Demo: Touchless Wireless Authentication via LocalVLC

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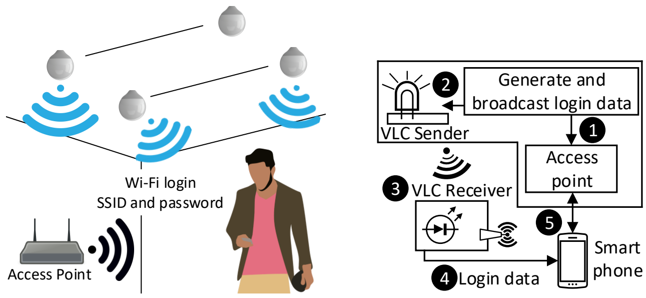
Visible light communication (VLC) has been enabling many applications related to Internet of Things (IoT) such as activity detection, occupation detection, and human sensing. Due to the emerging concern on IoT security and privacy, enforcing distance boundary is becoming a highly desired attribute for various IoT services. In theory, such distance boundary could be achieved by combining dedicated system design and communication technologies. In practice, we rarely find IoT services that can fully benefit from this safeguard feature. This is mainly due to the complexity of exploiting various radio-based communication technologies to attain the distance limit in different IoT environments. Since visible light does not pass through opaque objects, it is a good candidate to reinforce the spatial barrier control over different IoT services that demand for distance-bounding wireless communication.

In this demo, we present LocalVLC, a ready-to-deploy platform that takes advantage of VLC to realize distance-bounding services. Our goal is to build a user friendly VLC-based system that can harness the unique property of visible light to respect spatial barriers like doors and walls. LocalVLC transmits data by switching the current of the LEDs on and off at high frequency so that the switching effect is too quick to be noticed by human eyes. Our design suits for dense wireless IoT deployment as visible light does not interfere with other existing wireless infrastructure (Wi-Fi, Bluetooth Low Energy). LocalVLC introduces a lightweight Morse data encoding adjusted for VLC to deliver fine-grained and low-cost distance boundary control. We have implemented a full-fledged platform prototype to demonstrate the practicality of LocalVLC.

Fig. 1(a) presents our demo use case to automate indoor wireless (Wi-Fi) authentication. As such authentication process usually entails manual distribution and tedious input of passwords for login, we utilize LocalVLC to streamline the credential management and deliver “touchless” authentication experience in a distance-bounding manner. In detail, Fig. 1(b) shows the service architecture and workflow of our demo using LocalVLC. LocalVLC continuously generates time-based one-time passwords (TOTPs) and setups an access point with SSID and generated password ❶. For the wireless network, LocalVLC broadcasts the security credential data including SSID and password ❷. Via an add-on device equipped with a photodiode ❸, the user's smartphone is able to retrieve the VLC transmitted login data ❹. The smartphone continually scans for nearby wireless networks and in case of spotting a matching SSID ❺, it can perform automated wireless authentication without any manual interaction. Besides that, LocalVLC can automatically adapt data encoding parameters, e.g., sampling interval, to support different LED types and foster environments with changing light conditions. The shining LED aligned into one direction achieves different authentication results compared to a pervasive LED with a 360° communication range.



(a) Transmit credentials via LocalVLC for touchless wireless authentication

(b) System architecture of LocalVLC

Figure 1: Use case and overview of LocalVLC

Our demo includes two IoT boards to set up the LocalVLC platform. One board serves as AP and broadcasts login data via VLC for the managed network. The second board acts as light receiver, which connects to a smartphone via MQTT. As the light receiver constantly retrieves the login data, we plot both the raw and processed light signal in real-time to demonstrate the encoding scheme. To assess the quality of service, we show a live authentication monitor on the AP board including success rate of authentication attempts and latency.