PROJECT PLAN

GYROSCOPE/ACCELEROMETER BASED MORSE CODE INPUT ON ANDROID

Jincao Zhu

Motivation: It is always challenging for blind people to type on smartphone. Although speech to text is easy to use, but it does not satisfy all the requirements of users. Typing method is still has its advantage over speech, for example, speech is more likely been eavesdroped. There are existing typing methods that help blind to type, but still require the user to type on screen. So, I propose to use gyroscope/accelerometers embedded in current mobile phone as sensors to detect users typing on normal desk surfaces, accordingly I will build 'GyroMorse' App. GyroMorse brings more accessibility, as it does not require users to find and hold the mobile phone to type. As long as the phone is placed on the same surface and within certain range where the user is typing the Morse, GyroMorse can detect and recognize what the user is typing.

Challenging:

1. As claimed in [2], accelerometers are far less precise than acoustic sensors, accelerometers have sampling rate of only 100Hz. However, I believe such sensors is enough for simple Morse code input, which only have two taps (dot/dash) to be distinguished.
2. Previous works [1,2] use gyroscope/accelerometer for attack process data offline with help of computers (such as using Matlab). For building input method, I need implement the data processing/ML on mobile platform. I will search existing lib to leverage.

Schedule:

Week 1 (6/4)

1. Exploring existing related works/source codes and provide data processing arch, create project repository
2. Studying related Android API and library for data processing on mobile device. Such as what kind of API could be called to collect/storage/process data, what library could be used for signal processing and machine learning on mobile platform (android here).
3. Raw data collection: use android API to collect raw gyroscope/accelerometer data for posterior analysis. (I believe there are lots of existing works I can borrow and refer). Draw and display the raw signals for demon purpose.

Week2 (6/11)

4. For the purpose of proof of concept, I will process the collected data using Matlab offline (such as FFT, filtering, …) to check whether dot/dash taps on the desk are distinguishable or not. I will highly expect a positive result, in case of failure, the backup plane is to leverage the microphones.
5. Training phase: the process includes data collection (need predesigned training data), feature extraction, tap labeling, and learning processes.

Week3 (6/18)

6. Design App UI and implement real-time gyroscope/accelerometer based Morse input APP.
7. Finish write-up and demon video.

During the step4-7, I will do following experiments to check the practical of this App:

1. Does surface Materia matters? the vibration would be different for different surface Materia, such as wood, glass, metal. For this experiment, I will check how the App will works for different environments.
2. Does tap speed maters? The speed of tap will affect the accuracy of Morse input; I would check how it affects and seek improving methods.

Final delivery materials:

1. Code repository: https://github.com/fsboc/gyromorse
2. Write-up, it will been placed in the code repository and updated accordingly.
3. Demon video.

Reference:

1. Michalevsky, Y., Boneh, D., and Nakibly, G. Gyrophone: Recognizing speech from gyroscope signals. In Proc. 23rd USENIX Security Symposium (SEC?14), USENIX Association (2014).
2. P. Marquardt, A. Verma, H. Carter and P. Traynor, (sp)iPhone: Decoding Vibrations From Nearby Keyboards Using Mobile Phone Accelerometers, Proceedings of the ACM Conference on Computer and Communications Security (CCS), October, 2011.