Original Article

Doctor-Patient Queue for Emergency Contact Appointment Registration

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Abstract - *Mobile health applications (mHealth) are instantly and easily accessible to ordinary users of mobile devices, so mHealth applications can improve healthcare services availability and the ability to communicate information easily and quickly. Our proposed application scope contains all hospitals, a list of private doctor's clinics with their addresses on Google Maps and contact information, and an appointment booking service. Besides, the application will contain tips for pregnant women throughout pregnancy and the necessary information about what to do in each month of pregnancy with the service of knowing the date of delivery. The application used many algorithms techniques for searching like a linear search algorithm, selection sort algorithm, Queue, and Stack.*

Keywords - *Cuckoo Search Algorithm (CS), Patient compliance, Bat Algorithm (BA), Smartphone, IoT.*

1. Introduction

Pregnant women and newborns have been regarded as a private matter belonging to the realm of midwives and mothers for centuries. In Europe, public health services for maternal and child care have been in place since the late 1800s. Since some countries claim that unhealthy children jeopardize military and cultural aspirations, maternal and child health has been viewed as a political, economic, and military concern. As time passed, Medical, charitable, and government authorities gradually saw maternal and child welfare as a genuine cause in and of itself. At the same time, Women's groups and organizations raised the issue of women's and children's welfare. In the twentieth century beginning, maternal and child health became a top priority for the state, with accompanying obligations. The basis of a healthy population is healthy children. For maintaining a healthy child, health care must be started even before pregnancy and continued during and after pregnancy. One of the essential factors that affect the mother's and the fetus's health and development of the fetus during pregnancy is proper nutrition. During pregnancy, the low quality of pregnancy was correlated with maternal gaining weight, increased preterm birth rates and preeclampsia rates, and or raising the risk of abortion. Besides, gaining weight and unbalanced diets, especially among obese pregnant women, are specified as one glucose abnormal tolerance risk factor. These include lower fetus growth, lower birth weight, and increased chronic disease risk later in the baby's life. The alleged binds between chronic diseases and their effects on the fetus and pregnant women have been an active subject of discussions; however, the hypothesis has been proven by several recent reviews and studies [1].

Between July and October 2015, a survey was conducted on mothers of all nationalities having children aged one year or younger. They were inducted by adequate sampling from 25 clinics they visited for regular infant vaccination. Face-to-face interviews and questionnaires developed and validated by Dasman Diabetes Institute (DDI) have been used to gather data. All interviews were performed by Kuwait University medical students who had been qualified to use the survey. The interviews were conducted in Arabic or English, according to the respondent's preference. The survey was started with the ethical approval of the DDI Board and the Kuwaiti Health Ministry. All participants gave their informed acquiescence forms. Infants ranged in age from three months to one year: 27% were under three months old, 41% were three to five months old, 21% were six to eight months old, and 10% were nine months to one year old. About half of the mothers (49%) are Kuwaitis, while 51% are non-Kuwaitis. Non-Kuwaitis were underrepresented, given that expatriates account for roughly 70% of Kuwait's overall population. The survey covered all six health administrative regions, but the response rates diverged: 41% of Hawally district mothers. 27% of Jahra mothers, the capital (13 percent), 11 percent from Ahmadi, 6 percent from Farwaniya, and Mubarak Al-Kabeer were among the others (0.5 percent). The majority of mothers in this age group (40%) were between the ages of 26 and 30, with 24% being between the ages of 21 and 25, 24% were between the ages of 31 and 35, and 12% were between the

ages of 36 and 36. More than two-thirds of student mothers (68%) had a diploma or higher degree, while only 30% of mothers (almost a third) had finished high school. 50% of the respondents said they did not work or study six months before birth; 36% worked full-time; 13% worked part-time or were students [2].

Table 1. Participant characteristics according to breastfeeding pattern at discharge from hospital among a convenience sample of mothers (n 1484) with infants aged 12 months or less, Kuwait, July–October 2015 [2]

	Breast-feeding pattern at discharge from hospital		
Variable	Fully breast-feeding (Valid %)	Partially breast-feeding (Valid %)	Fully formula-feeding (Valid %)
Total	36.5	37.0	26.5
Mother's age			
21-25 Years	43.5	36.8	24.5
26-30 Years	36.9	36.8	26.3
31-35 Years	32.9	39.6	27.5
$\geq$ 36 Years	27.4	42.7	29.9
Nationality			
Kuwaiti	24.3	43.3	32.4
Non-Kuwaiti	48.3	31.0	20.7
Employment status 6 months prior to delivery			
No employment or studies	41.9	33.8	24.3
Full-time employed	33.0	41.8	25.3
Part-time employed	26.1	23.9	50.0
Student	25.0	47.6	27.4
Education			
Primary	44.0	32.0	24.0
Secondary	35.0	38.8	26.3
Diploma/University	36.1	36.9	27.0
Skin-to-Skin Contact			
Without skin-to-skin contact soon after delivery	31.0	40.8	28.2
With skin-to-skin contact soon after delivery	40.7	34.0	25.3
Sources of breast-feeding information			
Nurses	62.3	26.1	11.6
Paediatrician	39.6	31.4	29.0
Friends	30.5	41.5	28.0
Mother or Grandparents	35.2	38.0	26.8
Self-found	36.2	36.6	27.2

Abdullah Albassam, and Abdelmoneim Awad, created a study designed based on a questionnaire survey. The survey conducted was in Kuwait, a middle east country. It has an area of around eighteen thousand km 2 and a population of around three million individuals approximately (2011 estimates). The survey was conducted between March and December of 2015, with a study community consisting of pharmacists working in Kuwait. The preliminary survey contained four sections. Demographic and other characteristics are listed in Section one. Section two contains eleven questions; these questions cover the pharmacists' services of the community, which provide self-care during the pregnancy phase and lactation. According to the survey, the best services for both pregnant and lactating women were vitamins and supplement recommendations, almost 90%, and contraceptive advice, almost 83%, consecutively. More than 50% of the respondents demonstrate that their recommendation of medications includes constipation, nausea, sore throat, runny nose, headache, cough, vomiting, insufficient milk, cracked nipple, and indigestion. Symptoms, such as diarrhea, insomnia, hemorrhoids, varicose veins, feet and legs swelling, itching of vaginal, fever, back pain, mastitis, and inflammation, are often returned to doctors. Drugs use recommendations were sometimes unsuitable from where unnecessary drug treatment, unauthorized use, and drugs use safety.

Regarding counseling and solution to medicines and health difficulties of lactating women and pregnant women, above 50% of pharmacists showed that they have sufficient knowledge (50.5%) and confidence knowledge (53.1%) consecutively. The generality of participants, almost 88%, agreed on the fact that a continuing education program on the subject would be a valuable addition to their practice. Current results conclusion indicate that respondents have various recommendations for treating diseases associated with pregnancy and lactation. It also highlights the need for interference regarding continuous professional development and university pharmacy curricula revision [3].

For hospitals, the value of service quality cannot be overstated. Today, similar to all other public and private institutions in the environment of highly competitive healthcare, hospitals face the need to measure their both financial and non-financial performance functions, such as costs, profitability, revenues, and service quality, and raise their competitiveness. Measuring the performance of health services is a difficult challenge that involves a diverse variety of stakeholders. The quality of service is one of the eight fundamentals recommended for measuring performance. When it comes to selecting a hospital, customer determinants and perceptions of service quality are crucial. As a result, the patient's perspective on service quality should be measured and assessed regularly. It should be a proposed measuring tool to scale the difference between the priorities of the patient and his perceptions, as well as balance the patient's perspective with management [4].

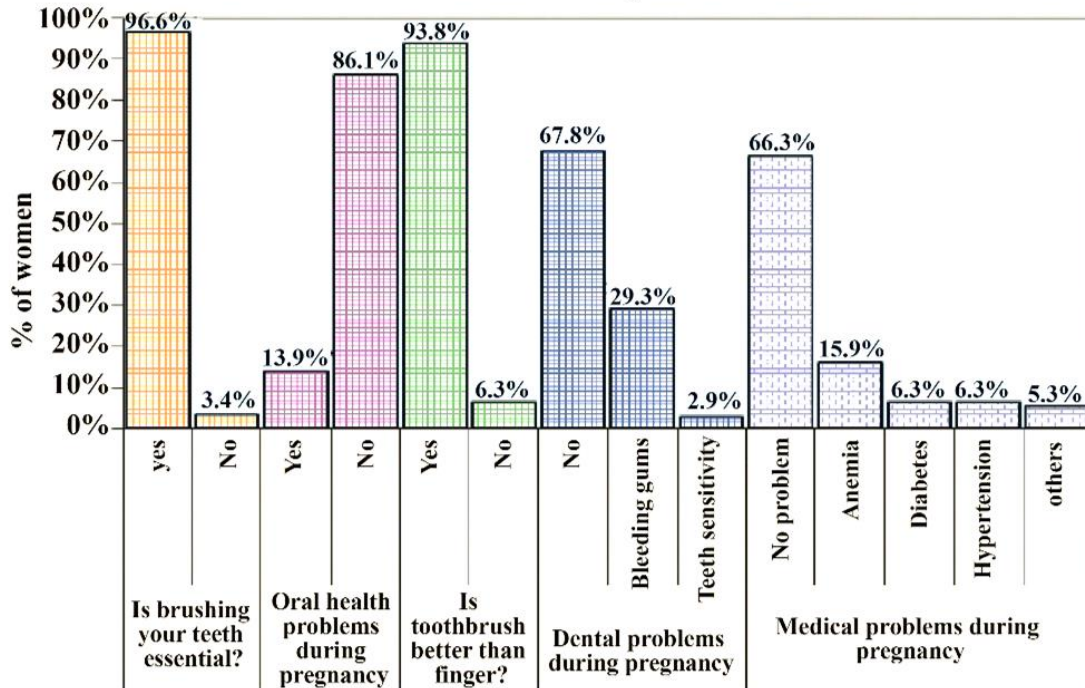**Table 2. Characteristics of respondents (n=192) [3]**

Gender	Frequency	Percentage (%)
Male	127	66.1
Female	65	33.9
Age (years)		
20-29	28	14.6
30-39	104	54.2
≥ 40	60	31.2
Basic qualification in Pharmacy		
Bachelor of Pharmacy	177	92.2
Master of Pharmacy	9	4.7
Doctor of Pharmacy	6	3.1
Post graduate qualification(s) in Pharmacy		
Diploma	15	7.8
Master degree	12	6.2
PhD	3	1.6
Experience as Practitioners (Years)		
≤ 10	92	47.9
> 10	100	52.1
Location of Pharmacy (governorates)		
Hawalll	57	29.7
Al Farwanlyah	43	22.4
Al Ahmad/Mubarak Alkabeer	43	22.4
Capital	25	13.0
Al Jahra	24	12.4

Fragmental research was carried on among pregnant women who visited Chennai's Government Maternity Hospital's antenatal outpatient department. The information was gathered by the Government Maternity Hospital surveying Chennai, specifically in Egmore. The relevant authorities were informed by introducing an abbreviated preface concerning the study's objective, kind, and prior authorization. A sample of size 200 at least was determined. The research was carried out for three weeks. Around 10-15, subjects were chosen for review on exam days. The questions were chosen using a random sampling methodology from those who visited the antenatal outpatient department. A 15-question personalized questionnaire was issued soon after, and patients were directed to complete it. One examiner did a clinical review. The periodontal index (GI) and the Oral Hygiene-Simplified Index (OHI-S) by Vermilion and Greene, 1964, were applied by Louie and Silence, 1963, to measure gum condition and oral hygiene levels for a group of women [5].

There was a tested sample of 208 pregnant women; most of them, 170 (81.7%), were in the age group 21-30. Women under 20 were 27 (13%), and women over 30 were 11 (5.3%). Pregnant mothers are between 17 and 38 years old, with a 24.53 average and a 3.8 standard deviation. Of the pregnant women majority, 89, around 42.8%, were in the first pregnancy, while just 6, around 2.9%, were in the fourth pregnancy. The third trimester was represented by 114 women (54.8%), while the first and second trimesters were equally represented by 47 women each (22.6%). 21 (10.1%) of women are uneducated, while 23 (11.1%) have completed their education [5].

Fig. 1 The estimated value of health problems, dental knowledge, and practices encountered through pregnancy. [5]

The worldwide maternal deaths number has decreased by around 43% between 1990 and 2015. Via interventions categorization with the application types of mHealth, a review was conducted to determine the efficacy of solutions of mHealth on a variety of outcomes of maternal health. Between January 2000 and January 2016, a search was conducted on three electronic databases of international online for studies examining the main function of mobile health solutions in developing preventive healthcare services of maternal. Fourteen full-text studies out of 1262 screened titles were used in the conclusive's analysis. Most studies found that interventions of mHealth, particularly those targeting changing pregnant women's behavior and the women in the postnatal period behavior, were effective in improving antenatal and postnatal care services. Other forms of mHealth applications, however, lack evidence [6]. Implementing mHealth technologies in reproductive, parental, unborn, and infant health (RMNCH) is becoming more common worldwide. Researchers conducted a systematic review and meta-analysis of mHealth intervention studies for RMNCH from all over the world to examine the characteristics, features, and efficacy of mHealth interventions. The studies were collected from six databases from January 2011 to December 2016. For exclusive breastfeeding (EBF) and antenatal checks (ANC), comparable studies in a random-effects meta-analysis were used. The outcomes showed that the number of studies on mHealth interventions for RMNCH is growing. Even though meta-analysis of randomized controlled trials (RCTs) on EBF and ANC revealed that mHealth approaches are successful, nearly half of the RCTs had unfavorable or indistinct outcomes. For clear conclusions and to analyze mHealth products in the app industry, more rigorous assessments are needed [25].

PRENACEL, a bi-directional and based mobile phone with short text message service (SMS), is the subject of another review to see how it improves coverage of recommended antenatal care (ANC) practices. In 20 PHCUs (Public Primary Health Care Units), a cluster-randomized experiment was conducted. Pregnant women with a gestational period of 20 weeks or less were included in the study. They received a series of SMS messages weekly with pregnancy and childbirth-related health education and promotion material, as well as the ability to explain ANC questions via SMS. The results were analyzed using Chi-square or Fisher's exact tests and multivariate log-binomial regression. According to the study's findings, PRENACEL could help improve the recommended ANC practice coverage, such as syphilis and HIV testing [8].

To define the factors that influence end-users intention to use mHealth applications. It was decided to use a quantitative research design. The information is gathered using an online self-completion questionnaire, and statistical analysis is performed using the SPSS program (Statistical Product and Service Solutions). The main finding of this study is that the mHealth app industry is only in its early stages, and end-users are unaware of it. The preliminary survey findings helped to narrow down the original eight factors to the five most important ones. Realized usefulness, realized ease of use, cost, time, reliability, and security and privacy were the most critical factors for the participants [9].

In single-level memory, there are several methods for allocating FIFO queues. The first approach (Garvic algorithm) is to distribute a queue one by one sequentially. There will be a memory loss in this situation since the other Queue may contain free memory modules while the Queue is overloaded. The second approach is using the associated execution list. In this status, any record number could coexist in a shared memory field without exhausting the free memory list. This approach, furthermore, necessitates an extra field of correlation for each object. The third option is to keep objects in lists connected to fixed-sized pages. In such a situation, first and second amnesia types were found [10].

Yang and Deb created the cuckoo search (CS) algorithm. The idea is inspired by the unusual reproduction behavior of certain cuckoo species, which involves their eggs laying in the other master birds' nests. The brazen cuckoo may cause direct confrontation with other host birds. If a host bird discovers that the eggs do not belong to him, he will either discard the eggs or abandon their nest and build a new one elsewhere. As a result, ideal CS, such as breeding behavior, can be applied to various enhancement problems. Each egg in the nest is a solution, and the cuckoo egg is a new solution.

The aim is to substitute non-good solutions in nests with possibly better new solutions (cuckoo). In its most basic form, each nest has one egg. The algorithm can be expanded to more complicated cases in which each nest contains several eggs that exemplify a series of solutions. The CS algorithm has the potential to specialize in other evolutionary algorithms (EAs) already in use. Choosing the ideal, exploiting thru local random walks, and experimenting with random distribution through Levy flights globally are the three main components of the CS algorithm. Selecting the best and preserving the best nests or solutions encourages the elitism of GAs by ensuring that the best resolution is handed on to the next generation. There is no danger that the best solutions will resolve by the general public [11].

1.1. Bat Algorithm (BA)
Bat Algorithm (BA) suggested that creating several bat algorithms or bat-inspired algorithms can be done if some echo-microbial positioning characteristics improve. For simplicity, the following optimal laws were used:

1. All bats use echo-positioning to sense distance and magically distinguish between food/prey barriers and background barriers.

2. To search for prey, the bat flies at a random velocity vi in the eleventh spot, with constant frequency accuracy, varying wavelength l, and loudness A0. Relying on their target's proximity, automatically, they could adjust their emitted pulse wavelength and set the pulse discharge rate r to [0, 1].

3. Despite the fact that loudness can differ in a variety of ways, it will presume that it ranges from A (large) A0 to the minimum Amin fixed value.

Another apparent simplification is that ray tracing is not used to estimate time delay or 3D topography. While this is a valuable feature in computational engineering, it would not be used because multidimensional situations are more comprehensive [12].

A Japanese corporation called Denso-Wave introduced, in 1994, the QR code as a two-dimensional bar code. It receives data in vertical and horizontal directions, while a standard barcode includes data in only one direction. The QR code can contain a lot more data than a standard barcode: for numbers, there are 7089 characters; for alphanumeric data, there are 4,296 characters; for binary data of 8 bits, there are 2,953 bytes. The term "QR" is inspired by the word "quick response," as the code's creator meant for it to decode its content rapidly. In addition, QR-Code has debugging capabilities. Moreover, if large sections of the code are distorted or corrupted, data can be recovered [13].

2. Problem Definition

Often it is needed a quick way to find a fast delivery hospital or private doctor clinic and whether there is a possibility to receive delivery cases or not. The prices of delivery vary significantly from one hospital to others, and the prices of the services provided. There is no Arabic application containing delivery doctors for pregnant women, what to do throughout pregnancy and the baby's development in each week of pregnancy. A pregnant mother often needs quick inquiries from a doctor because she feels pain or is about to deliver. The patient sometimes forgets lab results, medicines prescriptions, and sonar attachments when attending doctor appointments.
Want to apply search algorithms like query search algorithm, linear search algorithm, sorting, and queue algorithm to display data accurately.

3. Related Works

Panagiotis Tsinganos, and Athanassios Skodras, created a system for elderly people. The fall can be intense enough to cause certain disabilities for vulnerable inhabitants. Thus, providing urgent health care is necessary to prevent and recover any damage. Their proposal aims to create a fall detection system based on a smartphone that can differentiate between falls and everyday activities (ADL). A sensor and a notification unit make up a typical fall detection system. Android devices with services of communications and sensors are the best nominees for designing such systems. The accuracy of this work is enhanced by using a threshold-based algorithm and a k Nearest Neighbor (kNN) classifier. Furthermore, their proposal suggests applying the power allocation and regulation system. Similar to related work, it achieves high precision in falling detection (sensitivity of 97.53 percent and specificity of 94.89 percent) [14].

Software that provides health-related services via tablets and smartphones is referred to as mobile health (mHealth) applications. mHealth is an exciting area with the prospect of improving healthcare practitioners' efficiency, raising the satisfaction rate of patients, and lower healthcare costs. Medical applications are included in the mHealth definition. Medical systems come in a variety of types, with some requiring the use of external instruments such as medical sensors. On the other hand, some apps use the smartphone's assets, such as the camera, to treat the patient. Since the advent of smartphones, the use of mHealth applications by patients and doctors has increased remarkably. Doctors have the ability to access medical records and patient data at the point of care, and they can use mHealth apps to observe their patient's health [26].

Francesca Stradolini, and Nadia Tamburrano, have developed an Internet of Things (IoT) Anesthesia-based cloud internet for online monitoring applications. An anesthesiologist can stay connected to all anesthetized patients simultaneously thanks to an anaesthesia-based cloud structure via the Android app. Furthermore, patients' medical data can be shared on a cloud solution that can be accessed through a web application for online consultation. So, Medical experts can view shared data from anywhere and anytime by accessing the cloud. Because of the pliability and scalability of our monitoring architecture, specialists can communicate with any medical device that can transmit measured data wirelessly. Other medical surveillance applications can therefore be addressed [16].

Ilias Maglogiannis, George Spyroglou, and Christos Panagopoulos proposed a system in which a cloud-based service consisting of three modules. The first module is a web-based application which enables registered users to create reminders and monitor patient compliance. The second module is the Android app, which the patient uses to manage reminders. The application has an integrated background service that activates notifications and communicates with the smartwatch. The third module works

on Pebble and handles information from the patient's Android device [17].
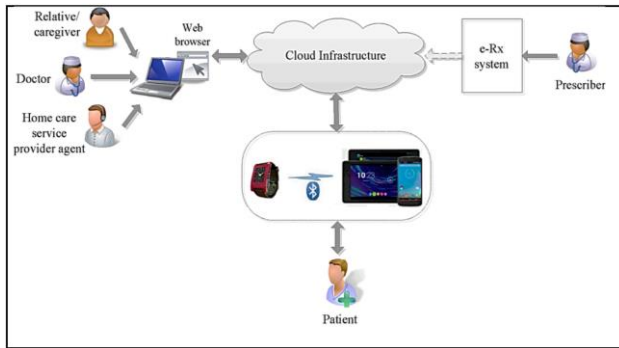
Fig. 2 The architecture of the proposed electronic reminder system. [17]

The system uses a Bluetooth protocol to communicate between an Android device and a smartwatch. The Pebble smartwatch chose for the prototype application due to its many positive characteristics. The system's primary role is to allow users to create reminders using their computer or an Android device connected to the cloud infrastructure. The patient was informed on time for each reminder, with audio and visual alerts. Additionally, the smartwatch receives reminder notifications. Other registered users may use the web application to build or update reminders, such as the patient's doctor or pharmacist. The system can also work with electronic prescription systems (e-Rx) to automatically create reminders about taking the drug [17].

Telecare Information Systems, a home care service of public health, was created as a result of developments in semiconductor and network technology (TMIS). The TMIS medical server uses the Internet to connect to a patient's general Body Area Network (BAN) and retrieve real-time patient health data such as heartbeat, temperature, blood pressure, etc. [27].

Android has authorized hundreds of millions of smartphone devices in over 190 countries worldwide. It has the most prominent mobile platform installed of any other mobile platform and is rapidly expanding; each day, another million users turn on their Android devices for the first time and begin searching for applications, games, and other content of interactive. Android provides developers with a global system for developing applications and games for users of Android around the world, alongside an open marketplace for instant distribution. Many platforms and application programming environments have been developed in response to the popularity and growth of mobile devices. Some features are available on Android [19].

Solomon Shiferaw, Andualem Workneh, and others have developed a mobile health system that automates data

collection and decision-making for mid-level health workers, enabling them to supply quality health care for maternal. The mHealth system includes data collection, electronic health records, decision support, and provider education throughout the continuum of care, including antenatal and postnatal care (POC). There were front-end and back-end components of the system. For health workers, the front-end component was created as a cellphone-based app. The back end was implemented as a web-based app that ran on a central server for data aggregation and report generation. A data collection of an open-source tool called Open Data Kit (ODK) was used to satisfy some of the system's requirements. Five electronic forms were created with ODK to collect information about the mother's well-being during antenatal, birth, and postnatal visits. Two additional electronic forms were created for ANC clients' baseline and end-line exit surveys. Before expanding to ten more health centers, the system was pilot tested in five. To build a successful mHealth intervention, a platform of open-source and local assets can be used [20].

Mavaluru et al. developed a location-based doctor's appointment mobile application that helps doctors get a list of booked appointments, manage their booking slots online, and view a summary of the patient's complaint. For the patients to search and find doctors based on their geographical location, book an appointment, summarize the symptoms, view doctor ratings, and find a list of hospitals from within the app. Using .Net for the API connecting the server, Android Studio for the client app, and Microsoft SQL Server as the Database Management System. Adding a prediction function to Supervised learning to report to the hospital on prediction accuracy and provide the scheduler with the most precise estimation of the appointment duration [28].

Samonte et al. built a system for doctors and people who could not afford healthcare in terms of consulting a specialist. Via the concept of telemedicine and the use of GPS, the program, which is a mobile application, provides an environment for doctors and patients to communicate remotely using mobile information and communication technology (ICT) tools.

Medical consultations between doctors and patients made it easier to communicate over long distances and to find a doctor, particularly in rural areas, thanks to the system. Patients may use mobile phone communication and GPS tools to find and consult a doctor of a particular specialization and locate and obtain the nearest healthcare facilities from their current location. Doctors, on the other hand, can accommodate patients remotely and benefit from the convenience as well as an additional source of income [22].
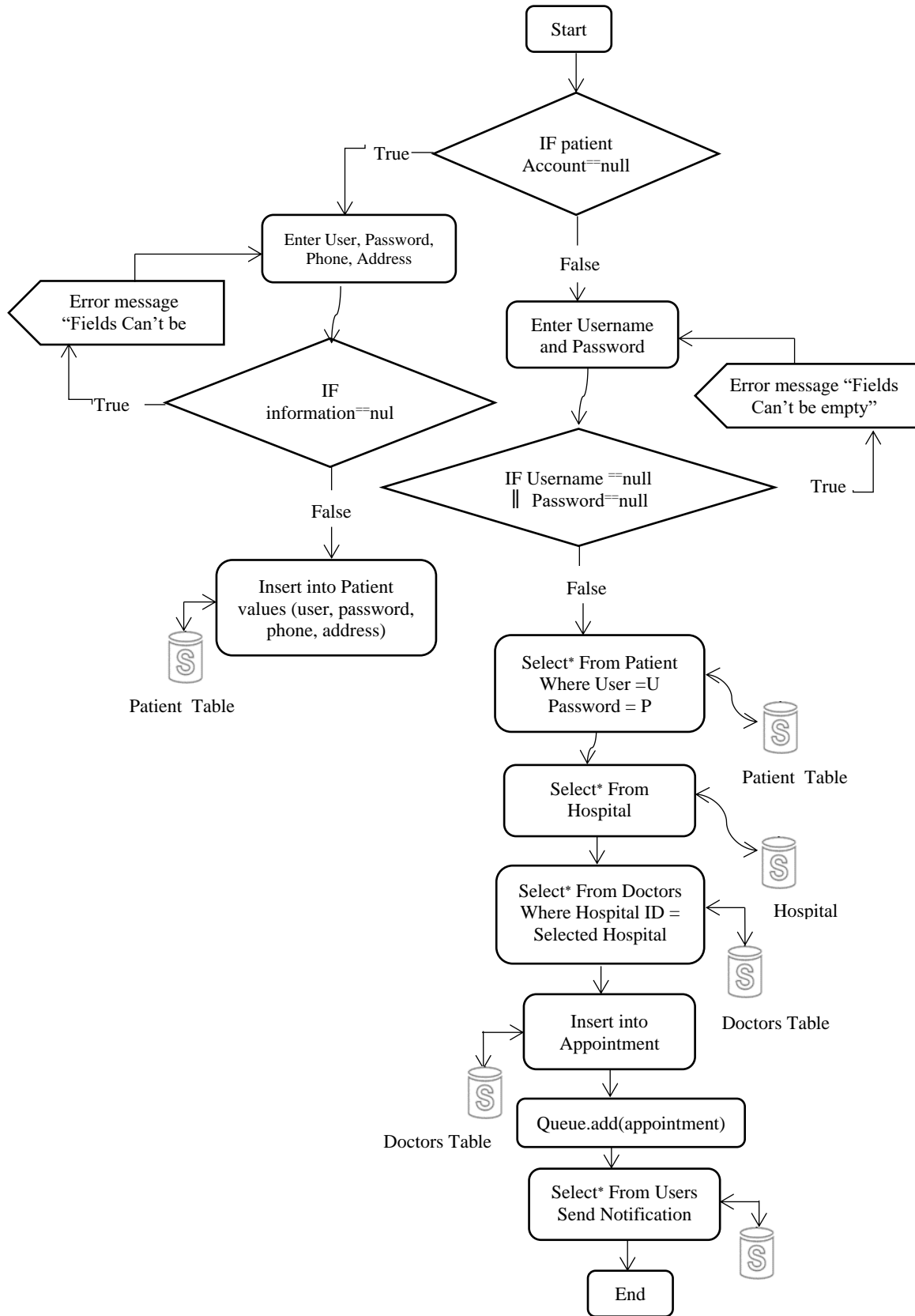
Fig. 3 Patient Appointment Request Flowchart

Ekwonwune Emmanuel Nwabueze and Onuoha Oju have created an interactive mobile healthcare app that meets the needs of both patients and doctors. To have improved healthcare services, the app allows patients and healthcare practitioners, such as doctors and pharmacists, to communicate effectively. It will enable them to communicate with one another at any time to schedule an appointment, manage perceptions, and manage patient data. Object-Oriented Analysis and Design Methodology (OOADM) was used in the software development methodology [23].

4. Implementation

4.1. Patient Appointment Request

Through the application, the patient can search for hospitals or outpatient clinics registered within the app. The search is done using a linear search algorithm and retrieved data using the Application Programming Interface (API) and then displayed to the app UI to the user. The hospital's name is displayed alphabetically; Selection Sort has used for this purpose, as it is useful in cases of little information and is done faster than the Insertion Sort. The clinics were retrieved from the database to the array list arranged in English letters in ascending order. After retrieving the private clinic's data is displayed on Google Maps has been used for this purpose to enable the user to know the addresses of clinics and access to it in an easy way as it enables the user to use Google Maps to access the clinic location by pressing the button Rout. After choosing the hospital, the pregnant woman can view all the services and know each service's details and price. Then the user sends an appointment request using the application form.

The user must log into his account by clicking on the login page and entering the username and password. Suppose the user does not have an account registered on the application. In that case, she must register within the application and enter all required data and enter all data correctly and not leave any of the fields blank. If the user leaves any fields blank, an error message will appear to her and then be redirected to the registration page. If the user enters the data correctly, the data will be sent to the database through API to store for user registration.

After successful registration or login, the user will open the date appointment screen and click on the Send button to send it to the hospital or clinic department. Here, the Queue is used to display the appointments requested from the patients to the hospital administration. The last patient to send an appointment request is placed at the end of the Queue, and the first applicant for the appointment is placed at the beginning of the Queue. Then the waiting list is sent to the hospital or clinic administration department. After the appointment is sent to the hospital, a notification will be sent to the hospital/clinic administration to notify them of the arrival of a new appointment request, display the patient's information to be coordinated with him in a timely manner, and confirm with her.

4.2. Pregnant and Doctor Chat

One of the essential features that distinguish our proposed design is the advantage of chat. This chat between the doctor and the pregnant woman begins when she reaches the seventh month by opening a communication channel between the doctor and the pregnant woman. A pregnant woman starts to access her personal account or register a new one; the pregnant woman should log in to her account by clicking on the login page and entering her username and password. Suppose the pregnant woman does not have an account registered on the application. In that case, she must register within the application and enter all her data, such as full name, username, password, phone number, e-mail, and address and then make sure to enter all data correctly and not leave any of the data empty. If the pregnant leaves any of the data blank, an error message will be sent to her and then returned to the registration page. If the pregnant woman enters the data correctly, the data will be sent to the API and then to the user registration database.

After successful registration or login, the user can search for hospitals or clinics registered in the application in various areas in Kuwait. The search is done using the Linear Search Algorithm, and the data is retrieved using the API to the Array List and then to the application to display to the pregnant. Hospitals are displayed and ordered with an alphabetical list. Selection Sort Algorithm has been used for this type of order, and then the pregnant women can search for doctors by clicking on the list of doctors found on the hospital/clinic profile. Here, the linear search algorithm has been used inside the database to retrieve the list of doctors and put them inside an array list to be ordered using the selection sort algorithm and then retrieved through the API to be displayed in ascending alphabetical order to the user.

The doctor will then be selected from the list. She can display his/her profile, such as the doctor's name, subspecialty, certificates, picture of the doctor, and the possibility of requesting an appointment or starting a conversation chat with him/her. For the patient to start talking to a doctor, a specific condition must be applied: she must have entered her pregnancy in the seventh month so the application can start to chat with the doctor.

After sending chat messages to the doctor, messages will be stored inside a Stack to order the latest conversation messages from newest to oldest. A notification will be sent to the doctor to notify him/her of the arrival of a new message from a patient. The doctor can then enter his/her chat page, view the latest chats in the Stack, select the conversation, and respond to her.
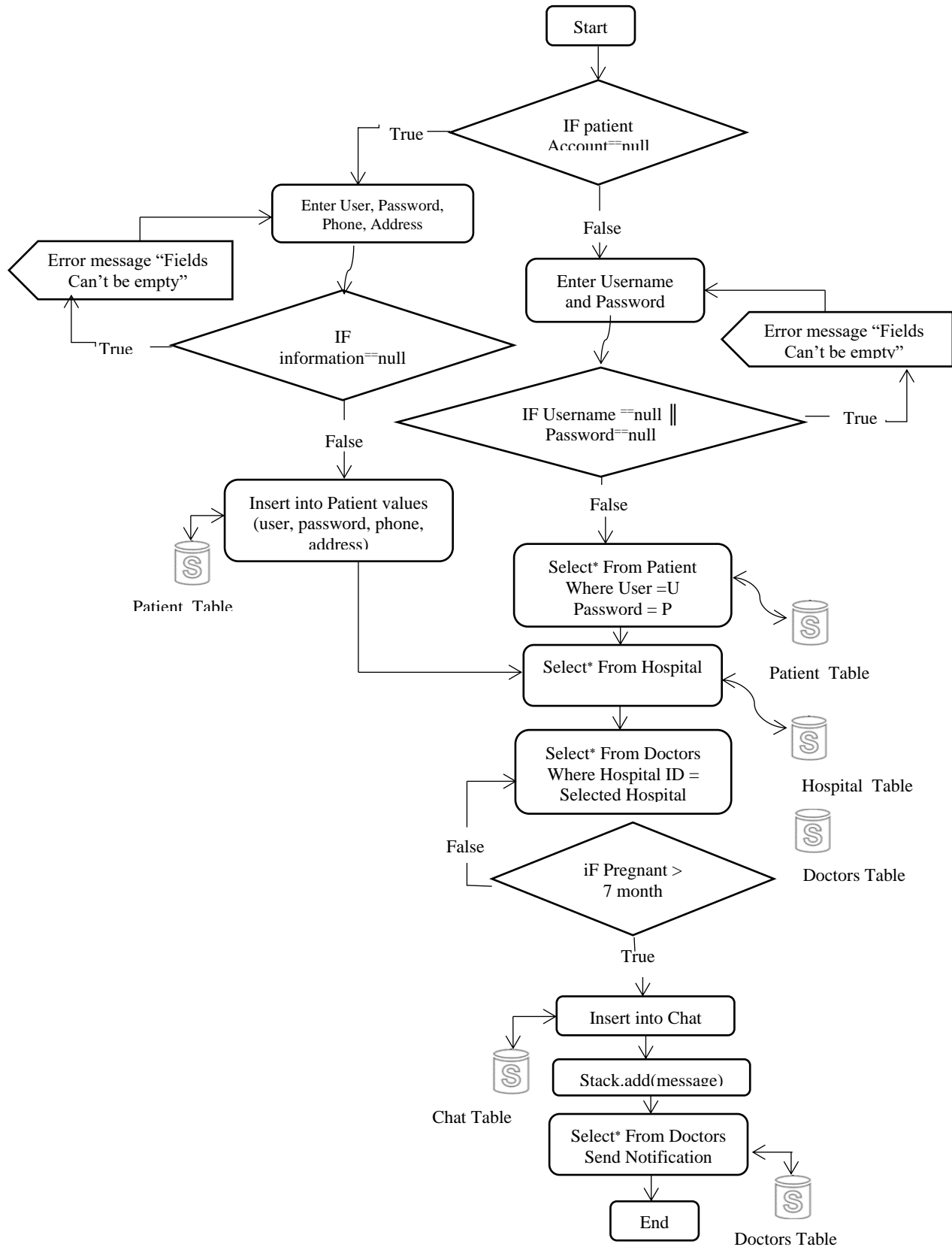
Start

IF patient
Account==null

True

Enter User, Password,
Phone, Address

Error message "Fields
Can't be empty"

True

IF
information==null

False

Enter Username
and Password

Error message "Fields
Can't be empty"

False

IF Username ==null ‖
Password==null

True

Insert into Patient values
(user, password, phone,
address)

Patient Table

False

Select* From Patient
Where User =U
Password = P

Patient Table

Select* From Hospital

Hospital Table

Select* From Doctors
Where Hospital ID =
Selected Hospital

Doctors Table

False

iF Pregnant >
7 month

True

Insert into Chat

Stack.add(message)

Chat Table

Select* From Doctors
Send Notification

End

Doctors Table

Fig. 4 Pregnant and Doctor Chat Flowchart

5. Results and Discussion

The application contains many algorithms, such as the use of search Leaner to search for hospitals, which is a useful search in cases of research that do not require large amounts of data and characterize by its speed in retrieving data. The results were ordered using Selection Sort to retrieve data orderly, such as retrieving hospital names in ascending order.

In Figure 5, for example, the data has been arranged in ascending order using the Selection Sort; It sorts an array by repeatedly locating the minimum value from the unsorted part and placing it at the beginning until it is all in order. From the array's elements to return, a sorted array ascending by the hospital's name.
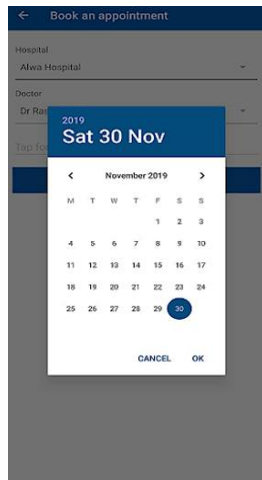

Fig. 5 Patient book appointment

Pregnant women can identify the hospital or clinic, access the services available inside them, and know the service's details. The pregnant woman can then request a service appointment or request a medical appointment by choosing the doctor's name and then choosing the appropriate date for them, as shown in Figure 5.

The Queue is used to display the appointments requested from the patients to the hospital administration. So that the last patient sent an appointment request is founded at the end of the list to take the first submitted as the head of the Queue and the last submitted appointment to the tail of the Queue to the hospital or clinic management department. After the appointment is sent to the hospital, a notification will be sent to the hospital/clinic administration to notify them of the arrival of a new appointment request, display the patient's information to be coordinated with him in a timely manner, and confirm with her.

After that, a notification will be sent to the hospital administration for the arrival of a new appointment or reservation request. The system will notify the patient of the appointment confirmation, as shown in Figure 6.
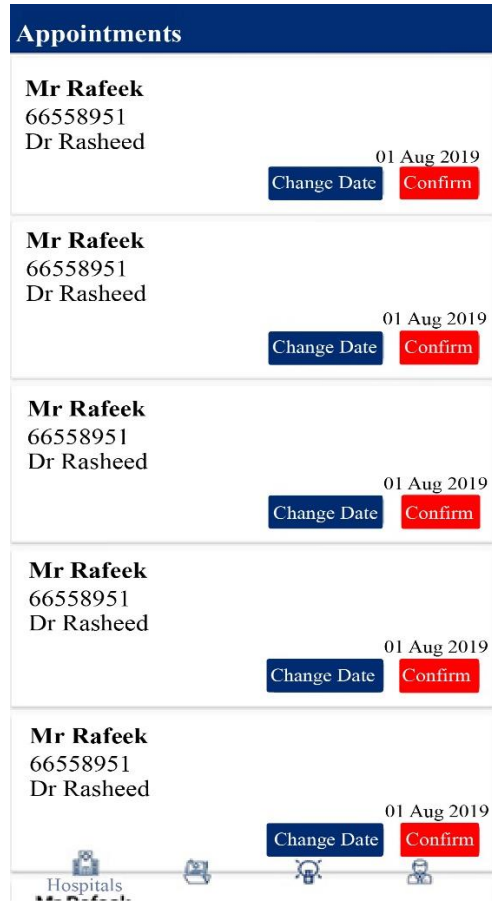

Fig. 6 Hospital Appointment Queue

6. Conclusion

Midwives' role in nutrition education can support pregnant women during the pregnancy period. The midwife approaches nutritional content, which represents significant support for their health to increase midwives' capacity to assist pregnant women's and their children's health. Besides, having a single application that combines the necessary information during pregnancy and consulting doctors quickly and efficiently will increase the awareness of pregnant women in their attention during pregnancy and enable them to give easy and comfortable delivery.

The proposed android application uses many algorithms, such as Linear Search and ordering techniques, Selection Sort, and Queue and Stack's use to display data to the end-users.

7. Future Work

Indeed, everyone knows the importance of health for all people. In this sense, it recommends providing the app with many features and features, including:

- The work application works in different fields of medicine.

- Enable patients to book appointments at various clinics.
- Make a specific section of ads for hospitals, such as visiting consultants.
- Work to use the latest algorithms and techniques to retrieve data in a fast way.

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