

## **SDA-COVID-19: Social Distancing App for COVID-19 track and control**

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**Abstract.** COVID-19 is a highly contagious and lethal virus-based disease. Social distancing is the only way to stop the virus from spreading. In this context, the re-

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searchers suggest a social distancing application named SDA-COVID-19. The suggested App (SDA-COVID-19) will help individuals maintain social distancing by the exchange of data among phones about potentially infected and/or contaminated people with COVID-19, with whom an individual socialized or came in contact, whereby, an individual will be alerted if a COVID-19 infected person is in close proximity. Two versions are suggested for SDA-COVID-19 one is Service-Oriented and the other is Bluetooth oriented.

**Keywords:** COVID-19, SDA-COVID-19, tracking, warning, disease control, social distancing.

## 1. Introduction

COVID-19 is a virus that brought the world to a dead halt. COVID-19 is highly contagious and lethal. Social distancing is the only way to stop the virus from spreading. Although, governments across the globe asked the people to practice social distancing still people responded slowly and with disregard to government advisement. Accordingly, some government escalated the advisement to lock down in some countries. However, long-term lock down is not a viable solution, due to the anticipated economic harmful repercussions, as well as plummeting productivity of people and organizations, particularly in view that reports stipulate that COVID-19 predicament will not end soon.

Evidently, not only would COVID-19 pandemic freeze the economic cycle, but the accompanying lock-down would also restrict people's mobility regardless of being sick or healthy. Thereby, allowing COVID-19 to control all aspects of life. As such, Governments have two options either enforcing lock down and save people or sacrifice people for economic reasons. Nevertheless, the researchers suggest another alternative, produce a technological solution that will allow healthy people to continue their lives by working while sick or risky people can rest until they feel better. The suggested solution will be used as an application developed to be used on smart phones. The application will be distributed in nature and has no intervention with the privacy issue as will be explained later. Since the current situation with COVID-19 will be long term such a solution will be a fair choice to bring the economy back to life and allow countries and nations to go back to normal life as much as possible.

The goal of the SDA-COVID-19 is to collect data from people that may be within 1.8M perimeter of a person. SDA-COVID-19 is installed on any smart phone, then it will collect the phone numbers of people that are within 1.8M proximity of other people. SDA-COVID-19 will accumulate the numbers in a storage on the phone. If a person become infected of COVID-19 then either personnel from hospital or the infected person can broadcast such information to the collected list. Hence, alerting all the list of phones stored on her/his list of the contamination. The alerted persons can then take the right measure of self-quarantine and receiving the right treatment. Furthermore, rather than locking down all people, only people who carry the virus or are sick of the virus can be quarantined.

This paper is composed of literature review that will consider the applications similar to the suggested SDA-COVID-19. The next section will shed light on the issues and challenges facing the implementation of the SDA-COVID-19 such as privacy, security, smart phone access, undocumented immigrant's data availability, and laws and regulations. Then, the paper will present the first and second versions of SDA-COVID-19. Further, the paper will produce the data structure of the SDA-COVID-19, as well as the Input and output Screen. Consequentially, the paper will present the implementation policy of SDA-COVID-19, as well as the Future work for the suggested Framework.

## 2. Literature review

This section first presents two Apps resembling the suggested SDA-COVID-19. Next present the practice of some countries like Israel, China, Taiwan, South Korea, and EU.

The researchers found two Apps resembling the suggested App namely: Private Kit: Safe Paths and FluPhone. According to [1] there is an App named Private Kit: Safe Paths that tracks COVID-19 positively tested patients and alarms anyone who crosses paths with the patient. The same source discuss the software FluPhone developed by Cambridge scientist in 2011 but failed since only 1% of the Cambridge community used it.

Another App TraceTogether app Developed by Singapore Government Agency Website [2]. The App trades contacts of previously met people in case a person gets sick. The App works on Bluetooth, when a person gets infected with COVID-19, the App will send a warning message to others. The App hinge on heavily on the cooperation of the people and works as a waning system.

According to [3] countries like Israel invoked an emergency in March-16-2020 [4] and [5] act to track COVID-19 infected people by tracking their smart phones. The same source mentioned that Iran asked people to download an App to locate their citizens, and China used smart phones and face recognition to locate infected people. South Korea sent message about the movement of people without using their names. According to [1] Taiwan used smart phone technology to build an electronic fence around quarantined patients. According to [5] the EU has General Data Protection Regulation (GDPR) which limits Mobile carriers use of customers personal data whether sharing or managing. Although in Italy's Lombardy region such data was used "helping authorities get a clearer picture of how well people are observing the rules" [5]. Previous work of the researchers were conducted in [6] [7] [8] [9] [10] [11] [12] [13] [14].

## 3. Issues and challenges facing SDA-COVID-19

There were several issues and challenges raised in the previously mentioned articles [8] [9] [10] [11] [12] [13] [14]:

1. Privacy

2. Security
3. Smart phone access.
4. Undocumented immigrant's data availability.
5. Laws and regulations.

### **3.1 Privacy**

Although many are concerned of disclosing their data privacy, still SDA-COVID-19 can be considered as a validation tool for people applying for work, and current staff to maintain a healthy workspace environment, synonym to a driver' license or electronic Identification Card. In addition, all data is stored on the person's own phone hence no one will be able to access such data. Furthermore, data required from Phone-Owner is not more than what a person would usually provide to his/her doctor when visiting for the first time. In this context, the researchers suggested two versions of SDA-COVID-19.

### **3.2 Security**

There are many aspects to security issue in SDA-COVID-19. First, data theft, the data of each phone owner resides on their own phone and is encrypted and distributed. Thief cannot follow people around to steal their data. And cannot decrypt each data from each phone. Hence security in numbers is the name of the game in this case.

### **3.3 Smart phone access**

Albeit, many do not own smart phones which is a personal choice to people. However, according to [15] the number of smart phone owners is 3.5 billion people, which "means 45.12% of the world's population owns a smartphone" [16]. Additionally, SDA-COVID-19 could entice people to purchase smart phones since the App will be their health detector and an early warning system of potential risk to be exposed to such a pandemic that is readily available.

### **3.4 Undocumented immigrant's data availability**

Many countries still suffer from illegal/ Undocumented immigrants. As such, Undocumented immigrants will not volunteer their data, still no one is willing to die from COVID-19. Taking into consideration that undocumented immigrants still need to work and practice their lives as normal as possible, as such, employers of illegal immigrants may turn a blind eye regarding immigration status but will not expose themselves and others to a deadly virus. Furthermore, SDA-COVID-19 does not require immigration status, nor cares to. SDA-COVID-19 will work between two smart phones as a pass of healthiness, seen in the second version of SDA-COVID-19.

### 3.5 Laws and regulations

Regarding the fifth issue, Laws and regulations, SDA-COVID-19 will benefit all stakeholders whether organization, government, or individual. An individual (aka smart phone owner) is the one to be at risk of getting the disease. The use of SDA-COVID-19 is most beneficial for a person since it will keep the individual informed about his/her health status. Furthermore, the issue of regulations and laws will not apply when a person is trying to detect a safe environment and to be informed about his/her life and health. In the same token, this research provides two version of the App.

### 4. Working steps of SDA-COVID-19 service oriented version

The First version of SDA-COVID-10 is described in this section. This version of SDA-COVID-19 is service oriented and needs to be in contact with communication service provider through internet cloud in order to exchange data. In this version of SDA-COVID-19 the data is transmitted to COVID-19 database and the communication service provider can manipulate and use the data to track COVID-19 infected people, see Figure 1. Such framework is duly connected to medical center. Medical centers can be any governmental health organizations like ministry of health. In the following the paper presents the essential 9 steps of SDA-COVID-19 as follows:

1- Global COVID-19 database accessed via the Internet will be updated by the COVID-19 health care agents responsible to record all the cases in each country around the world.

2- The SDA-COVID-19 will be downloaded and installed on smart phone from iPhone APP store, or Google play or Samsung Play Store. Each downloaded SDA-COVID-19 will give the smart phone a number (primary number) based on the smart phone serial number and phone number.

3- A person must register with SDA-COVID-19 using name, address, national ID, Date of birth, Health condition, as shown in the data structure section. Data given will be encrypted using phone owner password.

4- Using the Internet and the GPS, SDA-COVID-19 will track all the users' movements and locations and record all the places and the people who have within 1.8M proximity of the user all the time.

5- SDA-COVID-19 will not only notify the user in case there is an infected or potentially infected person by scanning the people around the user, but will also alert health care agents in case the user were close enough (less than 1.8M), and so health agents would follow up her/his case as s/he will be recorded as a suspected case in the COVID-19 database, and will be notified to stay home for 14 days.

6- When the health care agent discover that someone is infected with COVID-19, all the people who were in close proximity of the infected case during the last 3-4 weeks must be advised to go into self-quarantine and to be tested to make

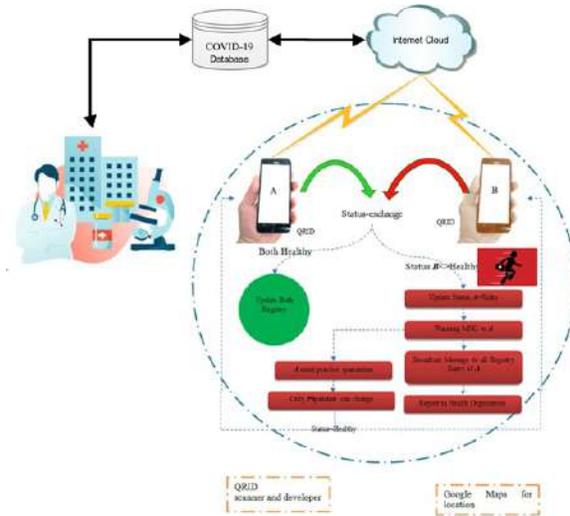


Figure 1: SDA-COVID-19 Service-Oriented Version.

sure that they are not infected with COVID-19 virus. 7- In case of a person hits a Contaminate Button on smart phone that he might be infected with the virus, SDA-COVID-19 will send warning message to all the people who were around during the last 3-4 weeks to notify them to take the necessary action.

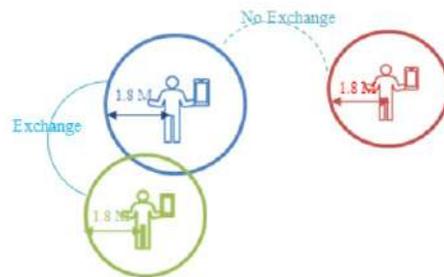


Figure 2: Simplified view of SDA-COVID-19 interaction.

8- When a warning message is received the status of the phone will change to status “Risk”, hence the phone owner must be quarantined for 14 days and contact the nearest health facility. Phone owner must practice precautionary measures so as not to infect others. The phone will also send contamination alert message to others on its registry in the form of a chain message.

9- Once the phone owner is cured and is no longer a threat, his/her status will be changed by a physician from an accredited health facility. The physician

will sign off the phone owner with his/her credentials using two-way factor authentication method.

**5. Working steps of SDA-COVID-19 bluetooth version**

The second version of SDA-COVID-19 is Bluetooth based. SDA-COVID-19 in this case is a stand-alone application with the option that is not connected to COVID-9 database, hence the communication service provider has no access to the data, see Figure 3 . The data in SDA-COVID-19 is distributed and each owner of smart-phone can voluntarily provide the her/his data to health care facilities. Such a version of SDA-COVID-19 will be more acceptable to public and people will not have a privacy issue or “Big Brother Watching” problem. In the following the paper presents the essential 9 steps of SDA-COVID-19 as follows:

1- The SDA-COVID-19 will be downloaded and installed on smart phone from iPhone APP store, or Google play or Samsung Play Store.

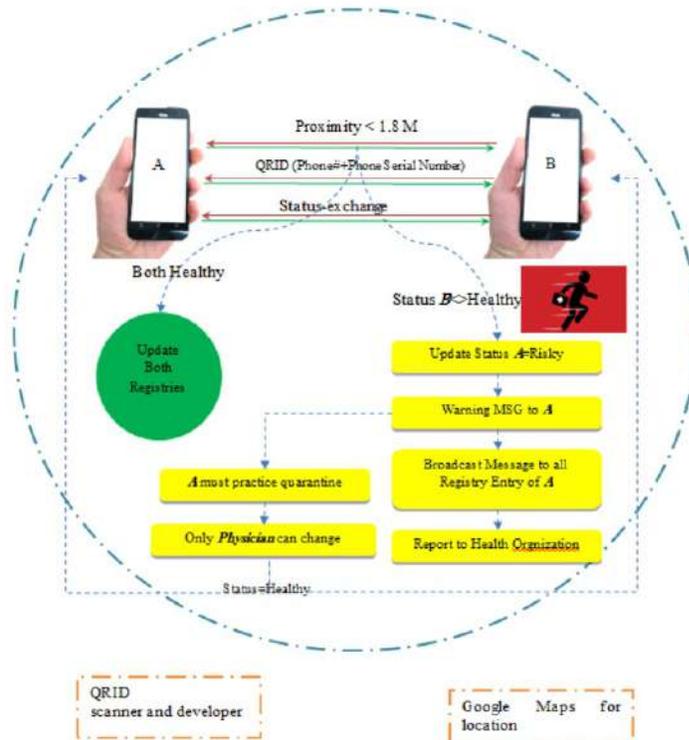


Figure 3: SDA-COVID-19 Bluetooth Oriented Version.

2- Each downloaded SDA-COVID-19 will give the smart phone a number (primary number) based on the smart phone serial number and phone number.

3- A person must register with SDA-COVID-19 using name, address, national ID, Date of birth, Health condition, as shown in the data structure section. Data given will be encrypted using phone owner password.

4- SDA-COVID-19 through phone will radiate its number to other phones withing 1.8M perimeter, see Figure 2.

5- SDA-COVID-19 also receives the radiated numbers and store it in a registry. Registry is composed of Phone Number and phone serial number, and proximity (distance) as shown in the data structure section.

6- In case of a person hits a Contaminate Button on smart phone. Smart phone will send warning message to all the registry entries.

## 6. Data structure

The underlying of the suggested SDA-COVID-19 is composed of two basic database table: Phone-owner database table which resides on the smart phone of the owner. The second database table is called Registry which also resides on the smart phone of the owner. The database table phone-owner is made of 12 attributes and is reflected in Figure 2. The phone-owner table will be filled by the phone owner using credentials as downloaded. The user may access two application QRID for building a QRID for identification purposes and Google maps for location. The data pertaining to database table will be filled only once. The same table is used when the role is physician where data is filled by medical institution that has credentials and uses two-way factor authentication scheme. Physician role has more privileges than user role since the person with physician role has the privilege to change the status attribute in the Registry database table from Risky/Sick to Healthy.

Phone-Owner	
Role	User – Physician (reserved to be set by institution)
QRID	Phone Senal Number+ Phone number (13 digits)
Name	Varchar 30
National ID Number	Varchar (24) may be validated
Sex	Male/Female
Date of birth	Date
Address- building, street, area, city, country	or location google map
Pres existing - Diabetes	Yes/No
Pres existing – Cardiovascular disease	Yes/No
Pres existing – Chronic respiratory disease	Yes/No
Pres existing – Hypertension	Yes/No
Pres existing – Cancer	Yes/No

Figure 4: Database table named phone-owner.

The second database table is Registry which is made of 6 attributes, see Figure 5. The attributes are filled automatically by SDA-COVID-19. The registry is updated automatically when two smart phones are in the proximity of 1.8m. The attribute Status reflects initially is Figure 5: The Registry database table and attributes.

Registry	
Sequence Number	Integer number
QRID	From the others <i>Phone-Owner</i>
Proximity	0-1.8 meter
Timestamp	Time + Date
Status	Healthy/Risky/Sick (only physician role can change status)
Location	Based on google maps

Figure 5: The Registry database table and attributes

Healthy, once the person is within proximity of 1.8m of a person with Risky or Sick smart phone the status will change to risky. Only a person with role of Physician can change the attribute Status back to Healthy. The change of attribute Status is protected by two-way factor security. Further, the database table Registry will be automatically updated daily by erasing all entries that are 24 days old, hence the Timestamp attribute.

## 7. Input and output screens of SDA-COVID-19

There are two types of screens in SDA-COVID-19: first the initial registration screen. This input screen, see Figure 6, allow the registration in SDA-COVID-19 and is based on the phone-owner database table previously explained. The second interface is an output screen shown in Figure 7 that reflects two things: QRID and the Status of the phone-owner. The Status of the phone-owner is three types: Healthy, Risky, Sick. The Healthy status is colored green, the Risky status is color blue, and the Sick status is colored red as shown in Figure 7.

## 8. Implementation policy

To succeed, this App must adhere to the following suggested implementation policy:

- 1- All organizations, companies, corporations, institutions will enforce the use of this App to be used by employees.
- 2- A person may not do the following if STATUS not equal HEALTHY
  - a. Enter working place
  - b. Use public transport
  - c. Enter a mall/ supermarket/shops/banks/ schools/universities/etc.
- 3- The registry will be updated by deleting all entries of 24 days old.
- 4- If a Sick/Risky person comes too close to Healthy person his/her phone will beep to warn others and their phones will beep also to warn healthy people from risky/sick person.
- 5- Only an accredited physician can change the status of a sick person to healthy, using two-way factor authentication.

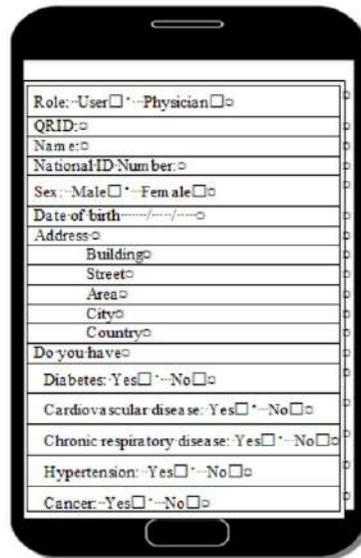


Figure 6: Screen of Initial Registration



Figure 7: Status of Phone Owner Sick, Risky, Healthy

6- The password for the App is either face recognition or fingerprint so as not allow phone trading among users.

### 9. Future work

This suggested SDA-COVID-19 need to be implemented by programming the SDA-COVID-19 and everyone must cooperate for their safety and well-being. Such use can be encouraged by government adoption of SDA-COVID-19.

### 10. Conclusion

In conclusion this paper presented SDA-COVID-19 mobile application. The SDA-COVID-19 will allow the user to be notified and warned about COVID-19

infected people that may cross her/his path. The SDA-COVID-19 will keep track of all the people that may come in proximity of the phone owner for the past period. Once an infected person is discovered all people that met her/him will be warned. Hence, precautionary measures to be taken.

SDA-COVID-19 is suggested as two versions: Service based, and Bluetooth based. The service-based version of SDA-COVID-19 is to be used with data exchanged through communication service provider. The Bluetooth SDA-COVID-19 version is totally distributed system with no need for intermediate for communication other than Bluetooth. Although this version is more likely the popular option since privacy issue is resolved, still, battery consumption and storage are to be raised as problem.

In this paper, the researchers, provided literature review of other application similar to SDA-COVID-19, then discussed all issue and challenges that may face SDA-COVID-19, then presented the design of SDA-COVID-19 input, output, data structure, framework of both Bluetooth and service versions, and implementation policy.

## 11. Acknowledgment and data

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