TPMS

Shashank Varshney (2017JVL2507)

Deep Narula(2017JVL2509)

Under the guidance of

Prof. Jayedeva

System

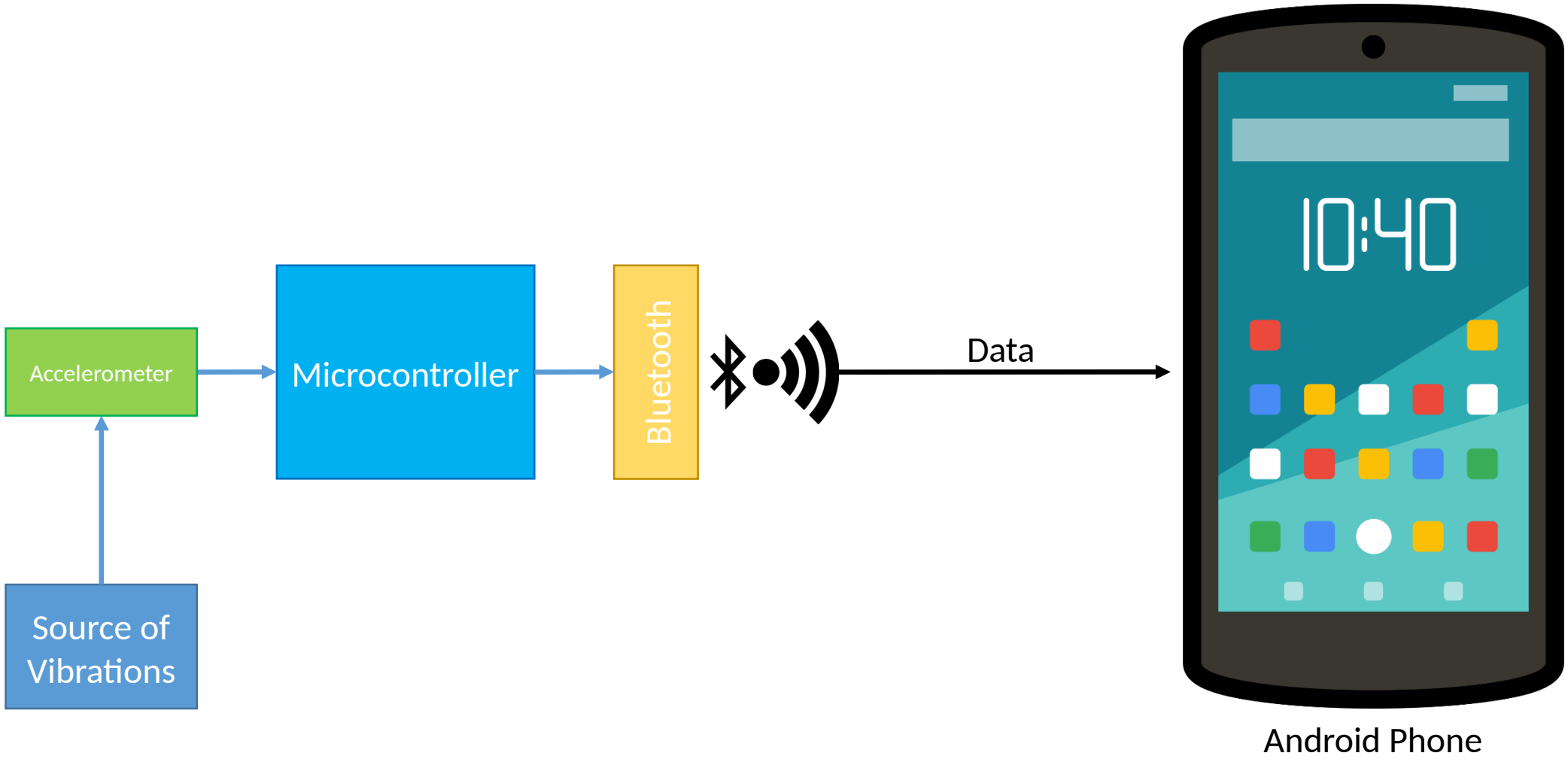
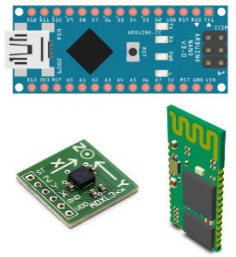
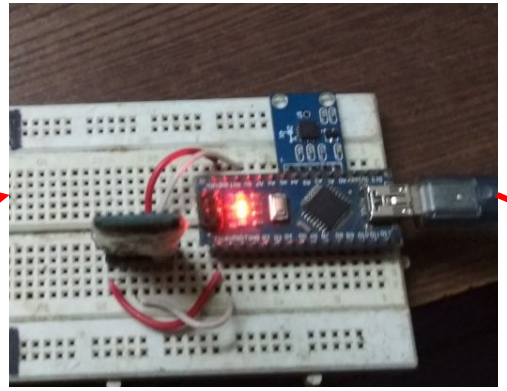


Fig. 1 System Block Diagram

System realizations



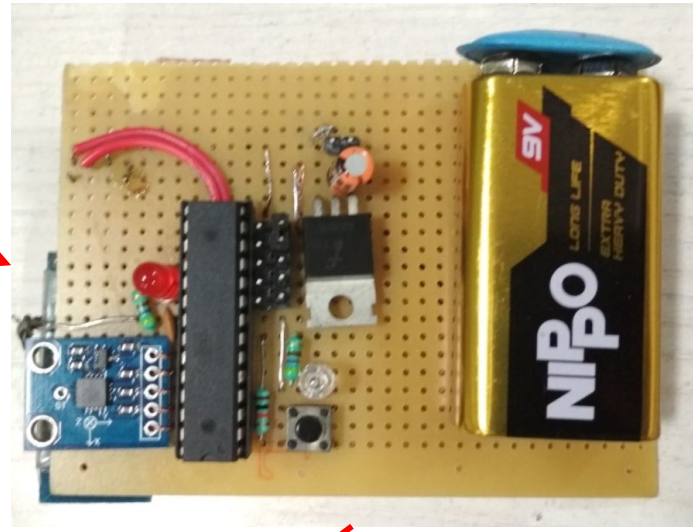
Breadboard assembly



α-model

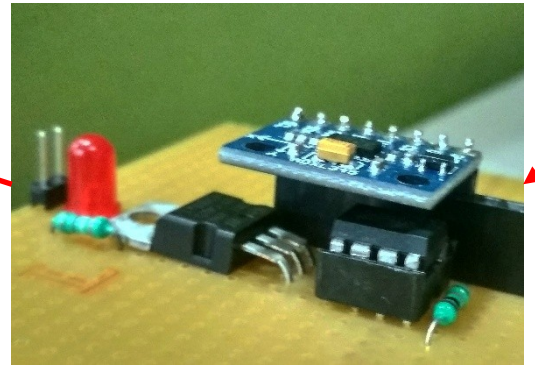
Zero-PCB V1

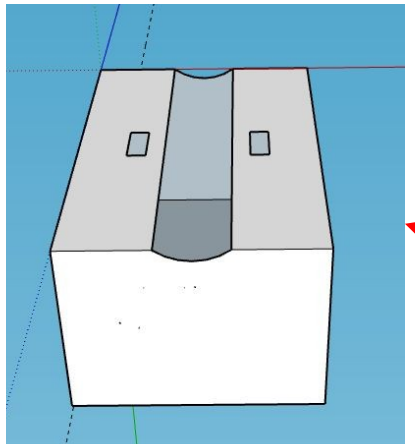
β-model



Zero-PCB V2

Reduced size





Housing for V2

Components

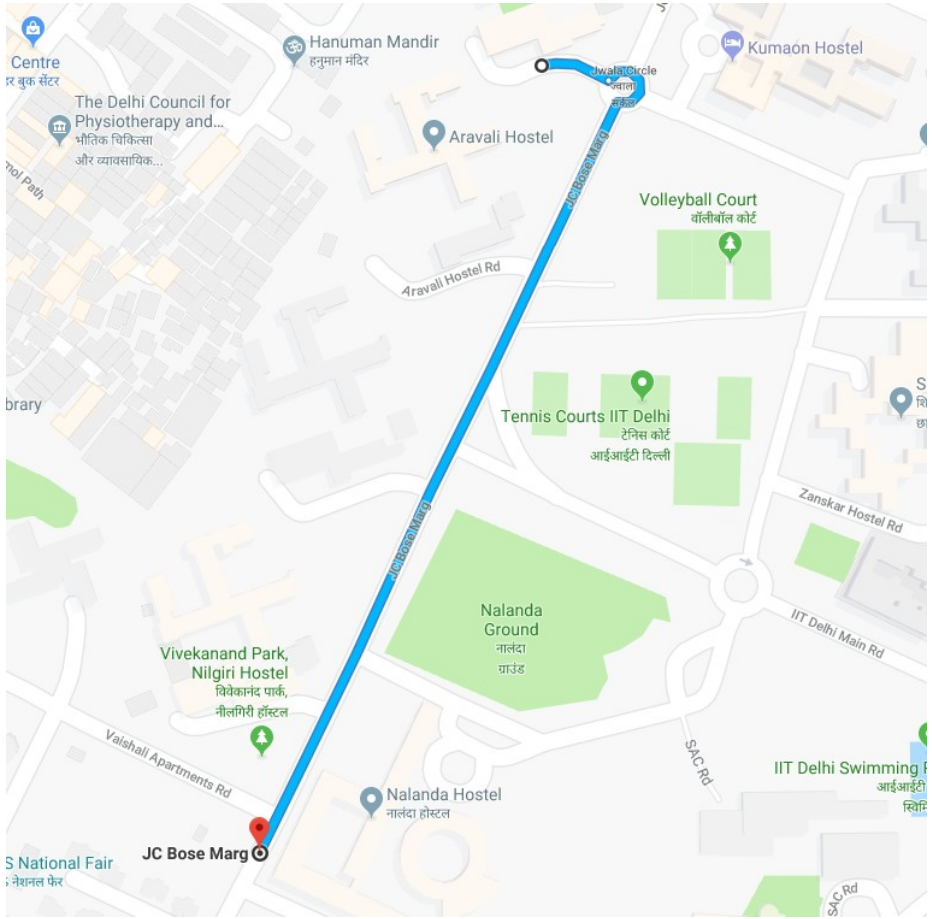
- Arduino
- Bluetooth
- Accelerometer

New Components in V2

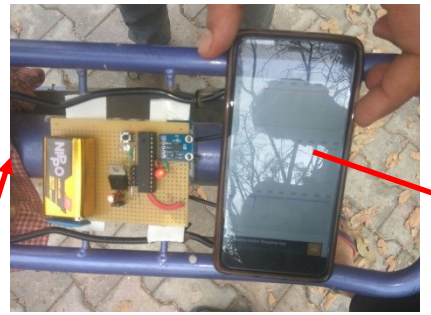
- ADXL345 ,Digital accelerometer 16 bit output
- ATtiny85, 8 Pin PDIP Package, Small form factor than ATmega8A
- Low power consumption, Minimum voltage requirement 1.8V @1MHz

Data Collection

- Data collection location : Jwalamukhi Circle to Nilgiri Hostel
- Distance between PT1 to PT2 : 500m
- No of samples collected : 20

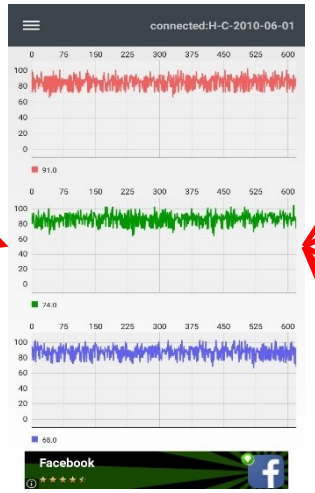


Data Collection



Data Logging

Data on Android app



System mounting

Pressure Measurement Before trial

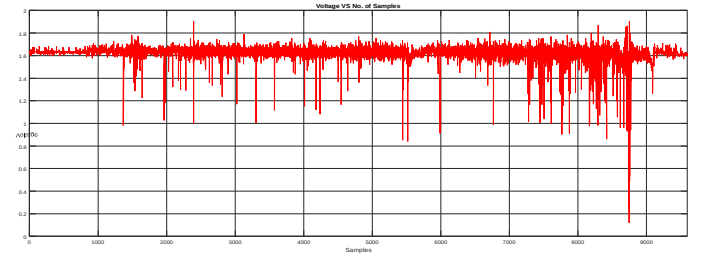
Trial 1

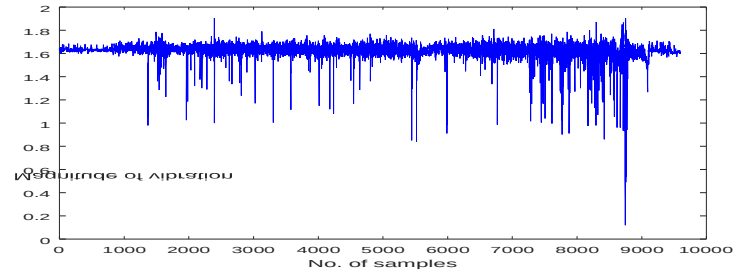
Trial 2

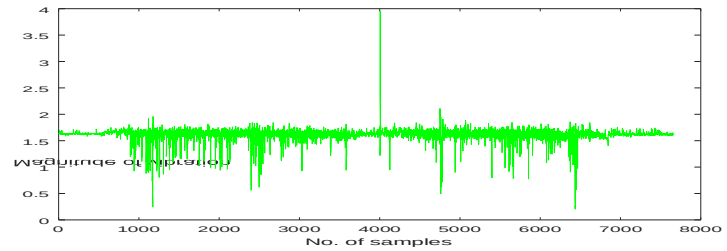
Trial 3

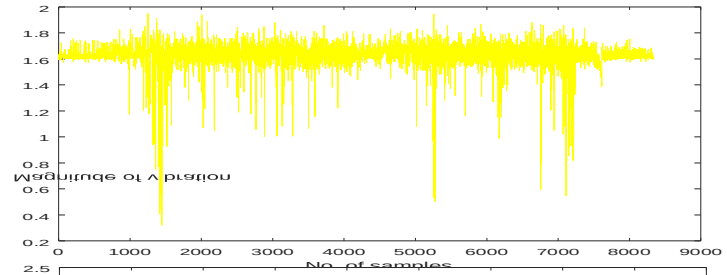
Trial 4

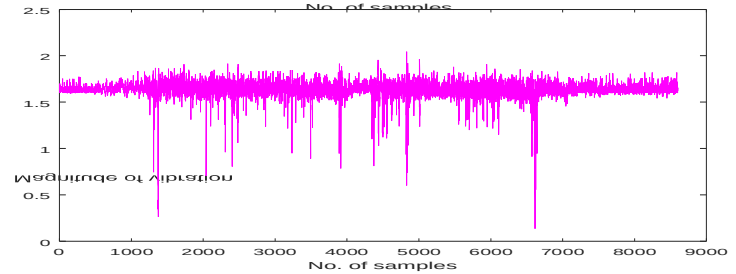
Trial 5





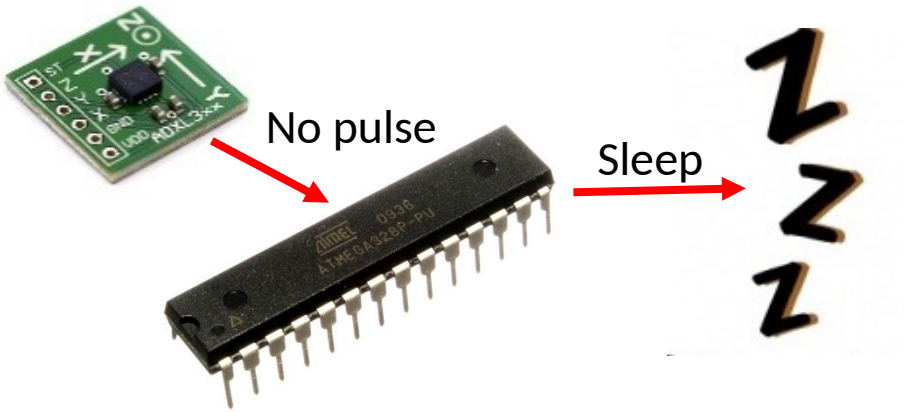




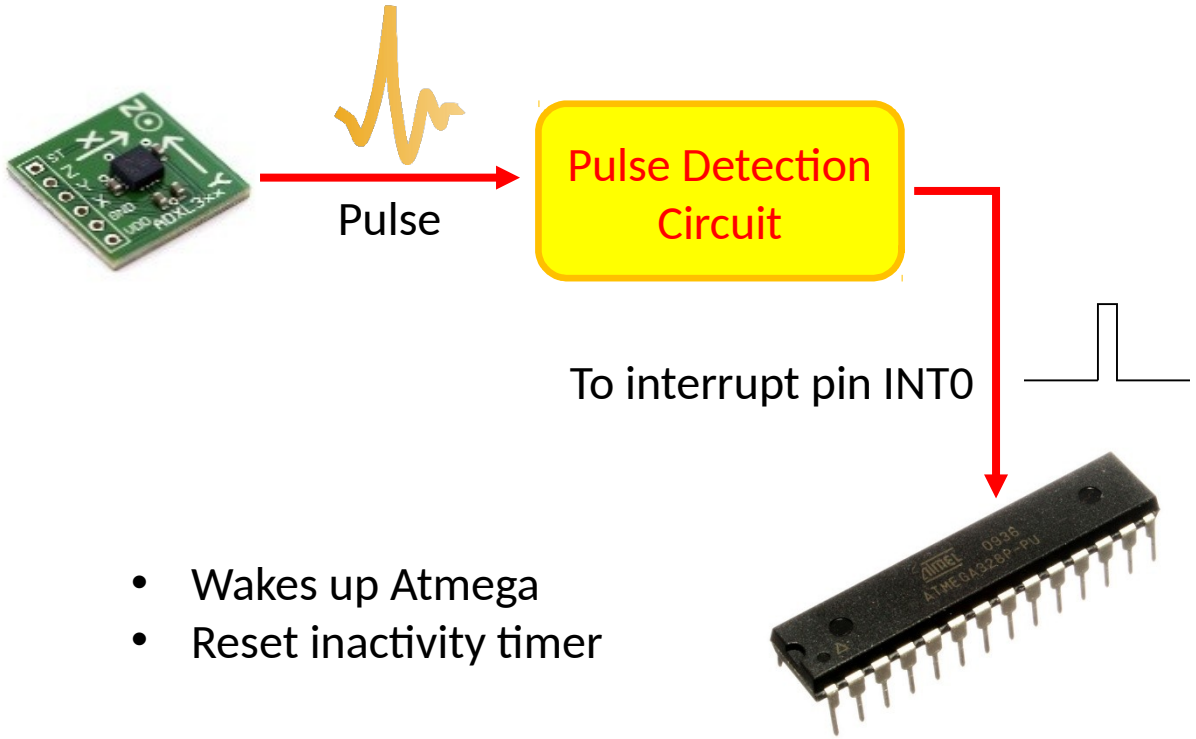


Increasing tyre pressure

Firmware Update: Power saving mode



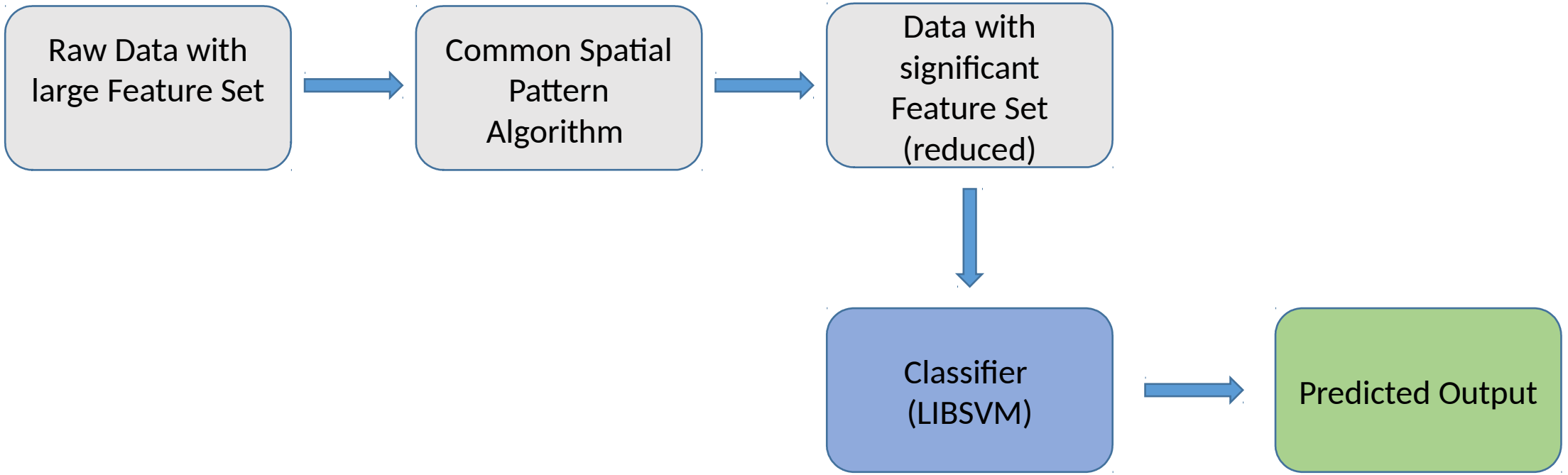
- Inactivity greater than 10 min Atmega goes to sleep
- Shutting down everything except accelerometer
- Input current is in nA
- Huge reduction in power



- Wakes up Atmega
- Reset inactivity timer

Ref: https://playground.arduino.cc/Learning/ArduinoSleepCode

2-Class Common Spatial Pattern (CSP)



2-Class Common Spatial Pattern (CSP)

- The CSP algorithm solves the optimization problem for 2-Class dataset

$$\vec{w}^* = \underset{\vec{w} \in \mathbb{R}^N}{\operatorname{argmax}} \left\{ \frac{\vec{w}^{\mathrm{T}} R_{\vec{x}|c_1} \vec{w}}{\vec{w}^{\mathrm{T}} R_{\vec{x}|c_2} \vec{w}} \right\}$$

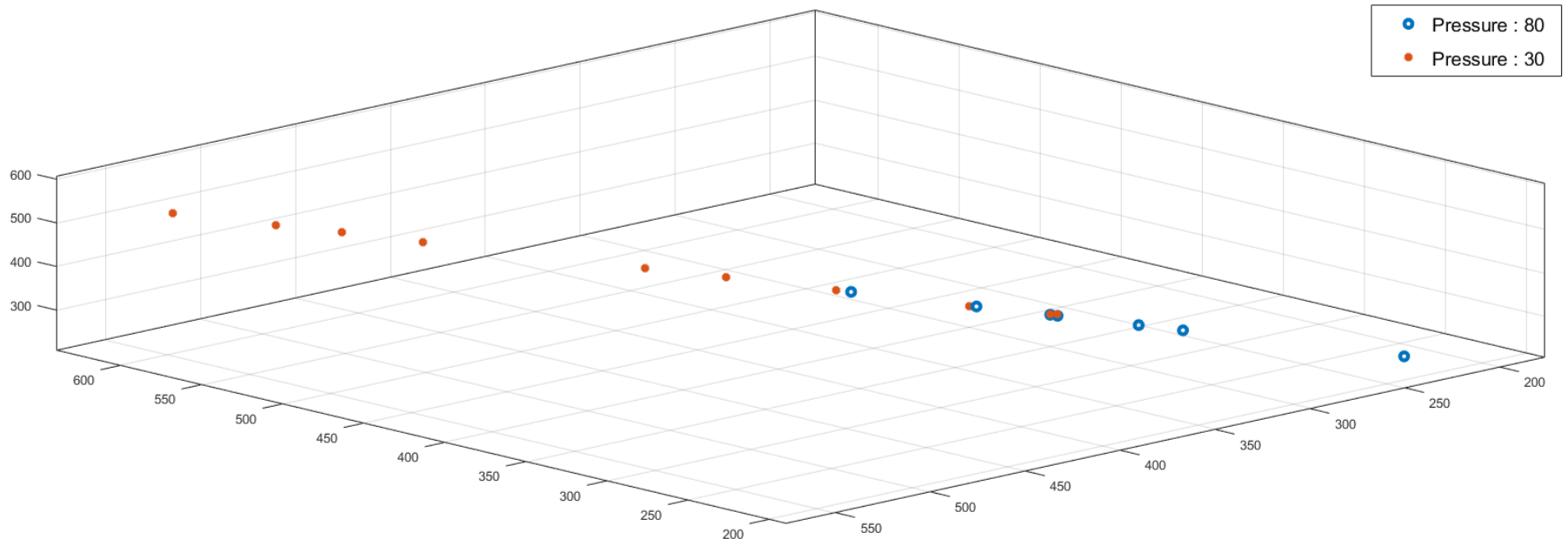
- solutions to above problem are given by eigenvectors of the generalized eigenvalue problem

$$R_{\vec{x}|c_1} \vec{w} = \lambda R_{\vec{x}|c_2} \vec{w}.$$

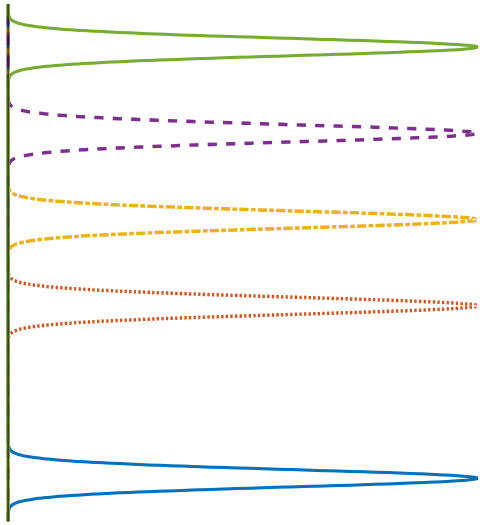
- The eigenvectors correspond to the desired spatial filters. For a given eigenvector w∗, the corresponding eigenvalue determines the value of the cost function

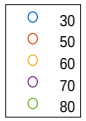
$$\lambda^* = \frac{\vec{w^*}^{\mathrm{T}} R_{\vec{x}|c_1} \vec{w^*}}{\vec{w^*}^{\mathrm{T}} R_{\vec{x}|c_2} \vec{w^*}}.$$

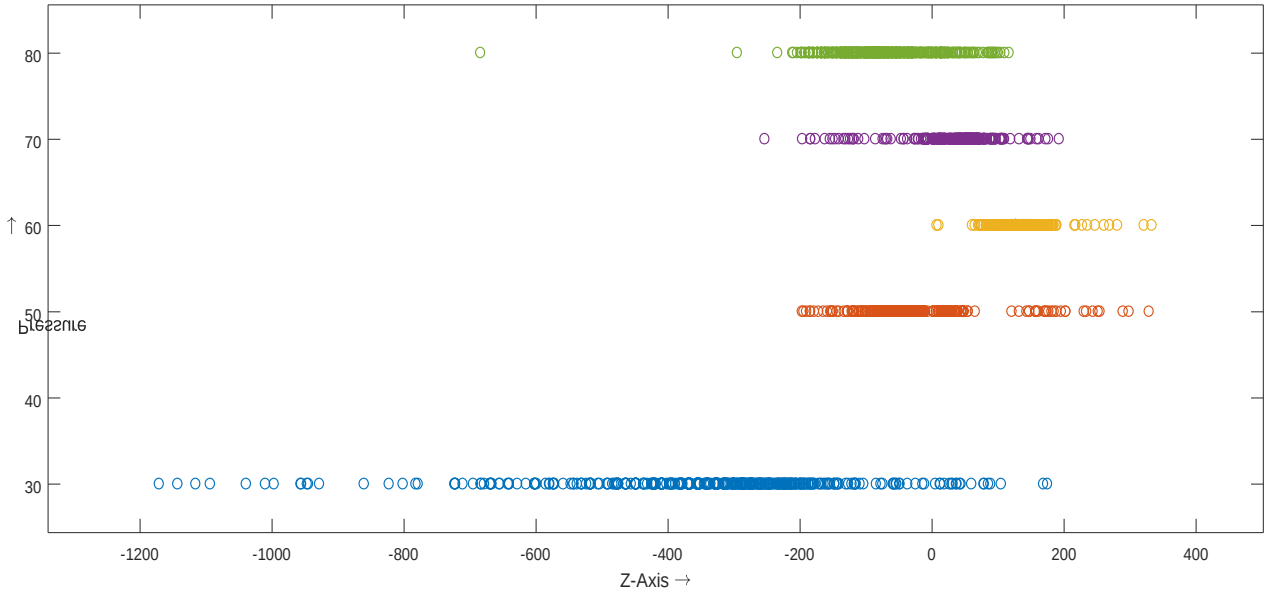
Data Analysis(1)

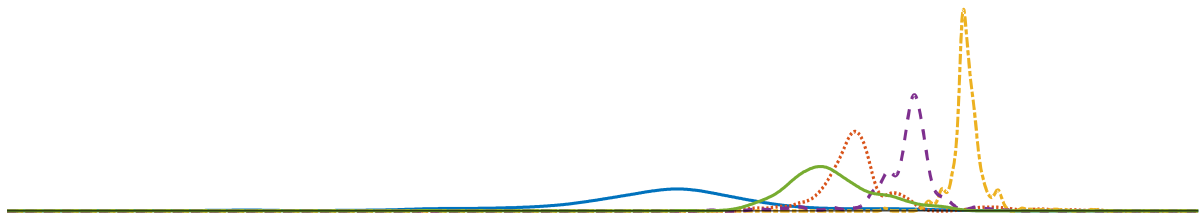


Data Analysis(2)









Classification(1)

- C-SVM has been used for classification.
- Kernel used: rbf
- Library used: sklearn
- 5-fold cross validation to train the model
- Number of samples used : 2500
- Accuracy = 90.758 ± 0.91 %

Classification(2)

- Linear Regression has been used.
- Library used: sklearn
- Number of samples used: 2500
- Root mean square error: 11.69
- R2 Score: 0.47

Classification(3)

- Non linear regression has been used.
- Kernel Used: rbf
- Library used: sklearn
- Number of samples used: 2500
- Root mean square error: 6.93
- R2 Score: 0.84


THANK
YOU