Final Presentation

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Use Case Requirements

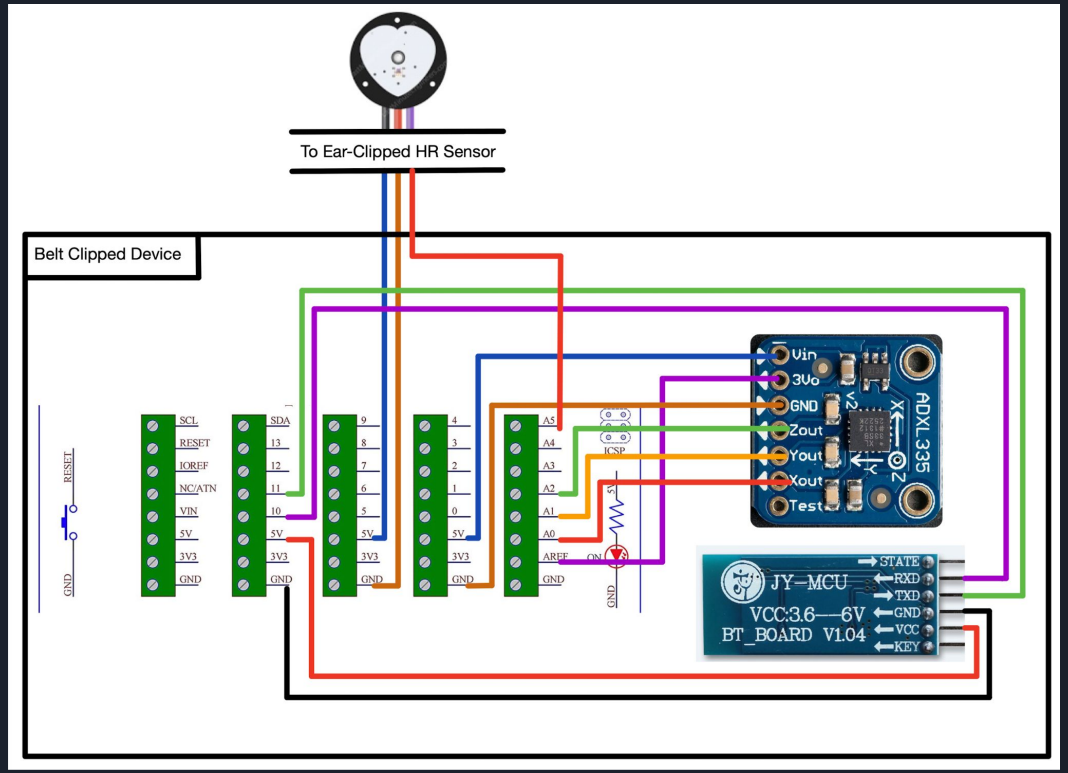
Quantitative Use Cases:

- Users of the application will be able to set 25 minute timers and monitor their Heart Rate (BPM), surrounding noise (DB), and movement (m/s^2).
    - Be able to detect if users are excited or not (a change of heart rate of > 40% after initial calibration)
    - Be able to detect if user is in a quiet environment (noise < **5** dB increase after initial calibration)
    - Be able to detect if user is moving around or not (any > 0.2 **distance difference between acceleration vectors of two consecutive time periods** is loss of focus)
- Based on completion of the focus session, users will be awarded or penalized in the form of Cryptocurrency (Near Tokens).

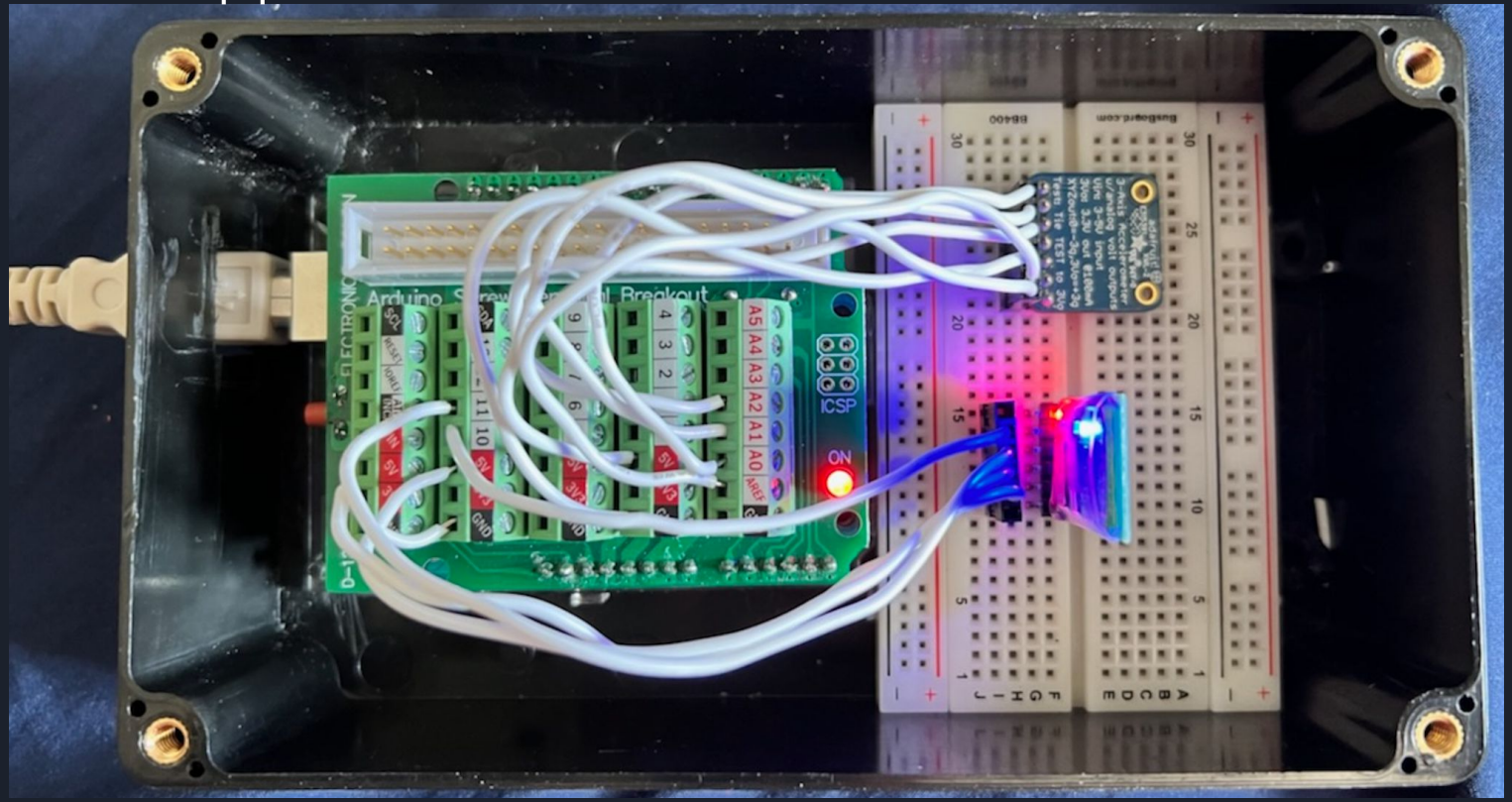
Solution Approach

- Changing the algorithm
  - Changing acceleration difference, thresholds are changed
  - Sound Decibel
  - Heart Rate Sensor is now attached to ear rather than wrist
- 2+ Criterias are failed for 30+ seconds at a time
- 1+ criteria fails for 6.25+ cumulative minutes
  - However, these criterias will be adjusted for demo purposes as we do not have enough time to show for that long.

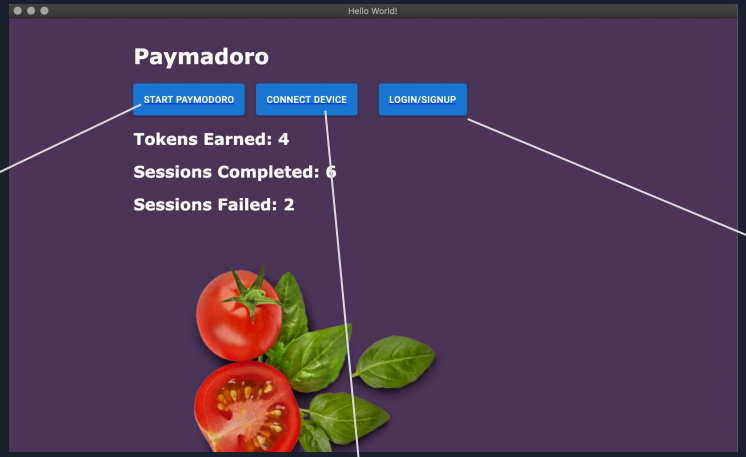
Complete Solution: Belt Clipped Device

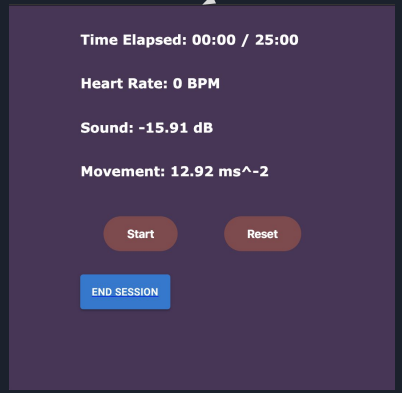


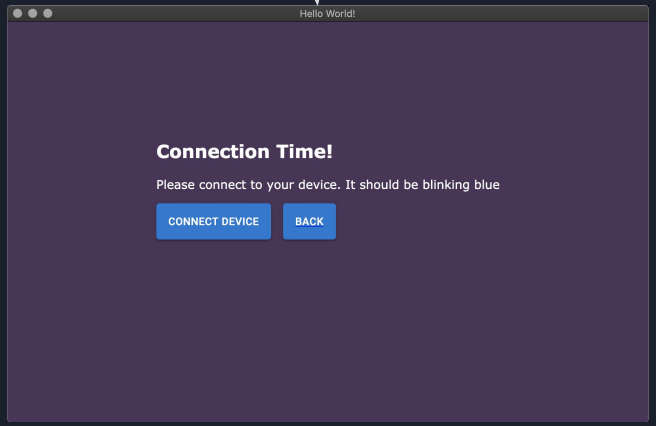
Complete Solution:
Belt Clipped Device

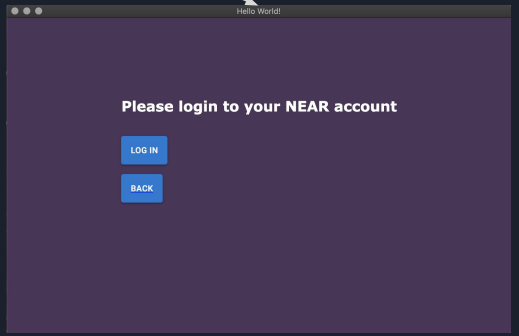


Screenshots of Desktop Application









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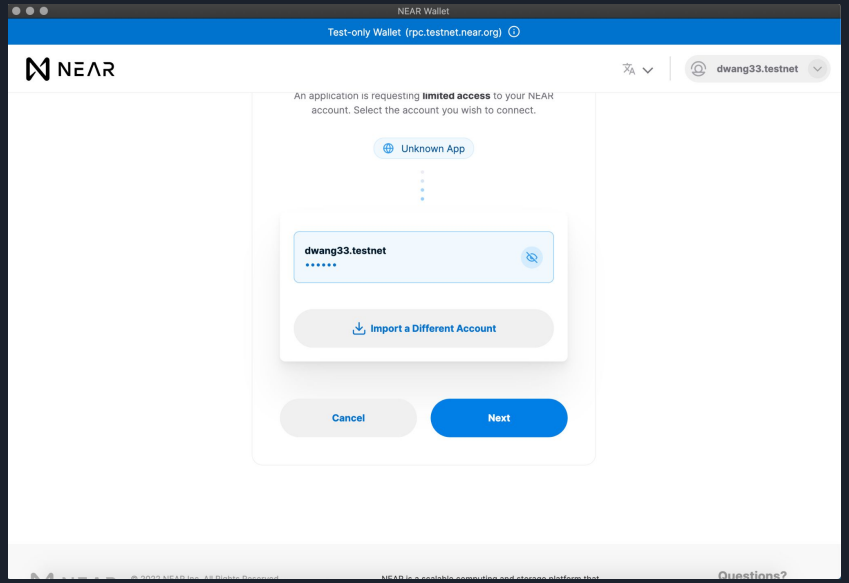

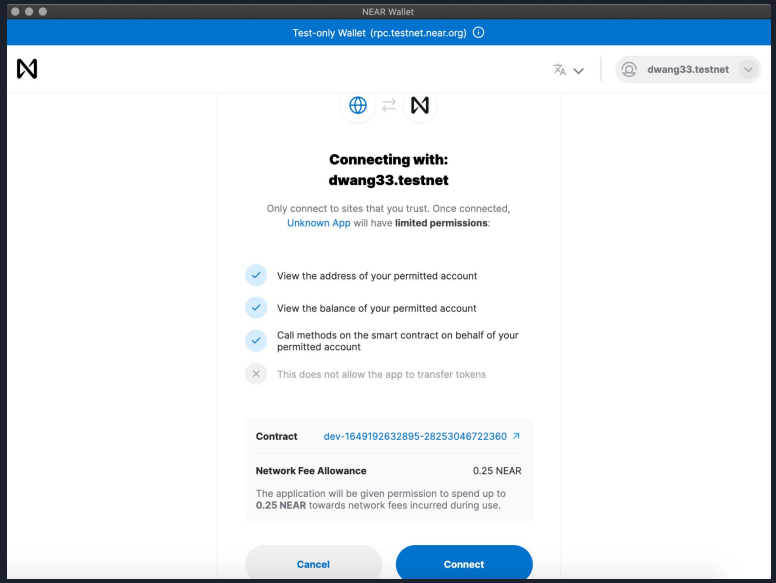

Test, Verification, Validation 1 (Updated from Design Review)

Test	Verification	Why?	Risks	Mitigation
Ending session time	< 15 seconds	Usability	The blockchain is slow, bluetooth issues	Strong bluetooth connection Getting a premium blockchain connection
Criteria failure: fail each criteria purposefully	Failed criteria are properly marked	Ensure that our algorithm computes correctly	Faulty sensor measurement	The “error of sensor test”
User agreement with result	< 20% false positive < 10% false negative	User satisfaction	The users each have different standards of what focus means	Tell testers our definition of focus

Test, Verification, Validation 2 (performance)

Test	Performance	Reasons
Ending session time	Great! < 8 seconds to start and stop a session	Assuming, BT connection is established, communicating with the Arduino and the blockchain take < 5 seconds.
Criteria failure: fail sound	Fantastic! 95% success rate once adjusting dB increase to 5dB	The laptop's microphone is quite consistent with its readouts of sound levels
Criteria failure: movement	Fantastic! 90% success rate once changing measurement to difference in acceleration measurements	We were able to remove the effects of gravity and constant conditions by re-adjusting for difference
Criteria failure: Heart Rate	Not so great. 30% success rate once changing to attaching to the ear.	We had to use a simple HR sensor instead of an ECG monitor (Supply Chain/ Ukraine and timing issues). HR monitor has issues unless it's perfectly attached.
User agreement with result (self testing)	15% false positives. 12% false negatives	The HR monitor triggered a lot of false negatives. Minor adjustments are needed

Test, Verification, Validation 3 (trade-offs)

Feature	Pro	Con
Bluetooth connectivity	Increases usability	Adds around **20s** to set up time
Higher HR Sensitivity (520 Voltage Threshold vs 512)	Decreases the number of false negatives for HR failure	Increase the number of false positives for HR failure
HR on the ear vs wrist	Very inconsistent on wrist	Decreases usability
Using laptop's microphone	Very consistent readout, usually uncovered	May be unwittingly covered/ muffled by the user
Using React JS for the desktop app	A lot of supported libraries and cross platform - Linux, Windows, Mac	Bluetooth libraries and blockchain libraries do not work together → increased complexity

Schedule

	14-Mar	21-Mar	28-Mar	4-Apr	11-Apr	18-Apr	25-Apr
Belt Clip	Code for Acceleration	Debug Acceleration code Code for HR sensing Code for BT RX/TX	Code for BT RX/TX		Design Enclosure and Wiring Fix Acceleration code	Build Enclosure and Wiring	Improve HR sensing accuracy
Desktop App	Research smart contract comm.	UI: Home Page, UI: Login Page UI: Session Page	Smart Contract Interface	Sign In Page Functionality		User Interface	
Smart Contract	Code for Start/End Session	Testing and Debugging					
Integration			Desktop App + Arduino BT	Desktop App + Belt Clip Bluetooth Smart Contract Integration: Login	Smart Contract + Desktop app		
System Testing						Start/Stop, HR, Accel	