

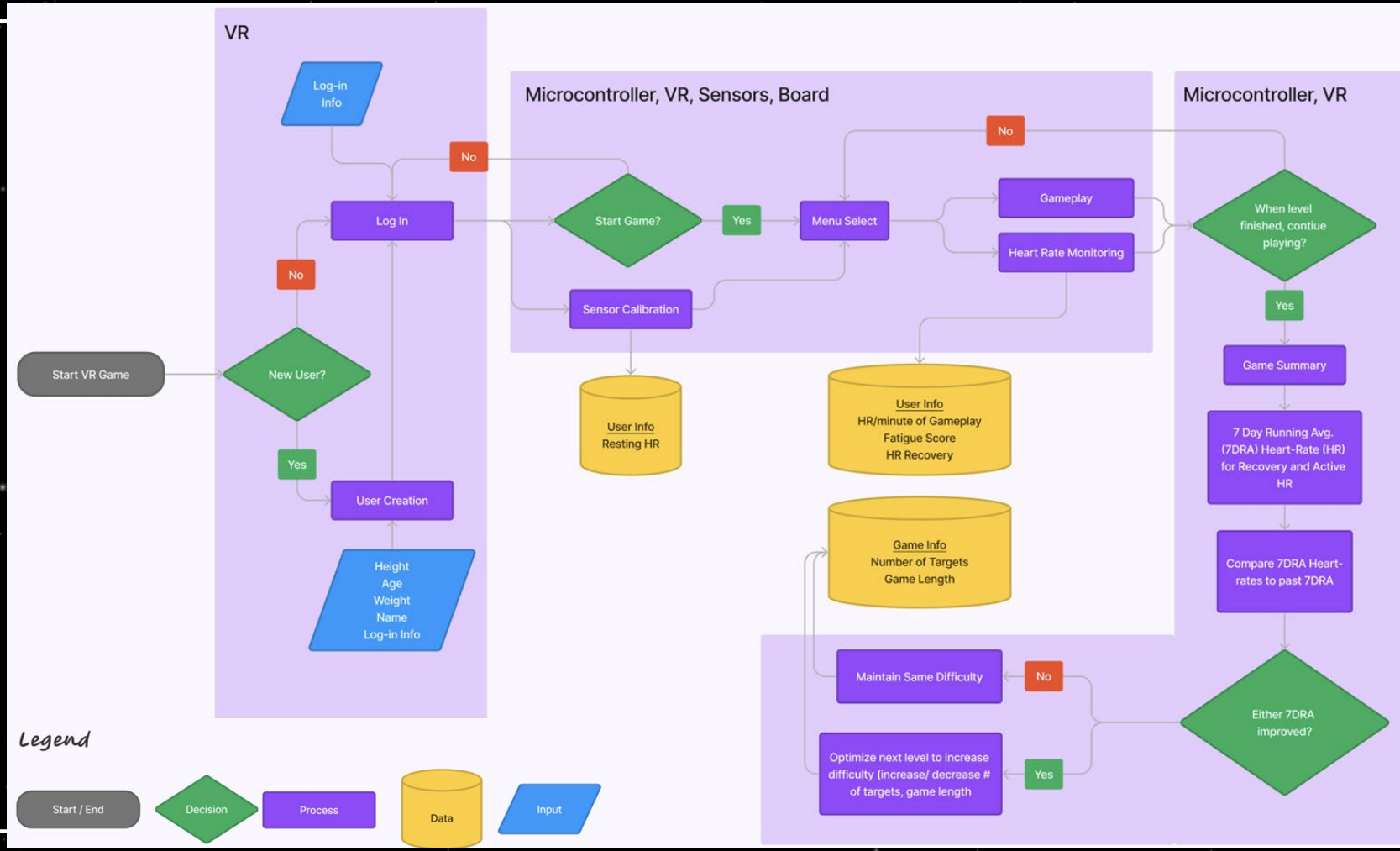
Autonomous Health Device FDR

MSD P18679

Final Agenda

- System Level
- Final Products
    - Physical Equipment
    - Wearable
    - VR/Game Mechanics
- Lessons Learned
- Future Improvements



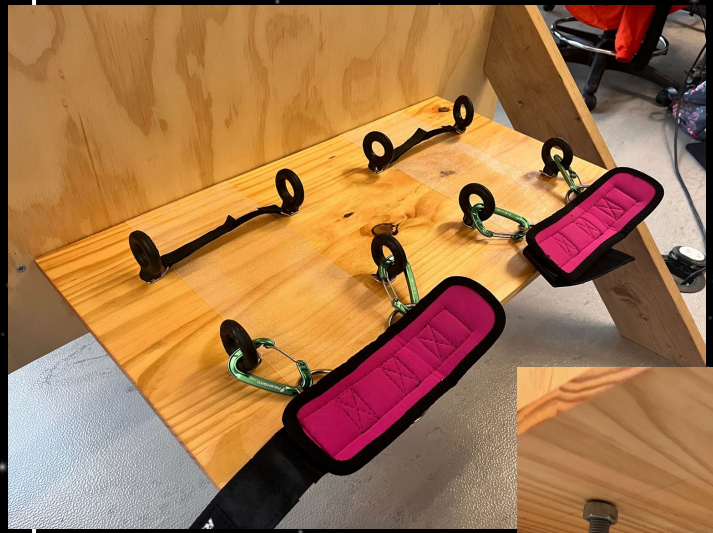

VR
Log-in Info
No
Log In
No
Start VR Game
New User?
Yes
User Creation
Height
Age
Weight
Name
Log-in Info
Microcontroller, VR, Sensors, Board
Start Game?
Yes
Menu Select
No
Gameplay
Heart Rate Monitoring
Sensor Calibration
User Info
Resting HR
User Info
HR/minute of Gameplay
Fatigue Score
HR Recovery
Game Info
Number of Targets
Game Length
Microcontroller, VR
When level finished, contiue playing?
Yes
Game Summary
7 Day Running Avg. (7DRA) Heart-Rate (HR) for Recovery and Active HR
Compare 7DRA Heart-rates to past 7DRA
Either 7DRA improved?
No
Maintain Same Difficulty
Yes
Optimize next level to increase difficulty (increase/ decrease # of targets, game length
Legend
Start / End
Decision
Process
Data
Input

Push-up board





Foothold



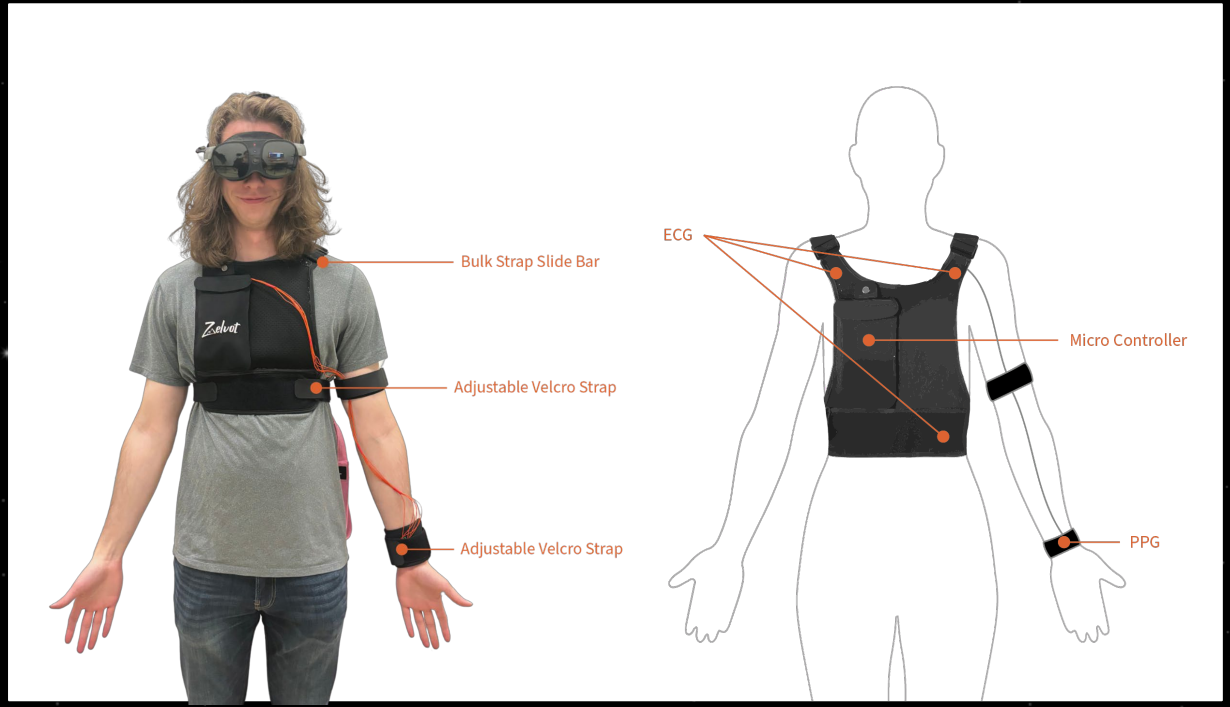






Wearable




Bulk Strap Slide Bar
Adjustable Velcro Strap
Adjustable Velcro Strap
ECG
Micro Controller
PPG

Sensors

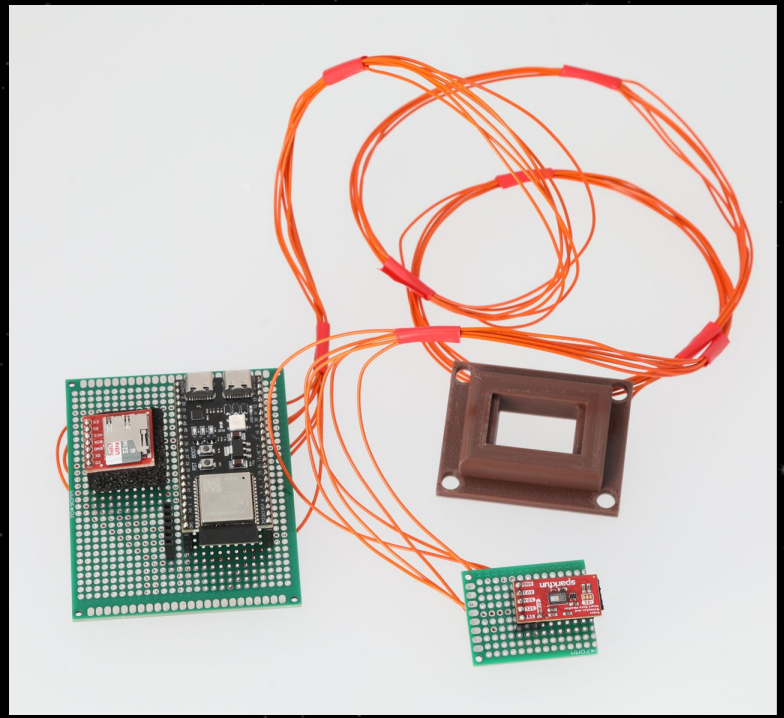
PPG Sensor



Silver Coated Nylon Integrated into Wearable



Engineering Development Test



```
Oxygen: 99
Status: 3
Heartrate: 73
Confidence: 99
Oxygen: 99
Status: 3
Heartrate: 76
Confidence: 99
Oxygen: 99
Status: 3
```

Health Data Analysis

- Initial Plan
  - Calibration:
    - Have the first exercise for each user be used as calibration data to gain a baseline reading of that user's health data
  - Heart Rate and QRS Complex:
    - Heart Rate Recovery after 1 minute
    - Track peak heart rate over time (PPG + ECG)
    - Graphical QRS complex over time (ECG)
  - Fatigue Score (Headset Location)
- Current Status
  - PPG - Heart Rate, Blood O2 (high variability, but in 95-100% range)
  - Movement artifacts present during data collection (ECG + PPG)
  - ECG is inconsistent with data collection, high noise

3D Game Mechanics + Art Integration

Paige Contorno: 3D Digital Design Team Lead

- Heads up display design complete
- Demo two levels at IMAGINE RIT - VRWorkout + Sky Gliding



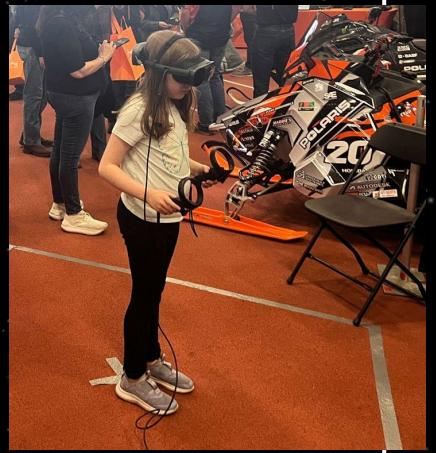




VR Workout -

RIT President





Sky Gliding



Lessons Learned

- Wearable
  - Prototype early as small scale sensors have more variability than sensors BME's are used to
- VR/Game Mechanics
  - Split mechanics into two levels
    - VR Exercise - matching poses and interacting with the board colors
    - Sky Glider - one color pose, do a push up to catch air draft
  - Testing of HMD difficult, no APK builds worked, had to stream with SteamVR to headset (more development required here to get the game packaged onto the headset)
  - Need to integrate sensor data into scores, right now the score is performance based, ie: did you do all the push ups.

Future Improvements

- Physical Equipment
  - Improve handles, make several versions
  - Expand on exercises - lat. pull downs
- Wearable
  - Improve accuracy of PPG and ECG sensors
    - Cheap sensors (more recreational than medical grade)
  - Integrate additional sensors (ex. hydration sensors)
- VR/Game Mechanics
  - Integrate fatigue score into game level difficulty
  - Integrate heart rate data into game level difficulty

Imagine RIT





Imagine RIT


EPIC SPACE: EXERCISE & PERFORMANCE INVESTIGATION FOR CREWS IN SPACE
RIT
INTRODUCTION
WEARABLE
ELECTRONICS
PHYSICAL EQUIPMENT
GAMIFICATION
CONCLUSION
ACKNOWLEDGMENTS
99 BPM
ell Done!



Thank you! Questions?