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UTILIZATION OF TIMESTAMP RECORDS FOR AN HOSPITAL CENTRALIZATION WITH CONSIDERATION OF EMERGENCY CASES

S. Srinivasa Rao[#1], Mandagani Prathyusha[*2], Bathula Surekha Devi[*3], Naraharasetti Jahnavi[*4], Gummadi Sujay[*5],

#Asst.Professor,Department of Computer Science and Engineering,
K L University, Green Fields, Vaddeswaram, Guntur District, A.P., INDIA. Pincode : 522502
*Students, B.tech, CSE, K L University

Abstract

These days, enhancing the quality of healthcare services, such as shortening waiting time and/or providing open-access policy, becomes an important issue even in mid-size hospitals. Even in small to midsize clinics, computerized health care management systems have replaced traditional paper based patient charts and have stored into a database not only patient information but also service-process related information. We introduced some departments like tools, medicine and emergency in order to reduce the patient waiting time deals with the issue of utilizing such per-existing but incomplete data for simulation study. Such an assumption may be justified in cases were data requirement for simulation is precisely defined and all necessary data have been collected according to such requirement. Aiming at the healthcare management systems that maintain the log of operation activities using timestamps. We considered the reduction of patient waiting time as main problem criteria and worked out for it.

Traditional

simulation studies of a hospital centralization is very often assume only till the data centralization and data assumption. Aiming at any of the multi-specialty hospitals of INDIA, to reduce the time wasted for the patients we proposed the present system which can suggest the timestamp that the patient should wait until the doctor will be free for that particular patient. We also designed by consideration of emergency case interruption for the doctors.

1. INTRODUCTION

1.1 TERMINOLOGY:

In this section we first want to introduce the different terms that we were going to use in our paper as fallows.

1.1.1 Time Stamp: A time stamp is a sequence of characters, denoting the date and/or time at which a certain event occurred. A timestamp is the time at which an event is recorded by a computer, not the time of the event is recorded by a timestamp (e.g., entered into a log file) should be very very close to the time of the occurrence of event recorded.

1.1.2 Open Access Policy: Open access (OA) refers to unrestricted access via the internet to the required hospital website. It is more advanced and very easy method to admit in a hospital now a days even md-size hospitals are providing these services.

1.1.3 Transition Rate: In this particular research paper the world transition rate means the time taken by the patients to get through from one department to other department of the hospital.

1.1.4 Arena: It is a simulation software that is used for the represents of the any/all simulation processes. Arena is a discrete event simulation software simulation and automation software developed by Systems Modeling and acquired by Rockwell Automation in 2000. It uses the SIMA processor and simulation language. As of 2010, it is in version 13.0. It has been suggested that Arena my join other Rockwell software packages under the Factory Talk brand. In Arena, the user builds an experiment model by placing modules (boxes of different shapes) that represent processes or logic. Connector lies are used to join these modules together and timing, the precise representation of each module and entity relative to real-life objects is subject to the modeler.

1.1.5 Service Time: In this particular needed service i.e., to meet the doctor for consultation in the hospitals.

1.1.6 Arrival Rate: The mean number of new calling units i.e., the new patients arriving at a service facility per unit time.

1.1.7 Sensor Networks: Simulation studies of outpatient clinics often involve significant data collection challenges. We describe an approach for data collection using sensor networks which facilitates the collection of a large volume of very detailed patient flow data through healthcare clinics. Such data requires extensive preprocessing before it is ready for analysis. We present a general data preparation framework for sensor network

generated data with particular emphasis on the creation and analysis of patient path strings.

1.1.8 Magnetic Resonance Imaging: MRI is a fairly new technique that has been used since the beginning of the 1980s. The MRI scan used magnetic and radio waves, meaning that there is no exposure to X-rays or any other damaging forms of radiation. An MRI scan is also able to provide clear pictures of parts of the body and spinal cord. Because the MRI scan gives very detailed pictures it is the best technique when it comes to finding tumors (begin or malignant abnormal growths) in the brain. If a tumor is present the scan can also be used to find out if it has spread into nearby brain tissue.

1.1.9 Computed Tomography: A CT scan is a method of taking an image of brain. It is a procedure that produces a clear, two-dimensional image of the brain that shows abnormalities such as brain tumors, blood clots, strokes, or damage due to head injury. A CT scan can help identify the cause of Alzheimer like symptoms either by finding an abnormality or by ruling out certain conditions.

1.1.10 Out Patients: people waiting for consultations or procedures not admitted to hospital are defined as outpatients. Outpatient surgery, also known as ambulatory surgery, same-day surgery or day surgery, is surgery that does not require an overnight hospital stay. The term outpatient arises from the fact that surgery patients may go home and do not need an overnight hospital bed. The purpose of outpatient surgery is to keep hospital costs down, as well as saving the patient time that would otherwise be wasted in the hospital.

1.1.11 Distribution: In mathematical analysis, distributions (or generalized functions) are objects that generalize functions. Distributions make it possible to differentiate functions whose derivatives do not exist in the classical sense. In particular, any locally integral function has a distributional derivative. Distributions are widely used to formulate generalized solutions of partial differential equations. Where a classical solution may not exist or be very difficult to establish, a distribution solution to a differential equation is often much easier. Distributions are also important in physics and engineering where many problems naturally lead to differential equations whose solutions or initial conditions are distributions.

1.1.12 Appointment Scheduling: Based on the patients incoming and outgoing rates and the time available for the doctors the appointment i.e., time given to meet the doctor is scheduled in a hospital. This is called appointment scheduling.

1.1.13 Simulation: Simulation is the imitation of some real thing available, state of affairs, or process. The act of simulating some thing generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation can be used to show the eventual real effects of alternative conditions and courses of action. Simulation is also used when the real system cannot engaged, because it may not be accessible, or it may be dangerous or unacceptable to engage, or it is being designed but not yet built, or it may simply not exist.

1.1.14 Incoming Logic: There are three parts that we use in the arena software. The incoming logic is a first one and the incoming logic simulates the incoming time rates of outpatients.

1.1.15 Lobby Logic: There are three parts that we use in the arena software. The lobby logic is the second one and the lobby logic simulates the patient movements by interconnecting the incoming logic and the process logic.

1.1.16 Process Logic: There are three parts that we use the arena software. The process logic is the third one and the process logic simulates hospital services information about patient incoming rates, transition rates, and service time are needed for simulation model.

1.1.17 Capacity Planning: Here capacity means the capacity of time or staff and all other modules that effects the patients waiting time in a hospital. Capacity planning is the task of managing the time or staff in order to reduce the waiting time of patients.

1.1.18 Electronic healthcare management system: EHMS is the representation of data in electronic medical records. An electronic medical record (EMR) is a computerized medical record that is created in an organization that delivers care, such as a hospital or physician's office. Electronic medical records tend to be a part of a local stand-alone health information system that allows storage, retrieval and modification of records.

1.1.19 Financial Payoff: The amount necessary to pay a loan in full, with all accrued interest and fees and the prepayment penalty, if applicable. Payoff figures are usually provided to a closing company as correct on a given day. If closing is delayed, the lender has also provided a per diem charge to increase the payoff for every day of delay.

1.1.20 Ultra Sound Scan: Ultra Sound is cyclic sound pressure with a frequency greater than the upper limit of human hearing. Ultrasound is thus not separated from normal (audible) sound based on differences in physical properties, only the fact that humans cannot hear it. Although this limit varies from person to person, it is approximately 20 Kilohertz (20,000 hertz) in healthy, young adults. The production of ultrasound is used in many different fields, typically to penetrate a medium and measure the reflection signature of the medium, a property also used by animals such as bats for hunting. The most

well-known application of ultrasound is its use in sonography to produce pictures of fetuses in the human womb. There are a vast number of other applications as well.

2 THEORETICAL STUDY:

We can see a large number of patients waiting in queues for a long time in hospitals for treatment every day. Service sector has been developing day by day to keep up with the changing world conditions. This development accompanies with planning and management problems. Methods developed for the services provided in hotels, markets, restaurants, factories and hospitals are the new topics of literature. Among these sector is the most reviewed one. There have been rapid changes in the health sector. Several studies have been carried out about hospitals.

Hospital administration striving to provide the best service to the patients with limited staff and equipment imposes some measures to increase the satisfaction and productivity by optimizing the conditions. As technology and science progress, waiting for something causes loss of time for both individuals and institutions. In health sector, patient waiting due to the density causes cost loss.

Patient waiting may also lead progressing of disease and bring social and economic burdens. To minimize this, various measures such as increasing the system working tie or the number of doctors in the system should be taken. Simulation needs data. Collecting data is the key process of simulation. These data cannot be obtained from health units in hospitals. The data used in simulations is non-collectible but available. There are several factors affecting the waiting time in the department. These are insufficient number of junior doctors and working time or greater number of patient admitted to hospital.

3 METHODOLOGY:

To improve resource utilization and to reduce patient waiting time of general hospitals by modifying appointment system, planning the time schedule, and staff assignment. Reduce patient waiting time via appointment scheduling and by open access policy.

We can reduce the patient's waiting time by knowing the service time of each patient as waiting time for a patient is nothing but service times of previous patients. Service time is calculated by using 2 methods, based on two assumptions.

First the service time does not depend on the time or day or the length of waiting queue. Second, a server immediately serves the next patient when its queue is not empty.

3.1 Busy period method:

It is designed for busy periods. We assume that when any patient is waiting in a queue, the server takes no ideal time and immediately serves the first patient in the queue.

$$T^s_{t+1} = T^s_t + S^s_t + I^s_t \quad \text{---------- (1)}$$

$$T^s_{t+1} - T^s_t = S^s_t + I^s_t \quad \text{---------- (2)}$$

$$T^s_{t+1} - T^s_t = S^s_t \text{ (when } I^s_t = 0) \text{ --- (3)}$$

T^s_t – In time of a patient "t" at server "S"

S^s_t – Service time for patient "t"

I^s_t – Idle time of the server.

Here the idle time of the server is 0 because in busy period method the server mostly will not be in idle time. When identifying the busy period, we use the patient inter-department time (or patient inter-arrival time).

In a busy period, there always are patients waiting for services such that the patient inter departure time will have very little, if any, idle time in it.

3.2 IDLE PERIOD METHOD:

When server operation policy is complex and/or the patient arrival is sparse, the busy period method cannot be used to compute service time distribution. In such cases idle period method is used

We need to trace each movement and calculate the service time by using the timestamps of the patient generated by different servers. In comparison, The busy period method uses multiple patient's time stamps belonging to the target server. When the number of patients being served is small, the availability of servers will be high and patients can move through the series of services without waiting.

In such an idle period, the waiting time can be ignored.

$$T^s_t = D^{s-1}_t + I^s_t \quad \text{---------- (4)}$$

$$T^s_t = D^{s-1}_t \text{ (when } I^s_t = 0) \quad \text{----- (5)}$$

$$S^s_t = D^s_t - T^s_t \quad \text{---------- (6)}$$

$$= T^s_{t+1} - T^s_t$$

$$= D^s_t - D^{s-1}_t$$

T^s_t – In time of a patient "t" at server "S"

S^s_t – Service time for patient "t"

I^s_t – Idle time of the server.

D^s_t – Out time stamp.

4 LIMMITATIONS:

The proposed paper is only considering the mid-size hospitals. All the problems faced by the patients are not solved in this proposed paper. Only some of the

problems are solved such as reduction of patients waiting time and increasing the number of departments.

A short coming of the idle period method is that the number of sample size may result in less accurate estimation of the service time distribution. Thus patients waiting time is calculated and in order to reduce it we need give appointments with respect to certain times that can be allocated for certain patients.

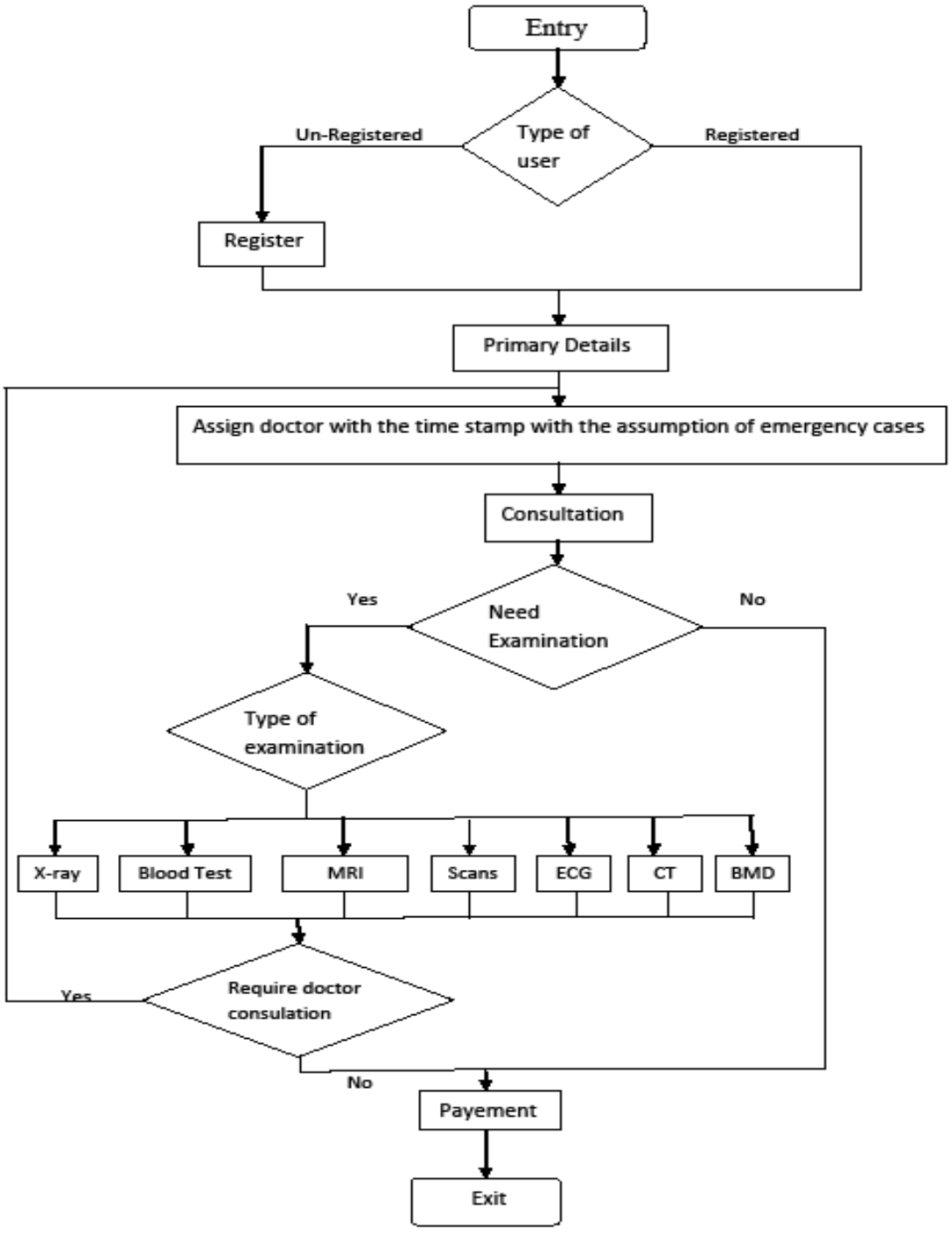

Figure 1: Patient Flow in the Hospital

A patient will enter into the hospital and get register first if he/she is not yet registered, then they will give some primary details about the disease basing on such details we (the hospital staff) have to assign a time slot for the patient. Allotting the slots is the major thing that we need to consider to reduce the patient's waiting time here we have to assume some emergency cases before allocating the slot. It should be make sure that even for the first patient the time should not be 0 (assuming that there will be emergency cases always) and for second (next) patient to go to the same doctor the emergency case time and first patient's time will be added, after that the patient will be send for the consultation if doctor advices for any examinations like X-Ray, Blood test, ECG, Scanning (MRI, CT etc) then patient has to go for the test and if the results demands to go for doctor's consultation again patient has to consult doctor and take correct prescription then go to payment counter after payment patient will exit.

5. RESULTS

5.1 SERVICE TIME DISTRIBUTION:

We need to compute the service time of each process. The service time distribution is derived from the three methods described as busy period method Busy Period Method, Idle Period Method and Emergency Period Method. The estimated service times were presented in Table.

Process	Mean	Variance	Standard Deviation	Methode Use
Check-in	128	20417	142	Busy
Consultation	324	48254	219	Busy
X-Ray	316	7084	84	Busy
Ultrasound	998	86600	294	Idle
CT	2011	43277	208	Idle
MRI	5012	859757	927	Idle
BMD	1517	157010	396	Idle
Payment	200	3056	55	Busy
Lab Test	1215	367348	607	Idle

Table 1. Service Time Distribution (in sec.)

5.2 TRANSITION RATES:

We also need to figure out how each of our patients moves inside the hospital. Using the timestamp created either at the beginning or at the end of each process, we compute the transition rates between processes.

From- To|	Check-in	Consultation	X-Ray	Ultrasound	CT	MRI	BMD	Payment	PT	Lab Test	Exit
Check-in	0	80.60	0.15	0.02	0	0.001	0	32.52	0.79	0.5	2.3
Consultation	3.5	0	52	0.77	0.56	0.85	0.99	87	5.76	3.38	1.7
X-Ray	2.3	67	0	0.13	0.28	0.67	0.12	3.56	45	0.45	0.33
Ultrasound	3.01	16.17	12.41	0	0.13	0.92	1.63	16.98	0.54	23.67	27.44
CT	2.34	65.27	39.21	0.45	0	0.11	5.26	9.09	0.98	1.89	9.32
MRI	12.23	75	6.23	0	0.23	0	1.35	6.23	0.47	6.7	9.5
BMD	0.1	17	79	1.20	0.005	9.45	0	13.55	0.23	4.56	9.5
Payment	0.23	0.76	0.85	0.01	0.97	0.28	0.9	0	48.14	5.51	45.51
PT	7.687	8.53	0.05	0.13	0	0.13	0.005	5.07	0	0.83	84.8
Lab Test	5.9	9.45	10.8	3.56	0.57	5.89	8.65	9.47	8.9	0	57.89
Pharmacy	0.12	69	2.09	0.36	0.5	3.46	2.32	8.64	4	8.1	0.56

Table 2. Transition Rates (in %)

6. CONCLUSION

An effective method of computing the service time distribution from incomplete timestamp information. Proposed method for a case study of a mid-size hospital. The proposed model also consists of adding number of departments for reducing the patients waiting time. The departments added here will be considering the emergency cases of those doctors every time and give the timestamps to the patients in an variant of range of time. So that the wastage of the time of the patient was reduced to maximum extent. In the same way the reduction of some viral and bacterial diseses in the hospital arena was reduced such that the number of patients waiting in the hospital and the time a particular patient staying in the hospital was reduced very much.

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