Posture Correcting Chair

Team 4 : Anant Sah, Dheeraj Kallakuri, Manikanta Badiga, Yash Shah

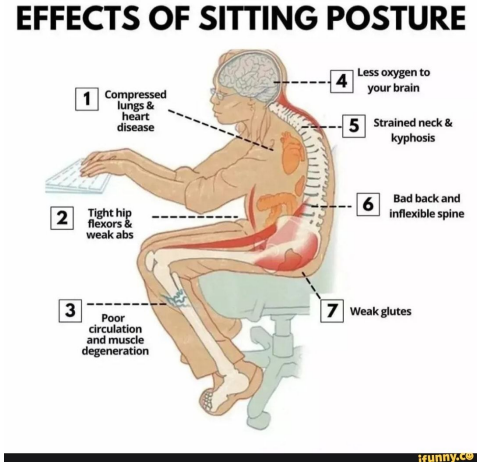
Overview

1. Introduction
2. Related Work
3. Domain- Reinforcement Learning
4. System Architecture
    a. Schematic diagram
    b. CAD models
5. Experiment Results
    a. Heatmaps
    b. State-action mapping
6. Baseline Results
7. Final Results
8. GUI and Data flow
9. Scope
10. Expenditure

Introduction

Why Smart Chair?

- Smart Chair helps the users with long sit time to stay in correct posture there by avoiding them with medical conditions like Spondylosis, incontinence and other disorders.
- Smart chair gives user of the chair active feedback and reminder to keep its ideal position



Related Work

[1] Smart Chair for Monitoring of Sitting Behavior
Mengjie Huang, Ian Gibson, Rui Yang

This paper proposes a system of posture classification using ANN architecture and pressure sensor array

[2] PostureCare - towards a Novel System for Posture Monitoring and Guidance
Andreas Schrempf, Gerold Schossleitner, Thomas Minarik, Michael Haller, Sabine Gross

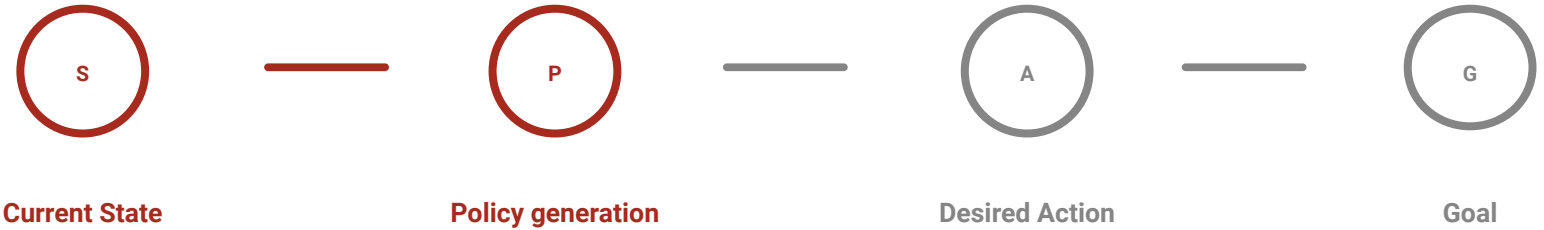
This paper proposes a Posture Correction using Force Transducers and wireless data monitoring using matlab

[3] Intelligent Chair Sensor Classification of Sitting Posture
Martins, Leonardo & Lucena, Rui & Belo, João & Santos, Marcelo & Quaresma, Claudia & Jesus, Adelaide & Vieira, Pedro

In this paper they have used pressure distribution sensors and used ANN architecture and has classification score of about 93.4%

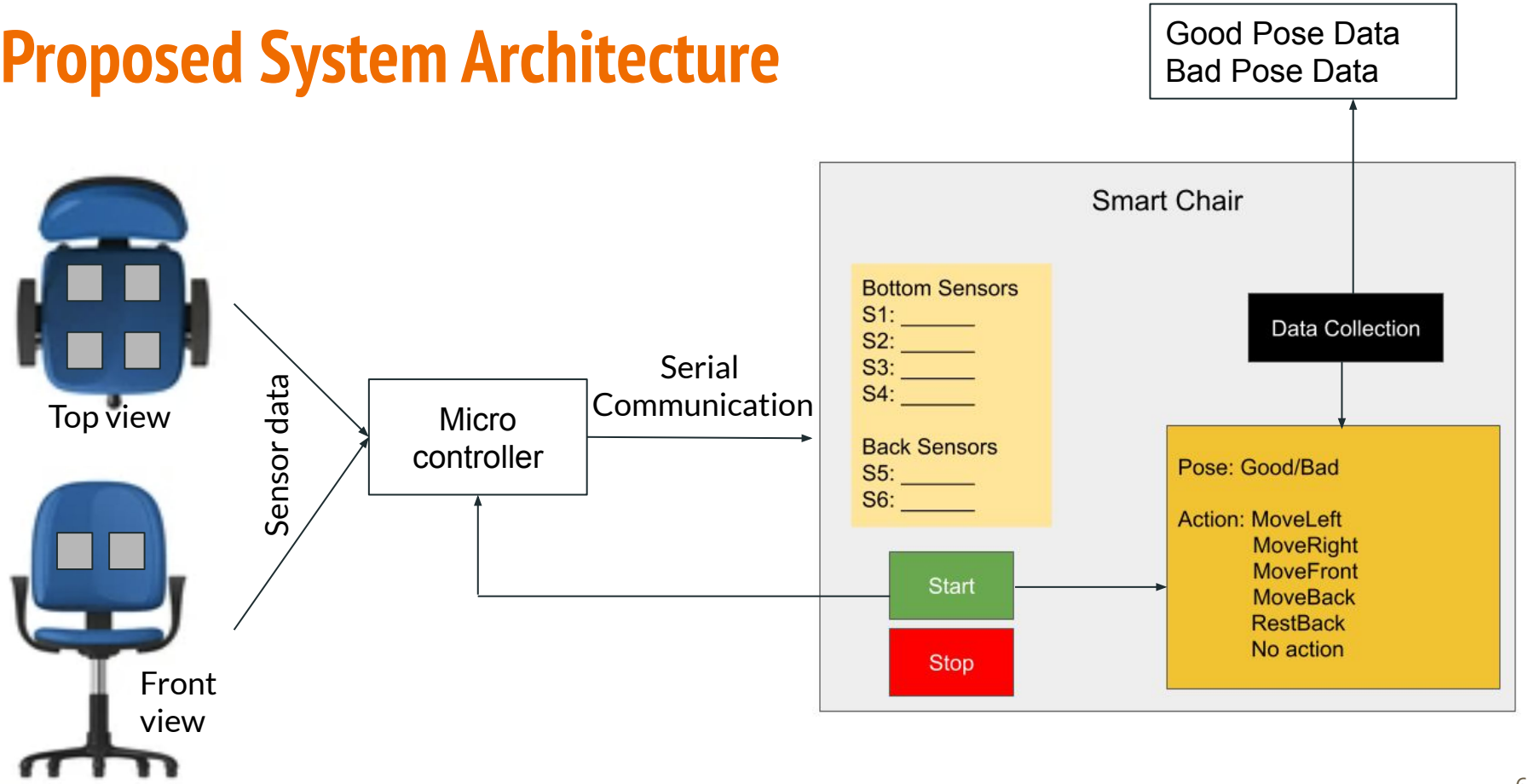
Reinforcement Learning - Markov Decision Process

The concept works on Markov Decision Process Algorithm



Goal is always an Ideal Position

Proposed System Architecture

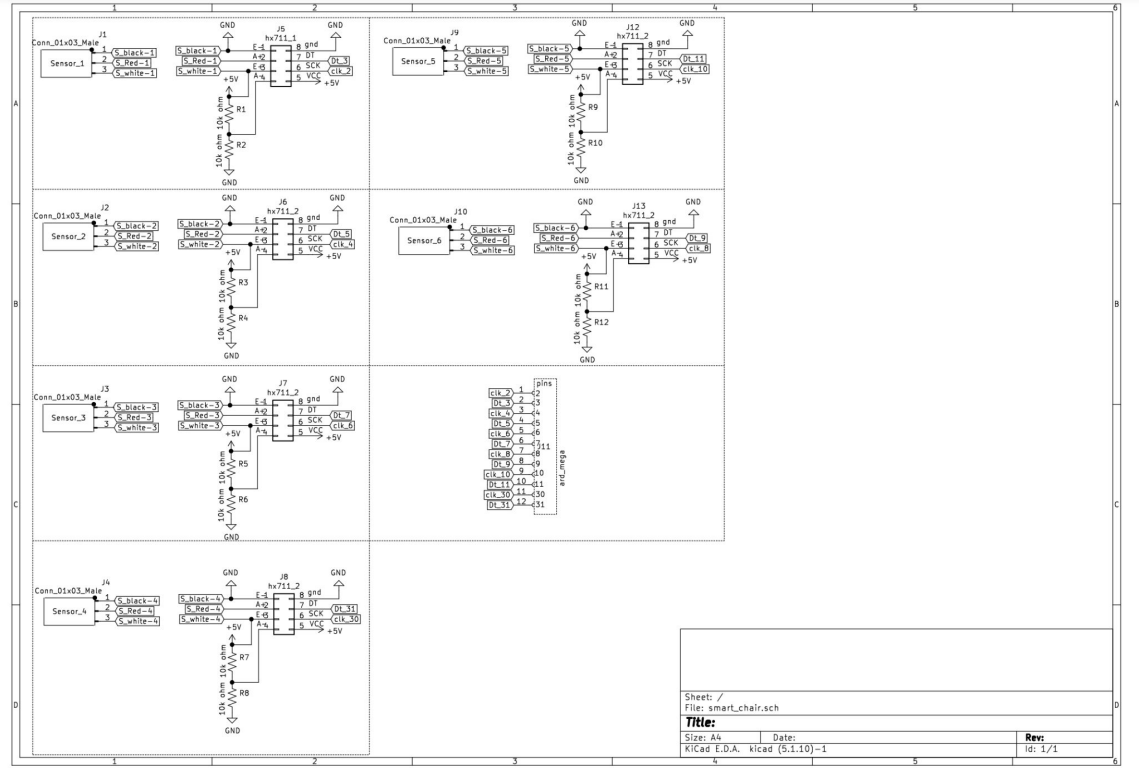


Schematic diagram

Software
KiCAD

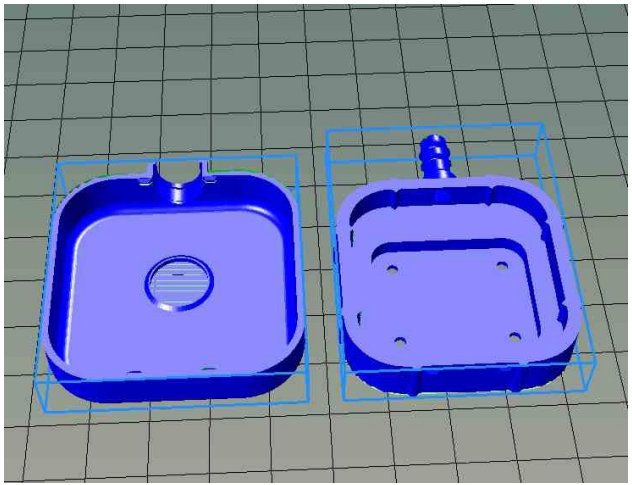
Components

Arduino Mega
Load Cell
HX711 ADC module
Resistors



CAD Models

software
FUSION 360

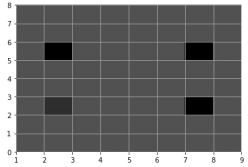


Experiment Results

MDP takes the State and gives the following commands as an Actions(combination of four UP,DOWN,LEFT,RIGHT)

1. Left and Lean back
2. Right and Lean back
3. Lean back
4. Left
5. Right
6. Shift back
7. Left and Shift back
8. Right and shift back

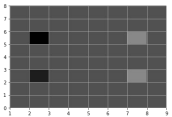
HeatMaps

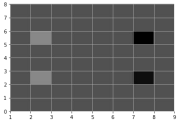


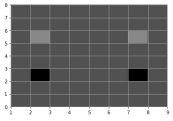
Good pose/ Goal state

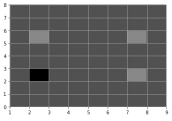
(2,0)	(2,1)	(2,2)
(1,0)	(1,1)	(1,2)
(0,0)	(0,1)	(0,2)

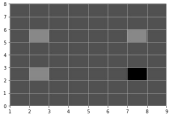
Bad poses/ Other states

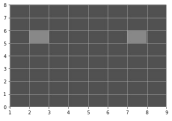


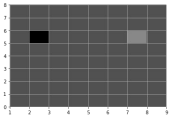


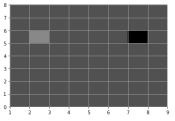




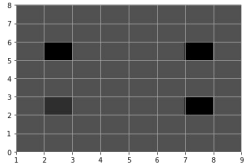








State-Action Mapping



Good pose/ Goal state

(2,0)	(2,1)	(2,2)
(1,0)	(1,1)	(1,2)
(0,0)	(0,1)	(0,2)

Bad poses/ Other states

Left

Right

Shift Back

Right

Shift Back

Left

Shift Back

Lean Back

Left

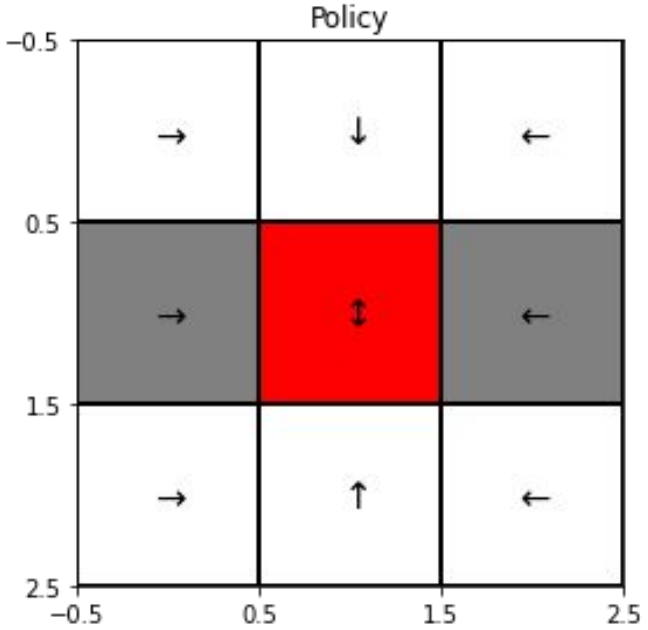
Lean Back

Right

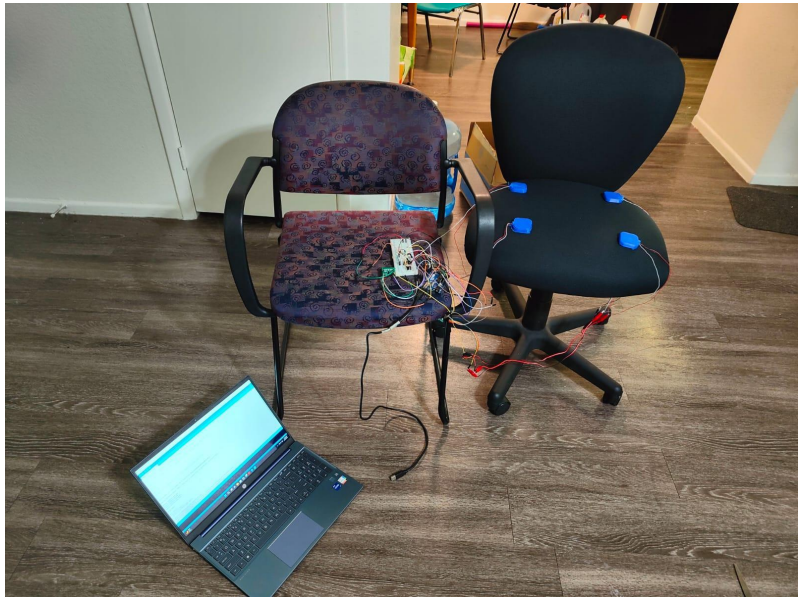
Lean Back

Baseline Results

(2,0)	(2,1)	(2,2)
(1,0)	(1,1)	(1,2)
(0,0)	(0,1)	(0,2)



Baseline Results



Current Results

Current Results

S1	S2	S3	S4	S5	S6	State
23%	21%	25%	32%	52%	49%	1,1
31%	26%	21%	24%	70%	31%	0,2
20%	24%	23%	34%	28%	73%	0,0
21%	19%	27%	35%	58%	43%	0,1
3%	34%	4%	61%	72%	29%	1,0
48%	3%	48%	3%	80%	20%	1,2
44%	46%	5%	6%	95%	5%	2,1
13%	77%	3%	9%	43%	58%	2,0
81%	9%	7%	5%	85%	16%	2,2

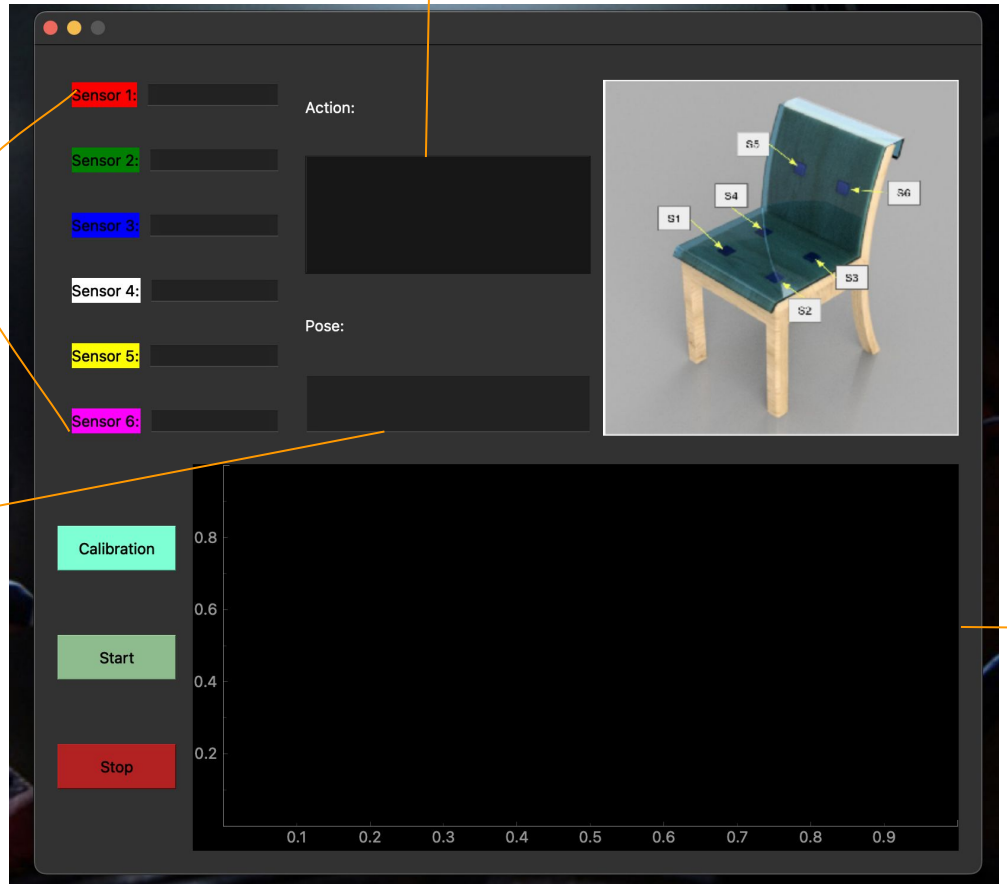
Current Results

GUI of
Posture Correction Chair

Novelty of the current result

- Pressure Sensor Value to Position Recommendation.
- Calibration to make the device more universal.
- GUI to make it more accessible to the user

GUI



Sensor values

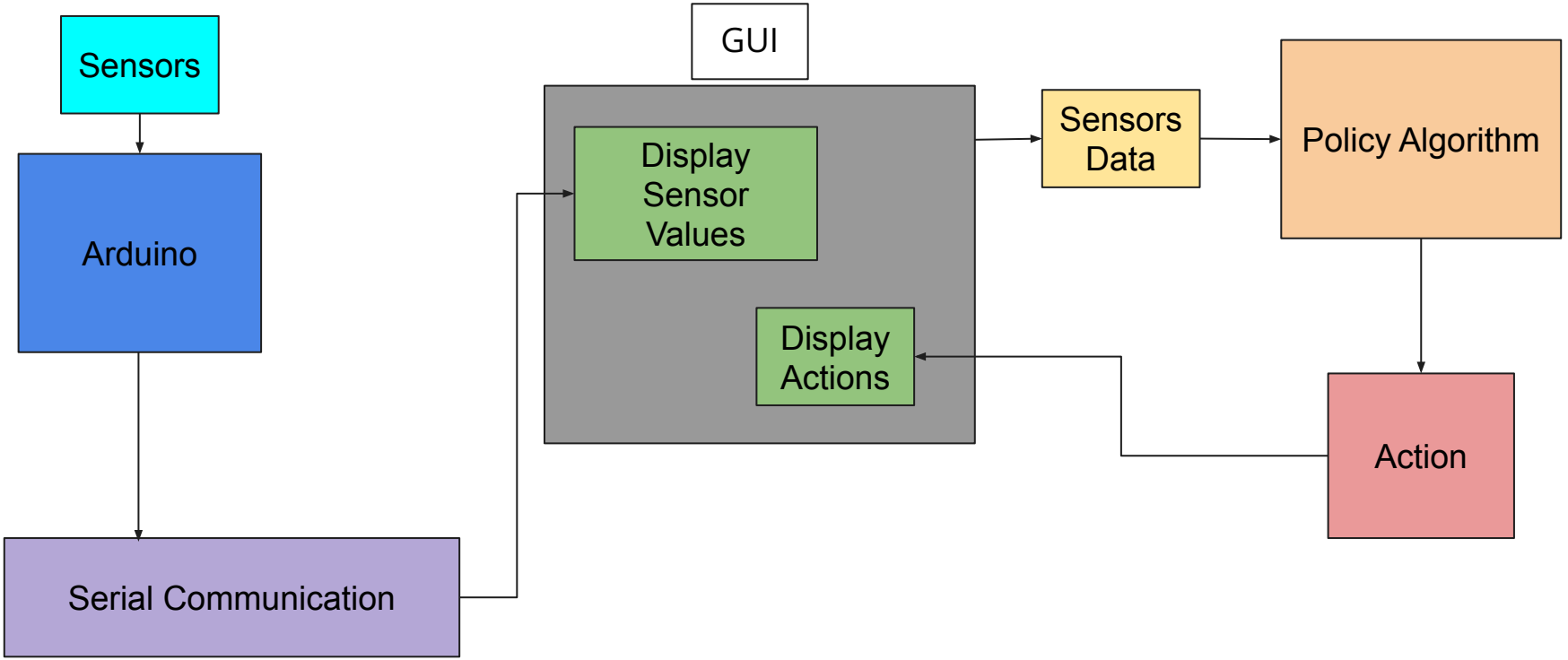
Pose

Actions Displayed

1. *Calibration in Progress*
2. *Calibration is Done*
3. *No One is Sitting*
4. Ideal Position
5. 8 Actions

Graph

Data Flow Integration



Scope

POC Scope

- Poses are fixed.
- calibration is done by sitting in ideal position.
- GUI is basic
- 2-3 secs action updates
- Tested on 6-7 individuals weighing between 135-150 lbs.

Product Scope

- User friendly GUI to be engineered with specialist.
- Discuss actions specifications with expert.
- More testing is required with diverse people
- Has potential to be portable system or compact chair
- Intelligent feedback system based on survey

Expenditure for POC

Item	Quantity	Cost($)
Arduino mega	1	20
Chair	1	5.80
Load Cells	6	12
HX711	6	12
3D filament		30
Wiring		12
Miscellaneous		25
Total		**116.8**

THANK YOU