Alternative Contact Tracing

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The Problem

Current Situation

Time

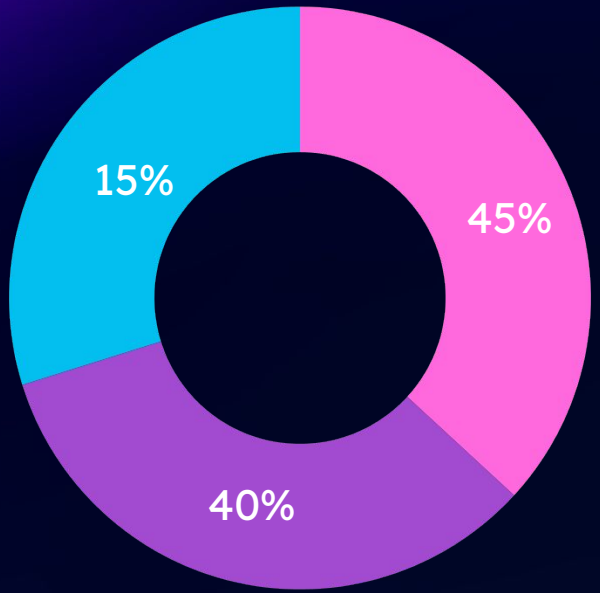
Only able to record immediate contact. Covid-19 can last for up to 72 hours on surfaces

Inaccuracy

Transmission & Accuracy of signal affected by concrete walls & ceilings , other bluetooth transmissions

Initial Survey

How concerned are you about virus transmission through liquids left on surfaces?



Very Concerned

Somewhat Concerned

Not Concerned

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Our Solution

GPS instead of Bluetooth

It has several advantages:

- Able to save locations & trace **indirect** contact
- Less susceptible to signal **interference**
- More **precise** (in terms of location)

GPS more effective at contact tracing than bluetooth **in some scenarios**

Basic Functionality

Recording

Client app saves location every 60 seconds

Saved

Stored locally and transmitted to server

Contact

If client visits same location as confirmed case, warning alert is given

App Functions

Location playback

Client App displays available **location history** to user

Warnings

Alert is given through Android and app displays contact

Desired Outcome & Target

Intended as a **general alternative** contact tracing system for the public

Contact tracing be made more **accurate** & identify additional **contact** cases

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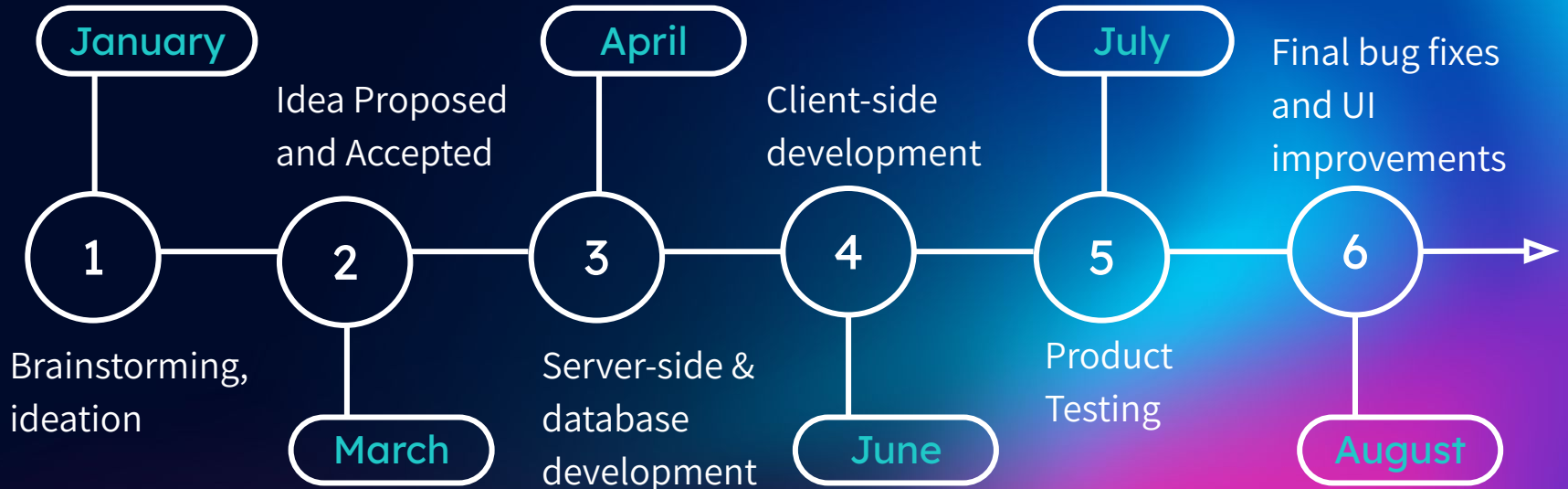
The Process

Project Timeline



Tools Utilised

C++

Java

Android

MongoDB

Ubuntu Server

GPS

Task Distribution

Jing Da

Client-side
Development

Chee Heng

Client-Server Integration
& Documentation

Alrik

Server-side
Development

Xuyuan

Client-server Interface
& Integration

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Our Product

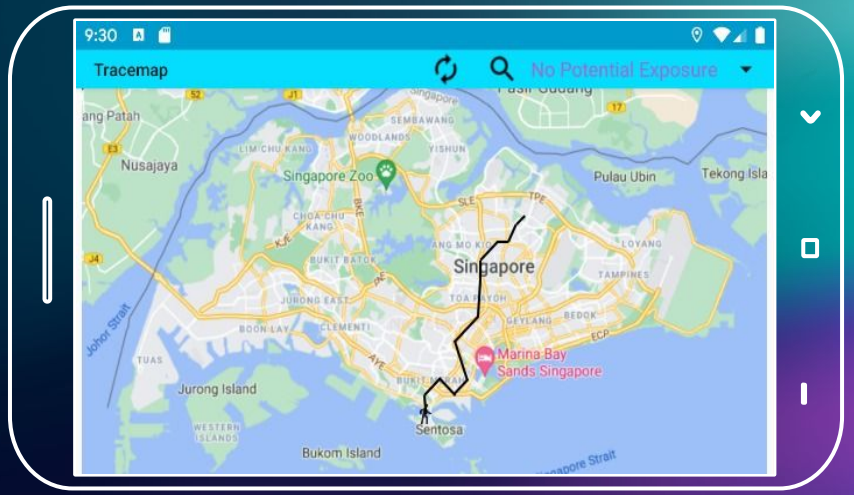
4.1

Product:

Client Application

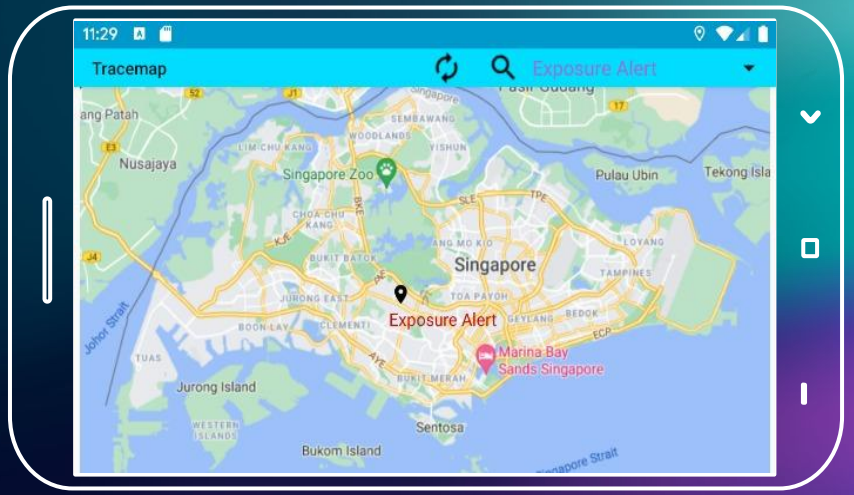
Location History

A map of location history is available to the user, when the search button is clicked



Exposure Alert

The app would display Exposure Alert if possible exposure is detected on the specific point of travel history.



Location Recording

Location recording every 60 seconds (Pulled from Android location services)

Data saved on local storage for 14 days

At 1AM, location data is sent to server for further analysis

4.2

Product:

Client-Server Interface

Interface

Tools

Utilises Socket.io and Java's network libraries *(java.net)*

Encryption

Encrypted with AES-256 for data security mid-transmit

Object Model

Used as library on client and server-side to unify coordinate format

Network Process

- UTF datastream received from client
- Verify that data received is not corrupted & is legitimate coordinates
- Convert Coordinate into MongoDB Document and insert into collection '**coordinates**'

Server
pre-processing

Filtering

Filters out coordinates significantly outside Singapore

Saving

Saves received coordinates into MongoDB database *(collection '**coordinates**')*

Return Match

Returns matches given by Backend software (4.3) *(collection '**matches**')*

4.3

Product:

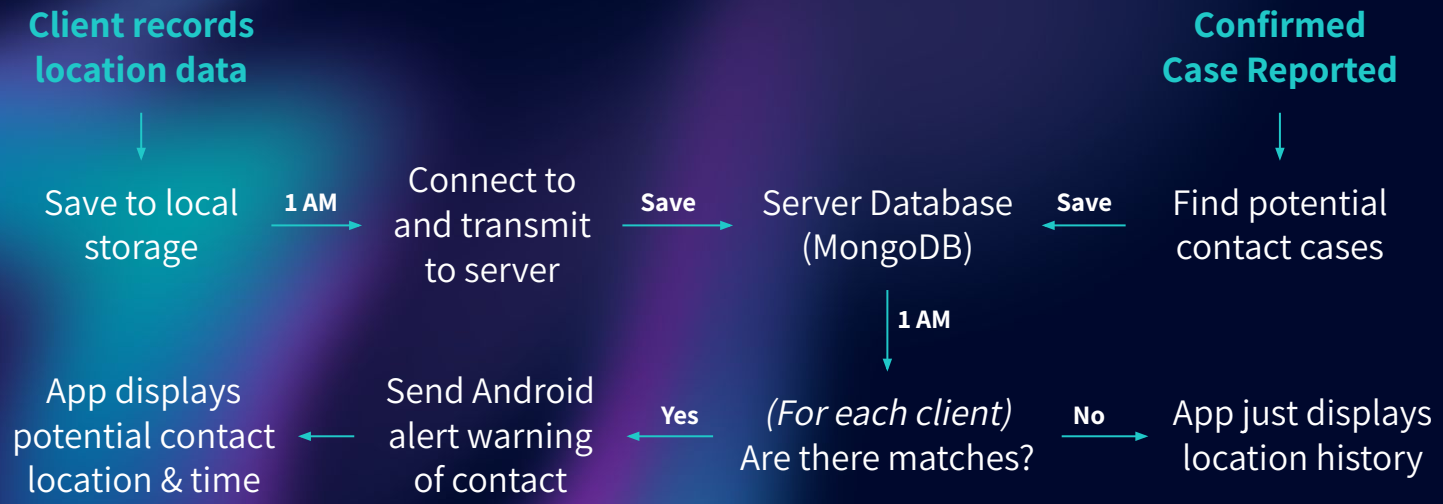
Backend Processing

Backend Processing

Once a there is a confirmed case, the client ID of person is entered into a C++ program that:

- Transfers coordinate data (in “coordinates” collection of MongoDB database) of infected person to “cases” collection in MongoDB database
- Iterates through coordinate data (“coordinates” collection) and compares them with coordinate data of confirmed cases (“cases” collection)
- Insert coordinate data of close contacts to “matches” collection

Overall Data Workflow



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Limitations

Potential difficulties

- Constant location recording could cause load on client device battery
- Client application only available on Android

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Room for improvement

Client UI

- Improvement on the client UI to improve and optimise user experience

- More user friendly and feature-packed user interface to allow ease of access for consumers

Security

- Measures to increase the security of the system
  - Database security could be improved by using an encrypted VPN tunnel for developer testing, along with systems to verify client authenticity
  - Hashing system introduced to protect location data sent to the server and ensure genuine location history never leaves the client device

References

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Thank You!

Any questions?