

AGENT-BASED ANALYSIS FOR DESIGN OF SIGNAGE SYSTEMS IN LARGE-SCALE FACILITIES

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ABSTRACT

Designing a signage system in complex and large-scale facilities such as airport passenger terminals, stations or shopping malls has a significant impact on usability of the facilities. Facility managers would like to provide appropriate guidance information to facility users by using a signage system. It is difficult, however, to create the signage system designed to provide the right information to various types of users in the right place at the right timing. This paper focuses on an airport terminal and develops an agent-based model that represents the behavioral characteristics of passengers and the essential features of signs. The simulation with the model can show possible passenger behaviors and congestion situations in the facility under many different types of signage systems. As the results, we can support the managers' decision to build the signage system before it is actually implemented.

1 INTRODUCTION

Large public facilities such as airport passenger terminals or shopping malls address the improvement of signage systems to increase service quality. A signage system unifies some signs each of which provides differently appropriate information on the facility for a specific purpose. The signage system should also give a way to represent the relationship between the contents of signs and the way to present the signs in the facility (Akase 2013). For example, in an airport terminal providing a wide variety of services, passengers cannot always get to the services corresponding to their needs because they cannot find out the appropriate information of receiving the services until their boarding time. So service managers aim to provide efficient guidance of information about the facilities in the airport terminal by using a signage system consisting of signs, pointing arrows and maps. It is difficult, however, to create the signage system designed to provide the right information to various types of users in the right place at the right timing.

The purpose of this study is primarily to develop a simulation tool that can evaluate a signage system to support a decision to build the signage system before it is actually implemented. In this paper, we provide an agent-based airport model consisting of a passenger agent model, a signage system model and a facility model. We evaluate some policies of designing a signage system by simulating passenger behaviors and congestion situations of facilities using the model. In the simulation we use the concept of LOS (Level Of Service) (Ushiro and Ueshima 2006, Fodness and Murray 2007) that represents standard indexes to evaluate how much the signage system contributes to improvements in service quality from the viewpoint of processing time and comfort.

2 SUMMARY OF MODEL

The signage system model is composed of an environmental model that represents a space where passenger agents walk and a sign model that provides information to the agents. The environmental model created using the cellular partition of space has several areas. In each area there are some facilities that passengers use such as shop, restaurant, or money exchange.

Each passenger agent is generated from a specified area and acts based on its own decision rule. The agent walks around the area and gets information from the sign or observes its environment in order to determine the area or facility that the agent wants to go. If the agent receives other information from another

sign on the way of going to the current destination, the agent can use it also as additional information to reach the destination. The model has the following three features to represent realistic passenger behaviors:

- **Information carrying capacity:** the agent can receive information from each sign only when the agent is walking within the given space of each sign.
- **Two-step selection:** the agent decides the area where the agent goes as a next destination and then selects a facility to use at the area.
- **Forgetting information:** the agent forgets the route information after a certain period of time has elapsed.

The model features can describe the processes of information loss and search in large-scale facilities and reproduce the agents' getting lost behavior.

3 SIMULATION EXPERIMENTS

We conduct simulation experiments with some scenarios by using the proposed model. The simulation assumes a virtual airport terminal as an experimental situation. The terminal is supposed to be divided into six areas: east, center and west areas each of which has additional areas before and after the immigration (Fig.1). There are basic facilities for boarding procedures such as check in and security check, and for exchange, eating and shopping between procedures.

In the simulation experiments, we set the installation location of signs and the amount of information that each sign has as the scenario variables. For example, although the sign which has the large amount of information can guide various types passengers to their destinations, it can only convey the information to a small number of passengers within a narrow space. We produce the various designs of signage systems by setting the scenario variables and evaluate the effectiveness of each design. As an essential evaluation index, we focus on the "time" how long the agent spent for searching information and stayed in facilities. Then we analyze the agent behavior especially concerning how the agent used facilities under the each scenario. As the results, we can reveal the possible agent behaviors generated by signage systems and the mechanisms of the behaviors.

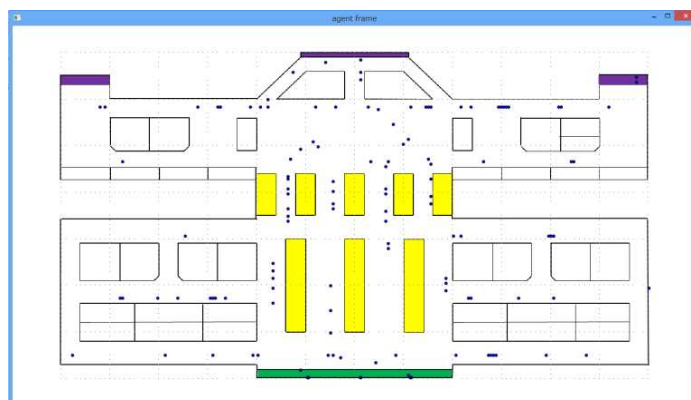


Figure 1. Example of screenshot of simulator under development

REFERENCES

1. Akase, T., "sign system planning :public space and system of sign", KAJIMA INSTITUTE PUBLISHING, 2013.
2. Ushiro, M., Ueshima, K., "A basic study on evaluation for passenger usability in the airport terminals," Technical Note of NILIM, No.313, 2006.
3. Fodness, D. and Murray, B., "Passengers' expectations of airport service quality," Journal of Services Marketing, Vol. 21, No. 7, pp492-506, 2007.