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COVID-19: The Internet of Things and Health

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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 a Health and Wellbeing sector-specific edition of COVID-19: IoT and Cybersecurity looking at the use of robots for healthcare purposes.

Past editions are found on the PETRAS website.

Robots in healthcare during COVID-19

Collaborative mobile robotics refers to the field of mobile robots that assist humans in a workspace. In a time where keeping a safe distance between people is crucial to stop the spread of COVID-19, robots have been deployed to perform autonomous tasks such as health monitoring, disinfection, social care, testing and manufacturing.

Monitoring COVID-19 patients

Six robot nurses were deployed in a hospital in Varese, Italy in March 2020[1]. The robots can monitor vital signs from equipment in the room and relay them to hospital staff. They also allow patients to record messages for doctors. All these functions can limit the amount of direct contact medical personnel has with patients, thus reducing the risk of infection.

In March 2020, a temporary field hospital (now closed), in Wuhan, China deployed 5G-enabled medical assistant robots in a trial to measure patient

Overview

- Hospitals, official authorities and companies around the world have deployed robots in the fight against COVID-19 to monitor patients, disinfect patient rooms and operating theatres, help with social distancing measures, process virus tests or produce masks
- As part of the efforts to increase security for hospital robots, the Spanish company Alias Robotics developed the first 'vaccine' for robots
- An increased use of robots is not currently considered to significantly threaten livelihoods in healthcare
- Bias and privacy issues would need to be considered before further reliance on robots for healthcare purposes during the pandemic and afterwards

temperature, clean and disinfect spaces, and deliver medicine[2]. Medical staff control the robots remotely via an information management platform that includes a control platform featuring digital twins for each robot[3]. The robots were donated by artificial intelligence tech company CloudMinds.

In Spain, the company Robotnik is developing logistic robots as part of the ENDORSE project[4], designed to automate tasks within the hospital such as medication distribution and health monitoring.

Disinfecting high-use areas

Robotnik has also begun developing a modular robot which 'allows the assembly of a module for disinfection and fumigation' as part of the 'Rapid Deployment Robot for Pandemic Crises (RADERPAC) project[5].

Danish company UVD Robots have shipped self-driving ultraviolet (UV) disinfection robots to Chinese hospitals[6]. The company also deployed similar robots in Romanian hospitals in March

2020[7]. The robots use concentrated UV-C light that removes viruses and bacteria in their range. They can work autonomously cleaning patient rooms and operating theatres and can limit the spread of COVID-19 as well as reduce hospital acquired infections.

Similar solutions using UV for disinfection were announced by the US-based company Dimer in partnership with Honeywell as a disinfection solution for aircrafts[8], however the system has not yet been tested on the virus that causes COVID-19[9].

Shanghai-based TMiRob has delivered disinfection robots to hospitals in Hubei province in China. The robot operates automatically and disinfects the environment by combining chloric acid and plasma in areas with high movement of patients and health workers[10].

The Advanced Centre for Aerospace Technologies in Spain in collaboration with the technology company Airvant is developing an aerial robot to disinfect containers in logistics areas, to ensure the safety of the rest of the supply chain and to avoid new virus outbreaks[11].

Helping with social distancing measures

Spot, Boston Dynamics' four-legged robot, was used in May 2020 to remind park goers in Singapore of social distancing rules[12]. The robot can broadcast pre-recorded messages reminding people of social distancing measures and it is also

equipped with cameras and sensors, which it can use to estimate the number of people in the park. The authorities have reassured locals that the robot will not be able to track individuals or record personal data.

Boston Dynamics were also approached to assist hospitals to minimise staff exposure to COVID-19. The robot has been repurposed as a mobile telemedicine platform, allowing healthcare providers to remotely triage patients. An iPad and radio is placed on the robot's back allowing video conferencing in a triage situation for patients suspected to have COVID-19[13].

The Japanese robot Pepper has been repurposed from greeting customers in hotels to easing loneliness[14] among mild COVID-19 cases in Japan or even helping German customers remain at a safe distance in supermarkets[15].

To support physiotherapists in mobilizing patients in times of social distancing, the Danish Life Science Robotics (LSR) deployed ROBERT[16], the only robot certified[17] for integration into a medical device. The robot works by allowing patients to either actively or passively train without contact by a physiotherapist. Already in use in Denmark and Germany, the robot has been cleared for sale by the US Food and Drug Administration since March 2020.

SPRING, a project under Horizon 2020 funding scheme, coordinated by the French Institut National De Recherche Informatique et Automatique, aims to create a social robot that would provide meaningful social interactions to elderly people in between medical appointments[18].

In Belgium, the company ZoraBots has been lending video-calling robots to elderly care homes to help residents to connect with family and friends, when visitors are not allowed[19]. The 'James' robot is mobile and voice-activated and requires no contact from patients[20].

ZoraBots have also developed robots that can deliver medicines and other essentials to COVID-19 patients in hospital settings protecting thus medical personnel by reducing exposure. Aside from delivery services, the robots can also screen patients' temperature and alert security if people are not wearing masks. Five of these 'smart anti-epidemic' robots were deployed by the United Nations Development Programme and the Rwanda Ministry of ICT and Innovation, for use in

Processing virus tests

Processing a large number of COVID-19 tests in a short amount of time was another endeavour where robotics could lend a hand.

- Kingfisher robots in Belgium, at the Flemish Institute of Biotechnology part of the Vrije Universiteit Brussels[31]
- COBAS 6800 from Roche has boosted the testing capabilities of the Liège Hospital Centre in Belgium[32] from 100 to 800 tests a day
- A robotic testing system was being drafted in Northern Ireland in March 2020[33]
- In March 2020 the Spanish government was also designing a plan to automate tests[34]

two treatment centres and at the Kigali International Airport[21].

Another company developing robots that can transport and deliver food, medication and biological samples within hospitals is PAL Robotics in Barcelona, Spain[22]. The delivery robot uses sensors provided by partner Accerion for positioning solutions.

Producing masks

Nagami Design, a Spanish design brand, has repurposed its 3D printing robots from furniture to face shields for medical personnel. The shields are made to be both durable and recyclable. Nagami is printing around 500 masks per day, which is around seven times faster than a desktop 3D printer[23].

Cybersecurity

Companies like Alias Robotics warn that the majority of robots currently used in hospitals are highly vulnerable to cyberattacks. The Spanish-based company has made the first 'vaccine' for robots, the RIS (Robot Immune System) software[24]. The software mimics the human immune system in identifying and blocking cyber threats.

The UK launched the Digital Security by Design programme in 2019. Among the nine grant winners of the programme, AppControl, led by the University of Glasgow, will continue its work on state-of-the-art microprocessors, to ensure the security of vital systems used in medical robots[25].

Social impact of automation

Oxford Economics estimates that, in manufacturing alone, 20 million jobs are set to be lost to robots by 2030[26]. The COVID-19 pandemic has increased the need for robots that can reduce the burden on doctors and nurses by taking over either time consuming or dangerous tasks[27]. At the current level of development experts do not believe robots and artificial intelligence can replace clinicians[28]. Robots are not currently considered to significantly threaten livelihoods in healthcare, although jobs like porters or cleaners might be affected[29].

Bias and privacy issues

A further reliance on robots for healthcare purposes during the pandemic and afterwards would need to take into consideration the potential for bias as well as potential privacy issues of the data they collect, says a MIT Sloan Management Review article in May 2020[30]. According to the article, current medical data sets contain many forms of bias (gender or racially based; for example, heart attack is often misdiagnosed in women). In addition, data collected from contact tracing bring sometimes unresolved privacy issues.

Endnotes

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