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 fifth 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[1].

How does the NHSX app work in practice?

Last week NHSX trialled the first version of its contact-tracing app on the Isle of Wight. Out of a population of 141,000 around 50,000 on the island have downloaded the app[2].

Users who think they may have COVID-19 self-report their symptoms by completing a short questionnaire on the app. If a new high temperature or continuous cough are reported, then the user is prompted to self isolate and request a swab test via an 0800 number. The app will also then contact anyone who has been in close contact with the user, and give them a reminder about social distancing. A stricter alert will be triggered asking these people to self-isolate if the potentially infected user tests positive[3].

There are three metrics used to decide when to send alerts. These are: the proximity of the devices; the length of time the phones are sending each other signals and 'how infectious the person

Overview

- Early insights from the Isle of Wight trial of the NHSX contact tracing app show there are usability issues on older phones.
- A parallel app, constructed using a decentralised approach, is reportedly being developed. The NHSX has not ruled out changing systems.
- The NHSX has published the front end source code and the Data Protection Impact Assessment for the Isle of Wight trial.
- An independent NHS COVID-19 App Data Ethics Advisory Board has been formed.
- While the UK Government have stated that they believe no further legislation is required in the roll out of a contact tracing app, data law experts are adamant that safeguards are needed.
- Draft legislation has been prepared.
- The Australian contact tracing app 'COVIDSafe', which takes a similar centralised approach to the NHSX app has encountered usability problems. It is thought that some of these have a workaround in the NHSX version.
- IoT sensor solutions are an increasingly popular option for industries looking to bring employees back to work. However there are concerns that increased monitoring may be done with little regard to human rights or well-being.

with the coronavirus was judged to be, based on how close the meeting happened to when they noticed their symptoms'.

A risk score is calculated by taking into account 'all the risky interactions an app user has had over a period of two weeks, rather than on just one occasion.'[4]

Healthcare workers are asked to switch Bluetooth off when wearing personal protective equipment

(PPE) to prevent them from being told to stay home after being in close contact with infected patients.

Problems encountered:

- There have been reports of users receiving alerts to self-isolate due to contact with a potentially infectious person despite these users not having been outside[5].
- Reports also indicate that the 'app did not work on phones more than three years old that use Google's Android operating system.'[6]
- Despite assurances that the app would work on Android 6+ devices, Privacy International (PI) have reported that the app was only successfully installed on two of five Android devices they had available[7].

Privacy International examined the apps' permissions through a platform to audit trackers used by Android application and found that some permissions 'directly contradict assertions made by UK Government ministers.' For example, the WAKE_LOCK permission stops the phone from 'going to sleep'. This will cause accelerated battery drain. Another example, that relates to the collection of location data, includes two permissions that require 'specific consent to operate properly'. Although PI does 'not believe the app to be using location data at this time', there is a risk that authorities could gain detailed location data in the future[8].

Widening the accessibility of the app

Development of the app is ongoing to ensure that it is as widely accessible as possible. The Secretary of State for Health and Social Care has stated that an 'equalities roundtable' is planned for May with groups representing a range of protected characteristics[9].

The Department for Digital, Culture, Media and Sport are also supporting the DevicesDotNow campaign[10] to distribute internet-enabled devices and to support digitally excluded people shielding or vulnerable due to age, disability, health conditions and social isolation.

The NHSX are developing a parallel app using a decentralised approach

Apple and Google are expected to release the first version of their exposure notification system in mid-

May. The UK is reportedly considering switching from their centralised system to a decentralised one to satisfy the tech companys' policies of use[11] and thereby be able to use their framework[12]. It appears that a Switzerland-based IT development firm will help develop this system.

Professor Christophe Fraser, a University of Oxford epidemiologist, who advises the NHSX on its contact tracing app, believes that data derived from a centralised system would make it easier to determine how 'meaningful' a meeting was. Nevertheless, he acknowledges the possibility that 'users of a decentralised app (could) donate data to improve the system.'[13]

Michael Veale, lecturer in Digital Rights and Regulation at University College London and working on the decentralised contact-tracing system DP3T, welcomes Prof. Fraser's comments. He says that 'it's good to hear the epidemiologists recognise that decentralised systems also provide the data needed to improve the risk scoring.' He continues, 'data donation as we have designed it doesn't even risk privacy of the users, we just feel that contact-tracing apps should just do what they say on the tin, and ask for consent before doing more.'[14]

The NHSX has published the front end source code and is asking for feedback

The source code (not backend) and additional documentation for the NHSX App for iOS and Android was released to Github on 6 May.[15] The code is licensed under the open-source MIT Licence[16].

The Head of Open Technology at NHSX has written about the code[17], and how they would appreciate responsible disclosure of security vulnerabilities via their secure reporting platform.[18] There is also a commitment to open sourcing the backend code 'shortly'.

A UK software company has done a technical deep-dive[19] into the source code. The main findings include that the claims that the Android app accesses location data is false, and that a prompt for location permissions is a consequence of how Android manages requests.[20] The report also details the technical work around on how the iOS app is able to function while in the background. They also confirm that 'no key data leaves the user's device until they report symptoms, and only then do the anonymised keys of devices it has been in close

proximity to leave the device'.

The NHSX has released the Data Protection Impact Assessment (DPIA) for the contact tracing app (Isle of Wight trial stage)

The NHSX released the [DPIA for the NHS COVID-19 App Pilot Live Release Isle of Wight](#)[21] (v.1.0, 6 May 2020). Of note, is that this DPIA is limited to the trial on the Isle of Wight.

A Data Protection Impact Assessment (DPIA) is used to help organisations identify and minimise the data protection risks of a project. The NHSX asked the ICO to [informally review its DPIAs](#)[22] for the contact tracing app for the Isle of Wight trial.

In an '[Analysis of the NHSX Contact Tracing App 'Isle of Wight' Data Protection Impact Statement](#)', data rights expert Dr Michael Veale finds 'significant issues which leave the app falling short of data protection legislation'. The main issues which are contrary to the DPIA are that the data is not anonymous; collection of personal data is not always a voluntary action; the NHSX App systematically monitors publicly accessible spaces; users are deprived of data protection rights; there is not a lawful basis for the soley automated, significant decision-making that is occuring; and that the DIPA is incomplete as the risks have been redacted.[23] Note: the [risk register](#)[24] has since been made public (12 May).

Consultation in preparation of the DPIA resulted in the creation of an [independent Ethics Advisory Board](#) (EAB)[25]. The [Terms of Reference](#)[26] for the EAB state that the EAB will provide timely advice, guidance and recommendations on ethical issues as requested by the App Oversight Board. The document also provides a PublicTrust Matrix against which 'the app can be speedily evaluated'.

Calls for legislation are getting louder. Will the UK Government introduce safeguards?

The Joint Committee on Human Rights [heard evidence](#)[27] on 4 May on the introduction of the contact tracing app. They have since [published a report](#)[28] that outlines the key actions the Government must take to ensure that the app respects human rights. They state that 'any data gathering by the app must be accompanied with the appropriate guaranteed data and human rights protections in the form of primary legislation'. In a [letter to the committee](#), the Secretary of

State for Health and Social Care wrote he did not consider that 'legislation is necessary in order to build and deliver the contact tracing app'[29].

In response, the committee said they believe that the current law has 'already proved inadequate to protect the individual from misuse of their data' and they have created a draft '[Contact Tracing (Data Protection) Bill 2020](#)', which they believe Parliament could 'quickly and consensually' pass[30].

Two academics in data and privacy law who gave evidence in the oral hearing on 4 May have since published [further supplementary written evidence](#)[31] where they also argue for additional safeguarding legislation.

A [draft Coronavirus (Safeguards) Bill 2020](#)[32] (v. 5.1, 6 May) has been available since mid-April. The author of this bill has said that the Contact Tracing (Data Protection) Bill 2020 is a welcome start, however [some safeguards are crucially missing](#)[33]. These are that '[there be no compulsion to carry a phone](#)', and that 'there not being compulsion to install the app or to display it'[34].

The Australian Government have released some of the source code for their app, however usability problems remain

On 8 May the Australian Government released the [source code](#)[35] for the [COVIDSafe](#)[36] contact tracing app on Github. Code relating to the COVIDSafe National Information Storage System [will not be released](#). The next update will focus on strengthening security and improving usability and accessibility and will occur in the week of 11 May[37].

The Australian centralised approach to the app has resulted in some usability problems.The app does not record all the data required if it is not running in the foreground or if it is used on an older model phone. The Head of the Digital Transformation Agency has said that [a further update to integrate the Apple and Google framework would fix these issues](#)[38]. It is unclear how the the Australian app would adhere to the [policies released by Apple and Google for the app to be approved for access to the new Exposure Notification API](#)[39].

'Back to work' contact tracing

As businesses eagerly await the re-opening of the economy, firms will be looking at ways to open up in a safe and secure manner to ensure employee

confidence. The accounting and consulting firm PwC has developed its own contact tracing app to be used within their Shanghai offices (its first and only re-opened office)[40]. This could be extended to other locations as governments around the world begin opening up their economies.

Bournemouth Airport is trialling thermal cameras to help lower the risk of spreading Covid-19 while traveling. 'The cameras have initially been installed at the staff entrance, but there are plans to expand the scheme into the terminal building.'[41] Heathrow airport is also currently reviewing a range of technologies including facial recognition thermal screening.[42]

A company that delivers IoT solutions for smart buildings[43] has been pushing for its system to be used for tracking people who have coronavirus symptoms. The system is currently installed in the 'offices of some of the largest Fortune 500 companies as well as hospitals and an NHS clinic' and uses an array of sensors that pick up Bluetooth signals from employee badges[44]. The current use case is finding individuals and equipment on an internal electronic map, however it can be repurposed as a contact tracing tool to monitor social distancing of employees[45] and the spread of coronavirus. The benefit of using this technology is that if the extent of the exposure is known, resources are saved as specific rooms can be identified for cleaning when an employee tests positive, rather than the entire facility.

Despite workplace tracking technologies being able to potentially speed up the lockdown process, as the lockdown ends, companies may decide to keep using them if there are no incentives to stop. There are also serious ethical issues involved with increased workplace surveillance. Privacy International believes that although increased monitoring and surveillance may bring greater efficiency and productivity in the workplace, there is 'little regard for workers rights and well-being'.[46]

Endnotes

1 https://petras-iot.org/update/covid-19-the-internet-of-things-and-cybersecurity/
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