COVID-19 Contact Tracing Application using Bluetooth and GPS

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***Abstract*- The aim of this study was to provide a tool that would control the rapid spread of corona virus among the masses. The coronavirus pandemic has severely affected the life of many people worldwide from different countries. It has bounded countless people to stay at their homes and forced industries to shut down causing a halt to the Financial, Economical, Personal and other aspects of the daily of the people. The government officials and developers worldwide are striving for measures to stop its spread. Manual assistance is time-consuming ad people around the remote areas lack assistance. In order to provide spontaneous assistance different COVID-19 contact tracing and health-assistance apps were launched by different countries. The previously created apps lack privacy measures for securing use's data. The proposed application provides a de-centralised approach along- with maintaining the users privacy and safety concerns.**

Keywords*-*Coronavirus, contact, COVID-19, GPS, credentials, pandemic, privacy, anonymous, tracing

I. INTRODUCTION

Covid-19 pandemic has been rampaging across the globe. People have been stuck up at their homes with fear of getting infected if they enter public zones. In this situation, any tool or system that can tell users about their safety is required, by also ensuring that they follow all the Covid-19 guidelines. COVID-19 is more infectious as compared to other known viruses (such as SARS and MERS) albeit with a lower mortality rate. Furthermore, a COVID-19 carrier can be contagious without experiencing any symptoms. One of the highlighting features which make it more robust than the other application are the user data secure by using the decentralized architecture. An End-to-End Encryption of the user data are provided and they prevent the unauthorised access to the user data. The proposed system provides the users with suggestive and precautionary health-care tips when the app is started. The apps guide the users with their current health status and a suggestion in case the user needs an immediate medical assistance. The user is prompted with the registration and login page to authenticate and authorize the right users. The app requires the user to grant the required permissions for better functioning of the app. After entering valid details user is redirected to home page. The app provides the user to check his/her risk status, opt for self-assessment questionnaire, safeguard the user from COVID-19 hotspot areas, notifications in case of contact with infected person, quarantine tips, etc.

II. LITERATURE SURVEY

There are different structures, working, features, etc that provides a vast variety of COVID-19 contact tracing apps. Based on the technology, software, detecting strategies, use of cases, data-storing methodology there are proximity tracking apps(using Bluetooth and GPS), Outbreak Response(that set up relational databases linking lists of contacts to line lists of cases) , Symptom Tracking (Used for self-checking and self- reporting of signs and symptoms by people through mobile phone apps or SMS technology),etc. There are two types of architectures that are proposed i.e Centralized and Decentralized Architecture.

After going through all the IEEE papers on Android-based Contact Tracing Apps, we have come up with the thinking that technology plays a vital role in every aspect. Although there have been significant technological advancements to aid COVID-19 response, contact tracing apps require further enhancements to achieve desired objectives in a privacy- aware manner. The Credentials of the infected people should not be shared without that person's concern. The notifications received by the contacts should specify the infected person as "someone" so as to maintain his description anonymous for privacy and safety concerns. A number of contact track and trace apps request permissions which may not be required for the successful operation of the app's function. Several apps try to mention the outsourcing data to third parties; without the user's knowledge of who these third parties are, what data is being shared, and how it is processed by these "so-called" parties. Some apps have not adopted appropriate security

measures for the exchange of the data to and from the user to the data centres. The app's privacy policy should be mentioned in a way that a user could easily understand. The location of the people in contact with the infected individual is being tracked by GPS(Global Positioning System) TrackingSystem.

After the survey of all the papers it is crystal clear that GPS tracking plays a very beneficial role in this application through which we can track the location of the infected individual. The most crucial factor that is being pointed in all the papers is theprivacy of the users.

III. PROBLEM STATEMENT

There are instances where people would require immediate assistance at home, people in lockdown are hesitating to seek manual health-care assistance, they may require guidance regarding the frequential changes in their health after being outdoors; for all such requirements a contact tracing app is in need. The problem statement for this topic are the ethical challenges that need to be taken into account and the issues that need careful consideration when planning, developing and implementing such tools. The technical shortcomings, lack of acceptance by the masses and inaccurate data values are all factors that could hinder their success. The proposed system provides a completely de-centralised approach with enhanced features in order to improve the contact tracing process and provide the app-users with multiple benefits.

IV. EXISTING SYSTEM

In centralized architecture the government officials have access to the server and they can use the information for malicious purposes. Generally, Android based contact tracing uses technologies such as GPS, Wi-Fi, and Bluetooth, to save locations and contact details of their users, so that if they come in contact with infected people their contacts can be traced since the start of the incubation period. Some technologies use GPS for location tracking which provides the actual location of user that can be a threat to his/her privacy. Trace together was one of the first android applications that utilized Bluetooth technology to trace contacts within close proximity, which was adopted by Singapore's government to control the spread of COVID-19. The proximity and duration details are shared confidentially between users that already installed the application. Another example is an innovative privacy preserving android based contact tracing solution named 'Tracy' that provides self-investigation and is designed and developed based on hybrid architecture to help the health authorities to limit and control the spread of COVID-19 especially with the upcoming second wave of the virus.

V. PROPOSED SYSTEM

The contact tracing mobile apps for COVID-19 using de- centralized approach with Bluetooth and GPS, communicates with users (people who installed the same app) via Bluetooth and stores their data locally (Device ID, other Device ID, and Timing) on the user's device.

When someone tests positive for COVID-19 and is marked in the system, the system allows to trace all the users to whom this person has made contact by time stamps. A record of their geographical movements gets tracked using GPS. Additionally, other phone owners who came close to the infected person's phone get notification of their infection risk and are then advised to self-isolate themselves.

The Proposed System is an Android-Application, using Java as the programming language and Firebase for Database Connectivity. The system consists of three individual modules namely, Self-Assessment Module, COVID Updates Module, Risk Analyzer and Help Module as shown in the diagram below:

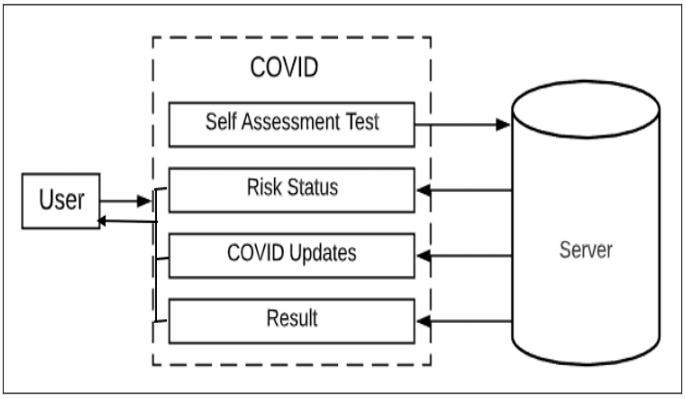

Fig 1. Block Diagram

1. Self-Assessment Module

The Self-Assessment Module is a symptoms-based COVID prediction module. This module takes input from the user. The user is asked some questionaries related to COVID prediction ranging from COIVD symptoms like Fever, Cough, etc, along with travel history and family background. The data collected in this module is sent to Risk Analyzer Module.

2. COVID Updates Module

This module is used to display the current COVID-19 outbreak status in India. The data is collected from external database, and is updated simultaneously. The basic idea for this module is to keep the user updated about the current COVID-19 disease outbreak scenario.

3. Risk Analyzer Module

The Risk Analyser takes the input from the Self-Assessment Module, based on the received data this module evaluates the data and calculates the severity of COVID present in the user.

The result of the RISK Analyzer is dependent on the accuracyof the model used.

4. Help Module

The Help module provides different emergency services, related to COVID-19 disease outbreak. The application uses CALL and SMS module to achieve this section. Different Emergency Services are listed on the

Application for emergency usage.

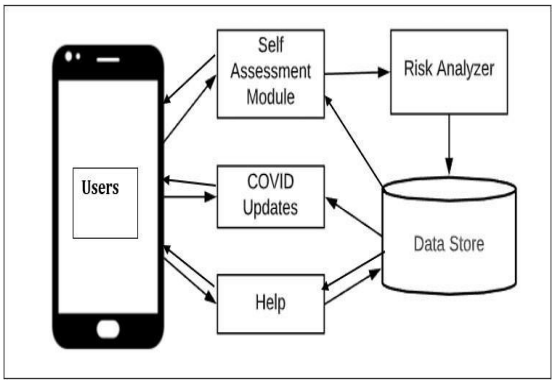

Fig 2. Architectural Diagram

Notifications:

- If the duration exposure of the user with the infected person is less than the specified limit then he/she is provided a notification saying that "Symptomatic Notation: You have been in contact with a COVID-19
  + person. Seek Medical help or stay in quarantine"
- If the duration exposure of the user with the infected person is more than the specified limit then he/she is provided a notification saying that "Asymptomatic Notation: You have been in contact with a COVID- 19+ person for a long duration. Immediately Seek Medical help and opt for health-checkups"

All the above listed modules work parallel to create a complete system. User protection is our main aim. The Notification module uses Nearby Messages API to detect nearby users with high risk to avoid contact between the users. The system constantly uses this API between both the users and provides warning messages, if they come closer to each other. Based on the result of contact duration, a result is declared.

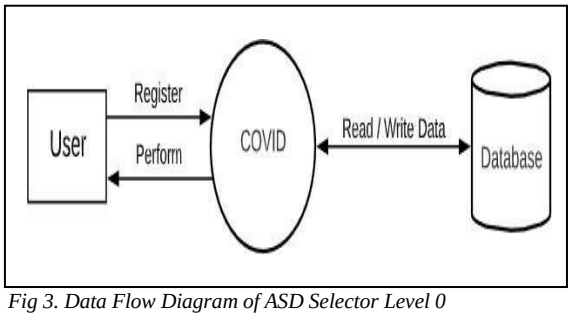

Fig 3. Data Flow Diagram of ASD Selector Level 0

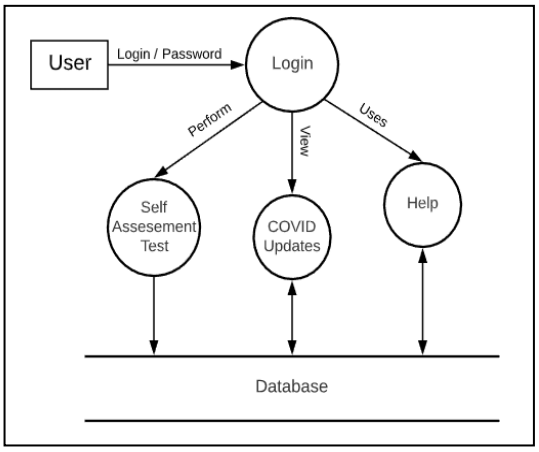

Fig 4. Data Flow Diagram of ASD Selector Level 1

VI. LIMITATIONS

The proposed system provides notifications to the user but they are not advised for future actions that need be taken in order to safe-guard themselves. The app requires internet connection so to provide risk status if the user is in COVID- 19 hotspot area. The exposure notifications need to be kept on for the functioning of the app. The hesitation of the infected individual to share his/her contact-list could hinder the controlof this pandemic spread.

VII. CONCLUSION AND FUTURE ASPECTS

The app is designed in a user-friendly manner so as to reduce the spread of the COVID-19 pandemic and provide the app-users with a supportive tool for health diagnosis. The app provides a self-assessment test to rate the users health, COVID-19 updates, risk analysis, helps privacy FAQS. The application identifies the user's location based on GPS and proximity tracking. If the user is in a crowded area it could hinder the effective tracking process as the Bluetooth-signal strength deteriorates. Measures can be taken to improve this tracking process. Based on the exposure duration and incubation period the user can be prompted with quarantine days/health-care assistance and tests to reduce severity and impact of exposure.

REFERENCES

- https://ieeexplore.ieee.org/stamp/stamp.jsp?tp =&arnumber=9268121
- https://arxiv.org/pdf/2007.11147.pdf
- https://downloads.hindawi.com/journals/wcm c/2020/8851429.pdf
- https://arxiv.org/pdf/2006.13354.pdf

- https://www.irjet.net/archives/V7/i9/IRJET-V7I981.pdf
- https://ieeexplore.ieee.org/stamp/stamp.jsp?ar number=9252092
- https://arxiv.org/pdf/2004.08812.pdf
- https://ieeexplore.ieee.org/stamp/stamp.jsp?tp =&arnumber=9257915
- https://ieeexplore.ieee.org/stamp/stamp.jsp?tp =&arnumber=9162209
- https://ieeexplore.ieee.org/stamp/stamp.jsp?tp =&arnumber=9222246
- https://ieeexplore.ieee.org/stamp/stamp.jsp?tp =&arnumber=9241466
- https://ieeexplore.ieee.org/stamp/stamp.jsp?ar number=9181512
- https://ieeexplore.ieee.org/stamp/stamp.jsp?tp =&arnumber=9162031
- https://ieeexplore.ieee.org/stamp/stamp.jsp?tp =&arnumber=9179284
- https://www.researchgate.net/publication/343 093194_A_Survey_of_COVID- 19_Contact_Tracing_Apps
- https://ieeexplore.ieee.org/stamp/stamp.jsp?tp =&arnumber=9141265
- https://ieeexplore.ieee.org/stamp/stamp.jsp?tp =&arnumber=9134762
- https://ieeexplore.ieee.org/stamp/stamp.jsp?tp =&arnumber=9238416
- https://ieeexplore.ieee.org/stamp/stamp.jsp?tp =&arnumber=9161820
- https://arxiv.org/pdf/2006.10306.pdf