

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 fourteenth edition of COVID-19: IoT and Cybersecurity.

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

Technical development on inferring proximity from Bluetooth Low Energy is progressing

Developers of the decentralised [NHSX app](#)¹, which is currently under development, are investigating techniques for assessing distance between two smartphones. Using Bluetooth Low Energy Received Signal Strength Indicator as a distance sensor has been a known problem. Due to variations in, for example, device type, device location, device orientation as well as the local environment², [inferring proximity from observed values is challenging](#)³ without taking into account uncertainties in how the data is generated.

A pre-print by researchers at the Alan Turing Institute presents an approach that suggests that [‘good risk prediction can be achieved’](#) in real-world data sets using ‘Unscented Kalman Smoother with Gaussian process data distribution’. The paper notes that the duration of signal contact has not been inferred in this study, and that this is an area of future work as the duration can make some encounters significantly more important.⁴

Coronavirus Safeguards Bill

A short [paper](#) has been published which focuses on the proposed [Coronavirus \(Safeguards\) Bill 2020](#).⁵

Overview

- The decentralised NHSX contact-tracing app is still under development with attention focused on new distance measuring techniques between smartphones
- A recent short paper explains the five main suggestions made in the proposed Coronavirus (Safeguards) Bill 2020
- The Ada Lovelace Institute has made its ‘Tracker’ of contact-tracing systems around the world publicly available
- The UK’s switch to a decentralised contract tracing app prior to rolling out its centralised version may prove critical. Countries who already launched centralised contact-tracing apps are finding this transition much more difficult.
- Research at Kings College London warns against the use of antibody certificates
- The use of ‘stalkerware’ apps have risen dramatically worldwide during the pandemic. There is a trend in increased domestic abuse as a result of self-isolation and lockdown. IBM has proposed five design principles to help combat technology-facilitated abuse
- Delivery drones are easing pressure on supply chains
- Location-aware devices and connected sensors are allowing the UK to collect an abundance of data to help manage its response to the COVID-19 pandemic
- Smart bins are providing useful and unexpected insights by acting as a proxy for economic activity.

The paper explains the five main suggestions made in the Bill - no compulsion to own a smartphone; no compulsion to install or use the app; hard limit on storing personal data; basic minimum safeguards to mitigate future harm from ‘immunity passports’; and setting up of an independent watchdog to act with the Information Commissioner’s Office. The paper also highlights that ‘this is not simply a debate about privacy and data protection but about the human rights that privacy has been acting as a proxy for in the public debate; i.e., autonomy, freedom of movement,

The Ada Lovelace Institute tracker

The Ada Lovelace Institute has been keeping track of contact tracing systems around the world and has made its findings [publicly available](#)⁴⁶. The Institute has also released a [summary of trends](#) on the state of play in July.⁴⁷ The trends are:

- Centralised or decentralised - [France](#)⁴⁸ is the only major European country pursuing its own system outside of the Google/Apple framework;
- Legislation - most countries have deemed existing data protection regulations and human rights regulations satisfactory, however, a number have introduced new regulation ([Australia](#)⁴⁹, [Switzerland](#)⁵⁰, [France](#)⁵¹, [Italy](#)⁵²);
- Uptake - almost all countries have made the app voluntary (except [India](#)⁵³); and
- Efficacy - limited evidence is available on the efficacy of contact tracing apps (however, [Australia is a case to watch](#)⁵⁴ with increasing infections and a relatively high app uptake).

freedom to work, and freedom from discrimination among others.¹⁶ While the Bill was written before the UK's pivot towards a decentralised app solution, the proposed legal safeguards are intended to be 'technology neutral'.⁷

For countries that already launched a centralised app, a transition to decentralised is much more difficult

In mid-June, the Digital Transformation Agency in Australia said it has been working on testing the COVIDSafe app [with the Google and Apple Exposure Notification Framework](#)⁸ (the current app uses a centralised protocol developed by Singapore). However, in an [interview](#)⁹ on 28 June, the Deputy Chief Medical Officer has since [ruled out a transition](#) to a decentralised protocol, citing the need to provide details of potentially exposed people to tracing teams.¹⁰

Antibody certificates may not be as useful as initially thought

Researchers at Kings College London analysed the immune response of more than 90 patients and healthcare workers at Guy's and St Thomas' NHS foundation trust, and found that 'people are producing a reasonable antibody response to the virus, but [it's waning over a short period of time](#) and depending on how high your peak is, that determines how long the antibodies are staying around'.¹¹ A [pre-print](#)

[published online](#) outlines the findings which have implications on the usefulness of antibody certificates and the durability of vaccine protection.¹² The role of T-cells generated through infection or vaccination on 'immunity' has not yet been studied, and these may provide some protection.¹³

These early studies are adding to the evidence that receipt of a [positive COVID-19 antibody](#)¹⁴ test does not prove immunity against acquiring the virus again or passing it on to others. Accordingly, a [passport, digital or paper, certifying that you have had coronavirus](#)¹⁵ and are therefore 'safe', should not be relied upon.

Stalkerware apps on the rise

According to Avast, a cybersecurity company, there has been a [51% increase in the use of stalkerware](#) during the lockdown, from March until June, in comparison to January and February 2020.¹⁶ In the UK, the monthly average of devices targeted during lockdown has [risen by 83%](#) compared to the first two months of the year.¹⁷ Most of the cases were made up by '[stalkerware](#)' apps: applications that 'allow users to monitor someone else's phone activity, including their call logs, the contents of text and chat messages, GPS data and photos'.¹⁸

IBM has labelled the new breed of domestic abuse 'technology-facilitated coercive control'. A [UN report on the impact of COVID-19 on women](#) 'highlighted a trend of increased abuse as homes are placed under strain from self-isolation and lockdown'.¹⁹

IBM has proposed [five design principles to help combat technology-facilitated abuse](#) and has reported on technologies and applications which, while 'designed with the best of intentions are being leveraged for malevolent purposes.' An example is a [smart doorbell](#)²⁰, developed to increase personal safety by allowing remote viewing of a person at the door, which can be repurposed to 'monitor and entrap victims, with instant notifications being sent when an attempt is made to leave the home'.²¹

The domestic abuse charity Refuge stated that in the first week of the UK lockdown 'calls to the National Domestic Abuse Helpline [increased by an average of 25%](#), while hits to the national domestic abuse website increased by 150%'.²² Smart devices give perpetrators [more ways to stalk, isolate and control](#) their victims²³.

Survivor-led design aims to support and empower survivors through smart, accessible technology. [Chayn](#)²⁴ produces intersectional, feminist resources for people impacted by gender-based violence and

its project [Soul Medicine](#)²⁵ emails bite-sized guides on key topics that help survivors, with an option to disguise the email's subject line. The [design principles of survivor-lead design](#)²⁶ and reflections on the [impact of these initiatives](#)²⁷ show progress in reaching a greater proportion of people impacted by gender-based violence.

What might a post-pandemic city look like?

Delivery drones

[Drones are being used](#) to collect coronavirus tests and medical equipment (e.g. [in Ghana](#)); deliver medications directly to patients or clinics; respond to demand surges and deliver equipment cost-effectively and rapidly (e.g. [in North Carolina, USA](#)).²⁸ The work eases pressure on supply chains and reduces in-person visits.

A robo-helmet with thermal imaging

On the [market](#)²⁹ is a smart augmented reality helmet that has been repurposed from 'providing security personnel with instant facial and number plate recognition'³⁰ to providing 'an audible and visible signal to the wearer when someone with a [raised body temperature comes into range](#).' This is done using infrared thermal imaging, which 'can scan crowds or queues at a rate of up to 200 people a minute'. The helmet is claimed to be able to take temperature readings with 98 per cent accuracy at up to 2m away.³¹

The UK has used location data to manage its response to the COVID-19 pandemic

Location-aware devices and connected sensors are allowing an abundance of data to be collected. This data has the potential to be used to improve lives and help the economy to recover after the pandemic. In June, the Geospatial Commission released the [UK's geospatial strategy 2020 to 2025](#) which sets out economic, social and environmental opportunities offered by location data, including those presented by a post-pandemic world.³² However, the strategy has received [criticism](#) for not meeting [recommendations](#)³³ to strengthen the UK's national geospatial data infrastructure.

Monitoring social distance and mobility

A camera feed network is [monitoring anonymous social distancing](#) across 16 of the UK's towns and cities. A company called Vivacity developed a new feature on their smart video sensor devices immediately following lockdown which is able to measure the distance between individual

pedestrians.³⁴ Data from this network is [being used to inform the COVID-19 response](#) in the UK.³⁵ An [analysis on social distancing adherence](#) has been released to support researchers, local authorities and government in decision-making as lockdown guidelines are relaxed.³⁶

The Newcastle Urban Observatory updates a COVID-19 Live Impact Dashboard for the Newcastle area. Data collected includes [traffic volumes against a baseline](#)³⁷; [pedestrian flow](#)³⁸; [car park occupancy](#)³⁹; [air quality](#)⁴⁰; and [energy consumption](#).⁴¹

A new website is using pedestrian flow and car park occupancy data to show real time information about the [number of people on a busy street in Newcastle](#) and produces a traffic light system which indicates how easy it is to practice social distancing at a certain time⁴².

Data from these networks have allowed decision-makers in Newcastle to see how changes in national policy [play out in real-time in the city](#).⁴³

Data can provide insights that were not expected

Smart bins can alert local services when [they are full and need collecting](#).⁴⁴ However, Leeds City Council realised that this data combined with knowing the location of these bins are a 'pretty [good proxy for the economic activity](#) going on around them'. For instance, the 'amount of rubbish going into bins around train stations has fallen...suggesting that public transportation is still being avoided by city dwellers'.

The head of data at the Open Data Institute in Leeds believes that smart bin data could 'boost small businesses' ability to recover in the long term, as they get a clearer picture of the places where potential customers are congregating'. The insights from this proxy data show that opening smart city data to the public allow smaller businesses, who cannot pay for detailed analysis, to make decisions. It also brings into focus the importance of utilising and repurposing data that is already available.⁴⁵

Endnotes

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