SBVLC: Secure Barcode-Based Visible Light Communication for Smartphones

Abstract:

2D barcodes have enjoyed a significant penetration rate in mobile applications. This is largely due to the extremely low barrier to adoption—almost every camera-enabled smartphone can scan 2D barcodes. As an alternative to NFC technology, 2D barcodes have been increasingly used for security-sensitive mobile applications including mobile payments and personal Identification. However, the security of barcode-based communication in mobile applications has not been systematically studied. Due to the visual nature, 2D barcodes are subject to eavesdropping when they are displayed on the smartphone screens. On the other hand, the fundamental design principles of 2D barcodes make it difficult to add security features. In this paper, we propose SBVLC—a secure system for barcode-based visible light communication (VLC) between smartphones. We formally analyze the security of SBVLC based on geometric models and propose physical security enhancement mechanisms for barcode communication by manipulating screen view angles and leveraging user-induced motions. We then develop three secure data exchange schemes that encode information in barcode streams. These schemes are useful in many security-sensitive mobile applications including private information sharing, secure device pairing, and contactless payment. SBVLC is evaluated through extensive experiments on both Android and IOS smartphones.

Introduction:

SHORT-RANGE communication technologies including near field communication (NFC) and 2D barcodes have enabled many popular smartphone applications such as contactless payments, mobile advertisements, and data sharing. Evolved from the radio frequency identification (RFID) technology, NFC can enable reliable low-power communication between RF tags and readers. However, NFC requires additional hardware and has been supported by only about a dozen of smartphone platforms on the market. Recent studies have shown that NFC is subject to security vulnerabilities such as eavesdropping and jamming. In addition, many types of active attacks, such as data corruption, relay attack and man-in-the-middle attack [3] also have been exploited on NFC-enabled portable devices. Compared with NFC, 2D barcodes have enjoyed a significantly higher penetration rate in mobile applications. This is largely due to the extremely low barrier to adoption—almost every camera-enabled smartphone can read and process 2D Barcodes. As an alternative to NFC, 2D barcodes have been increasingly used for security-sensitive applications including payments and personal identification. For instance, PayPal recently rolled out a barcode-based payment service for retail customers. As one of the handy

features of iPhone series, the Passbook App stores tickets, coupons, and gift/loyalty cards using scannable barcodes.