2025 EECMS Summer Internship Application Form

Main Supervisor	Dr. Lakmal Rupasinghe
Other supervisors (if applicable)	Dr. Nimalika Fernando
Project Title	User-centric navigation application for blind and visually impaired travellers in indoor environments
Student location(s) for the project	Project Lab in 207 or ICP
Duration of project	Eight weeks
Project Description	In the modern world, accessing complex built environments is an integral part of day-to-day lives to fulfill the daily needs of humans, including the blind and visually impaired (BVI) communities. Globally, of the 7·33 billion people alive in 2015, an estimated 253 million are blind or severely vision impaired, and the majority of them are in economically and socially disadvantageous environments. However, with limited capabilities to negotiate with the environment via visual clues, the BVI community has specific information needs (e.g., knowing about obstacles) and route planning needs (e.g., safe paths, paths avoiding escalators) in indoor environments, which would not be same as that of sighted people, and therefore not readily available via already existing assistive technology mechanisms. This project aims to provide a low-cost, mobile phone based indoor path-finding solution for visually impaired individuals that can be easily accessed and used. Localization (to know the current location of the traveller) including a suitable trust model, indoor map and route building, optimum route planning as per traveller needs, obstacle avoidance, and providing helpful information including navigation instructions to the traveller are key components of an indoor-navigation aid. It is essential to design and implement any assisting too for the community considering their perspective, and this is identified as one drawback in the present generation of indoor navigation tools for BVI communities. This project is strongly built based on the user perspective, obtained via different means including end-user engagement. For example, route planning needs, the need for reliable and accurate positioning, and communication are already identified via user studies. For example, route planning needs and communication needs are already identified via user studies.

	The diversity of the end-user needs was recognized as a core parameter to consider in this project. Cross-platform mobile technologies, integrated with open-source mapping tools preferred so that the solution can be made available to a wider community. Several components, including a route determination model, and an application with route optimization, are designed and implemented, considering different route planning needs. The core areas to integrate are localization and communication aspects, which are essential for real-time obstacle avoidance components as well. Both active and passive methods can be adopted for localization, including hybrid methods, with all localization data encrypted end-to-end and transmitted over secure channels resistant to interception or tampering. The user communication component involves converting routes and location descriptions to helpful verbal or other forms, considering the different needs of travellers, with this communication secured using strong encryption protocols to protect user privacy and prevent unauthorized access. To ensure trustworthiness, the system should implement a zero-trust architecture, continuously verifying the authenticity and integrity of data sources, employ digital signatures to verify the origin of all communicated information, and provide users with controls over their data sharing preferences. Regular security audits, updates to communication protocols, and transparent logging of all communication events should be conducted to address emerging threats, allowing users to review and verify the security of their interactions with the navigation system, thereby enhancing trust and reliability for the BVI community. The concepts and methods developed in this project can be adopted in resource-constraint environments such as emergency or resource monitoring. The summer internship aims to design, implement, and integrate localization and/or the human-computer interaction aspect of the application so that testing can be done with actual end users.