



A Posture-Correction Device

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Purpose

- Design a wearable device to aid in monitoring and correction of sitting posture
- Address and prevent back problems associated with poor posture by providing a posture tracking tool
- Compete with current products on the market with respect to functionality, cost, and comfort



Background Information

Scientific research has reported that individuals who experience back pain have often sat for long periods of time with bad posture than with good posture [1]

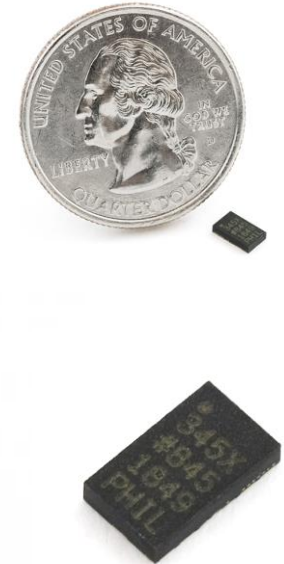
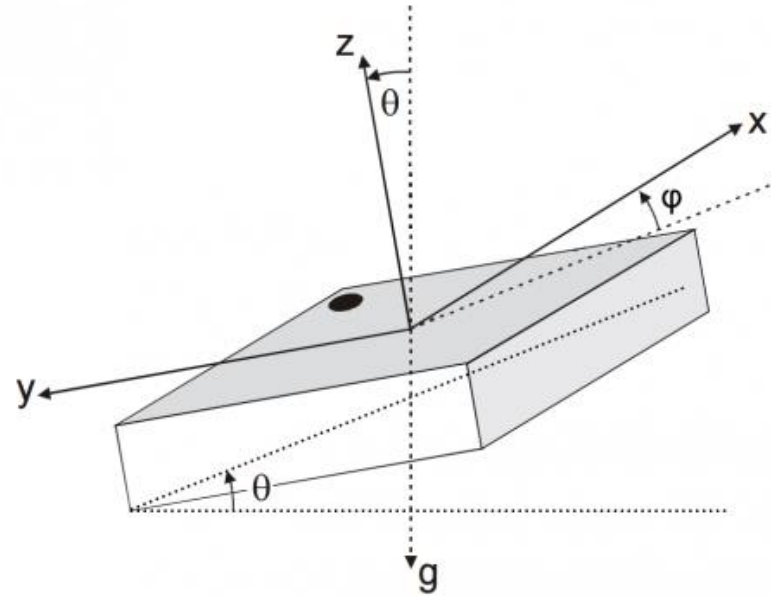
These results suggest that by maintaining good posture during long period of sitting (e.g., sitting at work, or at home), we may prevent developing chronic back pain/backache.



Background Information

Triple Axis Accelerometers

- Acceleration due to gravity acts as a convenient reference vector for tilt-sensing applications
- Accelerometers offer superior sensitivity over gyroscopes when sensing low frequency movement
- ADXL345 as our preferred accelerometer
 - Low power usage
 - Competitive price
 - Convenient digital output



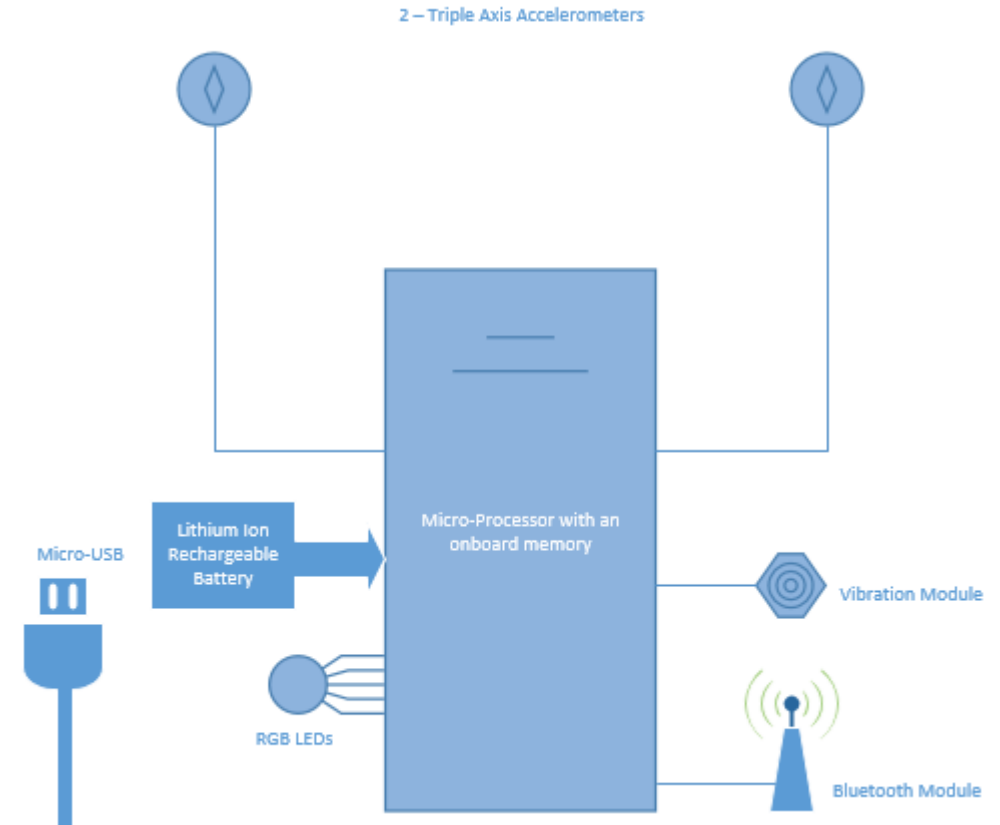
Overview

- Sleek, lightweight, flexible structure
- Device is worn comfortably around user's neck
- Vibration alert given when user has maintained poor posture for 5, 10, or 15 minutes
- Poor posture defined as slouching, forward-head, steep leaning angle
 - Research and testing for quantitative posture definitions ongoing
- Current design iteration uses 2-accelerometer configuration
- Accelerometers are located in the right arm and the back of the device



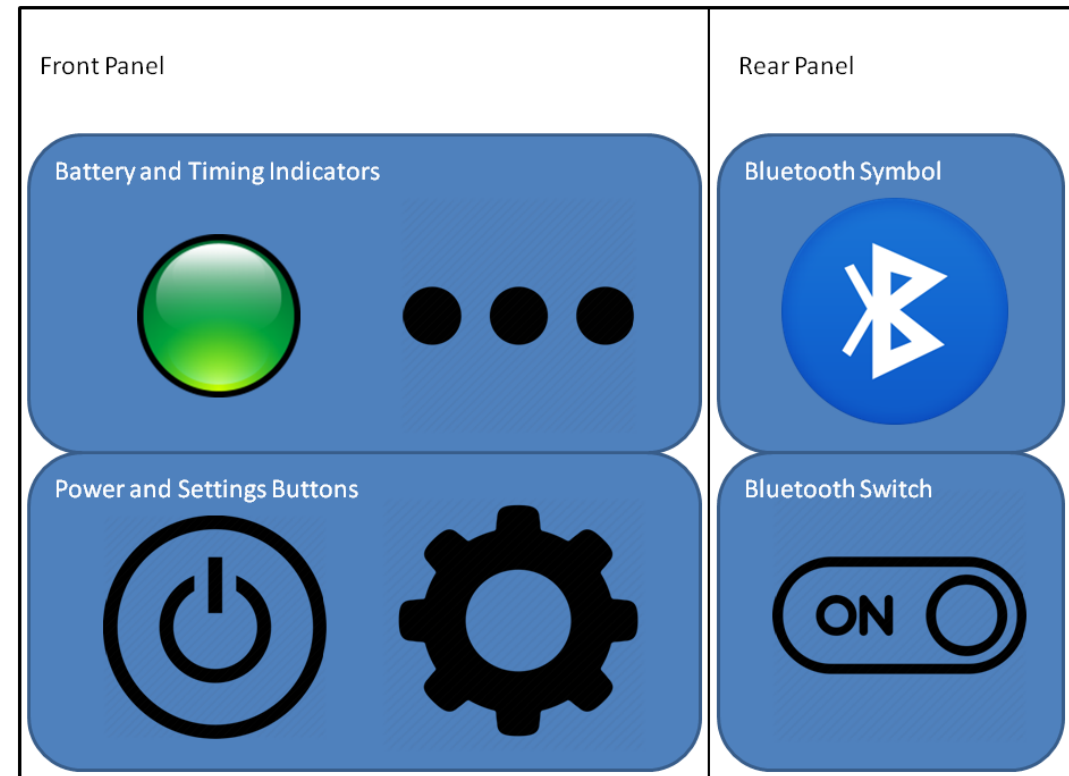
Hardware Components

- 2 Triple Axis Accelerometers
 - ADXL345
- Rechargeable Lithium Ion Battery
 - Recharge with cell phone standard micro USB cable and adapter
- Bluetooth module to connect with mobile Android app
- Vibration module to provide posture alerts
- 4 LED's for User Interface Feedback
- Flexible structure and casing
 - Materials research ongoing



User Interface

- 2-button configuration with Bluetooth switch on back of device
- Red power LED signals low battery
- Tri-LED Indicator
 - Timer threshold indicated by number of LED's. Five minutes per lit LED.
 - The three timing presets can be cycled through by pressing Settings button
- User-controlled Bluetooth module
 - Option to switch off to avoid unwanted pairing of device
 - Device can be used as standalone without Bluetooth pairing



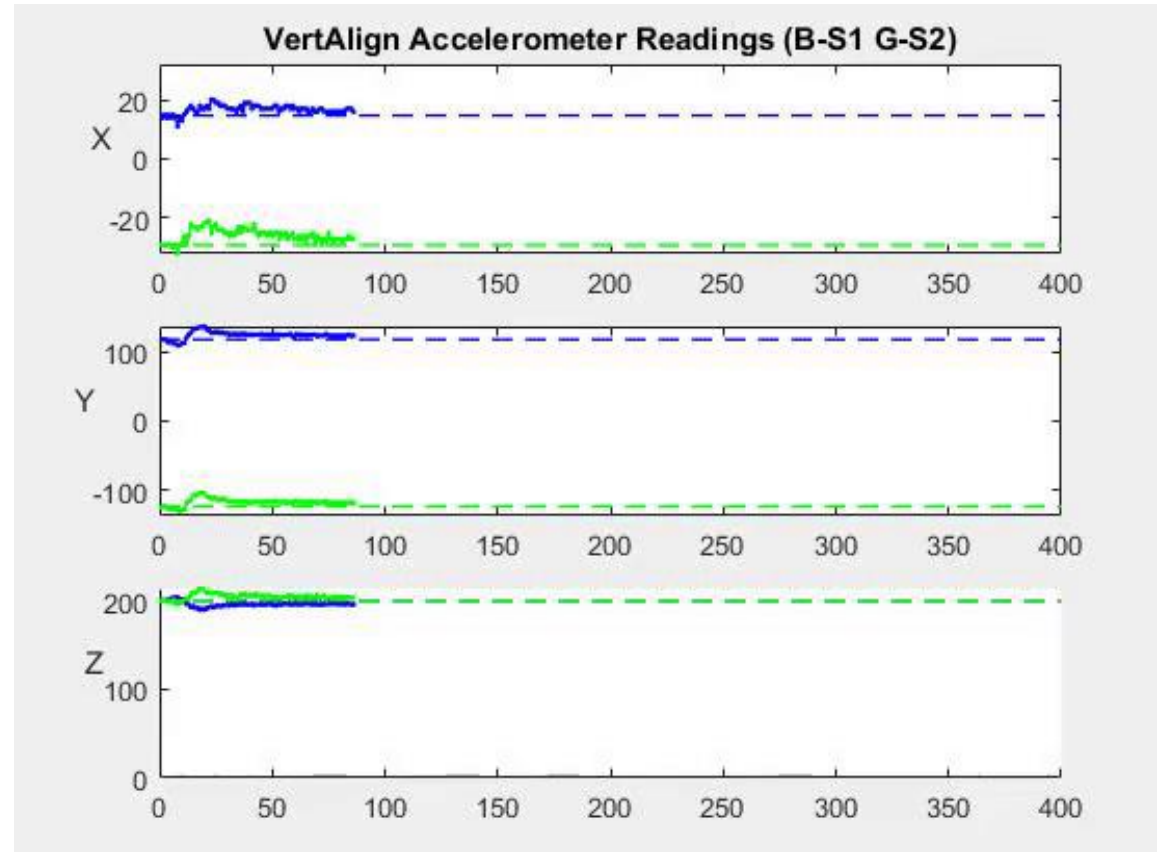
Software

- Android application supported by Android 4.4+
- Tracks posture over time so users can follow their improvement
- Can initiate calibration of device
- Can set custom notification timings other than the default presets

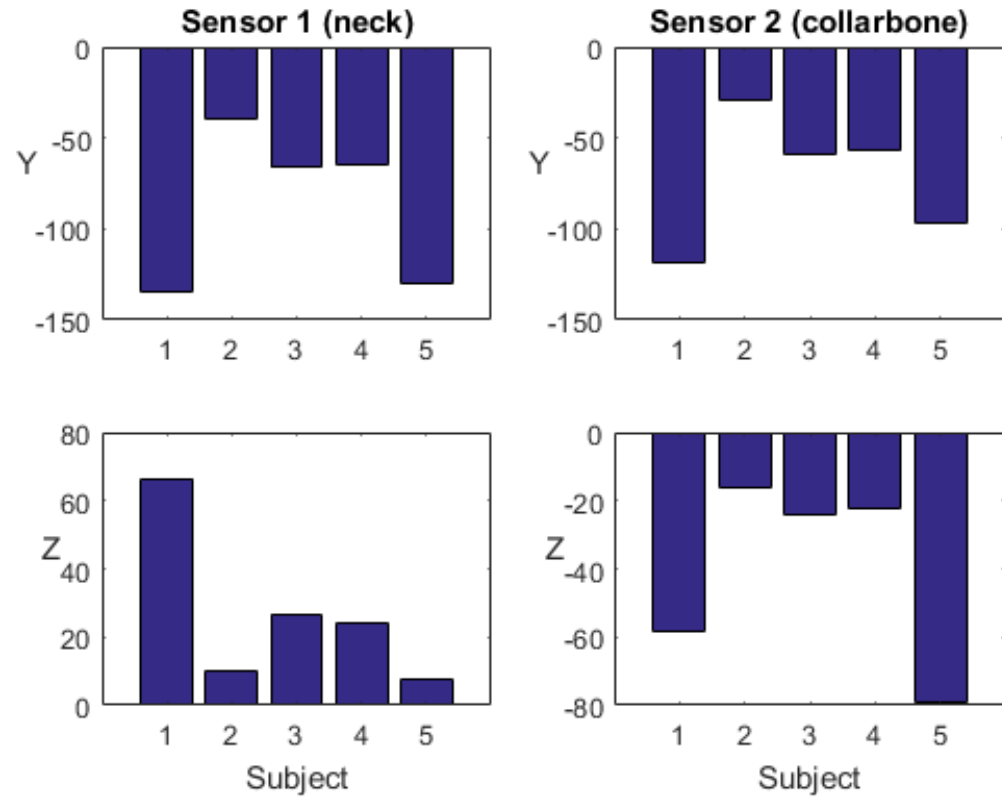


Research Results

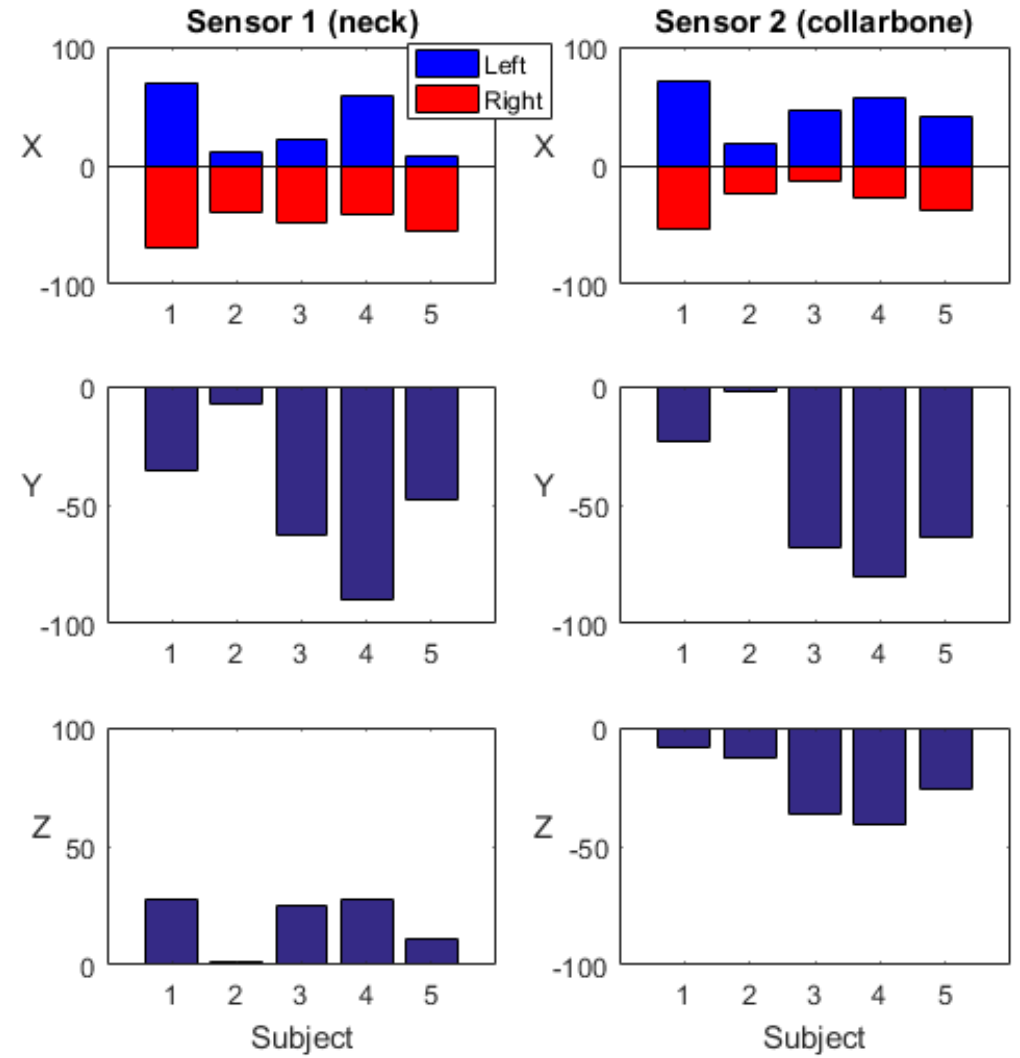
- Tested 5 subjects, preliminary routines
 - Slouching
 - Forward and sideways lean
 - Standing up motion
- Detectable changes in all postures
 - Figure: Sitting straight and slouching
- Need to isolate positions for further testing



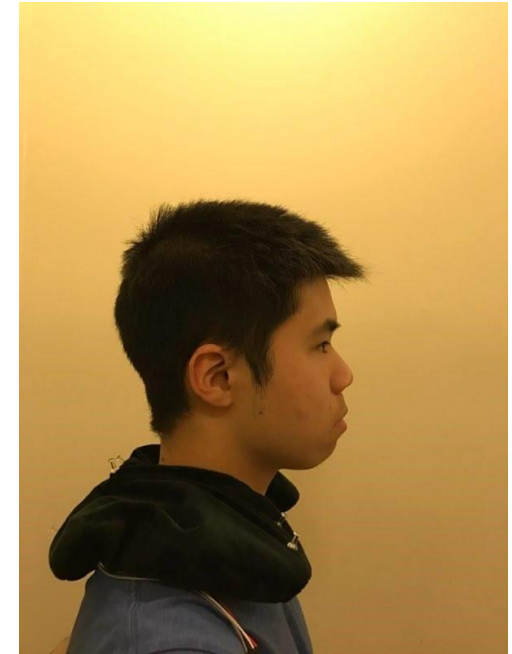
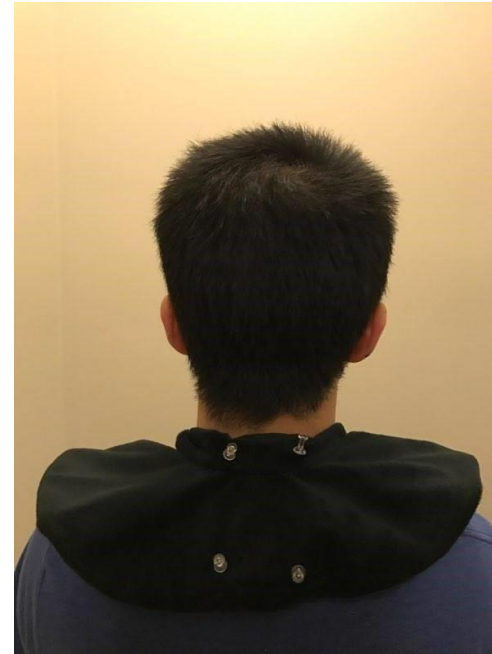
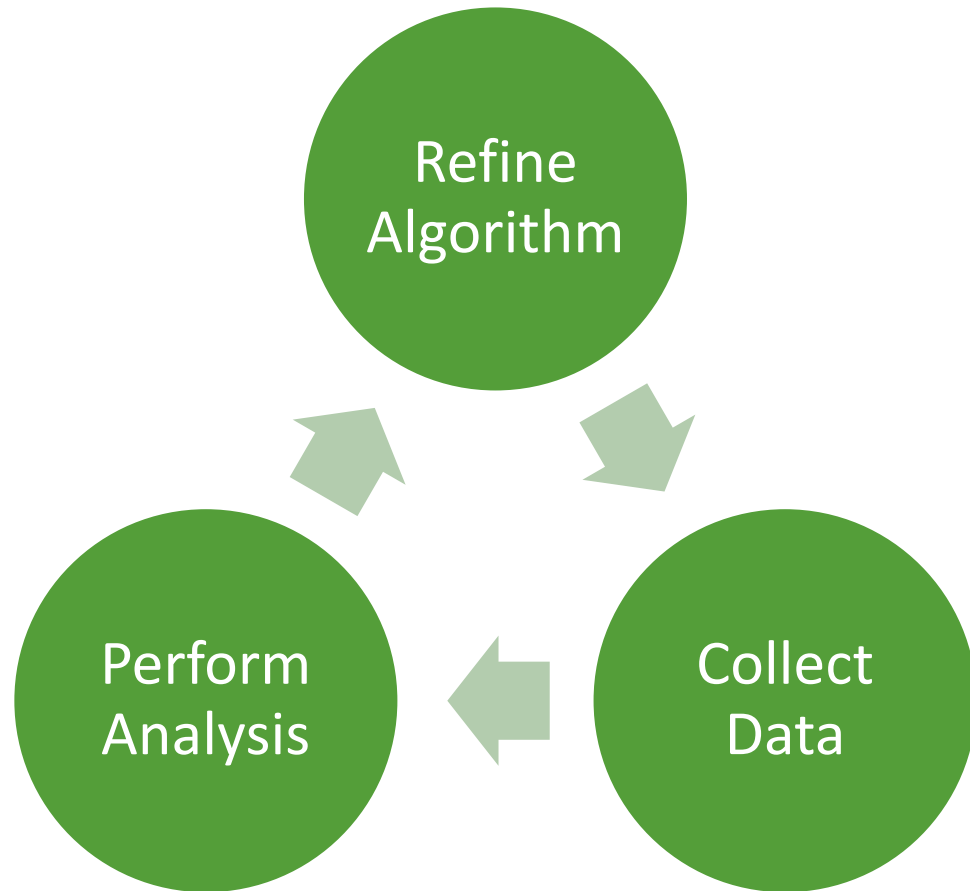
Average Deviations over Baseline in Regular Slouch



Average Deviations over Baseline in Sideways Lean



Iterative Development



Project Status

Proof-of-Concept

- Will be shown in demo

Future Directions

- Software development
- Refine Algorithm
- SoC Design and Fabrication
- Enclosure Prototype development



Conclusion

- VertAlign is a posture monitoring and correcting wearable device aimed to prevent chronic back pain
- Our proof-of-concept mockup has shown that in fact we calibrate user's baseline postures and detect misalignment
- The prototype of the product will provide user notifications via an onboard vibration module and a paired mobile application
- We will concurrently develop hardware (SoC), software and physical enclosure to create a functional prototype to meet our proposed timeline that different postures are detectable, which our notification algorithm can be designed around



Abbreviated References

[1] Womersley, Lauren, and Stephen May. "Sitting Posture Of Subjects With Postural Backache". *Journal of Manipulative and Physiological Therapeutics* 29.3 (2006): 213-218. Web.

