**Mobile Device Security: Recording Audio without a Microphone**
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**Introduction**

Mobile devices are ever-present around us today. The ubiquity of the devices makes it possible for malicious applications to be installed on the phones. Some of these malicious applications can be used to spy on the users via the myriad of sensors available on the mobile devices. In this project, we evaluate how the different sensors available on today's smart phones could be used to spy on users. A better understanding of the vulnerabilities will empower users to correctly give permissions to applications to use certain sensors or forgo installing applications that try to use certain other sensors.

Specifically, this project involves the evaluation of the audio recording capabilities of smart phones without using a microphone. We explore the possibility of using various motion sensors on modern day smart phones to pick up vibrations and recover audio from the vibrations.

**Method**

We will work on the Android platform to write an application that collects sensor inputs from the phone. The specific mobile phone device we will use is Samsung Galaxy Nexus that runs Android Jellybean v4.2.1. An application will be developed to gather data from sensors. Data will be collected from the following sensors:

- **Accelerometer (t, a_x, a_y, a_z)** where t = timestamp, a = acceleration
- **Gyroscope (t, ω_x, ω_y, ω_z)** where t = timestamp, ω = angular velocity
- **Barometer (t, ρ)** where t = timestamp, ρ = pressure
- **Digital compass (t, azimuth, pitch, roll)** where t = timestamp

Research will be done on various speech recognition algorithms that will be applied to the data collected from the sensors in an attempt to recover speech from the data. We hope to design a separate speech recognition module from open source implementations. We anticipate that we will require an intermediate step to process the raw data from the sensors before it can be fed into the speech recognition module. This intermediate processing will be done using Matlab to produce audio files in the correct format to be fed into the speech recognition module.

Finally, we hope to combine the application for gathering data from sensors with the speech recognition module so that speech can be recovered on the fly from the sensors using a single application. The following is a flowchart summarizing the methodology described thus far:
Project Deliverables

The following are the expected deliverables at the completion of this project:

- A technical report on the Android SDK and development phone installation.
- Code for application that records sensor readings into a file.
- Demo of decoding speech from "audio" samples using the speech recognition module.
- Code for application that reads the sensors and decodes the data to audio.
- Final demo of a standalone Android application that records audio without using microphone.
- Archive with all technical report files and open source code to be published online (may be embargo until after any paper publications).