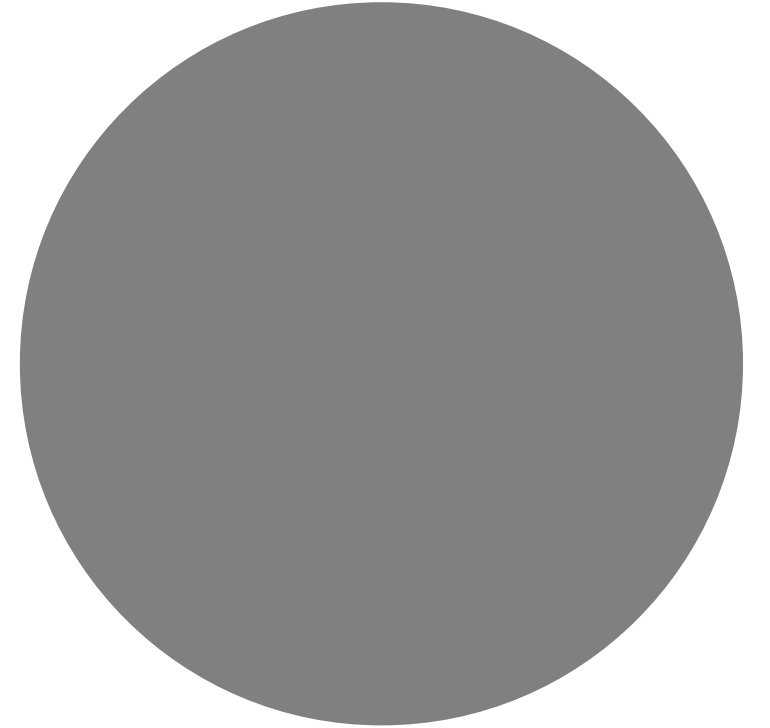# Audio based Activity Recognition
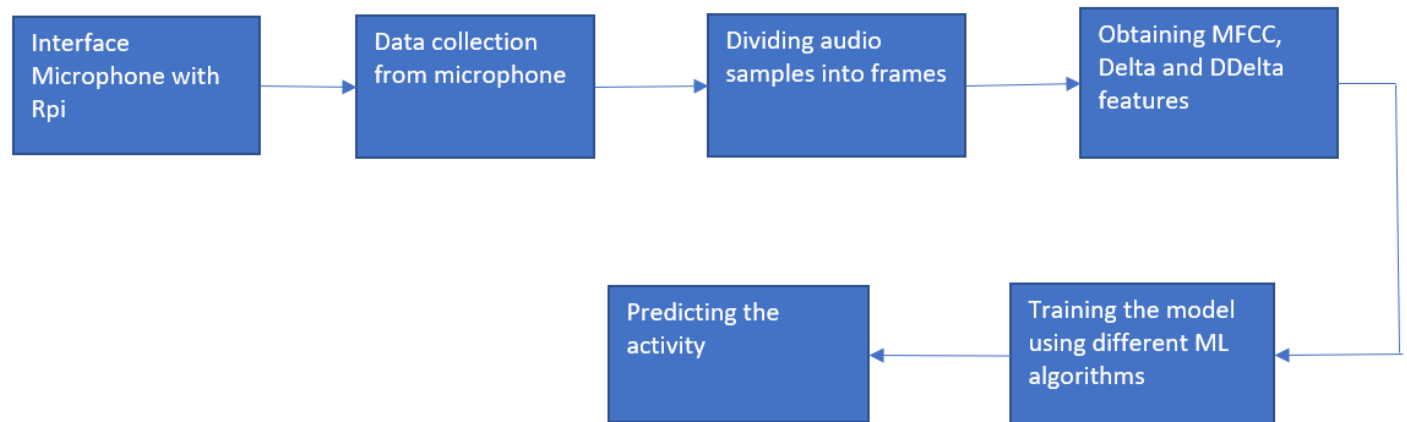
Chandhini Grandhi, A53272378

Sivasankar Palaniappan, A53275703

Key idea and System Design

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

- System Design:

```
┌─────────────────┐     ┌─────────────────┐     ┌─────────────────┐     ┌─────────────────┐
│ Interface       │     │ Data collection │     │ Dividing audio  │     │ Obtaining MFCC, │
│ Microphone with │ ──> │ from microphone │ ──> │ samples into    │ ──> │ Delta and DDelta│
│ Rpi             │     │                 │     │ frames          │     │ features        │
└─────────────────┘     └─────────────────┘     └─────────────────┘     └─────────────────┘
                                                                                  │
                                                                                  │
┌─────────────────┐     ┌─────────────────┐                                       │
│ Predicting the  │ <── │ Training the    │ <─────────────────────────────────────┘
│ activity        │     │ model using     │
│                 │     │ different ML    │
│                 │     │ algorithms      │
└─────────────────┘     └─────────────────┘
```

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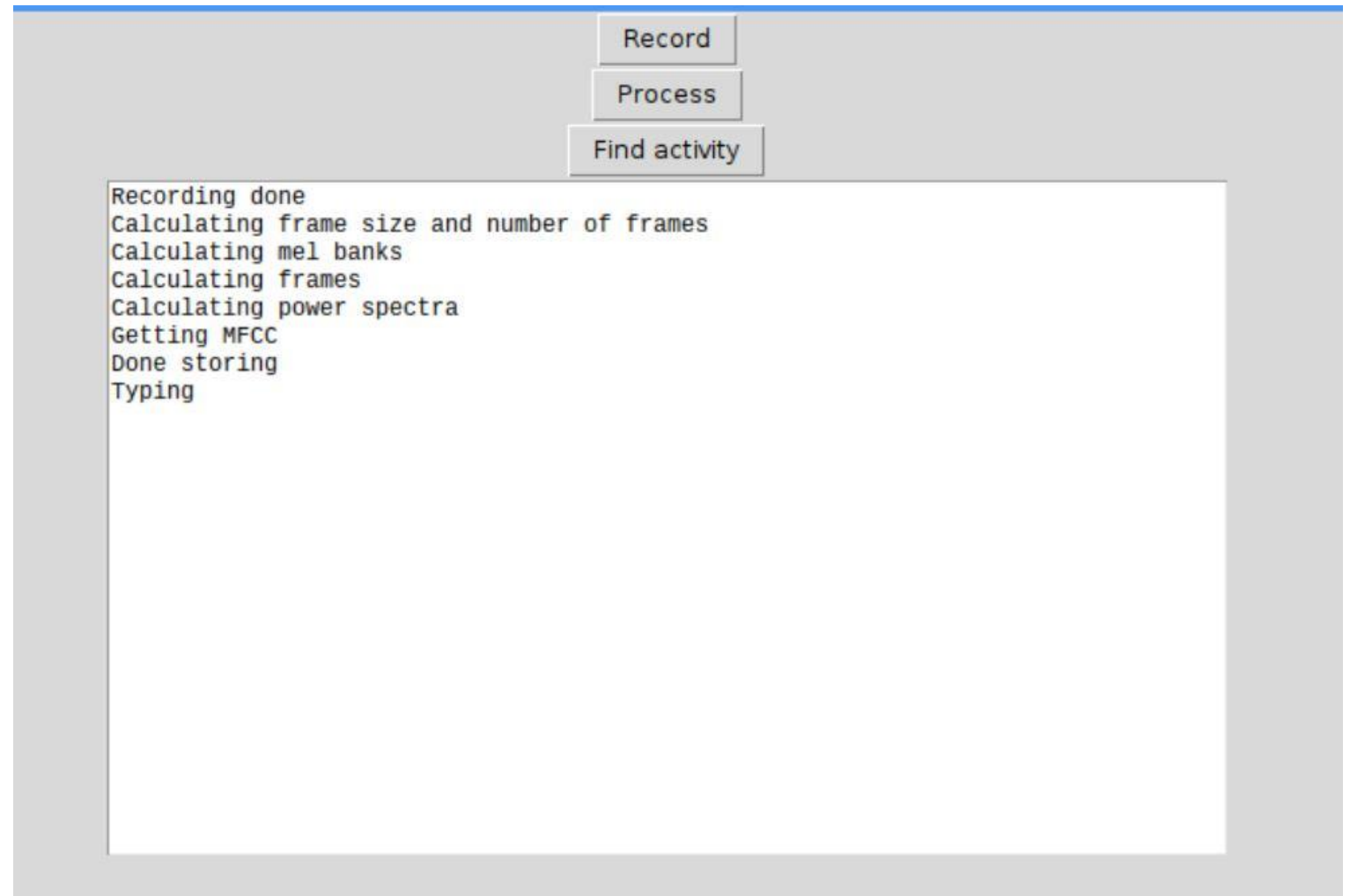
GUI – Real Time Processing
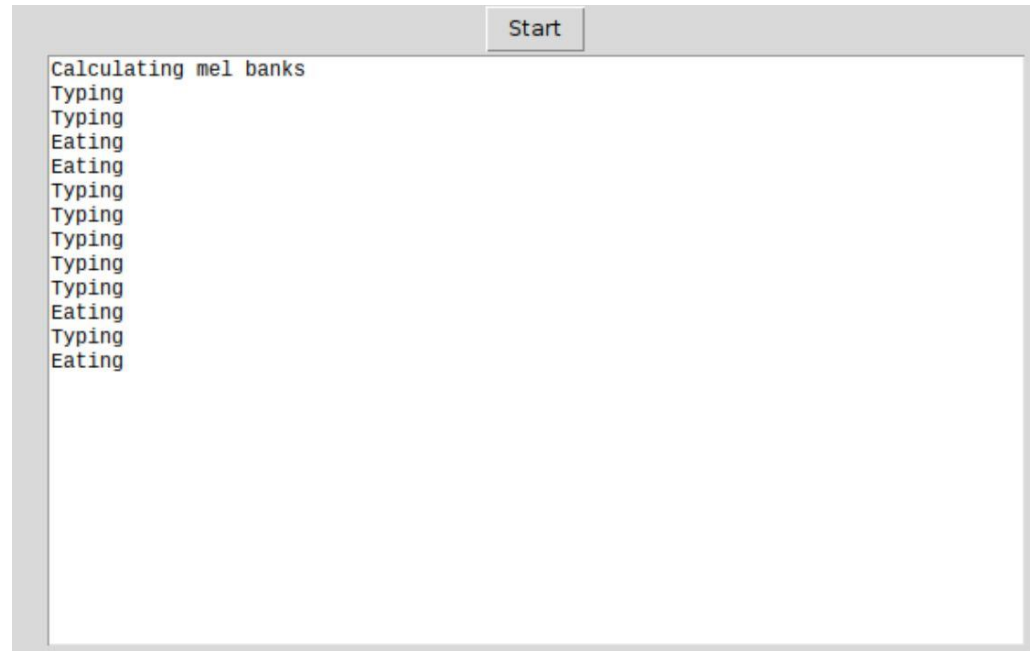
- Built feature vector comprising of 3 features – MFCC, Delta, DDelta
- Predicted the model using Random Forest as it gave a better accuracy with better execution time in non-real time processing