

Online Medicine Tracking System of Pharmacies in North Cyprus

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BACKGROUND/ AIMS

The main purpose of this study is to design an online mobile application to reach the nearest pharmacy in the fastest and most accurate way. It is vital in emergency situations. This application provides pharmacist locations, address, and contact numbers to users. In addition, it provides daily lists of pharmacies on duty. Thus, this study and the developed software will give us clues to contribute online medicine approach. Furthermore, this work is unique in this field; no such comprehensive study has been done before on online medicine tracking system.

MATERIAL and METHODS

The software was created using the android operating system on Massachusetts Institute of Technology App Inventor platform. Database was created with program codes, and necessary information was stored in the database. Finally, database is integrated into the interface.

RESULTS

The PHARNC was developed to provide a quick access to pharmacies. Nicosia, Famagusta, Kyrenia, Morpheus, and Iskele/Karpasia were selected as pilot regions. These districts vary in population and number of pharmacies. Nicosia is the district with the highest density in population and number pharmacies. As a result, there are 10 pharmacies per 10,000 people in Nicosia, while there is one pharmacy per 10,000 people in the Iskele/Karpasia.

CONCLUSION

This study showed that Nicosia has now reached the saturation point in the number of pharmacies. The necessary measures should be taken and a solution should be found for the accumulation of pharmacy in Nicosia because the number of pharmacies is higher than the population needs. Whereas, this situation is negative in Famagusta, Kyrenia, and Morpheus; there is a great risk for these districts in the upcoming years.

Keywords: Android, mobile application, online tracking system

INTRODUCTION

Pharmacies are important for health sector. This sector, which allows patients to access medicines quickly, is growing rapidly in recent years. The demand for pharmacies in direct proportion to the increase in population in North Cyprus has also increased. Government's state planning pharmacy department obtained from the work of Cyprus Turkish Pharmacies Association indicated that the distribution of pharmacies in North Cyprus is not ideal with respect to population to pharmacy number ratio.¹

Pharmacists have competence for medicine, and patients reach to medicine from them. There are a total of 268 pharmacies in North Cyprus, according to the May 2019 records of the Cyprus Turkish Pharmacists' Association.¹ Of these, 105 pharmacies are in the Nicosia, 56 in the Kyrenia, 57 in the Famagusta, seven in the Iskele, 23 in the Morpheus, six in the Upper Mesaoria, nine in the Lower Mesaoria, and five in the Karpasia.

The area of North Cyprus is small (3,355 km²), and it has low population density (286,257) according to the 2011 estimate.² So, the 268 pharmacies are very high for North Cyprus. Therefore, there is one pharmacy per 12 km².

In 2019, a study was performed about the online pharmacy system in India. The aim of the study was to take the order via internet and deliver the drug to the customer. The development of online pharmacies has led to regulatory and monitoring actions at federal and state levels. The online sale of medicines is potentially dangerous in international systems and requires international regulations. Therefore, they worked on local system.³

In another study conducted in 2018, it was stated that some individuals or institutions that were ordered online were fraudulent, and it was argued that measures should be taken to reduce this risk.⁴ Previous studies on the similar subject have generally focused on this security problem. This risk was taken into consideration in this study. Individuals or organization who received admin approval will be able to register for the PHARNC. This is how the system was designed. Those who wish to register on this application to receive online orders will be able to register by submitting official documents certifying that they are real pharmacists.

The PHARNC is a database designed to supply information both for people and pharmacists of the country. The distribution of pharmacies in North Cyprus is not well organized according to the population of the regions. So, patients have difficulties finding address and direction to the nearest pharmacy. This database provides easy and quick access to pharmacies. The PHARNC provides address and contact information of pharmacies via online, and people can make online contact via internet with pharmacies. Therefore, this system provides an instant communication. Another importance of PHARNC is that people can order drugs online with this system. The PHARNC database is designed to provide all contact information online in case of emergency situations. Day by day list of pharmacies on duty to be given, it is vital for emergency situations at nights. Furthermore, PHARNC provides services both in Turkish and English languages because the official language of North Cyprus is Turkish. Since there are too many foreign settlements, it is necessary to provide English language service.

The main purpose of this study is to design an online mobile application for people to reach the nearest pharmacy in the fastest and most accurate way. Quick reach to the pharmacy in emergency situations is vital. This application presents the pharmacist locations, address, and contact numbers to users. Also, it provides daily lists of pharmacies on duty. Another purposes of this study are to (1) develop and create a software program for online medicine tracking system and (2) design an application to reach the required medicine as soon as possible. Thus, this study

and the developed software will give us clues to contribute online medicine approach. There is no such similar application in North Cyprus. Furthermore, this work is unique in this field; no such comprehensive study has been done before on online medicine tracking system. So, this is the first application-based study associated with pharmacies in North Cyprus.

MATERIAL and METHODS

Computer

A computer was used to create the necessary database for this study. The operating system used in the computer was 32-bit Windows 10 Pro with an X64-based Intel (R) Core (TM) i5 processor, 2.53 GHz central processing unit, 3.00GB of random access memory, and 444GB of storage capacity.

Android Operating System

The software was created in accordance with the android operating system. Android is the operating system based on Linux for mobile devices. It is developed by Google and Open Handset Alliance. Although the system is open source, a small but very important part of the code is closed by Google. Because it is an open source, the system is quickly to develop, and to reach more people.⁵

An android-based software was developed in this study because android is the more common operating system worldwide. The android platform reaches more people around the world. Kantar WorldPanel has published the latest market research for mobile operating systems on 2016. According to the report, android usage rates in some countries around the world are as follows: United States 65.5%, Great Britain 57.3%, France 75.5%, Germany 79.2%, China 81.4%, and Japan 61%.⁶ Unfortunately, there are no data from North Cyprus. This information shows us that we will reach wider masses with the android operating system.

MIT App Inventor

App inventor (MIT App Inventor; MIT Computer Science and Artificial Intelligence Laboratory, MA, United States) is an open-source web application supported by Google and maintained by Massachusetts Institute of Technology (MIT) in the United States. In this study, the application was developed using the MIT App Inventor online programming platform.⁷

It consists of two parts: design and block. First, the application interface was designed in the design part. When creating this interface, the consideration is based on designing a clear and understandable interface for the user to learn the application easily. In other words, the view of the application was created in this section. Subsequently, application's programming part was created in the block section. Block section is the brain of the software. So, database was created with program codes, and necessary information was stored in the database. Finally, the created database is integrated into the interface, and the application is completed and ready for present to the public.

Database of Application

The database is the domain in which information related to each other is stored. Nowadays, databases are used in banking, automotive industry, and health information systems, for example, a wide range of computer systems are used to create the infrastructure.⁸

Main Points

- The PHARNC is a database designed to supply information both for people and pharmacists of the country.
- Quick reach to the pharmacy in emergency situations is vital.
- This application provides pharmacist locations, address, and contact numbers to users.
- The android platform reaches more people around the world.

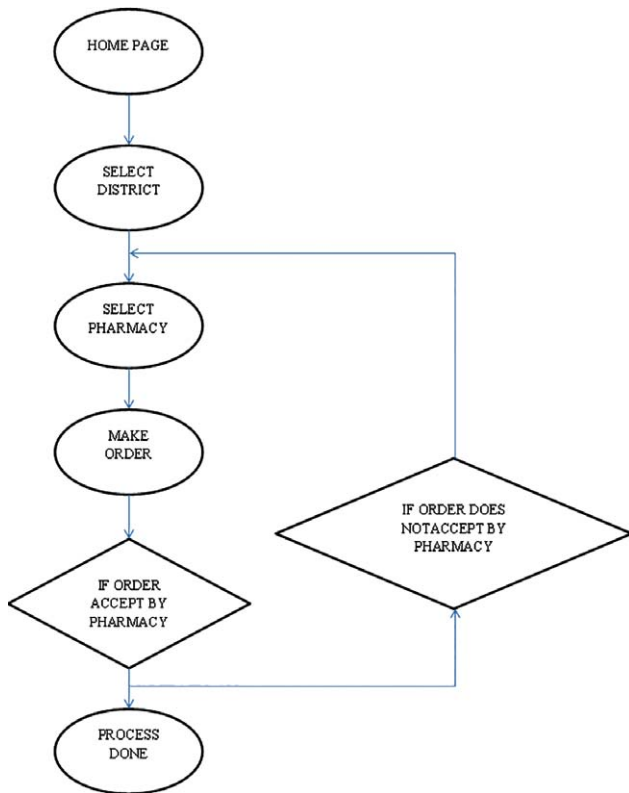


Figure 1. Flowchart of study

Pharmacy Name: Pharmacy #2
 Adress: Gönyeli
 Contact Number: xxxx xxx xx xx
 Email Address: xxx@xxx.com

To

Subject

Message

Send

Back to Home Page

Figure 3. The main part of the application is shown as a pilot

PLEASE CHOOSE DISTRICT

NICOSIA

KYRENIA

FAMAGUSTA

ISKELE

MORPHOU

KARPASIA

Back To Home Page

Figure 2. Available districts on application

In this study, a separate section has been created for each pharmacy in the database. Thus, it supports to keep the address and contact information of pharmacies in the database, and it was designed to communicate instantly on online orders.

The ethics committee approval, and informed consent and consent from are not required for this study. Also, this study has been written in accordance with the declaration of Helsinki.

RESULTS

The PHARNC is an android-based software. This software was developed to provide easy and quick access to pharmacies in North Cyprus. Thus, patients will be able to reach the pharmacies as soon as possible in case of emergency. This software consists of four main parts. The first part is the home page. When users log-in to the application, they first encounter the home page. On this page, there is an entry button that allows the user to log-in to the application. Also, application name and logo be on this page. After the users clicking the entry button, the application is designed to switch to the second part (Figure 1).

The second section has six toggle buttons. These buttons represent six districts in North Cyprus. These districts are Nicosia, Kyrenia, Famagusta, Iskele, Morphou, and Karpasia (Figure 2). The purpose of this second section is to find a pharmacy in a district close to where the people live or current location. After clicking on any district button, then user sees the list of pharmacies registered in that district in the application. In the third section, the user accesses the pharmacy lists in the district where they are located. Thus, they can get the contact information and address of the nearest pharmacy. In the last part of the application, the user gets the name, address, and contact numbers of the pharmacy (Figure 3). Users can send instant online

TABLE I. Population and Pharmacy Distributions in North Cyprus

Cities	Number of population in 2006	Number of population in 2011	Population growth rate between 2006 and 2011	Number of pharmacy	Number of pharmacy per 10,000 person
Nicosia	84,776	94,824	11.85	105	10
Famagusta	63,603	69,741	9.65	57	8
Kyrenia	57,902	69,163	19.45	56	8
Iskele/Karpasia	21,099	22,492	6.60	12	5
Morpheus	29,264	30,037	2.64	23	7.6
Total	256,644	286,257	11.54	268	9

messages through the application to pharmacy. Thus, they can make online order via internet. The pharmacy will reply to the user how long the order will be ready. So, the patients will not have to wait in the pharmacy for their order.

Nicosia, Famagusta, Kyrenia, Morpheus, and Iskele/Karpasia were selected as pilot regions. These districts vary in population and number of pharmacies. Nicosia is the district with the highest density in population and number of pharmacies. As a result, there are 10 pharmacies per 10,000 people in Nicosia (Table I). The statistical analysis of this study did not use any software program. The number of pharmacies in Nicosia is excessive compared to the population. This creates certain problems. The most important problem is the inaccurate distribution of the number of patients coming to pharmacies, namely, some pharmacies work less while some pharmacies work excessively. Thus, economic problems may occur in this sector. Because of this study, people who will use this application will be able to reach the nearest pharmacies in their location easily and quickly. Another positive aspect of this study is that the newly opened pharmacies can be discovered early by the public. In addition, this study aimed to provide an equal customers' distribution to each pharmacy in the same district. It provides two important advantages. First, it will provide customers earnings at a certain rate to pharmacies. Second, patients will be able to order medications over the internet and have early reach to these medications. Thus, the elimination or reduction of queues' in the pharmacies is aimed.

However, there is one pharmacy per 10,000 people in the Iskele/Karpasia. There are only 12 pharmacies in these regions (Table I). The most important problem in this region is distance. Some villages in the region do not have a pharmacy. Especially, pharmacies are located near the center. Therefore, patients in some villages have to go long distances to access the pharmacies. This is a life-threatening in emergency situations. Here, the importance of the application is obvious. In practice, people can make an online order and may spend the time required time for order preparation on the road. Thus, the patients waste less time.

In the remaining districts of North Cyprus, the distribution of pharmacies is almost identical. In Famagusta and Kyrenia, there are eight pharmacies per 10,000 people, while in Morphou, 7.6 pharmacies per 10,000 people (Table I). Finally, there are nine pharmacies per 10,000 people throughout the country.

DISCUSSION

The lack of medicines creates major challenges for medical care. Liang and Mackey created a website for the storage of all online pharmacies to the database in 2012. Also, their study provided access to online pharmacies to sell vaccine. Espe-

cially, a great importance has been attached for cancer and anesthetics medicine.⁹

This study is unique. Similar study has not been done before. It gives chance to online access to pharmacies in North Cyprus. Therefore, patients can reach pharmacies' contact information via online mobile application. This application provides pharmacies' address and online medicine orders.

The MIT App Inventor was used for the creation of this software. It is a computer programming platform based on android. This application works on all computer, smartphones, and other electronic devices with an android operating system. The android is the world's most widely used operating system. So, it will support to reach wider masses.

In concluding, this study showed that Nicosia has now reached the saturation point of the number of pharmacies. The necessary measures should be taken and a solution should be found for the accumulation of pharmacy in Nicosia because the number of pharmacies is higher than the population needs. Whereas, this situation is negative in Famagusta, Kyrenia, and Morpheus, but there is a great risk for these districts in the coming years. The most important factor of this risk is that more local students are interested studying in the pharmacy department at universities. This shows that more pharmacists will graduate from universities in the future, and more pharmacies will be opened in market. However, there is an opposite ratio in the Iskele and Karpasia districts. There are a total of 12 pharmacies in these districts: seven in the Iskele and five in the Karpasia. There are five pharmacies per 10,000 people in these districts. This rate is the lowest rate across the island. In particular, encouraging new pharmacists to the Iskele and Karpasia districts in order to prevent the accumulation in other districts may provide a small solution to this problem. Although this is not in the long term, it may to provide a solution in the short term.

Furthermore, the number of people per pharmacy in Europe varies by country. According to the 2004 data, the lower limit in Europe is Greece. There are 1,162 people per pharmacy in Greece. The upper limit is Denmark, there are 16,502 people per pharmacy. In addition, the situation in other major European countries is as follows: France 2,579, Germany 3,800, and the United Kingdom 4,867. Moreover, Turkey Statistical Institute reported that there should be a pharmacy to each 3,500 people. Accordingly, when the population and the number of pharmacies in the districts of North Cyprus were examined, some conclusions were reached. In result of this examine, there was an excess of pharmacy in each district. According to the population, there should be a maximum of 27 pharmacies in Nicosia, 20 in the Famagusta, 20 in the Kyrenia, seven in the

Iskele, and nine in the Morpheus. However, the number of pharmacies in each district is excessive. According to the current situation, there are 78 excess pharmacies in Nicosia. There are 37 pharmacies in the Famagusta, 36 in the Kyrenia, five in the Iskele/Karpasia, and 20 surplus in the Morpheus (Table I). Worse is increasing the excess of this pharmacy every day. Furthermore, the intensity of the pharmacy in the coming years predicts that it can lead to economic difficulties for pharmacists.

In the future, it is aimed to develop a comprehensive software that will include all pharmacies in North Cyprus.

This study has been written in accordance with the declaration of Helsinki. Also, conflict of interest and financial disclosure statement are not required for this study.

Ethics Committee Approval: N/A

Informed Consent: N/A

Peer-review: Externally peer-reviewed.

Conflict of Interest: The author has no conflicts of interest to declare.

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