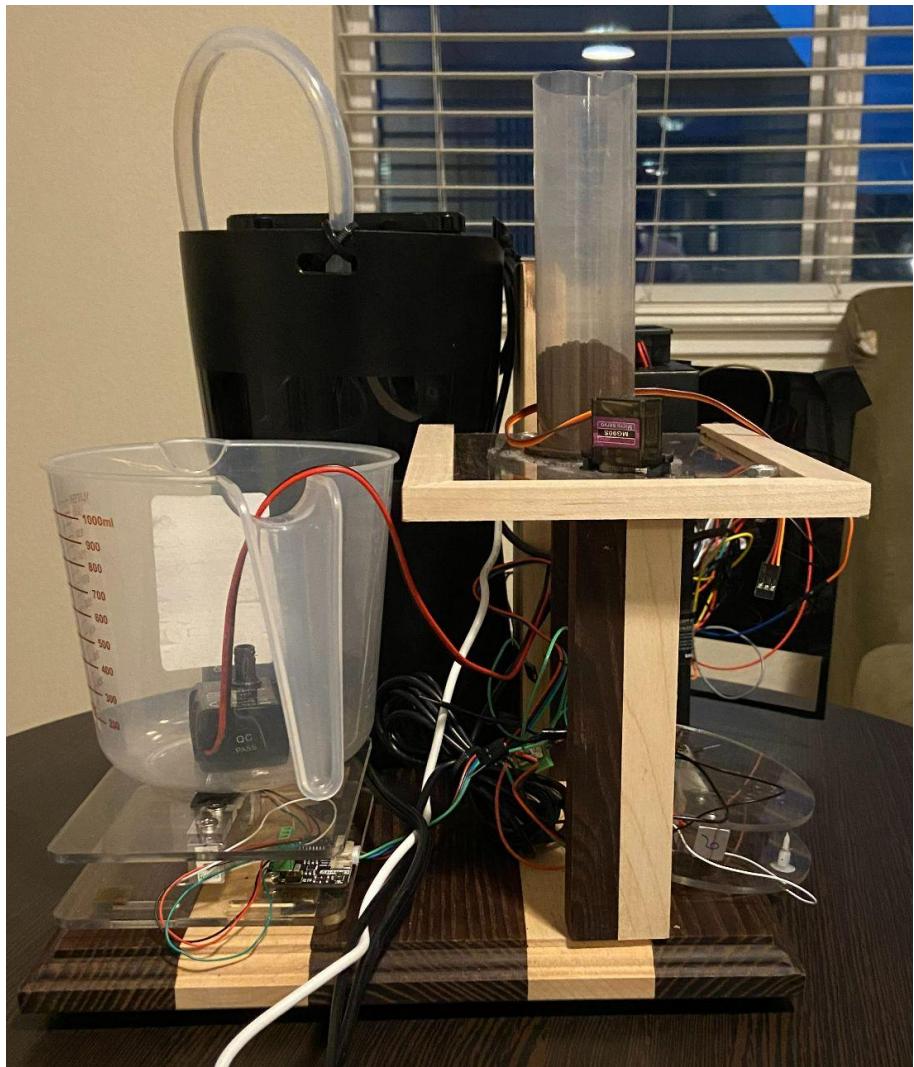


Why is it an IOT Project?

- How does it satisfy the sensing requirement?
- How does it satisfy the computing requirement?
- How does it satisfy the communication requirement?
- What is the mobile interface?
- What sort of cloud computing and/or analytic services were used?







Mr. Coffee 5-cup Mini Brew 2129512



Pros

- Not working with HV for heat
- Well known design

Cons

- Cannot control temp of water
- Space limitations

Components Used

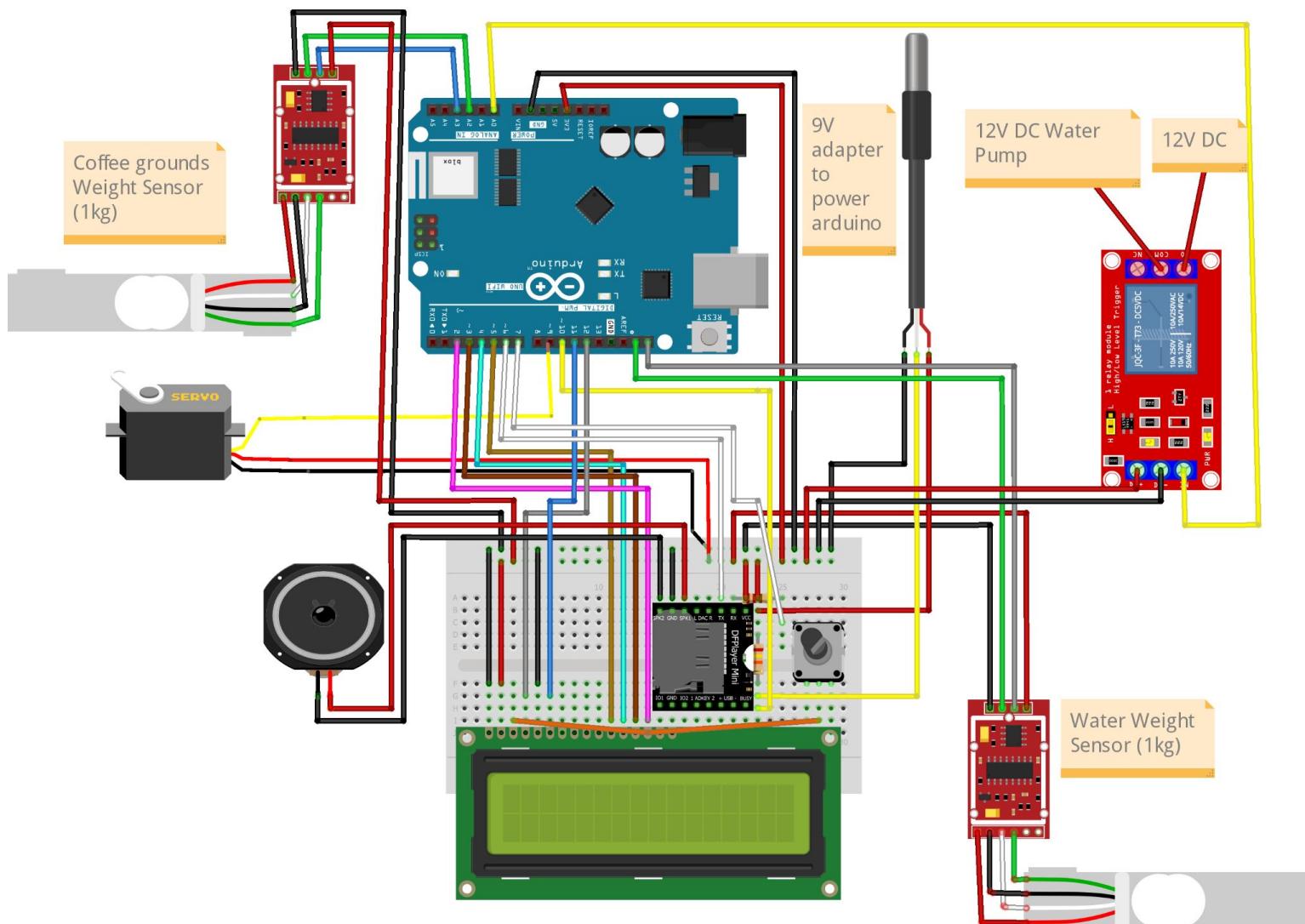
Sensors

1. Waterproof temperature sensor
 - Placed directly in coffee basket to tell user when their coffee is ready
2. Weight sensor (x2) *Load cell + HX711*
 - One calculates the weight of the pumping water and the other calculates the amount of dropped coffee grounds
 - uses I2C and analog inputs to communicate

Other Components

1. 12V water pump + Relay
 - Pumps the water into the coffee machine
2. Servo motor
 - Attached to a hatch that opens and closes to deposit coffee grounds
3. Speaker + DFPlayer module
 - Guides the user through the process of using the machine via voice
4. LCD
 - Displays important measurements and displays info the voice otherwise cannot

Hardware



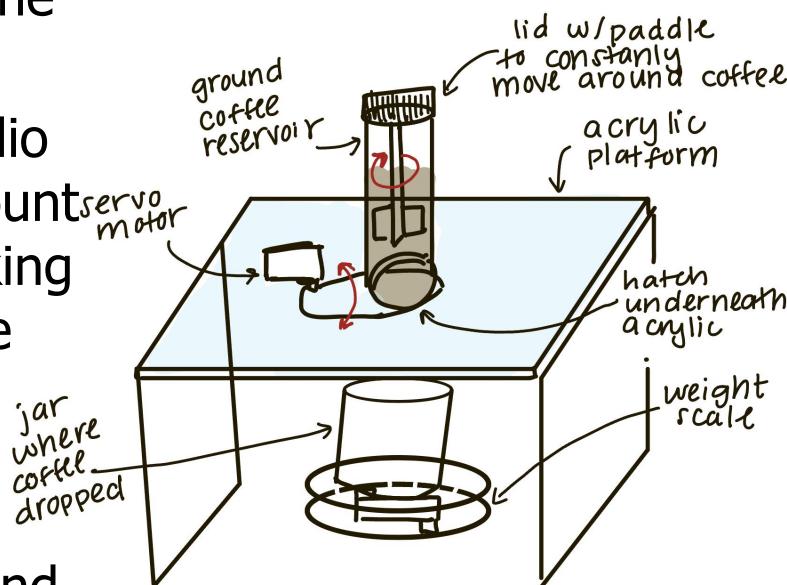
☆ We are using the Arduino UNO WiFi REV2

Hardware Limitations

- Most sensors don't work above 70C
 - a lot of the originally planned sensors had to be scrapped
- High power consumption
 1. 12V DC adapter to power the water pump
 2. 9V adapter to power the Arduino board
 3. 120AC wall plug for the coffee machine

Servo motor

- Works independently, however the audio module takes up an unpredictable amount of power which messes up all the working components especially the LCD and the analog weight sensor
- Additionally, the coffee reservoir still needed a paddle/gear system to continuously shift the coffee grounds and allow them to fall into the dispenser without user interaction



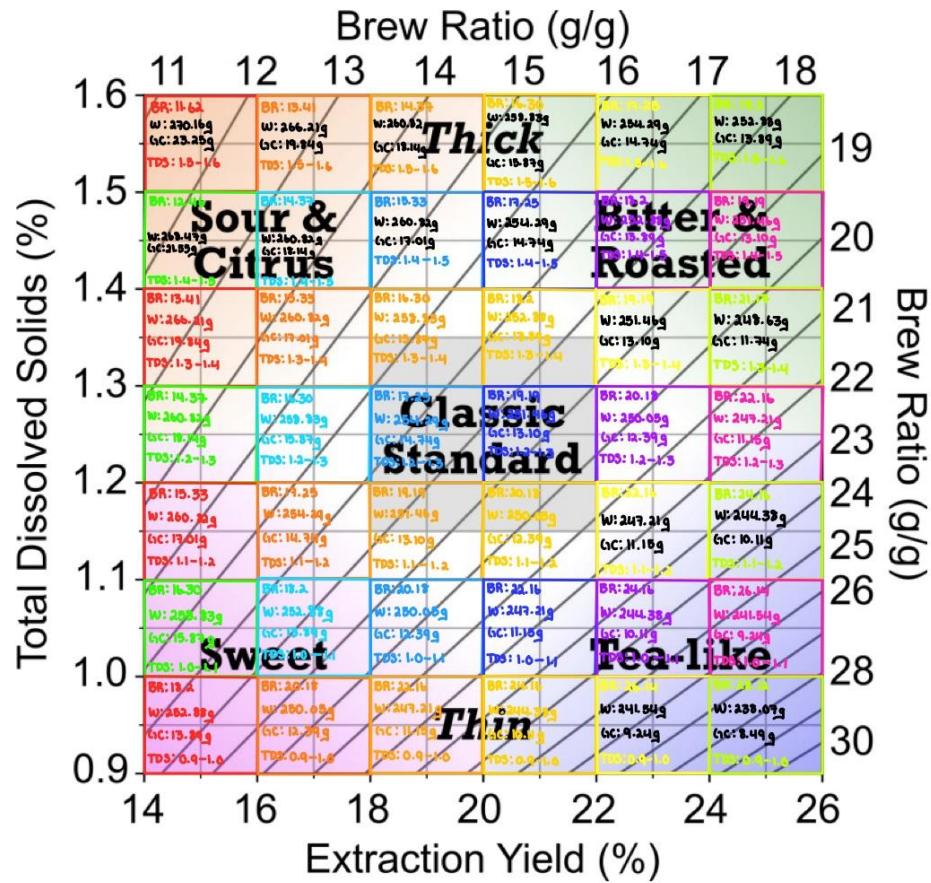
Sol: Add another voice clip telling user to measure out needed weight dictated on the LCD

Communication

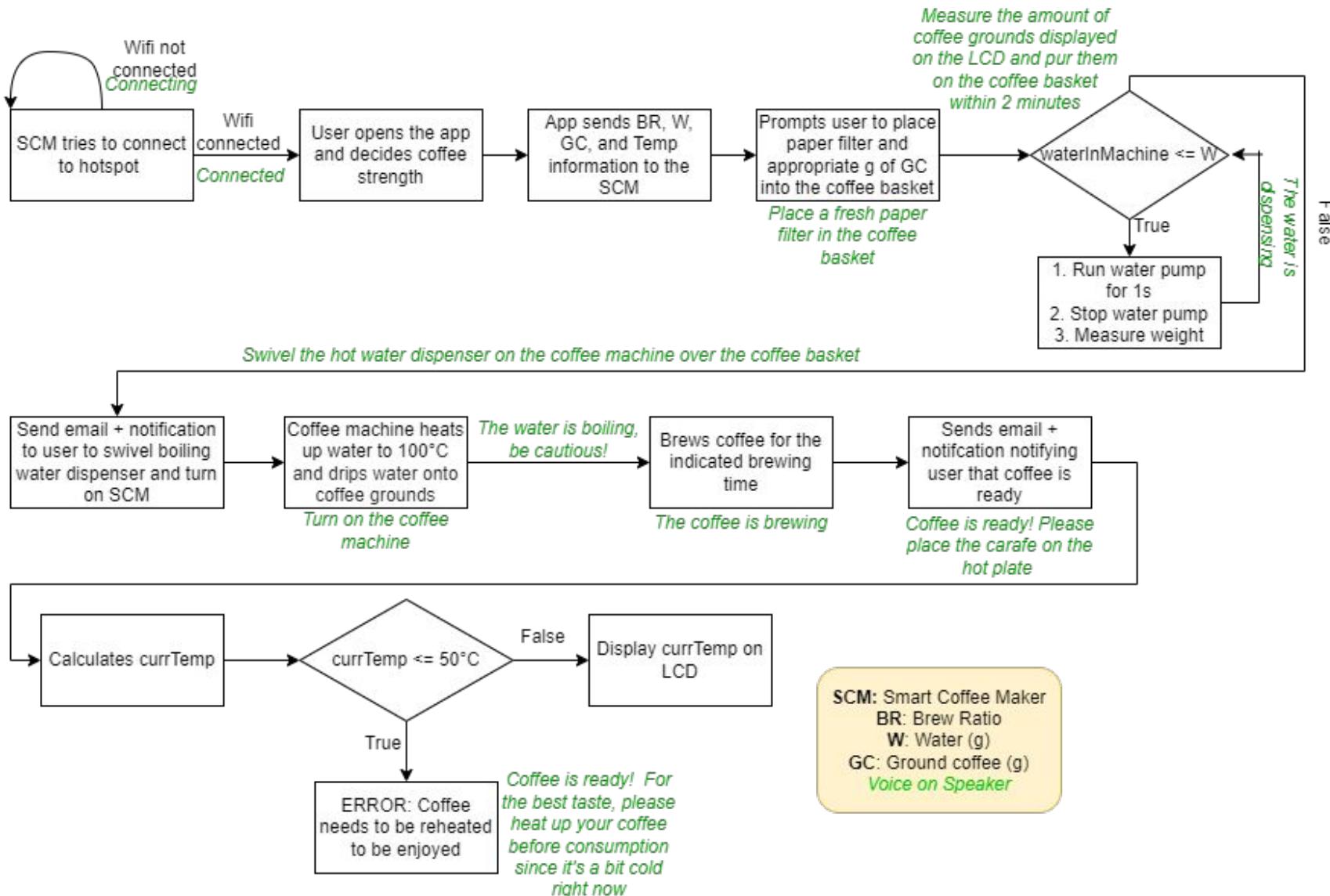
- Audio
 - Audio clips recorded by Jenny and converted into mp3 files on a SD card are played at specific parts of the coffee making process to guide the user
- LCD display
 - Displays variable information that audio can't such as specific measurements of the the grams of coffee grounds and how much water has been pumped into the machine
- App and email notifications
 - Zapier sets up a webhook to automate a message to the pushover app
 - Pushover app displays the message that we configured on zapier

Computing

- Based on the choice the user makes on the graph, the parameters to reach that desired taste (such as grams of water, coffee grounds, temperature, extraction time, etc.) are sent to the Arduino
- Arduino continuously monitors the sensors to make sure it is reaching those desired parameters and has appropriate delays to make sure processes don't interfere with one another



Project Schematic

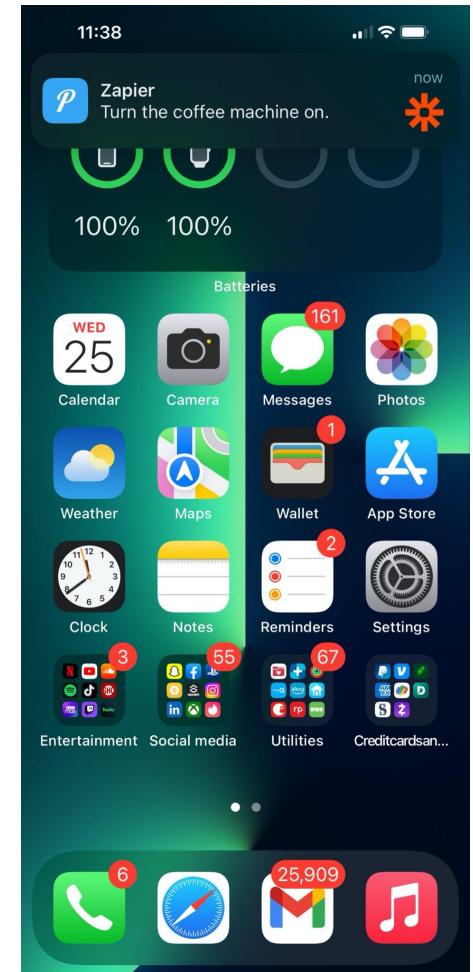


Cloud Computing

- Zapier
 - Created a webhook to send a message to the pushover app. We created three different messages that will be sent based on the status of the coffee machine.

Pushover

- App that displays the message we configured on zapier to the user.



Mobile Interface

- SwiftUI
 - The app was developed in Xcode using the swift language.
- Coffee Buttons
 - Once a spot has been selected on the graph a Coffee Preview page opens that gives a brief description of the taste of the coffee the user has selected. If the user would like to start making the coffee they would click on the “Start Brewing” button.
 - There is also a favorite buttons shaped like a heart next to the start brewing button. Once that button has been tapped it is filled in and the user selected coffee flavor is save.

Mobile Interface

- Coffee Videos
 - Once the brewing process begins, the user has the option to watch a few coffee videos that were curated by Sampson. These videos range from entertaining coffee videos to educational coffee videos that walk the user through popular coffee recipes like lattes, cappuccinos, etc.
 - These videos have been pulled from the YouTube API
- Favorites Section
 - The favorites section is a list of coffee flavors that the user has saved by tapping the heart shaped favorites button within the coffee preview page. This allows the user to have easy access to their favorite flavors, instead of remembering a selection of letters out of 42 different options.

9:13

Thick

Bitter & Roasted

Sour & Citrus

Classic Standard

Tea-like

Sweet

Thin

Letter C

Welcome to the smart coffee maker, an IoT project that automates the coffee making process to deliver you a consistent cup with a variety of different flavors you can choose from! before beginning, follow these setup instructions:

1. fill up the water jar
2. fill up the coffee dispenser with your choice of ground coffee beans
3. place a fresh coffee filter in the coffee basket and swivel the hot water dispenser so that it hangs above the basket

Home Coffee Videos Favorite

Home Coffee Videos Fav

9:13

Back

C

Letter C

Letter C has a sour and citrus taste, but it also introduces some bitter and roasted flavor. Letter C is also very thick to provide a full mouth feel.

Start Brewing

Home Coffee Videos Favorite

9:14

9:14

Coffee Videos

ECH 001Y A10 - SYS Coffee Design Competition

EMMA'S LEGENDARY COFFEE RECIPE

MY COFFEE RECIPE

TRYING VIRAL COFFEE RECIPES

Home Coffee Videos Favorite

9:14

Favorites

U Letter U

C Letter C

Home Coffee Videos Favorites

Software Difficulties and Solutions

- Arduino Wifi Communication
 - The most significant software difficulty that we ran into was having the Arduino time out
 - After a certain amount of time, the Arduino would disconnect from the wifi network, but we would still have wifi enabled activities that would follow later in the code. This would cause multiple http requests to fail.
 - To combat this we added a specific function that would explicitly reconnect to the wifi if the wifi connection isn't available
- Storing the 42 different parameters to achieve different tastes
 - Weren't able to initially send these values to the Arduino
 - Solved this with a struct class in the code that stores all this information and is associated with the button pressed from the app

Final Note

This project was developed for the University of California Davis's Computer Engineering Department senior project for the 2022 Spring quarter. This is an IoT project that meets the specifications outlined in the EEC193B curriculum under the instruction of Professor Avesta Sasan.

Our goal was to create a smart coffee machine that reveals the complexity a single coffee bean type can produce under a variety of different conditions. This machine takes in roasted beans and highlights flavor notes in the drink by changing the brewing methods based on the user's input.

Coffee making is a very specific and tedious process, so we hope this project opens avenues for further automation of this procedure.

We would like to thank the UCD Engineering Department and the UCD Undergraduate Coffee Lab for their support in the completion of this project.
