

Ubiquitous and Mobile Computing

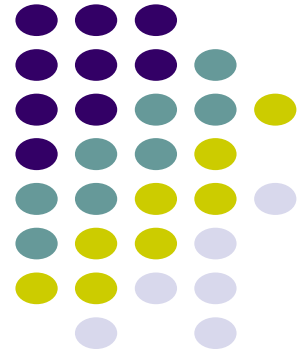
CS 528: *Crowd Sourced Contact Tracing*

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Problem

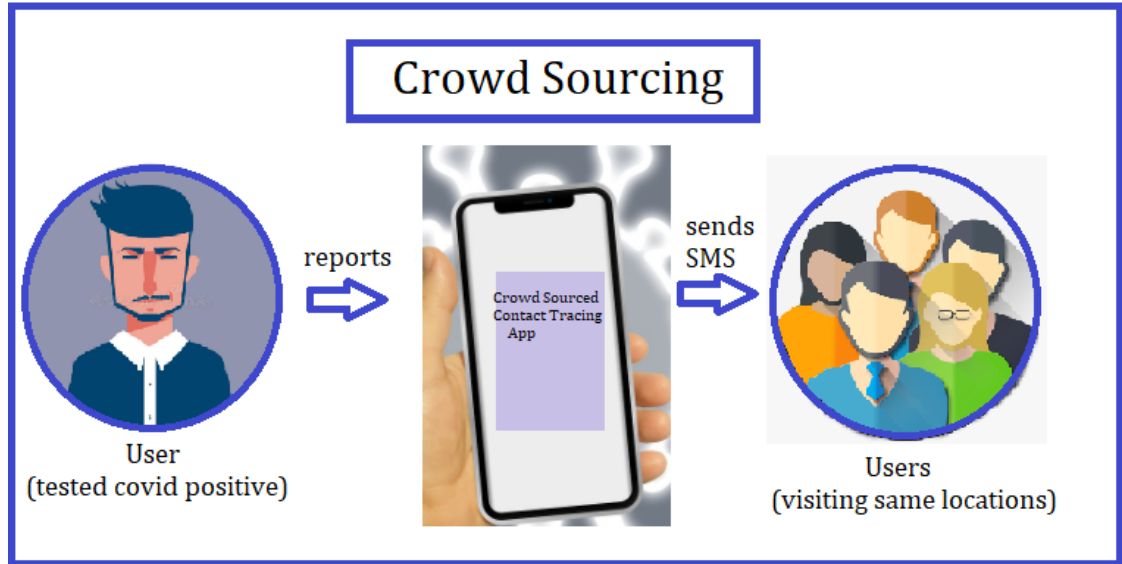
No mobile application for anonymous contact tracing for COVID-19 within small community (like college campus/town) with live notifications when entering a hot spot.



Crowd Sourcing



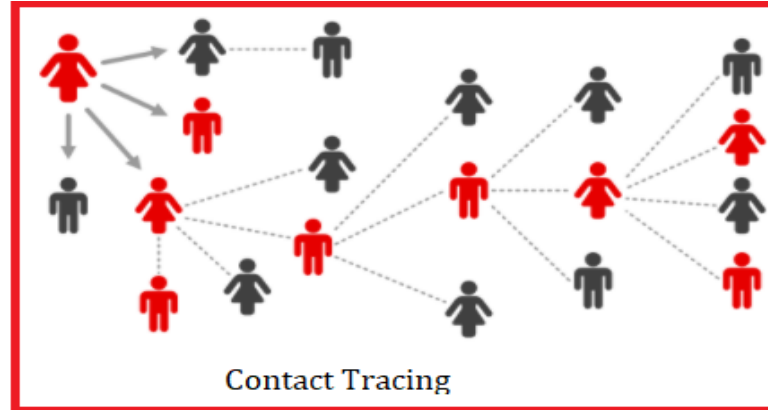
Crowdsourcing is the collection of information, opinions, or work from a group of people, usually sourced via the Internet



Contact Tracing for COVID-19



Contact Tracing aims to identify and alert people who have come into contact with a person infected with corona virus.

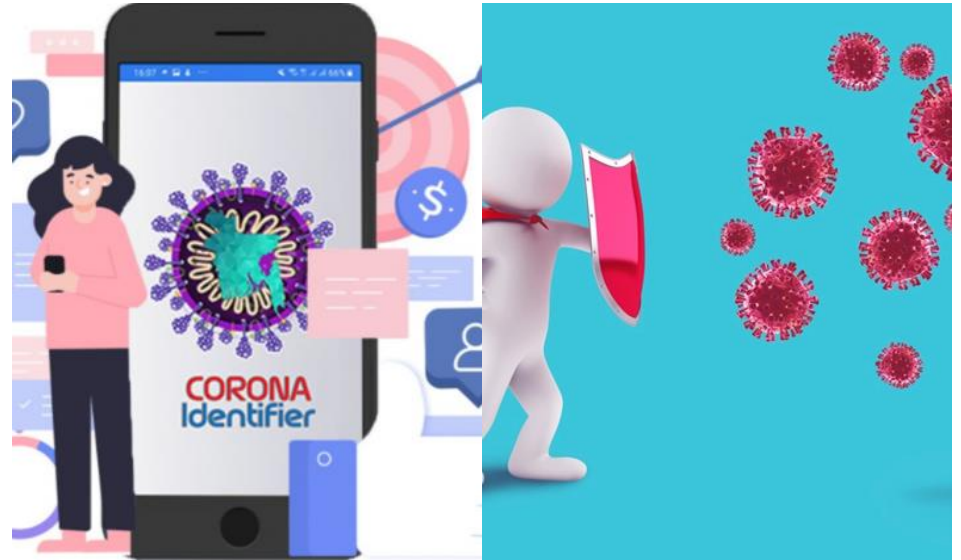


Smartphones can be used to quickly and automatically determine whether somebody has been in contact with an infected person.



Motivation

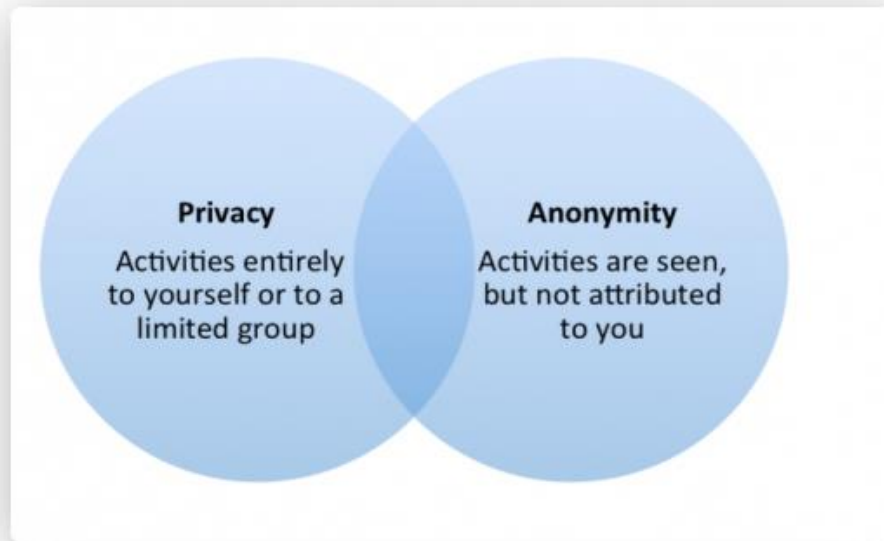
The spread of COVID-19 has affected our day to day life. To meet the daily necessities we have to go out. In order to help us in this situation, this app can be useful in keeping our communities aware and protected.



Importance



Not everyone is okay with sharing private medical conditions. This application provides us with the solution of anonymity while tracking data that can be useful in keeping everyone in our communities safe.



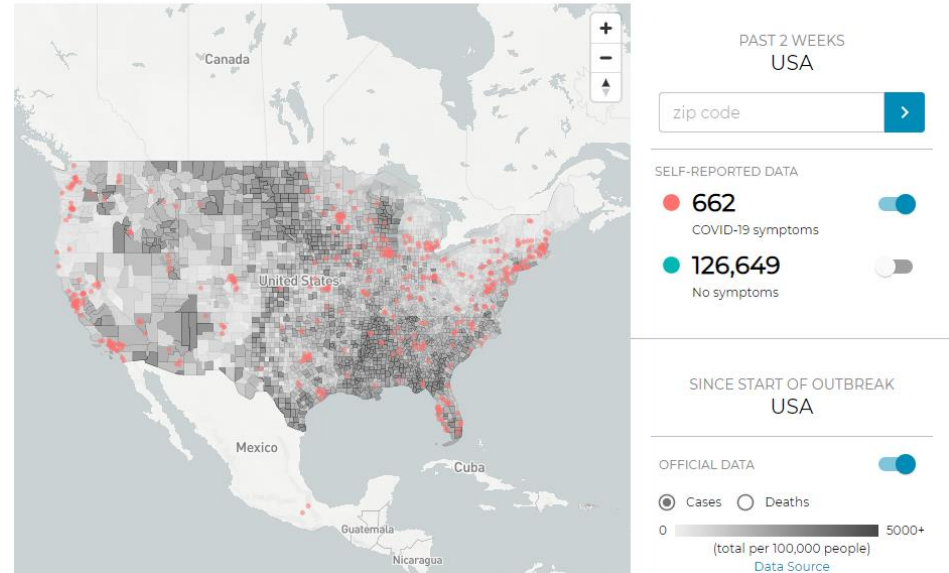
Related Works



Harvard's Medical School Crowdsourcing COVID-19

- Simple web application that identifies current and potential COVID hot spots throughout the US
- Uses user's location data (i.e. zip code) and self-reported cases

2,803,307 people in the USA have self-reported their health status

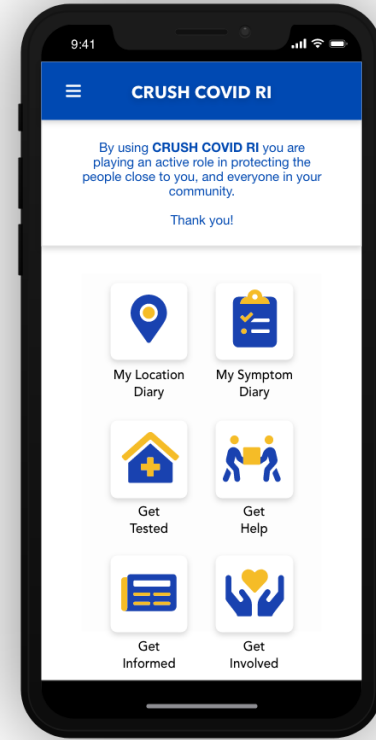


Source: covidnearyou.org

Related Works

Crush COVID RI

- Rhode Island contact tracing app.
- Automatic location diary tracking, using Android's location permission
- Symptom diary for people to keep track of potential COVID-19 symptoms
- Information on where to get tested, get help, and other FAQs



Source: health.ri.gov

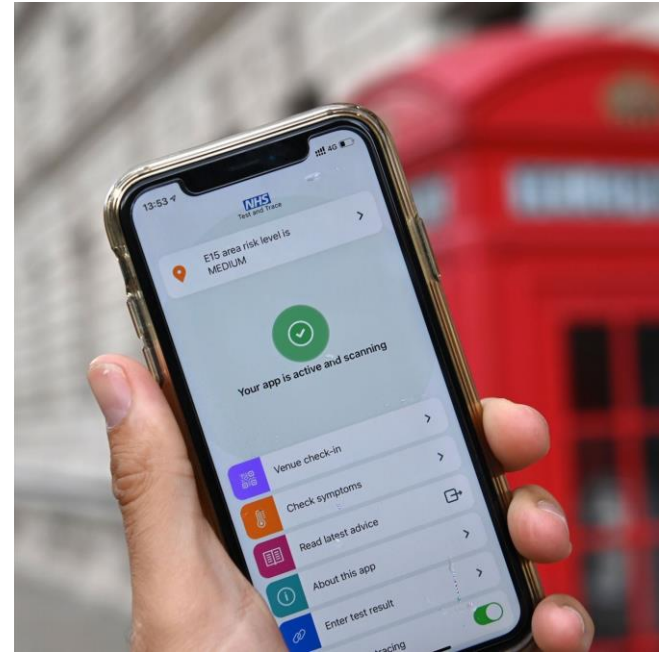


Related Works



NHS COVID-19

- England and Wales contact tracing app.
- Local COVID Alert Level by zip code
- Bluetooth contact tracing using Exposures Notifications



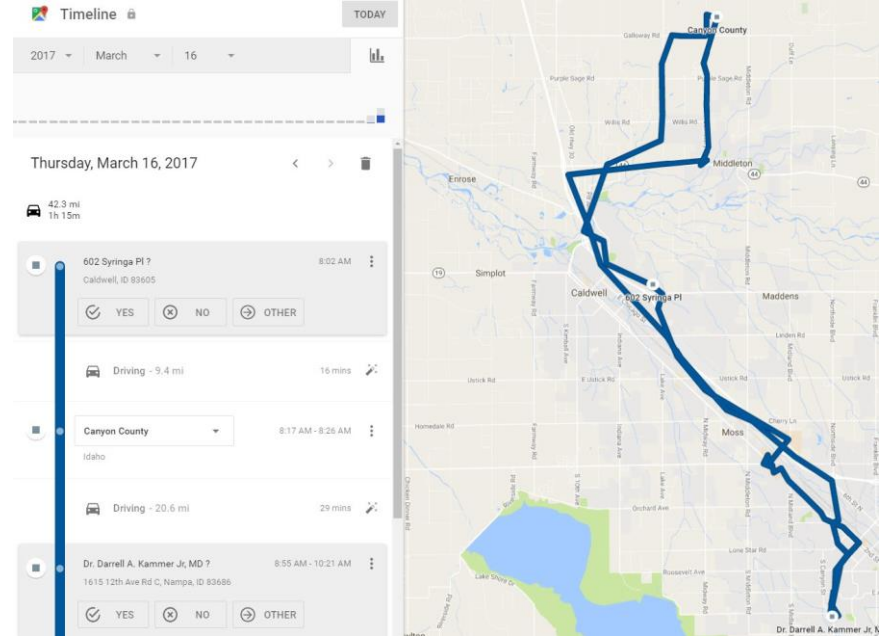
Source: www.nhs.uk

Related Works



Google Maps Timeline

- Automatically tracks the user's location history
- Requires location history permission



Source: google.com

Solution



A Contract-Tracing application that allows a User to:

- After contracting COVID, anonymously inform other Users that have visited the same locations over the past two weeks
- register for SMS updates of when they have crossed paths with other Users with positive cases of COVID
- Receive notifications when they come close to a location (or “Hot Spot”) that has been visited by a large number of positive Users in the last two weeks
- View ‘Hot Spots’ and laid out geographically on a map

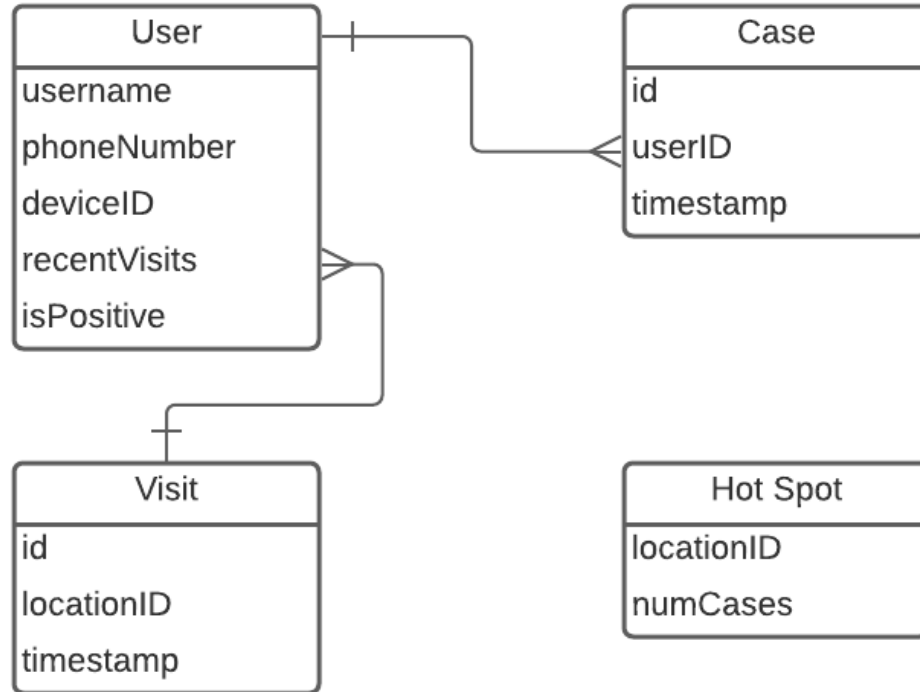
Methodology



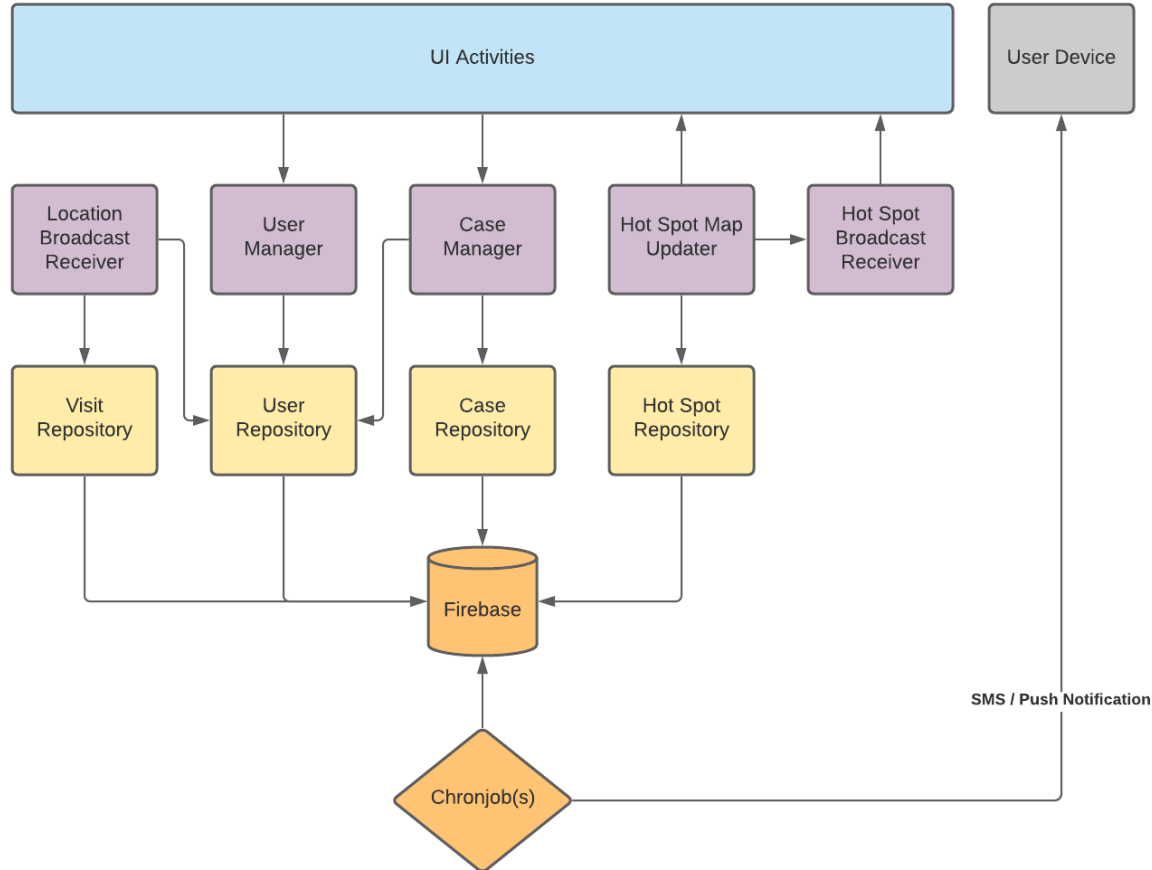
Implement services/broadcast receivers that run in the background, as well as Firebase Chronojob(s) that run server-side on predefined intervals, so that the user can have up-to-date information and spend minimal time in the application.



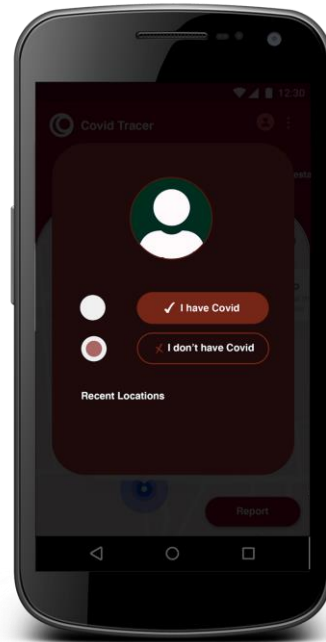
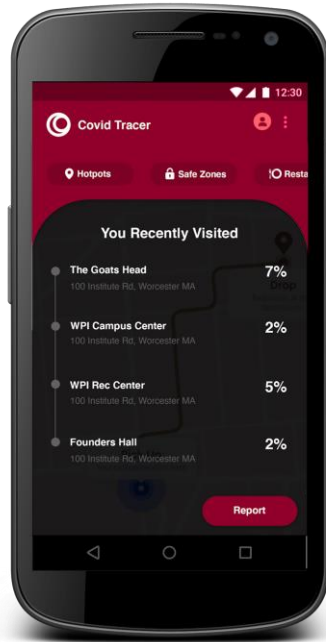
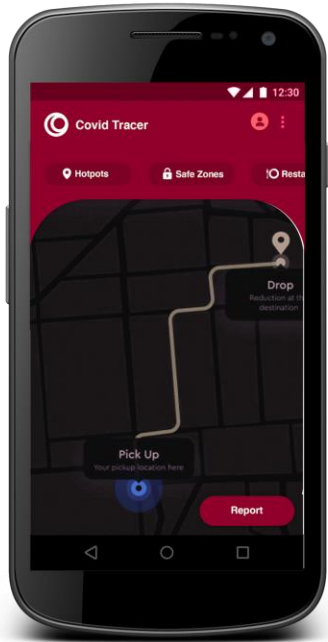
Database Schema



Software Architecture



UI Mockups



- Less is More (Minimalistic Design)
- Alternative Material Framework
- Emphasis on Anonymity within the User Experience

Android Frameworks



Cloud
Firestore



Google Maps



Google
Cloud
Functions



Firebase
Authentication

Timeline



Week #1 (11/1 - 11/7)	<ul style="list-style-type: none">• Create Git Repo• Create initial UI fragments/activities• Research how to use Firebase Realtime DB and Chronjobs
Week #2 (11/8 - 11/14)	<ul style="list-style-type: none">• Develop user authentication• Develop Location tracking and storage
Week #3 (11/15 - 11/21)	<ul style="list-style-type: none">• COVID Case reporting• Hot Spot tracking and geofencing
Week #4 (11/22 - 11/28)	<ul style="list-style-type: none">• Chronjob functions for automating Hot Spot management / Contract Tracing• Push Notifications• SMS messaging
Week #5 (11/29 - 12/5)	<ul style="list-style-type: none">• Conduct User Interviews• Start work on Paper and Presentation
Week #6 (12/6 - 12/9)	<ul style="list-style-type: none">• Finalizing Paper and Presentation

Difficulty Points



- Mobile Components and Android UI:
 - 5 Android Screens (4 points)
 - Maps / Location Sensing (4 points)
 - SMS and Notifications (4 points)
 - User Authentication (4 points)
- Ubiquitous Computing Components & Android UI:
 - Geofencing (6 Points)
- Machine/Deep Learning:
 - Machine learning to calculate danger percentage for each hotspot (10 points)



References

- <https://digital.hbs.edu/platform-rctom/submission/how-crowdsourcing-is-changing-the-waze-we-drive/>
- [*mCrowd | Proceedings of the 7th ACM Conference on Embedded Networked Sensor Systems*](#)
- [*Crowdsourcing to smartphones | Proceedings of the 18th annual international conference on Mobile computing and networking*](#)
- <https://hms.harvard.edu/news/crowdsourcing-covid-19>
- <https://www.investopedia.com/terms/c/crowdsourcing.asp>