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HELMHOLTZ CENTER FOR INFORMATION SECURITY

Investigating Verification Behavior and Perceptions of Visual Digital Certificates

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Motivation

NSW POLICE
NEW SOUTH WALES POLICE FORCE
NSW Driver Licence
Nina Therese
CITIZEN
LICENCE NUMBER
12345678
EXPIRY
12 May 2023
DATE OF BIRTH
25 Jul 1960
CLASS
C, R
CONDITIONS
S, P, Q, D, M
ADDRESS
4 Berwick St

Visual Digital Certificates

- Offline-verifiable **authentication documents**
- Consist of **digitally signed** QR code
- Reliance on **correct verification**
  - Check authenticity by scanning
  - Match personal data on certificate to presenter, i.e., with ID or passport
- Focused on **Digital COVID Certificates in EU** for our study

Visual Digital Certificates

- **Certificate verification often incorrect** or insufficient in the real world
- Enables malicious actors to use **counterfeit or others' certificates**

Present → Scan → Match identity → Decide

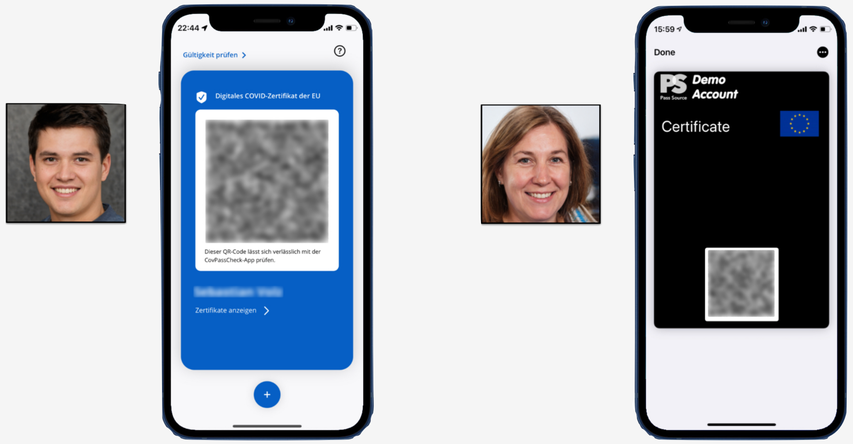
Methodology

RQ1 How do professional users verify Digital COVID Certificates?

RQ2 What understanding do professional users have of the underlying verification process of Digital COVID Certificates?

Semi-structured Interviews

- Three scenarios with verification task
- Questions about technical understanding

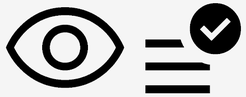


How do users verify Digital Certificates?

Behavioral building blocks

Scanning

ID Check



Visual Verification

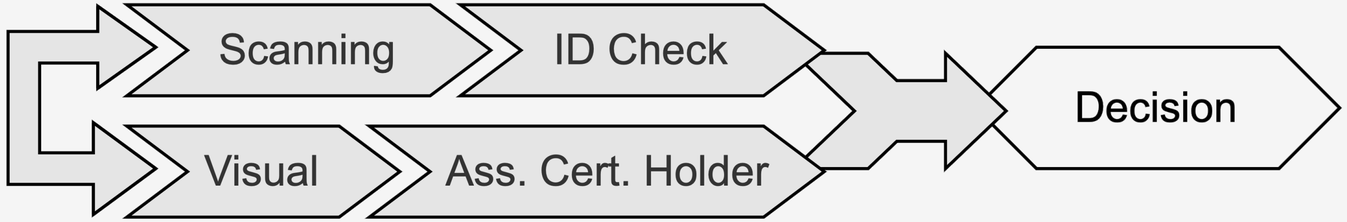
Assessment of Certificate Holder

How do users verify Digital Certificates?

Types of verification behavior

Type I: Consistent and Correct

Type II: Augmented Verification



Type III: Selective Scanning

Type IV: Fallback Verification

Users' understanding of the verification process?

Threat Models

Technical Understanding

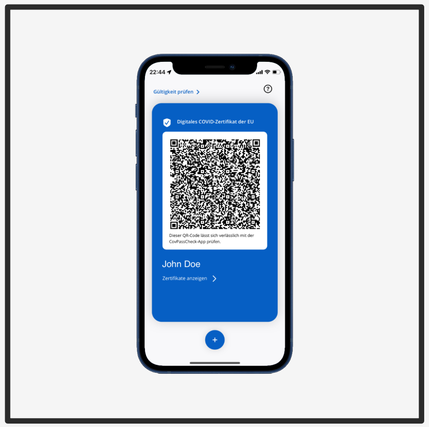
User Education

> *Being a young woman, it happened to me once that a couple of guys came in and they all obviously used **screenshots**, so I told them: "Guys, that's just not possible". But they started acting up and I was **working alone** and so unfortunately **I couldn't do anything** but accept it.*

interview 1, waitress

Challenges

Verifiers Misuse Auxiliary Data



→ Remove visual cues and auxiliary data

Verifiers Have Incomplete Threat Awareness

→ Consistent and coherent education about threats

Structural Issues Lead to Inconsistent Verification

→ Mandatory guidelines that cover verifier education

→ Employers must provide a verification device

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Abstract

This paper presents a qualitative study to explore how individuals perceive and verify visual digital certificates with QR codes. During the COVID-19 pandemic, such certificates have been used in the EU to provide standardized proof of vaccination.

We conducted semi-structured interviews with $N = 17$ participants responsible for verifying COVID-19 certificates as part of their job. Using a two-fold thematic analysis approach, we, among other things, identified and classified multiple behavioral patterns, including inadequate reliance on visual cues as a proxy for proper digital verification.

We present design and structural recommendations based on our findings, including conceptual changes and improvements to storage and verification apps to limit shortcut opportunities. Our empirical findings are hence essential to improve the usability, robustness, and effectiveness of visual digital certificates and their verification.

1 Introduction

Barcodes are a visual yet machine-readable representation of data. Historically, barcodes held very little data, merely repre-

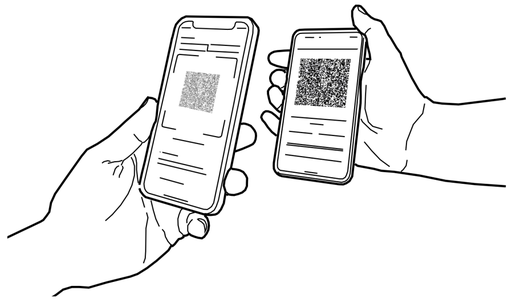

Figure 1: A *verifier* scanning the vaccination data of an EU-DCC *certificate holder*.

Soon after the COVID-19 pandemic was declared by the WHO [53], many countries recognized the need to impose limits on travel and entrance to public places based on vaccination, recovery, or testing status [9, 10]. In order to check the status of a person, the European Union coordinated development efforts on a standardized digital certificate, the EU Digital COVID Certificate (EUDCC) [12]. Subsequently, the EUDCC became the largest rollout of offline-verifiable state-

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https://publications.cispa.saarland/3793/

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