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Digital Healthcare Connect: A Comprehensive Mobile Application for Seamless Doctor-Patient Interaction and Tracking Specialization Availability

Abstract: - In the contemporary healthcare landscape, timely access to accurate medical information is pivotal, yet persisting challenges hinder seamless access to real-time data, particularly in regions like the Philippines. This paper delves into developing and assessing a sophisticated mobile application to address these challenges. Integrating Information Technology (IT) and emphasizing user experience, the application is a pivotal bridge connecting potential patients with healthcare providers. By leveraging IT advancements, especially during the COVID-19 pandemic, telemedicine has emerged as a transformative solution, enabling remote medical consultations and bolstering healthcare accessibility. The application's three distinct login options – Doctor, User, and Guest profiles have been meticulously crafted to

Delays in accessing appropriate medical treatment, especially for individuals with serious medical conditions, can have dire consequences. This application tackles this issue by efficiently locating specialists e.g. cardiologist, dermatologist, etc., thereby minimizing time wastage and potentially alleviating the severity of diseases. Furthermore, it confronts the challenge of outdated healthcare information in regions like the Philippines, where rural areas often need to grapple with tech illiteracy and limited internet infrastructure.

Additionally, the application incorporates crucial features such as doctor verification processes and safeguarding patients against fraudulent medical practitioners. The rise of fake clinics, particularly in Southeast Asia, necessitates robust solutions, and this application stands as a reliable tool in combating such malpractices. The architecture of the application, rooted in a Java-based backend, ensures robust performance and scalability, essential for accommodating evolving healthcare demands.

A survey was employed to evaluate the proposed software application's effectiveness comprehensively. Participants engaged with a prototype through a carefully curated SUS survey, resulting in an impressive SUS score of 74.93. This score places the application in the 'good' category, indicating its usability and functionality.

In essence, this research endeavor signifies a significant stride towards democratizing healthcare access. By seamlessly amalgamating technology, user experience, and medical expertise, the application emerges as a beacon of hope, particularly in regions facing healthcare disparities. The study's findings underline the application's efficacy and potential to revolutionize healthcare accessibility and user experience in an increasingly digital world.

CCS Concepts

• Human-centered computing → Human computer interaction (HCI) → HCI design and evaluation methods

Keywords: Healthcare, Mobile Application, Telemedicine, User Experience, Information Technology, Healthcare Access

I. INTRODUCTION

Having readily available access information is crucial at this modern age, especially in the healthcare industry. Some people experience delay due to the lack of access to real time information. In the Philippines, doctors' information on the internet is outdated or lacking. As IT can be integrated to help connect people, we can view this as a way to connect potential patients to our doctors. As stated by Yoshiki B. Kurata et al. Telemedicine refers to the use of technology to deliver medical care services remotely. Its utilization has been shown to increase access to healthcare services and bridge gaps to existing healthcare system issues during the COVID-19 pandemic [1]. Information Technology is rapidly advancing, and with the integration of IT in the healthcare system, this can assist hospital staffs, workers, and patients for the ease of information access, management, and healthcare delivery. Smith, K. T. (2018) et al. stated that Consequences of such delay may include missed opportunities to appropriately address chronic conditions and like such as heart disease, cancer, diabetes, and etc., which were responsible for approximately half of all American deaths in 2010 [2]. The software application aims patients to ease up in finding

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and viewing available doctors with the specialization they need, alternating and advancing in locating the right doctors. Patient-centered care, in which patients actively manage their own health and choose their medical providers after doing their research, is currently undergoing a big transformation in the healthcare industry. Mobile applications in particular play a crucial part in empowering patients and bridging the gap between those seeking healthcare and those providing it.

The study explores the creation and assessment of a feature-rich mobile application intended to speed up the process of locating and using healthcare services. This program provides three different login options with an emphasis on user experience and convenience of access. The three login options are User, Doctor, and Guest profile. According to research conducted by Harsh Tamakulawa et al (2020) it is a common issue for individuals facing serious medical conditions to encounter delays in accessing appropriate treatment. These delays primarily result from the specific expertise required in these cases, often necessitating the involvement of specialists. Failing to promptly identify the available location of the right specialist can lead to significant time wastage, potentially increasing the severity of the disease or illness [3].

In the Philippines, accessing doctors' information is hard and the available information on the internet is sometimes outdated. According to Dela Cruz et al. [2021] highlighted that Telemedicine allows for remote consultations and healthcare services, enabling patients in underserved areas to access medical care without the need for physical travel to healthcare facilities. While rural areas are tend to be more on the tech-illiterate side and rural areas have limited internet infrastructure [4]. The aforementioned challenges in accessing healthcare services and the scarcity of up-to-date information on healthcare providers in the Philippines highlight the pressing need for a user-friendly and comprehensive healthcare application. This study addresses these issues by introducing a feature-rich mobile application that caters to the unique demands of the healthcare industry in the region.

The research aims to present a comprehensive healthcare mobile application catering to the diverse needs of healthcare users. The three profiles—Doctor Profile, User Profile, and Guest Profile—facilitate efficient healthcare management, locating the nearest doctor relative to specialization, appointment booking, and the establishment of a transparent and user-driven healthcare ecosystem. As the healthcare landscape continues to evolve, this application represents a significant step towards improving accessibility and the overall healthcare experience for users.

II. Review Of Related Studies

Technology is ever evolving and the use of Telemedicine in the Healthcare industry has greatly helped in reaching out to patients for a better quality care and information management. As maintaining one's health is important, it's also important to update and keep up with accurate information. As studied by Bouras et al [2020] it was comprehensively examine the web-based tools and strategies available for healthcare professionals, including clinicians, medical researchers, and students, to stay updated with the ever-expanding body of medical information [5]. As being updated, and utilizing the use of IT, we can reach out to our patients easily and be more informed. With the use of application, it would ease reaching out to potential patients, and updating doctors schedule and location can greatly reduce the risk of delay treatment. As such previously discussed by Smith, K.T. et al [2018] delay treatment can lead to serious consequences [2].

In the Philippine context, telemedicine was drastically used during the period of the global pandemic. Telemedicine became one of the alternatives for conducting consultations between patients and health professionals that provides a more safe, efficient, more cost effective solution that can address the problem of the patients. According to the study conducted by Noceda et al [2022] Telemedicine is viewed as one of the safe and efficient alternative ways to have a consultation between the patient and professionals. Thus, with the usage of telemedicine there are some backlashes that might be encountered such as technical issues between ongoing consultations, privacy risks, and also patient risks. Having telemedicine as a mode of consultation is convenient and accessible, while having this positivity of using telemedicine, there are also some drawbacks such as limitations to utility especially for those patients who need physical presence inside laboratories that are limited in telemedicine [8].

In this concept of telemedicine, the Philippine Health Care system, telemedicine should be prioritized for outpatients. According to the study conducted by Domingo et al [2021] there are factors that might affect the applicability and usage of telemedicine based on the given perception of professionals, this includes the sociodemographic characteristics of the professionals. The study conducted shows that according to the medical

practitioners, it is most impactful in contributing to the health care system implies that telemedicine can provide rapid results and care [9].

The system purpose is also to prevent fake clinics victim. The app can help patients to be informed on what clinic and doctors are reliable and trusted. The spread of fake news around the internet has been steadily increasing and advancing, which makes it harder to verify which is legitimate or not. Sometimes, Filipinos opt to go to clinic than a hospital, as Journal published by Bandiola [2019] discussed that 60 pharmaceutical crime incidents took place within Southeast Asia from 2013 to 2017 while a total of 213 incidents occurred outside the region. Out of these 460 incidents, 193 of which occurred in the Philippines, 110 in Thailand, 93 in Indonesia, and 49 in Vietnam [6]. From that numbers alone, Philippines can be considered as the hotspot of fake medical workers in Southeast Asia.

The proposed application will also cater to a feature of the doctor verification process. As stated by Javed et al. [2021] the importance of decentralized identity management for healthcare providers in the context of remote healthcare. Central to this is the concept of "identity proofing" to ensure that healthcare providers' identities align with their professional credentials, particularly their licenses. The paper proposes the involvement of healthcare regulators as trusted entities responsible for conducting this identity proofing process and issuing practice licenses [7].

III. METHODOLOGY

They will be greeted with the sign up or sign in options. If the user doesn't have an account, they may sign up and if the user is a doctor, they need to undergo an additional process, which is the verification process. The software application offers three login options, namely a Doctor Profile, Patient Profile, and Guest Profile. With three distinct login methods, this app facilitates efficient information access, appointment management, and healthcare delivery. Whether you're a patient seeking specialized care, a doctor managing appointments and patient records, or a guest looking for the right healthcare provider, this application caters to your needs, ensuring informed decisions and improved healthcare access. As seen in Figure 1, you can find the nearest doctor with the specialization you need e.g. cardiologist, dermatology, etc. and make appointments through the app. The doctor's account, whether it may be the doctor itself or the secretary managing the account, can accept appointments from patients requesting their service.

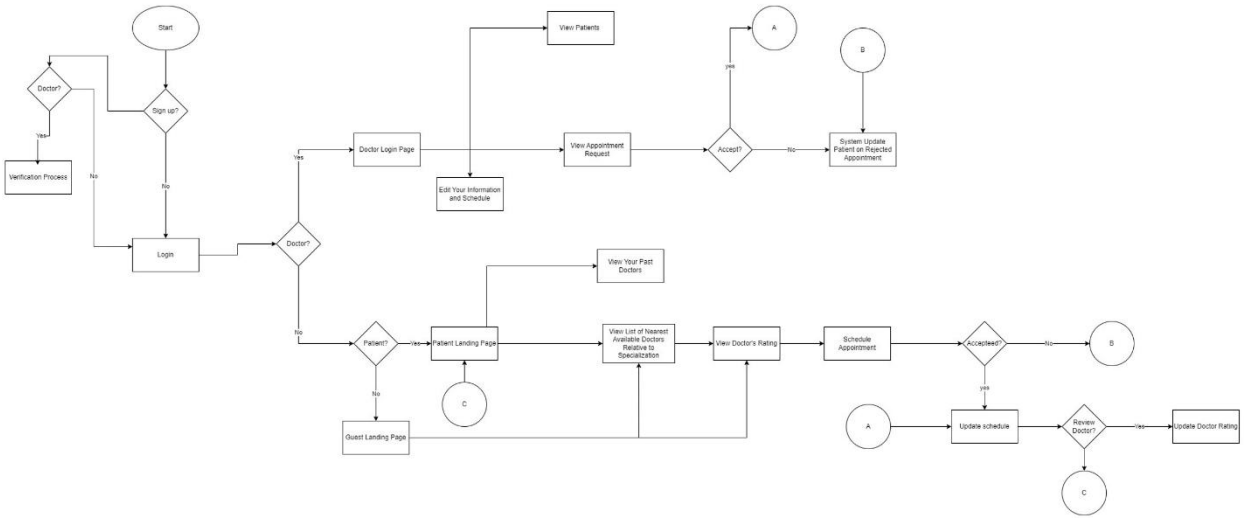

Figure 1. Process Flow (Doctor, User, and Guest Functionalities)

Since the software application features a functionality of booking appointments and receiving notifications, a sequence diagram has been created to emphasize the flow, which can be seen in figure 2, encompassing the detailed appointment booking and notifications.

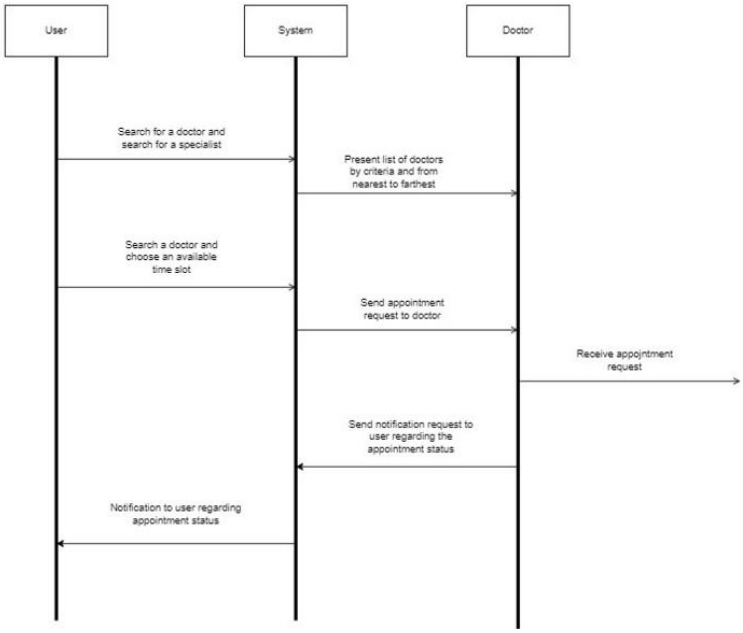

Figure 2. Sequence Diagram.

The planned architecture for the mobile healthcare app involves a Java-based backend, specifically designed for the Android platform, offering several advantages. The adoption of Java for backend development ensures a robust and scalable foundation. For the front-end, technologies like XML and Kotlin will be utilized, ensuring a seamless user experience across different Android devices. Hosting will be managed through Google Cloud Platform, providing flexibility and scalability. SQLite will be used as the local database solution, offering efficient data management capabilities tailored for mobile applications. This research-oriented approach aims to deliver a mobile healthcare platform with superior performance, security, and adaptability, meeting the evolving needs of users in the healthcare domain.

For determining the effectiveness of the proposed software application, a quantitative method is used to gain insights and evaluation through a survey. Participants are presented a video demo of the prototype and answered the survey corresponding on the features of the presented video demo of the application. Participants are chosen by simple random sampling, in which, the only category that the participants must met is to be 18 years old and above, as this age range can now schedule appointments on the doctor for themselves. The data was gathered through a survey called Google Forms, which helped the researcher to uniformly organize the questions and handpicked the right target audience. Questions are divided into 10, and we used the questions that are being used in the "System Usability Scale", where each question is recorded with a dedicated point. Those points will be used to identify the software SUS score.

For the statistical treatment, there are 10 questions presented and participants may answer the question in a 1-5 rating, which are strongly disagree, disagree, neutral, agree, and strongly agree. The SUS score will be calculated to evaluate the application effectiveness and ease of use. The total raw score, which can range from 0 to 40, is calculated by summing the assigned scores. This raw score is then adjusted to obtain the final SUS score [10].

In this formula:

Add up the total score for all odd-numbered questions, then subtract 5 from the total to get (X):

$$sum1 = q^1 + q^3 + q^5 + q^7 + q^9$$

$$X = sum1 - 5$$

Add up the total score for all even-numbered questions, then subtract that total from 25 to get (Y):

$$sum2 = q^2 + q^4 + q^6 + q^8 + q^{10}$$

$$Y = 25 - sum2$$

Add up the total score of the new values (X+Y) and multiply by 2.5:

$$SUS\ score = (X + Y) * 2.5$$

IV. Results And Discussions

The researcher gathered 34 participants to test the prototype and answer the SUS survey after using it. The data was gathered through a survey called Google Forms, which helped the researcher to uniformly organize the questions and handpicked the right target audience. Questions are divided into 10, and we used the questions that are being used in the "System Usability Scale", where each question is recorded with a dedicated point. Those points will be used to identify the software SUS score. The total number of participants is 34, in which the participants must've seen first the "Doctor Schedule Tracker" prototype video demo for their answers to be counted as valid.

Table 1. Survey Results

Respondent Number	SUS score
1	92.5
2	72.5
3	102.5
4	72.5
5	55
6	87.5
7	65
8	57.5
9	67.5
10	62.5
11	57.5
12	60
13	95
14	55
15	82.5
16	97.5
17	62.5
18	75
19	75
20	67.5
21	67.5
22	77.5
23	77.5
24	82.5
25	67.5
26	50
27	102.5
28	102.5
29	105
30	67.5
31	55
32	87.5
33	80
34	80
Overall Average SUS score	74.93

After giving the 34 users ten SUS questionnaires, computing each user's SUS score, and getting its average, the "Doctor Schedule Tracker" software scored 74.93 as its SUS score. This deems the software scored above average than the mean which is "68", expressing that the application is generally usable with little room for improvement. There are 6 categories for the SUS scores, which are divided into best imaginable, excellent, good, OK, poor, and

worst imaginable, the software is indicated in the “Good” zone. Taking all those factors into account, there isn’t a lot of major changes that need to be done.

V. CONCLUSION

In conclusion, the researchers evaluated the usability of the "Doctor Schedule Tracker" software with 34 people who filled out the System Usability Scale (SUS) survey. The poll was carefully designed and administered via Google Forms to the suitable audience. The SUS survey consisted of ten questions, each worth one point and used to compute the software's overall SUS score. The program had a SUS score of 74.93, which was higher than the average SUS score of 68. The program is classified as "good" in the SUS grading system, indicating that it is largely useful with little room for improvement. As a result, the findings indicate that the "Doctor Schedule Tracker" is in a good position, with no major revisions required at this time.

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