In shared space (a special type of mixed traffic), the lack of separation between traffic participates may cause traffic jam and unsafe in rush hours. To protect vulnerable road users and improve the efficiency when passing through the shared space, the road users with similar origin and destination will be formed as a group, then all groups will coordinate a virtual intersection which shows the feasible crossing priorities to avoid collision. The project will deal with some interesting problems such as online multi-agent path finding(MAPF), group merging and splitting, graph search and cooperative intersection management(CIM).

Group formation in shared space

‚Shared space‘ is a popular urban design strategy. In general, it decrease separation between all kind of road users by removing road signs and features (e.g. traffic lights, curbs etc.) The inventor of shared space believe that in this way, drivers will pay more attention and slow down when passing shared space, with which, the other road users (e.g. pedestrians and cyclists) gain more priority.

However, as this urban design method is applied all over the world, the safety issues arise in many countries. In the UK, a serious accident happens, when a blind man tried to pass through shared space, a van crushed on him and unfortunately he died. Later, a survey on how does people feel about using shared space launched. The feedback is relatively negative. Pedestrians and cyclists reported that they felt they were bullied by vehicles, meanwhile, from the driver's side, it‘s hard to estimate where will the others go when there is no traffic signs.

Not only safety aspect, current shared space has efficiency problem as well. When the traffic flow is quite high, it shows a bottleneck effect because there‘s no traffic lights to follow with.

To solve these problem, we come up with a hypothesis: by grouping traffic participants when they crossing, the safety and efficiency will increase. This is intuitive because when pedestrians become a group, they will gain more priority compared with individuals(case 4 & 3). What‘s more, grouping can decrease the number of traffic participants, therefore, it's easier to manage how all participants pass the shared space (case 1), the traffic flow will be more fluent.

The project will concentrate on two parts: collaborative multi-agent path planning and traffic management. State-of-art methods, like multi-agent reinforcement learning, graph search and other algorithms will be used to figure out the best way for several groups of traffic participates to pass through a shared space.