

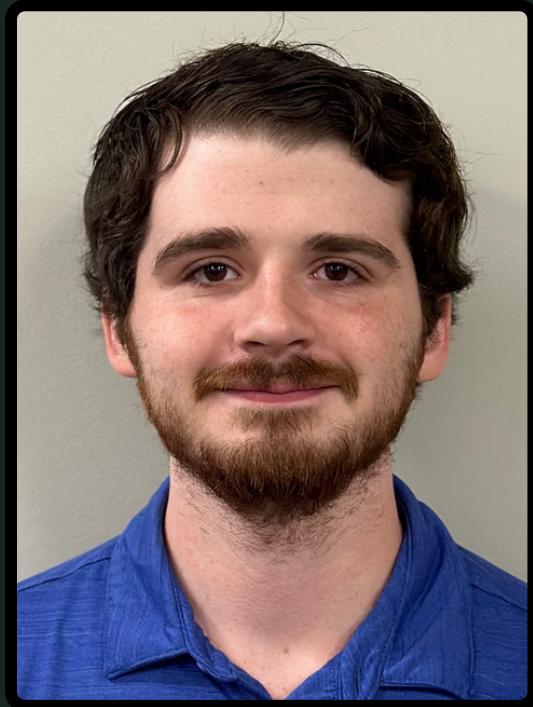
MID-SEMESTER DESIGN REVIEW

THE WORKOUT BUDDY

Brought to you by Bravo Builders



THE WORKOUT BUDDY TEAM



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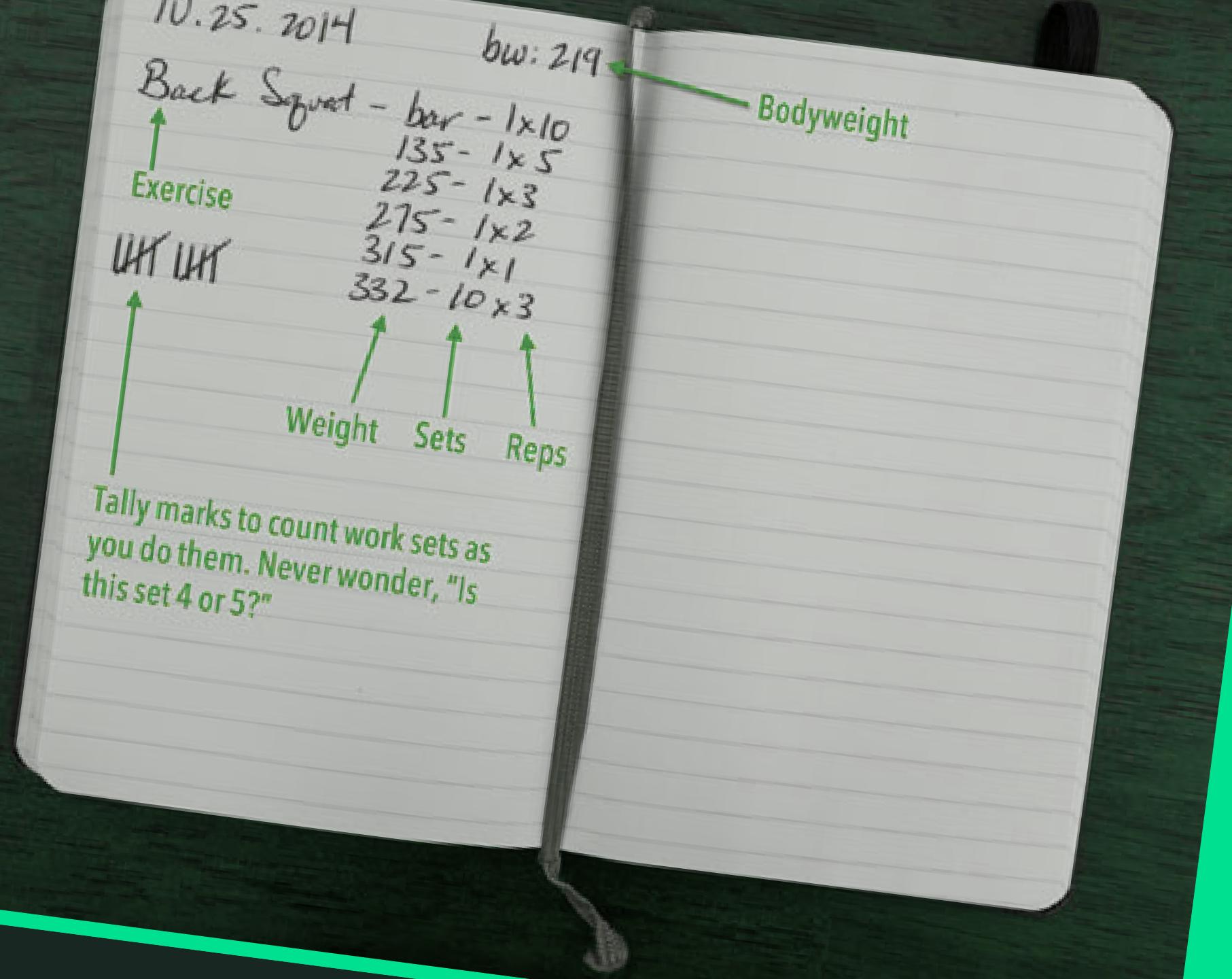


Figure 2 adapted from [1]

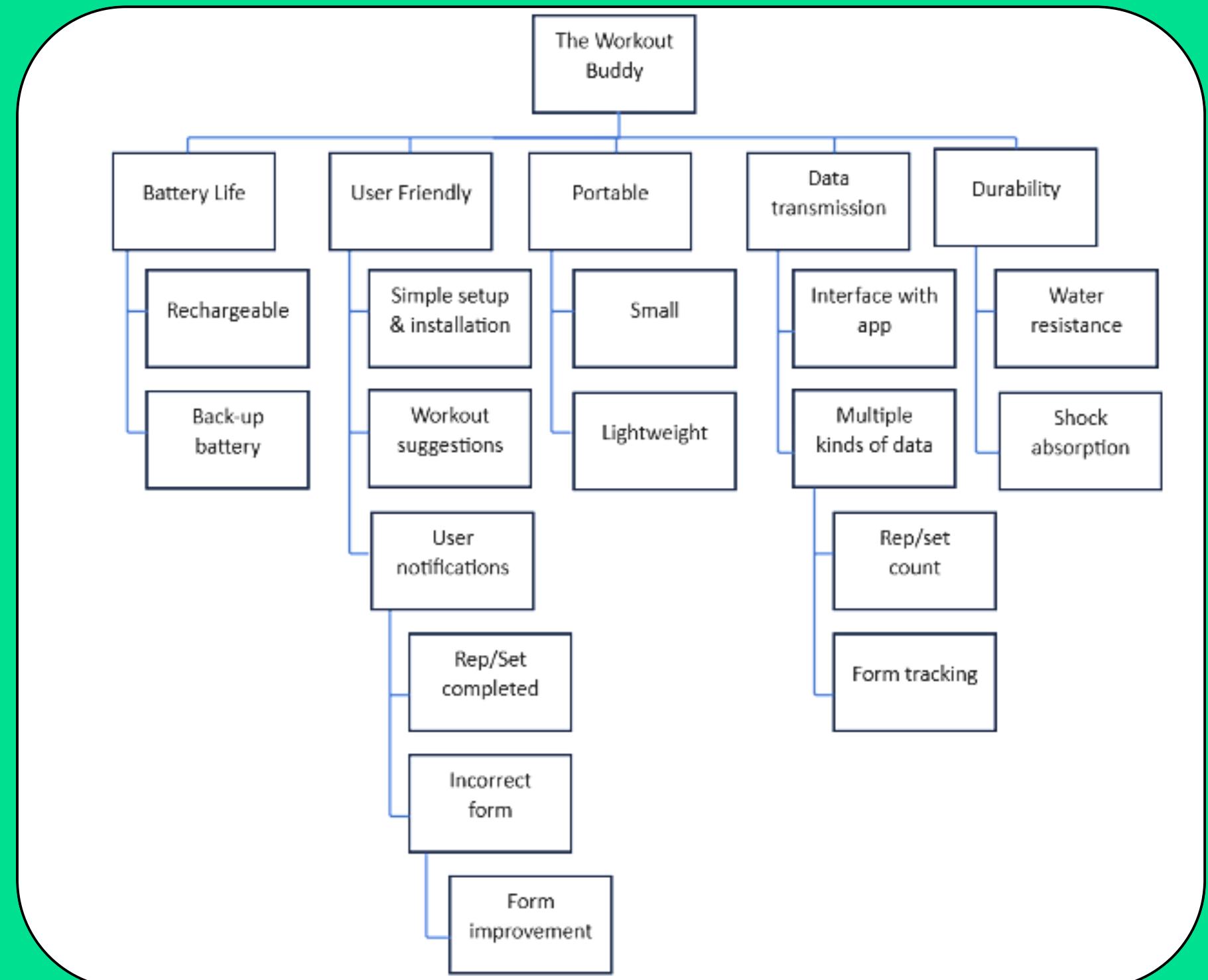
The Problems

THE WORKOUT BUDDY

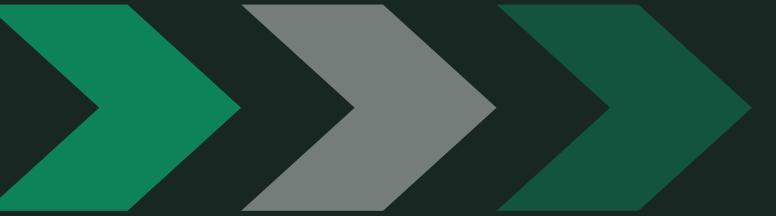
- Newcomer gym anxiety
- Risk of injury (overloading weights, poor form)
- Loss of repetition & set counting
- Uncertainty in exercise choice
- Lack of equipment

Marketing Requirements

1. The Workout Buddy has a long-lasting battery life.
2. The device collects data from the sensor module and transmits data to the user.
3. The device is portable.
4. The device is durable.
5. The device is user-friendly and accessible.



Engineering Requirements



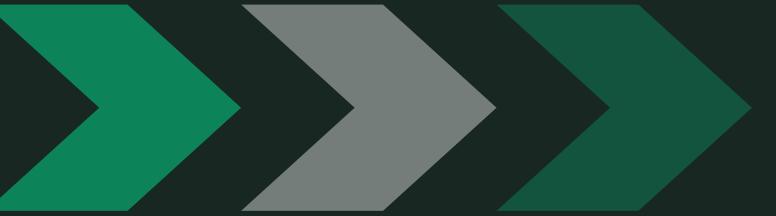
Marking Requirements	Engineering Requirements	Justifications
2 & 5	The product meets or exceeds X% accuracy in rep detection and logging	This accuracy ensures that the user receives an accurate number of reps and sets
1	The average battery life of the product is at least X hours in active use and X hours in standby mode.	The Workout Buddy has a long battery life so that the user is not required to charge the battery,
2 & 5	Product does not exceed safe levels of electromagnetic (EM) radiation at proximity.	This limit ensures that the user can safely use The Workout Buddy without adverse effects.
3 & 4	The sensors are housed in a protective casing for environmental resilience.	The sensor system is in a case that protects it and any wires from user sweat or other liquids, such as water
2 & 5	The product includes an audio output for feedback to the user as each rep/set is completed.	The device outputs a notification sound letting the user know that the set or workout is done.

Constraints



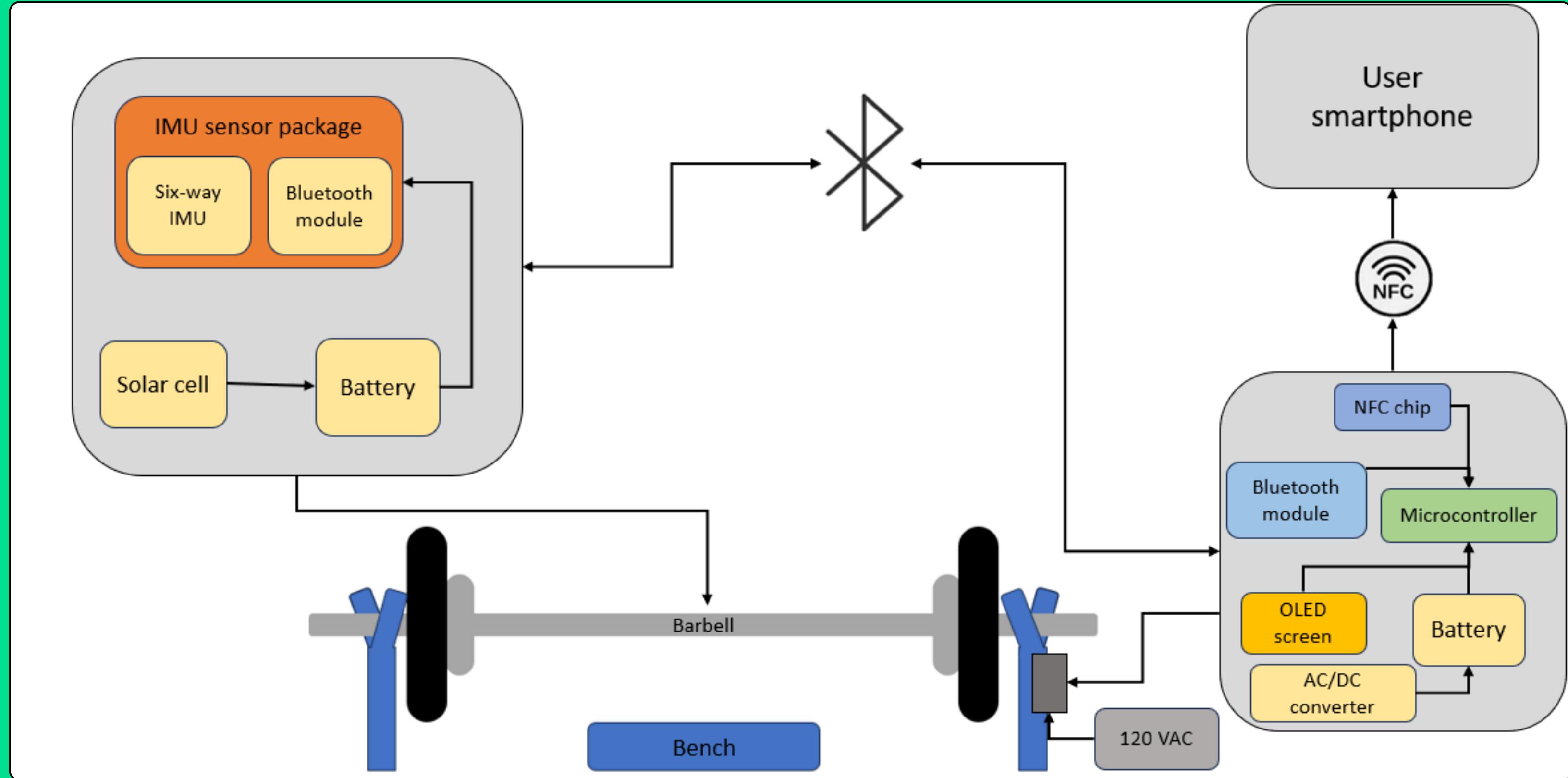
Type	Name	Justifications
Economic	Cost	The Workout Buddy has a \$1,000 development budget provided by Mississippi State University.
Economic	Time	The design team has two semesters in which to complete a working prototype.
Manufacturability	Size	The equipment dimensions do not interfere with the use of a standard 1-inch barbell.
Manufacturability	Weight	The total weight of equipment on a barbell does not exceed 2.5 pounds.
Health and Safety	Safety	Wires and equipment are isolated and protected from the user/environment.
Technical	Communication	The NFC transmitter has a maximum range of 4 cm.

Engineering Standards



Specific Standard	Standard Document	Specification/Application
IP-67	IEC (International Electrotechnical Commission) Standard 60529	The Workout Buddy is water and sweat proof. This ensures the safety of the equipment and user.
ISO/IEC 18092:2013(E)	NFCIP-1	The data is transmitted from the base station to the user's smartphone.
IEC 61960-3:2017	IEC standards for battery power electronics	This standard ensures that the battery is safe for consumers to use.
IEEE 829-2008	IEEE (Institute of Electrical and Electronics Engineers) standard for software and system test documentation	This standard is for software testing when using a software-based system.
Bluetooth Core Specification Version 5.4	Bluetooth Core Specification Version 5.4	This standard is used to communicate between the sensor and the home base.

Approach Overview Design



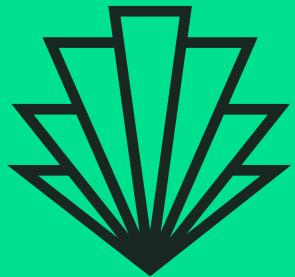
Subsystems



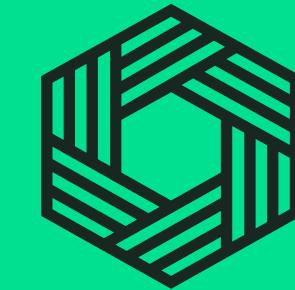
SENSORS



**POWER
DISTRIBUTION**



SOFTWARE



FITTING SYSTEM

SENSORS

- MICROCONTROLLER
- DATA TRANSMISSION
- ULTRA LOW POWER CONSUMPTION (5uA)
- THREE AXIS ORIENTATION DATA BASED ON THE CIRCUMFERENCE VECTORS
- TRACKING OF ANGULAR VELOCITY AND LINEAR ACCELERATION
- REPETITION COUNTING
- ANALYSIS OF BARBELL PATH METRICS
- BLUETOOTH CONNECTIVITY

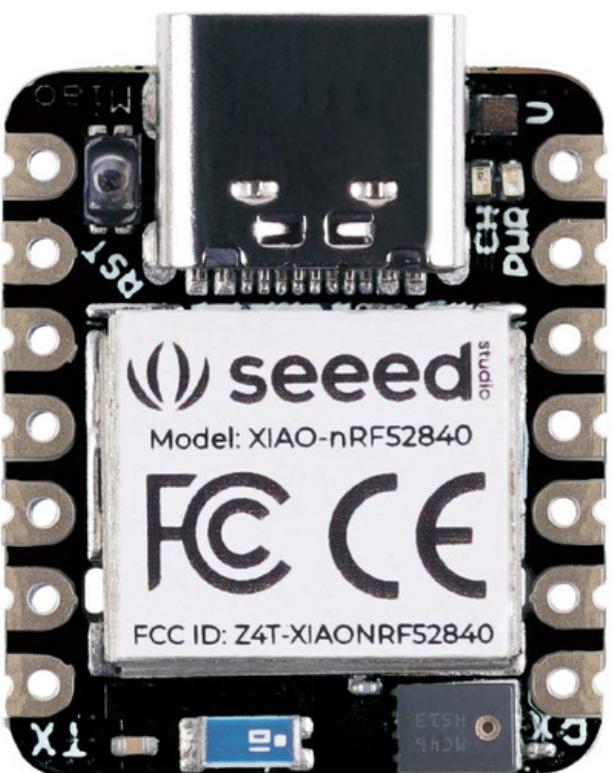


FIGURE 3 ADAPTED FROM [8]

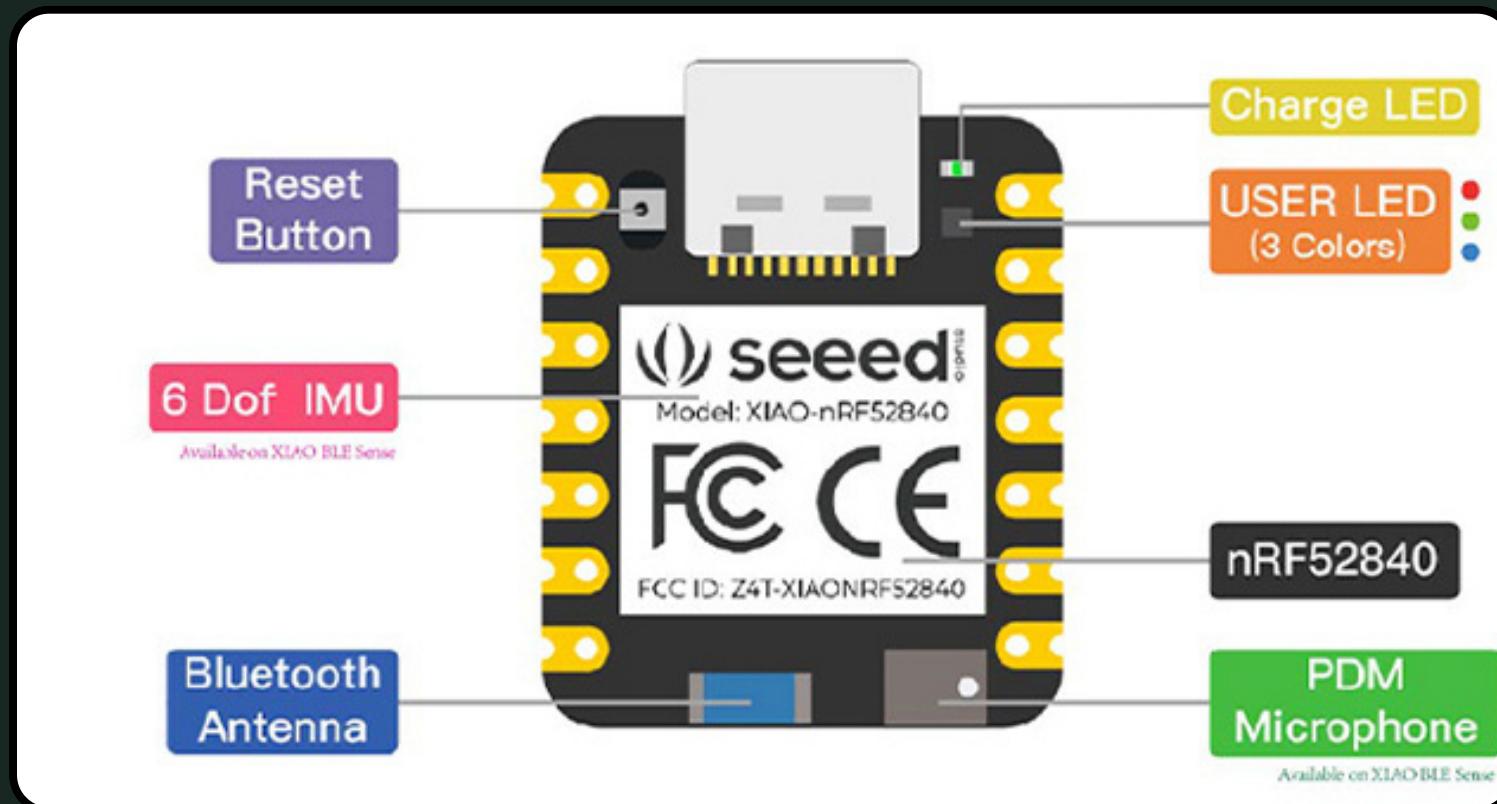


FIGURE 4 ADAPTED FROM [8]

POWER DISTRIBUTION

The microcontroller is powered through a normal United States 120VAC outlet.

The sensor is powered by a 3.7V Lithium battery with solar cells as a backup power source and battery charger.

Figure 6 adapted from [2]



Figure 5 adapted from [3]



COMMUNICATION

- IMU Sensor with built-in Bluetooth module
- Bluetooth communication between the sensor system and fitting system
- OLED screen (I₂C)
- RFID Transponder IC 13.56MHz ISO 15693, NFC PWM 1.8V ~ 5.5V

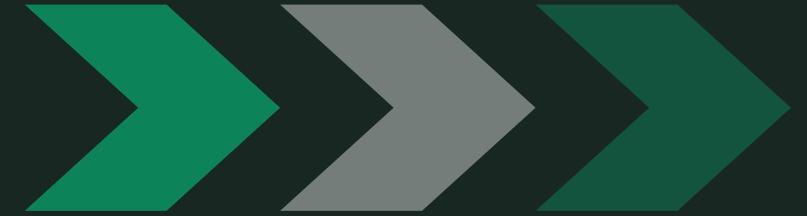
Figure 7 adapted from [5]



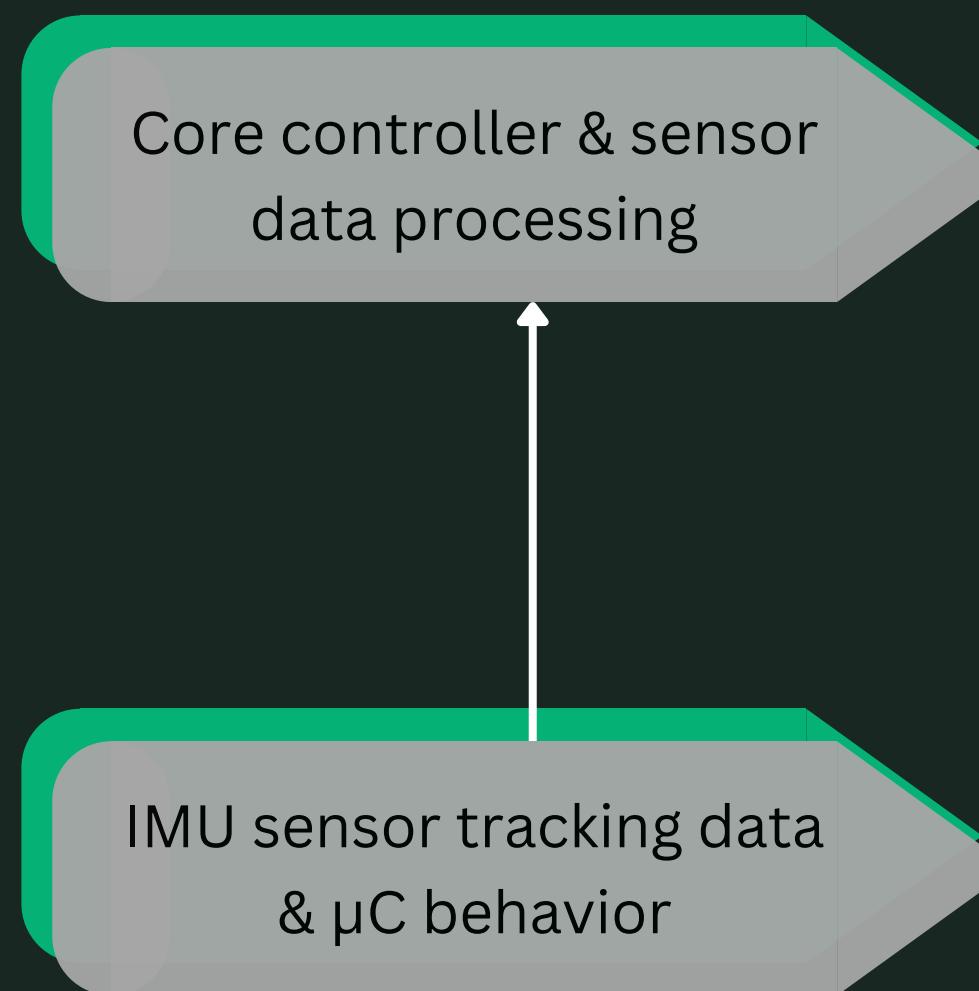
Figure 9 adapted from [7]

Figure 8 adapted from [6]

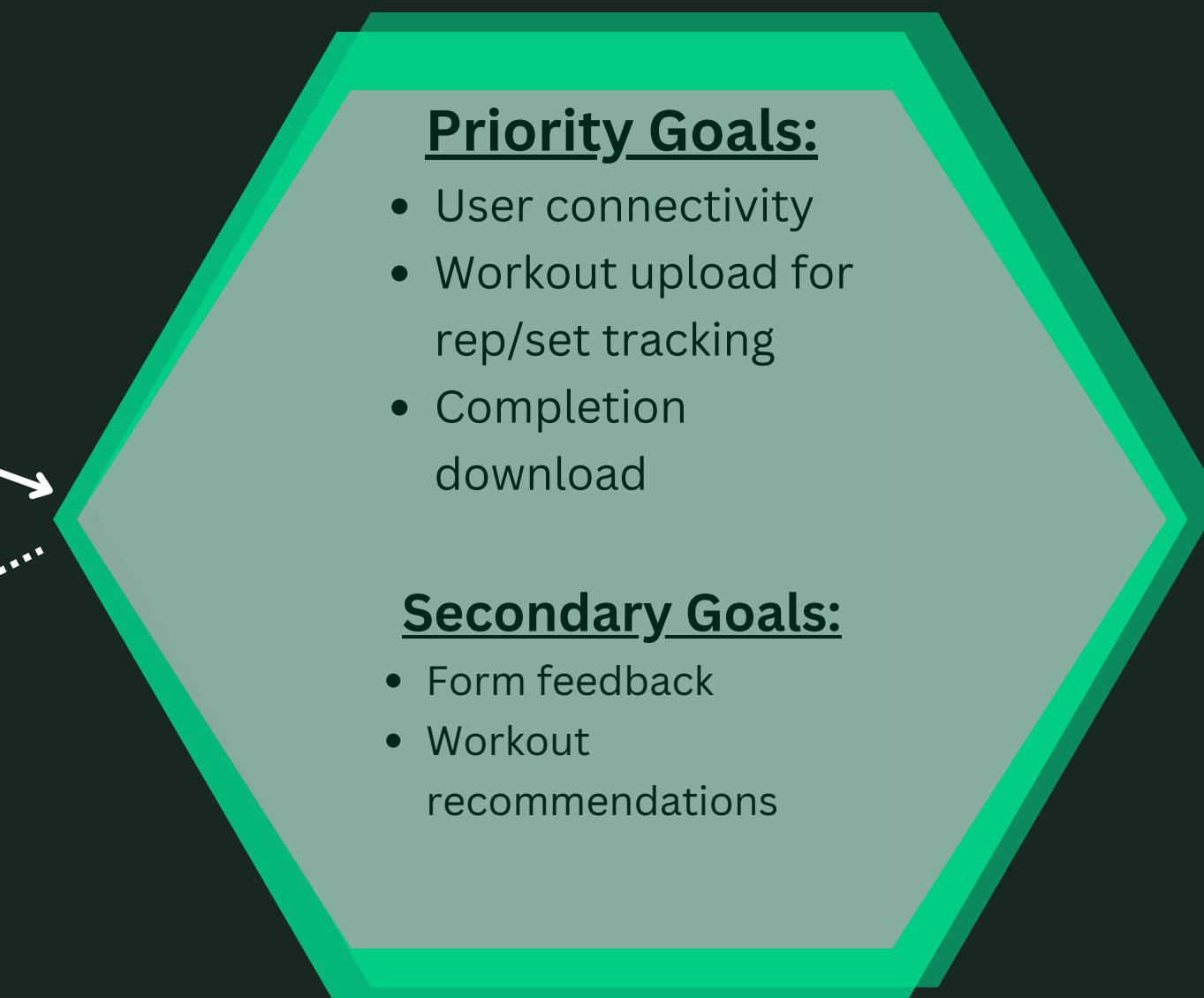
SOFTWARE DEVELOPMENT



System Software



Smartphone Application



FITTING SYSTEM

- Wires fit into rack as to be concealed to improve overall safety
- Housing circuit components to protect each component from outside factors such as sweat dust and pressure
- Mounting sensors to a position that is not interfering with the user at any time during use
- Cords attaching to exterior points in the system will not run across the floor
- System will be universally fitting new and old equipment



Figure 10 adapted from [4]

REFERENCES

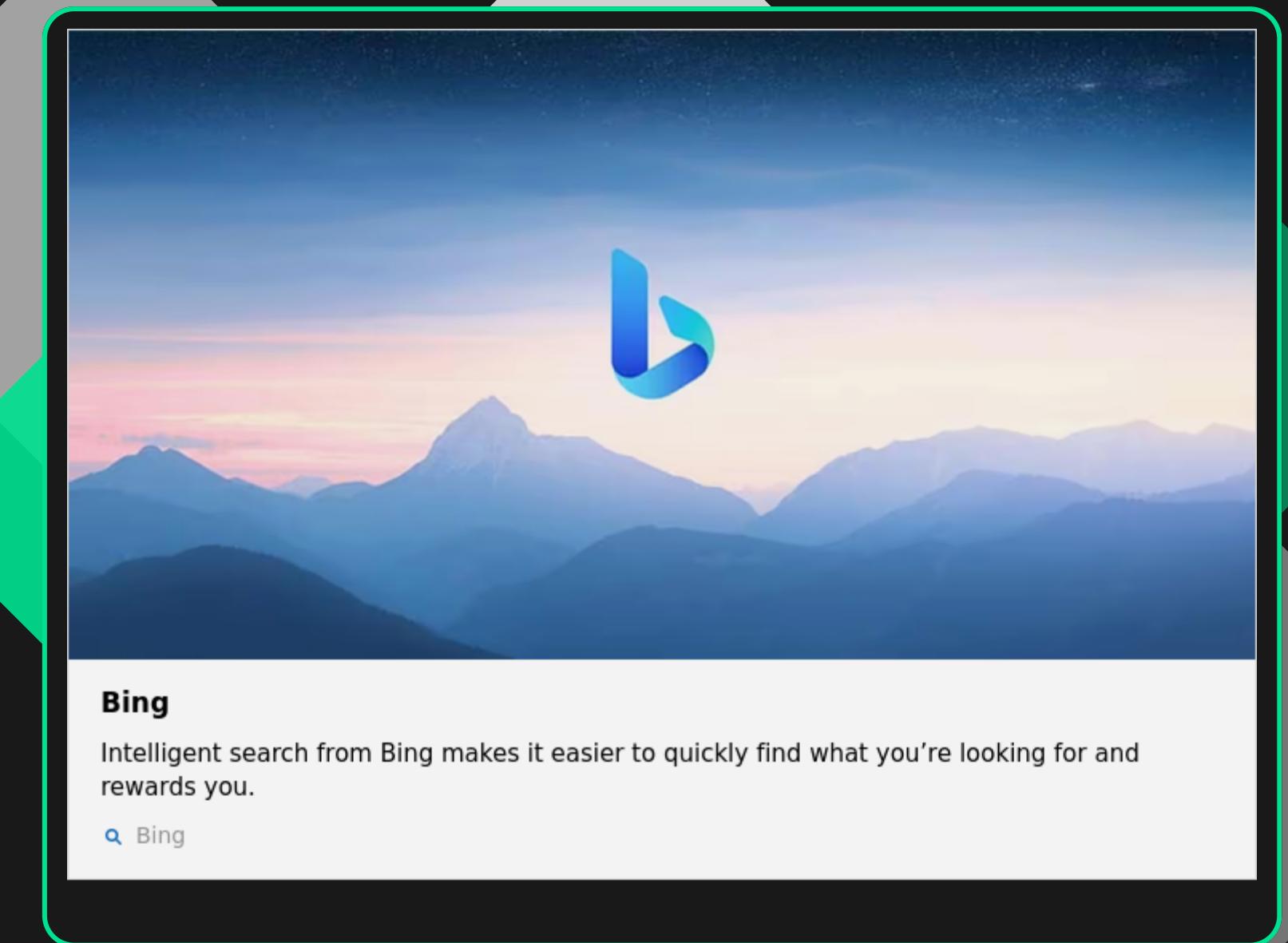
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AI USE ACKNOWLEDGEMENT

Bravo Builders acknowledge the use of Microsoft Bing Image Creator in the preparation of this assignment for image generation.





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