

Gesture Based Music Player & Recorder

Group 6

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Agenda:

Motivation

Initial idea and limitations

Goal Statement

New Idea

WSN Elements

Gesture Detection

Recording

Demo

Motivation:

Virtual Instrument

Play an Instrument intuitively without the presence of real instrument

real time play and record

Goal Statement 1.0:

Use the sensor nodes to detect gestures, based on hand movements, and play different tones of a music instrument.

Goal Statement 2.0:

Use the sensor nodes to detect and record gestures, and play drum beats in real time.

Initial Idea:

Intermediate node:

- Initiate the play based on light (multicast)
- Receive ADXL data
- Pattern matching computation
- Send result to router

with light sensor



PC:

- Play predefined music according to the pattern code received

Router



with sensor
ADXL330



with sensor
ADXL330



Nodes in hand:

- Sample ADXL sensor data
- Precomputing of the data
- Send the data to the intermediate node (unicast)

Limitations imposed by this idea:

1. Pattern detection algorithm too heavy to implement on a node.
2. No Real Time Capability , intermediate node introduce delay.
3. Integrating more than one Listeners

Pictorial View New Idea

Intermediate node:

- Receive ADXL data
- Record it if commanded
- Send record string to router

with light sensor



with sensor
ADXL330



Node in hand:

- Sample ADXL sensor data
- Process it to reco. drum hits
- Send the data to the intermediate node and router

PC:

- Play predefined music according to the received command

Router

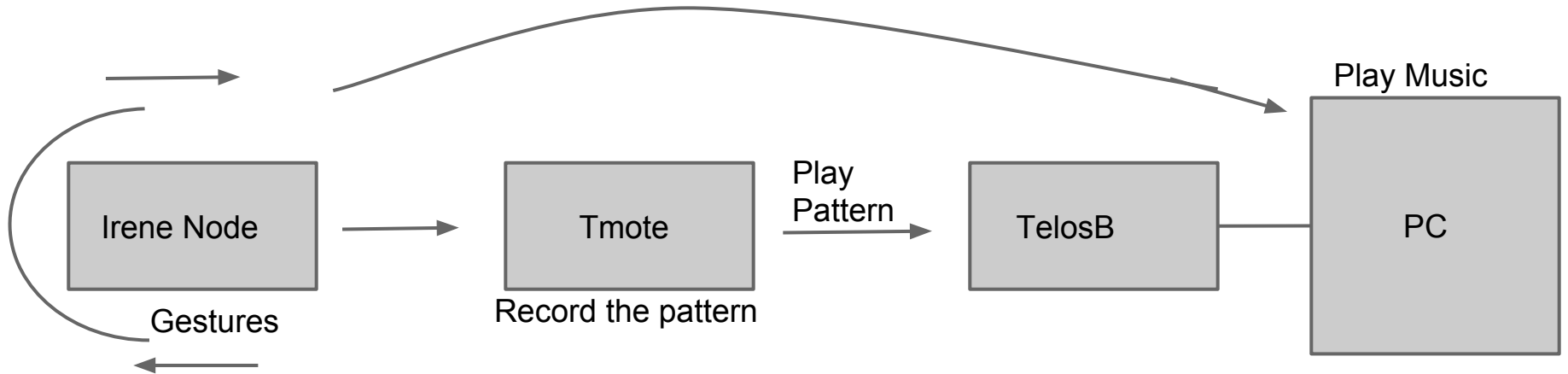


Hardware & Specification:

One Irene node to signal gestures

One Tmote as Intermediate node

One TelosB connected to the PC

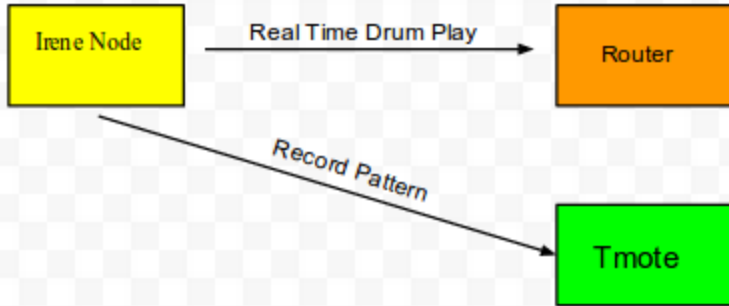


Functional Specification: Sensing Element

Accelerometer in the Irene nodes to recognize Drum hits

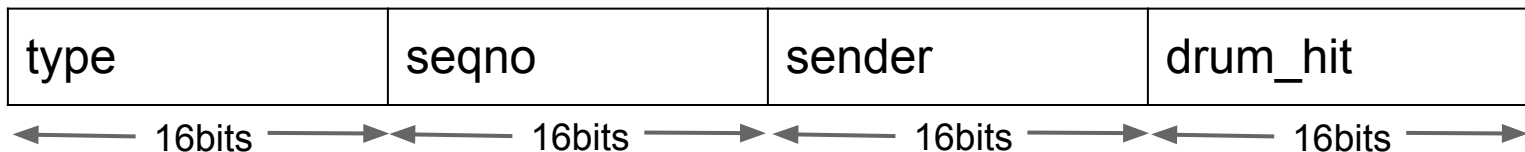
Sending Shell Command to the Tmote for Record & Stop & Replay the Drum hits

Functional Specification: Communication Element



Message Format:

Both Irene node and Tmote node use the same message structure



```
nx_struct drum_report {  
    nx_uint16_t type; // Irene node with type "DUMER", Tmote with type "RECORDER"  
    nx_uint16_t seqno;  
    nx_uint16_t sender;  
    nx_uint16_t drum_hit;  
};
```

Type is for distinguishing whether the message is from Irene node or Intermediate node at the listener.

Irene Node Configuration:

Accelerometer Sample Rate: 50ms/sample

Accelerometer axis used: Z axis

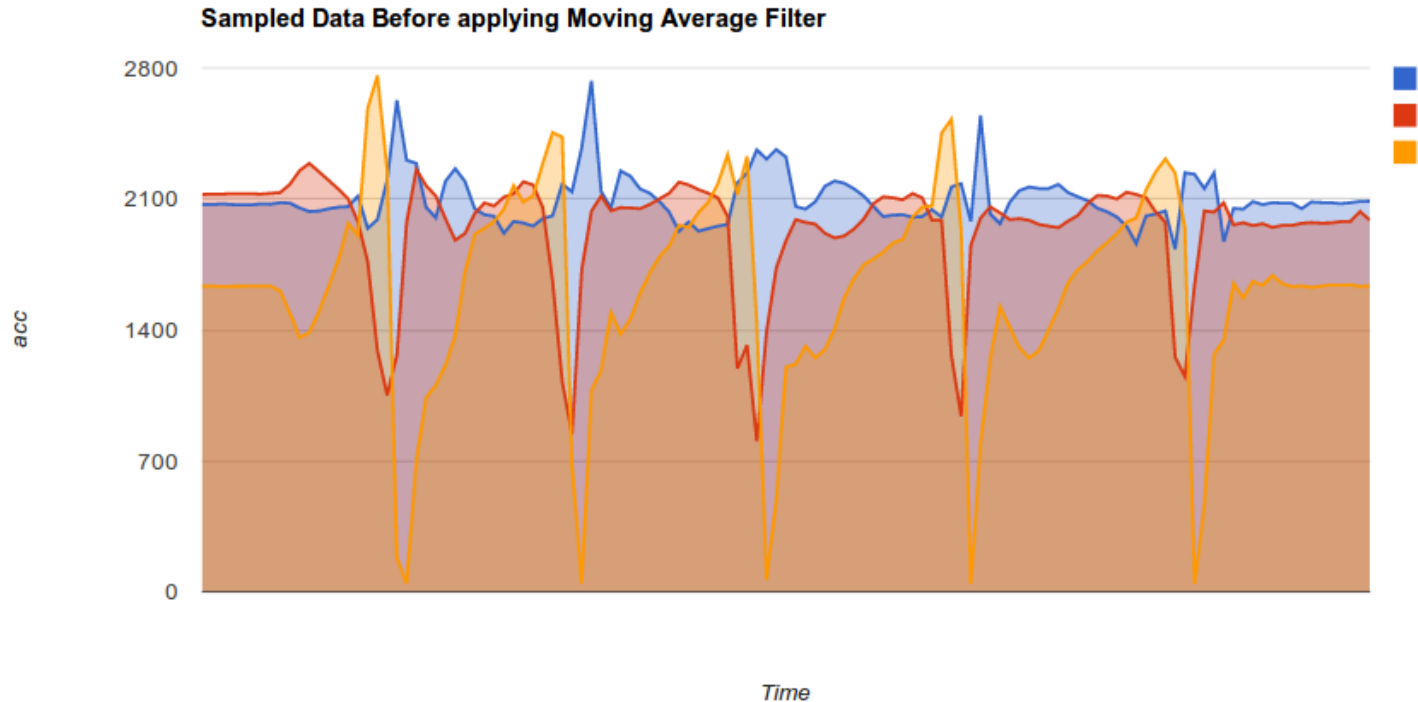
Moving Average Filter size : 4 samples

Functional Specification: Processing

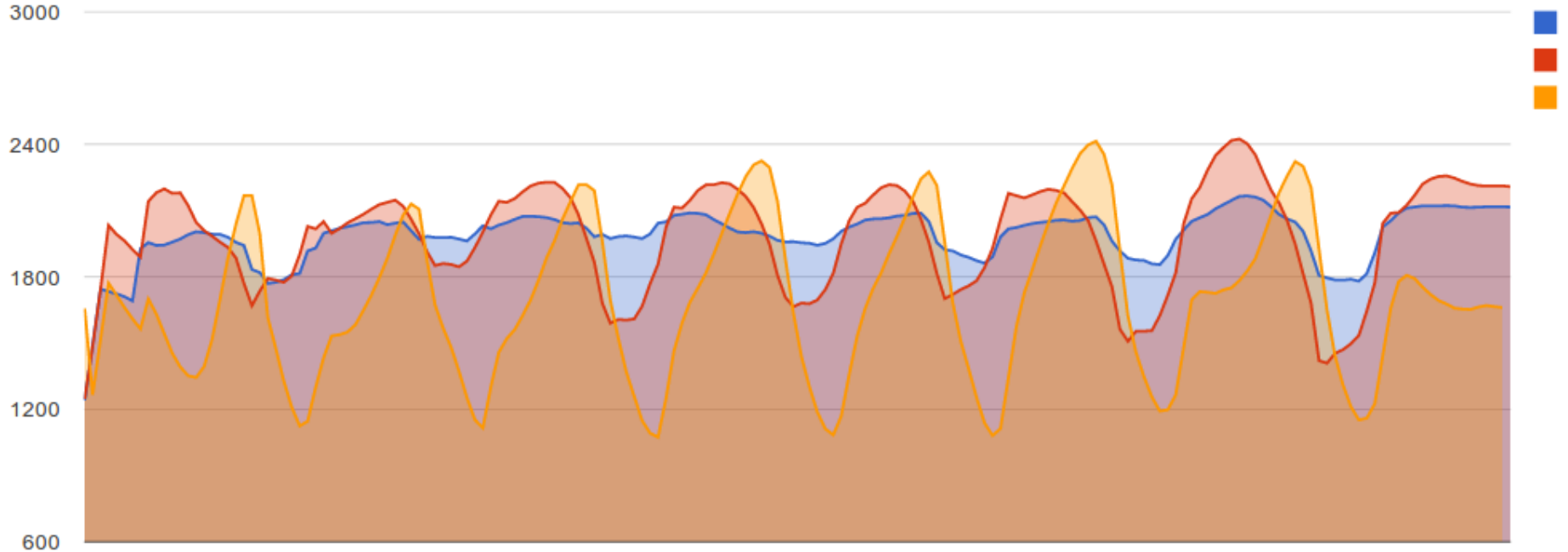
Getting the Accelerometer data and processing it to recognize the drum hit movement.

Recognizing the drum play movement

Sample the accelerometer data and apply moving average filter to smoothen it.

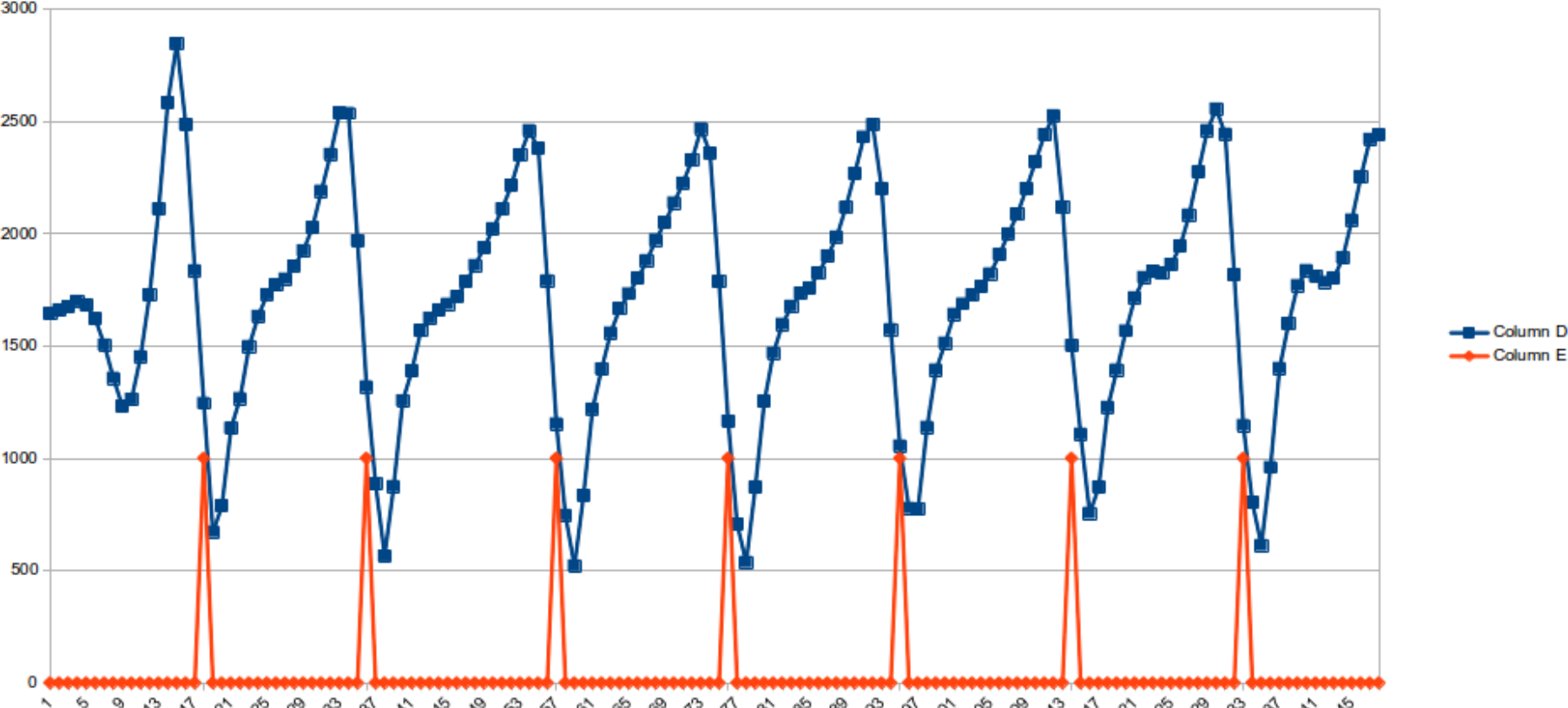


After applying Moving Average Filter

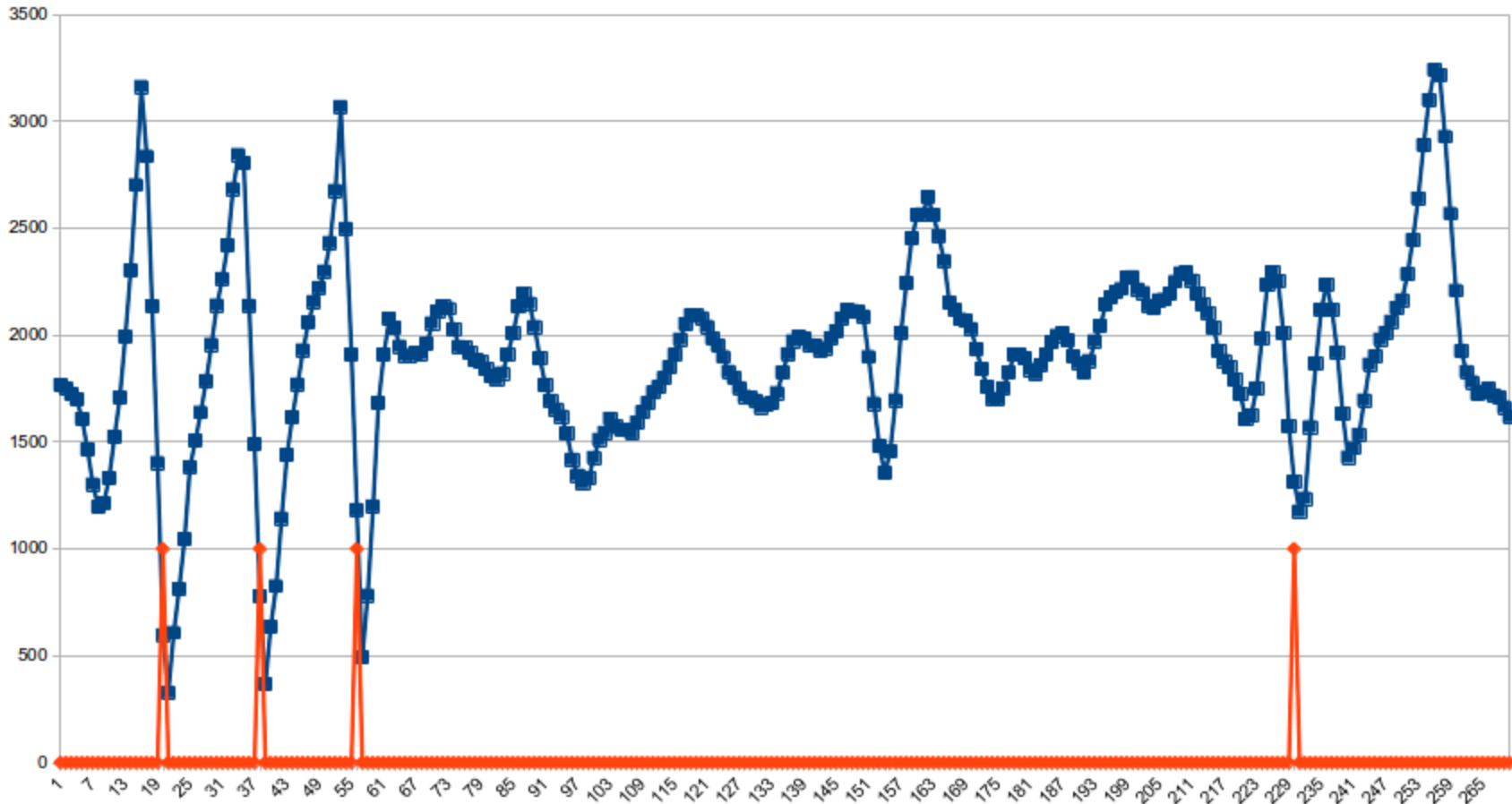


Recognized the pattern when the slope changes from +ve to +ve below 1200 level

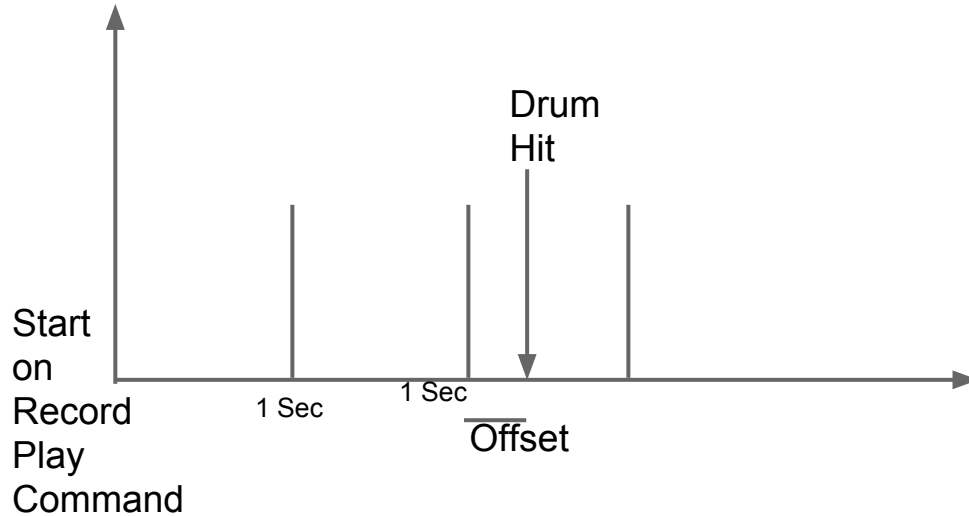
Drum Beat Detection:



Noise Presence:



Recording the pattern



Run a Periodic Timer of 1 Sec

Keep Counter to count time elapsed and the offset.

Make use of struct having the internal count and the offset.

Using a fixed size array to store the hits will have a limitation.

Removed by using linked list.

But as recursion is not used in Tiny-OS can't delete the stored pattern.

Work Division:

Drum Hit Detection Algorithm: Qian , Deepak , Vaibhav

Programming the Algorithm: Qian

Programming FIFO: Deepak, Vaibhav

Programming link list for recording algorithm :Qian

Intermediate node communications : Deepak

Programming the recording algorithm: Qian

Python implementation for playing sound: Vaibhav

Presentation and Project Proposal: Qian , Deepak , Vaibhav

Questions?

Demo

<http://youtu.be/VqgVAAk-EgM>

Thank You for your
Attention.