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Adopting the Use of Telecommunication for Contact Tracing to Curb the Spread of Infectious Disease (Covid 19)

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ABSTRACT: Contact tracing is a well-established and effective approach towards containing an outbreak. Effective contact tracing can allow societies to reopen from lock-down even before availability of vaccines. One common measure taken to contain or reduce diffusion is to detect infected individuals and trace their prior contacts so as to then selectively isolate any individuals likely to have been infected. The objective of mobile contact tracing is to speed up the manual interview based contact tracing process for containing an outbreak efficiently and quickly. These prior contacts can be traced using mobile devices such as smartphones or smartwatches, which can continuously collect the location and contacts of their owners by using their embedded localisation and communications technologies, such as GPS, Cellular networks, Wi-Fi, and Bluetooth. In this article, covidtracer app will be used to identify who you have been with rather than where you have been, we will also throw light on some of the issues and challenges pertaining to the adoption of mobile contact tracing solutions for fighting COVID-19.

KEYWORDS: COVID-19, Contact Tracing, Security, Privacy, Scalability

I. INTRODUCTION

On 11 March 2020, with over 294,000 cases worldwide, Covid-19 was declared a pandemic by the World Health Organization (WHO). The world is facing a global health and socio-economic crisis with governments adopting unprecedented measures to deal with this emergency. In order to reduce the contagion, and following WHO recommendations, states have implemented non-pharmaceutical measures and conducted outbreak investigations, including contact tracing and management, surveillance. Contact Tracing is a key strategy for mitigating the impact of infections like COVID-19 on health care systems in specific and health of the population in general, and is thereby expected to slow the spread of infectious diseases. According to WHO, contact-tracing occurs in three steps:

1. Identifying the Contact: From the already confirmed positive cases, identifying those that the patient had contact with (according to the transmission modalities of the pathogen).
2. Listing of Contacts: Keep a record of possible contacts of the infected patients and inform those individuals.
3. Contact Follow-Up: A necessary follow-up of the patients that are believed to have come in contact with the infected individuals and those who are positive.

II. BACKGROUND OF THE STUDY

A. What is Contact Tracing?

During epidemics of infectious diseases, such as the Coronavirus disease (COVID-19), it is important to lower the number of new infection cases and to stop it eventually. Therefore the infection chain of onward transmissions must be interrupted. When those persons known to be infected reveal their recent contacts, other infected persons may be identified, informed and e.g. isolated already early on, even before they become aware of their infection. The process to identify contacts of known cases is called contact tracing.

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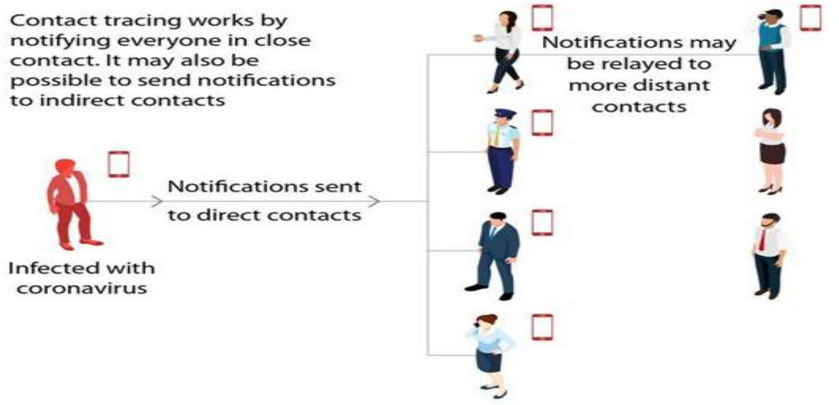

Figure 1: Contact Tracing.

B. Traditional Contact Tracing

After a confirmed or probable case of an infected person has been identified, health authorities usually interview the person, e.g. by phone. The European Centre For Disease Prevention and Control (2020) lists the following generic steps:

1. The person's clinical history is collected.
2. The contacts of the identified persons are gathered with their risk of exposure for classification, and background data like e.g. work with vulnerable populations.
3. The contacts are then called to confirm their health status and to test those with symptoms, monitor actively close contacts, and ask other contacts to self-monitor and apply precaution. This case-by-case approach is very resource intensive. Tracing all contacts can be difficult when people have many contacts, do not accurately remember them or cannot provide information on how to reach out to them.

C. What is digital contact tracing?

Digital contact tracing makes use of electronic information to identify exposures to infection; it has the potential to address limitations of traditional contact tracing, such as scalability, notification delays, recall errors and contact identification in public spaces. To support and complement traditional contact tracing, radio wave sensors built into smartphones could be used because they can automatically detect close contacts: the smartphone could be used to record when two people are in close enough proximity for long enough that there is a high risk of contagion if one of them has e.g. the coronavirus. Smartphones can be equipped with new functionalities, with the installation of a dedicated smartphone application and/or operating system software update, empowering their holders via the smartphone sensors to log preventively with little or no personal effort a list of proximity contacts even before a suspicion of an infection emerges. Digital tracing could be particularly useful when people may have been in touch with many contacts during longer periods of symptom-free contagion, who would otherwise be hard to recall afterwards.

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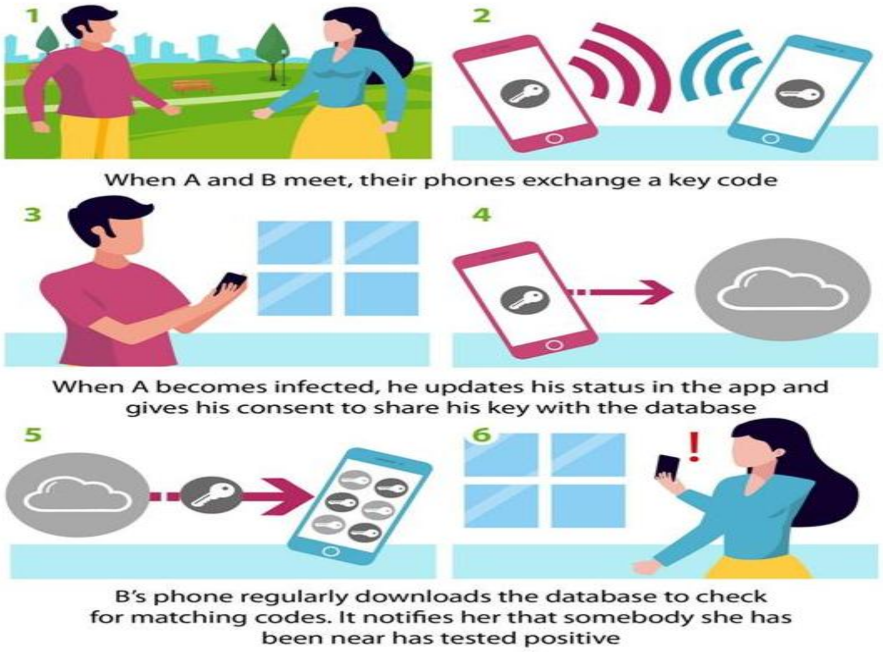

Figure 2: Digital Proximity Tracing.

iii. SIGNIFICANCE OF STUDY

The country has been struggling with finding a balance between tackling the economic recession due to the lockdown and the increased spread of diseases with the relaxed lockdown. Contact tracing app will curb the spread of the disease without interrupting economic activities. Digital contact tracing can significantly improve the capacity and scope of timely outbreak response and will help governments as well as other responders in Nigeria.

IV. LITERATURE SURVEY

Monitoring and controlling emerging infectious diseases is vital to public health. Through the use of new technologies such as internet-based surveillance, infectious disease modelling, remote sensing, telecommunications and mobile phones, these infectious diseases can be predicted, prevented and controlled. This new approach for dealing with epidemics is usually categorised with a newly coined term: digital epidemiology. Several works have evaluated the characterisation of human mobility patterns by using Call Detail Records (CDRs) for modelling and evaluating epidemic diseases. Particularly, in the authors explored the opportunity of using proxies of individual mobility to describe commuting flows and predict the diffusion of an influenzalike-illness epidemic. However, depending on the human mobility data source used, their predictive accuracy with regard to epidemic invasion timing and propagation patterns differed. Another method for detecting and tracing contacts uses wireless sensor network technologies, such as Bluetooth or ZigBee. One of the first experiments using MOTES was performed by Salathe et al. They obtained highresolution data of interpersonal contacts on one typical day at an American high school, which made it possible to reconstruct the relevant social network from an infectious disease transmission perspective. The paper also includes an SEIR (Susceptible, Exposed, Infectious, Recovered) model for evaluating disease diffusion and the impact of measures such as vaccination. Mastrandrea and Barrat also used wearable sensors to capture contacts between students and compared the results with contacts obtained from personal diaries. Furthermore, the authors compare how an epidemic disease was spread using two different contact networks (from sensors and diaries), which showed a notable difference in their dynamics. Recent years have seen increasing interest in evaluating the efficiency and impact of contact tracing in epidemics. Contact tracing is a very useful measure focusing primarily on potential next-generation cases.

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Figure 3: Population-based spread of infectious disease

Contact tracing has been proved to be a highly successful strategy when the number of infectious cases is low, or at the early stages of an outbreak, or especially when the disease may be asymptomatic (but still infectious), as it provides the only means by which such individuals can be easily identified. Other studies evaluate the main factor in making an outbreak controllable. There are two main approaches for modelling contact tracing: Population-based modelling is a top-down approach depicting disease dynamics on a system level that is typically used for analysing research matters from a macroscopic perspective; Agent-based modelling is a bottom-up approach dealing with each individual as an agent, each with their own movements and infection states, and is commonly used to evaluate heterogeneous and adaptive behaviours. In general, the latter method is more realistic, though it can be computationally demanding. Some recent studies specifically deal with the COVID19 pandemic. Ferretti et al claim that isolation and contact tracing as currently practised is not preventing the COVID-19 epidemic; this is mostly due to the high number of asymptomatic infected individuals that remain undetected, which contributes to the spread. Thus, they propose using mobile apps to trace the previous contacts, showing mathematically that epidemics can be contained even when not all the population uses the application (although the required portion is significantly high). Hellewell et al draw a similar conclusion through a simulated model. That is, in most scenarios, highly effective contact tracing and case isolation are enough to control a new outbreak of COVID19 within 3 months, even when only 79% of the contacts are traced. Nevertheless, these conditions make smartphonebased contact tracing far from being a realistic solution. One of the first attempts at using mobile phones to estimate contacts was the FluPhone application developed at Cambridge University. That application used Bluetooth and other wireless signals as a proxy for estimating physical contacts and asked users to report flu-like symptoms in order to evaluate the risk of infections. For COVID-19, the Singapore Government developed and released the TraceTogether mobile App for tracing, which also relied upon Bluetooth contacts and had already been used to control disease spread. Other similar proposals, also focusing on privacy issues, are the Pan-European Privacy-Preserving Proximity Tracing (PEPP-PT) [6] and SafePaths . Finally, Google and Apple have teamed up to develop and integrate similar solutions into the iOS and Android operating systems. As they are integrated into the operating system, the proposed solution is more efficient, and more importantly, will be ubiquitous for users.

V. METHODOLOGY

Bluetooth proximity tracing system relies on short-range Bluetooth signals emitted from people’s smart phones. These signals represent random strings of numbers, likened to “chirps” that other nearby smart phones can remember hearing.

VI. PROPOSED SYSTEM

A.How does it work?

Turn on your Bluetooth, because covidtracer app uses Bluetooth signals to determine when your phone is near another phone that also has the app installed. Both phones exchange anonymised IDS, which are then stored in encrypted form, only on your phone. If a user gets infected with covid 19. He or she will be asked to give contact tracer access to covid tracer data, a list of anonymised IDS has been closed to will display. No geolocation or other person data is collected.

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The anonymised IDS will help contact tracers quickly identify and contact people at high risk of infection to provide care and prevent the spread of the disease.

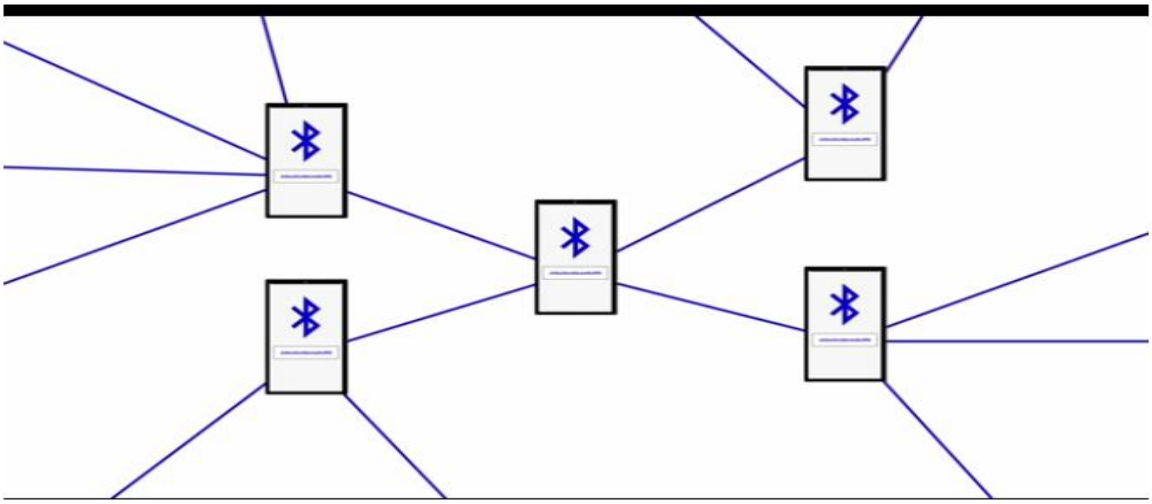

Figure 3 Covid tracer Bluetooth based system

The system relies on digital "chirps," which are short-range Bluetooth signals represented by long strings of random numbers. The strings continuously change so that they cannot be traced back to a single individual. When a smartphone is enabled with this app, it sends out such random chirps regularly and also logs its own signals. It logs signals from other phones only if the other phone is within a six-foot radius and has been nearby for a significant length of time.

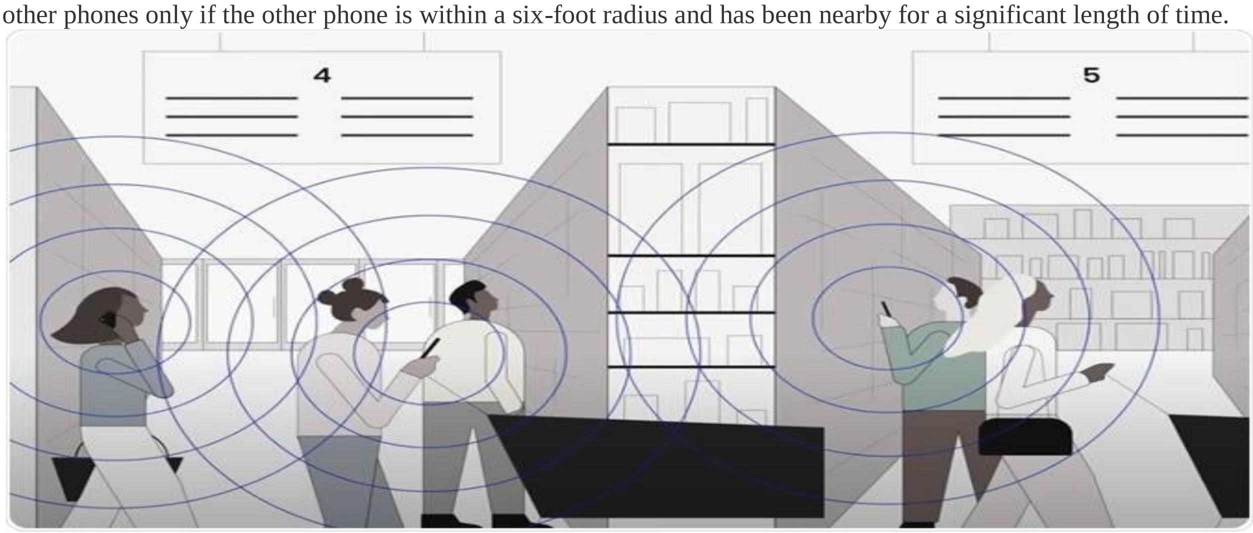

Figure 4: Continuous Bluetooth random strings

VII. WHAT ARE THE CHALLENGES OF BLUETOOTH APP-BASED CONTACT TRACING?

Contact-tracing apps have 5 major limitations. First, the effectiveness of a contact-tracing app is dependent on the degree of adoption: Both traditional and digital proximity contact tracing involve the processing of personal data. Where the data relates to infected persons, health data requires special protection. Some other limitations are.

A. Large scale surveillance

Digital proximity tracing raises novel data protection risks as it provides for preventive, contact recording of a very large number of the population in public and private spaces using radio wave signals invisible to human eyes Contact

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tracing applications are therefore likely to result in a high risk to the rights and freedoms of natural persons and to require a data protection impact assessment to be conducted prior to their deployment.

B.User identification

The contacts of a case may include family members, neighbors, or colleagues from work. Linked to other data, e.g. from social networks, it is technically possible to learn the name of the infected person, the place of residence and work and a number of other activities and potentially their location. The number of contacts and their frequency may even reveal social habits, such as religious practices. Linking with location data, as it happens with GPS-based tracing, could allow to infer a detailed picture of the daily routine.

C. Purpose limitation

In the context of a tracing apps, careful consideration should be given to aspects of purpose limita tion and storage limitation, i.e. determining in advance for which specific purposes (such as contact tracing and/or scientific research) the personal data may be used, and by whom and for how long it may be stored. Once the epidemic has stopped, and contact tracing apps are no longer needed, a procedure must be put in place to stop the collection of identifiers (global deactivation of the application, instructions to uninstall the application, automatic uninstallation, etc.) and to delete all collected data from all databases (mobile applications and servers).

D. Lack of transparency

Tracing apps may only achieve their maximum efficiency if used by the largest possible share of the population. Lack of explanations on how the tracing apps work and how they protect the user's privacy might create a lack of trust. Therefore the use of tracing apps should be voluntary and transparent to the user. The collected information should reside on the user's smartphone.

E. Insufficient data accuracy and integrity

Radio wave transmission follows different principles than transmission of infections. Unlike radio waves, infections cannot be transmitted through windows or walls. Radio waves cannot track other interaction aspects like the ability to touch contaminated surfaces or shake hands. Moreover, sensors can only detect other sensors of their kind and do not detect contacts without a suitable smartphone. In consequence, digital proximity tracing is prone to record contacts with false positives and false negatives.

VIII. CONCLUSION

With growing demand for contact tracing solutions it is the need of the hour. Non-pharmaceutical measures such as contact tracing, surveillance, and social distancing are the only instruments for fighting contagious diseases, in the absence of a specific vaccine and anti-viral agents. The impact of these measures on human rights and fundamental freedoms must be legal, necessary and proportionate in order to protect the right to health. The Covid-19 crisis is the first pandemic in which technology can support the containment and mitigation of the contagion and its deployment presents new challenges, together with great opportunities.

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