DEVELOPMENT OF NEW TELEDENTISTRY APPLICATION AS DENTAL PRACTICES' BUSINESS STRATEGY DURING COVID-19 AND NEW HABIT ERA

Fuad Husain Akbar[1*], Rasmidar Samad[2], Ayub Irmadani Anwar[3], Irene Edith Rieuwpassa[4], Sri Ramadany[5], Syarifuddin Mabe Parenreng[6], Burhanuddin Daeng Pasiga[7]

[1*,2,3]Department Dental Public Health, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia

[4]Department of Oral Biology, Faculty of Dentistry Hasanuddin University, Indonesia

[5]Department of Health Science, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia

[6]Industrial Engineering Department, Engineering Faculty, Hasanuddin University, Makassar, Indonesia

[7]Department of Dental Public Health, Faculty of Dentistry, Moestopo University, Jakarta, Indonesia

[*]**Corresponding Author:** Fuad Husain Akbar

*Department Dental Public Health, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, email: fuadgi2@gmail.com

Abstract

Background: Health is one of the basic needs of every human being. COVID-19 pandemic has challenged existing healthcare systems throughout the globe. The Information technology developments continue to increase.

Aim: create an Appstore and Playstore based teledentistry application for dentists to utilize during the COVID-19 pandemic.

Method: Literature studies, requirements engineering, system design, system implementation as well as drawing conclusions and suggestions.

Results: The application features functional test was directly proportional to the expected results. **Conclusion:** the design of an Android-based teledentistry application for dental practices can simplify dental healthcare services delivery, help improve time effectiveness, increase the efficiency of recording system in dental clinic thus shortening duration and increase accuracy. The development of this system can also help minimize losses due to errors in recording patient data.

Keywords: Teledentistry, Appstore, Playstore, COVID-19

1. INTRODUCTION

The COVID-19 pandemic has challenged existing healthcare systems around the globe. Due to its nature of spreading by droplet, fomite and contact transmission, face-to-face interactions of healthcare professionals with patients carry a risk of transmission. Because dental care always involves inspection, examination, diagnostics and therapeutic interventions from the naso-oro-pharynx area, dental professionals are most vulnerable to being infected with the Corona virus. As a result, during the current pandemic, most routine dental procedures worldwide have been suspended, and only emergency dental procedures and surgeries are

performed. However, seeing the current uptrend in cases of COVID-19, it seems that this pandemic will not end soon. In fact, even WHO recently demonstrated concern that this virus will just become another endemic virus in our communities and might never disappear. If these speculations are correct and COVID-19 does become endemic, dental practice will need to reorganize and innovate to continue dental care with minimal risk of cross-infection.[1,2,3,5]
With this study researchers saw an opportunity to enable public to utilize the sophistication of telecommunications technology and in consideration that this COVID-19 pandemic which seems like this pandemic will not end in the near future, thus the researchers created an android-based teledentistry application that aims to minimize direct contact between patients and the dentists.

2. THEORETICAL FRAMEWORK

2.1 Teledentistry

Teledentistry is part of telemedicine, which provides ease in providing dental health services, such as diagnosis, treatment plan, consultations, and follow-up through electronic transmission from remote locations.[7,8] Teledentistry finds its roots in telemedicine, telemedicine has long been a solution to meet healthcare services needed in remote locations, and was first used by NASA in the 1970s and has been defined as "the practice of health care delivery, diagnosis, consultation, treatment, and education using interactive audio, video, or data communications and using video technology to diagnose and advise on further treatment.[4,6]

2.2 Information Systems

Information System is a collection or arrangement consisting of hardware and software as well as their implementation personnel who work in a sequential process and mutually support each other to produce a product.

2.2.1 Information System Components

A computer-based information system (CBIS) in an organization consists of the following components[9]:

a. Hardware, namely hardware components to complete data input, data processing, and data output activities.
b. Software, programs and instructions provided to a computer.
c. Database, which is a collection of data and information organized in such a way that it is easily accessible to information system users.
d. Telecommunications, which connects system users with computer systems together into an effective network.
e. Humans, the personnel of information system, including managers, analysts, programmers, and operators, as well as those responsible for system maintenance.

2.3 The Kotlin Programming Language

Kotlin is a programming language based on the Java Virtual Machine (JVM) developed by JetBrains. Kotlin is a pragmatic programming language for Android that combines object oriented (OO) and functional programming. Kotlin is also an interoperable programming

language that allows this language to be combined in one project with the Java programming language.[10]

2.4 Android
Android is an operating system for mobile phones based on Linux as its kernel. Currently, Android is the main competitor of other smartphone products such as Apple and Blackberry because Android has several advantages over other smartphones, namely[11]:

a. Android is Open Source, meaning that developers (Android Developers) are free to develop applications on this platform
b. Android provides tools for building software that are very complete compared to other platforms.
c. Android is a mobile platform that has no limitations in developing its applications. There is no license needed in developing Android applications

2.5 MySQL
MySQL (My Structured Query Language) is a database relation system or Relational Database Management System (RDBMS) that is able to work quickly and is easy to use. MySQL is also a database access program that is networked, so it can be used for multi-user applications. MySQL is distributed free under the GPL (General Public License). Every program is free to use MySQL but cannot be used as a closed source or commercial derivative product

2.6 Firebase
Firebase is an API provided by Google for storing and syncing data into Android, iOS, or web applications. Realtime database is a facility which save data to database and fetch data from it quickly but firebase is not just realtime database it is much more than that.

3. METHODS
3.1 Research design
In this study, researchers deployed research and development methods, or better known as Research and Development. Research and development methods are research methods used to develop a new product or improve an existing product, and test the effectiveness of the product. The resulting product can be in the form of hardware or software. Approval for conducting this study was obtained from the Ethics Committee of the Health Research, Faculty of Dentistry-Educational Hospital, Hasanuddin University No. 0204/PL.09/KEPK FKG-RSGM UNHAS/2023.

3.2 Research methodology
In this research, a literature study was carried out to complete the references needed for analysis for the development of features in the teledentistry application that will be made. This literature study is important to do because there are several government regulations that serve as guidelines in the delivery of health services in Indonesia. It is also important to study the literature on teledentistry to see the results of previous studies that have produced similar studies as a reference for implementation in this study. From the results of the literature study

and needs analysis, the application design was then carried out and then development was carried out. The application that has been developed was then tested by testing the functionality of the Android-based dental and oral health service information system application.
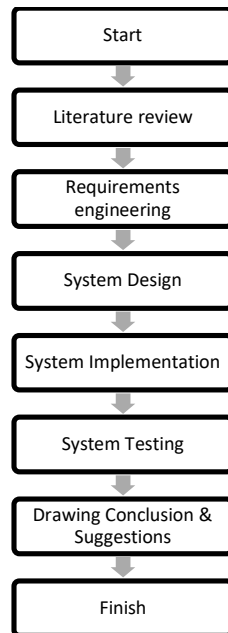
```
┌─────────────────────────┐
│          Start          │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│    Literature review    │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│      Requirements       │
│       engineering       │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│      System Design      │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│  System Implementation  │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│     System Testing      │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│  Drawing Conclusion &   │
│       Suggestions       │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│         Finish          │
└─────────────────────────┘
```

Figure 3.1: Research Methods

In the system design section, there is a use case diagram design that represents an interaction between actors and a system that describes the expected functionality of a system.[13]

3.3 Research Instruments

Several instruments were needed to conduct this research, and they were divided into two parts, namely: hardware and software[13].

a. Hardware
a) Laptop specifications: Intel i-5 processor, 8GB RAM, 10GB storage
b. Software
a) Operating System : Windows 10 Pro
b) Tools : Android Studio, SDK, Visual Studio Code, Postman, Xampp
c) Word Processor: Microsoft Office 2016

4. RESULTS
4.1 System Implementation and Testing
1. Patient's Interface
a) Application Logo Interface and Splash Screen Menu Interface
b) Sign In Menu Interface, Sign Up Menu and Verification Code
c) Home Layout Interface and Patient Identity Interface
d) Select Doctor, Consult, and Make Appointment Interface
e) Queue number, Treatment Card, and Transaction Info Interface

f) Doctor's prescription, transaction history and notifications interface

2. Clinic's Admin Interface
a) Admin main menu
b) Patient registration
c) Patient data
d) Transaction data
e) Information Data

3. Test Results
The results of system testing are as follows:
a. Application Main Menu Testing
Application's main menu test results can be observed in the following table:

Functions Tested	Expected Outcome	Observation	Conclusion
Login Button	Log In interface appears and user can input username and password	Login successful	[√] Accepted [ ] Denied
Sign Up Button	Sign Up interface appears and user dan Sign Up by inputting username, email, password and phone number	Login successful	[√] Accepted [ ] Denied
Menu Button	Home layout interface appears	Login successful	[√] Accepted [ ] Denied
Patient Identity Button	Patient Identity Interface appears and information regarding users' basic identity and additional information that needs to be filled out by patients, and edit profile option when patients wish to edit their information details, also log out button when patients wish to log out	Login successful	[√] Accepted [ ] Denied
Consultation Button	Consultation interface appears when user want to do a consultation with a dentist they had previously searched/selected and the patient can send an image to the dentist	Login successful	[√] Accepted [ ] Denied
Make Appointment dan Select Schedule Button	Make appointment interface appears when user click on it if after consultation further examination and treatment had to be performed, user can make an appointment and select appointment schedule according to schedule choices, after the appointment is approved by the provider user will receive queue number.	Login successful	[√] Accepted [ ] Denied

Treatment Card Button	Treatment card interface appears, the treatment card has been filled by the healthcare provider and contains information such as patient's identity, diagnosis, treatment, attending physician, fee and notes from the dentists.	Login successful	[√] Accepted [ ] Denied
Transaction Info Button	Transaction info interface appears if the user has already finished a transaction.	Login successful	[√] Accepted [ ] Denied
Prescription Button	Prescription interface appears if prescription were indicated	Login successful	[√] Accepted [ ] Denied
Transaction History Button	Transaction history interface appears and show all of the user's previous treatment history, fee, and duration spent on each clinic	Login successful	[√] Accepted [ ] Denied
Notification Button	Notification interface appears. For routine treatment such us scaling which needs to be performed once every 6 months, and routine consultation, notification will appear as reminder.	Login successful	[√] Accepted [ ] Denied

5. DISCUSSION

Android-based teledentistry applications for dental practice exist as an answer for people who are experiencing the COVID-19 Pandemic where this pandemic has challenged existing health care systems throughout the globe There have been many studies discussing teledentistry applications, one of which is in the journal from Dewi Lestari and Inge Handriani titled Analysis and Design of Dental Clinic Service System Applications (Case Study: Dental Echo Clinic) in 2019. The background is that the data processing, which was carried out manually takes too long and cause data invalidity, also data confidentiality cannot be properly maintained therefore the dental clinic really needs an information system as a means of promotion, registration and agreement that can support and provide satisfying services for patients. To solve the problems that exist in this clinic, as well as with this web-based system, more effective activities can be achieved in supporting registration activities and agreements at this clinic, the application of this computerized system is very much needed at the clinic, especially with regard to clinical services which include registration, examination, financing, and reporting, all data related to patient information will later be recorded and stored, hence patient documentation will be more organized.[14]

The journal found that with the Design of a Dental Clinic Service System Application that can simplify the service process, help increase time efficiency in the dental clinic service process at the Dental Echo Clinic, increase the efficiency of the recording system in dental clinic, thus enabling services to be delivered quickly and accurately. As well as the design of this system can help minimize losses due to errors in recording patient data.[15]

Not much different from the background of the design of this teledentistry application, Easy Dent is also here to simplify the service process; help increase the time efficiency in the dental clinic service process, and the main thing that becomes the background is the current COVID-

19 pandemic, especially in Indonesia. Easy Dent is not only intended for clinical services, but this application can also be used by the patient's attending dentists so that patients can receive information, conduct consultations, register and make payments from home, meaning that patients no longer need to come to the clinic. On the other side, dentist can also provide information, answer patients who do consultations about dental and oral health anywhere and anytime using a smartphone. This will minimize meetings between dentists and patients, thus the spreading of COVID-19 can be minimized.[16]

6. CONCLUSION

Based on the research that has been conducted, it can be concluded that with the design of an android-based teledentistry application in dental practice we can extract design and functional tests of the Covid-19 Teledentistry application so that it is expected to be able to simplify the service process, help increase time efficiency in the dental clinic service process, increasing the efficiency of the recording system in dental clinic thus providing services more quickly and accurately in accordance with what was designed when the Teledentistry application was launched on the PlayStore application. As well as the design of this system can help minimize losses due to errors in recording patient data.

REFERENCES

[1]. Ghai Suhani. Teledentistry during COVID-19 pandemic. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2020; 14: p.932-4

[2]. Santoso BS, Medina R, Trisnanti S, Puji S. The development and future of telemedicine in Indonesia. Department of Electrical Engineering and Information Technology, Faculty of Engineering, UGM. 2015. 15; ISSN:2085-6350: p.10

[3]. Kishimoto N, Luka S, Hiroyuki T, Kenji S. Tele-monitoring and tele-sedation for systemic management during dental treatment. Journal of Dental Sciences. 2019; 2(15): p.230

[4]. Rana N, Dhruvakumar D. Teledentistry: A must in the era of patient driven dentistry. Journal of Oral Research and Review. 2015; 7(2): p.77-8

[5]. Rahman N, Nathwani S, Kandiah T. Teledentistry from a patient perspective during the coronavirus pandemic. Br Dent J. 2020; 4.doi: 10.1038/s41415-020-1919-6

[6]. Rinto P. Electronic Medical Records Using Dental Intraoral Photo Storage Systems for Internet-based Teledentistry Applications. Journal of inovtek polbeng - informatics series. 2019; 4(2): p.s. 123

[7]. Karman J, Hardi M, Taqwa M. Android-based geographic information system. Yogyakarta: CV. Budi Utama; 2019.p.1-2

[8]. Ismayani A. An easy way to create Android-based learning applications with thunkable. Jakarta: PT. Alex Media Komputindo; 2018. p.3

[9]. Asmara Rini. Information system for processing disaster management data at the regional disaster management agency (BPBD) Padang Pariaman Regency. J-Click Journal. 2016; 3(2): 82-3.

[10]. Sibarani NS, Ghifari M, Bambang W. Performance analysis of Android applications in the Java and Kotlin programming languages. Industrial research workshop and national seminar. 2018: p.320

[11]. Payara GR, Radius T. Application of Firebase Realtime Database on Android-Based Food Ordering Application Prototype. Informatics Engineering and Information Systems. 2018; 4(3): p. 398-9.

[12]. Destiningrum M, Qadhli JA. A web-based doctor scheduling information system using the codeigniter framework (case study: Yukum Medical Center Hospital). TEKNOINFO Journal. 2017; 11(2): p.33

[13]. Listya FF, Mushlihudin, Kartika Firdausy, Anton Y. Android application information system based health services. Journal of Electrical Engineering Computer Science and Informatics. 2016;2(1): p.39-42

[14]. Gadupudi SS, Swet N, Srilatha Y. Teledentistry : A Futuristic Realm od Dental Care International Journal of Oral Heakth Science: 2017; 7(2): p.63-4

[15]. Amtha R, Gunardi I, Astoeti TE, Roeslan MO. Satisfaction Level of the Oral Medicine Patients Using Teledentistry During the COVID-19 Pandemic: A Factor Analysis. J Int Soc Prev Community Dent. 2021 Jul 30;11(4):414-420. doi: 10.4103/jispcd.JISPCD_72_21

[16]. Achmad H, Tanumihardja M, Ramadhany YF. Teledentistry as a solution in dentistry during the covid-19 pandemic period: A systematic review. Int J Pharm Res. 2020; 12(2): 272–278.