

BlinKey: A Two-Factor User Authentication Method for Virtual Reality Devices

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Motivation

- Rapid development of VR



VR market

\$ 11.52 billion
2019



\$ 87.97 billion
2025

- Massive p



Em

A robust and convenient authentication method for VR devices is in dire need!

nk info

- Current user authentication schemes fall short in security and usability

Knowledge-based authentication

PIN

Pattern Lock

LookUnlock

RubikAuth

Biometric authentication

Hand Gesture

Brain Biometric

SkullConduct

Eye Movement

Proposed Scheme

Pupil-based passcode

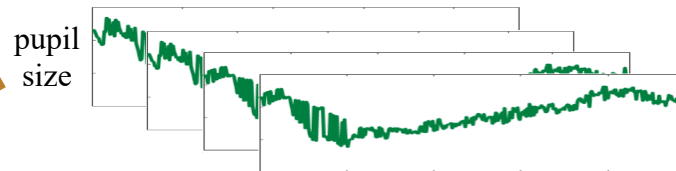
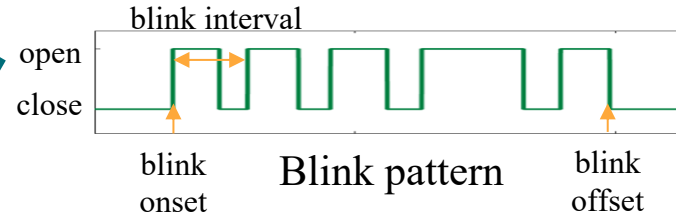
- Monitors pupil data as the secret key
 - Safe against observers
 - Easy to perform



Real-time pupil data

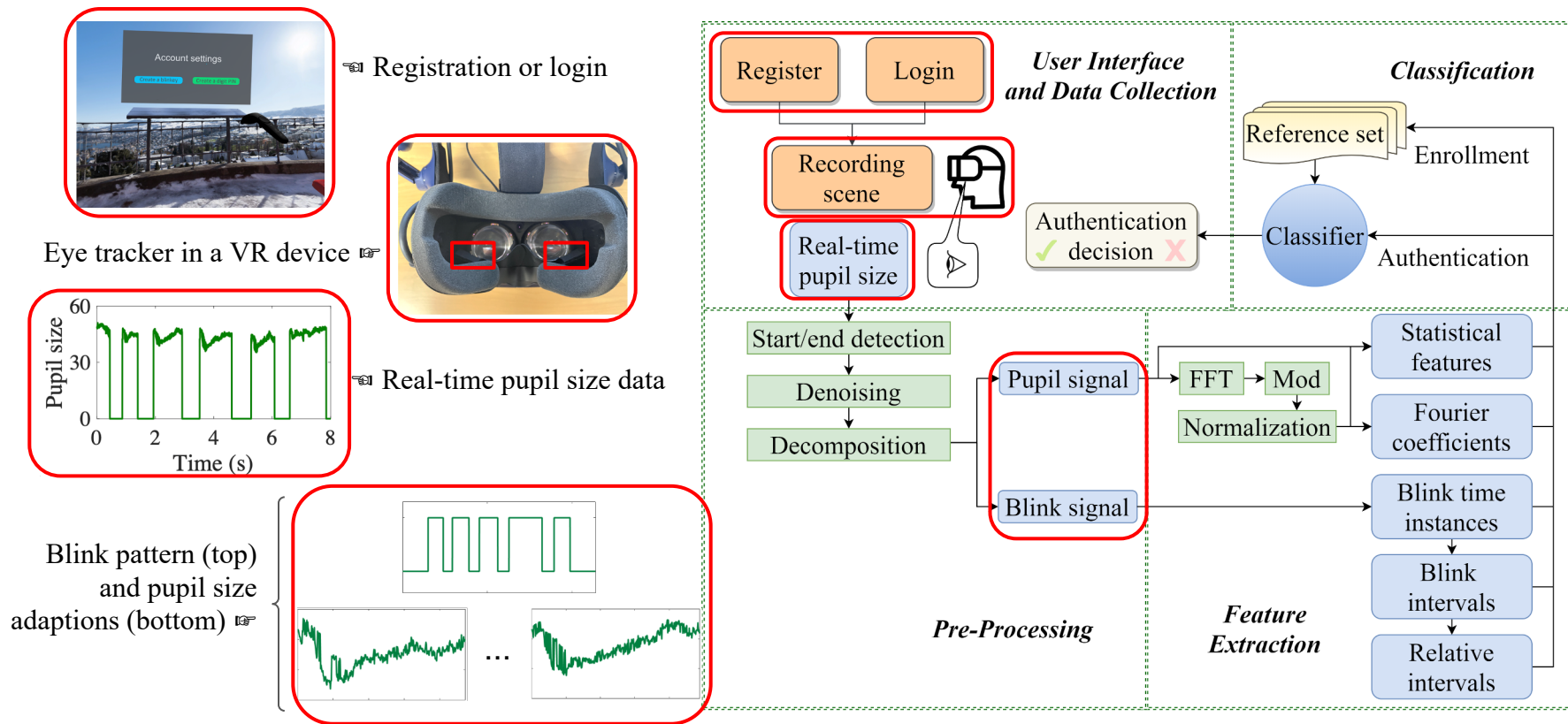
Knowledge-based

Biometric

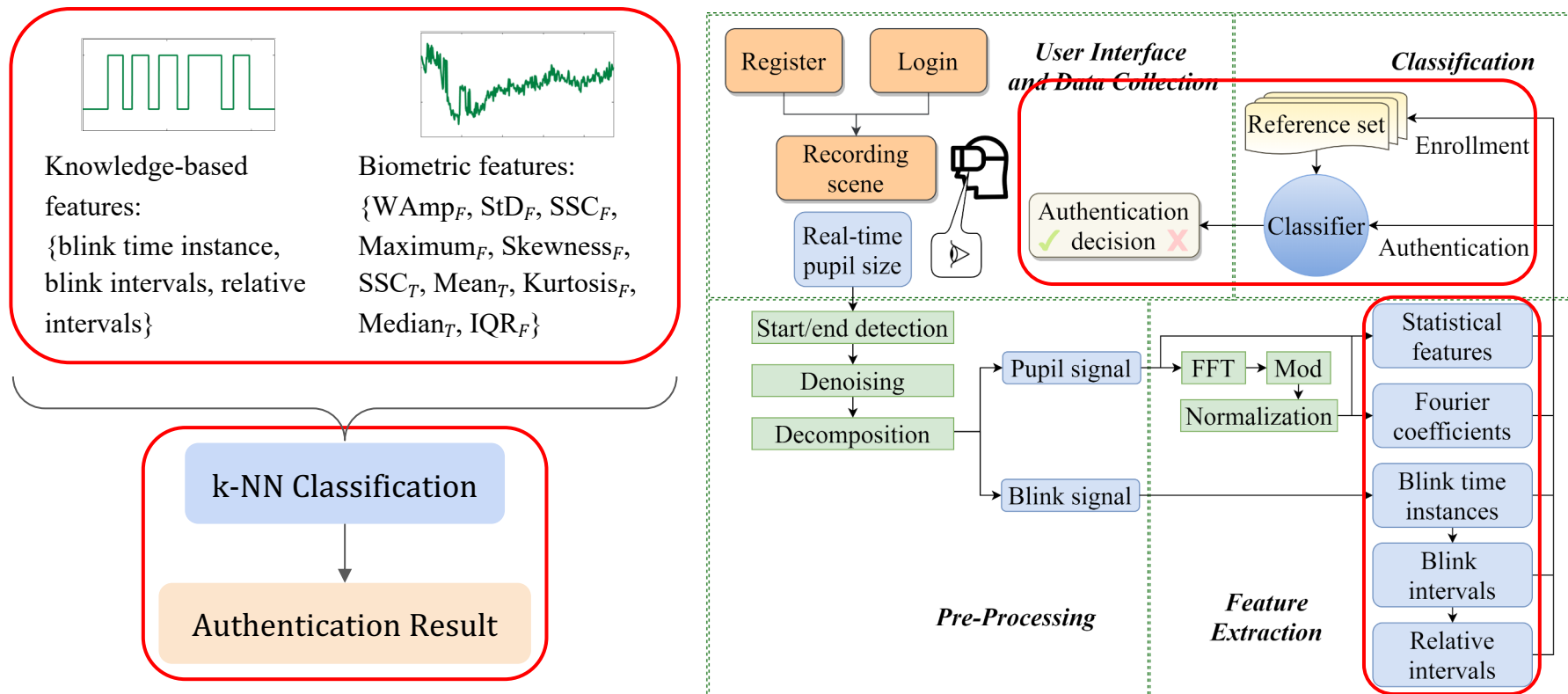


Pupil size adaption after each blink

BlinKey Architecture

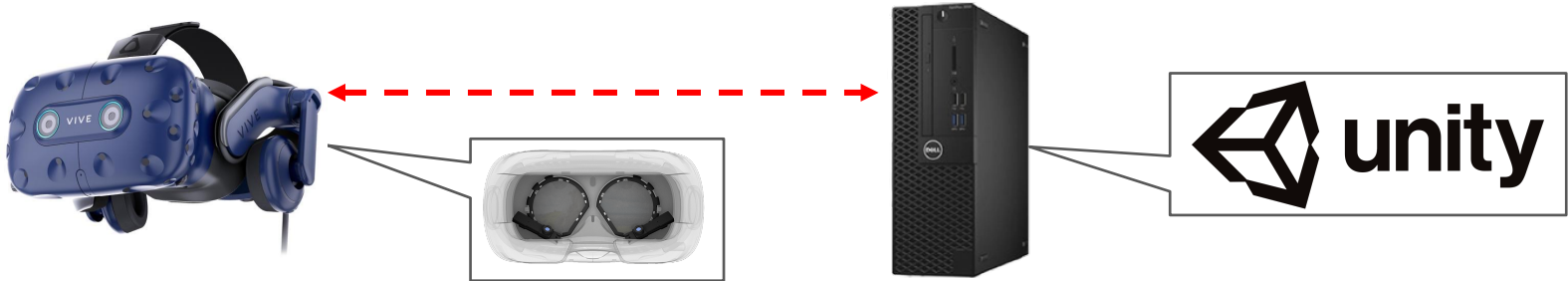


BlinKey Architecture



Prototype

- VR headset: HTC VIVE Pro
- Eye tracker: Pupil Labs VIVE Pro add-on
- Server: Exxact desktop
 - Processor: Intel Core i7 CPU
 - Graphic cards: 2x NVIDIA GeForce RTX
 - Operating system: Windows 10
- Software platform: Unity



Evaluation - Security

- Zero-effort attacks

Blinky length	3	4	5	6	7	8	9	10
FAR (%)	8.1	4.4	3.4	1.9	0	0	0	0

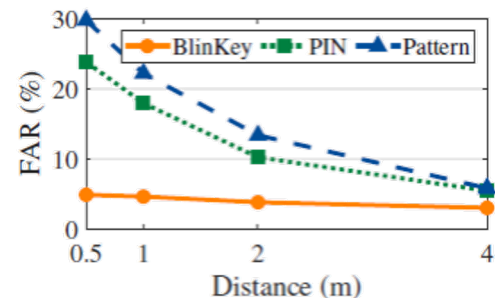
- Statistical attacks

Blinky length	3	4	5	6	7	8	9	10
FAR (%) of statistical attacks	5.2	6.4	2.8	2.4	1.8	0	0	0

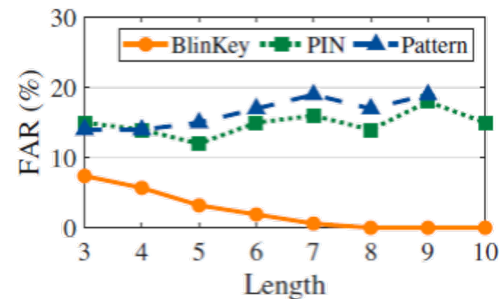
- Credential-aware attacks

Length	3	4	5	6	7	8	9	10
<i>BlinKey</i>	16.6%	25.4%	19.7%	15.5%	14.2%	10.6%	7.9%	4.4%
PIN	100%	100%	97.1%	100%	100%	100%	100%	100%
Pattern lock	100%	100%	100%	100%	100%	99.3%	97.1%	96.8

- Shoulder-surfing attacks



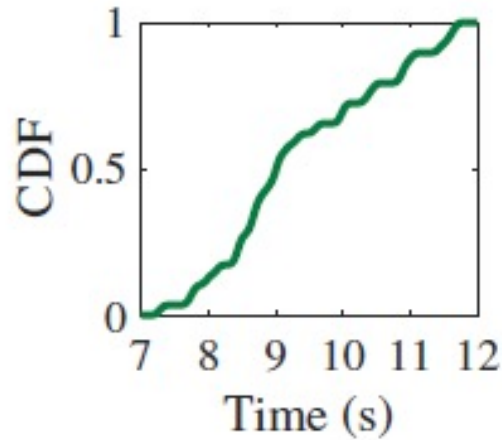
Impact of the victim-attacker distance



Impact of key length

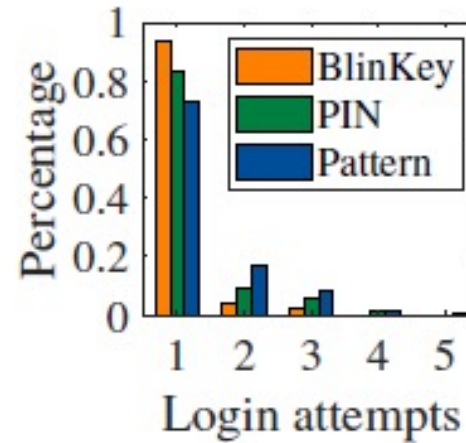
Evaluation - Usability

- Login time



- Mean time: 9.6 s
- 90th percentile: 11.2 s

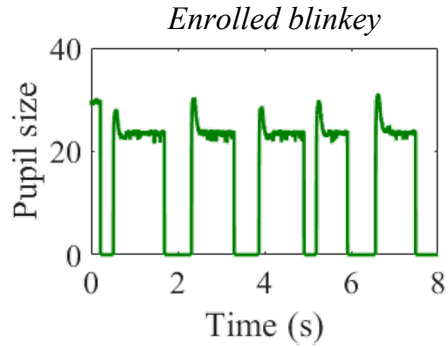
- Login attempts



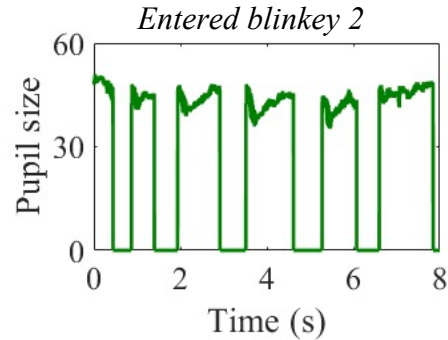
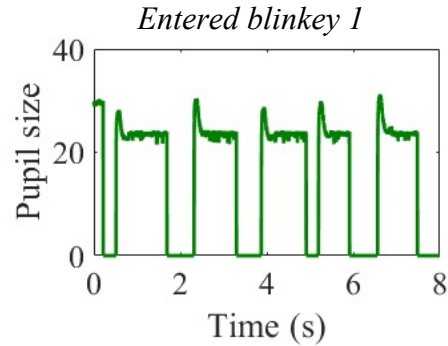
- 1st attempt: 93.3%
- Mean attempts: 1.07

Demonstration

Registration phase



Login (authentication) phase



Successful authentication



Failed authentication



Thank you for watching!