

The Role and Mechanism of COVID-19 Apps in Fighting the Current Pandemic: A Novel Study

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Abstract: *The outbreak of COVID pandemic, the number of cases has been rapidly increased and still increasing across the world. Consequently, various countries have developed mobile health applications to improve the delivery of healthcare services to contain the spread of the novel corona virus during the COVID-19 pandemic. As there is a rapid progression in the nature of the pandemic, with new symptoms and cases, and new emerging technologies, there is a need for a worldwide regular review of mobile applications. The objective of this paper was to review the functionalities and effectiveness of the free mobile health applications available in the Google Play and App stores used in Saudi Arabia, Italy, Singapore, the United Kingdom, USA, and India during the COVID-19 outbreak.*

Keywords: COVID-19, Application in the present pandemic, COVID-19 Applications

1. Introduction

The new corona virus severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) (COVID-19) outbreaks were declared a pandemic by the World Health Organization on March 11, 2020. With 17, 771, 634 confirmed instances of COVID-19 sickness and 683, 278 deaths reported to the World Health Organization, this highly contagious viral disease has already spread to over 213 nations (WHO). To combat the pandemic, the World Health Organization has advised governments to increase COVID-19 patient testing, isolation, and contact tracing, and this process has been aided by recent measures. The number of people who own a Smartphone has increased significantly in recent years [21]. In the present COVID-19 pandemic, Smartphone technology (SMT) has important potential both on its own and as an extension of telemedicine. It plays an important role in the monitoring and control of the disease including diabetes and hypertension. Currently, Smartphone have functions such as a camera, video recording, GPS navigation, games, sending and receiving electronic mail (email), and web search applications for a number of uses.

Using innovative technologies namely mobile health apps with Bluetooth, GPS, artificial intelligence (AI), and machine learning (ML) techniques to deliver healthcare remotely while adhering to preventive measures like social distancing and home quarantine can significantly improve the delivery of healthcare services remotely. Similarly, information and communication technologies (ICT) such as telemedicine, virtualized software, and virtual care can be used to treat COVID-19 patients remotely. These technology services are universal in scope and reduce the COVID-19 virus's exposure to patients and doctors. In this regard, the global penetration of ICT in the smart phone area was 3.2 billion users in 2019, and it is expected to reach 3.8 billion users in 2021 [22].

2. Literature Review

There are a few literature reviews focused on apps developed for contact-tracing, prevention, surveillance

measures, and mapping disease spread. In Jalabneh et al. (2020) were identified 17 primary studies whose current application is to monitor and diagnose infected individuals. However, the authors only share their view concerning data privacy regarding how users' information is not necessarily accurate, which affects data analysis [1].

Hendl, Chung & Wild, 2020 Contact-tracing apps collect a wide range of data, including personal, location, and health and fitness data. In many countries, individuals avoid using these apps due to privacy concerns. Debates about the COVID-19 app's ethics have been largely preoccupied with privacy concerns, as these data is shared with governments, health ministries, and organizations. It is an individual's right to understand what data these apps have access to, who has privileges to obtain them, and how their data is used. Vitak & Zimmer, 2020 Digital solutions must comply with confidentiality requirements (privacy and security) to ensure personal data protection. Examples of these actions could be obtaining users' consent, transparency, voluntary self-reporting, and anonymization. Moreover, clear and ethical principles must be stated. When designing and deploying these apps and any other solutions, it is necessary mitigating privacy concerns. [2] [3]

Regarding the collection of users' information, there is only mention of an app developed in the United Kingdom, where the data are stored in various places. Zimmermann et al. (2021) provided a set of population perceptions about contact-tracing apps regarding authority trusting and individual privacy, among others. However, the context of such work only considers the three main German-speaking countries: Germany, Austria, and Switzerland [4].

Mbunge, 2020 Many COVID-19-affected countries look at these technology-based solutions, facilitating and automating limiting infection and minimizing viral spread. These can be deployed following different approaches and adapting multiple technologies, such as a global positioning system (GPS), Wireless Fidelity (Wi-Fi) technology, and Bluetooth [5]

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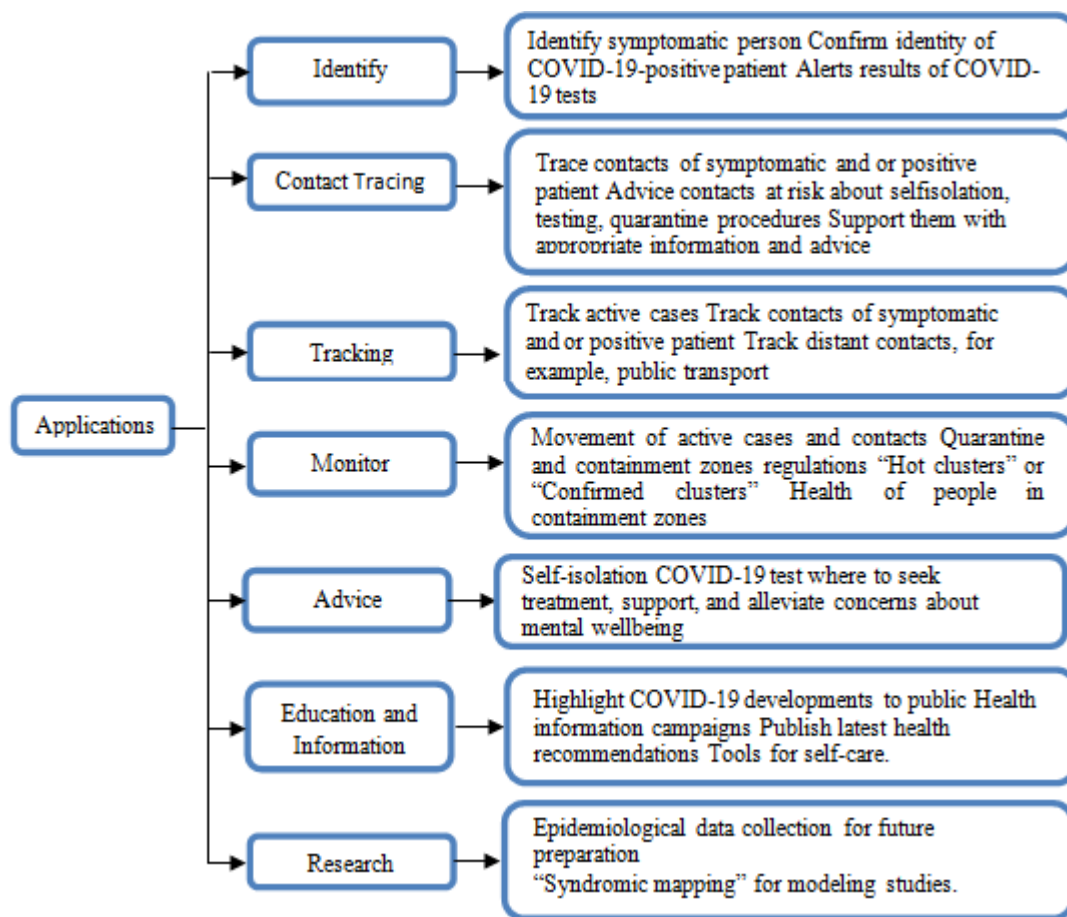


Figure 1: Application in the present pandemic

3. Mobile Application Features and Functionalities

Mawid, Tabaud, Tawakkalna, Sehha, Aarogya setu, Trace Together, COVID safe, Immuni, COVID symptom study, COVID watch, NHS COVID-19, and PathCheck are the features and functionalities of the 12 mobile applications that met the inclusion criteria. App overview (price, ratings, android, iOS, developer/owner, country, status), health tools (user status-risk assessment, self-assessment, E-pass integration, test results reporting, online consultation, contact tracing), learning options (personalized notes, educational resources, COVID-19 information), communication tools (query resolution, appointments, social network, notifications), app design (data visualization (alerts, data protection).

4. Description of the Applications

4.1 Mawid App

The Saudi Arabian Ministry of Health provides the Mawid application, which is a central appointment system. Patients can use the app to plan, change, and reschedule appointments, as well as manage transfer appointments, at any of Saudi Arabia's 2400 primary care centres. Patients can view the primary care centres closest to their area using the application's GPS and maps capabilities. They can choose any primary care facility and schedule appointments at their leisure. The app also notifies the user if an earlier

appointment window becomes available, which might be beneficial to those who require an early appointment [6]. The application includes a self-assessment option for COVID-19, as well as a consultation window for the general public. In the application for the self-assessment test, patients must submit information such as their travel history and symptoms, as well as answer other pertinent questions. The programme was integrated in 98 percent of hospitals and primary care centres at the time of its launch in May 2019, and it had over 6.5 million registered users.³¹ Since the COVID-19 outbreak in Saudi Arabia, the application has given consultation services to over half a million people and over 250, 000 self-assessment tests have been recorded. The Mawid application, which was originally created to promote digital health, has shown to be quite helpful in providing healthcare services during the COVID-19 pandemic [7].

4.2 Tabaud App

In relation of the Tabaud application, it was designed to help Saudi Arabia meet health and safety goals by controlling the COVID-19 pandemic and restricting the transmission of novel corona viruses, as well as to ease limitations on economic and social activities. The software is primarily intended for contact tracking, as it alerts users when they come into close proximity to other infected people who are also using the app [9]. For contact tracing, this software leverages the Google Apple API, which ensures that the users' privacy and security are maintained. As a result, the app does not use location mapping, instead relying on

Bluetooth technology to find other devices that are running the same software. This information is given if a user modifies their status in the app to infect. If a user reports itself as infected on the app, the information is submitted to the Ministry of Health for confirmation. If the ministry confirms the information, all Tabaud app users who were in close proximity to the infected person during the 14-day period prior to the illness will receive a notification to take the appropriate precautions [8].

4.3 Tawakkalna App

Tawakkalna is a Saudi Arabian Smartphone application that has been certified by the Saudi Ministry of Health. The goal of this software is to make emergency mobility of individuals easier during lockdowns and curfews. Furthermore, the application provides data about the COVID-19, such as the number of infections in various regions. In the event of an emergency during curfew, Saudi nationals can use the app to request travel permits. The application also warns users if they are near infected or hazardous areas [10]. It's a mock-up of a Chinese app that employs a color-coded QR to reflect the user's current position. Green indicates that the individual is in good health and has authorization to travel. The person is not allowed to move because they are suspected of having COVID-19. The red color signifies that the person is infected, unable to travel, and must be quarantined [11] [12].

4.4 Sehha App

The Sehha mobile application is one of Saudi Arabia's most advanced mobile health applications. The programme was created to provide users with e-consultations in the comfort of their own homes using voice and video modes. The application uses AI technology to enable users to obtain secure medical information while also improving the user's experience during the consultation process. It also includes a health assessment tool that requires users to complete a series of questions. Based on the responses, a health score for an illness or condition is calculated, and the appropriate feedback and warnings are prescribed. In terms of booking appointment, the Sehha app is similarly to the Mawid app, but it varies in that it allows for an e-consultation method.

4.5 Aarogya Setu App

Aarogya Setu is an official Smartphone application developed by the Indian government to track the COVID-19 epidemic and prevent it from spreading further. For tracking, the app use both GPS and Bluetooth technology. This programme, like Tawakkalna, uses Bluetooth to communicate with neighbouring devices and GPS to track the user's location in relation to other Smartphone users who have been infected and are using the same application. Additional features include self-assessment exams, test reports, e-permits for travel, COVID-19-related information, preventive approaches information, online consultations. More than 1.4 million users have been notified of the potential for contamination, and the app has assisted in the creation of 697 corona virus hotspots across the country. However, some privacy concerns were highlighted in respect to the data's use, such as data collecting, purpose limitation,

data storage, and institutional divergence, absence of law, transparency, and audit ability. Following the government's response to these concerns, the majority of people now utilize the app [13].

4.6 TraceTogether App

The Singapore government has introduced TraceTogether, a contact-tracking mobile app. This app, like the Aarogya Setu app, employs Bluetooth technology to detect when a user is in close proximity to an infected person and warns them appropriately. This programme employs anonymous IDs that are transferred across TraceTogether-enabled mobile phones. When developing the software, privacy and security were given top priority. After 25 days, the Bluetooth data in the Smartphone is automatically removed. Furthermore, consumers have the option of deleting their data, assuring a high level of privacy [14] [15].

4.7 COVID Safe App

The COVID Safe application, developed by the Australian Department of Health, is a contact-tracing Smartphone application. The Australian government has certified it as the only contact app. The app's goal is to track people's movements and determine whether they have come into close touch with infected individuals. If they do, the software sends them a notification. Furthermore, health professionals will contact and provide the necessary help and information. Users can register under a pseudonym to safeguard their identities, as well as providing their cell phone number. The software should be allowed to run in the background. It communicates with other devices that have installed the COVID Safe application utilizing Bluetooth technology (via a digital handshake). Date, time, and contact numbers are securely encrypted and saved on the phone for 21 days; users can erase the data after that period. Additionally, at the end of the epidemic, the data held in the National COVID Safe Data storage will be destroyed.

4.8 Immuni App

Immuni is a contact-tracing app that was launched in June 2020 by the Italian government. This programme works similarly to other contact-tracing apps in that it warns users if they come into close contact with someone who is infected and is using the same app. The app's distinguishing characteristic is that it use Bluetooth low energy technology, which ensures low power consumption. Furthermore, the app does not gather any personally identifiable information such as a user's name, date of birth, address, phone number, or email address. When two Smartphone with the Immuni app installed come into close proximity, the produced codes are automatically exchanged. If one of the users is diagnosed with the virus, the application will be able to track out past encounters. The code is then entered into a centralized system by health authorities with the patients' approval, and this system is utilized to inform all other users who have come into close contact with the patient (using the code). Furthermore, the application has a multi-language capability that allows people of many countries to utilize it in Italy. The application does not track user movements and simply shares contact tracking codes. By December 31, 2020, all

data gathered and exchanged with the central server will be destroyed [16].

4.9 COVID Symptom Study App

Researchers from King's College London's Guys and St Thomas' Hospitals collaborated on the COVID Symptom Study app, as did Zoe Global Limited, a health technology firm. The goal of this app is to look into the virus's propagation, identify high-risk areas in the UK, assess susceptible groups of people, and figure out how symptoms are linked to underlying health issues. This app does not provide any information or health advice; rather, it is designed to collect data from users in order to encourage COVID-19 research in the UK and better preventive measures. People can engage in the study willingly and provide two sorts of data on a daily basis. The first part is about known facts like age, health, and any underlying illnesses, while the second section is on the symptoms. More than 4 million people in the UK have volunteered to provide data to the programme, which has aided in the creation of an efficient database that can be used to analyze COVID-19 data [17].

4.10 NHS COVID-19 App

NHS Test and Trace in the United Kingdom has released the NHS COVID-19 app. The app tracks users' movements using Bluetooth low energy technology and GPS. This app can be used for a variety of things. For starters, it notifies a user if they have had close contact with other app users who have tested positive for COVID-19. Second, it allows users to report symptoms and schedule a free COVID-19 test. Finally, when users check into a location or venue, they are informed whether there are a large number of positive cases reported there. Fourth, it allows users to keep track of their self-isolation countdown and get helpful information. The programme does not save any personal data that can be used to identify a user [18].

4.11 COVID Watch App

The COVID watch app (USA) was created by the University of Arizona with funding from the Arizona Department of Health Services. The programme is presently being utilized within the institution, with plans to expand it out across Arizona in phases. The app's objective is to notify users if they come into close contact with any of the app's registered infected users. The app makes use of Bluetooth technology and does not track your position. Furthermore, it does not collect any personal data that can be used to identify the user. It was one of the first programmes to launch an open-source specification, and it has a unique feature in that no party or authority can trace who has been specified [19].

4.12 PathCheck App

Finally, the PathCheck application (USA) is a contact tracking application developed by MIT and Triple Blind, who teamed up to form the PathCheck Foundation, a newly formed non-profit organization. The app's goal is to bring people and health departments together to share information in order to stop the spread of the new corona virus. The

programme makes use of the Google Apple Exposure Notification API, which ensures that the data of users is kept private and secure. On their phones, individuals can save their private locations and symptom diaries. The app is integrated with a number of health departments, and users may choose which department they want to exchange information with and receive services from. Path Check's mission is to promote the re-emergence and re-opening of economies and communities [20].

5. Conclusion

The various applications have been built for various activities such as contact tracing, awareness development, appointment booking, online consultation, and so on, according to the study. Only a few programmes, however, have integrated functions and features including self-assessment, consultation, assistance, and information access. Moreover, the majority of the apps are geared toward contact tracing, with only a handful devoted to raising awareness and disseminating information about the COVID-19 epidemic. Similarly, for related operations, the bulk of applications rely on GPS and Bluetooth technologies. There were no apps found with built-in social media functionalities. It is advised that most of the characteristics and functionalities studied in this study be used to design and construct an integrated mobile health application.

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