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COVID-19: The Internet of Things and Cybersecurity

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The COVID-19 pandemic has inspired a range of Internet of Things (IoT) innovations to help stop the spread of the virus. This is the sixth edition of COVID-19: IoT and Cybersecurity and builds on the rapid advances in the issues surrounding contact tracing applications in the UK.

Past editions are found on the PETRAS website.

Overview

- New estimates place the roll-out of a combined manual and digital contact tracing in the UK to late May
- The NHSX is still open to make changes to the app as informed by the trial on the Isle of Wight
- The Joint Committee on Human Rights has asked for permission to move a private member's bill on data protection and contact tracing
- There are worries that the NHSX app's reliance on unverified self-diagnoses could be open to abuse and that the possibility of false negatives will be a barrier to uptake
- Guidelines and technical specifications for interoperability between decentralised systems in Europe have recently been published, designed to be secure, scalable and straightforward to implement
- The interoperability between decentralised and centralised systems, however, has not yet been resolved
- Vibrating bracelets have been deployed by companies eager to maintain social distancing in work environments

It's been nearly two weeks since the start of the NHSX trial on the Isle of Wight

It has now been eleven days since the deployment of the NHSX trial app on the Isle of Wight. There have been roughly 60,000 downloads, just over 40% of the Isle of Wight population (note: this number may include some who downloaded it twice or are from the mainland).

The government has changed its commitment of deploying the app across England in mid-May to rolling it out across the country 'in the coming weeks'.[1]

Issues remain. Those who have reported COVID-19 symptoms on the app and taken a test – cannot enter their positive or negative result. This means that their contacts, who will have been sent alerts, 'are effectively left in limbo'. Another issue raised is that 'if it's marginally easier to obtain a test via the app, people might be tempted to lie about their symptoms to get one, triggering pointless notifications as a consequence.'[2]

Efforts are underway to address these issues. It is likely a second version will be trialled on the Isle of Wight before releasing the app to everyone else.

A nationally-representative survey of the UK public on willingness to download a contact tracing app reports that '66.4% of participants said they probably or definitely would download it'.[3]

Is there a 'second' app?

Although a DHSC spokesperson has said that 'there is no alternative app', this does not eliminate the possibility that the app will change from its centralised version to a decentralised one. DHSC contends that the 'NHS continues to work constructively with many other organisations that are helping to develop and test the NHS COVID-19 app.' It has also been reported that some government officials doubt the survival of the app in its current form following the

trials on the Isle of Wight.[4]

Ethics Advisory Board disappointed

The NHS COVID-19 App Ethics Advisory Board[5] (EAB) was set up to 'ensure that the development of the NHS COVID APP helps control the COVID-19 epidemic and return people to normal life more rapidly whilst operating in line with ethical requirements, and is transparent and open to public scrutiny.'

Members of the board are increasingly worried that they may be side-lined by the Government in the process of creating the NHSX app. One board member claims that there have been 'many failings around communication and transparency'.[6] Furthermore, it has been reported that the final version of the data protection impact assessment[7] (DPIA) was 'substantially different' from the draft that the EAB were directed to comment on.[8]

Calls for a clearly defined legal framework

Some privacy advocates believe that simply relying on data protection regulation to govern the app is not going to be enough to cover the range of harms for groups who are most acutely targeted by intrusive surveillance and policing powers. A 'clearly defined legal framework is required', and although the Ethics Advisory Board is welcomed, it cannot 'substitute for legal oversight'.[9]

Still under concern is 'mission/function creep'. Internal NHS documents on Product Direction reportedly show plans for a future version of the app which would ask for further self-reported data such as your full post code, demographic information and co-location status.[10] The Open Rights Group has commented in response that, 'the NHS needs to be clear and transparent about what is in and out of scope,' and that 'the scope for misinterpretation skyrockets without clarity.'

The Joint Committee on Human Rights has produced a draft bill for the government that would prevent the government from using the information gathered for purposes other than contact tracing. If the government decides not to take up the bill, the committee has asked for special permission to move it as a private member's bill.[11]

The NHSX app is not 'anonymous'

'Personal data' is defined in the General Data Protection Regulation (GDPR) Art. 4 (1)[12]. which states that 'personal data are any information which are related to an identified or identifiable natural person.' NHSX creates an identifier for each phone with the app installed. A data privacy expert contends that 'the NHSX app does not preserve the anonymity of users, as it primarily processes pseudonymous, not anonymous, personal data'.

A detailed security analysis on the COVID-19 Contact tracing Android app by cryptographers in constructive dialogue with the NCSC has been published, concluding that messaging around the app risks undermining trust.[13] A response to this analysis by the Technical Director of the NCSC has been published on 19 May.[14]

Self-reporting vs confirmed test. What are the pros and cons?

In the current centralised design of the NHSX contact tracing app, the initial trigger for data release is self-reporting of new COVID-19 symptoms. Once you tell the NHS through the app that you have symptoms of coronavirus, other app users you've been near to should get an alert within 4 hours.[15] One reason given in favour of a centralised app, is the belief that contact tracing could be carried out faster if users are allowed to self-diagnose.[16]

However, this approach may lead to a higher number of false positives:

- The self reporter: Declares themselves ill, however not actually ill. This could either be through health anxiety with good intent, or deliberately spreading false information.
- The contact: Was in contact with an infected person, however not at clinically relevant range (e.g. wall between them). This can be

Australia

The Privacy Amendment (Public Health Contact Information) Bill[46] cleared the senate without amendments on 14 May. It introduces strict penalties of up to five years jail for those that collect, use, disclose (include outside of Australia) or decrypt COVIDSafe data for any purpose other than contact tracing.[47]

India

The Ministry of Home Affairs in India has changed its stance[48] on the government contact tracing app - the app was made mandatory on 1 May, which drew concerns from legal and cybersecurity experts. As of 18 May, under new MHA guidelines, the app is no longer mandatory, however employers 'should on best effort basis' ensure that the contact tracing app is downloaded by all employees who have 'compatible mobile phones'.[49]

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Engaging the public to support citizen empowerment

Tortoise Media studied the privacy policies of 48 contact tracing apps. They found that the policies are often 'opaque, incomplete and impenetrable to the average reader'. The investigation also found that the privacy policies of four apps explicitly said that data can be shared with law enforcement or police.[50]

The Ada Lovelace Institute's 'Exit through the App Store' rapid review[51] has helped inform an accessible interactive platform to support citizens in learning more about, and exploring the ethics surrounding the use of technology during the pandemic. The platform, 'Open Up' is 'designed for people who want to work out what they think about the issues of the day, but who don't have the time to read lots of material'.[52]

Call for contributions: Design Fictions about Contact Tracing[53]. A diverse range of voices and perspective is vital in helping anticipate a broad range of possible futures.

controlled by refinement in the precision of the measurement and is a technical limitation which depends on the phone model.

False negatives and false positives are a large problem for self-reporting systems, and affect the willingness for individuals to adopt the contact tracing app.[17]

Both centralised and decentralised approaches would find false positives resulting from malicious purposes hard to police. Fast, accurate testing to prove true positive diagnosis of COVID-19 has not been confirmed in the UK[18], meaning that false positives will not be disregarded quickly and people would wait for days for confirmation of contact. On 18 May, the Secretary of State for Health and Social Care announced that testing has been extended to include 'anyone with a new continuous cough, a high temperature or the loss or change of sense of taste or smell can book a test.'[19]

Germany has a high level of testing and has the capacity to analyse about 838,000 samples per week.[20] The country's approach to contact tracing pivoted from a centralised model to a decentralised model in April, and they have confirmed that their contact-tracing app will trigger alerts only if users test positive for COVID-19. Once a user has a positive test, they are given a verification code[21] to enter into the app, which then allows the contact tracing to continue.[22]

In a letter sent to the Secretary of State for Health and Social Care on April 24 (recently made public), the Chair of the NHSX Ethics Advisory Board states that 'false positive alerts could undermine trust in the app and cause undue stress to users….users may develop a false sense of security'. The Board cautions against proceeding with the app 'without widespread access to virological testing'. Incorporating widespread testing and allowing this function in the app would 'significantly increase both confidence in the app and its efficacy'.[23]

Internal NHS documents reportedly suggest that officials are worried that the app's reliance on unverified self-diagnoses could be open to abuse and extra pressure on the health service, and state that there is a 'high risk of accidental or malicious data poisoning'.[24] Risk reference 11 on the DPIA risk register[25] quantifies this risk as 'amber' with a 'possible' likelihood and a 'medium' impact. A rapid analysis[26] of this classification believes that this risk, and others, should be reported as higher, and as such require prior consultation of the ICO under Article 36[27] of the GDPR.

False negatives are also a concern. These would occur due to the absence of a self-diagnosis from an asymptomatic carrier. Someone in contact with this infected person would not receive an alert, and may go on to spread the virus unknowingly. False negatives would be somewhat lessened by widespread testing of all individuals, not just those who are showing symptoms.

If Iceland can only achieve a 38% uptake, could efforts in the UK to get the level of adoption required struggle?

The Icelandic Government rolled out a digital contact tracing app[28] to support its manual contact tracing efforts. It collects GPS location data which you can then agree to send to the government Contact Tracing Team if you receive a positive COVID-19 diagnosis.[29] The app has been downloaded by 38% of Iceland's population.[30] A detective inspector overseeing the contact tracing efforts has stated, 'it's the integration of the two [manual and digital] that gives you results. I would say [the app] has proven useful in a few cases, but it wasn't a game changer for us'.[31]

Technical foundations have been laid for the interoperability of decentralised apps in Europe

Once borders in Europe reopen[32], the effectiveness of each country's digital contact tracing apps could be weakened if systems cannot talk to each other. For

instance, a UK citizen who travels to Germany and comes into contact with someone who tests positive for COVID-19 may not be alerted to their exposure risk.

This is a specific challenge for countries who have chosen to use a centralised approach where exposure data and risk analysis takes place on a central server controlled by a national authority. This is especially a problem for the border between Northern Ireland (centralised app) and the Republic of Ireland (decentralised app). A solution to this has so far not been proposed.

The team behind the decentralised approach DP-3T have written a proposal on how to allow contacts to be traced between regions and countries that use separate decentralised contact tracing apps.[33] They emphasise that the technological foundation to provide interoperability must also be supported by commitments that 'permit secure communication of data between proximity tracing systems run by different operators in different regions'. On 18 May, the team also published a first draft that is open to comments, describing a technical specification for interoperability between decentralised systems that is designed to be secure, scalable and straightforward to implement.[34]

The eHealth Network has adopted Interoperability guidelines for approved contact tracing mobile applications in the EU[35] (13 May) as a follow up action to the previously released 'Toolbox'[36].

The European Telecommunications Standards Institute (ETSI) has established a new group to work on a standardisation framework that will enable developers to build interoperable mobile apps[37] for proximity detection.

A third solution 'DESIRE[38]' - presented as 'an optimal tradeoff between centralised and decentralised contact tracing' - has been developed by the French government agency, Irina. A 'practical assessment' by the developers of DP-3T suggests that the concept is 'an interesting academic proposal, but not a practical solution'.[39]

Companies have started rolling out smart wearables that send warning signals based on proximity

In Issue 3, dated 28 April, we reported that a private company, after a call by the Flemish Government, were working on a digital bracelet to prevent coronavirus infections on the workfloor.[40] This bracelet, that works by sending warning signals (visual and vibration) to the user when they get too close to another worker, has now been introduced at the Port of Antwerp. If used for contact tracing purposes, the device will track bracelet IDs – this ID data is kept for up to 3 three weeks.[41]

Germany, Switzerland and the US are interested in a wearable chip usually used to track the performance of elite basketball and football players. A start-up based in Munich designs the chips and will measure 'the proximity of manufacturing staff to ensure physical distancing remains in place'.[42] Similarly to the digital bracelet deployed in Antwerp (above), warning signals will emit when two devices are too close. It is reported that it is already 'being used by one of the biggest car parts makers, as well as multinational logistics companies and food suppliers.'[43] The company also claims that its product 'locates machines, people, goods and much more precisely, stably and scalably'[44] than other tracking technologies including GPS location, WiFi and Bluetooth/BLE.

With an increase in remote working, companies are worried about cybersecurity

Due to the COVID-19, an unprecedented number of people are working from home. This has increased the risk of data breaches. It has led some companies to deploy analytic tools in order to monitor their staff and ensure that no data is leaked or stolen. When trying to track and analyse an employees work activity, one cloud and security group 'examines factors including when an employee typically works, what files they access and how much data they download'.[45]

Endnotes

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