Computer Discrete Event Modeling of a Hotel Activity Using the Simevents Matlab*

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Abstract. This paper explores the features of the use of discrete-event modeling in the decision-making process on the regulation and improvement of hotel activities. A discrete-event model of mini-hotel activity is presented. The computer implementation of the model is performed in the SimEvents environment of the MATLAB R2018b Discrete-Event System Block. As a result of a series of computer experiments, probabilistic variants of the development of events were obtained and some recommendations for optimizing the control of the investigated hotel were provided.

Keywords: event modeling, hotel activity Simevents Matlab.

1 Introduction

An important stage in the development of man-made systems is research and optimization. The most effective method for studying complex systems is the simulation. When solving the problems of optimizing management in the service sector, we are dealing with service systems that are designed to repeatedly perform typical tasks.

The queuing system is characterized by indicators of its effectiveness. If the system works in the mode of performing the same tasks, then it is possible, once the system is tuned, to operate it in the mode of fixed results. However, in the modern world, situations of changing circumstances most often arise and, accordingly, there arises the need to adjust the system in a short time in the new conditions.

In this paper, the activity of a tourist mini-hotel is studied in the context of various scenarios for the development of market events.

2 The simulation model of the tourist service system

Our simulation model of the tourist service system should adequately reflect the properties of the system. The properties of the system are understood as its internal mechanisms and functions, the connection with the external environment, the means of monitoring the behavior of entities (clients) when entering, staying inside and exiting the system.

The basis of the construction of our model is the principle of discrete-event modeling.

This model studies the process of customer service (entities) within the analyzed system. At each stage of the client's journey within the tourist location, we can get all the information that interests us, concerning both the state of the entity (client) and the state of the service node. It is also possible to find out information about the internal resources of the service system. Finally, within the model, algorithms for determining system bottlenecks are provided.

Below is described the direct model of the mini-hotel, created in the simulation system Matlab R2018b, Simulink, SimEvents.

Figure 1 shows a block diagram of a model space with zoning.

Fig. 1.

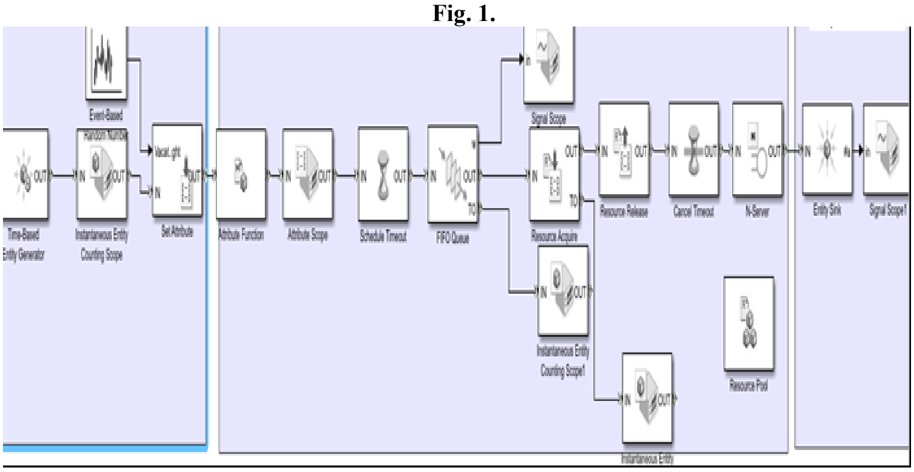

Fig. 2. Block diagram of model space with zoning

In our model, the different situations in which clients enter the service system are determined by the type of statistical distribution of client receipts on the client entity generator block. It is necessary to talk about three main types of laws for the distribution of customers over time (Permanent, Exponential, and Uniform). It should be noted that for special cases, the law of distribution of customer receipts in time can be set manually using external blocks.

Before entering the service system, the generated entities (clients) are given attributes. In the case of our model, each entity is assigned two attributes - exactingness (that is, the ability to tolerate inconveniences and disadvantages of the service system) and the length of stay in the mini-hotel. Thus, the distribution of customers by the qualities (attributes) is created, which brings the simulated situation closer to the actual one.

In the future, the aggregate of clients staying at the hotel passes through local service systems (so-called servers), which are characterized by the number of service elements and the service time. Due to the fact that not all client-server relationships are ideally optimized, situations arise, on the one hand - queues, on the other - irrationally used resources.

Of course, one of the main objectives of the hotel management system is to minimize queues and, as a result, maximize customer satisfaction. Finally, it is necessary to specify the monitoring systems for the state of customers in the service system (various monitoring systems), their number is arbitrary, and the quality allows us to count and monitor all the necessary parameters of customers and the service system.

The article considers several different situations, which will be discussed below

3 The situation of hotel activities in the tourist season

For this situation, a stable and predictable load is typical during the main operating time of the service system. At the same time, minor deviations from the norm are possible, in the form of short-term recessions or upsurge in the flow of tourists. Also possible to note possible bottlenecks associated with the work of personnel or logistics services.

Accordingly, in management planning, it is necessary to configure the maintenance system in such a way that:

- Minimize customer waiting time
- Minimize resource loss
- Select the segment of tourists who are most profitable for the service system.

For all graphs, it is true that 500 conventional units of model time correspond approximately to 30 calendar days.

The forecast of the frequency of incoming orders from customers in the analyzed system (on the graph on the abscissa axis shows the conditional simulation time and on the vertical axis - the frequency of incoming orders) (figure 2).

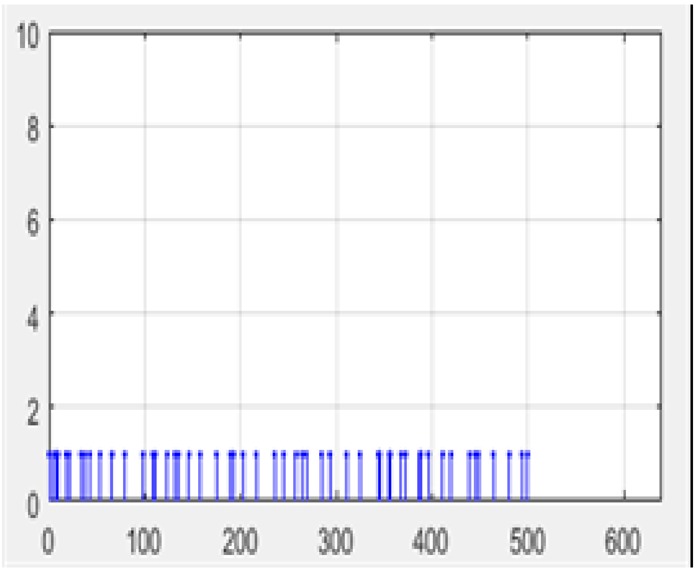

Fig. 3. The forecast of the frequency of incoming orders from customers in the analyzed system

Figure 3 shows the actual arrival of tourists to the destination, taking into account the distribution by the duration of stay (on the chart on the abscissa axis, the conditional simulation time is shown, and on the ordinate axis - the number of days in the tour)

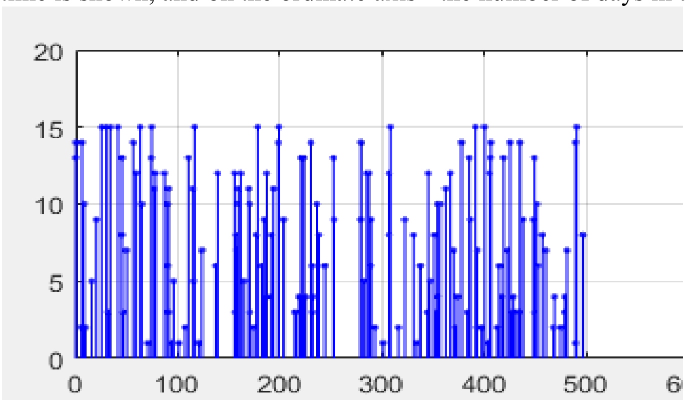

Fig. 4. The actual arrival of tourists in the destination, taking into account the distribution by the duration of stay

The dynamics of growth in hotel revenue are shown in Figure 4 (the graph shows the usual simulation time on the abscissa axis and the number of arriving tourists on the ordinate axis). The number of tourists who left the mini-hotel before the stated time during the observation period is shown in Figure 5 (The graph on the x-axis shows the simulated simulation time, and the ordinate shows the frequency of tourists who left the hotel).

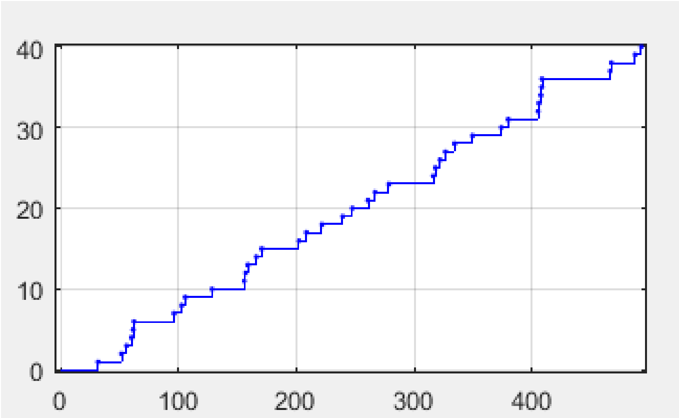

Fig. 5. Dynamics of growth of hotel income (on the graph on the x-axis shows the conditional simulation time, and on the y-axis - the number of arriving tourists

4 The situation of the hotel activity in the off-season.

Service systems are characterized by certain periods of long-term uniform loads, outside of which a fall time occurs. Usually, the time of intensive work is called the season, and the time of recession is called the offseason. Obviously, working in the offseason requires different management approaches and solutions than during the season.

We will analyze the second situation when in low season hotel services are in demand in the peak version for a short period of time.

When entering the distribution of customers will be exponential, the conditions for all will be about the same. Quality requirements will increase. It is possible that dissatisfaction with the service of one or several important guests may lead to large losses of the mini-hotel.

Consider the results (in the form of graphs) in this case, when the right management decisions are made. The graphs show the following parameters of the simulated service system

Figure 6 shows the distribution of incoming tourist traffic, along the X-axis - the frequency of the incoming tourist flow, along Y - the duration of stay of tourists in a hotel

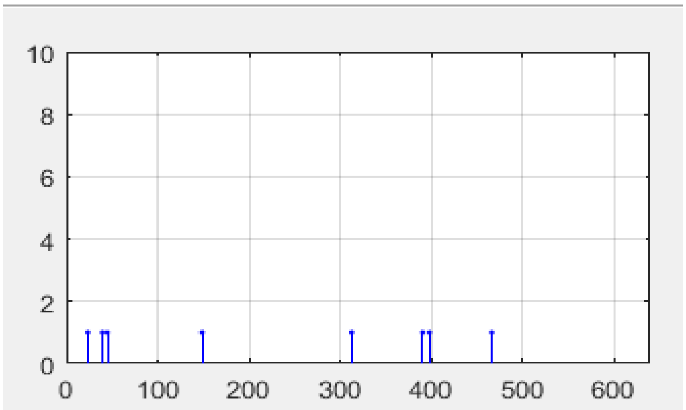

Fig. 6. The number of tourists who left the mini-hotel before the stated time during the observation period (the abscissa shows the simulation time on the axis and the frequency of the tourists leaving the hotel on the ordinate axis)

The number of customers waiting for servicing in different parts of the service system is shown in Figure 7, the frequency of customers leaving the service system due to a service that is not satisfactory to customers is shown in Figure 8, the dynamics of the mini-hotel revenue growth are shown in Figure 9.

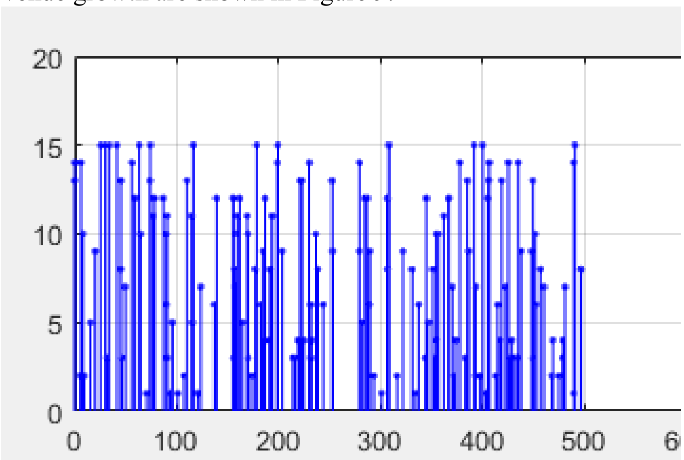

Fig. 7. The distribution of incoming tourist traffic, along the X-axis - the frequency of the incoming tourist flow, along Y - the duration of stay of tourists in a hotel

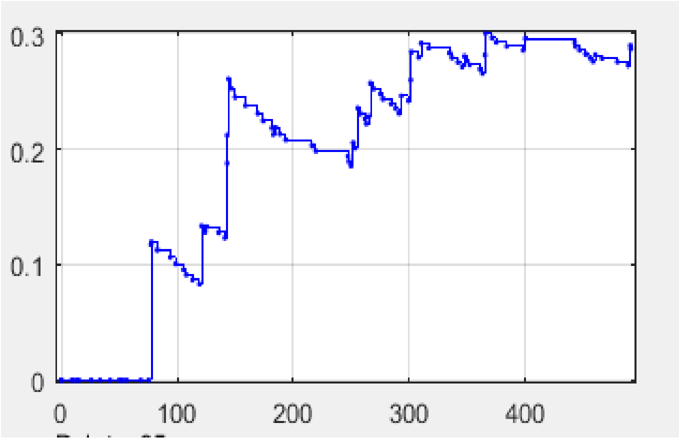

Fig. 8. The number of customers waiting for servicing in different parts of the service

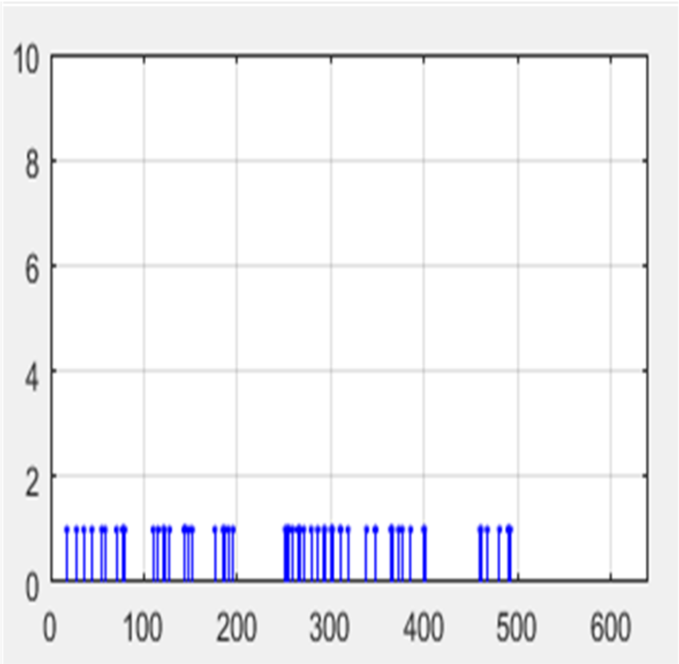

Fig. 9. The frequency of customers leaving the service system due to a service that is not satisfactory to customers

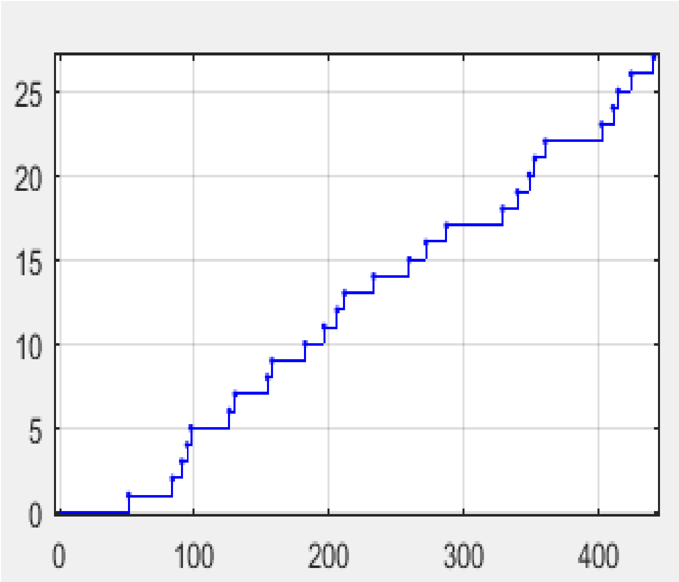

Fig. 10. The dynamics of the mini-hotel revenue growth

5 Conclusions

Computer simulation of the service system in a variety of situations allows you to check and predict future market situations. This process can be effective through the use of mathematical modeling methods in the SimEvents environment using standard blocks. SimEvents allows you to simulate various system parameters, and then connect the model blocks in such a way as to ensure a high level of adequacy to the actual conditions.

The article shows how to simulate the activities of a mini-hotel in the SimEvents environment and how to calculate the load on the system. This model allows you to optimally boot the system by regrouping services.

This example of developing a system model architecture, taking into account the logistics of moving groupings of objects, can also be used to optimize the calculation of workload loading and other digitalization problems of hotel management.

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