

DEVELOPMENT AND IMPLEMENTATION OF DATABASE MANAGEMENT SYSTEM IN HEALTHCARE CENTERS

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ABSTRACT

The current research paper describes the development process of relational database management system in one of the private, multidisciplinary, local hospitals of Uzbekistan. Initially the requirements, operation processes, and data recording points of the hospital has been analysed. Following, the relational database has been created using MS SQL server, based on all the requirements found. In the second stage of the research, the operations flow of the Hospital has been modelled in Simul8 tool. Further the end results has been analysed, to find out if the DBMS implementation can really benefit the hospital and improve the operations by removing queues in several bottleneck touchpoints of the hospital.

Keywords: Data, DBMS, hospital DBMS system, Simulation model, Simul8, SQL.

INTRODUCTION

The hospitals in developing countries, including Uzbekistan is still referring to papers instead of computers to record and store the data. As it has been stated by Wijesekara (2020) in some Asian countries the manual paper based systems are still in use, even though it has a range of drawbacks like document and data stored on paper will be lost, loose quality or become illegible at all.

The main aim of this paper is to develop user friendly, electronic, SQL based database management system for a local hospital to eliminate operations related problems such as, long registration processes, inaccurate data recording and storing, lack of information sharing and retrieving, and other time consuming processes faced due to manual paper based hospital system.

METHODOLOGY

By considering the requirements of the hospital, the list of hospital departments that needs to be included in database is listed and database schema is created. Following questions are clarified:

- How many data tables must be created
- What degree of relationship they will have (one to one, one to many, many to many)
- Should they have optional or mandatory relationships
- Maximum and minimum participation in the relationship
- How many attributes should be recorded in each table
- Types of attributes (int, var, varchar, identity, decimal etc.)
- Additional trigger and check constraints

For the research, the relational database is created using Microsoft SQL server. The ability to construct meaningful information by linking the entity tables is the major advantage of the relational database system. Understanding the relationships between the data, or how the tables relate, can be accomplished via joining them. SQL supports joining, grouping, and combining queries. Basic math and subtraction functions, as well as logical transformations, are available in SQL. The results can be sorted by date, name, or any column. (Education, 2022) The relational database driven SQL has several benefits compared to other types of databases. For instance, it is flexible making it possible to do changes to the

tables easily, it allows easily backup and thanks to easy export and import functions, the recovery of data is also possible. What is more important, thanks to relations between the tables, the data will not be redundant, and no double insertion is required for several tables. With just one linkage, the data can be transferred between different data tables and interfaces easily.

Results

Initial Entity-relationship model provided below illustrates and describes the interrelated operations of specified domains of hospital. It includes main entities with their attributes along with the relations. The ER diagram has several binary and one ternary relations. What is more the parent and child relation has also been constructed while developing “Employer”, “Doctor”, “Nurse” and “Staff” relations.

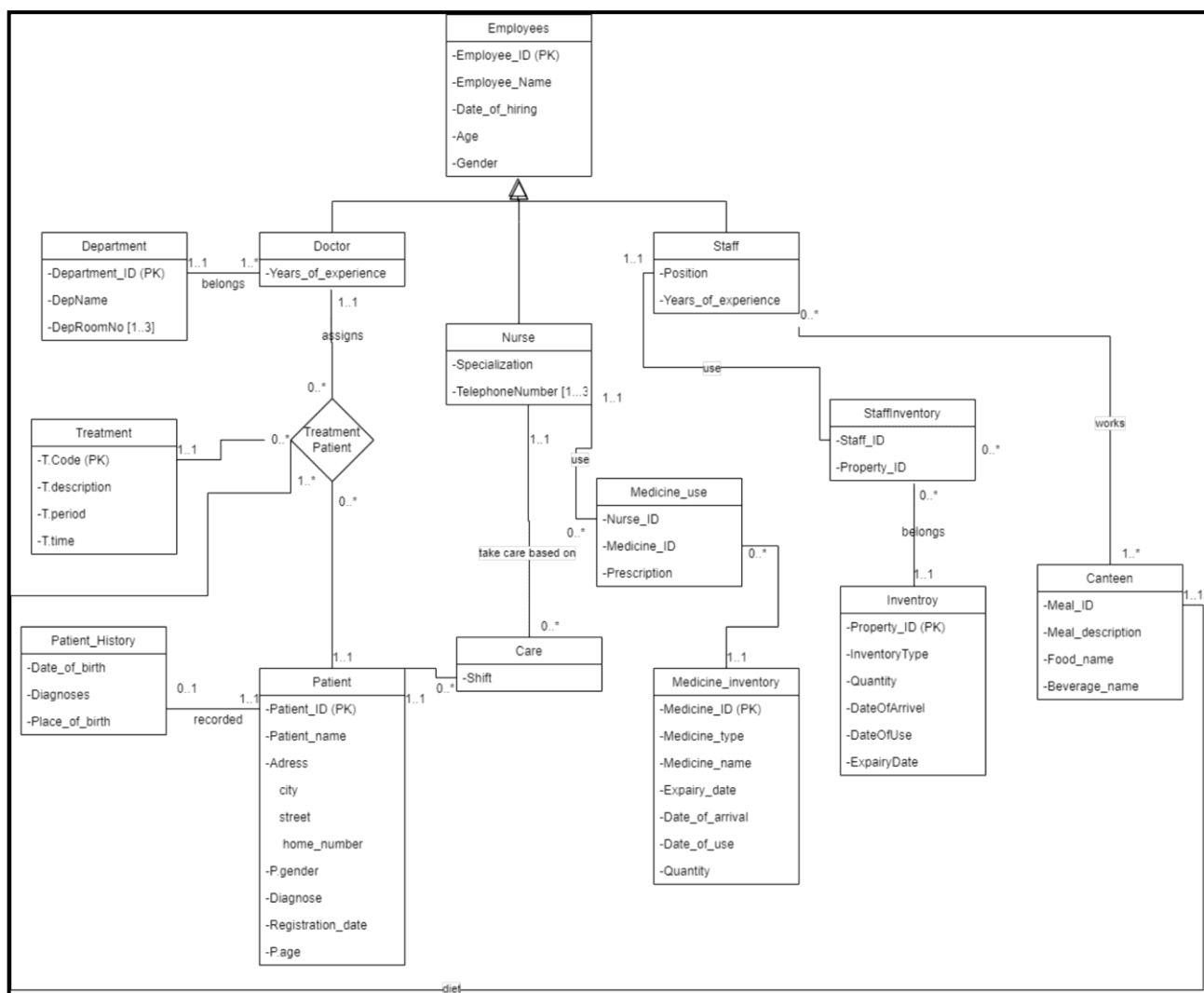


Fig. 1. The Entity-relationship model of Hospital database

The next step of the research was to build the database in MS SQL. The visual result of the process in the form of relational database diagram is provided below.

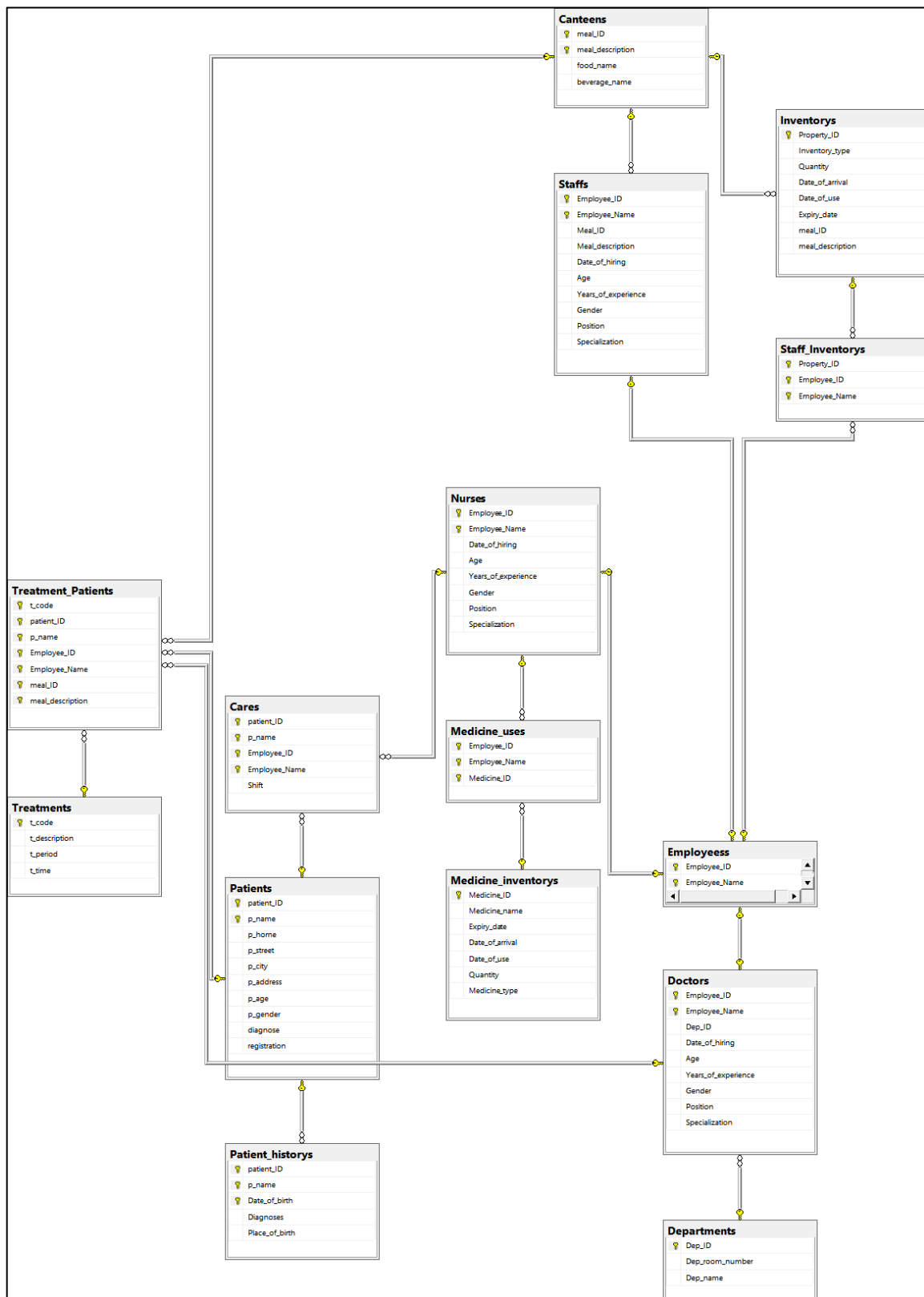


Fig. 2. The relational database diagram of Hospital in MS SQL

DISCUSSIONS

The research developed the following hypothetic results of developed database in the operations of the hospital.

The created DBMS covers all aspects of operations and records the data on each touchpoint of patient serving process in the clinic. The relations between the entity tables allows transacting and sharing the patient data between each stakeholder. Consequently, the bureaucracy, time consuming paper works and awaiting long queues will be diminished

Recording all the data of operations, like employee data or inventory data, the hospital will be able to control the operational aspect of the business, while patient data can be used to improve the services and do scientific research on healthcare sphere. Considering these aspects, additional constraints, triggers and export scripts have also been created. These additions allows the hospital to gain the needed results.

The numeric expected results of the implementation has also been put into simulation model in order to have the real visual result infographics. For this purpose Simul8 software has been used. The simulation model itself has been built according to standard patient flow that occurs in almost every hospital, however, the input data was uniquely recoded, analysed, and used based on observation.

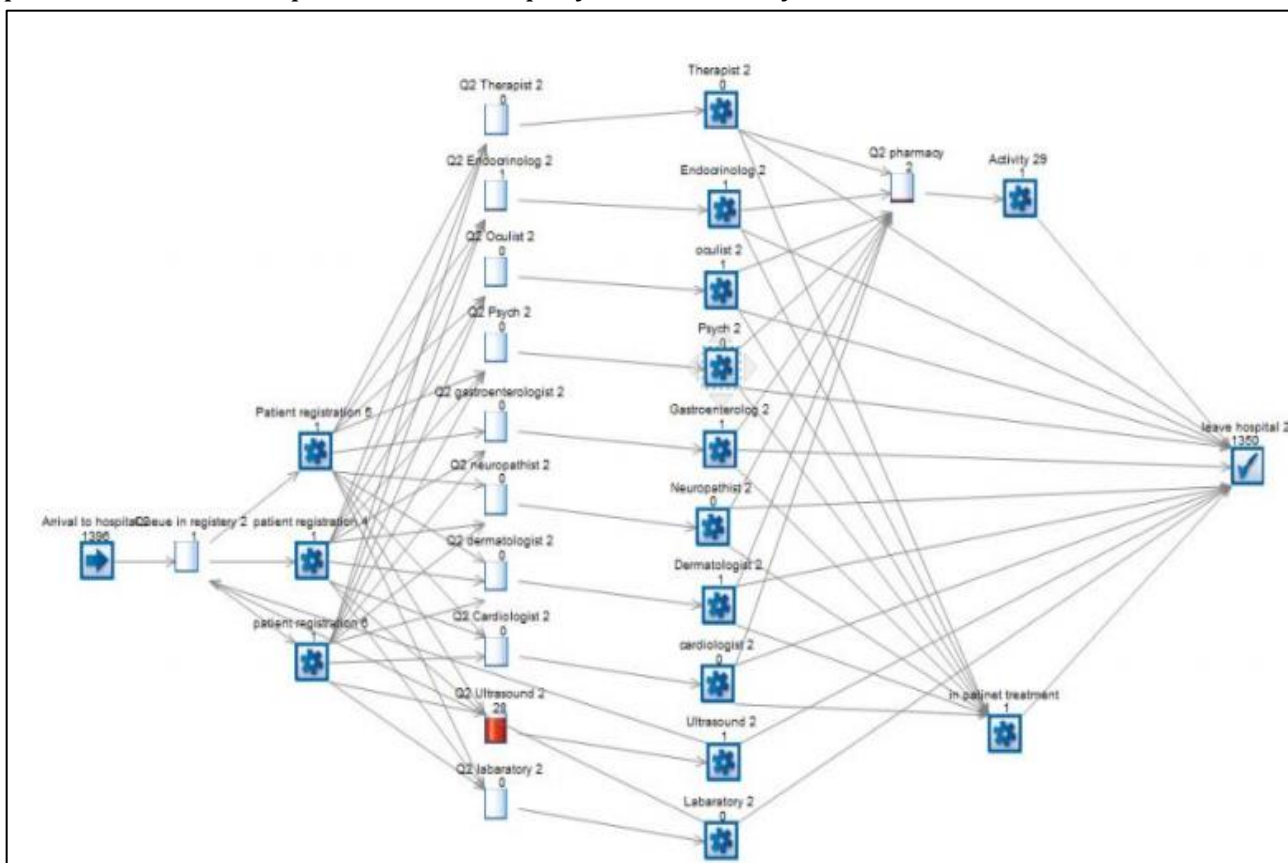


Fig. 3. The simulation model of the queuing flow within a hospital.

The simulation model has been run twice with two different data set. The first data set considered the current working peace and time spent in the queue in hospitals. And the second data set considered the expected improvements in the operations and the resulted queuing time within the queuing system of the hospital. The infographics of queue data shows the noticeable results compared to initial results. The total queuing time in the reception desk has diminished from 1600 minutes to just 73 minutes, having 33% customers waiting just several minutes. The results for other parts also noticeable, since now the waiting time for all processes apart from ultrasound cabinet has the maximum total waiting time less than 80 minutes, with majority of customers waiting up to 1 to 7 minutes in total.

CONCLUSION

All in all, the DBMS implementation and computerisation of the local hospitals of Uzbekistan can significantly improve the internal operations of the organisations. Digitisation of the healthcare centres can have following results:

- Overall satisfaction from the healthcare service – less queues less anxiety, more satisfaction
- Better customer service in each touchpoint of the patient journey – starting from registration, to doctors office and further treatment processes
- Better operations control and supervision by authority – the data analysis allows hospital authorities to manage the services and improve it
- The room for improvement and further researches in healthcare industry – the patient data, patient history data, treatment processes data accumulated in databases allows researchers in healthcare system to do more innovations and discoveries in this field

The results of the project can be followed up by several suggestions regarding the operations, implementation processes and other aspects. For instance, the hospital is recommended to supply the staff members with needed technological hardware such as laptop or tabs. This will allow implementing the DBMS within the hospital, and will give the interface access to insert and get the data from database without any problems. These technologies does not cost much these days, and the benefit acquired from DBMS implementation supplements these costs.

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