A Simulation Model for FIU’s Parking Garages

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ABSTRACT

Parking guidance systems which provide information and recommendations on finding available parking in parking garages are significantly beneficial to users. These systems require calibration and evaluation before their application in the field. One way to accomplish this step is to evaluate them in a simulated environment. In this work, we report on a discrete simulation model of cruising for garage parking that serves as a virtual test bed for calibrating and evaluating the garage parking guidance algorithms. The developed model has been validated based on real-world data of several of Florida International University’s (FIU) parking garages. The validation results show an average deviation of under 10%.

BACKGROUND

Informed Traveler Program and Applications (ITPA) is an advanced consumer-oriented and multimodal transportation management software and technology system currently under development by Florida International University High Performance Database Research Center. ITPA will provide customized real-time and predictive information in the areas of multimodal and intermodal transportation. It will offer innovative solutions using real-time and predictive data to improve the decisions each individual can make before determining traveling to an intermodal station, desired parking space and final destination. ITPA will also provide management support to traffic, transit, and parking providers, enabling them to manage their resources more effectively and more efficiently.

PARKING SIMULATION MODEL

• An agent-based simulation model usually includes two components: the agents themselves and the environment they interact with.

Modeling parking garages

• The parking garage is modeled as an attributed graph G(A,E).
• A node a ∈ A represents an area of the parking garage.
• Each node a ∈ A is attributed by its total number of parking slots sz, the number of currently occupied slots oz, at time t, by extension also the number of free slots sz(t) = sz − oz(t) at time t, and the average time ra needs to traverse and search the area.
• An edge e(a1,a2) ∈ E with a1,a2 ∈ A represents a direct connection between two areas a1 and a2 which is traversable by a car.
• Each edge e(a1,a2) ∈ E is attributed by a time ra needed to move from area a1 to area a2. In cases where areas are directly adjoining, ra = 0 can be assumed.

Figure 1: ITPA components and environment

Figure 2: Simplified parking garage level

Figure 3: Partial model graph of a parking garage level

Validation and results

• The Florida International University Parkview Housing Garage provides students living in adjacent dorms with 282 parking slots on three levels.
• It consists of 16 areas with an average of 17.6 slots.
• The model was applied to simulate 100 operational days.
• A simulation run generates approx. 1,700,000 events of nine event types.

Figure 4: Number of simulation events per operational day

Figure 5: Validation results

CONCLUSION

• This work presented an agent-based simulation model of cruising for parking in parking garages.
• The validation shows the model’s capability to predict the state of a garage over the course of an operational day based upon layout data, attractiveness values, and parking durations.
• After further validation based on improved data streams, the model will be applied to the evaluation of parking recommendation methods.
• It will also be extended to accept real-time input data, and then be utilized as basis for a predictive parking information and recommendation system.