ANALYZING, DESIGNING AND IMPLEMENTING A WEB-BASED COMMAND CENTER SYSTEM

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Abstract - *Command Center construction and design is more complex and challenging than ever before. New organizational challenges, new technologies, and evolving threats have made Command Center design more challenging than ever. This work will focus on analyzing and implementing a Command Center (911CC) for Imam Abdulrahman Al Faisal Hospital which is located at Dammam city, the challenges of designing technologies for Command Centers. In the proposed 911CC, the UML offering several diagrams to enable the new functions to be updated and added easily such as use case and functional decomposition diagrams. The proposed 911CC will help for receiving and recording communications, locating callers quickly and accurately using caller extension without requesting a lot of information (location, building number, floor number and room number) from the caller and the acquired information will be sent directly to the Civil Defense, Medical Ambulance and Police based on the reported case. This speeds up the rescue and response for the case reported.*

*Key Words***:** Command Center, Information System and Unified Modeling Language.

1. INTRODUCTION

Imam Abdulrahman Al Faisal Hospital in Dammam is one of the Ministry of National Guard Health Affairs Medical Cities. It was officially opened on October 14th 2002. It is considered one of the leading hospitals in the Eastern Region due to the international accreditation from JCIA for its recognized efforts. The hospital accommodates 112 beds, an Intensive Care Unit of 6 beds, Neonatal Intensive Care Unit of 5 beds, 4 Operation Rooms, and 4 Delivery Rooms all equipped with the latest high-quality medical devices to provide the best services for patients. Imam Abdulrahman Hospital's location between Dammam, Al Khobar and Dhahran -the most important cities in the eastern region- make it a strategic location.

2. Related work

A new electronic service launched by the Civil Defense in the Kingdom of Saudi Arabia (KSA) called "فزعة (Fazaah)" [1]. This service is designed to facilitate the reporting of incidents such as fire, rescue, detention, etc. This service operates through an electronic application on smart devices and can be used for all categories of society. The Authority mentioned that the application is very helpful to people with special needs in particular. The application has many advantages, notably: determining the geographical location of the message sender, the possibility of identifying another location for the incident other than the message sender current location, the possibility of pre-positioning the recipient's locations such as home, work place ... etc. Figure 1 shows the "فزعة" application interfaces.

Figure -1: "فزعة" application interfaces [1].

The Saudi Red Crescent has also launched the "Asafni أسعفني " application to receive emergency service requests via smart phones to increase the accuracy of the location [2]. The application user can also send an urgent emergency message to the Red Crescent and its close contacts via SMS. The implementation of the application is not limited to the request of the Red Crescent ambulance service but also defines the user of the application to nearby medical facilities, such as hospitals, dispensaries and pharmacies, along with drawing the path on the map of the facility that the user wishes to go to. Figure 2 shows the "أسعفني" application interfaces.
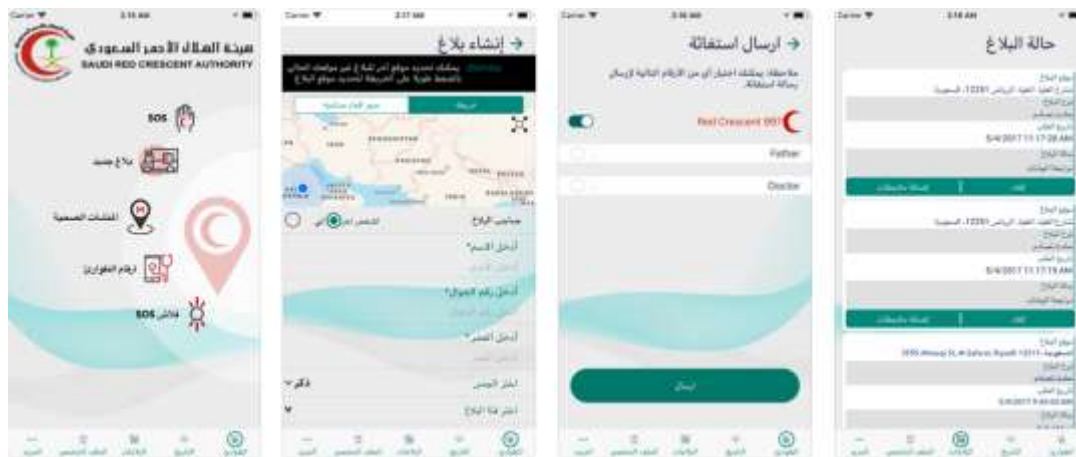

Figure -2: "أسعفني" application interfaces [2].

The core of the integrated medical system is the call centers, which in turn enhance the success of the medical sector in responding to patients, doctors, nurses and employees quickly and accurately while maintaining quality of service and compliance with the relevant laws and regulations. Therefore, delivering the right information to the right person at the right time can in turn improve patient safety, increase satisfaction, and raise the level of work efficiency, sometimes it may make the difference between life and death, and at last, quality is the key to successful service.

The technological revolution influenced everything [3-24], even the methods of marketing, business and educational applications for the real world business issues. Today, the use of Artificial Intelligence (AI) algorithms is expansive, particularly in providing solution to challenging problems including image segmentation [25-34], analysis of medical image [35-39], nurse rostering problem [40], Healthcare Monitoring system [41, 42], patterns recognition and retrieval of information [43-60], Learning Management System [61-68], as well as prediction of river flow [69-71]. Accordingly, the combination of human and artificial intelligence have been utilized to design and implement a command center system using advanced analytics in a purpose-built space will help caregivers help patients, all the time [72].

The rest of the paper is organized as follows; Unified Modeling Language (UML) will be described in section 3, database testing and construction will be illustrated in section 4. System implementation will be illustrated in section 5. Results will be discussed in section 6. Finally, the conclusion is presented in section 7.

3. Unified Modeling Language (UML)

The Unified Modeling Language (UML) is a standardized modeling language consisting of an integrated set of diagrams, developed to help system and software developers for specifying, visualizing, constructing, and documenting the artifacts of software systems, as well as for business modeling and other non-software systems. The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems. The UML is a very important part of developing objects oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects. Using the UML helps project teams to communicate, explore potential designs, and validate the architectural design of the software [73-77].

3.1 Use Case Diagram

A use-case model describes a system's functional requirements in terms of use cases. It is a model of the system's intended functionality (use cases) and its environment (actors). Use cases enable the developers to relate what they need from a system to how the system delivers those needs [76, 78-81]. Figure 3 shows the use case diagram for the actions that the actors (Seller, Bidder and Admin) can perform in an auction.
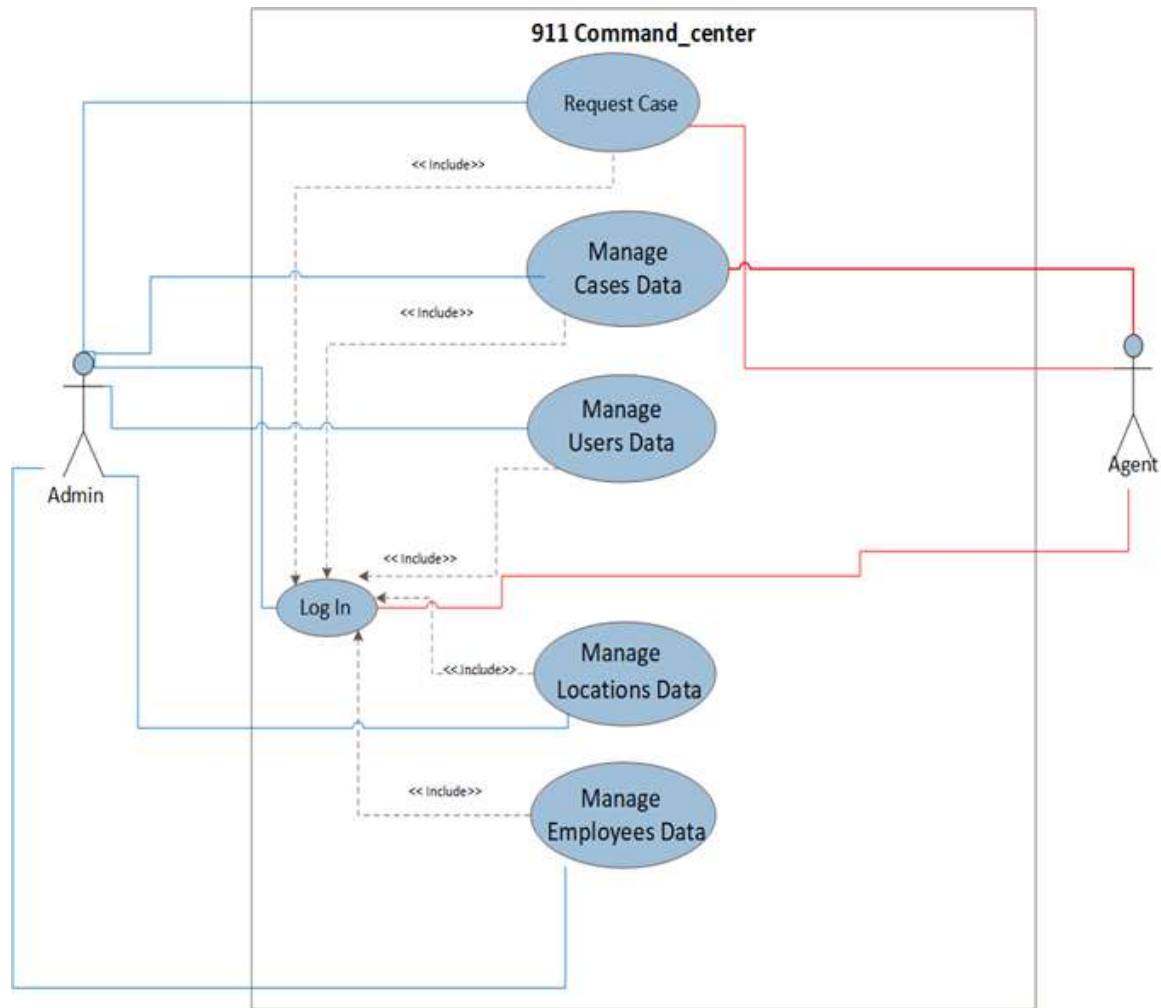
Figure -3: The use case diagram.

Mainly 2 actors (Admin, and Agent) will be interacting with the proposed system; each one can do the following:

- **Admin**:
  - ✓ Admin can request case
  - ✓ Admin can manage cases data
  - ✓ Admin can manage users data
  - ✓ Admin can manage locations data
  - ✓ Admin can manage employees data
- **Agent**:
  - ✓ Bidder can request case
  - ✓ Bidder can manage cases data

3.2 Functional Decomposition Diagram

A Functional Decomposition Diagram (FDD) is a picture that engineers draw to help them to understand how all of the general tasks and subtasks in a design fit together. They use tree diagrams because these are good for showing how big things can split into smaller things. Figure 4 shows the functional decomposition diagram for the proposed 911CC system.
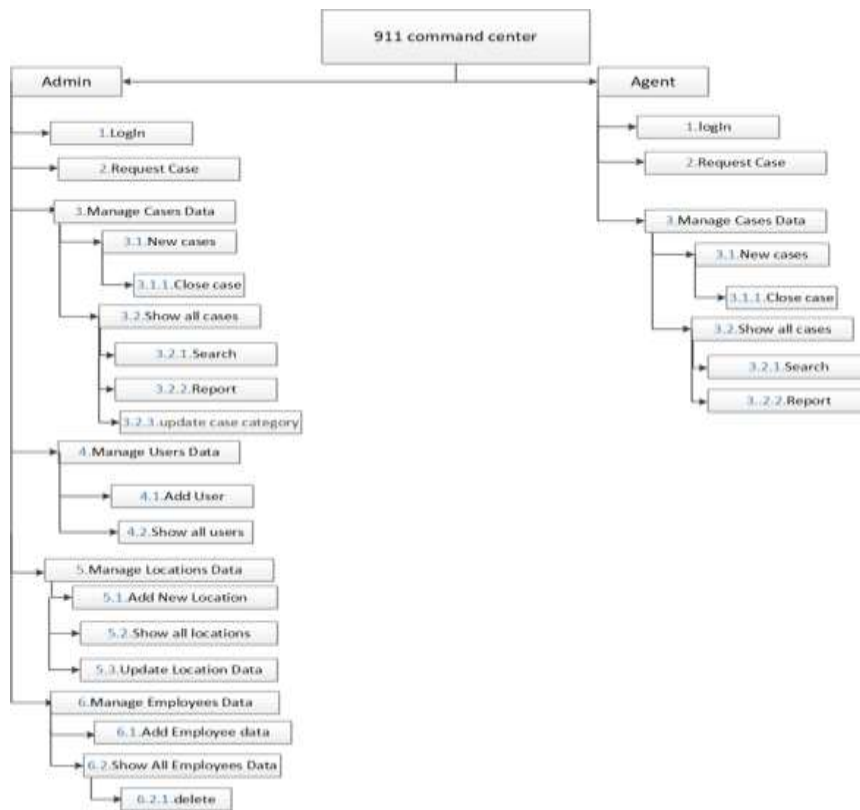
Figure -4: The functional decomposition diagram for the proposed 911CC system.

3.3 Entity Relationship Diagram

An ER diagram shows the relationship among entity sets. An entity set is a group of similar entities and these entities can have attributes. In terms of DBMS, an entity is a table or attribute of a table in database, so by showing relationship among tables and their attributes, ER diagram shows the complete logical structure of a database [82-85]. Figure 5 demonstrates the ER diagram of the proposed 911CC.
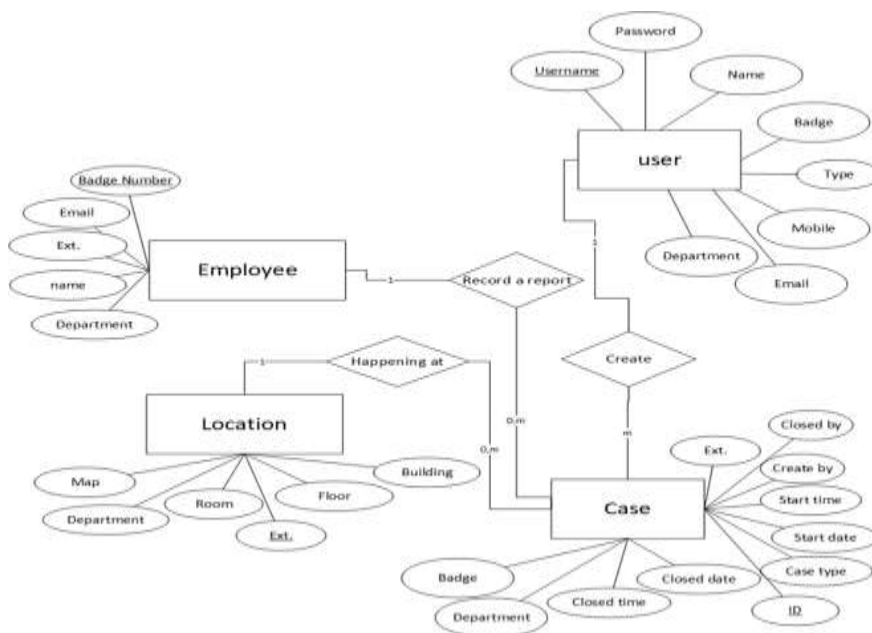

Figure -5: The ER diagram of the proposed 911CC.

4. Database Testing and Construction

The database testing is essential for finding errors that can affect the security, consistency, reliability and performance of the system, and it is important for system validation against the user specified requirements [86, 87]. SQL was used for database implementation. The tables below are examples of the created tables.

Table -1: Users table

	Name	Data Type	Allow Nulls	Default	
▸○	userName	char(10)	☐		
	password	char(10)	☐		
	name	char(100)	☐		
	badge	char(10)	☐		
	type	char(10)	☐		
	department	char(50)	☐		
	mobile	char(10)	☑		
	email	nvarchar(100)	☑		

Table -2: Employee table

	Name	Data Type	Allow Nulls	Default	
▸○	badge	int	☐		
	name	nchar(50)	☐		
	department	nchar(50)	☐		
	Ext	nchar(10)	☐		
	email	nchar(70)	☑		

Table -3: Locations table

	Name	Data Type	Allow Nulls	Default	
▸○	Ext	int	☐		
	bulding	nchar(50)	☐		
	floor	nchar(10)	☐		
	room	nchar(10)	☐		
	department	nchar(50)	☐		
	map	varchar(MAX)	☐		
	biulding_map	varchar(MAX)	☑		

5. System Implementation

This section shows the proposed work's artifacts in addition to the implementation which came after the system analysis and design. The system analysis and configuration results of the proposed system are presented. ASP.NET programming language has been used relying on their features that make them appropriate for this work. The figures below are examples of the designed and implemented interfaces. The figures below are examples of the implemented interfaces.
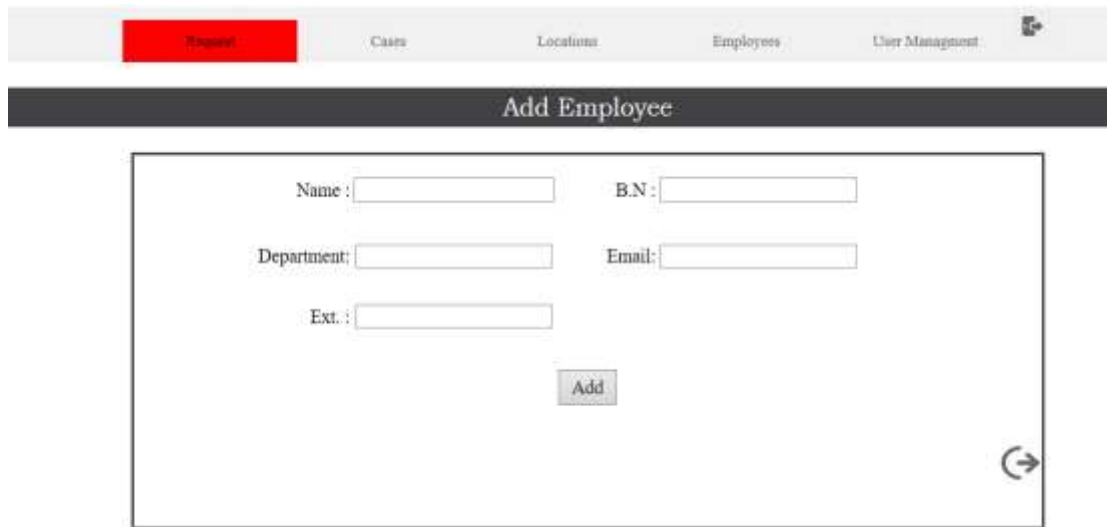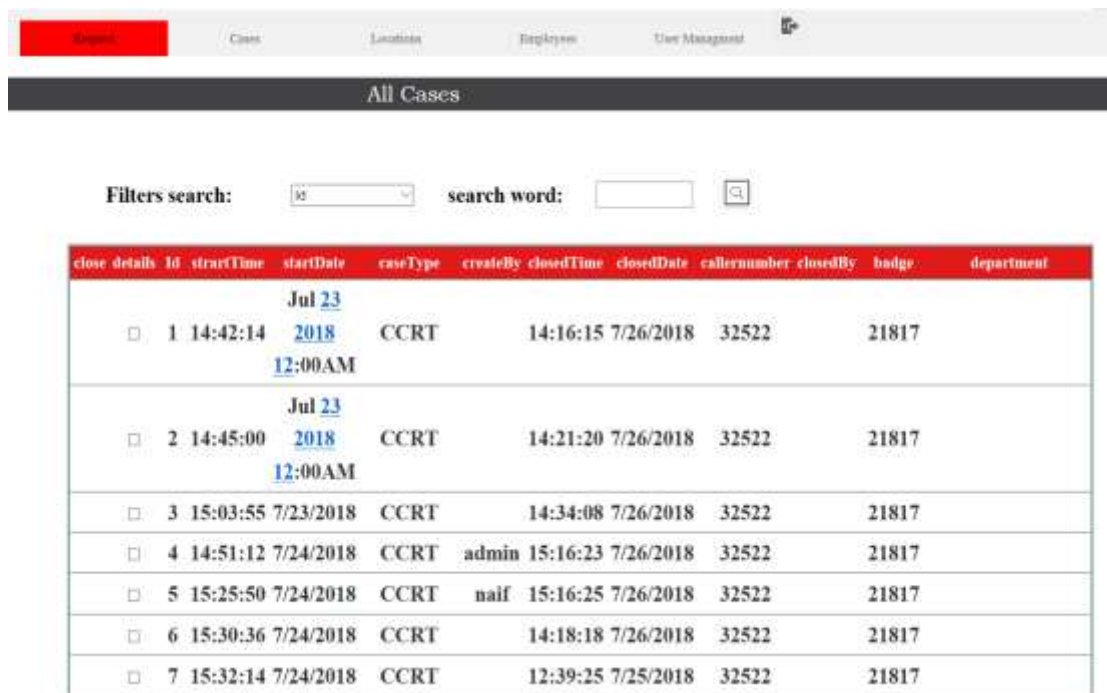

Figure 6: Log in interface.

Figure -7: Employee interface.

Figure -8: Management of Cases data interface.

6. Results and Discussion

The proposed system has been tested in order to measure its usability, where the proposed system was tested by operating on Internet Explorer, Google Chrome and Mozilla Firefox with are the local host server. Thirty students evaluated the system prototype from Imam Abdulrahman Bin Faisal University (IAU). After given a brief explanations about how to use the system, the students have tested the proposed system and answered the survey questionnaire (contains 10 questions measured by 5-point Likert Scale). The aim of the proposed survey is to measure the user's satisfaction about the proposed system and to prove its usability. The results obtained show that high percentage of the students approve that the OAS is usable, useful and achieved the main project target (see table 4).

Table -4: The results of data collected from the 30 students.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Strongly disagree										
Disagree										
Neutral	10	7	8	9	9	8	10	6	9	12
Agree	8	14	10	7	12	8	14	15	14	10
Strongly agree	12	9	12	14	9	14	6	9	7	8

7. Conclusion

This paper highlights the best practices in building and designing a Command Center (911CC) for Imam Abdulrahman Al Faisal Hospital which is located at Dammam city. In this work, we designed and implemented a Command Center (911CC) using the UML, SQL and ASP.NET programming language. The proposed 911CC will help for receiving and recording communications, locating callers quickly and accurately using caller extension without requesting a lot of information (location, building number, floor number and room number) from the caller and the acquired information that will be sent directly to the Civil Defense, Medical Ambulance and Police based on the reported case. This speeds up the rescue and response for the case reported.

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