Central Projection Augmentation for pedestrian AV interactions

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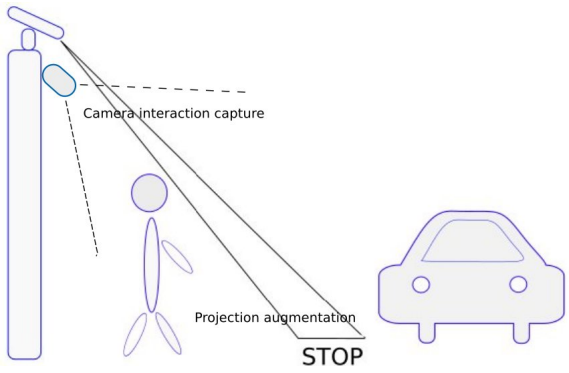

Fig. 1. Conflict Resolution using Augmentation

Pedestrian autonomous vehicle (AV) interactions where people are unaware of their priority on having the right of way in a traffic conflict is a seemingly complex situation. As making judgment of priority in these situations are difficult, it becomes all the more challenging when its a shared space. The idea proposed in the paper focuses to solving traffic conflicts using projection augmentation hence assisting such interactions with decision making based on adhoc rules.

Additional Key Words and Phrases: Traffic conflict, Adhoc rules, Pedestrian AV interactions

1 INTRODUCTION

Considering the benefits introduced from social interactions between traffic participants , shared space designs have been proposed to counter the dominance of motor transport. In these shared spaces, road signs, signals, and markings are removed to allow mixed traffic directly interact with each other [4]. The lack of regulations makes interactions between multimodal road users more complex compared with conventional designs. All users have to follow informal social protocols and negotiation to use the road resources, and avoid any potential collisions.

As autonomous vehicles would dominate the streets, the social interactions would heavily be dominated through its external communication capabilities [3]. However even while foreseeing such capabilities , conflicts arising from these interactions would need to be addressed. In [6] ,the author highlights the need of communication in scenarios when pedestrians are unaware of priority (foreigners etc..) and in complex situations. We have focused to address conflicts between participants, a complex situation which has not been researched much in context of right of way for pedestrian AV interactions .The idea proposal centers along a projector based augmentation system which detects conflicts using a fixed camera mounted over a shared space and resolves them by projecting stop and go signals to participants based on adhoc rules hence simulating the functions of a virtual traffic infrastructure.

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2 RELATED WORKS

The use of dynamic pedestrian information has been tested with a prototype in [1] where the projection was used to communicate the intention of an AV to the pedestrian. In [5] the authors introduced a drone based hyperreal prototype for the evaluation of HCI (Human Computer Interactions) solutions in high-risk scenarios in a virtual-reality environment. The system projects a crossing augmentation for pedestrians to safety cross roads. The use of augmentation to attract youths and to improve social life was mentioned in [8], where its use to also project traffic light countdown to inform participates to control crossing behaviour has been studied.

3 PROPOSED SYSTEM

The proposed system for controlling the behaviour of traffic participants is an extension from our previous work [9] were an architecture for such a system was highlighted. The proposal considers a camera based surveillance system overlooking a shared space.

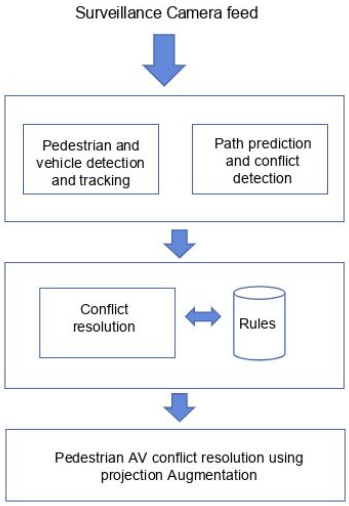

Fig. 2. Sytem overview with components

The camera feeds are processed for the positional information of pedestrians and autonomous vehicles. This can be achieved using image based object detection approaches like YOLO [7] and tracking algorithms like deepSort [10]. Once the positional information of the pedestrians and AV obtained, prediction approaches [2] can be used to identify near collisions in real-time. These conflicts can be evaluated against a rule base to identify prior participants to have the right of way. A central projection system overlooking the interaction would project one of the participants to have the right of way. The work would also consider interaction between group of pedestrians and fleet of autonomous vehicles , each resolving conflicts via adhoc rules each addressing specific participant configurations .

4 CONCLUSION AND FUTURE WORK

As the idea is still in its proposal stage, the hurdles of technical feasibility are still not completely understood. However some of the challenges on the use of a single camera overlooking the space could limit the possibility to capture all

interactions also considering for occlusions. A central projection system would seem an attractive option for children but would fail to meet the expectations of the blind community. Hence other modalities like audio augmentation would seem a promising alternative in such cases.

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