AutoPark – Collaborative Parking For Autonomous Robots
Mohak Bhardwaj, Shivam Gautam, Dorothy Kirlew, Pranav Maheshwari, Richa Varma
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Project Description

With the ever increasing presence of autonomous cars in our world, vehicles no longer need to operate as disjoint systems. Vehicle to vehicle communication enables a vehicle to communicate and collaborate, leading to more optimized performance and higher safety. AutoPark showcases these capabilities in the context of a parking lot, by enabling cars to autonomously park in a lot and exit the lot as efficiently as possible with no human interference.

Physical System

Problem Statement
Create a system that allows multiple autonomous vehicles to cooperatively and efficiently park in a parking lot by sharing information. Interface with drivers to drop-off and recall vehicles through a mobile device.

Functional Architecture

Software Architecture

Implementation

Simulation System

System Architecture

Optimization

Global Optimization:
Multi-armed bandit based exploration vs. exploitation approach in search of Global Maxima

Heuristic Driven Local Optimization:
Track and guide system towards a state of less entropy

Event Triggered Reward Maximization:
Alter state of Vehicles via Numerical Optimization in a tradeoff between cost minimization and reward maximization

Performance

Greedy Approach

AutoPark Approach

Results

Success Criteria

The entire routine is followed in a predictable manner and the vehicles park themselves in the most optimal spot

Performance

Yes

Time taken by the system with collaboration is less than that by the platform without collaboration

Some collisions occurred between vehicle and infrastructure leading to manual intervention

User Interface accurately shows the state of the parking lot

The app accurately shows the state of its vehicle

AutoPark Approach

Average Parking Time 12.5 seconds

Average Pause Time 15.37 seconds

Average Return Time 15.6 seconds

Conclusion

Systems that facilitate collaboration between vehicles hold great potential and will be a direct demand of the new age autonomous systems which will be much more aware of their surroundings than present manned systems. Continued work should focus on optimization strategies in varied use cases and encryption of shared data.

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