Mobile Phone Based Contact Tracing Applications for Combating Covid-19 Pandemic

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ABSTRACT

Covid-19 pandemic has engulfed the whole world by causing more than 47 million infections (as on date 03 November 2020). Since, its outbreak in December 2019 from Wuhan, China, it has drastically affected the world economies and healthcare. Because of the fact that currently there is no medication or vaccine available that be effectively used to treat the Covid-19 corona virus infection, the only way to contain the spread of this infection is to prevent it from spreading. One way to prevent this virus from spreading is to impose lockdowns, but this has drastic effect on economy and every other sector. On the other hand, mobile phone-based contact tracing applications have proved to be an effective method for preventing the spread of this virus. This mini review tries to present a brief and precise information about the various contact tracing applications used to contain the spread of this corona virus.

Keywords: Contact Tracing; Covid-19; Pandemic; Corona Virus

Mini Review

Since its outbreak in December 2019, the covid- 19 has spread havoc all over the globe. This is currently the greatest challenge that world is facing as this has led to death of over a million people and more than 47 million infections worldwide (as per WHO, 03rd November 2020). These statistics are changing rapidly, as such the accurate facts can be attained from the WHO website1. Researchers all over the globe are working continuously to develop an anti-viral drug or vaccine that could be used to treat the corona virus (covid-19) infection effectively. Various clinical trials are underway, but the attainability of drug or vaccine still seems to be far away. As such, taking precautions like avoiding social gathering, washing hands frequently, applying alcohol-based sanitizers, wearing masks and gloves etc. are necessary to contain the spread of this infection. Another alternate effective approach to contain the community transmission of this virus is through Contact Tracing. The process of contact tracing involves getting information from an infected person about the people who are at the risk of acquiring infection from the infected person at a given time. Since, contact tracing by means of conventional methods is very hectic and error prone, so researchers have come up with mobile phone-based contact tracing process to recognize the persons who are at the risk of infection.

Considering the fact that currently there are more than 3.8 billion smart phone users [1]. Smartphones can keep track of user location, along with ingrained bluetooth connectivity makes it an effective device for contact tracing. Contact tracing involves the following three stages:

a. Identification of contacts: - Identify all the persons, the infected person had contact with.

b. Listing of contacts: Recording possible contacts of infected person and apprise them about isolation or quarantine.

c. Follow up with contacts: - regular follow up of contacts to monitor health symptoms and test result.

The covid-19 coronavirus has an incubation period of 14 days [2-7], that is why the contacts are advised to stay in isolation or quarantine for 14 days. In present scenario, rapid testing and efficient contact tracing mechanisms seem to be the only alternatives to come out of this crisis.

Contract Tracing Applications

Researchers, technologists and other health organizations all over the globe are currently in a race to develop efficient contact

tracing applications to contain the spread of covid-19 coronavirus. Many Governments (like India and China) have made it mandatory for its citizens to have contact tracing application installed in their mobile phones. At present, there are numerous contact tracing application available to notify its users about the possible risk of infection. These contact tracing applications allow us to know about the people we have been in contact with. Contact tracing applications make use of the Bluetooth technology and the GPS for contact tracing [2,4]. Bluetooth based contact tracing do not store the location or data of the person, they only notify the individual about the possible exposure to infection. Such techniques could be centralized or decentralized. In case of decentralized techniques,

the details are stored on user's device only, which gives the users the power and control over their own data. The analysis and processing of the data for tracking the contacts are also done on the user device, which promotes the transparency, privacy and consent of the users [3]. While in centralized applications, the analysis and processing are done on the central server and then the users are alerted if required. Figure 1 shows how the contact tracing mechanism works. At a time when there is no drug or vaccine available for covid-19, contact tracing applications are extremely beneficial for healthcare workers, administration and the people. Some of the most widely used contact tracing applications are mentioned below in Table 1.
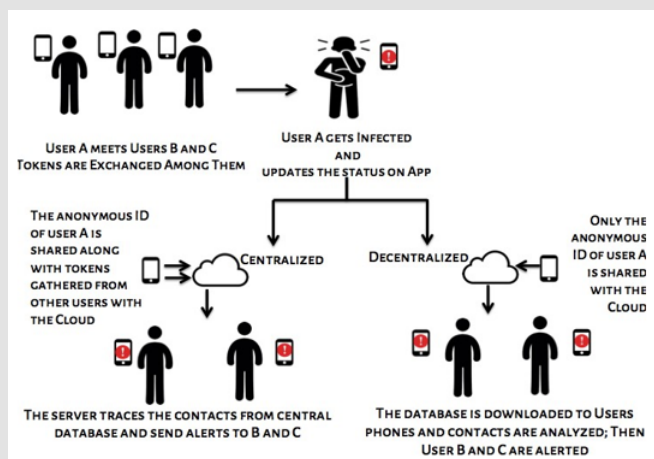

Figure 1: Mechanism for contact tracing.

Table 1.

Contact Tracing Application	Developer	Mode of Information Gathering	Type of Data Collected	Data Storage and Managemnt
Covid Safe	Australian Govt.	Low power Short range Bluetooth	Registration information: a name, mobile phone number, age range and post code. • Close contact information: encrypted reference code, date and time, proximity and duration of contact. • App logs: app performance, troubleshooti ng and error data.	All information collected by the app is encrypted and stored within the app on the phone. Users cannot access this information stored on their phone
TraceTog ether [4]	Singapore Govt	Bluetooth	The Bluetooth data collected is stored locally in the user's phone in an encrypted form. The data will never be accessed, unless the user tests positive. Also proximity of contacts.	Data correspondi ng to anonymous IDs is generated from mobile devices and stored on central server; the real identity of the users is hidden from other users but known to the server
Exposure Notification [3]	Apple- Google	Bluetooth	Bluetooth data	If a user decides to participate, exposure notification data will be stored and processed on device. Other than the random Bluetooth identifiers that are broadcast, no data will be shared by the system with public health authority unless when notified to be in contact with positive person.

NOVID	Carnegie Mellon University	Bluetooth & Ultrasonic Sound Waves	Device details, OS version, time, language, Bluetooth, sonic signals specification s, proximity of the contacts	Generated user ID and correspondi ng password; utilization and managemen t by the central server
HowWe Feel	Harvard University	Manually, location, bluetooth	Age, sex, postal code, self-assessed symptoms	Self- reported Data is integrated and stored along with user ID; storing and managing by a central application server
Aarogya setu[5]	Indian Government	Bluetooth, Location, and self-assesment Data	Mobile number, name, gender, age, profession, countries visited in last 30 days and willingness to volunteer in times of neds	The information is encrypted and stored on the Aarogya Setu server. When this App comes within range of another Aarogya setu user it collects the anonymized Device ID of the other user and details of the interaction (time, duration, distance and location). This information is encrypted and stored on mobile phone.
COVIDSh ield	Volunteer group canada	Bluetooth	Unique Random ID, application	Data is not directly uploaded on the server; generated user ID is uploaded on central server in a secure manner
Zero (safemap)	Childrens service council	Manual and Automatic	Mobile number, e- mail ID, GPS information, IP address	The data is stored in users individual server; a central server manages it
ShareTra ce	ShareTrace technology	Bluetooth	Proximity of contacts, symptoms of users, diagnosis results	The data is stored in users individual server; a central server manages it
Safe2	Not for business organization	Bluetooth and GPS	Proximity of contacts, locations, self-assessed symptoms, lab test results	Random User IDs generated, and data is stored on user devices; federated servers are used for handling data

Platform Support for Contact Tracing

Google and Apple have recently announced [8] a joint effort to fight Covid-19 by empowering the usage of Bluetooth technology for contact tracing to help the Governments and healthcare Organizations to contain the spread of this virus. This has been named as Exposure Notifications system. This system has been designed keeping in mind the importance of user privacy and security. A random ID is generated when a user installs Exposure Notifications system in his mobile phone. To preserve the user privacy, these random ID's change for every 10-20 minutes so that the identity of the user or the geographical location cannot be detected. User's mobile phone and those in the proximity will then continue to exchange these random ID's through the Bluetooth technology. In an exposure notification system, all the data is collected, stored and processed on the user's mobile phone only. If at any point of time a user is diagnosed positive for the virus, he updates the status in the app. Concurrently the other user's device occasionally matches all the random Id's with the positive covid-19 cases against its own random ID's. During the whole process, the user's identity is not shared with anyone- not even Google and Apple. Users have full control over the exposure notification system. It is up to the user when to turn the application ON or OFF. The geographical location of the user is not shared with anyone whether it is Government, Apple or Google. To preserve the user privacy the random Bluetooth ID's change for every 10-20 minutes. The Exposure Notifications are carried out on the user's mobile phone only. To preserve the privacy of the user, if a person tests positive, his identity is not shared with other users or Apple or Google. The objective of this system is to help the help the healthcare system to fight the Covid-19 Corona Virus, that is why Google and Apple expects to deactivate this system when it is no longer needed. The uptake of this new Operating System facilities is to be seen, and so far, not many applications have used this functionality yet, even though it offers superior privacy properties compared to alternatives.

Conclusion

Inspite of the fact that numerous contact tracing application are available, there is a growing concern among people regarding the privacy of their data. Mass adoption of the mobile contact tracing applications will help the healthcare authorities and other organizations to contain the spread of this virus. But, at present majority of the people are unwilling to download the contact tracing app because they are unwilling to trust the organizations with how they are going to use their data, and for how long. These applications are currently facing several concerns related to user privacy, data security, data management, data regulatory, non-trivial false positive and negative infection information. As an example, Indian Aarogya Setu App has been in major controversy for a long time with people blaming the government for keeping watch over them. Similarly, in Norway, the health authorities had to pull down the contact tracing app because it violated the data protection regulations. So, the need of the hour is to work on the domain to enhance the trust building among people and handle the user data lawfully in accordance with the GDPR compliance. Other issues that need to be equally taken care of include [6] app malfunctioning, proper contact detection, performance and acceptance rate. The assessment of contact tracing applications is directly grounded upon the rate of testing, extensive acceptance and the underlying technologies to recognize contacts.

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