COVID CONTAINMENT ZONE ALERTING APPLICATION

ABSTRACT:

The recent outbreak of COVID-19 has taken the world by surprise, forcing lockdowns and straining public health care systems. COVID-19 is known to be a highly infectious virus, and infected individuals do not initially exhibit symptoms, while some remain asymptomatic. Thus, a non-negligible fraction of the population can, at any given time, be a hidden source of transmissions. In response, many governments have shown great interest in smartphone contact tracing apps that help automate the difficult task of tracing all recent contacts of newly identified infected individuals. However, tracing apps have generated much discussion around their key attributes, including system architecture, data management, privacy, security, proximity estimation, and attack vulnerability. In this article, we provide the first comprehensive review of these much-discussed tracing app attributes. We also present an overview of many proposed tracing app examples, some of which have been deployed countrywide, and discuss the concerns users have reported regarding their usage. We close by outlining potential research directions for next-generation app design, which would facilitate improved tracing and security performance, as well as wide adoption by the population at large.

EVOLUTION OF COVID 19 :

According to Zhu et al. (2020), the first pneumonia case was discovered on December 8, 2019 in a wet market in Wuhan, the capital city of Hubei Province of China. Afterwards, several clusters of patients with such pneumonia were reported throughout late December 2019. Table 2 below provides a timeline of key events, starting from January 2020.

COVID-19 - Timeline Date Events 4 January 2020 WHO reports cluster of pneumonia cases in Wuhan, Hubei, China

- 7 January 2020 WHO identifies COVID-19 11 January 2020 China announces 1 st death from COVID-19.
- 13 January 2020 1 st official case of COVID-19 reported outside China in Thailand.
- 17 January 2020 Authorities in the Nepal, France, Australia, Malaysia, Singapore, South Korea, Vietnam and Taiwan confirm cases.
- 21 January 2020 1 st case of COVID-19 reported in the United States of America (US).
- 22 January 2020 WHO finds evidence of human-to-human transmission from China.
- 23 January 2020 China imposes lockdown in the cities of Wuhan, Xiantao and Chibi of the Hubei province.

- 30 January 2020 WHO declares COVID-19 to be a Public Health Emergency of International Concern.
- 31 January 2020 US declares COVID-19 a domestic public health emergency .
- 2 February 2020 1 st death due to COVID-19 outside of China in Philippines.
- 9 February 2020 The death toll in China surpasses that of 2002-03 Severe Acute Respiratory Syndrome (SARS).
- 14 February 2020 Egypt reports 1st case of COVID-19, the 1st case in the African continent.
- 15 February 2020 France reports 1 st death from COVID-19 outside of Asia.
- 23 February 2020 COVID-19 cases rise in Italy in what becomes the largest outbreak outside of Asia.
- 26 February 2020 Brazil confirms 1st case of COVID-19, the 1st case in South America.
- 27 February 2020 1 st case of community transmission reported in the US.
- 29 February 2020 1 st death due to COVID-19 in the US 8 March 2020 Over 100 countries report COVID-19 cases Italy imposes quarantine in Lombardy region.
- 11 March 2020 WHO declares COVID-19 a pandemic 13 March 2020 Donald Trump declares national emergency in the US.
- 17 March 2020 All 50 states in US have at least one confirmed case of COVID-19 California first state to implement 'stay-at-home' order in US.
- 19 March 2020 Italy's death toll surpasses that of China.
- 21 March 2020 EU suspends public deficit rules to inject fiscal stimulus across countries.
- 25 March 2020 The White House and Senate leaders of both the Democratic and Republican parties in the US come to an agreement on a US$2 trillion stimulus to aid workers, businesses, and the health-care system in response to the pandemic.
- 26 March 2020 US leads the world in COVID-19 cases.
- 2 April 2020 Global cases of COVID-19 reach 1 million 8 April 2020 China lifts lockdown in Wuhan, 76 days after it was sealed off to contain COVID-19 11 April 2020 US records 2,000 deaths in one day, the highest single-day death toll recorded by any country .
- 15 April 2020 Global cases of COVID-19 reach 2 million.
- 24 April 2020 US's death toll surpasses 50,000 27 April 2020 Global cases of COVID-19 reach 3 million.
- 28 April 2020 COVID-19 cases in US surpass 1 million 21.
- May 2020 Global cases of COVID-19 surpass 5 million.
- 22 May 2020 Brazil surpasses Russia as the country with the 2nd highest number of cases, after the US.
- 27 May 2020 US's death toll surpasses 100,000.

PURPOSE:

The COVID-19 pandemic has spread with increased fatalities around the world and has become an international public health crisis. Public health authorities in many countries have introduced contact tracing apps to track and trace infected persons as part of measures to contain the spread of the Severe Acute Respiratory Syndrome-Coronavirus 2. However, there are major concerns about its efficacy and privacy which affects mass acceptance amongst a population. This systematic literature review encompasses the current challenges facing this technology and recommendations to address such challenges in the fight against the COVID-19 pandemic in neo-liberal societies.

METHODS:

The systematic literature review was conducted by searching databases of Google Scholar, Web of Science, PubMed, IEEE Xplore Digital Library, PsycInfo and ScienceDirect using the search terms ("Contact Tracing" OR "Contact Tracing apps") AND ("COVID-19" OR "Coronavirus") to identify relevant literature. The searches were run against the title, keywords, or abstract, depending on the search platforms. The searches were conducted between January 1, 2020, through 31st January 2021. Further inputs were also taken from preprints, published government and technical reports. We explore and discuss from the selected literature, the key challenges and issues that influence unwillingness to use these contact tracing apps in neo-liberal societies which include the plausibility of abuse of user privacy rights and lack of trust in the government and public health authorities by their citizens. Other challenges identified and discussed include ethical issues, security vulnerabilities, user behaviour and participation, and technical constraint.

DISCUSSION:

The decision to develop and deploy contact tracing apps for tracking and tracing the spread of the COVID-19 pandemic continues to raise data privacy concerns and a balance between user data privacy and societal benefit has been considered [48]. This coupled with its effectiveness, ethical considerations, security risks, and technical issues has been highlighted as major challenges affecting mass acceptance amongst the population in neo-liberal societies. In this section, we present findings from the selected primary studies that highlight the major challenges affecting contact tracing apps in the fight against COVID-19, recommendations to address these challenges and future directions in the use of digital contact tracing technology to fight future pandemics.

REVIEWS:

Timmers et al

- eHealth mobile apps for COVID-19 that support several functionalities such as tracking of symptoms and provision of accurate and timely information as well as self-assessment can be implemented in a short time to be used by individuals.
- Those apps provide valuable information to both governments and health care providers, since they support monitoring of patient health status and provide summary statistics regarding the progress of health.
- Such apv\] j ps could be used in future outbreaks of other viruses to support all involved stakeholders.

Yamamoto et al

- Such apps could be used in future outbreaks of other viruses to support all involved stakeholders.

Zamberg et a

- Mobile health (mHealth) apps could help solve some of the COVID-19 challenges by providing more accurate and timely information to health care professionals. This benefit is sourced by the centralized management and storage of main, up-to-date, validated, and easily accessed information in one platform.
- mHealth apps used in health care organizations as communication tools of validated information should be assessed in the context of clinical studies, with regards to their impact on clinical outcomes.

Kodali et al

- According to users, the app should be enhanced with additional functionalities including tracking of location, provision of up-to-date information on COVID-19 as well as information on areas with high/medium/low epidemiological burden, and deployment in nonmobile platforms.

Huckins et al

- According to the findings, since the beginning of the COVID-19 pandemic, there has been an extended negative impact both on the physical health of individuals, resulting in an increased number of deaths, and in their mental health, resulting in changes in their behavior.

Drew et al

- The research of a broader range of potential risk factors for COVID-19 results will be largely supported by the use of the app within several large epidemiology cohorts for which there are a large amount of data on lifestyle, diet and health factors, and genetic information.

- It will be useful to deploy the tool in several clinical studies, in centralized actions related to biobanking, and in health care worker monitoring programs.

Medina et al

- The intervention impacts several organizational matters and provides answers regarding the following questions related to COVID-19:
- Which situations should we focus on to provide effective care to prevent patient admission to intensive care unit and mechanical support?
- How can those situations be better supported by increased patient self-reporting?
- Can we predict, based on time data, future inpatient demand?
- How can we manage not having conflicts between patient choice and availability of treatment?

Menni et al

- Routine screening for COVID-19 could also include loss of sense of taste and smell. These two symptoms should also be included in the related symptom list provided by the World Health Organization.

Ros and Neuwirth

- The implementation and deployment of the described digital tutorials, as an effective and swift global public health educational tool, help alleviate the burden that hospitals, health care professionals/responders, and patients face due to the COVID-19 pandemic.

Bae et al

Episode triage, timely diagnosis, isolation of patients, and their treatment can be largely supported by telemedicine solutions.

Ben Hassen et al

- Mobile apps can be used by patients, their caregivers, and health care professionals to better monitor and manage patient health status in the context of patient hospitalization. Moreover, such apps are cost-effective, reliable, and safe, providing important economic benefits to hospitals. Overall, they are accepted to a great extent by patients and individuals.

Bourdon et al

- The use of telemedicine tools for consultation purposes improved the access to health care services for patients with ophthalmological problems. At the same time, such tools preserved social distancing and sanitary measures.
- Such tools can be used in emergency situations by ophthalmological patients who have limited access to specialized care.

ADVANTAGES:

- Users can know if they have been near a person suspected to be affected by COVID-19.
- You can scan a QR code on your smart devices to get registered.
- After registration, you can use your Id number, Name, and Phone number to check the status of at least 3 people using by entering their respective Id numbers.
- Users can use the Close Contact Detector through Alipay or WeChat.
- It is the easiest tool to predict COVID-19 symptoms even if you don't exhibit any.
- COVID Symptom Tracker App takes less time to load and run.
- You can keep track of your health as well as the ones near you.
- It keeps you updated with a centralized database of cases found so far nation-wide.
- You can use this app through Bluetooth and identify other nearby phones with the app installed.
- This app lets you recognize the close contacts and encounters you had with others.
- You can launch this through 4 simple steps which are, Registering your Mobile number, enabling your push notification, and Turning Bluetooth on.
- Your personal information remains confidential for 21 days and can't be accessed by anyone (including government authorities).
- In case you are identified as infected, only then will your details be accessed.

CONCLUSION:

The COVID-19 pandemic continues to affect the way of life of everyone. The contact tracing apps are likely to play a vital role in aiding health authorities quickly identify individuals that may have been exposed to the virus. The imminent interest and adoption of tracing app technology will improve the tracing capability of health authorities; however, as this article highlighted, it is not a silver bullet. These apps still face many concerns from users, data protection agencies, and researchers. The main concerns are related to the user data management, potentially non-trivial false positive and negative instances, and the security and privacy issues of these apps.

Guided by these concerns, this article presented an overview of the three common tracing app architectures: centralised, decentralised, and hybrid; and an overview of popular apps within these categories. Additionally, the paper focused on the privacy and security aspects, mapping attacks that could be possibly performed in each of the three architectures. This article also elucidates some other users' concerns regarding battery drain, compatibility, consent withdrawal, and transparency. Finally, we discussed some of the near and long term future research directions. We note that each architecture has pros and cons, different attack models and protections, varying complexity of implementation, and operating costs. The adoption of a particular architecture, by a

government, is based on familiarity with technology, integration with existing tracing processes, and ease of deployment. On the other hand, the adoption of an app by users is voluntary.

The users have their due concerns regarding the privacy and security of their PII collected through these apps. The adoption rate by users can be increased significantly if complete transparency and legislative guarantees against misuse of data originating from this ecosystem can be assured by the authorities. We also highlight that government agencies and service providers such as ISPs, and large corporations such as Apple/Google can already track people by using traditional apps and technologies such as WiFi connections, the cellular communication tower areas, GPS navigation apps and a whole range of cameras deployed across cities. Since many users already install a myriad of apps on their phones or smart watches (games, social media, etc.) without knowing the security/privacy implications, installing a tracing app that primarily aims at helping in a noble cause of keeping the community safe from spreading the COVID-19 disease, in the opinion of the authors, should not cause undue concern. We hope that this article will aid the research community to understand various technological and cyber security aspects of tracing apps and help users and agencies to make a more informed decision about the voluntary adoption of an app offered in their geographical areas.

REFERENCES:

1] P. H. O'Neill, T. Ryan-Mosley, and B. Johnson. (2020). A Flood of Coronavirus Apps are Tracking Us. Now it's Time to Keep Track of Them. [Online]. Available: https://www.technologyreview.com/2020/05/ 07/1000961/launching-mittr-cov%id-tracing-tracker.

[2] S. Vaudenay, ''Centralized or decentralized? The contact tracing dilemma,'' IACR Cryptol. ePrint Arch., vol. 2020, p. 531, May 2020. [Online]. Available: https://eprint.iacr.org/2020/531

[3] C. Criddle and L. Kelion. (2020). Coronavirus Contact-Tracing: World Split Between Two Types of App. [Online]. Available: https://www.bbc. com/news/technology-52355028

[4] J. Duball. (2020). Centralized vs. Decentralized: EU's Contact Tracing Privacy Conundrum. [Online]. Available: https://iapp.org/news/a/ centralized-vs-decentralized-eus-contact-tracin%g-privacy-conundrum.

[5] R. Jennings. (2020).What are the Data Privacy Considerations of Contact Tracing Apps. [Online]. Available: https://ukhumanrightsblog. com/2020/05/01/what-are-the-data-privacy-cons%iderations-of-contacttracing-apps

[6] D. Palmer. (2020). Security Experts Warn: Don't Let Contact-Tracing App Lead to Surveillance. [Online]. Available: https://www.zdnet.com/ article/security-experts-warn-dont-let-contact-tr%acing-app-lead-tosurveillance

[7] P. Farrell. (2020). Experts Raise Concerns About Security of Coronavirus Tracing App Covidsafe. [Online]. Available: https://www.abc.net.au/ news/2020-05-14/experts-concerned-about-coronavi%rus-tracingcovidsafe-security/12245122

[8] E. M. Redmiles, ''User concerns & tradeoffs in technology-facilitated contact tracing,'' 2020, arXiv:2004.13219. [Online]. Available: https://arxiv. org/abs/2004.13219

[9] J. Li and X. Guo, ''COVID-19 contact-tracing apps: A survey on the global deployment and challenges,'' 2020, arXiv:2005.03599. [Online]. Available: https://arxiv.org/abs/2005.03599

[10] L. Reichert, S. Brack, and B. Scheuermann, ''A survey of automatic contact tracing approaches,'' Cryptol. ePrint Arch., IACR, Bellevue, WA, USA, Tech. Rep. 2020/672, 2020. [Online]. Available: https://eprint.iacr.org/2020/672

[11] Q. Tang, ''Privacy-preserving contact tracing: Current solutions and open questions,'' 2020, arXiv:2004.06818. [Online]. Available: http://arxiv. org/abs/2004.06818

[12] C. Kuhn, M. Beck, and T. Strufe, ''Covid notions: Towards formal definitions - and documented understanding–of privacy goals and claimed protection in proximity-tracing services,'' 2020, arXiv:2004.07723. [Online]. Available: http://arxiv.org/abs/2004.07723

[13] J. Bay, J. Kek, A. Tan, C. S. Hau, L. Yongquan, J. Tan, and T. A. Quy. (2020). Bluetrace: A Privacy-Preserving Protocol Forcommunity-Driven Contact Tracing Across Borders. [Online]. Ava [14] O. Health. (2020). Covidsafe Legislation. [Online]. Available: https:// www.ag.gov.au/RightsAndProtections/Privacy/Pages/ COVIDSafelegislation.aspx

[15] R. L. Rivest, J. Callas, and R. Canetti, ''The pact protocol specifications,'' Private Automated Contact Tracing Team, MIT, Cambridge, MA, USA, Tech. Rep. 0.1, Apr. 2020. [Online]. Available: https://pact.mit.edu/wpcontent/uploads/2020/04/The-PACT-protocol-specification-ver-0.1.pdf