TRASH-IT

Senior Design II
Team 12

Team 12

Zion Armstrong

Daniel Artz

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Project Goals

Dieudonne Muhirwa

What we designed

1. Casing for electronic to attach to the trash bin
2. Companion App (Android)
3. Firebase database
4. Trash bin embedded system

What we built

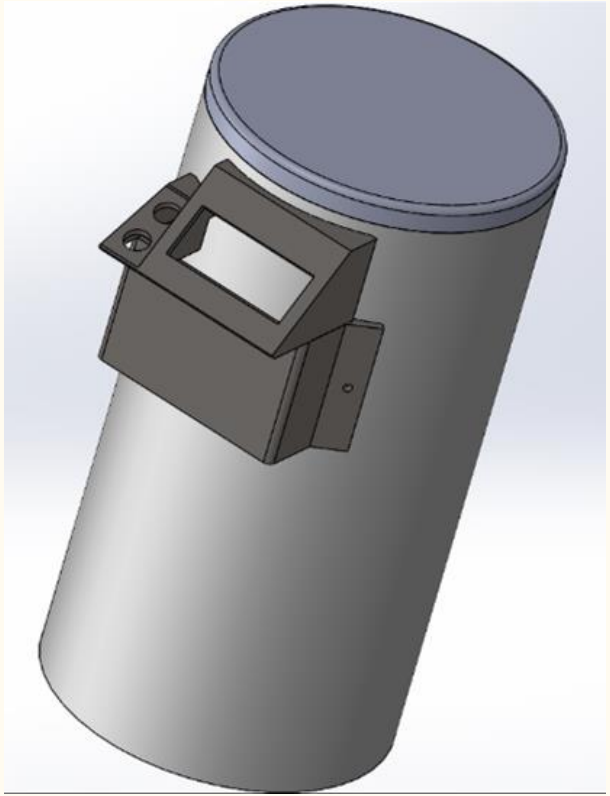
1. Casing for electronic to attach to the trash bin
2. Companion App (Android)
3. Firebase database
4. Trash bin embedded system
    a. Was not able to add weight sensors
    b. Did not have strong enough servo to lift lid
    c. Did not attach system to trash bin

Design Approach: Fabrication

Zion Armstrong

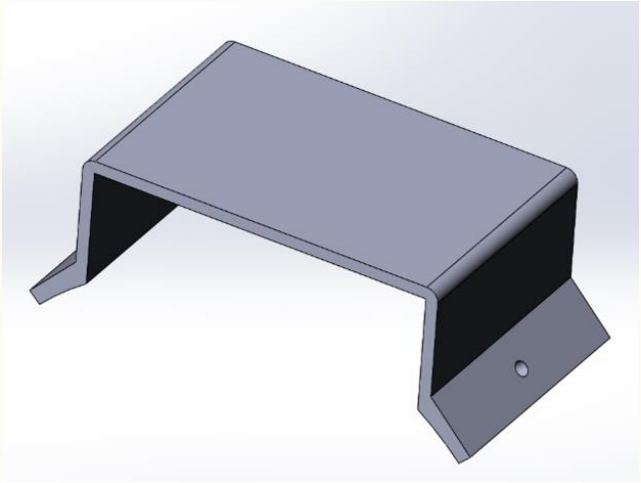
Solidwork assembly

- Holds the electrical components of the smart trash bin
- Easily accessible on the side of trash bin



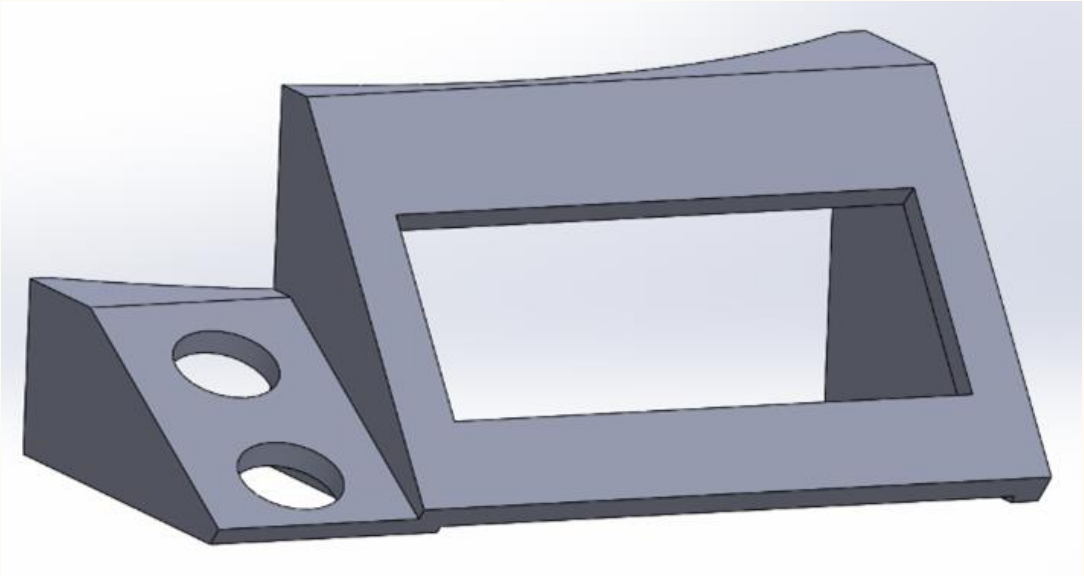
Electronic holder

- Designed to fasten to the rounded side of trash bin via two screw holes
- Covers Raspberry Pi and Arduino
- Provides support for LCD/motion sensor holder



LCD and motion sensor holder

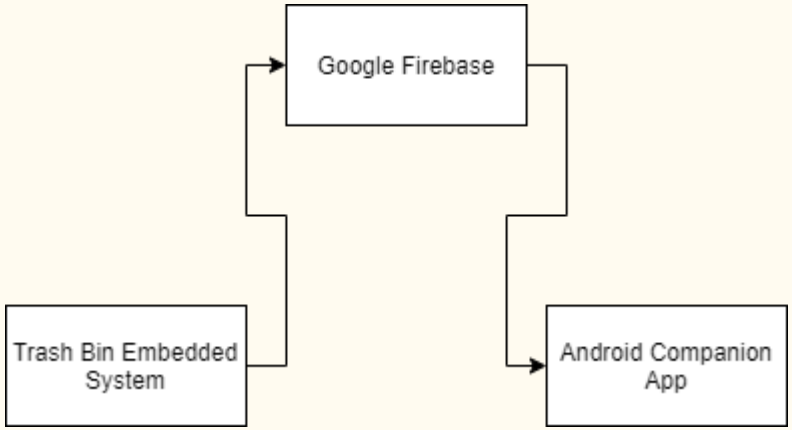
- Right side of case to house LCD screen
- Left side of case contains motion sensing device
- Attaches to top of Arduino/Pi casing
- Back designed to fit around the trash bin



Design Approach: Overview

Daniel Artz

Design Approach Overview



Design Approach: Embedded System

Trent Church

System Overview

1.Microprocessor – A device with memory processor IO.

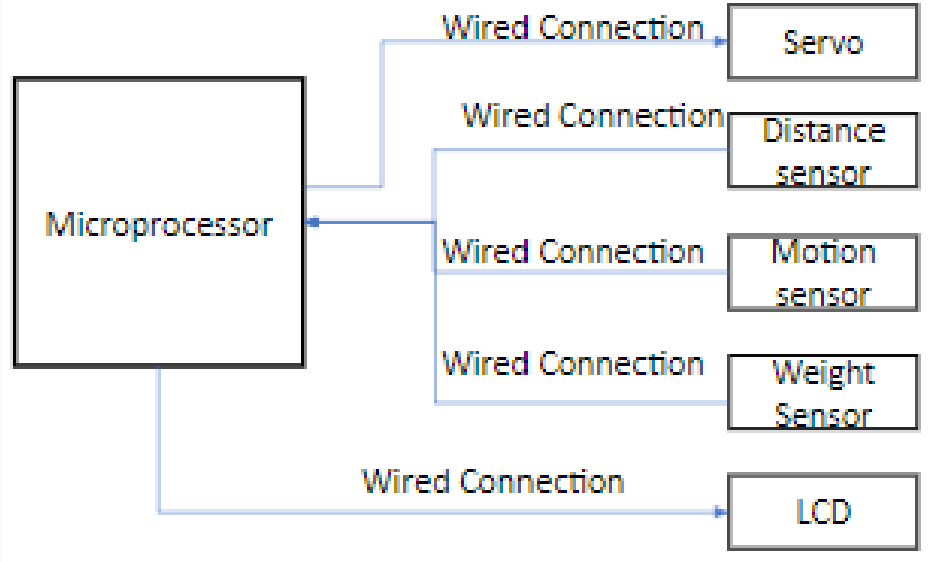
2.Servo - A Servo is a small device that incorporates DC motor, and an integrated circuit to rotate an output shaft.

3. Distance sensor – A device capable of measuring the distance between itself and another object (measures the height of the trash bin).

4.Motion sensor – A device capable of measuring an object's movement within range.

5.Weight sensor – Devices that measure the effect of earth's gravity on an object.

6. **LCD –** A device to display data



System Pinout

1.Raspberry Pi - Raspberry Pi 3B+

2. Arduino Uno

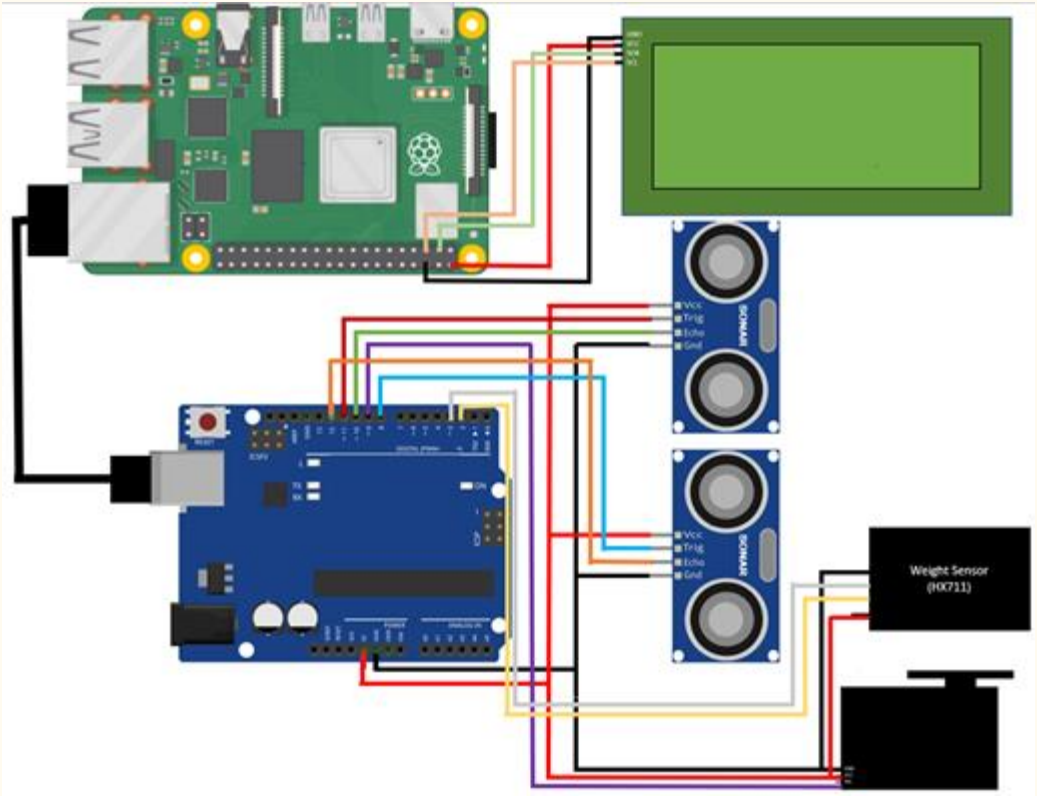
3. LCD - 20x4 character LCD

4. Distance sensor – Ultrasonic Sensor

5.Motion sensor – Ultrasonic Sensor

6.Weight sensor – Load cell sensors

7. Servo - D-20MG

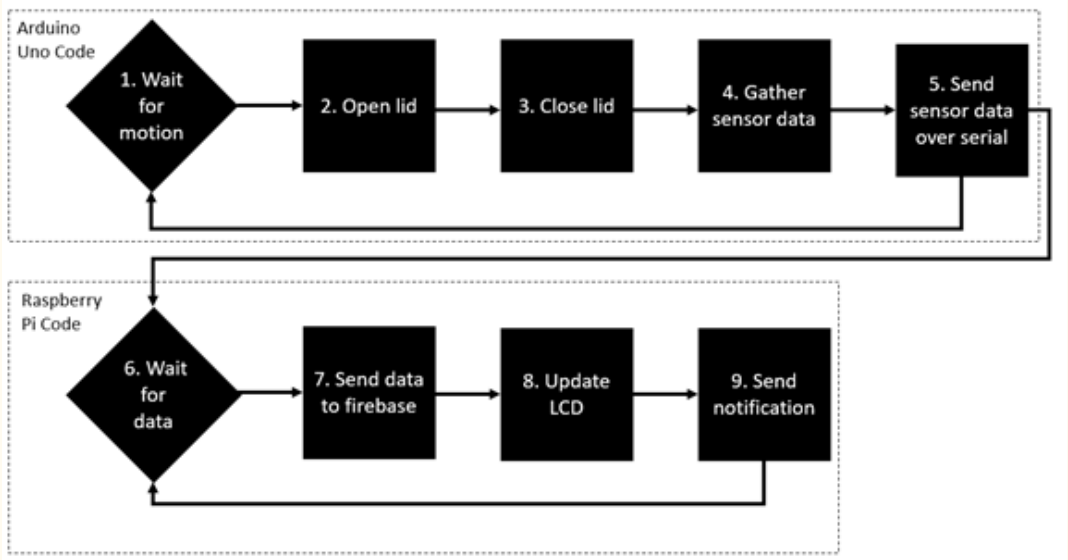


Design Approach: Embedded System Software

Trent Church

Arduino Uno Code

1. Wait for motion: Blocker that waits for the motion sensor to detect motion
2. Open Lid: Statement to use the servo to open the lid for at least 4 seconds
3. Close Lid: Statement to use the servo to close the lid
4. Gather sensor data: statement to gather the data from both the height and weight sensors and convert them to percents
5. Send sensor data over serial: Formats the sensor data into a string and sends it via the serial port to the raspberry pi.



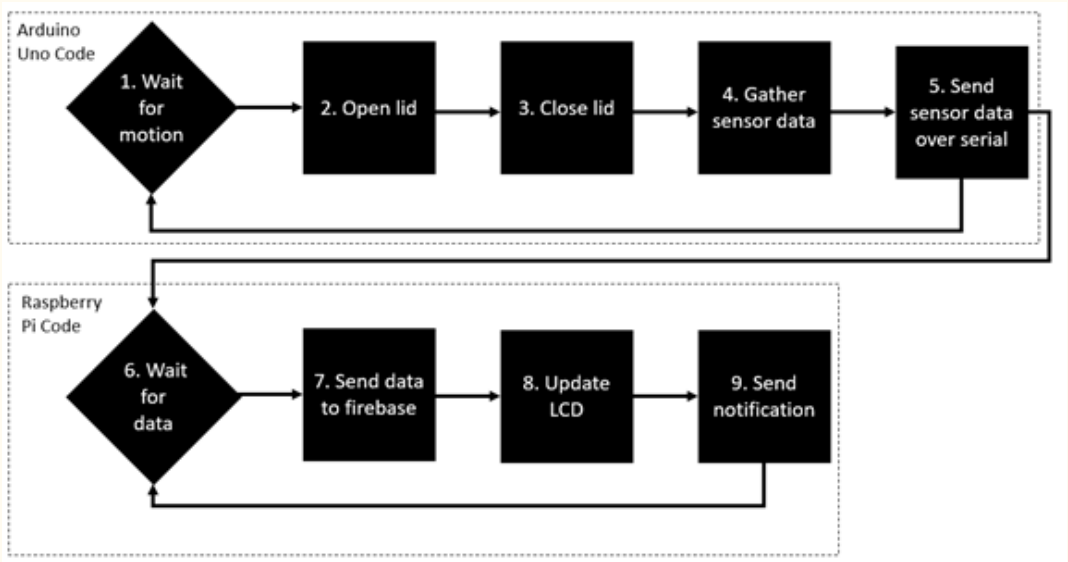
Raspberry Pi Code

6. Wait for data: Blocker that wait for data from the Arduino Uno

7. Send data to firebase: Updates data fields, organizes the data into a json and sends it to the firebase database

8. Update LCD: Update the LCD with the most recent data

9. Send notification: send notification if the trash is above the user specified levels



Design Approach: Companion App

Daniel Artz

Android Companion App Design Approach

Software functional block definitions

1.) Firebase Realtime Database

1.1)JSON Snapshot of Database

2.)Write to file

3.)Reversed trash list

3.1)Trash History Adapter

4.)Delete

4.1)Parent key Sent to Firebase

5.)Trash History Listview

6.)Trash Name List

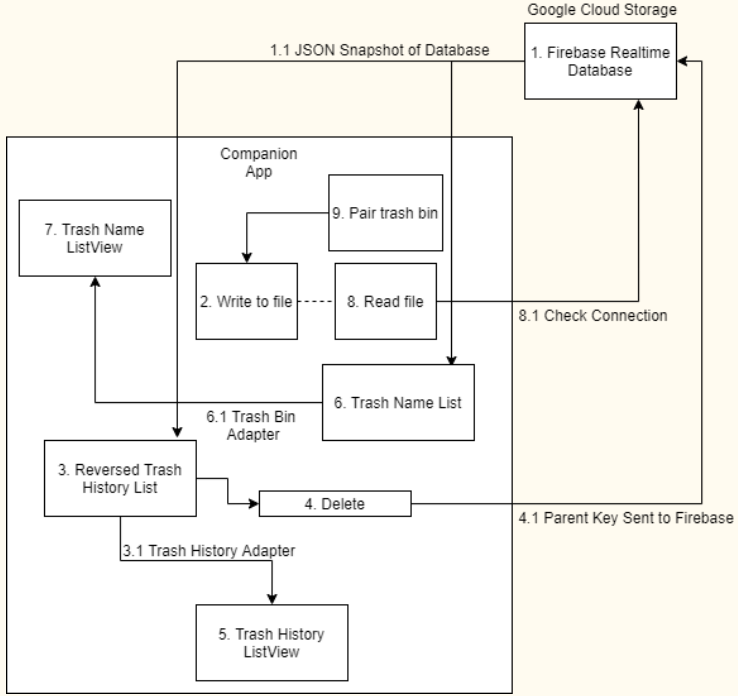
6.1)Trash bin adapter

7.)Trash Name Listview

8.)Read file

8.1)Check Connection

9.)Pair Trash Bin

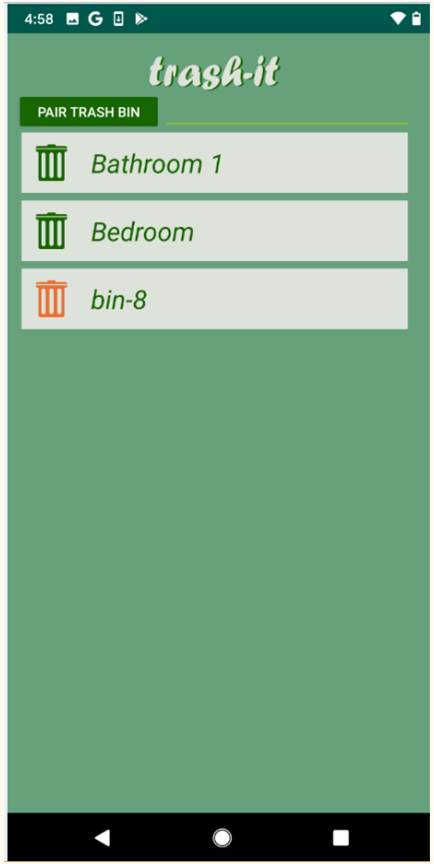


Android App Bin History Screen

- Displays history of trash data
- Allows user to clear history
- Estimates next day trash bin will be full
- Displays the height capacity
- Displays the weight capacity
- Screen updates live

Android App Main Screen

- Displays paired trash bins
- Allows user to pair new trash bins
- Trash bin icon turns orange if height or weight capacity is >= 80%
- Screen updates live



Trash day prediction

trash_day_pred = predicted day the trash bin will be emptied again
height_cap_icon = Current height / height capacity
home_icon = click to go to home screen
last_emptied = date of the last time the trash bin was emptied
weight_cap_icon = current weight / weight capacity

Demonstration: Embedded system

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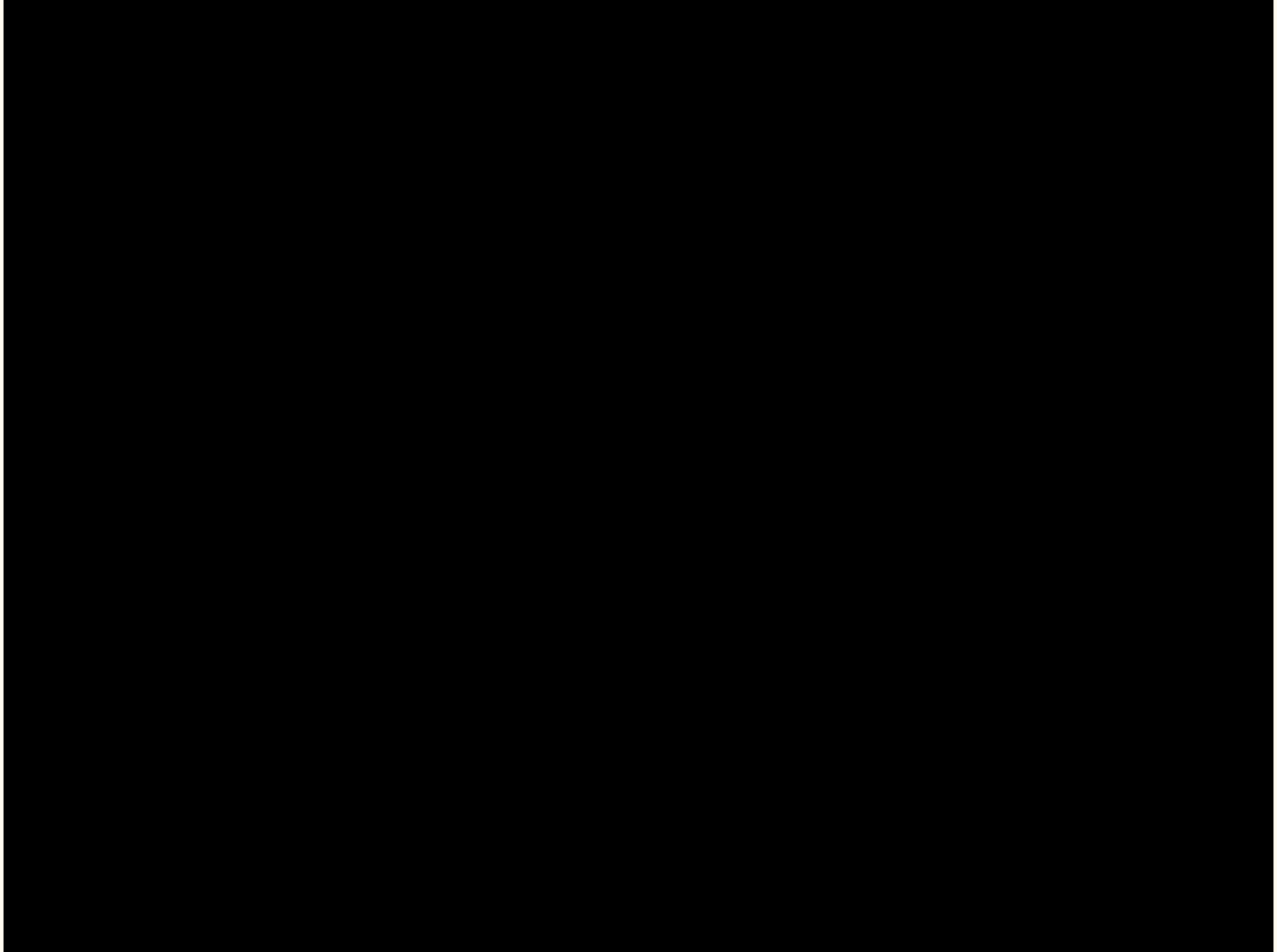
Trent Church

Demonstration: Companion App

Daniel Artz



Testing and Analysis

Magloire Redah

TEST & ANALYSIS

1. Companion app testing
    a. Tested on multiple phones
    b. Tested with multiple entries
    c. Test by Analysis GIT was used for version control (stored repo on Bitbucket)
    d. Tested with and without an internet connection
2. Embedded software testing
    a. Tested the upload of multiple data points to the database
    b. Tested multiple waste height
    c. Tested the setup of trash bin

Summary of results

Magloire Redah

Passed tests (9)

Requirements	Summary
10	The trash bin held 11.25 liters
20	The trash bin is equipped with a motion sensing device
21	Tested at 5cm, 15cm, 25cm, and 35cm
40	The sensor successfully measured the correct height
41	The user was notified when the sensor reached the capacity
50	The App worked on a device using Android 10
51	User was able to add Maximum weight limit
52	User was able to add Maximum height limit
53	The user was notified when the sensor reached the capacity

Failed tests (4)

Requirements	Summary
22	While the servo motor was not attached to the lid of the trash bin, it still rotated (COVID-19 impact)
23	While the servo was not attached, it still activated for 4 seconds(COVID-19 impact)
30	The lack of weight sensor prevented the measurement of the correct weight(COVID-19 impact)
31	The lack of weight measurements prevented the user to be notified due the weight capacity being reached (COVID-19 impact)

TEST RESULTS

Companion app: 4 out of 4 passed

Embedded system: 3 out of 3 passed

Requirements: 9 out of 13 passed

Constraints: 11 out of 11 passed

Standards: 6 out of 6 passed

TOTAL TESTS: 33 out of 37 passed

Conclusion

Magloire Redah

Challenges

- Parts were never received
- Covid 19
  - Testing remotely
  - Communicating remotely

Conclusion

In conclusion, due to the lack of parts and testing equipment some of the design objectives and requirements were not met but we were still able to:

- Create a companion app that displays pertinent information.
- Develop the necessary software to interact with hardware and display appropriate data.
- Connect the device to the internet.
- Build and connect all available hardware components in an efficient way.

Q & A ?