

COVID-19: The Internet of Things and Cybersecurity

Prepared by Fredrik Skippervold and Dr Catherine Wheller



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 sixteenth edition of COVID-19: IoT and Cybersecurity.

Past editions are found on the [PETRAS website](#).

On 20 July 2020, the NHS COVID-19 App became 'part of the Department of Health and Social Care's NHS [Test and Trace Programme](#)'.¹

The independent [Ethics Advisory Board \(EAB\)](#)², created in mid-May to provide timely advice, guidance and recommendations on ethical issues during the development of the NHSX contact tracing app [has been disbanded](#). The [webpage](#)³ and most documentation and advice stemming from the board has been deleted. Privacy experts have stated that 'removing accountability would be a disappointing step to take', and caution that the move could [undermine public trust](#).⁴ The Department of Health has indicated that the ethical and policy framework of the coronavirus app is now part of the Test and Trace Programme.⁵

The decentralised approach to digital contact tracing is better at preserving privacy than a centralised approach, however how well the app works is not easily monitored.

The Corona-Warn-App in Germany has been installed by 16 million people (out of a country of 83 million people). Apparently 500 app uses have tested positive for COVID-19 and were given the opportunity to use the app to warn others. The

Overview:

- The Ethics Advisory Board created to support the development of the NHSX contact tracing app has been disbanded
- Monitoring the efficacy of decentralised contact tracing apps is difficult
- Results from the Irish contact tracing app show early success
- Northern Ireland's contact tracing app is expected to launch within days and will be the first digital contact tracing solution in the UK
- There are privacy concerns about the type and frequency of data that are transmitted by just enabling Google Play Services in order to download Android versions of contact tracing apps
- CNIL gives formal notice to the French government on obligations to GDPR and the Data Protection Act
- Finland is targeting 31 August to launch their contact tracing app
- King's College London have released an app to support a study to investigate how wearables (like Fitbit) could detect COVID-19
- Updates on how the Internet of Things are being used to support responding, recovering, and rebuilding during COVID-19 - air buttons, QR codes, vein mapping, and remote cleaning

decentralised approach to the app design however, means that the [app's developers cannot say if people then used the app to warn their contacts](#). In order to do this, the developers need access to the log history, which in a decentralised approach, is encrypted and stored on user devices. The SwissCovid app has faced the same limitations on efficacy statistics, 'we don't know - and have no way of finding out - the number of people warned by the app or any false positives/false negatives'.⁶

A [comment](#) on the reporting on the efficacy of decentralised app, points to the observation that the true test of whether the app works is by the number of people notified who test positive (and then isolate), and that the log history could be later obtained from the tested individual.⁷

Contact tracing app ‘working in Ireland’

The team behind the Irish contact tracing app, Covid Tracker, [do not share this concern](#). While it is unknown how they intend to collect efficacy statistics, users of the app are asked to agree to the collection of ‘anonymous metrics’ about the ‘effectiveness of contact-tracing processes’.⁸ No other country is able to [supply data showing how many people have received alerts](#) telling them they may have been in touch with an infected person. In the two weeks that Ireland’s Covid Tracker app has been running, 91 users have received a ‘close contact exposure alert’.⁹

Northern Ireland’s app, StopCOVID NI, will also be able to collect some data on how it is performing. Importantly, the [two apps will work across the border](#), and is ‘expected to be compatible with the app being developed by the NHS for use in Great Britain’.¹⁰

The Northern Ireland app [could launch as soon as 29 July](#) and will be the first of the UK to have a contact tracing app. The solution will have cost less than £1m to build and operate.¹¹

The decentralised apps around Europe are generally privacy preserving, however the intrusive level of data collected by Google Play Services is a concern

An [analysis on the data that is sent by the backend of different contact tracing apps](#) around Europe gives insight on user privacy. The researchers find that ‘the health authority client apps are generally well behaved from a privacy point of view, although the privacy of the Irish, Polish, Danish and Latvian apps could be improved’. However, they are concerned by the type and frequency of data that are transmitted by just enabling Google Play Services, and is unavoidable for Android users. The researchers state that ‘this level of intrusiveness seems incompatible with a recommendation for population-wide usage’ and their key recommendation is that ‘extending public governance to the full contact tracing ecosystem, not just of the health authority client app component, therefore seems to be urgently needed

if public confidence is to be maintained’.¹²

The French government has received a formal notice from their data watchdog to fix breaches of the GDPR and the DPA

The French data watchdog CNIL has made public a formal notice to the French government after it [found breaches of the GDPR and the Data Protection Act](#) in the first version of the app. A second version of the app was released to fix some of these problems, however the initial version is still available. CNIL calls for the government to bring the app into conformity within one month and to make users of the app aware of the need to update the app to increase privacy of their data.¹³

Finland on target to deploy a decentralised contact tracing app

The Finnish Institute for Health and Welfare has [announced the development](#) of a decentralised contact tracing app, with a target deployment date of 31 August. The developers of the app state that they will ‘draw on international experiences as far as they can’ and that ‘any ready-made codes and standards suitable for our interfaces will be utilised where possible’.¹⁴

A new app is launched to support study into wearables and detecting COVID-19

King’s College London researchers have launched a mobile app for scientists to [investigate the use of wearable devices and smartphones for detection of COVID-19](#).¹⁵ The app is called Mass Science and is available on [Android](#)¹⁶ or [iOS](#)¹⁷. The app will allow [COVID-Collab research study](#)¹⁸ participants to ‘connect wearables, such as Fitbit devices, and share data including heart rate, activity and sleep. Participants can also use the app to provide information on geographic location, mood, and mental health in addition to COVID-19 symptoms and a diagnosis if they have tested positive for the disease’.¹⁹ The data will help researchers better understand how COVID-19 spreads and how the pandemic is affecting people’s mental and physical health with the aim of developing a ‘digital test for early warning signs of coronavirus’.²⁰ Anyone can participate in the study; while Fitbit owners are especially encouraged to take part.

Updates on how the Internet of Things are being used to support responding, recovering, and rebuilding during COVID-19

Touchless technology

There is an [increased demand](#) for 'air button' technologies which allow users to operate devices without the need to physically touch them, thereby reducing the risk of spreading bacteria or viruses on surfaces.²¹ Jaguar Land Rover have [newly announced](#) the trial of a contactless movement-tracking system for this exact purpose. The carmaker has named it 'Predictive touch' and is being developed with the University of Cambridge. The technology uses artificial intelligence to determine what the user intends to select on the screen early in the task using a combination of vision-based and radio frequency-based sensors.²²

Another similar concept called 'mid-air haptics' is also finding more demand amidst the pandemic. This involves 'using ultrasound radiation to mimic a sense of touch'.²³ The touchless technology is being [deployed at cinemas](#) in the US as they begin to reopen, as a way to limit the spread of germs while providing a safe way to interact with screens.²⁴ This technology may also be developed for fast-food restaurant kiosks, elevator buttons, ATMs and map kiosks.²⁵

Machine Learning and AI to understand critical care

Pre-COVID, a team from Imperial College London developed an algorithm, the AI Clinician, to suggest treatment for sepsis. As reports show sepsis is a major part of severe cases of COVID-19, the team are [using tools in machine learning and AI to map the COVID-19 pandemic](#) to 'understand the longitudinal critical care disease trajectory in infected ventilated patients in order to provide clinicians with prediction models of survival, deterioration, and intervention success'.²⁶

Contactless contact tracing

QR codes are [becoming more popular than ever during the pandemic](#), as a way for businesses to interact with customers on their own phones. They are being used for contactless ordering in pubs and restaurants, where the QR code can be printed or carved into surfaces, then scanned with a smartphone to show a menu. The codes are also being used by companies such as Starbucks and Pret a Manger to record user data for contact

tracing.²⁷

However, using QR codes is not without risk. Cybersecurity experts warn that [security flaws could pose a danger to the user](#).²⁸ It is possible to [trick users via phishing attacks](#) by putting up fake QR codes, and QR codes themselves can be manipulated to change encoded information, potentially producing attacks on backend software.²⁹

Other digital solutions to retaining customer details for contact tracing include 'vein scanning technology' where users can [register their contact details to their 'unique vein map'](#) through an app called FinGo. The customer can also use the system to start a tab to pay for food and drink, minimising interaction with staff. The company also plans to add a function allowing confirmation of a person's COVID-19 health status.³⁰ The technology is being [trialed](#) in Manchester.³¹

Remote cleaning

In May Heathrow Airport began trialling thermal imaging temperature checks which 'continues to perform well in a live operational environment. The airport has since also [installed disinfection robots](#) that use ultraviolet (UV-C) light to kill viruses overnight.³²

Researchers from the University of Essex have partnered with facilities management company Cloudfm to [develop an IoT based system to minimise human involvement in the cleaning process](#). The plan is to deliver automated disinfection systems for personal protective equipment (PPE), testing and monitoring equipment, ventilators and beds in a hospital setting.³³

Endnotes

- 1 <https://www.nhs.uk/covid-19-response/nhs-covid-19-app/>
- 2 https://www.nhs.uk/media/documents/NHS_COVID-19_App_Ethics_Advisory_Board_Terms_of_Reference.pdf
- 3 <https://www.nhs.uk/covid-19-response/nhs-covid-19-app/members-ethics-advisory-board/>
- 4 <https://twitter.com/AdaLovelaceInst/status/1286676032226041862>
- 5 <https://www.telegraph.co.uk/technology/2020/07/23/nhs-contact-tracing-app-ethics-board-scrapped/>
- 6 <https://www.bbc.co.uk/news/technology-53485569>
- 7 <https://paravirtualization.blogspot.com/2020/07/confusion-regarding-privacy-of.html>
- 8 <https://www.bbc.co.uk/news/technology-53485569>
- 9 <https://www.bbc.com/news/technology-53525712>
- 10 <https://www.health-ni.gov.uk/news/new-mobile-app-stopcovid-ni>
- 11 <https://www.bbc.co.uk/news/uk-northern-ireland-53518999>
- 12 https://www.scss.tcd.ie/Doug.Leith/pubs/contact_tracing_app_traffic.pdf
- 13 <https://www.cnil.fr/fr/application-stopcovid-la-cnil-tire-les-consequences-de-ses-controles>
- 14 <https://thl.fi/en/web/infectious-diseases-and-vaccinations/what-s-new/coronavirus-covid-19-latest-updates/transmission-and-protection-coronavirus/contact-tracing-app-will-help-stop-chains-of-infection>
- 15 <https://www.kcl.ac.uk/news/can-wearables-like-fitbit-devices-be-used-to-help-detect-covid-19>
- 16 <https://play.google.com/store/apps/details?id=org.phidatalab.masssci>
- 17 <https://apps.apple.com/us/app/mass-science/id1511915099>
- 18 <https://covid-collab.org>
- 19 <https://www.kcl.ac.uk/news/can-wearables-like-fitbit-devices-be-used-to-help-detect-covid-19>
- 20 <https://www.kcl.ac.uk/news/can-wearables-like-fitbit-devices-be-used-to-help-detect-covid-19>
- 21 <https://www.ft.com/content/fe947a1d-5e23-4a35-a40c-d243ed6d561b>
- 22 <https://media.jaguarlandrover.com/news/2020/07/jaguar-land-rover-develops-contactless-touch-screen-help-fight-bacteria-and-viruses>
- 23 <https://www.ft.com/content/fe947a1d-5e23-4a35-a40c-d243ed6d561b>
- 24 <https://www.ultraleap.com/company/news/press-release/cen-ultraleap-touchless-tech/>
- 25 <https://www.ft.com/content/fe947a1d-5e23-4a35-a40c-d243ed6d561b>
- 26 <https://www.imperial.ac.uk/events/119848/bioeng-covid-19-virtual-seminars-series-dr-aldo-faisal/>
- 27 <https://www.telegraph.co.uk/technology/2020/07/27/curious-return-qr-code/>
- 28 <https://nakedsecurity.sophos.com/2019/09/04/qr-codes-need-security-revamp-says-creator/>
- 29 <https://courses.csail.mit.edu/6.857/2014/files/12-peng-sanabria-wu-zhu-qr-codes.pdf>
- 30 <https://fingo.to/helping-uk-hospitality-venues-to-reopen-safely/>
- 31 <https://www.telegraph.co.uk/technology/2020/07/26/restaurants-turn-vein-scanning-technology-covid-contact-tracing/>
- 32 <https://mediacentre.heathrow.com/pressrelease/details/81/Corporate-operational-24/12408>
- 33 <https://www.essex.ac.uk/news/2020/07/27/cloudfm-fights-covid19>