

## Challenges and Mitigation Strategies for Privacy and Security Issues of Indoor Positioning System: A Review

RW Kalupahana<sup>1#</sup>, MWP Maduranga<sup>1</sup>, and WAAM Wanniarachchi<sup>1</sup>

<sup>1</sup>Faculty of Computing, General Sir John Kotelawala Defence University, Ratmalana, Sri Lanka

<sup>#</sup>38-bis-0001@kdu.ac.lk

### Abstract

Indoor positioning systems (IPS) have grown rapidly in applications across sectors such as retail, healthcare and logistics. However, as location tracking expands within closed environments, protecting user privacy and data security becomes increasingly vital. This paper presents a systematic review of key challenges emerging in IPS and evaluates mitigation strategies discussed in current research. The review first identifies privacy issues such as unauthorized monitoring of user whereabouts and profiling of behaviors that can compromise attributes. Mechanisms for anonymizing location datasets as well as frameworks strengthening individual consent are discussed. Regarding security risks, potential vulnerabilities in IPS infrastructure, positioning signals and device authentication are evaluated. Various mitigation strategies proposed in academic literature are surveyed, including techniques for anonymizing location datasets, strengthening consent processes, implementing multi-factor authentication and building redundancy into localization networks. The paper identifies three dominant challenge categories through analysis: location tracking and privacy; system manipulation and security and infrastructure dependencies/fault tolerance. Example techniques proposed to address each category are summarized and references are provided.

**Keywords:** *Indoor localization, Privacy issues, Indoor-location tracking*