ORBIT – Optimized Roundabout Behavior via Intelligent Trajectory-Mapping

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Roundabouts have become increasingly popular as they offer numerous benefits over traditional intersections for traffic management. Despite this they can be a source of driver confusion due to their unconventional geometry and lack of signaling which can become a problem at high traffic densities. This research proposes an intelligent traffic control system designed to account for the issues of roundabouts via computer vision and adaptive signal control done through trajectory calculation. Using YOLO (Computer Vision AI Model), vehicles are detected and tracked. However in computer vision the size and positioning of detection can vary. Thus to improve detection consistency across varying vehicle sizes, detection is anchored to tire positioning rather than the vehicle, significantly reducing variance as tires remain relatively uniform in size. From these tire-derived points, positional data is used to construct vehicle paths. These paths are then resampled to a fixed number of points to enable combination, allowing the system to refine common paths for each section of the roundabout with every new vehicle that passes through. Finally, incoming vehicles are then compared against all pre-generated trajectories in real time. This predicts which path each vehicle is most likely to follow based on their distance from these paths. These predictions provide the information for the signal control system, which activates lights to direct vehicles through the roundabout in a clear and coordinated manner, minimizing driver confusion, and maximizing efficiency and safety.

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