Proposal: Manual Interaction Recording (MIR) App

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Introduction

Tracing and isolation of confirmed Covid-19 cases is a key strategy to counteract the spread of the disease. Since the beginning of the epidemic, governments have been performing contact tracing by manual means such as personal interviews and questionnaires. Although effective in tracing many of the possible infections, manual tracing has several associated deficiencies which can be listed as follows:

1. Relies on patients' ability to remember all people they exposed the disease to and the degree of exposure per contact. Every missed (forgotten) contact will be left to infect many others.
2. People may not want to disclose all their interactions due to personal reasons.
3. Once the contacts have been identified it will take a great effort to contact them individually specially when the number of cases per day rises to many thousands.

In response, Automatic Interaction Recording (AIR) where smartphones automatically discover and record interactions using Bluetooth proximity technology has been gaining popularity all over the world. Many countries have already released their own AIR systems with different underlying technologies (Bluetooth/GPS) and topologies (centralised vs distributed). Recently, Apple and Google have cooperated by releasing a unified API to support AIR apps based on decentralised/Bluetooth scheme.

AIR addresses the MIR problems above while bringing many additional benefits:

1. Interactions are recorded automatically in the background thus reducing the effort taken by MIR.
2. Interactions are recorded without knowing the identity of the other individual.
3. Interactions are shared anonymously with contacts conserving privacy.
4. Data collected (in centralised deployment) can be used in Covid-related studies.

However, the success of any AIR-based solution relies on a wide adoption rate (>60% of the population). Otherwise, the solution will not work as expected. To put it simply, if only 20% of the population installs the AIR App, any app user (in the 20%) will record one interaction in every 5 interactions on average. This is because for AIR to work, both sides must be using the app. Therefore, the probability that an interaction between two persons is recorded by the app will be 0.2 X 0.2 = 0.04 or 4% of all interactions in the community (given 20% adoption).

Reaching a high adoption value in a very short period is very challenging due to many factors:

1. Many people have old devices with old software. Developing the AIR app to work on all versions of iOS and Android in use will be expensive and complex since different phone models, software use different protocols and standards of Bluetooth and P2P connectivity.
2. Old devices tend to have poor battery life which discourages users from leaving the Bluetooth continuously enabled.
3. Some people may not have smartphone devices.
4. When the adoption percentage is still low the few app users will not feel the effectiveness of the app which may discourage new user to join in.

There are still many workarounds solutions that governments can implement to increase AIR adoption rate. The government may require the use of AIR app to apply for curfew permits, purchase goods, or attend schools and workplaces. In addition to the vast deployment problem, AIR may not work at all times due to false-negatives caused by:

1. The other person not using the app.
2. Any of the users disabled Bluetooth, the app crashed, or failed for any reason.
3. Communication issues (interference, etc).

By false negatives, we mean the occasion when AIR does not record an interaction that it should. In addition, AIR is prone to false positives caused by error in distance estimation. For example, if two users are separated by a glass door AIR will record an interaction which is non-infectious. False-positives are very harmful to AIR than it may sound. If a user gets many false positives by getting notified of possible infections so often without showing symptoms or testing positive later, then he/she may lose confidence in the App.

The proposed Manual Interaction Recording App:

Given the issues with the AIR system and manual tracing (using paper questionnaires), we propose a Manual Interaction Recording (MIR) App by which the user can manually create an Interaction entry for a person he/she interacted with or a place he/she visited. Hence, this is effectively a personal diary of the user's own interactions.

This MIR App can either complement an existing AIR system to overcome its limitations or as a standalone App. Some advantages of the proposed MIR App are as follows:

1. MIR app works with any number of users (as it only depends on the user creating the record). It does not require a significant number users. Despite that the overall benefit increases exponentially with the number of users, a single MIR user in the community can still independently record his/her own contacts and share them with the authorities if he is diagnosed positive to prevent many infections.

2. MIR adds context to AIR interaction information thus increasing its accuracy in estimating the infection risk and minimising false-positives and false-negatives.

MIR App can be implemented in two ways:

1. <u>Separate from AIR:</u>
    1. Records created by MIR are not linked to those created by AIR. The user cannot view or delete AIR created interactions.
    2. MIR works side-by-side with any other AIR system (CoEpi, SafePath, etc) without modification to the AIR system.
    3. Each system independently records and broadcasts alerts. A user receiving an alert from both AIR and MIR will have a high confidence in the alert. Alerts missed by AIR may be detected by MIR and vice versa.

2. <u>Integrated into AIR:</u>
    1. User can review all entries created by AIR immediately after creation or after a while (for privacy issues).
    2. User can report an AIR entry as "Inaccurate".
    3. User can add/overwrite information in AIR entry (distance, duration, safety measures).

Scenario: The user receives a delivery and interacts with the delivery man. The user cannot see an interaction created by AIR which indicates the delivery man is either not using an AIR app or something went wrong with it. The user can manually create an interaction and indicate the (persons's name, contact, company he belongs to, etc). The use can add information about infection risk (wearing masking? gloves? distance?).
Scenario 2: The user finds many AIR interactions created during the period he was driving his/her car with all windows shut. The user may safely tag all these interactions as "inaccurate".

4. Based on this information, the app will determine whether to send AIR interactions to the server or not.

MIR Creation Process:

1. The user can manually create an "Interaction entry" by clicking on the "ADD Interaction" Button in the app UI.

2. The user can choose between "Add Person" to add an interaction with an individual, or "Add Place" to add a place visited.

3. The App may automatically remind the user to "Add Person" based on location information or when a nearby user is detected by BLE (if this notification option is enabled).

4. For each entry created, the user associates an "Avatar" (Profile) for the contacted person. The Avatar resembles the picture of the contacted individual using a simple Avatar builder UI to specify for example (gender, age, eye colour, skin colour, ethnicity, etc) as well as other information including (name, phone number, email, relationship, job, company, etc). The more information provided the easier contact tracing will be.

5. The user can create a new Avatar or modify stored avatars created previously or select from many built-in avatars (delivery man, work colleague, family member, etc). In avatar creation, the user can import contact information (phone/email) from the phone's address book if permission is granted.

6. The user can create a continuous MIR entry for persons he/she interacts with regularly on a daily-bases (family members, colleagues at work, etc). Later, the user can indicate when the continuous interaction ends.

MIR Entry Data:

Field	Description	Data Type	Default	Conditions	Normal and Private Mode
Unique ID	Unique ID generated by the app for each new interaction created	String	-		Compulsory
User A ID	User ID of the first user (creator)	String	My ID		Compulsory
User A P&H	protection of User A taken directly from user status	Int			Compulsory
User B ID	User ID of the second user (if known)	String			Optional
User B Avatar	Create an Avatar for B	String			Compulsory
User B P&H	protection of User B. Manually select from dropdown menu.	Int			Optional
Date/Time of Interaction	Select from Calender	Date	current time		Optional
Duration (If Not continuous)	Duration in minutes	Int	1	1-1500	Optional
Location	Drop pin on map	Coordinates	Current location		Optional
Contineous	yes/no	Bool	FALSE		Optional

7. The user can edit or delete an interaction entry created manually by selecting the interaction entry and choosing “Edit” or “Delete” Entry.

8. The user should be able to view a list of all MIR interactions (sorted from the most recent).

9. The user should be able to search MIR interactions by any of the entry fields.

10. The user should be able to export all interaction data to spreadsheet format sent to a specified email address or stored on the device’s file system.

11. The App may automatically hide/delete interactions created more than 14 days (28 days) in the past.

12. The user can choose to receive repeated notifications at specific times of the day to remind him/her to review/create MIR records.

Symptom and Positive Test Reporting:

1. If the user develops COVID-19 symptoms, the user can select “Report to all MIR contacts” to send a broadcast message (email/sms/whatsapp) to all recent Avatars (using contact information in their Avatars if available).

2. The user can deselect any entry from the broadcast message.

3. The user can define the message to be sent.

4. If the user test positive for COVID-19, the user may notify the MIR contacts as above or export the MIR data to a spreadsheet and send it to the health authorities so they can trace the MIR contacts anonymously.

5. If a user receives a notification (by email/sms) or by the AIR server about a recent contact with a symptomatic/positive person, the user may manually report the event to his/her own MIR entries as above (only entries occurred after the reported interaction) or choose to notify AIR server if AIR/MIR integration is adopted.