P^3

Poor to Proper Posture

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Team members

Karl
CSE

Team manager & MCU programming

Tong
CSE

MCU programming & Curvature Sensor

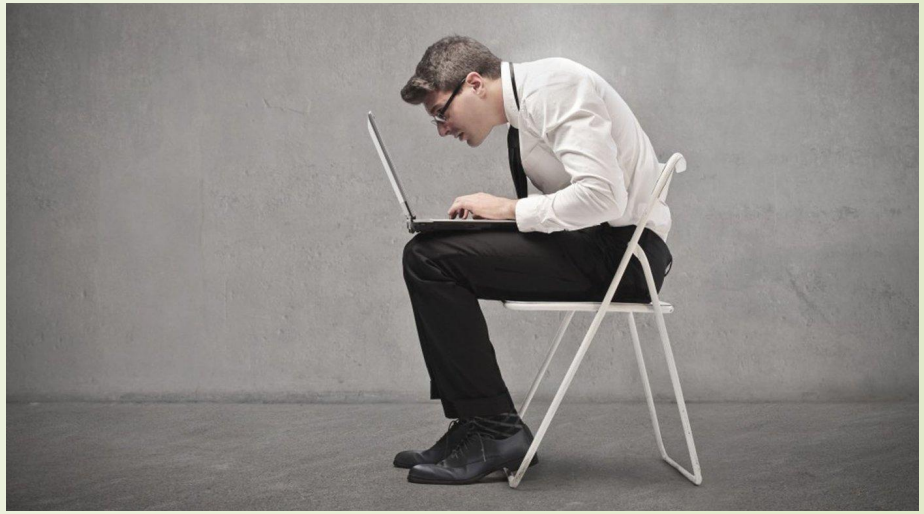
O-Dom
EE

Curvature Sensor & PCB design

Kiet
EE

Inductive Charging & PCB design

The Problem



The Modern World

- More screen time
- More sitting
- More stationary

BAD POSTURE

P^3 - Our Solution

- Detect User posture using curvature sensor
- Vibrate at the most problematic area to notify user's bad posture instead of forcing the user in uncomfortable position
- Help user to create good habit through their own effort

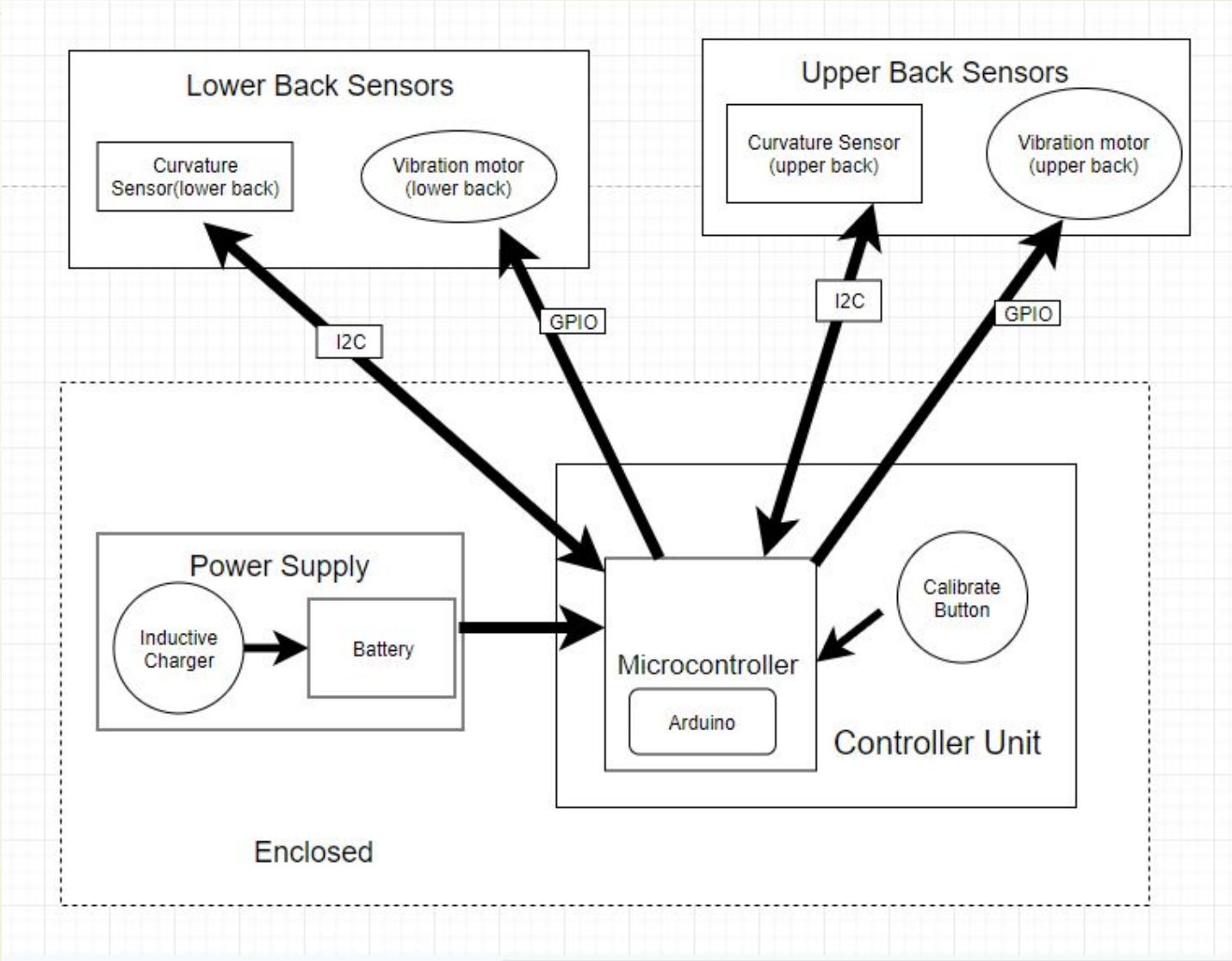
System Requirements

- Calibrating body posture by standing against the wall and pressing button
- Calibrate hunching position by hunching and pressing button
- Once user hunches at a certain angle, vibration motor will vibrate

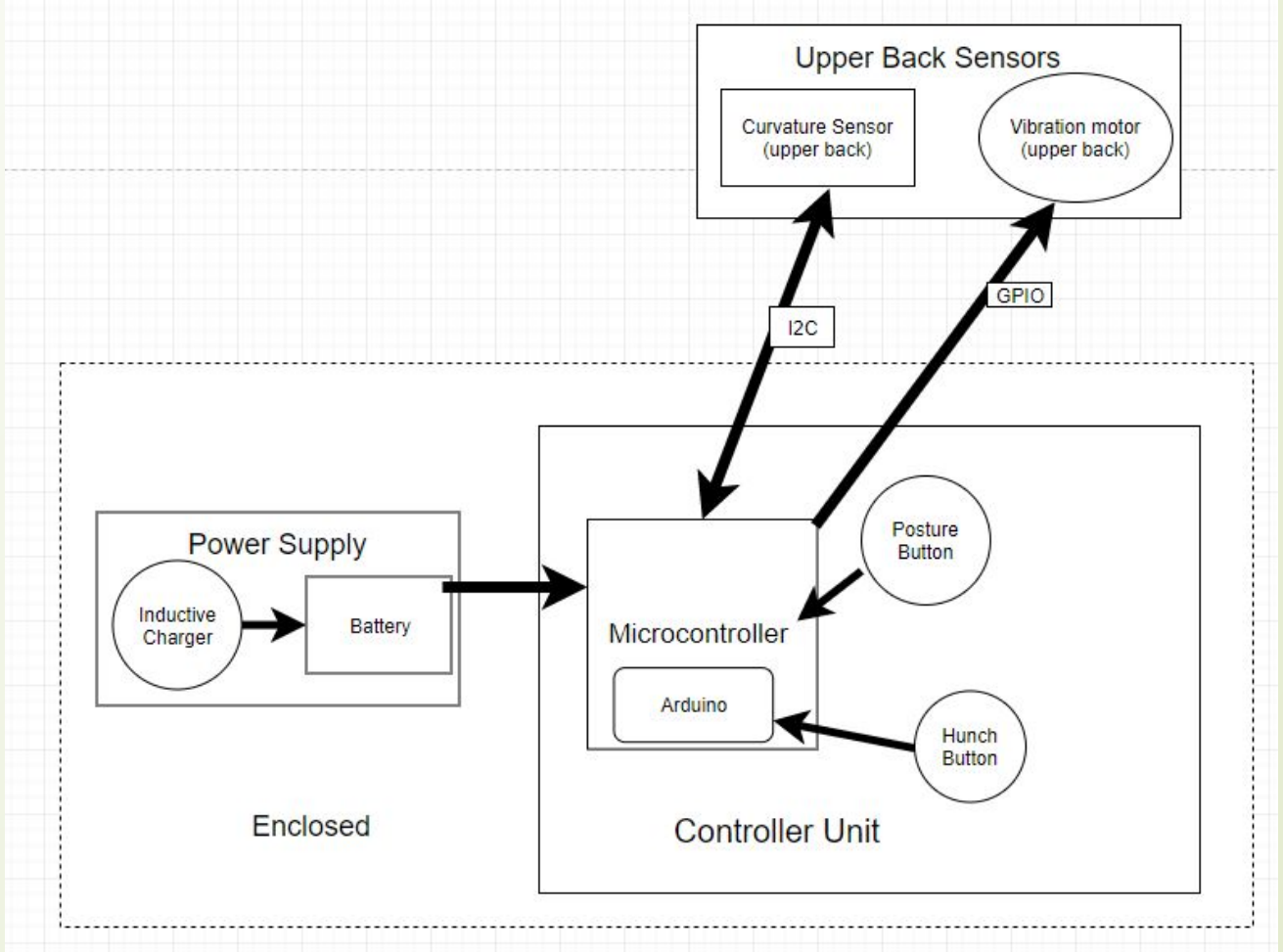
System Specification

- Product should be light and power efficient
- Battery powered, should last for 20 hours on average
- User will be notified of hunching within 5 seconds
- Total electronic size within 10 squared cm

Updated Block Diagram for FPR



MDR Block Diagram



Parts used for prototype

- ATTINY416-XNANO
- Vibration Motor
- 2 Buttons
- 1 BendLabs Curvature Sensor
- 2 10K Resistors (pulldown)
- Extension Wires

Cost Breakdown

Quantity	Product	Price Per Unit	Total Price
1	Bendlabs Curvature Sensor	$50.00	$50.00
1	Vibration Motors	$1.95	$1.95
1	ATTINY416-XNANO	$8.88	$8.88
2	10kOhm Resistors	$0.05	$0.10
2	Tactile Switch	$0.11	$0.22
1	Battery	$5.95	$5.95
1	Inductive Charger Set -5V 500mA max	$9.95	$9.95
1	Shirt	$0.00	$0.00
1	Li-Poly/Li-Ion Charger	$12.50	$12.50
1	Micro USB Breakout Board	$1.50	$1.50
		Total Cost:	$91.05

Inductive charger Requirements and Specifications

- Inductively charge Li-ion battery
- Supports power delivered through a micro usb cable.
- Allows for simultaneous charging and use
- Trickle charge to keep battery topped off
- 100mA - 500mA Charging current

Battery Selection

Power consumption

- Worst case consumption: 72.5mA at 4V
- Typical consumption: 30mA at 4V
  - Estimated 620mAh for a 20hr use

Battery

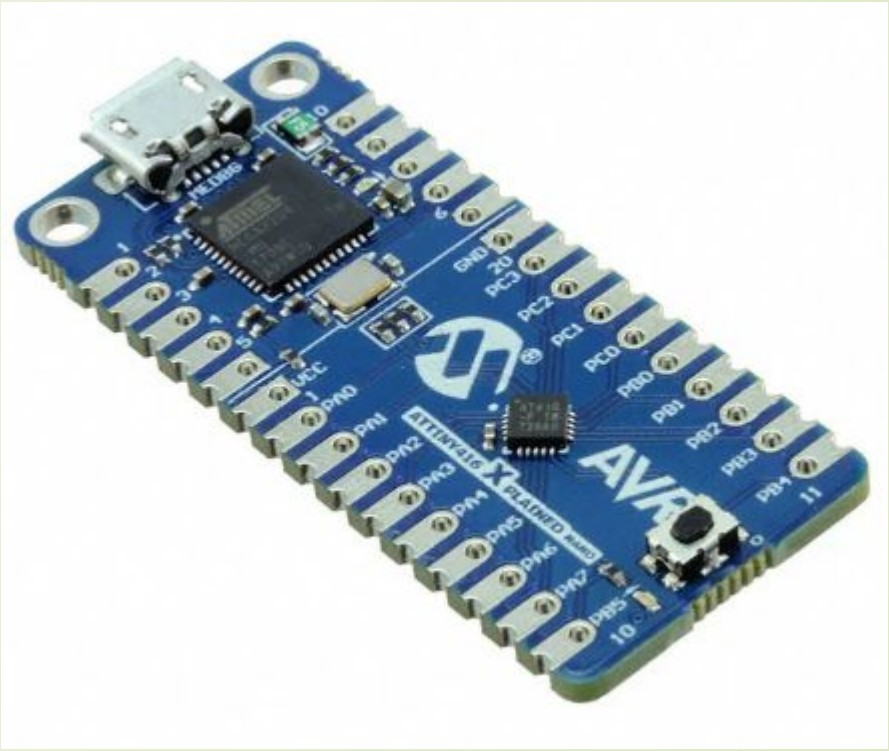
- Li-Ion battery 4V 1000mAh

Software

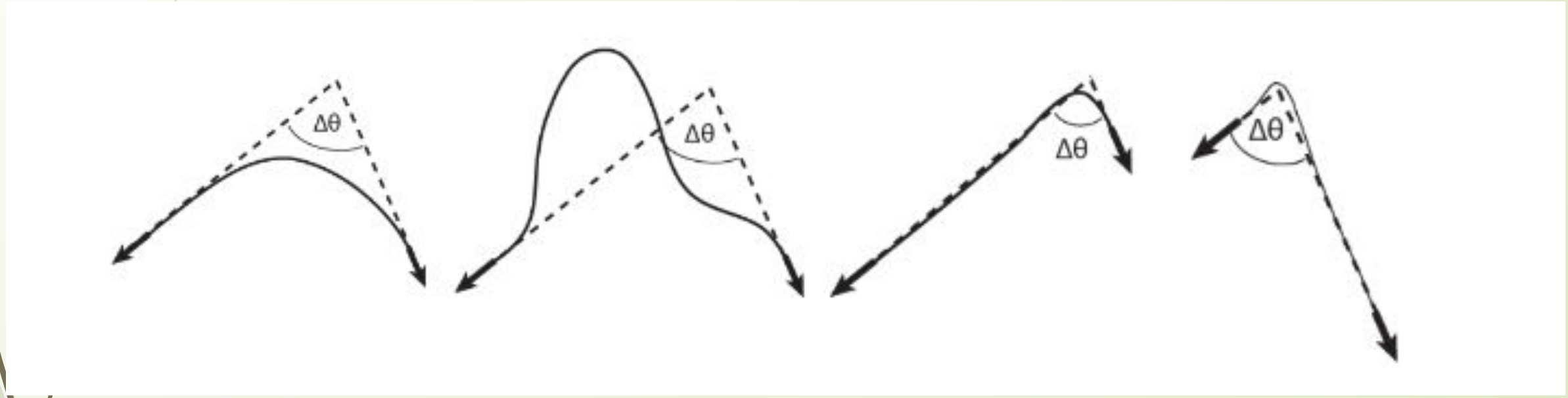
- BendLabs Library (C++)
- User hunches, send signal to vibration motor to vibrate
- Hysteresis
- Store values for proper posture and hunching posture

ATTINY416-XNANO

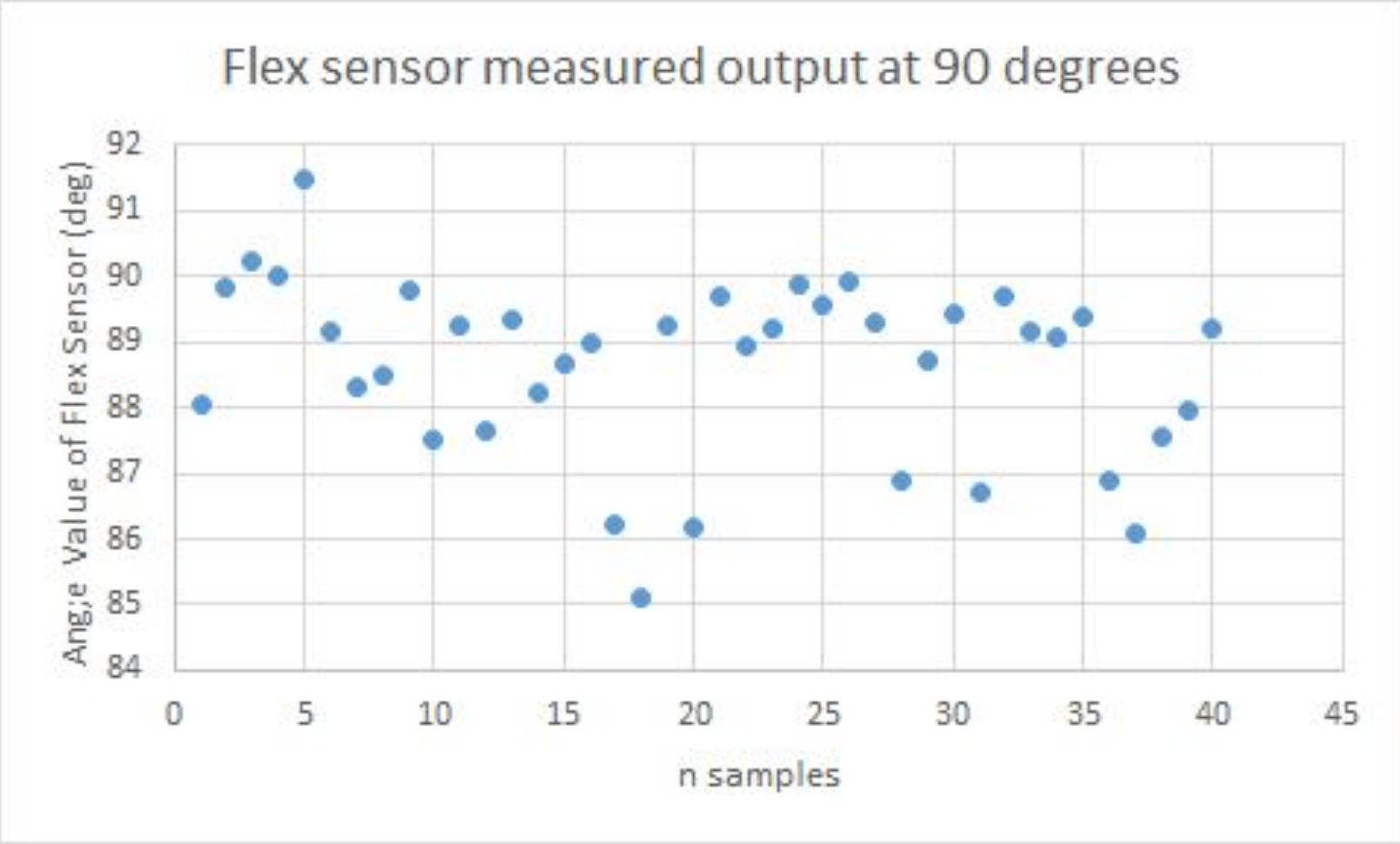
- Uses ATtiny416 microcontroller
- SCL
- SDA
- Pins for Buttons
- Ultra Low Power



Bendlabs Curvature Sensor



Flex Sensor Data



$$\bar{X} \pm Z \frac{s}{\sqrt{(n)}}$$

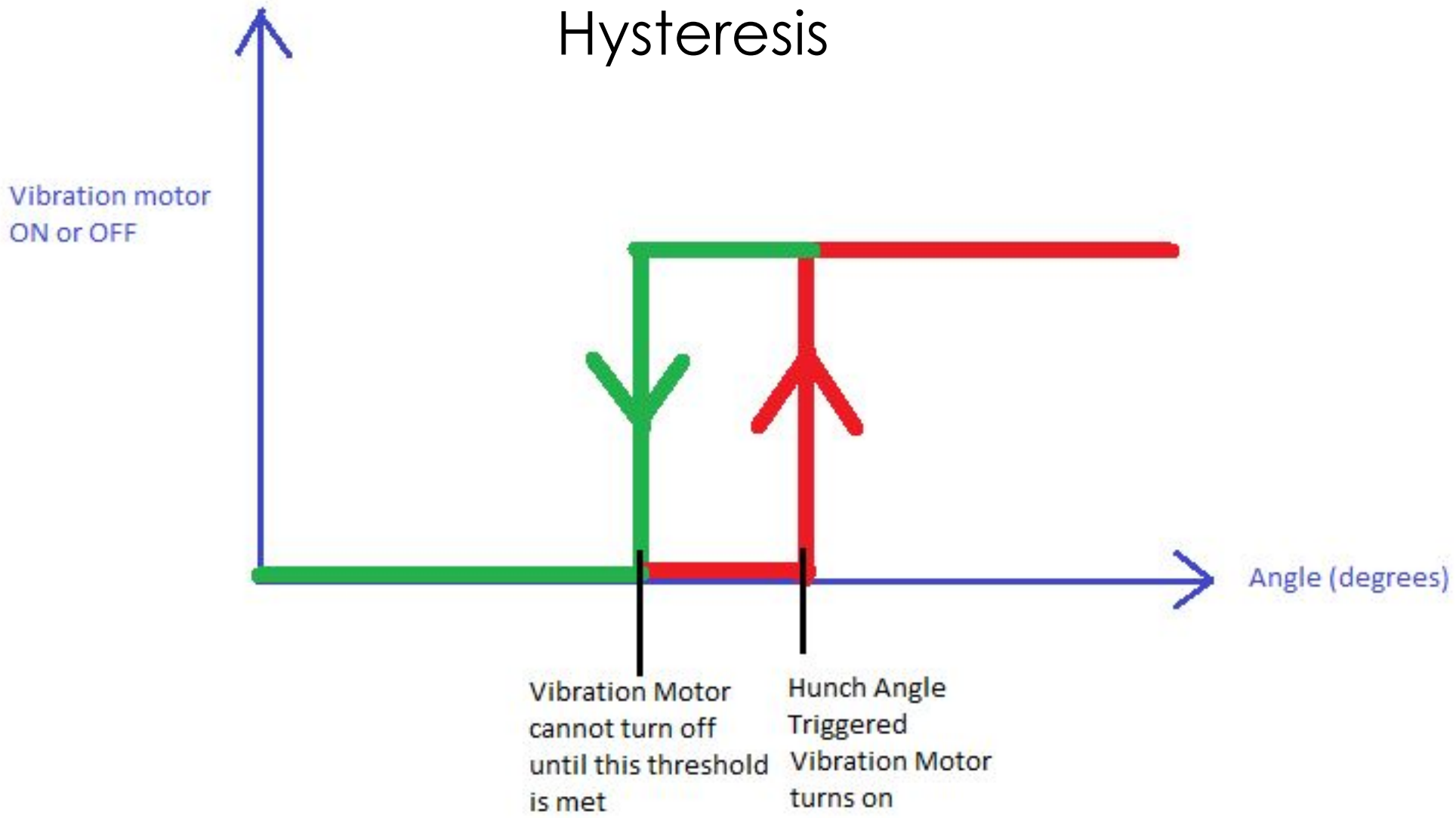
Sample Mean: 88.6265 deg

Z = 1.96

standard dev = 1.335

95% confident the true mean of our output is 88.6265 ± 0.413661 deg

Hysteresis


Vibration motor
ON or OFF
Angle (degrees)
Vibration Motor
cannot turn off
until this threshold
is met
Hunch Angle
Triggered
Vibration Motor
turns on

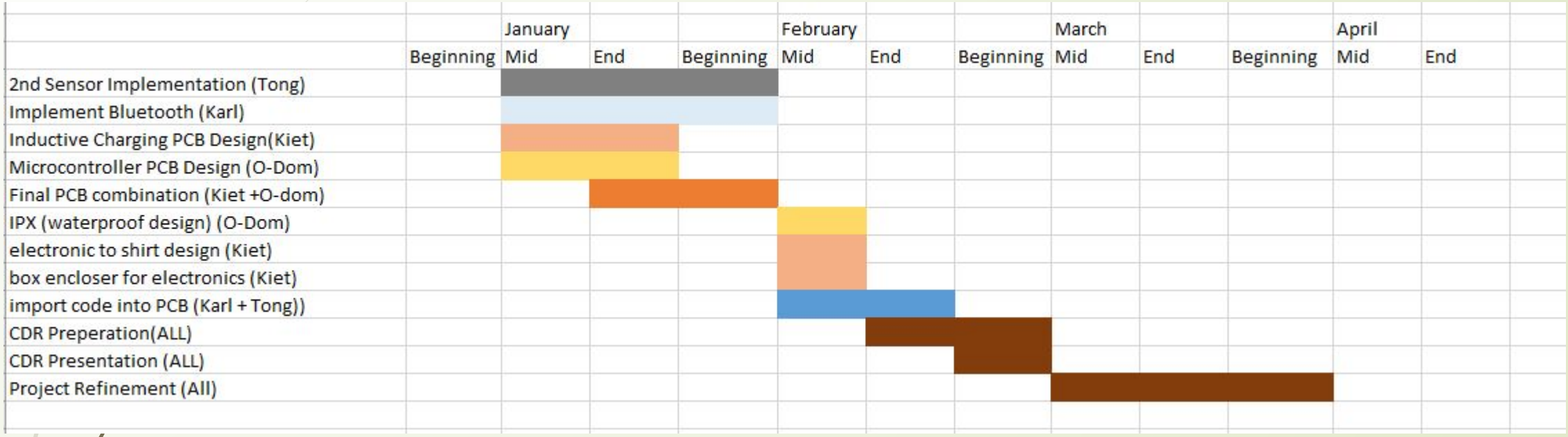
Proposed CDR Deliverables

- Implement Lower Back Sensor
- Battery should last for 20 hours
- Replace Buttons controls with Bluetooth
- Designing and constructing PCB for inductive charging with the ATtiny416 microcontroller
- User should be able set trigger points to be notified of hunching
- Consider when user picks up items off floor

MDR Deliverables

- ✓ Be able to read the curvature sensor data
- ✓ User will be able to recalibrate the curvature sensor based on their correct posture
- ✓ When a certain angle is reached a LED will light up with the vibration motor running
- ✓✗ The battery will be inductively charged.

Gantt Chart


January
February
March
April
Beginning
Mid
End
Beginning
Mid
End
Beginning
Mid
End
Beginning
Mid
End
2nd Sensor Implementation (Tong)
Implement Bluetooth (Karl)
Inductive Charging PCB Design(Kiet)
Microcontroller PCB Design (O-Dom)
Final PCB combination (Kiet +O-dom)
IPX (waterproof design) (O-Dom)
electronic to shirt design (Kiet)
box encloser for electronics (Kiet)
import code into PCB (Karl + Tong))
CDR Preperation(ALL)
CDR Presentation (ALL)
Project Refinement (All)

Questions?