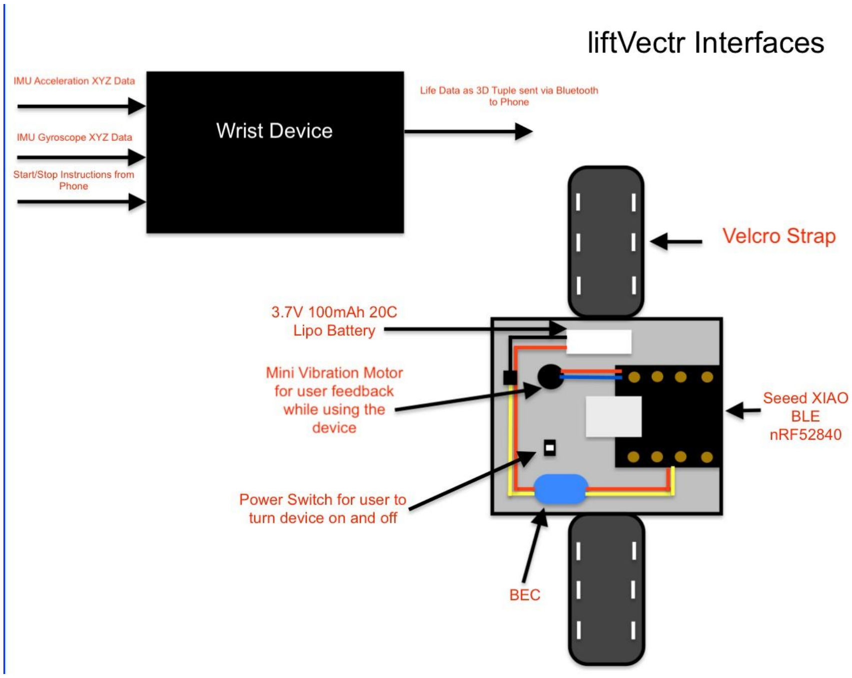
liftVectr Mockups

Praveen Anbu, Micah Bowonthamachakr, Antoine Ferguson, Cole Fisher, Timothy Krause

INTERFACES



SYSTEMS

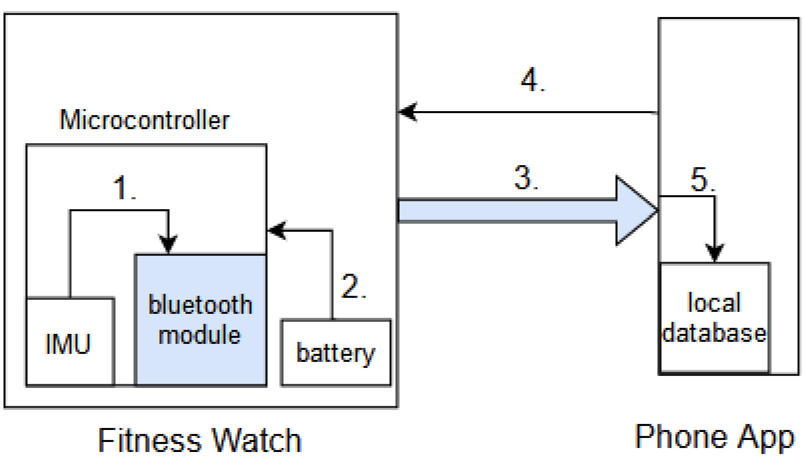


Figure A1: System design displaying connections between the app and the watch

1. IMU records data from the user's movements and is transferred to the bluetooth module
2. Rechargeable lithium battery powers the microcontroller
3. IMU data is sent from the bluetooth module to the phone app

4. App will control when to start and stop recording IMU data
5. IMU data used by the phone app is stored in a local database

NETWORKING

Wireless Networks

Due to scenarios where users are weightlifting without internet access, the liftVectr needs to be fully functional without the use of a wireless network. Thus, the application will store gathered IMU data in a local database utilizing the Android Room library, and perform calculations based on the persisted data.

Bluetooth Communication

The microcontroller within the fitness watch will initialize the bluetooth module, creating a SoftwareSerial object with Rx/Tx pins set to the BLE module. It will then continually wait for bluetooth transmissions, indicating whether or not it should transmit the IMU data.

The phone app will attempt to connect to the wrist device on startup. When a user wants to begin an exercise, they will press a button, sending a "true" transmit boolean value over bluetooth to the microcontroller (only if a bluetooth connection still exists). The data received from the watch via bluetooth will be parsed and stored in an **imu_raw** data object, which will contain floats for all data values (Xa, Ya, Za, Xg, Yg, Zg). Sets of **imu_raw** objects will be stored into an array list, likely within an **exercise** object. The app will continue to receive and log IMU data until a button is pressed to end the exercise.

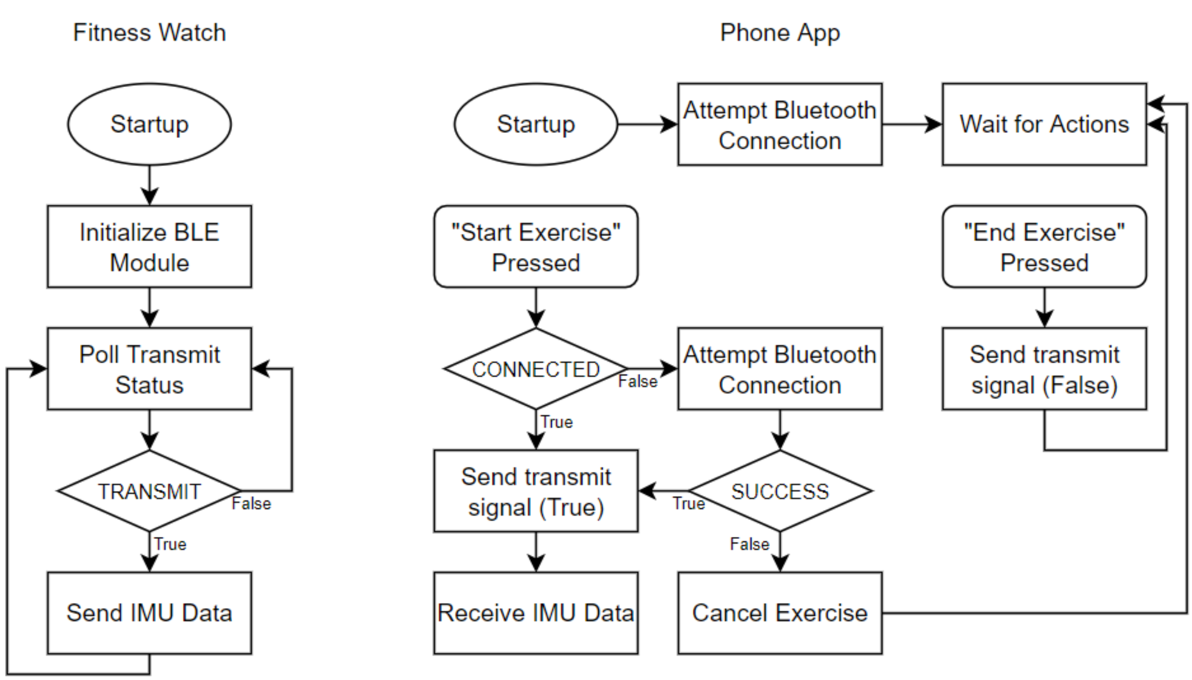


Figure B1: Bluetooth transmission flowchart for watch and app

STORYBOARDS

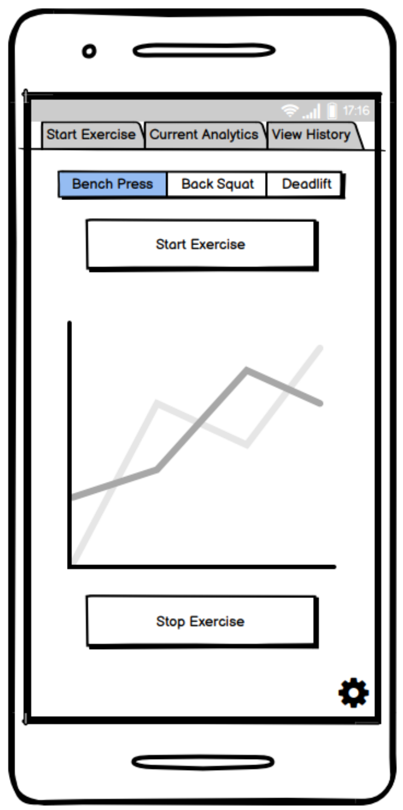


Figure C1: Home Screen/Exercise Initiation
This is the home screen of the application and reached through the ‘Start Exercise’ tab, where the user can initiate and stop the data gathering during a workout set and view the real-time readings of the IMU.

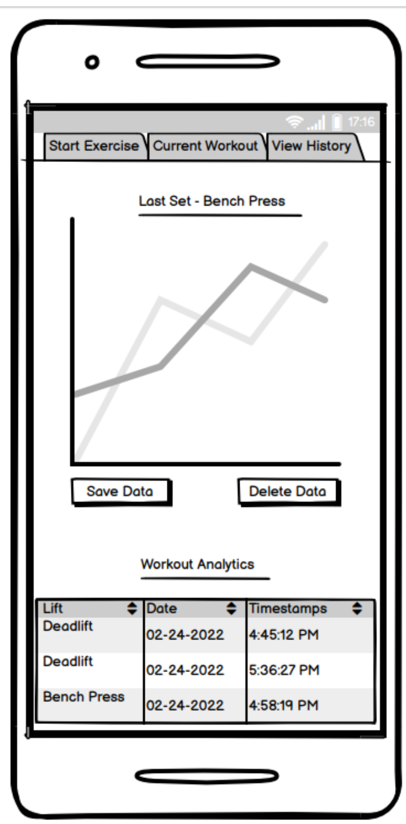


Figure C2: Current Workout Data
This figure shows the data visual of the user’s most previous set and a chart with hyperlinks to data visuals of the previous lifts within the current workout through the ‘Timestamps’ category. The user will be able to save or delete the data of a certain set.

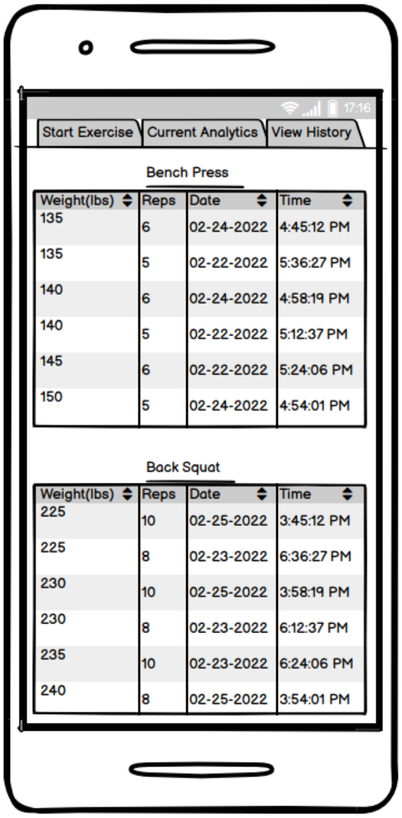


Figure C3: Historical Lifting Data
This screen can be reached by clicking the View History tab at the top, and will display a chart of the attempts at each of the lifts as well as a hyperlink to the data visuals through the 'Time' category.

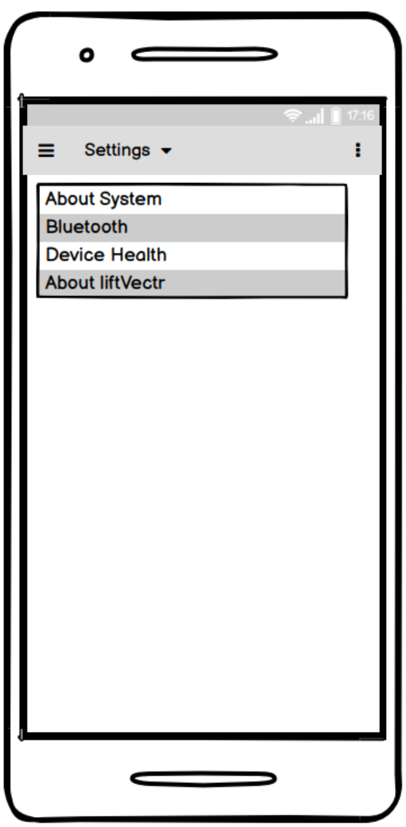


Figure C4: Application Settings
This screen can be reached by clicking the gear on the Home Screen, and can be used to learn about the app, view the wearable device battery, and view the bluetooth connection status.

DRAFT SCHEMATICS

Although the parts for the project have not been ordered, rough dimensions for the parts are available online. Thus, the first prototype schematic shown here is an approximation of the actual prototype to be CAD modeled after parts have been received and measured accurately using calipers and such. Note that a main battery on/off switch may be added, depending on experimental results of power draw when the device is idle. This depends on the programming efficiency and if we are able to use the XIAO's low-power mode (5 uA). A hole on the side of the chassis allows for access to the XIAO's USB-C port for all-in-one programming and charging of the battery.

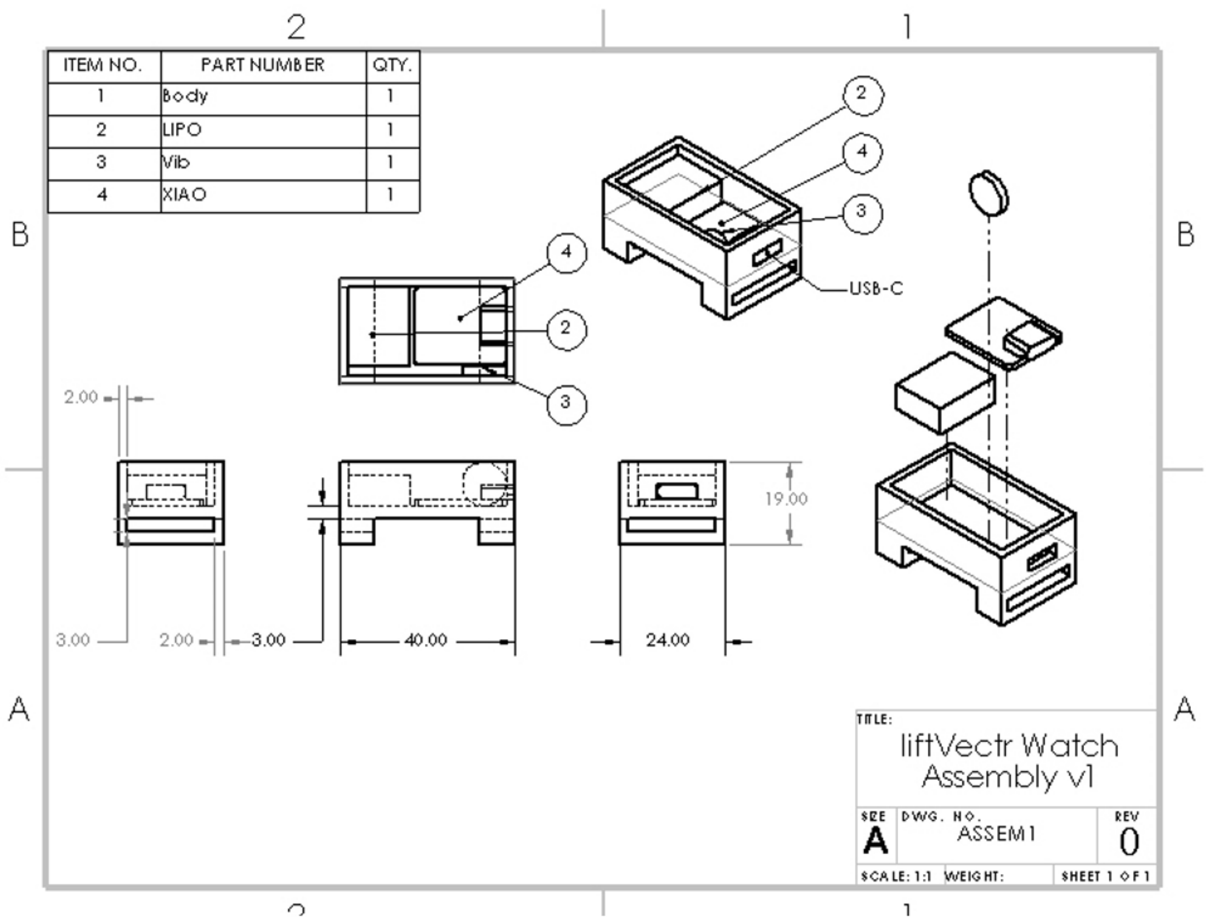


Figure D1: SolidWorks assembly schematic for watch body design.

The schematic above depicts the chassis/body for the watch, and some positioning of the internal parts. As of right now, the watch requires only the SeeedStudio XIAO BLE Sense board, a single 3.7V 100mAh lipo battery, and a 3v vibrating motor. These all fit in the chassis and for the first prototype are intended to be affixed using light adhesives. The figure below demonstrates how the open-faced prototype chassis will be affixed to the tester's wrist using a simple velcro strap:

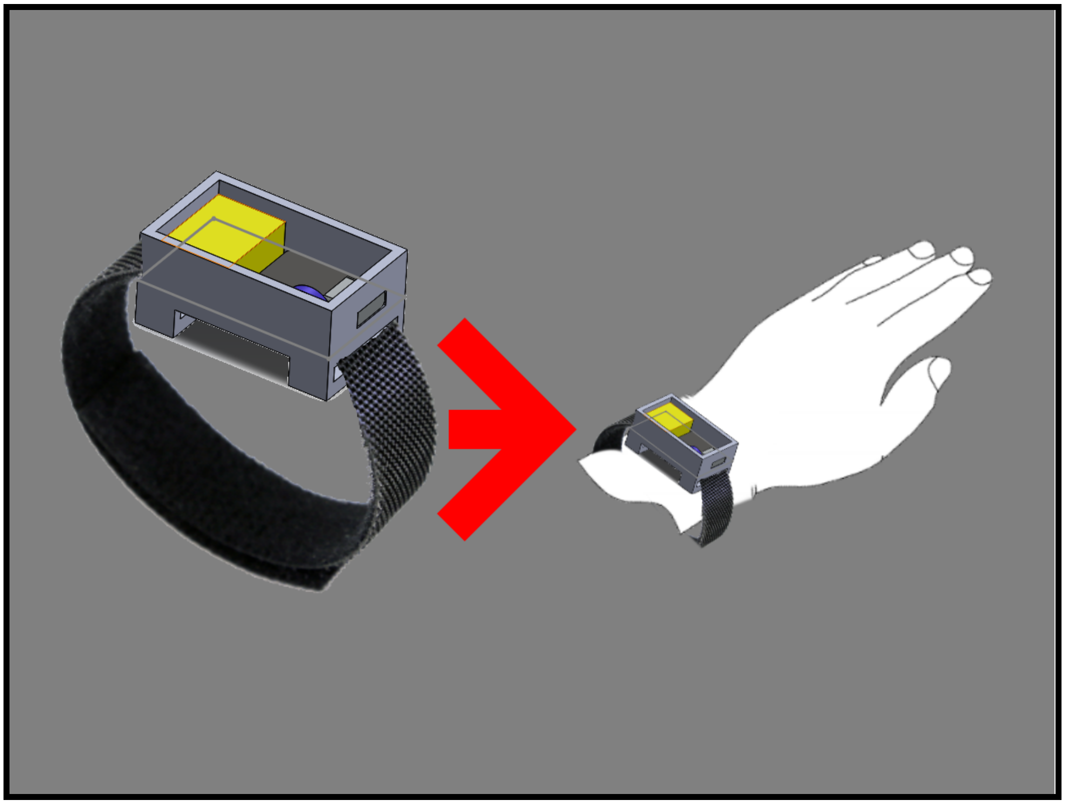


Figure D2: Depiction of how to wear the prototype using a simple velcro band inserted through the slots under the watch chassis (not to scale).

For hardware parts and tools, it may be also useful to reference the bill of materials shown below. This was submitted to the ECE Senior Project Assistance program and covers the costs required to produce 4 prototypes (the budget limit was $200).

liftVectr Tentative Project Parts List			
Item Name	Unit Price	Quantity	Subtotal
Seeed XIAO BLE nRF52840 Sense	$15.99	4	$63.96
Small breadboard kit with 170 Tie Points, 12Pack	$12.99	1	$12.99
15PCS 10mmx2mm Mini Tiny Vibration Motors	$12.99	1	$12.99
840 Solderless Breadboard Connecting Line	$13.99	1	$13.99
Diatone 2-6S Mamba Micro BEC 2A 5V/9V	$3.39	4	$13.56
3.7V 100mAh 20C Lipo Battery 4 Pack With Charger	$18.99	2	$37.98
Mini Solder-able Breadboard 5Pack	$10.28	1	$10.28
Total:			$165.75

Table D3: Tentative Bill of Materials/Budgeting List.