Introduction

With the increasing number of vehicles in the world, the supply-demand problem of parking spaces has become more relevant than ever. In traditional parking lots and structures, drivers circle around until they find an available parking spot. Current research has explored the use of sensors to identify available parking spaces. This Internet of Things (IoT) approach to efficient parking has been widely explored and is implemented in select parking structures. However, in the age of information, entire parking systems can be more efficient with data. In this regard, considering additional also IoT provided information from the drivers can increase overall parking system efficiency.

Algorithm Design

The algorithm was devised first by determining possible input data collected from vehicles entering the specific parking lot. Next, considering the objective of this algorithm, variables were defined:

- General variables:
  - occupancy of entering vehicle
  - cost of a vehicle entering the parking lot
  - time of day
  - length of stay
  - walking distance from car to exit
  - status of the passenger: [Elderly/Pregnant/Disabled]

Considering these variables, a score is calculated for each vehicle indicating the “Walk-Cost Factor” of the vehicle. The factor is used for prioritizing the cars in the optimization algorithm.

Event Based Parking Lot Simulation

Running the optimization algorithm in a simulation revealed an important feature of this approach to parking efficiency. The simulation showed that this approach directly countered the first-come, first-served paradigm in transportation. As pictured above, the first car into the lot is actually asked to park the furthest away. However, the notion of picking the closer available spots was not challenged.

Conclusion

This research accomplished both creating a smart parking algorithm and creating an event based simulation to see the implementation of this algorithm. Through this simulation it is shown that there are more system-wide efficient approaches to managing parking than the traditional methods which rely on the user and the first-come, first-served paradigm.

Future Work

Future work in this topic would include looking at applications in:
- Different styles of parking lots
- Effect of length of stay on spot allocation
- More complex links between nodes in the lot
- Multiple paths to parking spot
- Shortest path guidance
- Complex arrangements for walking paths and their distances
- Implementing sensor in the parking lot to get real time data of the lot conditions
- Real time negotiated spot pricing

While all of the above topics can be considered with human drivers, the overarching future of research on topics like this is the implementation in autonomous vehicles.

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