Security Impact of High Resolution Smartphone Cameras

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Introduction

This talk presents our work on "Security Impact of High Resolution Smartphone Cameras":

- By now nearly every smartphone has at least one, usually two high quality cameras.

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- "In Device" communication gets harder and harder with new multicompartment security measures.

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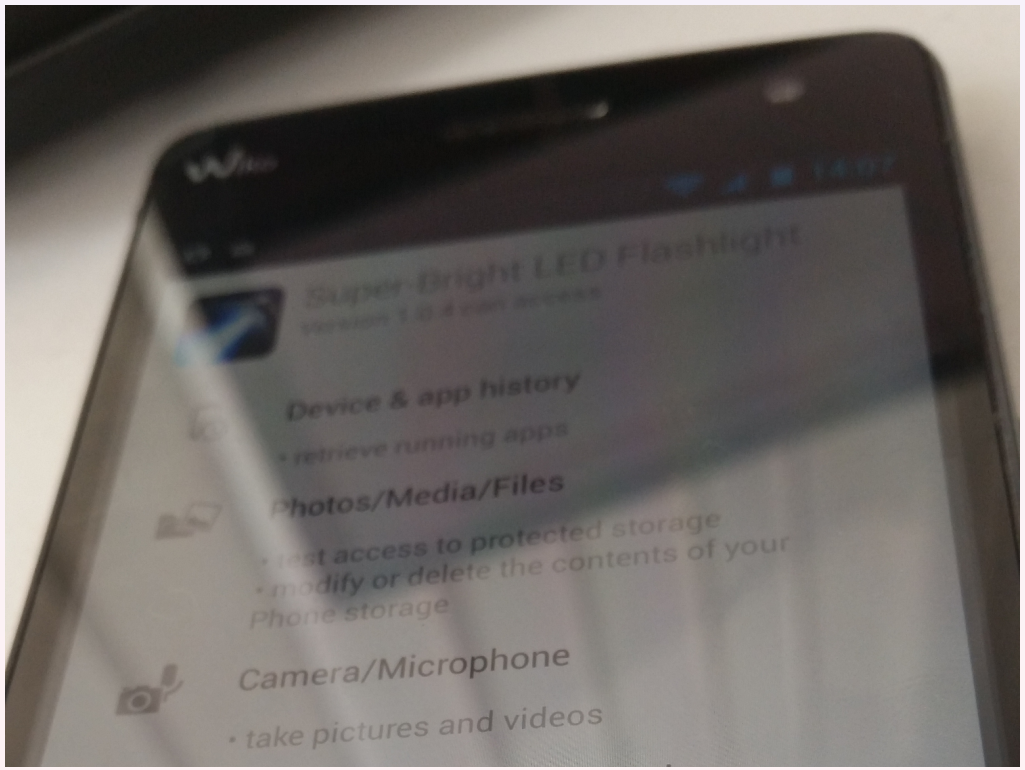
This talk presents our work on "Security Impact of High Resolution Smartphone Cameras":

- Getting the camera permission with an evil app is apparently rather easy [Felt et al., 2011, Felt et al., 2012].



Contribution

- We demonstrate, that the front camera of modern smartphones can be used for visual keylogging. Without the need of physical proximity [Xu et al., 2013] and with higher precision than previous approaches [Simon and Anderson, 2013].
- We evaluate the required border conditions and possible mitigation for this approach.

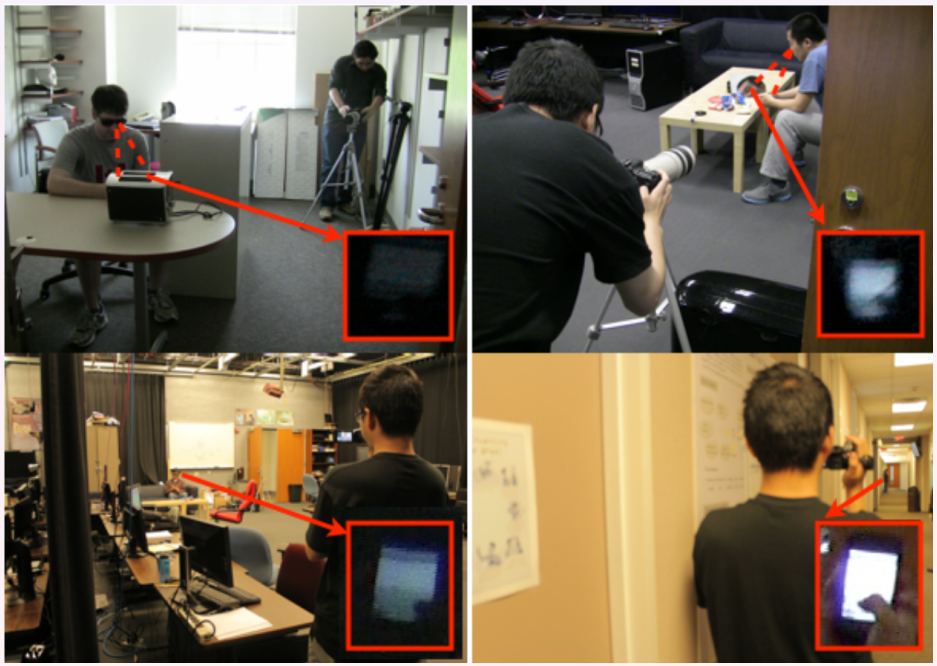


Figure: Approach of Xu et al. [Xu et al., 2013]

Contribution

- We demonstrate how and that an attacker can obtain high quality fingerprint images of a target, sufficient to utilize forgeries created from them on the most advanced sensors.

On Smartphone Back-Camera Resolution

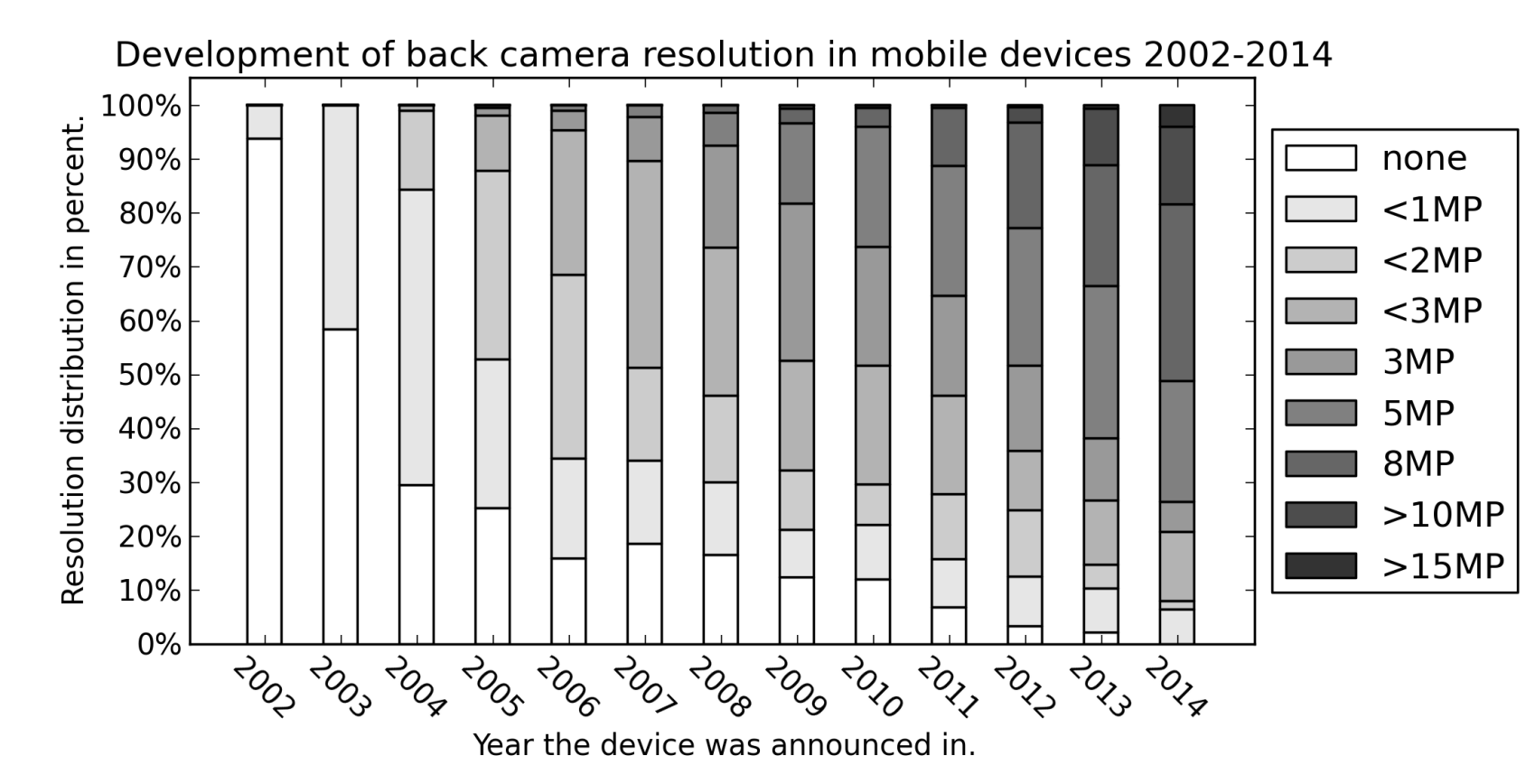
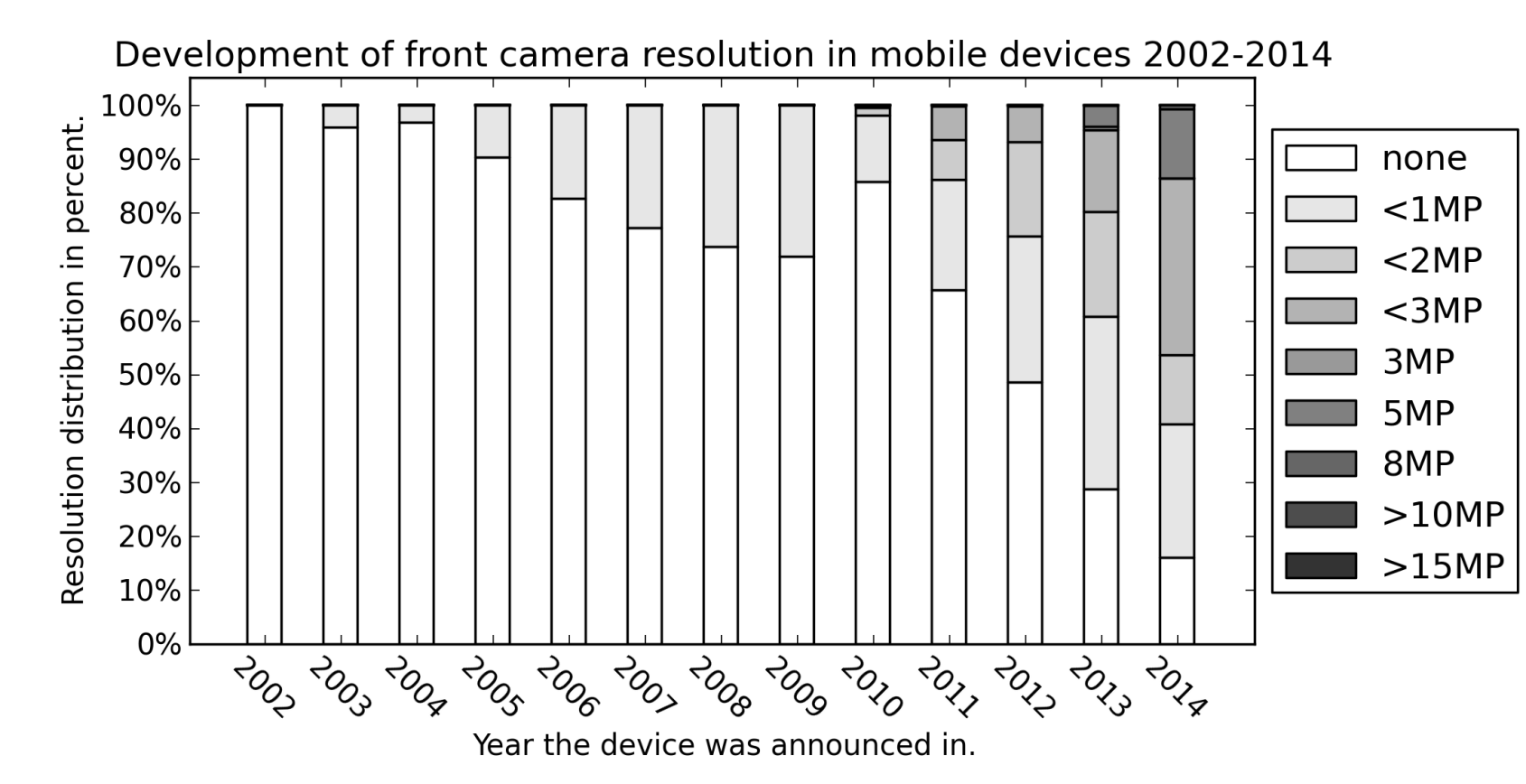


Figure: Based on data gathered from gsmarena.com end of Feburary 2014.

On Smartphone Front-Camera Resolution



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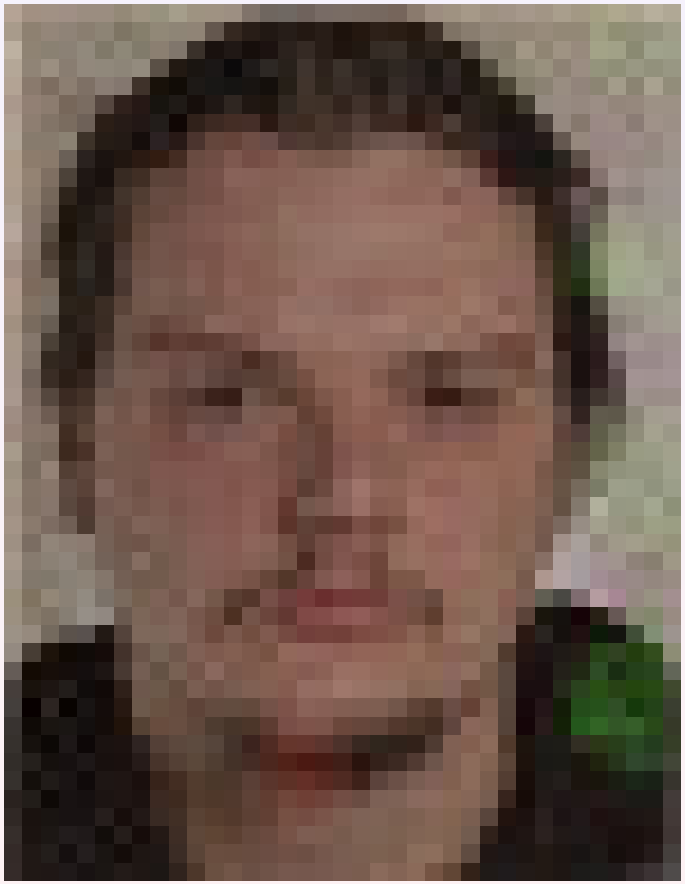
So... why does this happen?

- People do like the feature of having a camera with them... always.

So... why does this happen?

- Pictures taken should not be like... pixel-heaps.



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- And of course a front camera for serious video-conferencing!
  - Ok, just kidding, more like for what the sales-droids call "generation selfie" - at least the high resolution ones, 8 Megapixel and up.

Attacker and Victim Model

- Attacker:
  - Somebody with a lot of resources...
  - With a lot of knowledge on computers...
  - Mainly attacking high-profile targets...

So, who might it be?

About the victim...

- Interesting enough for our attacker.

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About the victim...

- Interesting enough for our attacker.
- Probably using some fancy secure-phone.
- Probably somewhat well known... or something...

Uhmmmm... that's hard... any ideas... ?

Yeah... might be her...

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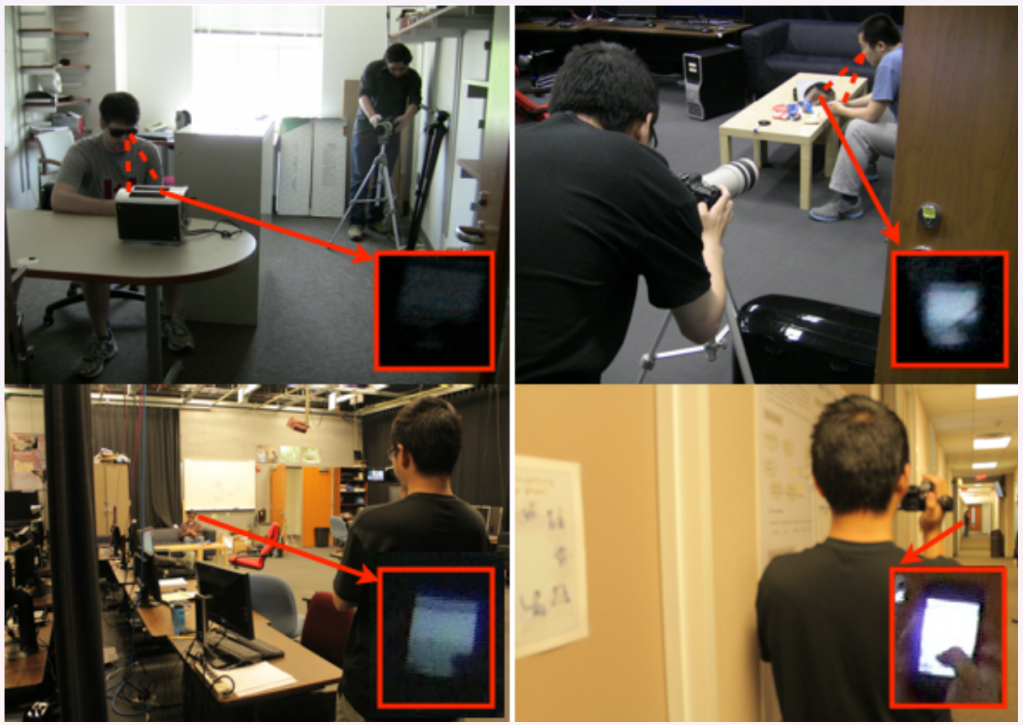
- Use reflections in the user's face.
- Ideally sunglasses, worst case: eyes.
- Used by Xu et al. for some really advanced shoulder surfing using e.g. camcorders while standing nearby [Xu et al., 2013].



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Wait, can this work?

- Xu et al. had perfect reconstruction using the shadow of the moving (input) finger, if the display reflection in the recording had a size of around 10px.

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- Xu et al. had perfect reconstruction using the shadow of the moving (input) finger, if the display reflection in the recording had a size of around 10px.
- Gave us a nice formula to calculate how big the reflection for a given camera and a given distance is:
- $$Size_{Reflection} = \left(\frac{SensorResolution}{SensorSize} \cdot \frac{ObjectSize}{\frac{TargetDistance}{FocalLength} - 1}\right) \cdot \frac{1}{\frac{2 \cdot DistanceFromSurface}{CurvatureRadius} + 1}$$

Reading eyes.

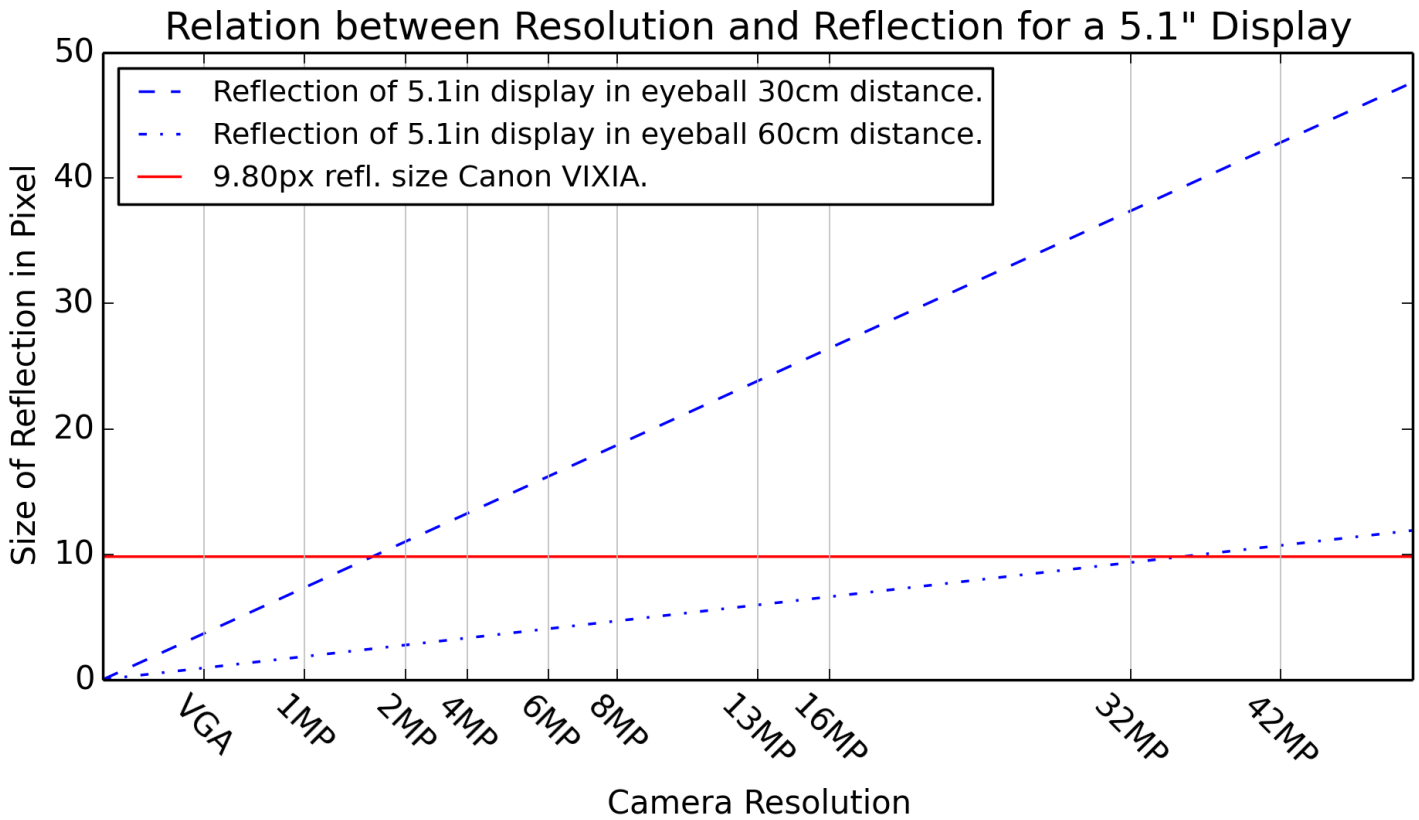
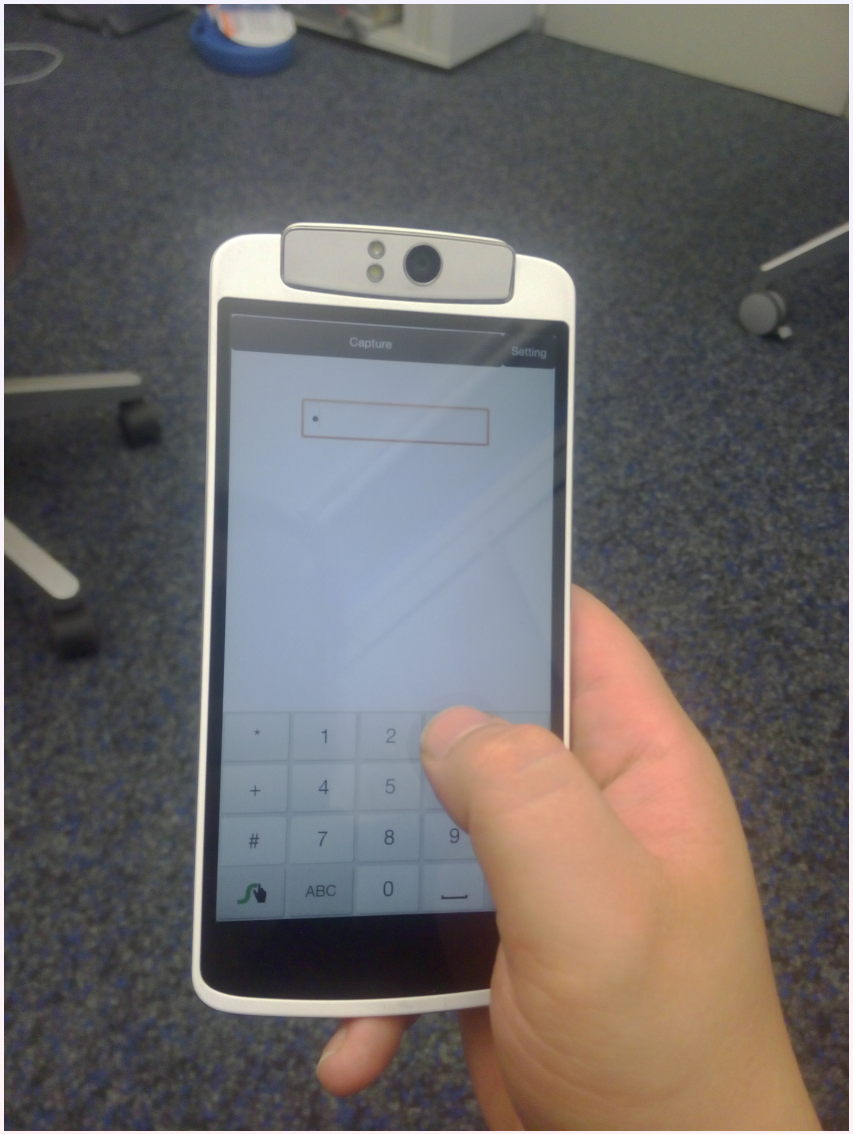


Figure: Reflection-size in the user's eyes. Red line indicates border of perfect reconstruction. Everything above yields reconstructability.

What the user does.

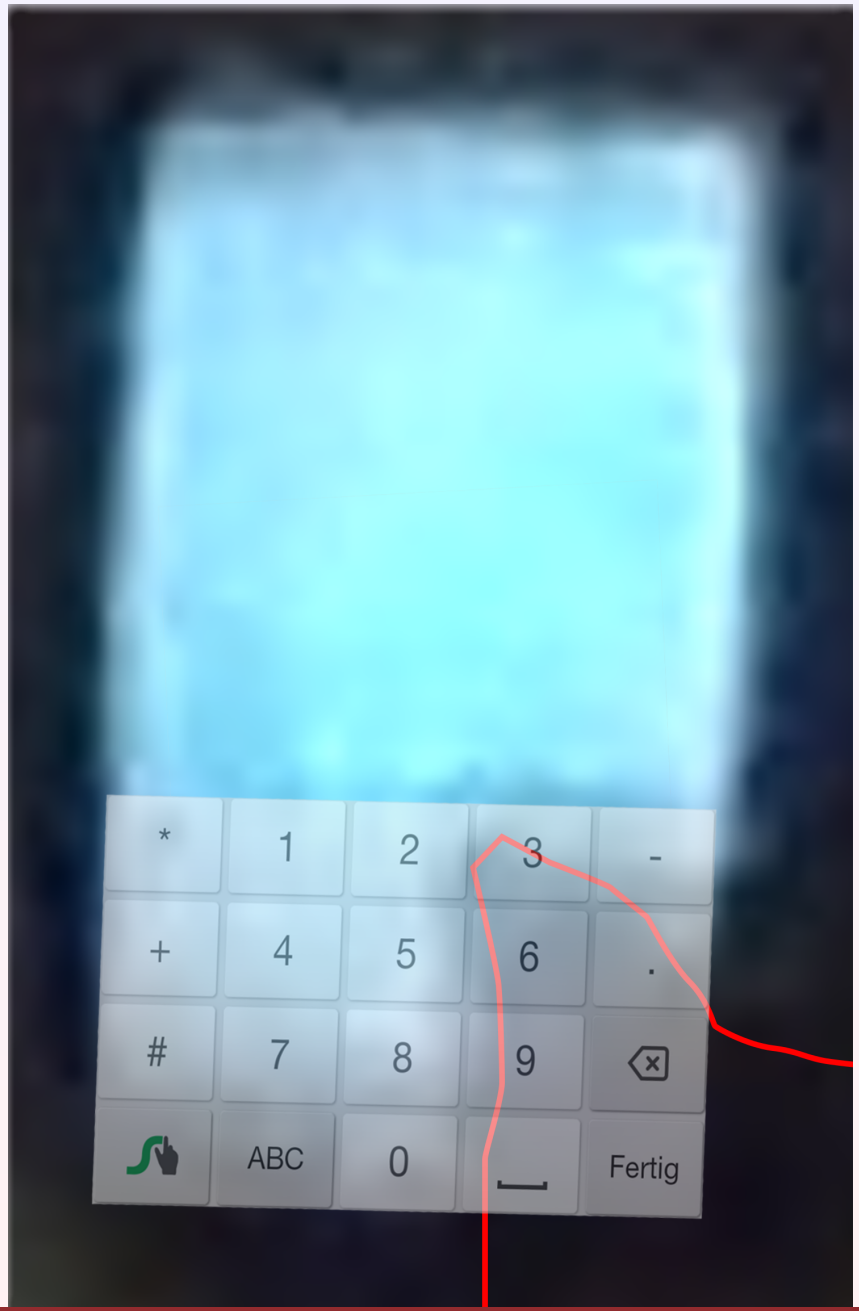


What we see in the eye.

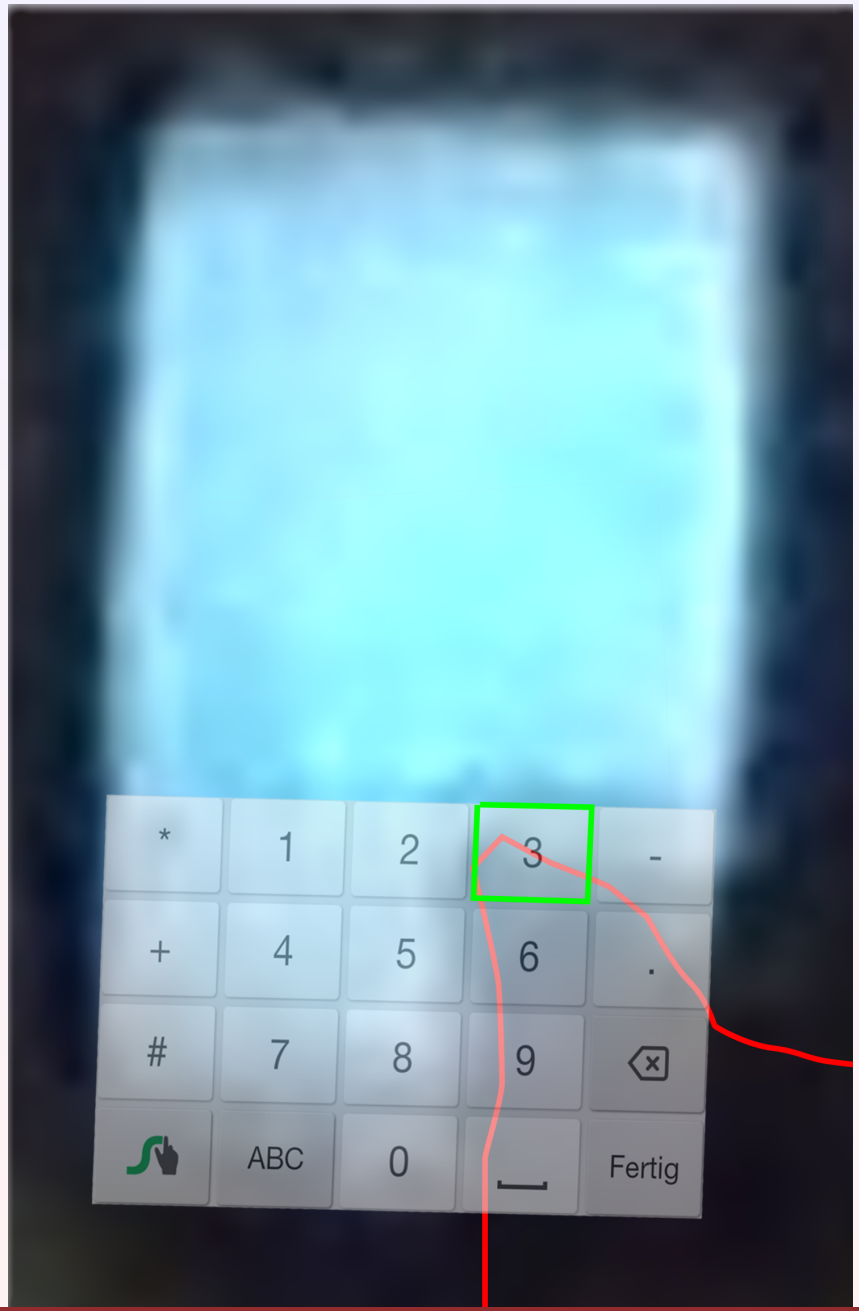
Zooming in.

A thumb!

Lets put on a keyboard.



Yep, that's a 3.



But what if our victims wears sunglasses?

Of course we prefer sunglasses like these...

Figure: Former *Dr. jur.* and *German Secretary of Defense* Karl-Theodor zu Guttenberg - currently *neither*.

What sunglasses can do?

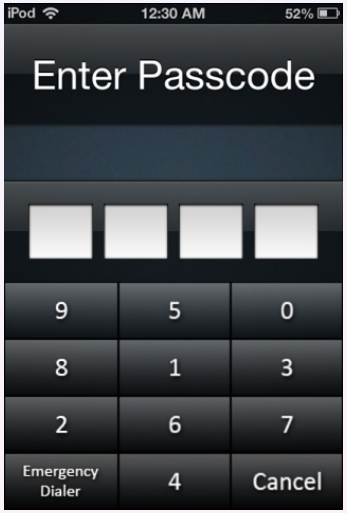
Figure: Sunglasses can even make the keyboard of the device visible.

Provide amazing results!

Mitigation

- Viewport/Privacy filters:

- Randomized Keyboards:



- Gaze Based Passwords
- Biometric Authentication?
  - Lets see...

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- What issues may arise from the back camera?
- Biometry is kind of a big thing, especially in high security access controls...
- ...and fingerprints are usually the poison of choice.

Think about this situation...

Figure: Red: Viewport of the camera.

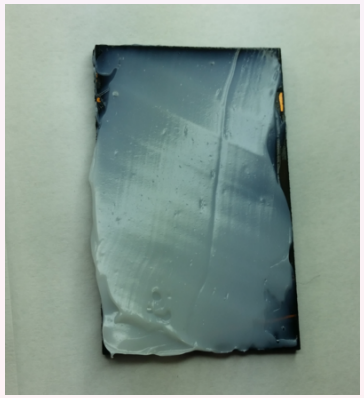
Allowing us to do this:

(a) Captured Photo

(b) Extracted Binary Print

(c) Etched PCB negative

(d) Graphite applied



(e) Wood-glue applied

(f) Ready forgery

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- Unlock somebodies iPhone.
- Plant false prints somewhere
  - At least last I heard "Officer, I have NO idea how my fingerprints got on that knife!" was not in the sum of things helping you in court...
- Track users across devices. (Ok, we do not need the forgeries for that...)

Conclusion

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- Back-cameras are rather useful at extracting biometric features.
- Mitigation is hard.

Mitigation

Mitigation

Figure: Seriously... having those hardwareshutters again would be nice

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