Emergency patient health service simulation as a supporter of smart health care

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Abstract. Providing health services for patient requests obtained from smart devices installed in each patient can be done if the service center has adequate resources and there are no criteria for emergency patients, but this will be different if in real life an emergency service request occurs. Providing emergency services to hospitals is growing, especially with the introduction and evolution of triage systems by giving priority services to patients based on their level of urgency. Providing services to emergency patients must be a priority in service delivery, because it can be ascertained that this emergency request is closely related to the safety of the patient's life, such as an accident or sudden onset of disease. Service simulations in patients are carried out using Simulink, by limiting the availability of all the resources in the service center, and providing real life simulation events for 56 emergency patients, and the simulation concludes that priority queuing systems can serve all patient requests and perform as quickly as possible.

1. Introduction

The occurrence of queues in patients is a big problem for hospital services [1], service satisfaction for patients is difficult because the queue takes a long time to wait and each patient may need to undergo a variety of other services [2]. The capacity plan is also proposed to work in terms of statistical data, and performance evaluation of plans carried out through the patient model. Static scheduling policies can reduce the waiting queue length to be lower and more stable. However, there are some very big problems that cause patients to be scheduled too late. This situation really utilizes the consultation process at a low level before the queue length becomes a stable level. Thus, a dynamic scheduling policy is considered to improve the scheduling process so that the queue length can reach a stable and faster level. Dynamic policies use function levels to control the scheduling process based on different time slots. The level of a function includes dynamic factors that can change over time [3].

The service model in the queue in the system using the first come first serve method can utilize resources optimally if the resources needed are still sufficient, but this will be a new problem if the demand for resources exceeds the number of available resources, this can cause long lines to causes the queue to increase in length. Access to inadequate service center resources can also be a problem, to overcome this challenge, it is necessary to communicate in real-time between the resources available at the service center (server) so that they can provide maximum service.

Providing optimal health services based on the concept of "Smart Health" is how to provide services as early as possible based on the request of each patient with the use of health resources that are limited to service centers [4]. The need for patient requests will vary, depending on the patient's illness, as well as requests for emergency services, for this reason only emergency services for patients are discussed.

2. State of The Art

In health care is a model of queuing with various types of patients, in which one or more types of patients have priority over other types. It is more appropriate to consider the M / G / 1 queue model with the patient type. Type 1 priority for patients is the highest priority handler, type 2 priority for customers is the second highest priority customer and so on [5].

Providing emergency services to hospitals is growing, especially with the introduction and evolution of triage systems [6] by giving priority services to patients based on their level of urgency. One of the most extensive triage methods used is the Manchester system [7], [8]. In a triage system, patients are classified into five groups according to their level of urgency [9].

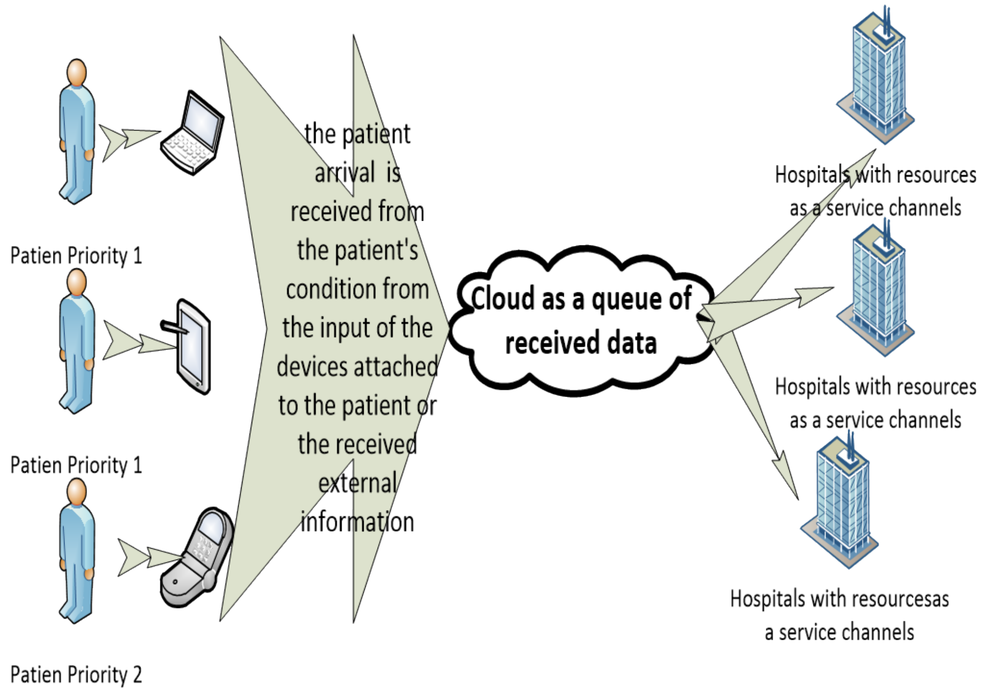

Figure 1. Queue Model.

The results of the design of this model will provide a better decision support system in dealing with medical problems in patients, so patients are quickly given first aid and what actions will be taken. In Figure 1. data will be received by the server that handles the patient service distribution [10], if the patient is priority 1 / main in this case has been cleared in the previous section, the patient must be served and prioritized at the nearest hospital that is connected. to the server system, and in this condition it is also proposed to immediately bring the patient, and maybe the patient can be escorted by the patient's family or the closest person is encouraged because in this case, the condition of patients with the first priority is patients who must receive the first service.

Furthermore, the priority distribution of patient care with priority 2 will be provided by a specialist doctor who handles the disease or the availability of a polyclinic in accordance with the illness, supporting equipment needed and available rooms that provide information about the type/class of the room [11].

3. Simulation of the Queue Model

Simulation in the queuing model is done to find out whether the queuing model can provide better service or not, this is very important because it can provide information if there is an error in the model and of course a solution can be found in the part where the model must be repaired. Simulink model simulation in Matlab. The design of the priority queue model is illustrated in the figure below:

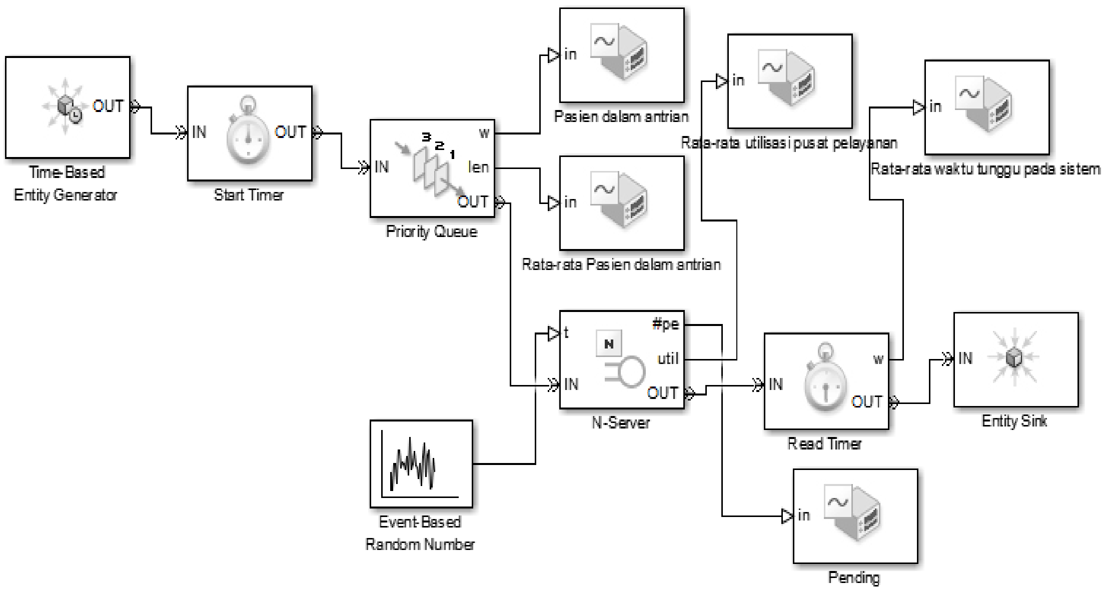

Figure 2. Queue Priority Model.

From the summation results, it was found that in the simulation of 1440 minutes, equivalent to 24 hours a day, the average probability of a busy service center was 12%, so it can be concluded that the service center can service all service requests. The simulation results are illustrated in Figure 3 below:

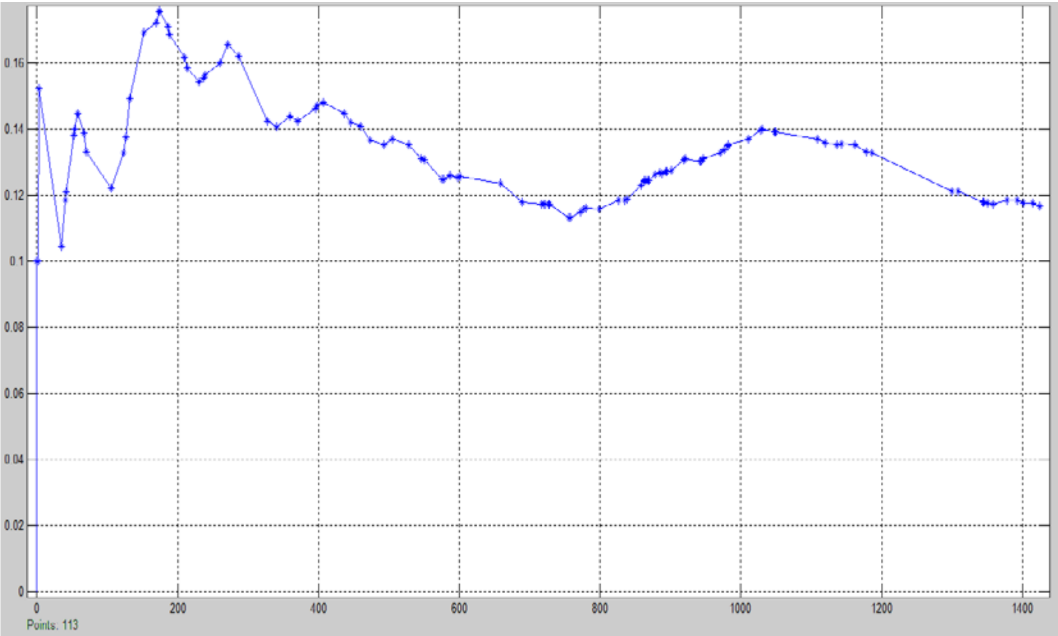

Figure 3. Average graph of service center utilization in 1 day.

From the results of simulation, it was found that in 1440 minutes of simulation, equivalent to 24 hours a day, the average waiting time for patients to receive services was 30 minutes, and in this simulation the service center could service 56 (fifty-six) service requests, so that it can be concluded that the service center can service all service requests quickly. The simulation results are illustrated in Figure 4 below:

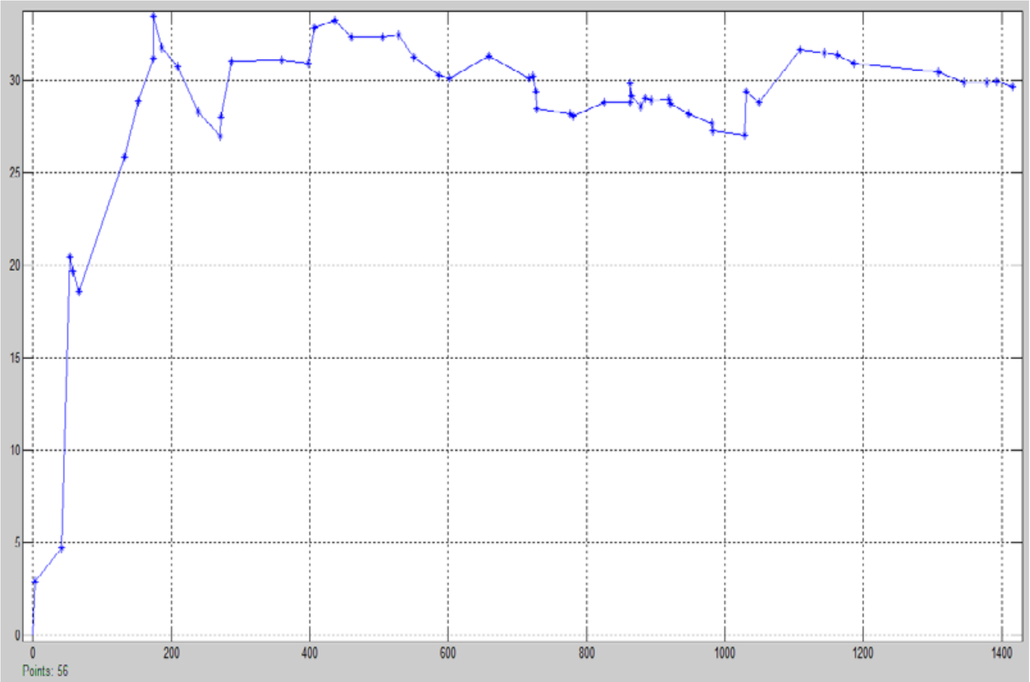

Figure 4. Graph of average patient waiting time within 1 day.

4. Conclusion

From the results of simulation, it was found that in 1440 minutes of simulation, equivalent to 24 hours a day, the average probability of a busy service center was 12%, and the average waiting time for patients to receive services was 30 minutes, so it could be concluded that the service center all service requests quickly.

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