

Wave-to-Access: Protecting Sensitive Mobile Device Services via a Hand Waving Gesture

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Outline

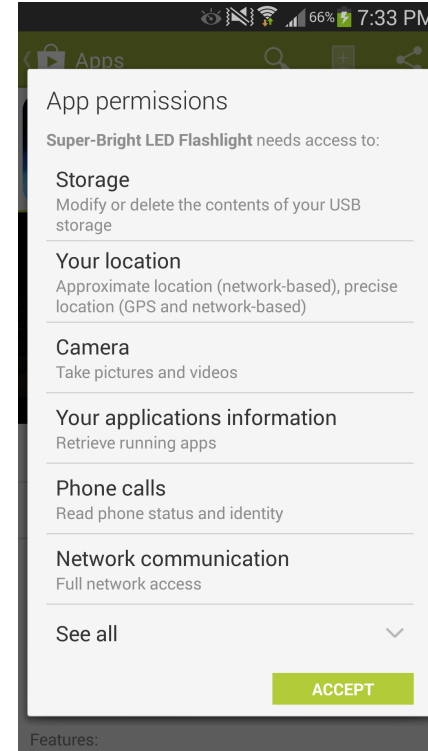
- Introduction and Motivation
- Contributions
- Threat Model
- Wave-to-Access: Design and Implementation
- Discussion

Introduction and Motivation

- Usage of Mobile devices
- Phones with NFC
- Security and Privacy Threats

Security and Privacy Threats

- Mobile Device Malware
- NFC Unauthorized Reading



Controlling Access via Intuitive Gestures

- Better Access Control
 - App ask for permission
 - Capture user's intent
- Intuitive Gesture
 - Typing pins vs No security
 - Not “Yes/No”

Haoyu Li, et al. "Tap-Wave-Rub: Lightweight Malware Prevention For Smartphones Using Intuitive Human Gestures". In Proceedings Of The Sixth ACM Conference On Security And Privacy In Wireless And Mobile Networks. ACM, 2013.

Our Contributions

- Novel Approach To Malware Defense For Mobile Devices Based On Intuitive Gesture Recognition
- Gesture For The Purpose Of Selective Unlocking
- Report On The Implementation Of Our Prototypes
- Conduct Various Experimenting Simulating The Behavior Of Attacker And Normal User Usage Activity

Threat Model

- Insider Attack / Outsider Attack
 - Malware Installed
 - Attacker Close By
- OS Kernel - Healthy
 - Control Flow
 - Onboard Sensor
- Attacker Not for User authentication

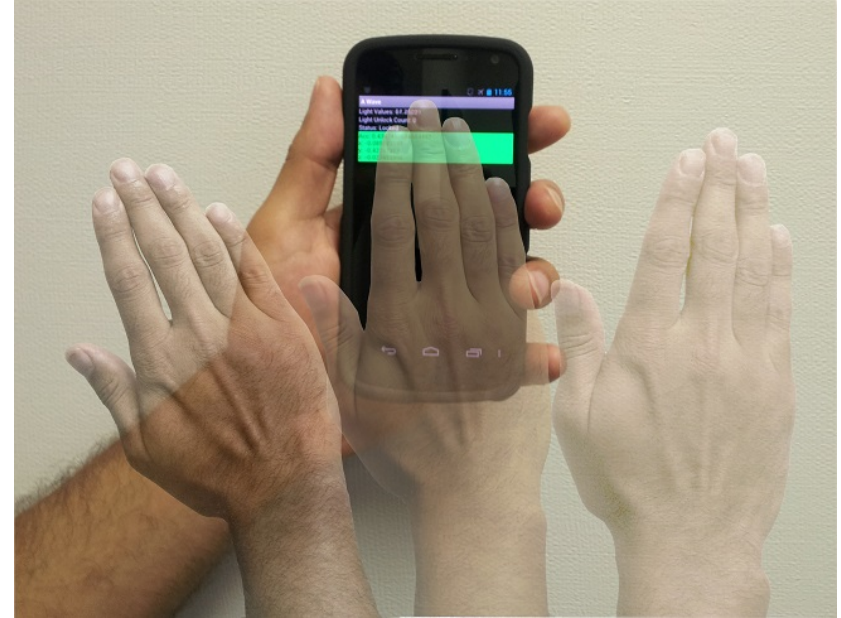
Design Goals

- Lightweight
- Less Delay
- Tolerant To Errors
 - Low False Negative Rates (FNR) (measure of usability)
 - Low False Positive Rates (FPR) (measure of security)
- Less Modification

Hand Wave Detection

- Light Sensor
- Accelerometer

Light Sensor in
Samsung Galaxy
Nexus



Algorithm

1. IF sensors are locked, wait for *MOVEMENT_LOCK_TIME*
ELSE get accelerometer sensor readings x , y and z
2. IF $\sqrt{x^2+y^2+z^2} > ACC_THRESHOLD$ THEN lock sensors for *MOVEMENT_LOCK_TIME* and return to STEP 1.
3. IF sensors are not locked, check for wave gesture.

Algorithm (contd..)

3. IF sensors are not locked, check for wave gesture
 - I. Analyze *WINDOW_SIZE_FOR_LIGHT* data to find out how many extremas (maximas and minimas) were there using *LIGHT_THRESHOLD*
 - II. IF *extremaCount* > *CHANGE_COUNT_FOR_LIGHT* AND All the light data are recorded within *WAVE_TIME_LIMIT_FOR_LIGHT* THEN
SET *unlockAttempted* = true;
RECORD first unlock attempted time
DISPLAY Message "Stop Waving" for *WAVE_TIME_LIMIT_FOR_LIGHT*

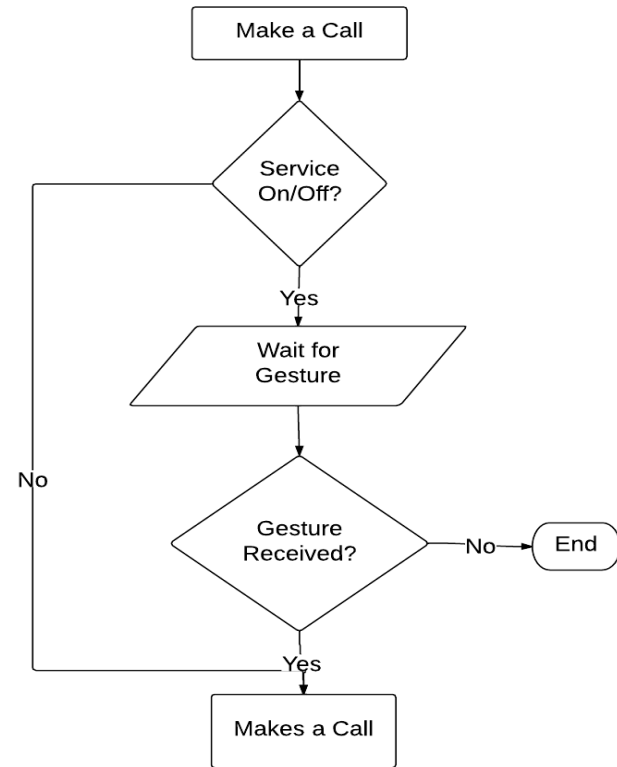
Algorithm (contd..)

III. IF unlockAttempted THEN

- a) IF another unlockAttempt is obtained within less than *WAVE_TIME_LIMIT_FOR_LIGHT* THEN Do not unlock, reset everything and start over, i.e., return to Step 2.
- b) IF another unlockattempt is not obtained within *WAVE_TIME_LIMIT_FOR_LIGHT* THEN Unlock the phone for *UNLOCK_TIME_FRAME*.

Implementation

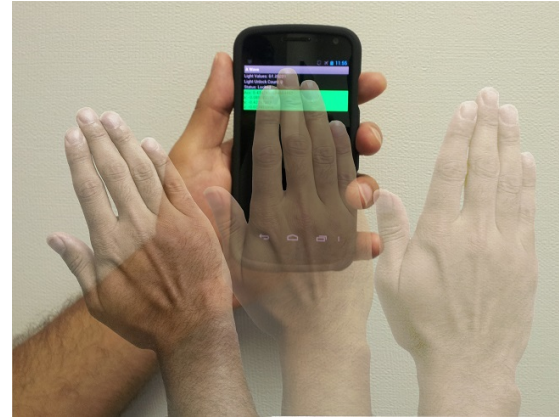
- Device
 - Motorola Droid X2
 - API Level 10
- Wave To Call



Process To Make A Call

Evaluation

- Error Rates
 - FNR
 - Developer 7.5%
 - Other Users 9.5%
 - Light > 700 lux -> 4.29%
 - Light between 350 lux and 700 lux -> 13%
 - Light < 350 lux -> 16.7%



Evaluation

- Error Rates

- FPR

- Monitor blinking 3.3 time/sec -> 1.15%
 - In front of TV -> 0.67%
 - Needs To Be Dark Room
 - TV Display Should Alternate As Monitor Flicker



Discussion

- Hand Waving
 - Intuitive
 - Effective With Low FPR And FNRs
 - Difficult For Adversary To Coerce
- Battery Consumption & Efficiency
- Effect Of Light
- Targeted Attacks
- Sensitivity Of Sensors

Conclusion & Future Work

- Novel Approach To Unlock Critical Services
- Intuitive Gesture Easy For User Difficult For Attacker
- Implement For Different Services And Resources

Thank You!

- Questions?