Audio based Activity Recognition

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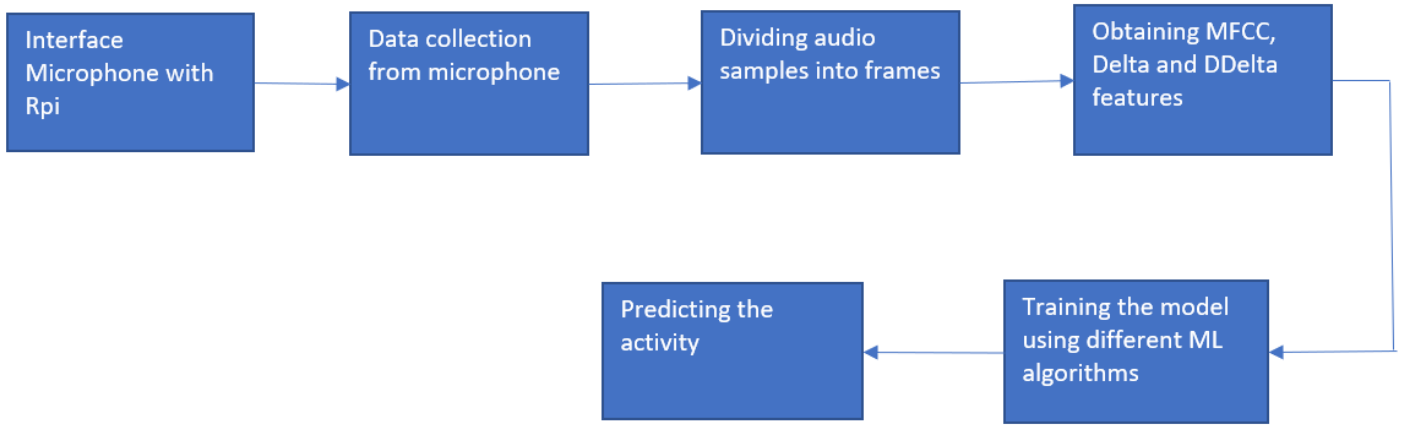
Key idea and System Design

- Key idea: Detect sound based activities using a simple and cheap microphone based setup.
- System Design:



HW and SW components

- Hardware:
  - Raspberry pi 3 – Model B
  - Computer USB Microphone

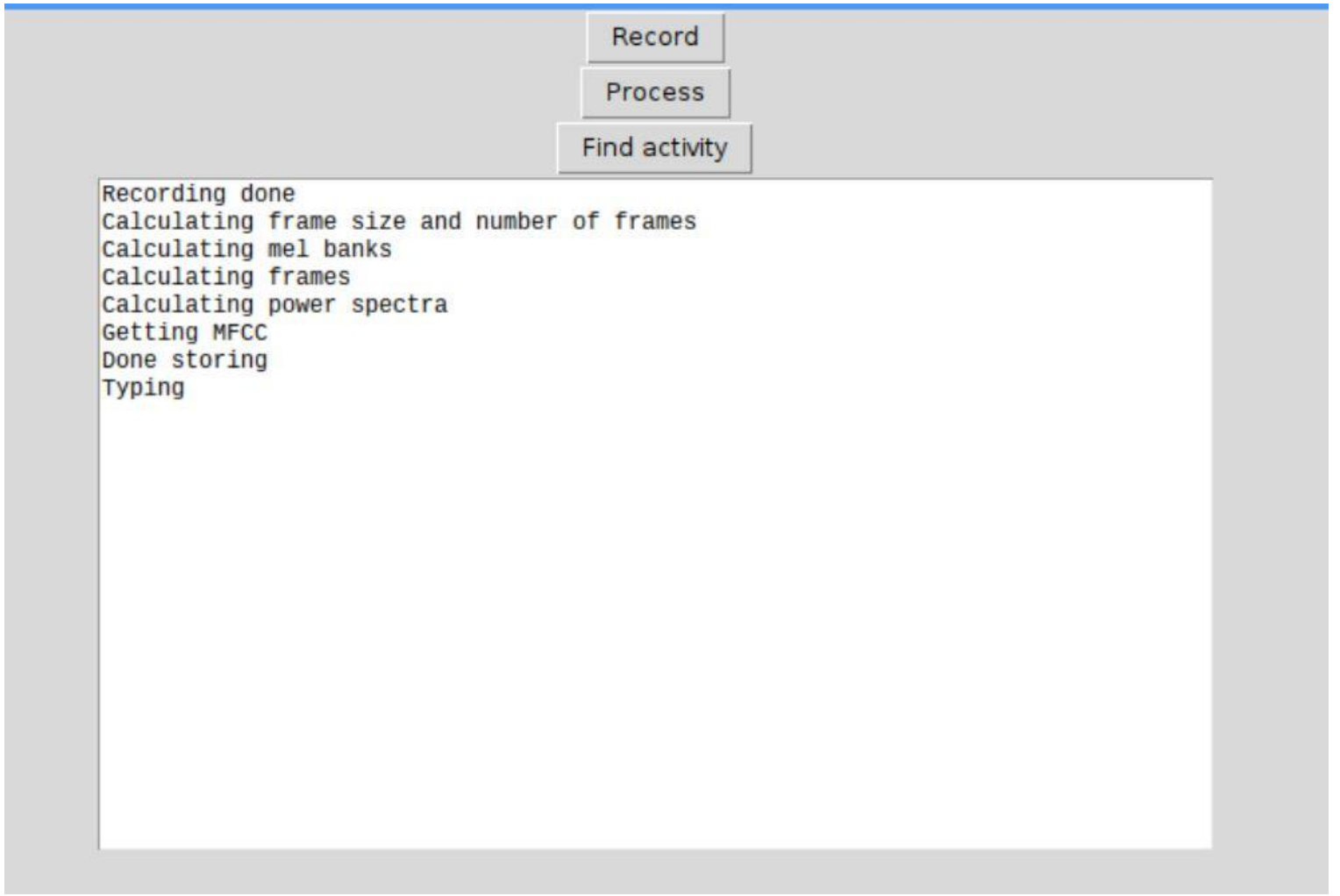
- Software:
  - Python
  - Frameworks:
    - Mic : Alsa Audio, Pyaudio
    - ML algorithms - Scikit-Learn, Numpy
    - GUI - Tkinter

Results:

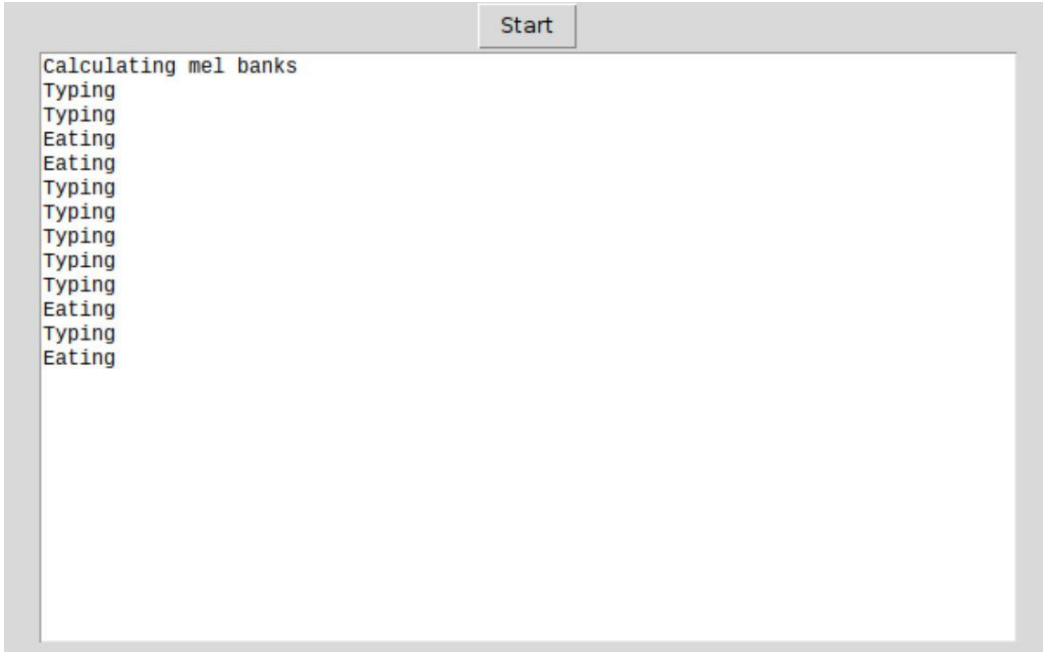
- Non-Real Time Processing:
  - Detected 5 activities with 10sec audio samples – 50 audio files for each activity.
  - Compared different ML classification algorithms based on accuracy and time for Raspberry Pi.

ML algorithm	Accuracy Percentage	Time taken to execute (in seconds)
Logistic Regression	73.01%	95.17
SVM- Linear Kernel	66.67%	7.58
SVM – RBF Kernel	66.67%	110
KNN	79.36%	3.192
Decision Tree	100%	7.6s
MLPC	47%	23.28
Random Forest	100%	0.6
Boosting – Ada Boost	99.92%	185

GUI - Non-Real Time Processing



GUI – Real Time Processing



- Built feature vector comprising of 3 features – MFCC, Delta, DDelta
- Predicted the model using Random Forest as it gave a better accuracy with better execution time in non-real time processing

Video Demo

Laundry – Non Real Time:
https://youtu.be/0m3kBEFjWR4

Laundry – Real Time :
https://youtu.be/Ud1WwnJU2n0

Vacuum- Non Real Time:
https://youtu.be/f9YrJ3E30Mk

Vacuum- Real Time:
https://youtu.be/93BD09TxFtk