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Self-Diagnosis of COVID-19 Through Mobile App: Need of the Hour in Pandemic Situation

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Abstract

Recent pandemic situation have clearly shown us how rapidly a new disease can take root and cause a huge damage to humanity. COVID-19 is one such disease that was born in Wuhan-China, spreading quickly across the world and terrorizing the entire world. Even the most advanced countries can't able to find a solution for this. Many countries have adopted various methods to curtail the disease through lockout and quarantine. As this is vigorously transmitting from person to person, people felt panic to step out of their houses. Even with common flue, people are getting stressed about the situation and they find difficulty in distinguishing the common flue and COVID-19. The present paper aims in helping such people to self-diagnose the disease from indoors and thereby avoiding a rush in hospital. To address this issue, a mobile Application is developed for Android, Black-Berry, IOS

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and windows OS platforms by using HTML, CSS and AngularJS. PhoneGap software development framework is used to develop the proposed mobile application. Further, location tracking is accomplished through GPS and also a Unified Mass Notification System can be used to deliver alerting messages.

Keywords: COVID-19, Quarantine, Location tracking, Unified Mass notification, PhoneGap

1 Introduction

Based on the available data, it is found that the median time from onset to clinical recovery of covid-19 is approximately 2 weeks for mild cases and is 3-6 weeks for patients with critical diseases. Since, it is possible for people of any age can be infected with COVID-19 exclusively Older people and those with the history of pre existing medical problems like diabetes, HIV, cardiovascular disease and cancer are more likely to develop such serious illness. On the other side, the number of COVID-19 cases is increasing day by day and the available medical staffs are not sufficient to screen everyone.

Health care plays an important role in people's life quality. The technology is advancing to improve the medical services and quality of life. Mobile health care service providing Apps are one such advancement. Rather than going to hospital, people can receive the medical services through their smart phones.

In this paper, a mobile App is being developed that allows an individual to have a self-check for diagnosing the presence of COVID-19. The mobile app is developed with the help of PhoneGap framework as the PhoneGap is a reliable and easy to use software development framework. PhoneGap makes the developers to develop their apps using standard web APIs for all major mobile operating systems. Moreover, the added feature that this PhoneGap is open-source and freeware.

The mobile app that was developed for self-diagnosis helps the individual in 2 ways. When the symptoms of the individual don't match with doctor's prediction (stored in database), he/she will be relieved from their anxiety. In the second case, if the symptoms match with the doctor's prediction, he/she will be automatically connected to the health care providers with the help of the proposed application software. This will help the individual to self-quarantine themselves from their family members untill the health care providers reach them to provide proper medication. It will

avoid spreading of disease to others. Further, it helps the individuals to ask more informed questions about the pandemic situation due to COVID-19.

2 Literature Survey

Kluge et al. [1] clearly illustrated the situation of refugees and migrants who live in overcrowded conditions without access to basic sanitation. It reported the inclusion of Refugees and migrants in national public health systems, with no risk of financial or legal consequences for them.

Norwegian Refugee Council [2] have reported about the potential impact the global spread of Coronavirus could have on vulnerable refugees and internally displaced people

Naina S Thorat and Kulkarni [3] reviewed the use of smart phones in getting more attention in health care and medical services. They have reported the advantages of using mobile phones in health care sector.

Ekwonwune Emmanuel Nwabueze and Onuoha Oju [4] have demonstrated how a mobile application rendered help in developing a better communication between patient and doctors in countries like Africa where the doctor-patient interaction is dominated by doctor.

Obulor, R. and Eke, B.O [5] have designed an appointment system for health care appointment queuing system to reduce the patient waiting time and to improve the development of the hospital services.

Steinhubl, S.R et al. [6] have shown the use of wearable sensors for getting alerts on health conditions.

Ayanthi Saranga Jayawardena [7] has focussed towards the computerization of hospital health record systems and automated medication reports. The prescriptions reports generated proved an improvement over the safety of drug administration.

Ventola, C. Lee [8] has prsented the types and Prevalence of Devices Used, need for Mobile Devices at the Point of Care, how Health care professionals can use mobile Apps for providing better communication.

Wani, Swabik Musa Abdulla and Suresh Sankaranarayanan [9] have shown different ways of booking appointments and medicine collection by avoiding wastage of time and automatic calling of patient based on priority for appointment scheduling. Further, it clearly shows how it enforced the timing constraints towards making, rescheduling and cancelling appointment.

Divall, Pip et al. [10] have conducted trials that shows statistically about the significant benefits related to safer prescribing, appropriate diagnosis and antimicrobial prescribing when personal digital assistants were used as clinical decision tools.

Sclafani et al. [11] have demonstrated the support rendered by mobile computing towards medical diagnosis in the form of remote patient data access and patient care applications.

Martínez-Pérez et al. [12] have presented the studies related to the existing applications for mobile devices that are exclusively dedicated to the eight most prevalent health conditions.

Prithiviraj [13] have demonstrated an HSDPA based emergency telemedicine system that has been proposed with reduced latency.

3 Proposed System

This interactive health care Mobile Application consists of three parts front end, middle ware and back end. Front end consists of Graphical User Interface (GUI) which allows the user to easily interact with the system by using icons, placeholders, buttons, text field and other interactive elements. The Middle ware is software which lies between an operating system and applications that run on it. Back end of the applications helps in storing and manipulating the data that has been entered through the front end which will be stored in database by the back end.

Our proposed system has the following 4 modules:

1. Doctor Module
2. Patient module
3. Lab Report Module
4. Admin module

3.1 Doctor Module

The prerequisite in this doctor module is that the Google location needs to be active. Health care doctors who are all providing treatment to the individuals have to be approved by the Government which in turn they have been provided with a unique identification number to each of them. This unique number can be used as a login id by the doctor into the registration portal. Whenever an alert message is triggered by the App, the doctor should provide health care to the patient from whom the alert is triggered. Based on the report received from the laboratory, doctor will decide whether to move the patient to quarantine facility or to treat him as individual in the hospital.

The following figure 1 shows the login page for the doctor:

Figure 1 Doctor Login Page

Doctor is responsible for updating the patient's current status to their family members. The doctors can perform the following activities:

- Doctors may login to the system with unique identification number given by Government and they can receive alert message based on the doctor's location.
- Once the doctor receives an alert message, he/she can view patient's symptoms and patient's location.
- Doctor can personally visit the patient and examine the patient based on the need.
- Based on the doctor's advice, samples from the patient will be sent to the laboratory for further testing.
- Based on the Lab reports, the doctor may take decision whether the patient need to be quarantined or to be taken to quarantine facility in the hospital.

3.2 Patient Module

The prerequisite for the use of patient module is that the Google location need to be active. The patient is supposed to answer some set of questions posed by our App. Once the first question has been answered, he/she will be directed to next set of questions based on the answers provided by the individuals to the previous question. For example, if he/she answers yes for the question trouble breathing, then he/she will be directed to the next question inability to arouse. These questions are sequenced based on the doctor's direction.

The following Figure 2 shows the Login page for patient:

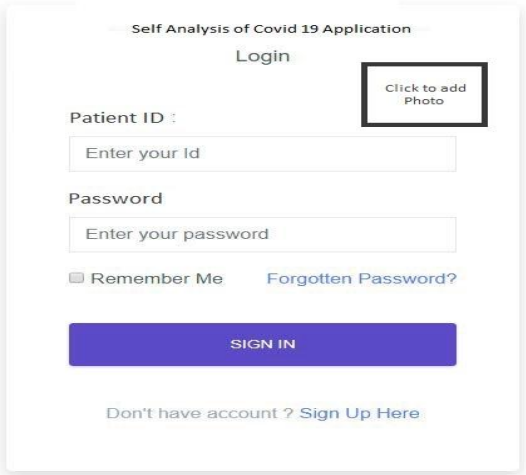

Figure 2: Patient Login Page

The patient can perform the following tasks through the Application developed:

- The patient can register their detail into the system and may log in to the system
- The patient can take part with the preset questionnaire as decided by the doctor
- The patient can perform self-diagnosis of the symptoms by attending the questionnaire and the patient can receive doctors' advice
- Further, the patient can also view his/her test reports received from the laboratory

Once the user gets log on to the system, the App will prompt the user to attend the questionnaire. After answering all the questions, he/she will be either directed to the doctor or he/she might receive a message saying that "Symptoms does not relate to COVID-19".

The below Figure 3 shows the questionnaire page for the user:

Figure 3: Patient's Questionnaire

3.3 Lab Report Module

Based on the reply provided by the individuals to the questionnaire, the app will identify whether the individual need medical attention or not. If so, an alert message will be triggered to the nearest doctor by using location tracking which is present in the App. Based on the alert, the doctor will take necessary action. In case if testing is required, the doctor may collect the samples from the patient and send it to the lab for further investigations.

3.4 Admin Module

The admin module can be used to update the questionnaire and this update will be performed on all the registered users of COVID-19. The admin is responsible for overall data base management. Admin can perform the following tasks through the Application developed:

- The Admin can be able to login to the system
- The Admin can search for the required user details
- The Admin can edit user information details
- The Admin can check for the retrieved updates
- The Admin is responsible for the overall system management.

4 System Architecture

System architecture represents the fundamental structures of a software system and the elements that can interact with each other.

The data flow starts from the user whenever the user log in to the system. The entered details by the user will be stored in the database for further processing. Blood samples of the patient will be collected if needed and sent to the laboratory. The test reports will be updated to the doctor who may also take the necessary action if required according to the status of the report.

The following Figure 4 showcases the architecture of the application which depicts the the data flow from one module to other using the GUI.

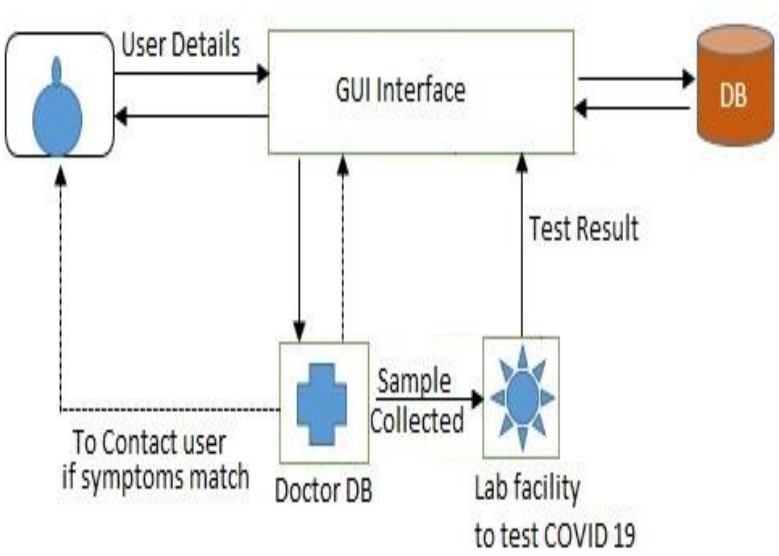

Figure 4 System Architecture

5 Conclusion

This paper presents a mobile health care application that can help the individual to self-analyze & diagnose the symptoms of COVID-19 and aids in seeking an appropriate medical assistance from the health care providers. The proposed system can be easily portable to any where and can be installed on all Android based mobiles. The interface provided by the App is easily user friendly in which the user may easily handle them by following the procedureal steps.

The main advantage of this application is that the individuals will ease from their anxiety and they need not step out of their houses unnecessarily, thereby avoiding the spread of disease. This aids in saving the fruitful-time of both doctors and patients. This App also may also help the users to receive latest notifications from the government on COVID-19.

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Biographies

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Karthik Murugesan graduated in Electrical and Electronics Engineering from Manonmaniam Sundaranar University, Tirunelveli, India and received the Master degree in Applied Electronics from Anna University, Chennai, India in 2004 and he was awarded PhD in Electrical Engineering in 2016 at Anna University, Chennai. He is currently with Kongu Engineering College affiliated with Anna University, Chennai. He has published and presented several papers in International journals and conferences respectively. He has also conducted several workshops and seminars in his research area. His research interest includes IoT based Embedded systems, Fuel Cell Hybrid Electric Vehicles, Energy conversion/storage systems, Renewable Energy systems Modeling and Integration with Electric Grid.

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Lalitha R is a Professor in the Department of Computer Science and Engineering at Rajalakshmi Institute of Technology, Chennai. She graduated as Computer Science Engineer from Bharathiyar University in 1992. Her Post-Graduation degrees includes M.E. in Computer Science and Engineering from Anna University, M.Tech in Information Technology from Punjabi University, M.B.A. in Systems Management from IGNOU. She has got dual Ph.D. One from Anna University Chennai and another from SathyaBama University, Chennai. Her areas of interests include Software Engineering, Machine Learning, Deep Learning, Virtual Reality and Augmented Reality. She has guided many students in research-oriented projects and published many papers in leading International Journals.