Mobile Device Security- Detecting Keystrokes without a Microphone

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Introduction
Hardware

Samsung Galaxy Nexus
Android OS v4.2.1 Jellybean

Dell RT7D50 Keyboard
Original Plan

Gather data from sensors

Convert data to audio format

Speech recognition from audio
Sampling Rates

- Accelerometer: 50-100 Hz
- Gyroscope: ~100 Hz
- Barometer: 10-15 Hz
- Human voice: 300 Hz – 3.4 kHz
Revised Plan

Gather data from sensors

Recover keystrokes from data
Gathering Data

- Accelerometer - \((t, a_x, a_y, a_z)\)
- Gyroscope - \((t, \omega_x, \omega_y, \omega_z)\)
- Barometer - \((t, \rho)\)
Parsing

Parsing log files into matrices

Visual analysis using MATLAB plots

Keystrokes identification

Timestamp, $a_x$, $a_y$, $a_z$
7496169159219, 0.1922, -0.535886, 9.579479
7496177307413, 0.15388, -0.689167, 9.579479
7496185455606, 0.15388, -0.497565, 9.426198
Visual Analysis

- Parsing log files into matrices
- Visual analysis using MATLAB plots
- Keystrokes identification

Gyroscope’s y-axis captured the vibrations

![Graph showing vibrations over time]
Keystrokes Identification

- Parsing log files into matrices
- Visual analysis using MATLAB plots
- Keystrokes identification

```matlab
findpeaks(minpeakdistance, threshold)
```

minpeakdistance

threshold
Keystrokes Identification

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Envelope using imerode() & imdilate()
findpeaks(minpeakdistance, minpeakheight)
Results

Spacebar key pressed six times

- Minpeakdistance = 20
- Threshold = 0.005
- Minpeakheight = 0.012
Results

F key pressed six times

- Minpeakdistance = 20
- Threshold = 0.003
- Minpeakheight = 0.015
A key pressed six times

- Minpeakdistance = 
- Threshold = 
- Minpeakheight = ?
Better Sensors?

Samsung Galaxy S4

iPhone 5S