2025년도 한국통신학회 동계종합학술발표회 특별프로그램

Emerging Systems and their Security 특별세션

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장소 용평리조트 타워콘도 1층 주목

강연 소개

PowDew: Detecting Counterfeit Powdered Food Products using a Commodity Smartphone

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The prevalence of counterfeit infant formulas worldwide poses serious threats to infant health and safety, a concern highlighted by the notorious Melamine Milk Scandal that affected hundreds of thousands of children. The primary challenge in detecting counterfeit formulas lies in their sophisticated adulteration and substitution techniques. Such detection is feasible only in laboratory settings, making it nearly impossible for average consumers to test the formula before feeding their infants. In this talk, I will present PowDew, a novel and practical system that enables counterfeit infant formula detection using only a commodity smartphone. PowDew operates by capturing and analyzing the interaction of a water droplet with the powdered formula, focusing on the droplet motion, namely its spreading and penetration. Our key insight is that the droplet motions are governed by powder-specific properties such as wettability and porosity. PowDew analyzes the subtle differences in droplet motions, and infers the formula's authenticity. To demonstrate PowDew's effectiveness, we implement PowDew and conduct comprehensive real-world experiments under varying conditions with different brands of powdered infant formula and adulterants. Our extensive real-world evaluation, comprising 12,000 minutes of video recordings across various brands of authentic and altered infant formulas under different conditions, demonstrates that PowDew achieves a detection accuracy of up to 96.1%.

RampScope: Ramp-Level Localization of Shared Mobility Devices Using Sidewalk Ramps

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Short-term rentals of shared mobility devices (SMDs) including bikes, e-bikes, and e-scooters are gaining significant popularity across different countries. These services equip their SMDs with GPS receivers which allows the riders the flexibility to park their SMDs anywhere, and the next user simply finds the nearest parked SMDs. However, GPS accuracy decreases significantly in urban areas and causes real-world problems (e.g., users and chargers not being able to locate the SMDs). To overcome this problem, we propose Ramp-Scope that utilizes physical characteristics of ramps on the sidewalks – which are prevalent in urban areas – to correct for GPS error. As the user rides over a sidewalk ramp, the SMD equipped with a gyroscope captures the motion signal to uniquely identify the ramp and localizes the SMD to the nearest driven ramp. As a proof-of-concept, we present a preliminary evaluation of RampScope with real-world experiments by driving three different SMD types over 800 m to demonstrate an average ramp prediction accuracy of 98.1%.

Remote Keystroke Inference Attack via mmWave Sensing

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Keystroke information is highly privacy-sensitive, revealing details from personal messages to confidential data. Prior methods use sensors like microphones or smartphone accelerometers to infer keystrokes but are limited by their need for proximity or malicious app installation, reducing scalability. To overcome these limitations, we present MilliKey, a remote keystroke inference attack that exploits software vulnerabilities in commercial devices equipped with mmWave sensors, such as air conditioners and motion sensors. By remotely accessing these sensors, MilliKey captures subtle keystroke vibrations, leveraging the widespread use of mmWave sensors and known cloud vulnerabilities to expand the scale of attacks. Our preliminary evaluation with several participants demonstrates the effectiveness of MilliKey, showcasing its ability to infer keystrokes remotely and underscoring the significant privacy risks posed by this novel attack method.

PsiMo: Patient State Classification in Psychiatric Seclusion Room using mmWave Radar

서동진

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Continuous monitoring of patients in psychiatric seclusion rooms is essential yet challenging, particularly with staff shortages that can delay responses to sudden changes in patient conditions. To this end, we propose PsiMo, a remote patient state monitoring system using mmWave Frequency Modulated Continuous Wave (FMCW) radar. Unlike existing vision-based or wearable systems, PsiMo captures patient movements without compromising privacy or risking potential self-harm. Our system continuously monitors patient's state of motion to alert medical staff in the event of abnormal conditions, such as agitation. Our preliminary evaluation shows PsiMo achieves 97.0% accuracy in patient state classification, demonstrating its potential for effective, non-contact monitoring.

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