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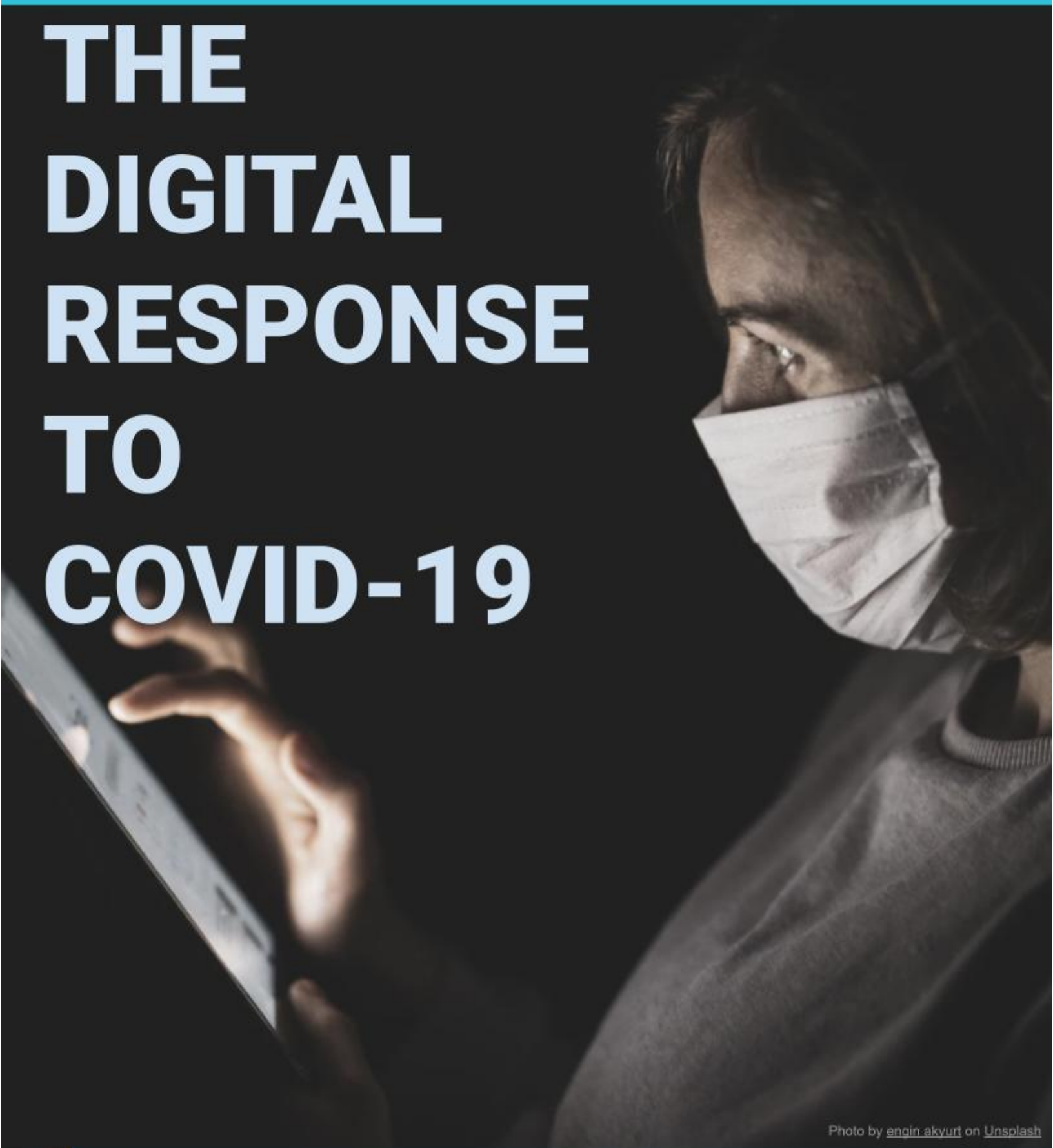
THE DIGITAL RESPONSE TO COVID-19



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ABOUT OUR LAB

Our research aims to shed insight into the different ways digital technologies are used in disasters and emergencies, the challenges and risks, and benefits and opportunities associated with digital technology use. We seek to provide strategies for guidance, and support efficacy-focused, ethical, low-risk interventions around the world. Our research adopts systems and complex networked perspectives, where we creating understanding through interconnectivity. We engage experts and organizations, both academic and practitioner, across disciplines to evolve research at the intersection of systems to enhance context-driven understanding.

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DIGITAL RESPONSE OVERVIEW

MODULE 2.

Social Behaviour Monitoring

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1. The Digital Response to COVID-19 Study: An Introduction

The ongoing COVID-19 pandemic requires global clinical public health mitigation interventions. These are designed to identify, contain, control, and prevent outbreaks of COVID-19 infection. These mitigation interventions include isolation of active COVID-19 cases; social distancing practices ranging from 'lock-down' to limited social interaction in 'bubbles' of varying size; rapid individual or population testing for the presence of COVID-19; and contact tracing to identify and limit the further transmission of the virus.[1] The rapid spread of COVID-19 coupled with inadequate or insufficient public health resources and tools to identify, contain, mitigate and control the pandemic, has sparked the need to find innovative ways of using digital technologies to assist with the response. In turn, a digital response to the COVID-19 pandemic has emerged, where we are both observers of, and participants in (willingly or unwillingly), a global surge of digital innovations being used to identify, track, and mitigate the spread of COVID-19. While the digital response has been highly distributed with many novel solutions, these are typically ad-hoc, vary widely in their utility and in their proactive adherence to security, privacy and human rights protections. Early research of the media coverage offers a piece-meal attempt to generate an understanding of this digital response. Furthermore, little research exists that attempts to capture the digital response's nature, scale, scope, and wider implications.

This research study aims to fill this gap with three modules that describe the landscape of the Digital Response to COVID-19. These modules provide a *descriptive overview* of digital technologies used in COVID-19 in terms of 1) Digital Contact Tracing, or tracking viral spread; 2) Social Behavior Monitoring Communications, which is designed to influence or control social behavior, and 3) Public Communications alongside Remote Diagnostics & Treatment. Technologies assessed include mobile devices (SMS, apps, data), web platforms, drones, telemedicine, and Artificial Intelligence (AI). This study was conducted through meta-analysis of peer-reviewed and grey literature including media reports, blog posts, and social media data along the three research themes identified above.

The three modules (plus an Executive Summary) of the *Digital Response to COVID-19 Study* are:

Executive Summary
Module 1. Digital Response Overview: Digital Contact Tracing
Module 2. Digital Response Overview: Social Behaviour Monitoring
Module 3. Digital Response Overview: Public Communications, and Remote Diagnostics & Treatment

Note: *As this field is rapidly emerging, and the scale of innovation around the world is vast, this study is by no means comprehensive. It is meant to provide a rapid overview of the different initiatives in use around the world from the start of the pandemic to the end of June 2020. A brief examination was conducted in August 2020 to update any clearly outdated information, yet it is out of the scope to evaluate the impact, viability, and sustainability of all the tools identified.*

[1] S Hsiang, et al., The effect of large-scale anti-contagion policies on the COVID-19 pandemic, Nature, 584, 262–267 (2020).)

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2. Introduction to Module 2

This module of the *Digital Response to COVID-19 Study* focuses specifically on digital measures used to **monitor and control social behaviours during the coronavirus outbreak** during the COVID-19 pandemic. Social behaviour monitoring is introduced by explaining the concept as applied to COVID-19, and the need for digital intervention. Applications of social behaviour monitoring are described through three main approaches: quarantine monitoring, social distancing and other public health measures enforcement, and informing future planning & policy.

3. Social Behaviour Monitoring

3.1. Introduction

3.1.1. What is social behaviour monitoring?

Social behaviour monitoring can be described as when a system or person observes behaviours and analyzes patterns in those behaviours; the focus is not on the behaviour itself but the patterns related to the behaviour.[2] This is not the same as social behaviour surveillance, which is the close inspection of social behaviours with the aim of controlling or managing those behaviours; the focus is on the behaviour itself.[3] Ultimately, there is a small but important difference between social behaviour monitoring and surveillance.

An example of social behaviour monitoring in day-to-day life is the surveying and analysis of society's use of public transit. One potential goal is to monitor the use of public transit to identify patterns – such as peak public transiting times – in order to improve the public transit system. In comparison, an example of social behaviour surveillance could be the use of security cameras at airports to scrutinize specific individuals' behaviours. The existence of security cameras alone will have an impact on behaviour and control behaviour to some degree.[4] The examination of behaviour by those behind the security camera may lead to actions meant to further control or manage unwanted behaviour, such as authority intervention.

Social behaviour monitoring and surveillance can occur using a variety of technologies for a wide range of purposes. On one end of the spectrum, video surveillance technology – such as car dash, police body, security, and stoplight cameras – are used to monitor and surveil social behaviour (often for legal purposes). On the other end of the spectrum, there is the location tracking component of food delivery

[2] Young, C. S. (2015). Chapter 8—Electronic Terrorism Threats, Risk, and Risk Mitigation. In C. S. Young (Ed.), *The Science and Technology of Counterterrorism* (pp. 221–281). Butterworth-Heinemann. Retrieved from https://doi.org/10.1016/B978-0-12-420056-2.00008-7

[3] Marx, G. T. (2004). Surveillance and Society. In G. Ritzer (Ed.), *Encyclopedia of Social Theory* (Vol. 1–2). Sage Publications Inc. Retrieved from https://web.mit.edu/gtmarx/www/surandsoc.html; Young, C. S. (2015). Chapter 8—Electronic Terrorism Threats, Risk, and Risk Mitigation. In C. S. Young (Ed.), *The Science and Technology of Counterterrorism* (pp. 221–281). Butterworth-Heinemann. Retrieved from https://doi.org/10.1016/B978-0-12-420056-2.00008-7

[4] Mazerolle, L., Hurley, D., & Chamlin, M. (2002). Social Behavior in Public Space: An Analysis of Behavioral Adaptations to CCTV. *Security Journal*, 15, 59–75. Retrieved from https://doi.org/10.1057/palgrave.sj.8340118

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service applications to ensure food is delivered to the appropriate location. Further examples include the monitoring of: 1) sensors, cameras, and smartphone data to show traffic congestion on web and mobile map applications (like Google Maps); 2) search engine entry history to provide targeted advertisements on social media platforms; and 3) health and fitness behaviours – such as sleep or exercise patterns – through smart and/or wearable technology and mobile applications (these applications often collect the data to share or sell with third parties for various purposes). How social behaviour monitoring and surveillance technologies are situated in the context of COVID-19 will be thoroughly explained in the following section.

An important point to note is that this analysis of the digital response to social behaviour monitoring and surveillance during the COVID-19 pandemic encompasses the concepts of surveillance and monitoring and does not attempt to make a distinction as to whether individual digital responses fall under monitoring or surveillance. Doing so requires a deep understanding of the political environment, legal considerations, and social/cultural values in each country where a specific technology is being used – it is subsequently considered outside the scope of this report.

3.1.2. COVID-19 Social Behaviour Monitoring & Surveillance

The COVID-19 pandemic is unique because social behaviours are strongly correlated with an individual's risk of contracting and/or spreading the virus once infected. For example, the use of public services and spaces can have an impact on one's health (i.e. contracting COVID-19) and public health in general (i.e. the overall spreading of the disease). In this situation, monitoring social behaviours – a task that is traditionally outside the scope of the healthcare field (although there are a few exceptions) – has become a critical piece of the COVID-19 response. Around the world, teams, individuals, and businesses have responded to this need by developing or adapting technology to monitor COVID-19 associated social behaviours in public and/or private spaces. For instance, tracking technology initially designed to look at travel patterns was adapted in March to monitor population movement and determine the effectiveness of lockdown procedures in Austria and Italy.[5] Public transit monitoring methods also are being used to determine whether social distancing measures are being followed and how effective these measures are in many communities across the world.[6] In the examples below, the extent of technology being used to monitor and surveil social behaviour for health purposes during the COVID-19 pandemic comes to full light.

Our research revealed that there are three main approaches to social behaviour monitoring and surveillance during the pandemic: 1) Quarantine-Monitoring and Surveillance, 2) Social Distancing and Other Public Health Measures Enforcement, and 3) Next-Step Planning. Each of these approaches is described in the following sections.

[5] Bodoni, S. (2020, March 20). EU Privacy Chiefs Say Data Laws Don't Hinder Virus Fight. *Bloomberg*. Retrieved from https://www.bloomberg.com/news/articles/2020-03-20/eu-privacy-chiefs-say-data-laws-don-t-hinder-virus-fight

[6] Google. (2020). *COVID-19 Community Mobility Report*. Google. Retrieved from https://www.google.com/covid19/mobility?hl=en

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3.2. Quarantine-Monitoring and Surveillance

This category of social behaviour monitoring is used to ensure people who are quarantined stay in quarantine and do not violate quarantine protocols. The Government of **Singapore** is using text messaging and GPS technology to check if the people who are required to quarantine at home for 14 days are at home.[7] Individuals receive a text message at various times each day and must then share their phone's GPS location via a unique link provided in the text message within one hour of receiving the text.[8] Authorities also complete random house visits or phone calls to ensure compliance with quarantine protocols; those who receive a phone call are required to take a photo of their whereabouts.[9] A similar approach is being taken in **Poland** where quarantined persons are required to send geo-located selfies through a mobile application.[10] In Moscow, **Russia,** those who have tested positive for COVID-19 or are suspected of having COVID must install *Social Monitoring*, a smartphone application that sends notifications every two hours to upload a selfie to ensure people in quarantine are staying home; it also uses GPS to track these persons.[11]

The use of mobile applications to check quarantine compliance also has become quite common. **Turkey** is using a mobile application that leverages mobile device location data to pinpoint the location of those in quarantine.[12] Similarly, upon arrival in **Thailand**, all travelers who have traveled to/from high-risk countries are provided with SIM cards and required to download the *AoT Airports* mobile application which tracks these persons for 14 days to ensure they remain in quarantine.[13] **Ecuador**, on the other hand, is tracking mobile phones through GPS but without the use of a specific mobile application.[14] Interestingly, in

[7] Mahmud, A.H. (2020, May 12). More than 7,000 Stay-Home Notices issued for COVID-19; checks done through GPS, photos: ICA. *CNA*. Retrieved from https://www.channelnewsasia.com/news/singapore/covid-19-coronavirus-ica-7000-stay-home-notice-enforcement-gps-12530060; Lee, Y. (2020, March 20). Taiwan's new "electronic fence" for quarantines leads wave of virus monitoring. *Reuters*. Retrieved from https://www.reuters.com/article/us-health-coronavirus-taiwan-surveillanc-idUSKBN2170SK

[8] Mahmud, A.H. (2020, May 12). More than 7,000 Stay-Home Notices issued for COVID-19; checks done through GPS, photos: ICA. *CNA*. Retrieved from https://www.channelnewsasia.com/news/singapore/covid-19-coronavirus-ica-7000-stay-home-notice-enforcement-gps-12530060

[9] Ibid.

[10] Hamilton, I. A. (2020, March 23). Poland made an app that forces coronavirus patients to take regular selfies to prove they're indoors or face a police visit. *Business Insider*. Retrieved from https://www.businessinsider.com/poland-app-coronavirus-patients-mandaotory-selfie-2020-3; Privacy International. (2020, March 19). Poland: App helps police monitor home quarantine. *Privacy International.* Retrieved from https://www.privacyinternational.org/examples/3473/poland-app-helps-police-monitor-home-quarantine

[11] Luxmoore, M. (2020, June 11). As Russia Lifts Lockdowns, Expanded Surveillance Network May Remain. R*adioFreeEurope RadioLiberty.* Retrieved from https://www.rferl.org/a/as-russia-lifts-lockdowns-expanded-surveillance-network-may-remain/30665176.html

[12] Bayar, G. (2020, April 9). Turkey launches COVID-19 isolation tracking project. *Anadolu Agency*. Retrieved from https://www.aa.com.tr/en/latest-on-coronavirus-outbreak/turkey-launches-covid-19-isolation-tracking-project/1797961; Hürriyet Daily News. (2020, April 9). Turkey to use mobile data to track isolation—Turkey News. *Hürriyet Daily News.* Retrieved from http://www.hurriyetdailynews.com/turkey-to-use-mobile-data-to-track-isolation-15369

[13] The Nation Thailand. (2020, March 17). Movement of visitors from high-risk areas to be tracked with mandatory sim and app. *The Nation Thailand.* Retrieved from https://www.nationthailand.com/news/30384226?utm_source=category&utm_medium=internal_referral

[14] EcuadorTV. (2020, March 17). Government authorizes satellite tracking to improve epidemiological surveillance. *EcuadorTV*. Retrieved from https://www.ecuadortv.ec/noticias/covid-19/romo-vigilancia-epidemiologico-covid19-?

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Argentina, it is only those caught breaking quarantine that are forced to download an application that tracks the person's location.[15]

Taiwan, praised for having one of the best responses to the pandemic to-date, is believed to be the first country to use mobile data for the purpose of enforcing quarantine.[16] While largely using a self-surveillance approach where the country's citizens voluntarily partnered with the government to create a bottom-up and top-down flow of information, Taiwan also is using an 'electronic fence' approach which uses location tracking to ensure people under quarantine stay home.[17] If people move away from their address or turn off their phones, the police and local authorities are notified and either contact or visit those who trigger the alert within 15 minutes.[18] In addition to tracking mobile location data, local police call twice a day to ensure people are not leaving their phones at home to avoid tracking.[19] Facing the same tracking evasion issues with their mobile application that uses GPS to pinpoint the location of those in quarantine, **South Korea** is resorting to the use of electronic wristbands – that connect to the mobile application via Bluetooth – to monitor those who avoided tracking by leaving their phones at home and subsequently broke quarantine.[20]

Many countries have combined GPS tracking capability with electronic wristbands to further enforce compliance with quarantine measures. **Bahrain**, for example, is using its *BeAware App* (explained earlier in Module 1) to track the movement of active home quarantine cases over the 14-day quarantine period alongside eBracelets that connect to the application via Bluetooth to ensure accuracy.[21] Similarly, **Hong Kong** implemented the mandatory wearing of electronic wristbands that are connected to its smartphone application, *StayHomeSafe*, for incoming travellers to ensure they remain at home.[22]

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[15] Gershgorn, D. (2020, April 9). We Mapped How the Coronavirus Is Driving New Surveillance Programs Around the World. *OneZero*. Retrieved from https://onezero.medium.com/the-pandemic-is-a-trojan-horse-for-surveillance-programs-around-the-world-887fa6f12ec9

[16] Lee, Y. (2020, March 20). Taiwan's new "electronic fence" for quarantines leads wave of virus monitoring. *Reuters*. Retrieved from https://www.reuters.com/article/us-health-coronavirus-taiwan-surveillanc-idUSKBN2170SK

[17] Kluth, A. (2020, April 22). If we must build a surveillance state, let's do it properly. *Bloomberg*. Retrieved from https://www.bloomberg.com/opinion/articles/2020-04-22/taiwan-offers-the-best-model-for-coronavirus-data-tracking; Lee, Y. (2020, March 20). Taiwan's new "electronic fence" for quarantines leads wave of virus monitoring. *Reuters*. Retrieved from https://www.reuters.com/article/us-health-coronavirus-taiwan-surveillanc-idUSKBN2170SK

[18] Lee, Y. (2020, March 20). Taiwan's new "electronic fence" for quarantines leads wave of virus monitoring. *Reuters*. Retrieved from https://www.reuters.com/article/us-health-coronavirus-taiwan-surveillanc-idUSKBN2170SK

[19] Ibid.

[20] Kim, M. S. (2020, March 6). South Korea is watching quarantined citizens with a smartphone app. *MIT Technology Review*. Retrieved from https://www.technologyreview.com/2020/03/06/905459/coronavirus-south-korea-smartphone-app-quarantine/; Bostock, B. (2020, April 11). South Korea launched wristbands for those breaking quarantine because people were leaving their phones at home to trick government tracking apps. *Business Insider*. Retrieved from https://www.businessinsider.com/south-korea-wristbands-coronavirus-catch-people-dodging-tracking-app-2020-4

[21] Kingdom of Bahrain. 2020. *BeAware Bahrain*. Kingdom of Bahrain. Retrieved from https://apps.bahrain.bh/CMSWebApplication/action/ShowAppDetailsAction?selectedAppID=321&appLanguage=en; Bahrain News Agency. (2020, April 17). BeAware App now sending contact tracing notifications. *Bahrain News Agency*. Retrieved from https://www.bna.bh/en/iGABeAwareAppnowsendingcontacttracingnotifications.aspx?cms=q8FmFJgiscL2fwIzON1%2BDrMlRMF0AjEnBlu8qoVX6M0%3D; Arabian Business. (2020, April 5). Bahrain distributing bracelets to track active cases of coronavirus. *Arabian Business*. Retrieved from https://www.arabianbusiness.com/healthcare/444361-bahrain-distributing-bracelets-to-track-active-cases-of-coronavirus

[22] Saiidi, U. (2020, March 18). Hong Kong is putting electronic wristbands on arriving passengers to enforce coronavirus quarantine. *CNBC*. Retrieved from https://www.cnbc.com/2020/03/18/hong-kong-uses-electronic-wristbands-to-enforce-coronavirus-quarantine.html

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In addition to the use of mobile data and applications to enforce quarantine, **Russia** is also using a network of over 100,000 cameras equipped with facial recognition technology to enforce quarantine in Moscow.[23] **China**, on the other hand, is installing CCTV security cameras outside (or inside) quarantined persons' residences to ensure they do not leave home.[24] Furthermore, upon lifting lockdown orders, **China** integrated a QR health code approach (the '*Alipay Health Code*') dictating who can access public spaces and who should stay home.[25] Combining national identity number or passport numbers, phone numbers, and completed questionnaires about travel history and current symptoms, all information is verified and individuals are assigned a colour-coded QR code.[26] Codes range from green (COVID-19 free), yellow (COVID-19 risk), or red (COVID-19 positive). A green code implies free movement, enabling people to roam freely in public (like entering malls or using subways), while yellow or red codes force individuals to stay home.[27] Upon trying to enter a location, users of the app must scan the QR code and have their temperature taken before being approved to enter.[28]

Sri Lanka's surveillance strategy also is particularly unique in comparison to the other examples seen above. Within two days of Sri Lanka's first suspected case of COVID-19, the country had built a tracker for COVID-19 surveillance using *DHIS2* (an "open-source, web-based health management information system (HMIS) platform" used around the globe).[29] The focus of this surveillance strategy is to register and track "incoming travelers from areas with high risk of COVID-19 infection" for 14 days.[30] The process involves three stages of contact with the individual: 1) the initial 'registration' phrase at the port of entry (i.e. airport); 2) the follow-up within 14 days of registration; and 3) the follow-up at the end of 14 days.[31] Inspired by Sri Lanka's innovation, the *DHIS2* team developed a digital data package to "accelerate case detection, situation reporting, active surveillance, and response for COVID19;" this digital data package is currently operational in 19 countries and in the development stage in 27 countries.[32]

In the majority of these contexts, if authorities are notified of individuals breaking quarantine rules then there are various subsequent actions taken to control the behaviour and enforce quarantine further - from

[23] Ilyushina, M. (2020, March 29). How Russia is using authoritarian tech to curb coronavirus. *CNN.* Retrieved from https://www.cnn.com/2020/03/29/europe/russia-coronavirus-authoritarian-tech-intl/index.html
[24] Kharpal, A. (2020, March 26). Use of surveillance to fight coronavirus raises concerns about government power after pandemic ends. *CNBC.* Retrieved from https://www.cnbc.com/2020/03/27/coronavirus-surveillance-used-by-governments-to-fight-pandemic-privacy-concerns.html; Gan, N. (2020, April 28). China is installing surveillance cameras outside people's front doors ... and sometimes inside their homes. *CNN.* Retrieved from https://www.cnn.com/2020/04/27/asia/cctv-cameras-china-hnk-intl/index.html
[25] Mozur, P., Zhong, R.,Krolik, A. (2020, March 1). In Coronavirus Fight, China Gives Citizens a Color Code, With Red Flags. *The New York Times.* Retrieved from https://www.nytimes.com/2020/03/01/business/china-coronavirus-surveillance.html
[26] Tangermann, V. (2020, April 16). In China, This Coronavirus App Pretty Much Controls Your Life. *Futurism.* Retrieved from https://futurism.com/contact-tracing-apps-china-coronavirus
[27] Ibid.
[28] Mozur, P., Zhong, R.,Krolik, A. (2020, March 1). In Coronavirus Fight, China Gives Citizens a Color Code, With Red Flags. *The New York Times.* Retrieved from https://www.nytimes.com/2020/03/01/business/china-coronavirus-surveillance.html
[29] DHIS2. (2020). *About DHIS2.* DHIS2. Retrieved from https://www.dhis2.org/about; DHIS2. (2020). *Innovating DHIS2 Tracker and Apps for COVID-19 Surveillance in Sri Lanka.* DHIS2. Retrieved from https://www.dhis2.org/sri-lanka-covid-surveillance
[30] DHIS2. (2020). *Innovating DHIS2 Tracker and Apps for COVID-19 Surveillance in Sri Lanka*. DHIS2. Retrieved from https://www.dhis2.org/sri-lanka-covid-surveillance
[31] Amarakoon, Pamod. (2020, Feb 26). DHIS2 for COVID-19 Surveillance: Sri Lankan use case. *DHIS2Community.* Retrieved from https://community.dhis2.org/t/dhis2-for-covid-19-surveillance-sri-lankan-use-case/38516
[32] DHIS2. (2020). *COVID-19 Surveillance Digital Data Package.* DHIS2. Retrieved from https://www.dhis2.org/covid-19

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sending a text alert to the individual to return home to having authorities handle the incident in-person to facing legal penalties such as imprisonment or fines.[33]

3.3. Social Distancing and Other Public Health Measures Enforcement

Digital technologies also are being used to monitor and surveil social behaviours connected to the enforcement of social distancing measures. This can be observed in **Hungary** and **Italy** where both countries are using drones to monitor and enforce social distancing practices.[34] A particularly prominent approach to facilitate this second task however, is the use of AI-based video analytics technology. For instance, L&T Smart World & Communication is using AI-based video analytics to alert authorities on crowd gathering in cities across **India**.[35] Similarly, Landing AI and Camio – both based in California, **United States** – have developed for its customers AI-driven software that can be integrated into security cameras to analyze video streams and detect whether people are standing 6-feet apart.[36] More specifically, Camio's program turns 2D camera footage into a "virtual 3D floor-plane grid" to provide insights about whether people are standing 6 feet apart; the program also analyzes whether individuals are wearing masks.[37] In New Brunswick, **Canada,** an application (*2metre*) that helps companies maintain physical distancing between employees by tracking and enforcing building capacity limits has been deployed.[38]

Dubai is taking a different surveillance approach to enforce residents to stay home (not for quarantine purposes). On March 26 2020, the UAE implemented the "National Sterilization Programme" which required residents to stay home between 8 pm and 6 am to facilitate the "complete sterilisation of all public utilities and public transport."[39] Outside of these times, residents were permitted to leave home

[33] Hamilton, I. A. (2020, March 23). Poland made an app that forces coronavirus patients to take regular selfies to prove they're indoors or face a police visit. *Business Insider*. Retrieved from https://www.businessinsider.com/poland-app-coronavirus-patients-mandaotory-selfie-2020-3; Hürriyet Daily News. (2020, April 9). Turkey to use mobile data to track isolation—Turkey News. *Hürriyet Daily News.* Retrieved from http://www.hurriyetdailynews.com/turkey-to-use-mobile-data-to-track-isolation-15369; Arabian Business. (2020, April 5). Bahrain distributing bracelets to track active cases of coronavirus. *Arabian Business.* Retrieved From https://www.arabianbusiness.com/healthcare/444361-bahrain-distributing-bracelets-to-track-active-cases-of-coronavirus; Saiidi, U. (2020, March 18). Hong Kong is putting electronic wristbands on arriving passengers to enforce coronavirus quarantine. *CNBC*. Retrieved from https://www.cnbc.com/2020/03/18/hong-kong-uses-electronic-wristbands-to-enforce-coronavirus-quarantine.html

[34] Holroyd, M. (2020, March 23). Coronavirus: Italy approves use of drones to monitor social distancing. *Euronews*. Retrieved from https://www.euronews.com/2020/03/23/coronavirus-italy-approves-use-of-drones-to-monitor-social-distancing; Roth, A., Kirchgaessner, S., Boffey, D., Holmes, O., & Davidson, H. (2020, April 14). Growth in surveillance may be hard to scale back after pandemic, experts say. *The Guardian*. Retrieved from https://www.theguardian.com/world/2020/apr/14/growth-in-surveillance-may-be-hard-to-scale-back-after-coronavirus-pandemic-experts-say

[35] Larsen & Toubro. (2020). *Technology to fight COVID19*. Larsen & Toubro. Retrieved from https://www.larsentoubro.com/corporate/about-lt-group/technology-for-growth/technology-to-fight-covid19/

[36] Landing AI. (2020, April 16). *Landing AI Creates an AI Tool to Help Customers Monitor Social Distancing in the Workplace.* Landing AI. Retrieved from https://landing.ai/landing-ai-creates-an-ai-tool-to-help-customers-monitor-social-distancing-in-the-workplace/; Camio. (2020). *Camio*. Camio. Retrieved from https://camio.com/covid-19

[37] Camio. (2020). *Camio*. Camio. Retrieved from https://camio.com/covid-19

[38] Yamoah, M. (2020, August 14). Fredericton-based company launches COVID-19 contact tracing app 2metre. *Global News.* Retrieved from https://globalnews.ca/news/7275120/coronavirus-fredericton-contact-tracing-app-2metre/

[39] Omar, A. A. (2020, April 17). Dubai Extends 24-Hour Movement Restrictions for Another Week. *Bloomberg.* Retrieved from https://www.bloomberg.com/news/articles/2020-04-17/dubai-extends-24-hour-movement-restrictions-for-another-week; Time Out Dubai. (2020, May 18). UAE announces new timings for National Sterilisation Programme ahead of Eid al-Fitr 2020. *Time Out Dubai.* Retrieved from https://www.timeoutdubai.com/news/441062-uae-announces-new-timings-for-national-sterilisation-programme-ahead-of-eid-al-fitr-2020

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only for essential services.[40] On April 5 2020, this restriction in movement was extended to 24-hours a day and residents were allowed to leave the home for essential services but required permits to leave the home.[41] The requirements changed ahead of Ramadan and continue to change based on the number of COVID-19 cases.[42] For the period of time this programme and its movement restrictions remain in place, speed radars "controlled by systems using artificial intelligence" are being used to track vehicles to determine whether travel is for essential purposes.[43] For instance, the system can determine whom the vehicle belongs to and if that person is an essential worker travelling to their workplace.[44] Alternatively, the system can determine whether the vehicle has a movement permit and in either case, will determine the route of the vehicle in order to decide whether the person was running an essential errand, such as grocery shopping, before issuing a fine.[45] In addition to speed radars, it is said that the city's network of AI-powered surveillance cameras are not only watching people but also checking temperatures of those passing by as well as making sure people are maintaining proper physical distance.[46]

Another city is innovatively monitoring residents through QR codes. Nizhny Novgorod in **Russia**, is implementing a QR code pass system to allow citizens to leave their homes for various purposes – walking the dog, getting groceries, taking out the garbage, etc. – while also tracking individuals and enforcing the city's lockdown measures.[47] Authorities in Nizhny Novogrod also have made it mandatory for service providers (beauty salons, barbers, etc.) to install surveillance cameras at their own expense as a condition to reopen the city after the lockdown; these cameras will be connected to a central database.[48]

3.4. Informing Future Planning & Policy

In this category, technologies are used to monitor social behaviour and subsequently collect and/or analyze social behaviour data to help governments and organizations (such as healthcare facilities and non-profits) determine how to deploy resources and decide which next steps to take to combat the virus.

Many nations are leveraging mobile phone capabilities to gain insight into the effectiveness of social distancing and lockdown or quarantine measures. A tech company in **Brazil**, Inloco, launched a platform

[40] Ibid.
[41] Ibid.
[42] Ibid.
[43] Al Shouk, A. (2020, April 6). COVID-19 precaution: Dubai Police using AI to find out if your trip was essential. *Gulf News.* Retrieved from https://gulfnews.com/uae/covid-19-precaution-dubai-police-using-ai-to-find-out-if-your-trip-was-essential-1.70829268
[44] Ibid.
[45] Ibid.
[46] Gambrell, J. (2020, July 9). Virus projects renew questions about UAE's mass surveillance. *CTV News.* Retrieved from https://www.ctvnews.ca/world/virus-projects-renew-questions-about-uae-s-mass-surveillance-1.5016922
[47] Khurshudyan,I. (2020, April 5). Coronavirus is testing the limits of Russia's surveillance state. *The Washington Post.* Retrieved from https://www.washingtonpost.com/world/europe/coronavirus-russia-surveillance-tracking/2020/04/04/0798f4dc-7519-11ea-ad9b-254ec99993bc_story.html; The Moscow Times. (2020, April 2). Russia's Nizhny Novgorod Unveils Digital Passes to Enforce Virus Lockdown. *The Moscow Times.* Retrieved from https://www.themoscowtimes.com/2020/04/02/russias-nizhny-novgorod-unveils-digital-passes-to-enforce-virus-lockdown-a69845
[48] Luxmoore, M. (2020, June 11). As Russia Lifts Lockdowns, Expanded Surveillance Network May Remain. R*adioFreeEurope RadioLiberty.* Retrieved from https://www.rferl.org/a/as-russia-lifts-lockdowns-expanded-surveillance-network-may-remain/30665176.html

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to determine how lockdown protocols and related measures to combat the disease are being followed.[49] InLoco provides reports to relevant authorities, who use the data to determine where further action is needed – such as where resources should be located to most effectively enforce social distancing.[50] **Germany** is using a voluntary mobile application that connects to smartwatches to monitor vital signs to determine whether an individual is symptomatic.[51] While this seems like a screening/diagnostic tool or even may be useful for contact tracing, one of the objectives is to "to draw conclusions on how infections are spreading and whether containment measures are working."[52] Telekom, a cell phone company in **Germany**, announced that its affiliate Motionlogic is sharing anonymized data with the Robert Koch Institute (Germany's public health agency group, similar to the CDC) to determine if public health measures are working and to decide on next steps that are effective and targeted.[53]

Meanwhile, **Belgium's** Data Against COVID-19 task force was reported to have analyzed anonymized and aggregated data provided by mobile companies (Proximus, Orange, and Telenet) to determine the effectiveness of measures and decide on future steps.[54] In **Austria**, A1 Telekom Austria is providing the government with results from a "motion analysis application developed by Invenium, a spin-off from the Graz University of Technology" to analyze population/individual movements and determine the effectiveness of the COVID-19 restriction measures.[55] Vodafone is producing an "aggregated and anonymous heat map for the Lombardy region in **Italy** to help the authorities to better understand movements in order to help thwart the spread of COVID-19."[56] **Switzerland** is taking a different approach, using SIM card geolocation data to specifically inform authorities about gatherings of more than 20 people in an area of 100x100 meters.[57] Interestingly, the authorities will not be notified in real-time for the

[49] Mari, A. (2020, March 27). Brazil introduces surveillance tech to slow the spread of coronavirus. *ZDnet.* Retrieved from https://www.zdnet.com/article/brazil-introduces-surveillance-tech-to-slow-the-spread-of-coronavirus/; Inloco. (2020). *Location data to control COVID-19 while respecting individual privacy*. Inloco. Retrieved from https://www.inloco.ai/covid-19?hsCtaTracking=f0be6e1c-cfdb-4a99-bcdb-8de048835500%7Cbdd18bed-4478-4302-9d95-3b7211a58696

[50] Ibid.

[51] Busvine, D. (2020, April 7). Germany launches smartwatch app to monitor coronavirus spread. *The Guardian.* Retrieved from https://www.theguardian.pe.ca/business/reuters/germany-launches-smartwatch-app-to-monitor-coronavirus-spread-434738/

[52] Ibid.

[53] Schmidt, N. (2020, March 20). Mit Schwarmdaten gegen Ansteckung. *Telekom.* Retrieved from https://www.telekom.com/de/blog/konzern/artikel/mit-schwarmdaten-gegen-ansteckung-597374

[54] Zaimova, Rosita. (2020, March 31). How data can help fight a health crisis like the coronavirus. *World Economic Forum.* Retrieved from https://www.weforum.org/agenda/2020/03/role-data-fight-coronavirus-epidemic/; Telenet. (2020). *COVID-19: Belgium analyses telecom data to measure the impact of confinement*. Telenet. Retrieved from https://press.telenet.be/covid-19-belgium-analyses-telecom-data-to-measure-the-impact-of-confinement; Proximus. *Data taskforce against corona*. Proximus. Retrieved from https://www.proximus.be/en/id_b_cl_data_against_corona_taskforce/companies-and-public-sector/blog/news-blog/innovate/data-against-corona-taskforce.html

[55] Tirone, J., Seal, T., & Drozdiak, N. (2020, March 18). Location Data to Gauge Lockdowns Tests Europe's Love of Privacy. *Bloomberg*. Retrieved from https://www.bloomberg.com/news/articles/2020-03-18/austria-italy-join-push-to-use-mobile-data-to-gauge-lockdown; Pollina, E., Busvine, D. (2020, March 18). European mobile operators share data for coronavirus fight. *Reuters.* Retrieved from https://www.reuters.com/article/us-health-coronavirus-europe-telecoms/european-mobile-operators-share-data-for-coronavirus-fight-idUSKBN2152C2; Invenium. (2020). *Helping in the COVID Crisis.* Invenium. Retrieved from https://www.invenium.io/en/

[56] Vodafone. (2020, March 18). *Vodafone launches five-point plan to help counter the impacts of the COVID-19 outbreak.* Vodafone. Retrieved from https://www.vodafone.com/news-and-media/vodafone-group-releases/news/vodafone-launches-five-point-plan-to-help-counter-the-impacts-of-the-covid-19-outbreak

[57] Seydtaghia, A. (2020, March 25). Swisscom aidera la Confédération à détecter les attroupements via les téléphones. *Le Temps.* Retrieved from https://www.letemps.ch/economie/swisscom-aidera-confederation-detecter-attroupements-via-telephones

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purpose of enforcing social distancing measures quickly.[58] Instead, the aim is to determine where gatherings in public areas take place for multiple days in a row and then subsequently "take measures to disperse them."[59]

A final example of utilizing mobile data to inform COVID-19 measures is in **France** where Inserm – a public health organization – is analyzing aggregated mobile data provided by telecom company Orange to: 1) understand the impact of confinement on the course of the pandemic; 2) "evaluate how it is respected by the population;" 3) predict "how the virus will spread by taking into account mobility;" 4) identify regions at risk, and 5) model "the impact on the healthcare system."[60] This data ìs described as important to "better advise public decision-makers on how to allocate healthcare sources and to inform them of the most vulnerable regions."[61]

AI also is prominently used for 'next-step planning' in a variety of ways. BlueDot (a **Canadian** AI company) is "starting to produce metrics that allow the [Canadian] government to understand where social distancing has been effective, if people are following public health advice and where to deploy valuable resources."[62] A team at the University of Texas's Health Science Center in the **United States** developed an AI-driven model that looks at varying degrees of interventions and when interventions should be implemented to ultimately see how COVID-19 would spread (specifically within the Greater Houston area) depending on those factors.[63] Similarly, a team at Stanford Woods Institute for the Environment used computing software to model the effectiveness of different non-pharmaceutical interventions for COVID-19 within the **United States** to assist U.S. decision-makers.[64] Another approach has been taken by AI startup DatakaLab who have created a mask detection software program that can be integrated into security cameras; it is now being used in the Paris metro system to detect whether people are wearing masks to gather data on mask adoption in **France**.[65] The **China**-based AI company, Baidu, also has released an AI model that detects whether individuals in crowded areas are wearing masks to provide an indicator of the "population's view and response to the coronavirus, by gauging the public's adoption of safe health procedures like wearing face masks and regularly washing hands" (Baidu Research, 2020).[66]

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[58] Ibid.
[59] Ibid.
[60] Inserm. (2020, March 27). *Deploying Cellphone Data to Fight COVID-19*. Inserm. Retrieved from https://presse.inserm.fr/en/deploying-cellphone-data-to-fight-covid-19/38831/
[61] Ibid.
[62] BlueDot. (2020). *BlueDot: Outbreak Risk Software*. BlueDot. Retrieved from https://bluedot.global/; Vendeville, G. (2020, March 27). U of T infectious disease expert's AI firm now part of Canada's COVID-19 arsenal. *University of Toronto News*. Retrieved from https://www.utoronto.ca/news/u-t-infectious-disease-expert-s-ai-firm-now-part-canada-s-covid-19-arsenal
[63] Lake, D. M. (2020, March 25). Stricter, immediate intervention critical for keeping COVID-19 cases manageable for health care facilities, according to UTHealth modeling. *UTHealth News*. Retrieved from https://www.uth.edu/news/story.htm?id=53b9ba63-b0e5-46c5-8293-92ecd5a6575c
[64] Jordan, R. (2020, March 30). Modeling social distancing's impact. *Stanford News*. Retrieved from https://news.stanford.edu/2020/03/30/modeling-social-distancings-impact/; Mordecai, E., Childs, M., Kain, M., Nova, N., Ritchie, J., Harris, M. (2020). Potential Long-Term Intervention Strategies for COVID-19. *Stanford*. Retrieved from https://covid-measures.stanford.edu/
[65] Vincent, J. (2020, May 7). France is using AI to check whether people are wearing masks on public transport. *The Verge*. Retrieved from https://www.theverge.com/2020/5/7/21250357/france-masks-public-transport-mandatory-ai-surveillance-camera-software
[66] Baidu Research. (2020, March 12). *How Baidu is harnessing the power of AI in the battle against coronavirus*. Baidu Research. Retrieved from http://research.baidu.com/Blog/index-view?id=133

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Finally, **Argentina** was trialing **Israel**-based SparkBeyond's predictive analytics AI platform to look "at how the country can allow citizens to return to work and minimize economic impact" (SparkBeyond, 2020; Earley, 2020).[67]

Indeed, some social behaviour monitoring and surveillance initiatives for 'next step planning' have a more global scope. For instance, the COVID-19 Mobility Data Network – a global network of infectious disease epidemiologists working with technology companies around the world – uses anonymized, aggregated data sets from mobile location data to "provide daily updates to decision-makers at the state and local levels on how well social distancing interventions are working" (COVID-19 Mobility Data Network, 2020).[68] Google also uses data from mobile devices to develop and provide "COVID-19 Community Mobility Reports" to 131 countries for the purpose of helping public health officials "make critical decisions about COVID-19" (Google, 2020).[69] Similarly, Facebook's Data for Good program is using aggregated data to provide maps of population movement to help researchers and nonprofits understand the COVID-19 crisis and effectively respond to the virus (Jin, 2020).[70]

4. Conclusions

This module describes **social behaviour monitoring and surveillance** to help build understanding of how digital technologies have been used to understand and influence social behaviours during COVID-19. Discussion begins by introducing the concept of social behaviour monitoring, how it is usually performed and how applications are different during COVID-19. Applications are described through three main approaches observed worldwide: Quarantine-Monitoring and Surveillance, Social Distancing Enforcement, and Informing Future Planning & Policy.

To continue learning more about the digital response to COVID-19:

Executive Summary.
Module 1. Digital Response Overview: Digital Contact Tracing, describes the concept of digital contact tracing and how it works, and explains different types of applications around the world from centralized (involuntary and voluntary) to decentralized interventions.
Module 3. Digital Response Overview: Public Communications, and Remote Diagnostics & Treatment, explains how digital technologies have been used to diagnose and treat remotely, for example, the use of drones for crowd temperature checking.

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[67] SparkBeyond. (2020, April 8). *How SparkBeyond is powering a global response to COVID-19*. SparkBeyond. Retrieved from https://www.sparkbeyond.com/blog/covid19/; Earley, K. (2020, April 7). Argentina may use AI to make decisions about Covid-19 restrictions. *Silicon Republic*. Retrieved from https://www.siliconrepublic.com/start-ups/argentina-ai-covid-19-coronavirus-restrictions?utm_source=Website%20Link

[68] COVID-19 Mobility Data Network. (2020, May 15). *COVID-19 Mobility Data Network*. COVID-19 Mobility Data Network. Retrieved from https://www.covid19mobility.org/

[69] Google. (2020). *COVID-19 Community Mobility Report*. Google. Retrieved from https://www.google.com/covid19/mobility?hl=en

[70] Jin, K. (2020, April 6). Data for Good: New Tools to Help Health Researchers Track and Combat COVID-19. *About Facebook*. Retrieved from https://about.fb.com/news/2020/04/data-for-good/

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