

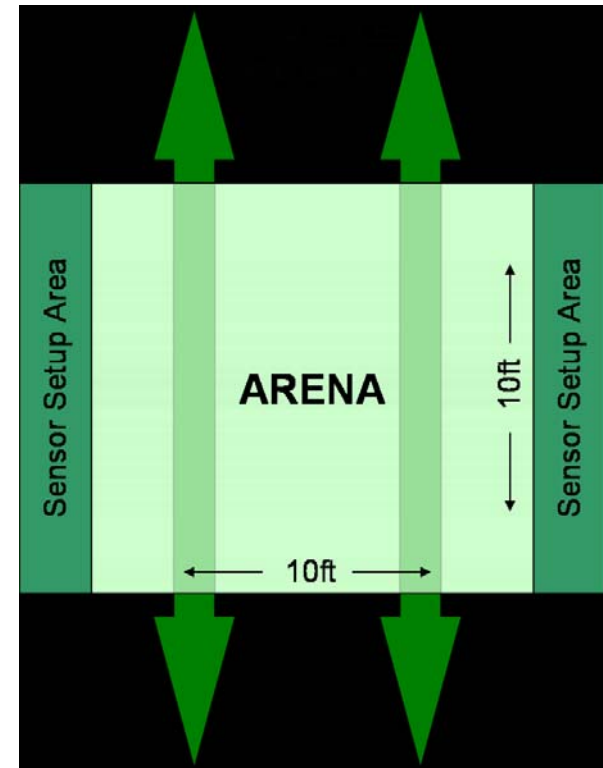
Floor that Knows

Manas Mittal / Kyle Buza

MAS 836

IPSN Extreme Sensing

- Count People
- < 5 Pixels
- < 10 Inches Wire
- 2 Rounds



Vision

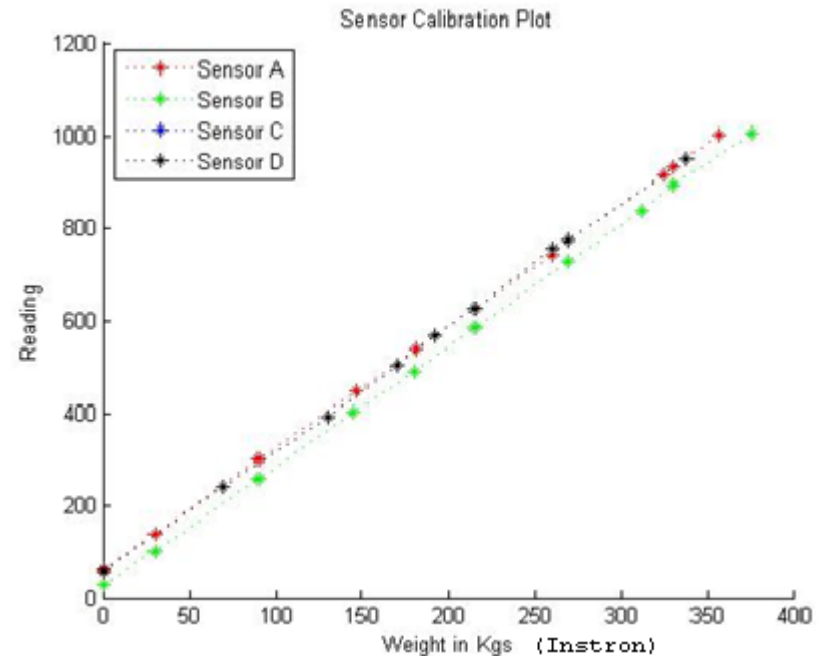
- Weight
- Unfoolable ? Robust ?

Steps

- Sensing
- Communication
- Signal Processing / Algorithm

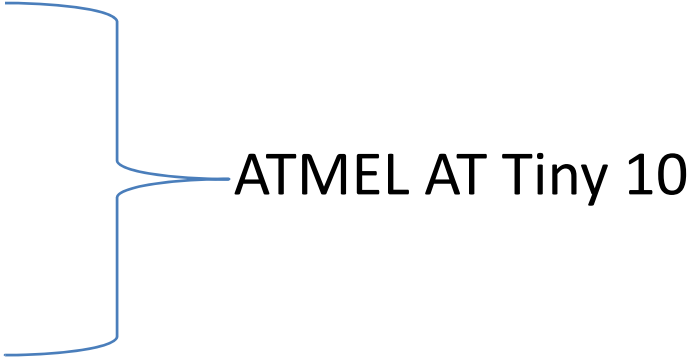
Sensing

- Platform 10' X 10'
- 4 Weight Sensors
 - 1000 lbs each
- Metal Supports
- Instrumentation Amp.



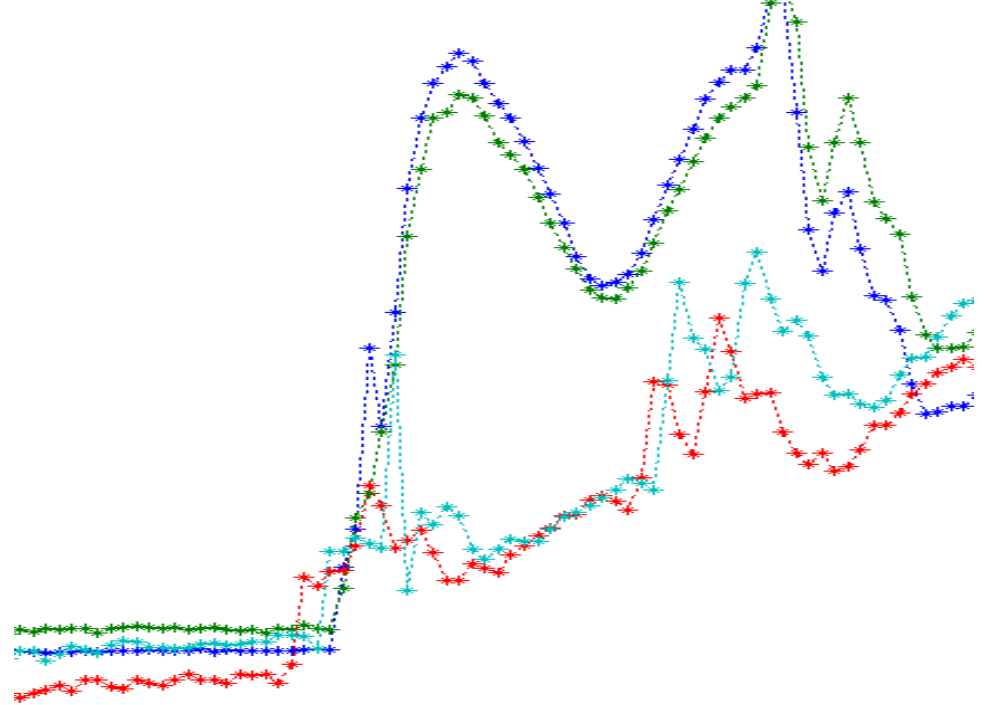


Communication

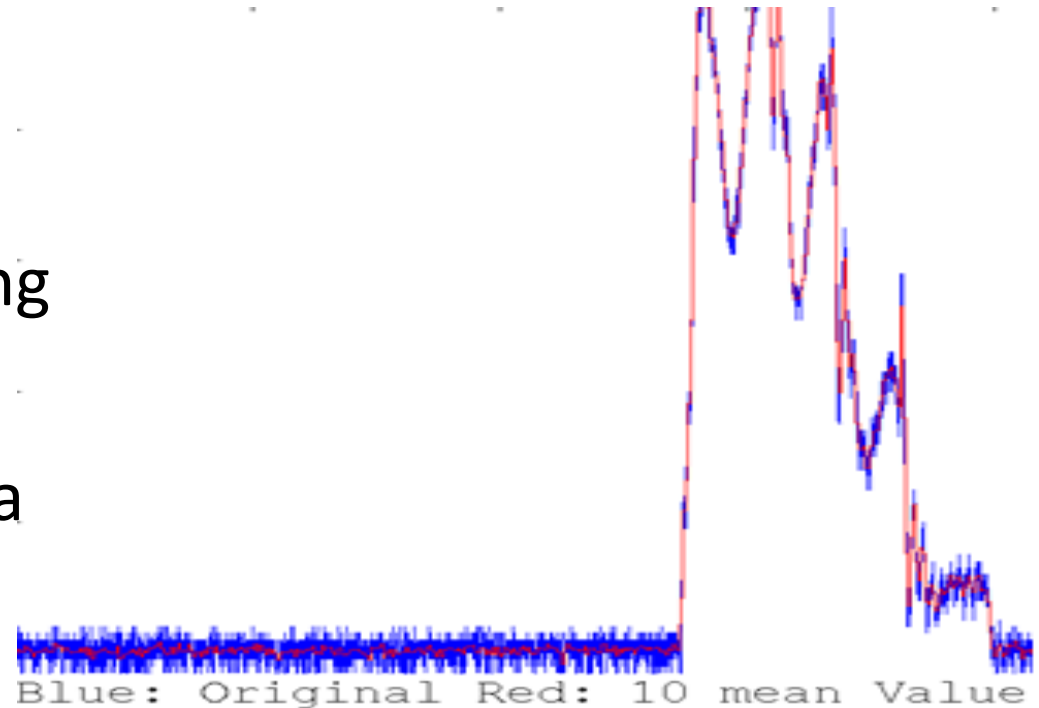
- 10 Bit A/D
 - USART
- 
- ATMEL AT Tiny 10
- ~~RS232~~ → Serial to USB TTL to USB Cable
 - Mac Mini's + WiFi

Algorithms

- Input
 - 4 Sensor Streams



- Preprocessing:
 - a. 10 pt Smoothing at Client
 - b/w, no real data

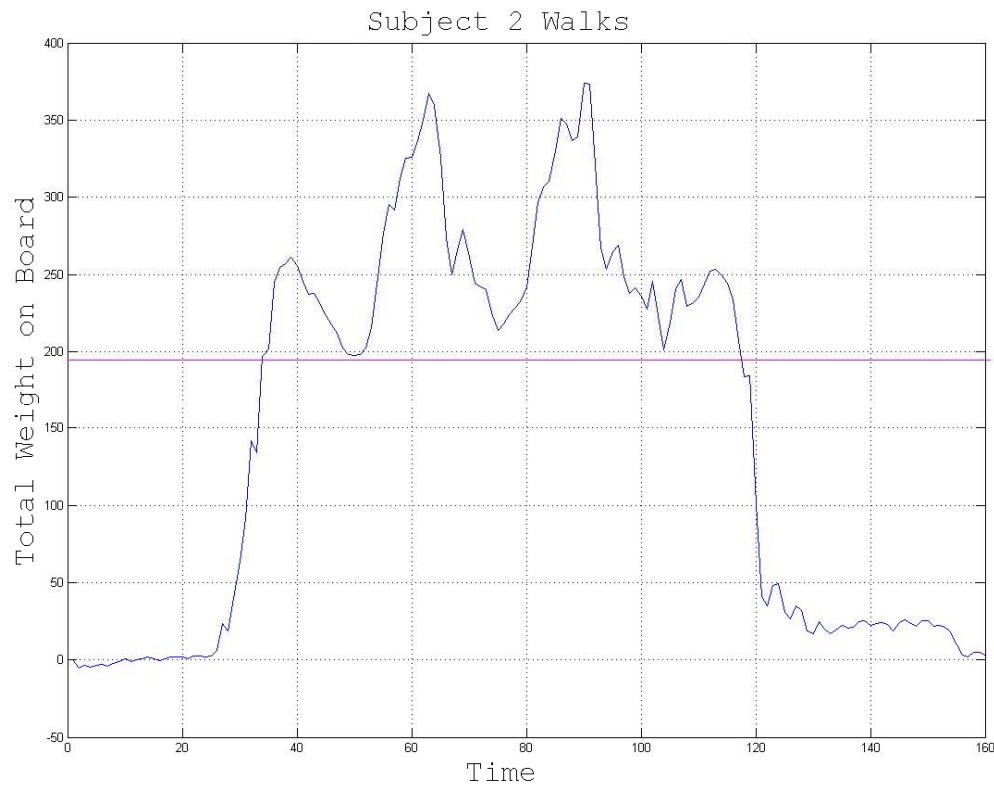




Algorithms

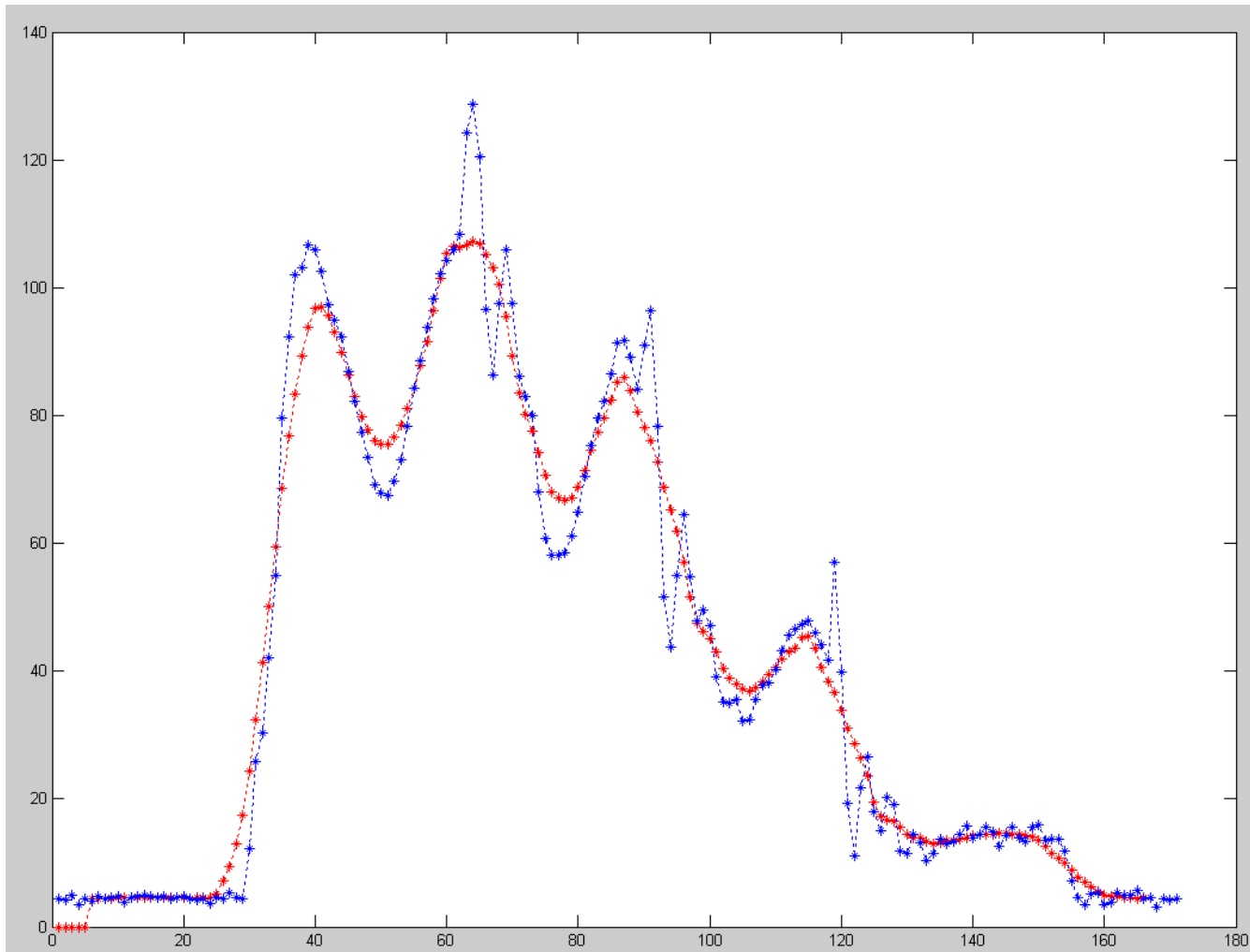
- nPeople =

$$\text{Round} \left(\frac{\sum_{i=1}^{i=4} (\text{Load Reading} - \text{Load at Rest})}{\text{Average Person's Load Reading}} \right)$$



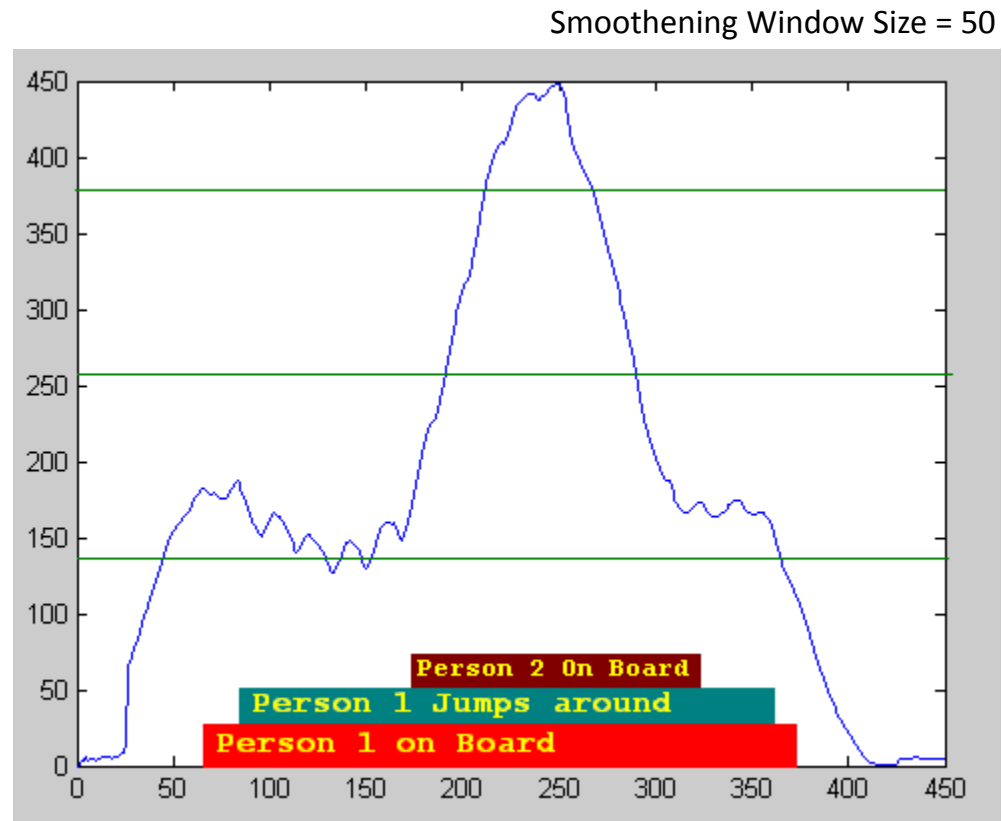
Smoothing

- Low Pass – 10



Jumping

- Low Passed
- Only 1 Error
- Stop Reporting if Spikes



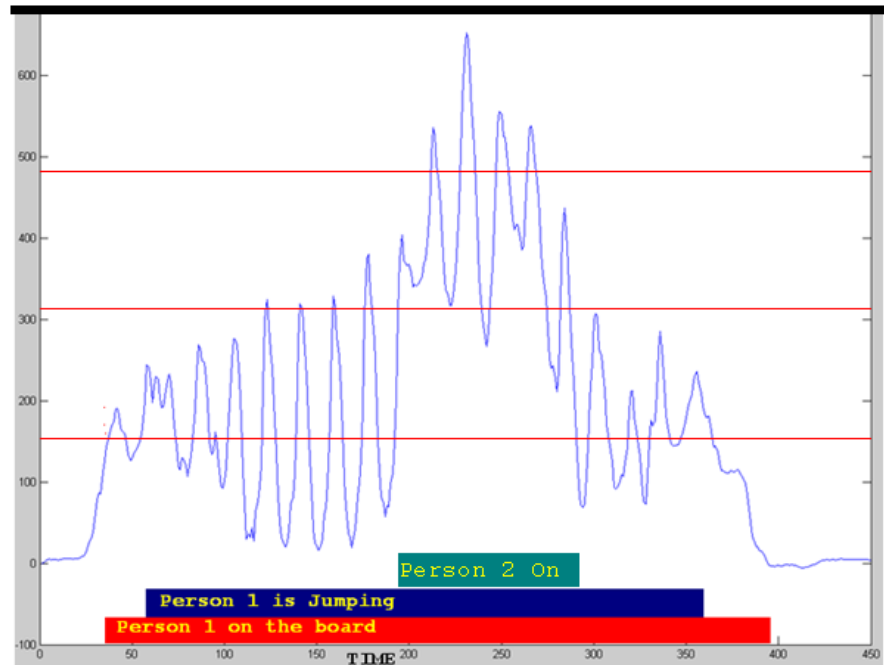
Jumping

- Thresholding
Algo. \rightarrow Bad

- Approach :
delayed reporting,

if derivative $>$ thresh at time t :

do not report events in time t -delta

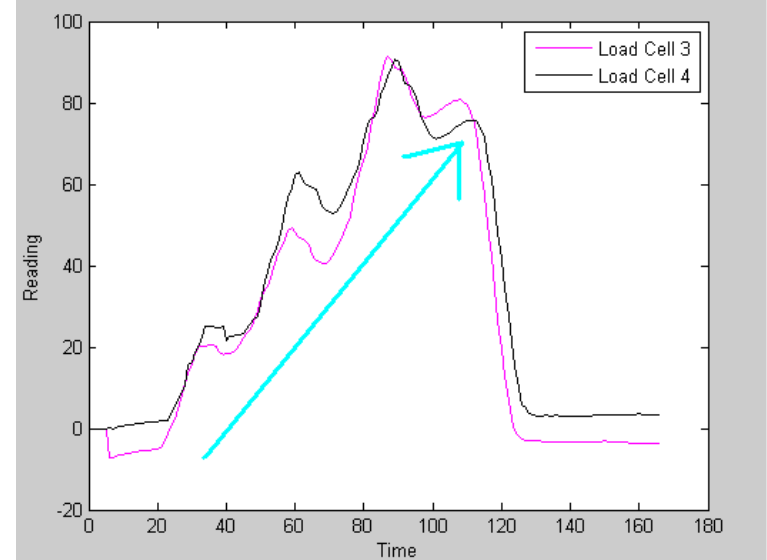
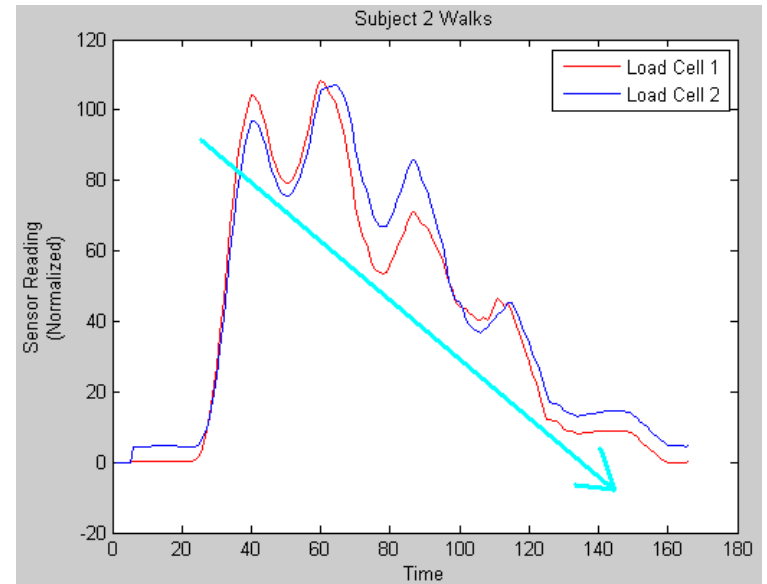
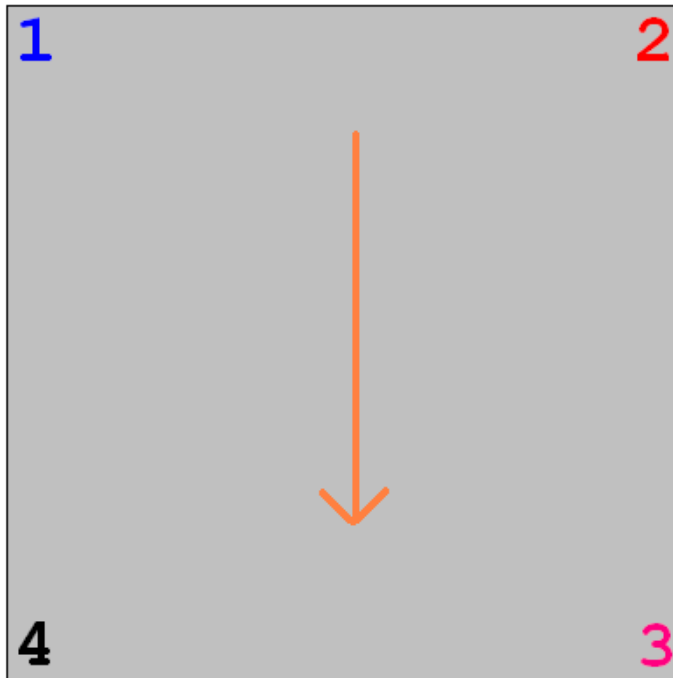


Results

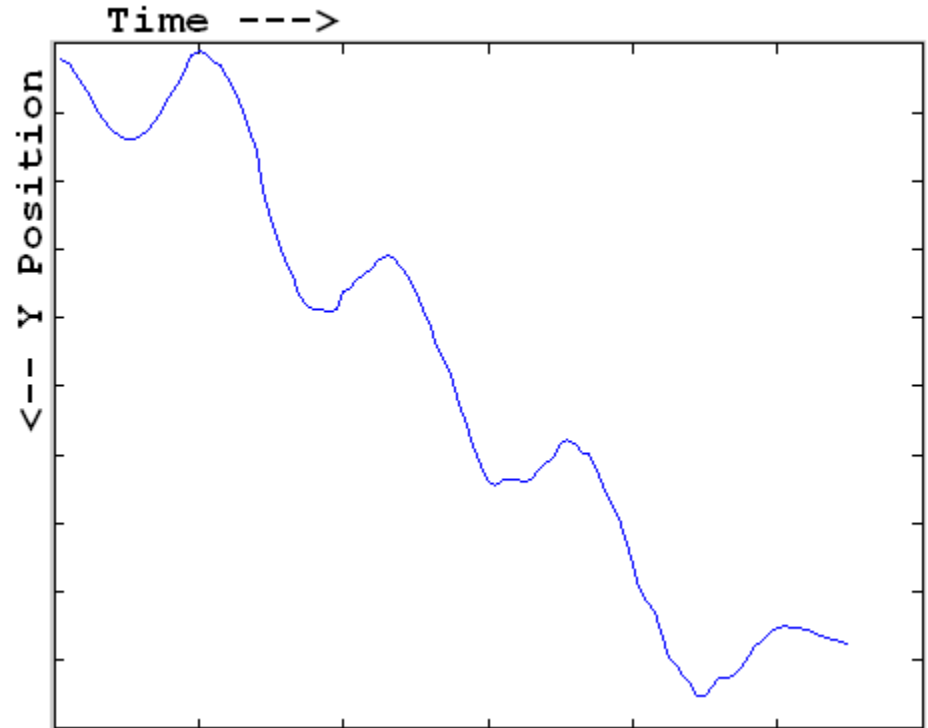
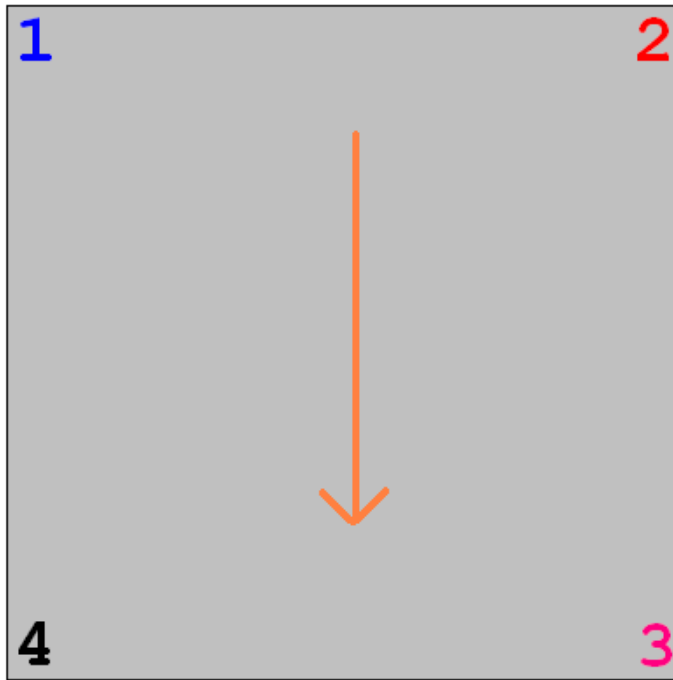
- Reported 254, Ground Truth: 204
- Working System,
- 3rd Place,

- Why ?
 - Jumping (26)
 - Many People → Steps had a higher Effect (24)
 - Demo like testing → Positive Skew.

Localization ?



Localization



Linear Fit

Sensor 1, 3

$$Y \text{ pos} = \frac{\text{abs}((s1 - \text{min}(s1)) / (\text{max}(s1) - \text{min}(s1))) * 10 + (s3 - \text{min}(s3)) / (\text{max}(s3) - \text{min}(s3)) * 10}{2}$$

2

Contributions

- A Sensing System (Sensing, Communication, Algorithms).
- Proof of concept of Localization of moving person.