Project Summary

Problem Domain

- Very troublesome to measure exact quantities for mixed drinks.
- Hard to keep track of alcohols consumed while drinking

Solution Domain

- Automated bartending robot to create cocktails and other mixed drinks
- Interactive and intuitive mobile application to order drinks and track drinking statistics

Challenges Deep-Dive

Challenge 1

Calibrating Hardware

- The Nema-17 stepper motor had to be calibrated perfectly to avoid slippages in timing belt
- Pumping rate

Challenge 2

iOS App Development

- Highly mismatched documentation
- Very steep learning curve

Challenge 3

Bluetooth Communication

- Integration of iOS application with bluetooth interface
- Relaying two way communication

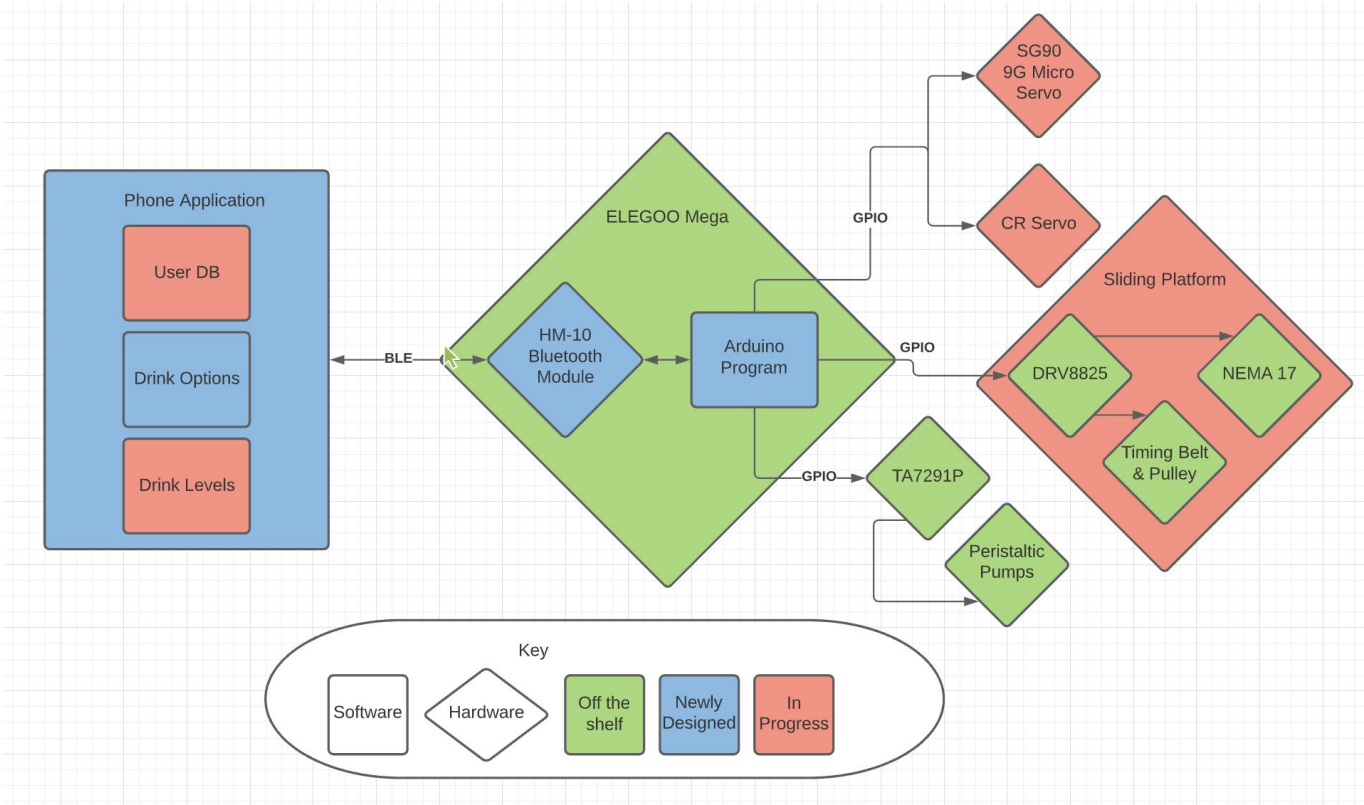
Hardware - Mechanical Layer

- Wooden support structure (encapsulation)
- Mounted platform for bottle placement
- Required liquids dispensed in exact amount
  - Peristaltic pumps used to pump liquids from bottle to glass
- Sliding Platform
  - Nema-17 stepper motor
  - Timing belt
- ELEGOO Mega
- DSD Tech HM-10 Bluetooth Module

Software Layer

- iOS mobile application
- User login and registration
- Allow user to place a drink based on available alcohols/mixers
- Track user drinks data - calories consumed, alcohols consumed, average frequency (drinking habits)
- Notifications when drink is ready or when alcohol/mixers need to be replaced

Overall Block Diagram



Pumps

Motors

Solution - Overall System

- ELEGOO Mega used as overall microcontroller
  - Bridge drivers to control pumps
  - Bluetooth module to relay communications between mobile application and drinks maker machine
  - Controllers for sliding platform (Nema-17 stepper motor and timing belt.)
- iOS Mobile Application
  - Built using Swift and Xcode
  - Able to communicate with the automated bartender to place drink orders - over bluetooth
  - Has a registration/login authorization to track users
  - Provides insightful data analysis of user’s drinks habits with monthly reports

Metrics and Validation

Requirement	**Testing Strategy**	**Quantitative Metric**
Cup positioning	Physical measurement (ruler)	Center of valve is always within 1 inch of the center of the glass
Pouring accuracy	Physical measurement (measuring cups)	Within 5% of expected amount
Arduino and application communication	Send multiple requests and record latency	- Drink making begins within 3 seconds - 100% accuracy on drink orders (all drinks are correct)
Spillage	Observation	Full drink never spills
UX (user feedback and statistics)	Time latency using software	All user requests and drink updates provided within 3 seconds

Metrics & Validation Results

1. Pouring Accuracy - Tested with multiple drink orders and dispenses correct amount every time
    a. 1 ounce / 40 seconds
    b. Instant start/stop of pumps allows for high accuracy
2. Arduino & App communication
    a. 100% accuracy as connection always successful and communications (order being processed) is valid.
    b. ~0 latency (drinks are made/started <= 3 seconds)
3. Spillage
    a. Initial testing had ~50% spillage/slippage as glass not stable
    b. Indent in wooden platform

Design Trade-Offs

- Having one stop on sliding platform instead of multiple stops (for each required liquid.)
  - Allows multiple liquids to be dispensed at once (due to slow pump speeds)
- Peristaltic pumps vs Dispensers
  - Speed vs Reliability
- Web Application vs iOS Application

Difficulties Faced & Solutions

- Difficulty - Working with Swift and Xcode was extremely challenging
- Solution - We learned early on that we need to be highly proactive
  - Prioritizing iOS development as it was new technology (team was inexperienced)
- Difficulty - Assorted challenges with hardware components
  - Slow pump rate
  - Stepper motor difficulties
- Solution - More research into setting up and running parts as they arrived
  - Prompt orders
  - Early testing to ensure parts function properly/no missing components

Project Management