Department of Software Engineering

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Conceptual Design and Implementation of Appointment System

In the Example of Medical Doctors in Afghanistan

A bachelor's thesis

Specialization: Computer Science

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Declaration

Hereby I declare that I wrote this thesis myself with the help of no more than the mentioned literature and auxiliary means.

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Abstract

Setting appointment with and visiting a well-known medical doctor is somehow a time consuming process in Afghanistan. But in a modern society it is not a matter you can simply set an appointment with a doctor using a mobile app or a web application with the minimum time wastage and effort. So we want to bring this facility to our society by designing and implementing a mobile app that makes it easy to set appointments with doctors. Also the doctors will find it easy to manage their visitors.

Keywords

- Appointment
- Design
- Implementation
- Medical doctors
- Computer science
- Kabul university

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Chapter 1

1. Introduction

Appointment scheduling systems are one of the information systems used in everyday life of busy people. These systems automate, the appointment time management of individuals who meets with others according to a pre-scheduled time table and they do not want to waste their time in waiting for others specially in a formal meeting.

Big organizations use web based **CAM** (Customer Appointment Management) to manage their customer visit and appointments [Wikipedia,2019]. These systems are not suitable for small organizations and individual professionals, instead they should use mobile based systems to schedule their appointments. Because mobile based systems do not need any additional staff to manage the system and it can be managed personally only using a smart phone or a tablet.

Doctors are one of the professional individuals who needs such a solution more than others as they visit patients in a pre-scheduled and turn based style. Our study specifically focuses on an appointment scheduling system for medical doctors of Afghanistan. The system will provide reasonable time saving to both, doctors and the people who use the system to book appointments with doctors.

1.1 Background

Before emergence of new technology, appointment scheduling was a paper based task. But it is now common to manage appointment scheduling using a computer based or mobile based system. Organizations and individual professionals schedule their appointments using a web or mobile application. The first one is mostly used by big organizations with a large number of staff and services. But the second option, the mobile applications are mostly used by individuals like doctors or other professionals. That is the case with modern societies and countries.

The case is different when it came to Afghanistan. People still schedule every kind of appointment manually without using any technology facility like mobile applications, because such things are somehow new here. But lack of using online systems and mobile apps has the following problems and disadvantages:

- Waste of time in meetings and appointments
- Location and address finding challenges

1.2 Motivation

My motivation to choose such a topic was the idea to facilitate visiting medical doctors in Afghanistan. Nowadays if you want to meet a well-known doctor in Afghanistan, first you should take a ticket of visit then you should go to the doctor and wait until your turn specified by the ticket you have taken. Sometimes you should wait even two up to three hours and that is a big challenge and time consuming process. This problem can be solved using a mobile application which makes it easy to make appointments with doctors and automatically schedules the time for both doctors and their patients.

Developing a mobile application to book appointment with doctors can be a big achievement in the area of good and modern medical services.

1.3 Aim and Objectives

The overall aim of this project is to develop a mobile application of appointment scheduling which automates and digitalizes the process of doctor's appointment scheduling in the Kabul city in first step also for other cities as it reaches them. This thesis and its outcome application will be a starting point of using mobile applications to schedule time and appointments in Afghanistan. Also it will become a big facility for medical doctors of Kabul in managing their time and patient visits. And on the other hand it will bring an easiness for people in taking turn from medical doctors.

In order to achieve this aim, we have to follow some objectives:

- Identify the needs of users and doctors using interview.
- Identify the needs of different doctors.
- Stablish relationship between needs of different users and doctors.
- Specify the actual requirements of the system.
- Draw and develop the necessary UML diagrams.
- Implement the system in android application format.
- Finally, we should test and launch the system.

1.4 Achievement

After completion of this project our achievement is an appointment scheduling mobile app for medical doctors. This application will provide the following services and benefits to the doctors:

- Easy appointment management.
- The app will be a good marketing tool for doctors.
- Easy address and information sharing.
- And many more…

And on the other hand it will provide the following benefits and services to other users of the system:

- Easy appointment booking with doctors.
- Easy to find the appropriate doctors.
- Visiting doctors without waiting for a long time.

1.5 Thesis organization

The structure of this thesis is as follow:

Chapter 1: Introduction

The introduction chapter begin with the brief description of the background of appointment scheduling in Afghanistan. After reading the first chapter we can find the current situation of the system and we can imagine the system after completion of this thesis.

Chapter 2: Literature review

In the literature review chapter, we will describe details of the existing appointment scheduling systems. I have studied many legacy appointment scheduling systems like manual appointment scheduling, web based appointment booking systems and mobile based systems. The purpose of this study is to develop a mobile based system as the mobile technology is the newly emerged technology.

Chapter 3: Concept

This chapter will describe our solution to the problem described in problem statement. Our solution is in the form of a mobile application which will be used for doctor's appointment booking.

Chapter 4: Implementation

The chapter 4 will describe some of implementation details of our thesis. I have developed the front-end in android studio using Java programming language and for the backend I have used firebase backend services.

Chapter 5: Conclusion

The final chapter describes the achievement of overall thesis. Here you will find a brief description of our finding and the conclusion of each individual step of this study.

Chapter 2

2. Literature Review

In this chapter we will discuss about current situation of appointment scheduling with medical doctors of Afghanistan. I have done all of my literature review task through web pages, because there is other source of information in this are available.

Nowadays doctors and patients all over the world uses many types of systems to manage and schedule their appointments. These systems are one of the following types:

- Web based online booking systems
- Appointment booking mobile apps
- Manual appointment booking

Below we will further investigate about each of them:

2.1 Manual appointment scheduling

Most of the medical doctors and hospitals of Afghanistan do not have any online system for appointment booking or scheduling. They only use a paper based list of their patients to manage and schedule their appointments.

Every doctor has an appointment representative which will register the patients before visiting the doctor. The representatives are mostly careless persons and they don't think about patients and their problems. Some of the representatives even don't have a good behavior with patients so it will affect the popularity and services of a doctor.

This system has lots of problems and challenges for doctors and patients as follow:

- You need to find and go to the doctor's clinic only to book an appointment.
- The appointment time is not assigned appropriately.
- Finding the doctors is also a challenge.
- Waiting for a long time to visit a doctor.
- The doctors do not Know the number of their patients.
- The patients will not be notified if the doctor cancel the appointments or delay the appointments time.
- The patients don't know if the doctor is available or not.
- The patients will be unaware of doctor's location change.
- And many more problems…

2.2 Online appointment booking systems

Online appointment booking systems are a good solution to the problems listed with manual appointment scheduling systems. But there is no web based system in Afghanistan to book appointments online. There is only one website with the name of **200bastar.com** which belongs to the medical doctors of Khatamul-Nabiyin private hospital [200baster.com,2019]. Using that system, you can book appointments only with the doctors of that private hospital and that is not a sufficient solution to our actual problems and challenges.

In addition, web based appointment booking systems are not suitable for Afghanistan because people use website very in rare and mostly the don't have access to the computers and internet in their computers.

2.3 Mobile-based Appointment Booking System

Currently in Afghanistan there is a mobile app by the name of Salam Zindagi which provides appointment booking services for medical doctors. This app is running by a pharmaceutical company by the name of **Aria Medica** [Area Medica,2019]**.** The company is registered with ministry of health in Afghanistan.

The mobile app developed by this company have good functionalities and services with a number of doctors and hospitals registered with them. The functionalities are as follow:

- Displaying doctors in different categories like: Dentists …etc.
- Information and background of doctors.
- Hospitals, pharmacies, laboratory, and many more medical services providers are registered with this app and its web based system.

But it has some issues as below:

- The application is somehow complicated.
- The process of appointment booking is a little time consuming.
- The date and location system used in this app is not localized for Afghanistan.
- Currently the app server is not responding 11/23/2019 [Google Play Store,2019].

Chapter 3

3. Concept

In this section after analyzing the current situation of the appointment scheduling in Afghanistan, I want to propose my own solution to the problem. My mobile app is a simple appointment scheduling and appointment booking system, which provides ease of use to its users and it makes the process of appointment booking as easy as touching your smart phone with a few and simple steps.

3.1 Mobile-based appointment booking system

As you know better mobile applications has emerged as a fast growing technology in the field of computer science. And most of the services provided by web based systems mirrored or even migrated to the mobile based systems.

Appointment scheduling systems are one of the systems which we can say that migrated from web to the mobile technology. Today most of the appointment scheduling systems are implemented as mobile application. So I have decided to implement my appointment scheduling system as mobile app using android platform.

The system will be developed to address the following problems:

- Problems in finding a good doctor.
- Problem of knowing the doctors working time
- Booking appointments with doctors.
- Waiting for a long time before visiting the doctor.

The system will have the following functionalities:

3.2 Functionalities

3.2.1 User authentication: Any user before using the system should login to the system. The authentication is a must in our app because it is an appointment booking app, which is kind of formal meeting. Through this functionality the real patients and unreal ones will be known.

3.2.2 Display the doctors in categories: After login the users will see the list of doctors in categories of dentist, surgeon …etc. This functionality will help the users of the system to choose appropriate doctor according to their need.

3.2.3 **Details of each doctor:** By clicking on each doctor the user will see profile information of each doctor. Information will include: name, years of experience, specialization, address …etc. The user can choose the most experienced ones.

3.2.4 **Book appointment:** When the user clicks on details of a doctor, the system will display a Book appointment button along with other information and the user will be able to book appointment only by providing a few and simple information like: patient name, age …etc. In addition, we can say that our system changes the time wasting and dull process of visiting a doctor to a simple and a good experience of visiting a doctor.

These are the services of the system for patients, but the following is the services of the system for the doctors:

1. **Login:** login is a necessary functionality for both doctors and normal users.
2. **List of booked appointments:** Doctors will be able to see the list of booked appointments by the users.
3. **Calculation of appointment time for each patient:** The system will automatically calculate the appointment time for each patient according to the time assigned for each patient by the doctor. The doctor will set only the starting time of his/her availability hours.
4. **Total number of patients for every day, week, month and year:** system will keep the records of appointments and it will be available for doctors to see. This will be added to the next version of the app because of the data maintenance costs.
5. **Delay or absence notification:** If the doctor face a problem, they can notify the patients that they will come late or they will not come at all.

Chapter 4

4. Implementation

In this chapter and its associated sections, you will find information about the implementation details such as: developments tools used in front-end and back-end of the system. In general, we have used native android development and firebase backend for the development of our system, read the following sections for more details.

4.1 Development Tools

4.1.1 Tools and Technologies for Front-end

The front end of our application is designed and developed in android studio, using the xml markup and Java programming language. And in some parts we have used some libraries and also material design guide and components. The purpose of using external libraries in this project was better look of the user interface and also implementation of some complicated parts.

4.1.2 Tools and Technologies for Back-end

The system is data oriented system and it works around storing and retrieving real-time data. So I have chosen Firebase real-time database and firebase storage as the back-end of the system. User management and authentication also used from firebase authentication services.

The advantages of using firebase over other back-end systems are as follow:

- No need to manage back-end, firebase itself has done everything.
- No need to develop API to connect the app with back-end.
- Faster than other back-ends
- Reasonable free storage and database
- Free cloud functions
- And many more advantages…

4.1.2.1 Firebase real-time database

The Firebase Real-time Database is a cloud-hosted database. Data is stored as JSON and synchronized in real-time to every connected client. All the effort is done by firebase itself, we only need to connect our app with the firebase [Firebase,2019].

4.1.2.2 Firebase authentication

When using firebase authentication, it is very easy to manage users and rules. We don't have to do anything more than connecting with firebase authentication services.

4.1.2.1 Firebase storage

The appointment app uses firebase storage in order to store doctors profile image. The firebase cloud storage can be used to store files such as: images, videos, audios and other objects that cannot be stored in a database directly[Firebase,2019].

4.1.2.1 Firebase cloud functions

Firebase cloud functions let you automatically run backend code in response to events triggered by firebase features and HTTPS requests[Firebase,2019].

I have used some cloud functions in order to do some background tasks in firebase servers instead of the client mobiles.

4.2 Current State of the Product

4.2.1 development results

Upon writing this thesis the current state of the product is as the following:

1. Easy to find doctors registered with this application.
2. Easy access to the doctor's profile and information.
3. Easy to book appointments.
4. Easy to manage appointments.
5. No waste of time for booking appointments.

Among other achievements by developing the app, I have achieved a means to use as demo when interviewing with doctors about the appointment scheduling and their challenges.

I have achieved the following results from the interviews with doctors:

More than 20 doctors from many categories with experiences of 3 up to 25 years are interviewed. Among 22 doctors I have interviewed only 2 of them were not using smartphones, all others were using smartphones and internet and they welcomed the development of appointment booking app for their patients.

The feedbacks of doctors about the development of a mobile app for their appointment booking was positive. They pointed to some problems like internet connection problems and people who don't use smartphones but as starting point for using technology in appointment booking, most of the medical doctors are interested in using this system.

Chapter 5

5. Conclusion

The appointment booking app is a quite new trend in Afghanistan. This app will bring the following facilities to the patients and doctors who use it:

To the doctors:

- Easy sharing of profile and time information with clients(patients).
- Manage the appointments without any trouble.

To the patients:

- Find the doctors easily.
- Easy appointment booking.
- Less waiting time when visiting the doctor.

After realizing the above points, it is obvious that this app will contribute in better health services as it brings easiness in getting health services.

Appointment scheduling and appointment booking is an important task, when it comes to formal and important meetings. In a formal meeting both visitor and meeter have some kind of restrictions, may be time restriction or some other kind.

In this study we have selected the doctor and patient's appointment and their problems in the Afghanistan and I have investigated on how we can change the current situation and bring the possible facilities in the context.

The investigation drove me to develop an appointment booking system using Android platform. As I mentioned we have used the Android platform and some of the google firebase backend services for the development of the system.

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