**Towards a Smart, Safe, and Sustainable Sidewalk: A Quantitative Analysis on How Sidewalk Infrastructure Affect Personal Delivery Devices**

### Data Collection

**What data will you collect or create?**

In this project, we aim to establish a digital twin for sidewalks in Pittsburgh dedicated to analysing the impact of sidewalk infrastructure on Personal Delivery Devices (PDDs). We will use the advanced 3D sensing system that equipped on the robots to perceive real-world sensory data, such as LiDAR point cloud, vision information and GPS, to help construct the digital twin simulation scenarios. The simulation platform will be used to analyze the impact of sidewalk infrastructure and activities on the deployment strategy for PDDs. The team will finally provide a quantitative analysis report towards a smart, safe, and sustainable deployment strategy.

**How will the data be collected or created?**

We plan to develop a fleet of mobile robots as data collection platform to digitalized the sidework geometric and semantic information in Pittsburgh city. In particular, we plan to build 3D semantic maps for sidewalks that utilizing the state-of-the-art simultaneously localization and mapping techniques and deep-learning-based 3D perception methods. The built 3D semantic map could be used as the training samples for generative models to generate novel scenarios, which is helpful for analysing and evaluating the PDDs deployment strategy.

### Documentation and Metadata

**What documentation and metadata will accompany the data?**

Each 3D semantic map instance will be accompanied with (1) the geometric information, such as the location, of each component appeared in the scenario, (2) the semantic information, such as the object type, of each component in the map, (3) the description of the scenario in the map.

### Ethics and Legal Compliance

**How will you manage any ethical issues?**

The ethic issues will be reported to the PI's university and subject to the university's Ethics policy.

### Storage and Backup

**How will the data be stored and backed up during the research?**

All collected data will reside on PCs and workstations belonging to the PIs’ university. A data server which is expected to have MySQL installed will be set up to store all the data and hold the web application. All data will be regularly backed up either onto multiple external hard drives, or a centralized backup cloud storage, to ensure full data recovery in the event of equipment failure. In the case of catastrophic failures, we will maintain both the data server and the web application indefinitely.

**How will you manage access and security?**

Data derived from this project shall be retained for at least one year. The selected research results will be open source and shared to the research community through technical reports or publications. The data in this project does not contain private or confidential information. The research results belong to PI’s university, selected result data and visualization can be obtained upon request by asking PI and research assistants.

### Data Sharing

**How will you share the data?**

Throughout the duration of the work, the PI will in a timely manner communicate any significant findings with the scientific community through journal publications, national and international conference presentations, and seminars. The reported results will be made available to the research community, where possible and permitted and upon request.