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Role of IoT in COVID-19

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ABSTRACT

The COVID-19 pandemic provided a needed sanity check for IoT-inspired frameworks and solutions. IoT solutions like remote health monitoring and make contact with tracing provided support for authorities to successfully manage the spread of the coronavirus. This article provides the first comprehensive review of key IoT solutions that impact COVID-19 in healthcare, contact tracing, and transportation during the pandemic. Each sector is investigated in-depth; and potential applications, social and economic impact, and barriers for mass adaptation are discussed intimately. It elaborates on the challenges and opportunities for IoT framework solutions within the immediate post-COVID-19 era. To this end, privacy and security concerns of IoT applications are analyzed in-depth and emerging standards and code of practices for mass adaptation are discussed. The main contribution of this review paper is the in-depth analysis and categorization of sector-wise IoT technologies, which have the potential to be prominent applications within the new normal. IoT applications in each selected sector are rated for their potential economic and social impact, the timeline for mass adaptation, and Technology Readiness Level (TRL). In addition, this article outlines potential research directions for next-generation IoT applications that would improve performance with preserved privacy and security and wider adaptation by the population.

Keywords: *Internet of Things; COVID-19; Global Pandemic; IoT Solutions; IoT privacy and Security Challenges; IoT Applications*

1. INTRODUCTION

The Internet of Things (IoT) may be a collection of interconnected devices, humans, objects, and services that share data to accomplish a standard objective in several areas and applications, as defined by. IoT is employed in many various domains, like healthcare, agriculture, transportation, distribution, and energy production. Rapid development was made within the IoT industry thanks to both Wireless Sensor Network (WSN) that permits the communication between devices and frequency Identification (RFID), which allows the labeling of devices (1). IoT currently plays a crucial role in many fields. Healthcare is one of the prominent sectors which benefitted from the advancement of IoT (2). In the health sector, IoT has drastically changed the lives of both the young and elderly, because it can constantly track their health (3). The role of the IoT landscape has been significantly changed thanks to the COVID-19 pandemic (4). Some use is directly associated with mitigating the spread of the virus (e.g., contact tracing, temperature screening, etc.) whereas others seek to facilitate the new normal created by the pandemic (e.g., working from home, homeschooling, home fitness, etc.). The coronavirus disease (COVID) is a contagious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which can be spread through cold and saliva drops from the sneezes or coughs of infected people.

A. IoT Solutions for Social Distancing

Social distancing plays a very important role to decrease the amount of virus together with countrywide lock-down and reduction of the workforce to essential workers only. IoT systems using AI in combination with social media posts to warn area to avoid high-risk areas . Often when there is a outbreak in a particular area, people tend to share reports and opinions on social media, mentioning locations and statistics in question. This information in merging of suitable AI algorithm can produce vital social distancing data for affected areas. We visualize this warning data to be integrated with embedded geolocation sensors in user smartphones as a provision for notification whenever one is near a reported high-risk area.

2. DRONE TECHNOLOGY FOR IoT

Drones can be sent in tracing the outbreak of COVID-19 including tracking of persons who came in contact with COVID-19 patients . Similarly, drones are helpful to track patients who break quarantine as well as ensure commitment to wearing face masks .

For instance, in Europe and the USA, drones were used to ensure that lock-down and social distancing rules were strictly adhered to by residents . Similarly, drones equipped with cameras are sent to issue instructions and warnings to residents for not wearing a face mask or breaking emergency protocols , . Also, drones can be used to check in-home patients . For instance, drones get sent to deliver life-saving materials to healthcare supplies in nearby facilities.

3. H-IoT BASED ARTIFICIAL INTELLIGENCE:

In China, AI-assisted CCTV cameras with face recognition capabilities were installed in apartment doors to ensure that people follow quarantine rules and do not leave their homes. Moreover, Organizations e.g., Megvil technology limited, Baidu, SenseTime have each developed AI-assisted contactless body temperature screening system which can be installed in public places to identify those infected with COVID-19. Generally, AI systems gives benefit in manufacturing equipment required to fight the COVID-19 pandemic situation. Also, it has provided relief for the overstretched health care systems

4. SMARTPHONE APPLICATIONS

Smartphone applications limit tasks within a mobile device such as a smartphone. Since there are 3.5 billion active smartphones in 2019-2020, these IoT-based smartphone applications could be very efficient in various domains such as healthcare, retail, and agriculture. Many smartphone applications have been developed for the healthcare of the people, and some of them have been used in response to COVID-19

a. Aarogya Setu

Aarogya Setu is an Application Devloped by Indian Government to connect essential need of health services with the people of the country to fight against the Pandamic of Covid-19.

Technologies Enforcing Social Distancing:

S. no	Social distancing measure	Description	Application use-cases	Challenges
1	Social media approaches	Based on using data from social media posts in combination with AI.	COVIDSens [34]	High chance of false positives due to hoax social media posts.
2	Smartphone applications	Usually involves the installation of a tracker application on smartphone. Users can be notified if they are near a potential risk patient.	TraceTogether [41], Corona-warn-app [42], Aarogya-Setu [43].	Privacy concers are still a huge challenge.
3	Drones	During pandemics drones can be used to deliver goods and services. Drones can also be used in combination with a loudspeaker to propagate social distancing guidelines to communities.	India [44], Spain [38]	Device travel range and battery life still remain critical. Privacy concerns regarding being monitored by drones.
4	Smart city and ITS	Data-driven approach using AI and data provided by smart city and ITS infrastructure to guide traffic and minimize large crowds through smart scheduling.	Smart city drone monitoring [45], smart packing and traffic re-routing.	Security, privacy and policies regarding the collection of data from public infrastructure.
5	AI and Big data	IoT hardware deployed in communities and also embedded in smartphones can provide essential big data necessary for developing social distancing AI systems.	Crowd hot spot identification in a city. Tracing and limiting movement of infected individuals with the general population [46]	May require large amounts of classified and labeled data to be effective.
6	Remote meetings	Providing an alternative to meeting in person against social distancing guidelines. This approach makes use of a network of smart IoT devices and application packages to enable virtual meetings from multiple locations.	Zoom, Microsoft Teams, Google Meet, Cisco Webex [39]	Requires a solid internet connection and users need to familiarize themselves with the application packages.
7	Wearable smart devices	This involves wearing a smart device to provide localization and tracking of people around the user. Thermal sensing technology can also be incorporated to detect potential COVID-19 symptoms in a crowd.	Crowd and risk warning systems [40]	Ethical and safety requirements of wearable health devices.

Fingertip Pulse oximeter

Fingertip Pulse oximeter is a COVID CONTROL IMPEX pulse oximeter which has been perfectly engineered to effectively determine and read your pulse rate and oxygen percentage in your blood . It is a oximeter that needs to be clipped onto your fingers ,and preferably your index finger for the light sensors in the oximeter. To quickly measure the saturated oxygen in your blood. This pulse oximeter allows enhanced portability. Armed with a clear and easy-to-view LED screen, the pulse oximeter capably displays your blood saturated oxygen levels in BPM and pulse rate. You can also view your reading results comfortably by 4 modes of display . It provides comfortable measuring procedure as this device utilizes a non-invasive method to procure your saturated oxygen readings or the amount of oxygen carried by the hemoglobin in your red blood cells. In simple way you have to place your fingers between the clip-ons in the device and press the button for your measurement process to function. When you start the device, it emits light which immediately passes through the sensors in your skin, measuring the hemoglobin in your blood.

Infrared Thermometer:

It is a kind of thermometer that decides the temperature from the portion of thermal radiation it is also called black-body radiation. These type of thermometer are non-contact thermometers or temperature guns, It is use to check persons temperature before entering public place such as malls and theatre etc.

5. CONCLUSION

As we know that Covid-19 is a very Infectious disease as it caused a Global Pandemic IoT solutions have given successful solution of early detection of the Infection. IoT helped to monitor the treatment and to isolate the effected people, healthcare workers get guidance through IoT Applications. These Applications Fight against the global pandemic .Role of IoT is major in such global situations.

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