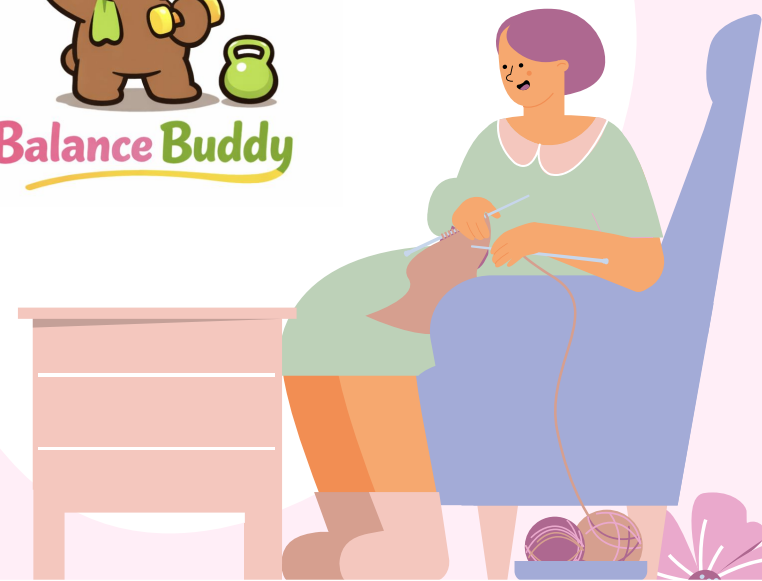


# Balance Buddy

Stay Centered, Stay Active.

---

By: Riya Shah, Tanisha Suresh,  
Vanessa Lemanski, Riddhima Datta



# What is the problem?

Problem Space - Exercise Tracking and Measurement

Initial focus: exercise tracking and form accuracy for older adults

Goal was to measure posture and movement during workouts

Realized a bigger risk during exercise sessions was falls, not imperfect form  
*“Approximately one in three older adults fall every year, and the risk increases with age.” - CDC*

New focus on fall risk and safety monitoring

Pivoted solution toward detecting instability and alerting volunteers when help is needed

# How we are tackling it

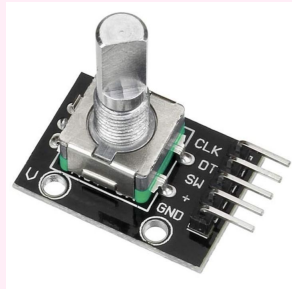
Designed a wearable belt positioned at the hip to monitor balance related movement

Use movement based sensing (rotary sensor in prototype) to detect abnormal angles of movement or instability during exercise

Defined thresholds to distinguish normal exercise motion from potential fall risk

Integrated an alert system (arduino inputs to computer in prototype) to notify staff when intervention may be needed

Focused on real time monitoring to enable fast responses



# Impact on Stakeholders

Older adults: increased safety and confidence while exercising

Gym volunteers/staff: easier to prioritize who needs assistance

Facilities/caregivers: reduced injury risk and safer workout environments

Overall shift from reactive help to prevention and fast response



# What makes us different?



Focuses on safety first  
monitoring, not just fitness  
metrics

Designed specifically for older  
adults in crowded/personal  
exercise settings



Belt placement allows effective  
detection of balance and  
instability

Alert system supports human  
assistance instead of replacing it

# Thought Process and Concerns

Originally focusing on form and quality of movement

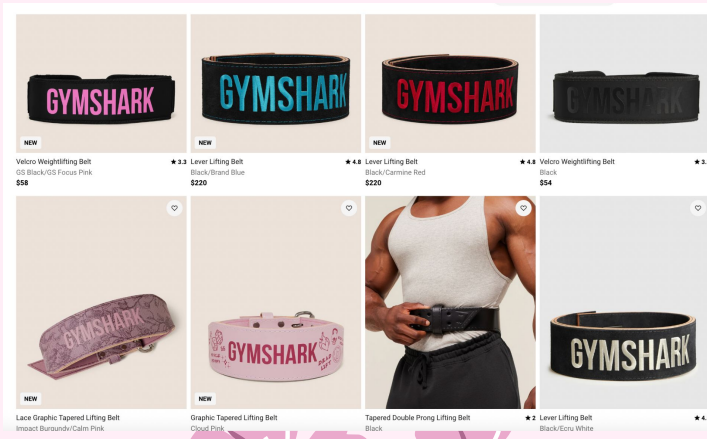
Avoiding false alerts from normal exercise movements

Shifted from tracking exercise accuracy to detecting fall risk

How to incorporate accurate thresholds for each person

Safety was identified as the most critical unmet need

Designing a solution that is discreet and non-intrusive



# Workflow & End Result

- Staff shortages reduce 1-on-1 supervision
- Falls = major elderly safety risk
- Designed wearable stability monitoring belt
- Balance Buddy detects instability using personalized thresholds
- Real-time monitoring through staff dashboard



# Tech Stack & Unique Elements

## Tech

- Wearable belt system
- Rotary sensor + thigh band
- Microcontroller + monitoring app

## Unique Elements

- Personalized thresholds
- Instability detection → fall prevention
- Low cost + scalable
- Designed for real healthcare workflows





# Implementation & Ease of use



## Healthcare Use

- Worn during exercise / rehab sessions
- Data sent to monitoring dashboard
- Staff monitor patients in real time
- Alerts triggered only when needed

## Ease of Use

- Worn like a normal belt
- Fully automatic once fitted
- Simple stable / unstable indicators
- Designed for elderly + busy staff

# Future Plans

- Add motion sensors for higher accuracy
- Multi-sensor data validation
- Rep counting + exercise quality tracking
- Long-term recovery monitoring
- Audio alerts for accessibility



# Ethical Considerations

- **Inclusivity and accessibility**
  - Designed for users with limited mobility or balance challenges
  - Wearable belt is adjustable
  - Visual alerts are paired with color and text, not text alone
- **Bias and Data Considerations**
  - Our prototype does not rely on large external datasets
  - Thresholds are currently user-specific, not population-averaged
  - We recognize that balance and movement vary by age, body type, and ability

# Ethical Considerations

- **Ethical research and calibration**

- We recognised that average stability thresholds could misclassify users with different body types, mobility levels, or assistive devices
- This could unfairly label some users as “unstable,” potentially causing anxiety or unnecessary intervention
- Thus led us to use individual calibration thresholds which is based on each users’ movement patterns
- Though the system doesn't learn from patterns yet, we hope that can be a future implementation
- Also did not include any cameras, microphones or recording devices for user privacy.

# Safety & Regulations

## **Medical Device Classification**

- Medical devices that diagnose or treat conditions are strictly regulated.
- Our system does not diagnose falls or medical conditions so it is a non-diagnostic exercise monitoring tool.

## **Safety and Performance Expectations**

- Wearable devices must manage electrical and mechanical safety risks.
- Data should not mislead users or be treated as clinical grade accuracy.
- Our design uses low power electronics and provides real-time alerts to caregivers.

## **Hygiene Considerations**

- Wearable devices contacting skin must be easy to clean between users.
- Smooth, non porous surfaces reduce bacteria and sweat buildup.
- Minimal external components support effective wiping and disinfection.

## **Data Privacy**

- Healthcare systems must protect patient data.
- Only essential, anonymized data is displayed.
- Could implement future encryption software.

# Sources

- <https://www.aoshearman.com/en/insights/life-sciences-and-healthcare-insights/medical-wearables-under-the-microscope-us-regulatory-data-privacy-and-cybersecurity-perspectives>
- <https://laws-lois.justice.gc.ca/eng/regulations/sor-98-282/page-2.html#:~:text=13%20During%20the%20projected%20useful,or%20entering%20into%20the%20device.>
- <https://www.steris-ast.com/resources/techtips/reprocessing-the-top-7-considerations-in-reusable-device-design>
- <https://www.emergobyul.com/sites/default/files/2023-02/human-factors-wearables-whitepaper.pdf>
- <https://allpointwireless.com/managing-patient-data-privacy-across-iot-devices/>
- <https://censinet.com/perspectives/iot-device-authentication-for-medical-devices-guide>
- <https://pmc.ncbi.nlm.nih.gov/articles/PMC12167361/>
- <https://www.emergobyul.com/sites/default/files/2023-02/human-factors-wearables-whitepaper.pdf>
- <https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-devices/application-information/guidance-documents/using-standards-support-compliance-regulations.html>



Thank  
you