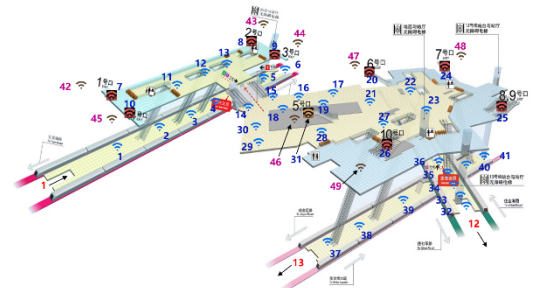# Passenger traffic state estimation
- Estimation of various flow variables based on empirical data collected from a metro station in Shanghai

Problem description

Nowadays, pedestrian crowds gather in large-scale events such as sports events, religious events, music festivals, but also in transportation hubs. The number of severe incidents involving large crowds has increased in recent decades. Tragedies, like the love parade in Duisburg, Germany in 2010, the pilgrimage in Saudi Arabia in 2015 and the one in Iraq in 2019, the stampede in Shanghai in 2015 new year eve, create societal upset and show the need for improved monitoring and management of large gatherings.

Technical advancements in data collection and information dissemination allow for further development of crowd monitoring and management support systems to ensure the safety of pedestrians during large-scale events as well as during regular operations at walking facilities. This way, pedestrian behaviour can be monitored, and potential dangerous situations can be identified in a timely manner.

(Real-time) passenger/crowd monitoring systems have been developed in urban rail transit systems in big cities, like Amsterdam, Utrecht, and Shanghai. For instance, a pilot passenger flow monitoring system based on WiFi sensors has been developed and tested in one of the major stations in Shanghai metro network, whose daily demand at normal weekdays reaches 10 million passengers. The success and implication of this system could be inspiring for the crowd monitoring and management in other stations as well as other cities with similar transportation networks.

Assignment

This graduation project will perform traffic state estimation research, focus on the assessment and evaluation of this pilot passenger flow monitoring framework (and its existing modules), based on the empirical data collected from this system operating in a real-life (at a metro station), and exploring the potential enhancement of the current system. The data quality and their implications have not yet been fully investigated, besides more pedestrian estimation modules can be developed based on the available data sources. The available datasets include raw WiFi data, AFC passenger counts for a period of one week.

Possible assignment tasks:
1. Literature study on passenger traffic state estimation (data and approach)
2. Data processing/data quality assessment
- Assess the accuracy and data quality of the WiFi sensors for crowd monitoring, to derive scale factor (penetration rate) for sensor data processing.
3. Assessment of existing modules
- Assess various existing monitoring modules, including, crowd density estimation, flow estimation, overcrowded flow warning.
4. Monitoring framework extension
- Consider further develop functions for route-choice estimation, and/or level of service evaluation, incident detection.
5. Sensor network optimization
- Design optimal sensor layout, develop guideline for sensor displacement.

Information:

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