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AI Economical Smart Device to Identify Covid-19 Pandemic, and Alert on Social Distancing WHO Measures

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Abstract-*The COVID-19 pandemic has spread throughout the world and changed all facets of our everyday lives dramatically. The WHO and CDC expect substantial spikes in the rate of infection cases and deaths, although there are signs of hope due to the availability of vaccines that are currently administered. The situation is still bad in many countries and new ways of dealing with the pandemic will be significant. Inspired by the rapid application and development of AIs and Big Data in different fields, this paper aims to underline their significance to respond to the COVID-19 outbreak and avoid the severe consequences of the disease* [1]. *First, I will include a review of artificial intelligence and then describe its applications to combat COVID-19, some up with a smart device that will detect the disease and alert people to maintain social distance. Since the outbreak of the pandemic, various groups of researchers have been making rapid efforts to leverage a broad range of technology to tackle this threat worldwide [2]. This paper will offer new perspectives to epidemiologists and communities on the significance of AI and big data to help in reducing the spread of the disease. The use of AI-linked smart devices during this crisis reduces the potential spread of COVID-19 to other patients through early detection and alerting patients to maintain social distance protocol. The main aim of this research paper is to come up with an artificial intelligence smart device that is economical in identifying the Covid-19 pandemic and alerting people about social distance per the WHO measure* [3].

Keywords: Security systems, Covid-19 social distancing, artificial intelligence, Detection, Passive Infrared sensor, Pandemic, sensor, infectious disease

I. INTRODUCTION

The novel coronaviral infection (COVID-19) will not likely decrease without a vaccine, but cases of infection can be reduced by utilizing artificial intelligence technologies. To effectively curb COVID-19 spread, innovations and novel strategies should be implemented [4]. The focus should involve how smart technology plays a major role in minimizing the spread of COVID-19, with particular emphasis on the development and integration of AI and sensor technology. According to the WHO, the current mitigation strategies should involve early precautionary measures to reduce its spread. However, integrating smart technologies in dealing with the crisis will go on to reduce the spread and burden to the medical workers in handling the number of increased cases [5]. The emergence and implementation of advanced computer modeling technology have led to changes and improved quality assessments locally and globally. This will transform the medical tactics by improving the predictive modeling capacity due to the increased use of health data accentuated with the introduction of advanced technologies such as artificial intelligence (AI). The emergence and future use of predictive computer tools globally will bring notable improvements by enhancing accuracy, particularly concerning the detection of the disease. These transformations offer predictive analytical tools through a new assessment of historical and current medical data [6]. Under this context, AI and data-driven technologies have enabled the creation of a strategic framework to improve the identification, monitoring, and analysis of the data. AI has recently been introduced to predict areas with infection concerns, medication or in computing diagnostic results, etc., because of the ability to function autonomously, its ability to self-learn by incorporating new data and drawing imperatives in a short time [7]. These activities involve an advanced network of indoor sensor technologies for the detection and remediation of contaminants, such as virus sensors [8]. Besides, home telemedicine technology using wearable devices will track and maintain close relations with the healthcare professional

of the affected patients instead of the physical visits to minimize the workload on healthcare workers and minimize social interaction. To minimize the burden on the healthcare system facilities, infected patients can be monitored closely through telemedicine. The use of AI-powered algorithms for early pandemic detection is in maturity and can help boost preparedness in the future [9]. If the technology's accuracy continues to progress, they are projected to play a larger role in implementing new health policies. This research paper will involve the creation of an AI-driven smart device that will be valuable in detecting the Covid-19 virus and alerting people to maintain a social distance to avoid contracting the disease.

II. RESEARCH PROBLEM

Covid-19 has been a major health risk to many people with different measures being introduced by various health experts on how to avoid contracting the disease. The AI smart device that I will create will be meant to address the issue of social distancing which can be a major challenge for many people. Some of the research questions that will guide my research include: How does the smart device help in minimizing the spread of the Covid-19 pandemic? What are the main components of the AI smart device? How will the device work in making sure that people maintain social distance?

III. LITERATURE REVIEW

A. Social distance monitoring with artificial intelligence

Most of the IoT devices are installed according to users' demands. IoT like smart sensors and devices will support potential smart connected communities to boost nations' health and economic structures to effectively tackle COVID-19 as well as other future pandemics. These AI smart devices can be a promising development in attempts to monitor and tackle the current pandemic [10]. This is a significant research topic, combined with the wider adoption of smart technology and the increased threats of infectious diseases, which spread across the globe, demands its application in the identification, monitoring, and tracking of COVID-19.

BlueDot becomes one of the popular cases for the Canadian AI model. It goes to show an economically viable AI device (BlueDot which was financed with a US$9 million start-up investment) helps predict in spotting outbreaks faster as compared to human beings [11]. The findings showed that even before WHO made the announcements, BlueDot had already predicted a pandemic outbreak at the end of 2019, sending warning messages to its customers early [12]. Research teams working with BlueDot released an announcement on 14 January 2020 which listed the arrival of Wuhan's passengers in the top 20 destination cities. It cautioned that these cities could lead in the world in the spread of the Covid-19 disease. Whereas AI is hindered by a lack of historical training data to model and identifies COVID-19, AI instruments, such as computer visions and robots, are not affected. There is a high likelihood that AI will be used more often for social control. Similar technologies are more likely to be acquired, like smartphones with AI-powered applications or wearable devices that capture their owners' location, use as well as health information. More diagnostic tests can help to stop the pandemic at long last, reduce economic loss due to lockdowns and prevent the second wave of the pandemic once restrictions are relaxed [13].

Whether AI is a powerful technique for fighting potential epidemics and pandemics is dependent on data. Concerns about public health outweigh privacy concerns. Government agencies may choose to continue their citizens' unprecedented monitoring long after the pandemic has ended. Childcare may be fitted with RFID tags, motion sensors, door sensors, and intelligent child protection devices [10]. The sensors can be fastened to children's clothes to track sleep patterns, body temperature, breathing patterns, and position of their bodies. These files can be accessed only on an edge server to ensure child protection, while data created by staff/teachers can be stored on the local cloud. For childcare rooms, an AI-assisted camera can be mounted to assess the social distance between children and teachers [14]. However, keeping physical distance in childcare is a demanding endeavor. The sensor-based partitions within each room in such a scenario would create a distance between the children possible and permit only one or two children in each room to keep a distance between them.

AI was and can be used to handle the pandemic through the monitoring of public spaces and the introduction of social distance and lock-down steps for those potentially infected. "Infrared cameras in Chinese airports and train stations are used to scan huge crowds [15]. They are often used with the face recognition device, which shows whether the person wears a surgical mask at a high temperature. The Chinese company Baidu is among the first innovators to produce infrared cameras that are capable of scanning people using computer vision. These cameras have the capability of scanning 200 people per minute and identify people with body temperatures of over 37 degrees Celsius [16]. However, thermal imaging techniques have been heavily criticized as inaccurate in determining a fever from distance (since imaging the internal tear duct shows the most effective measure) in people with lenses and because it is difficult to decide if an individual's temperature has been elevated due to COVID-19 or some other cause [17].

IV. DESIGN OF THE AI SMART DEVICE

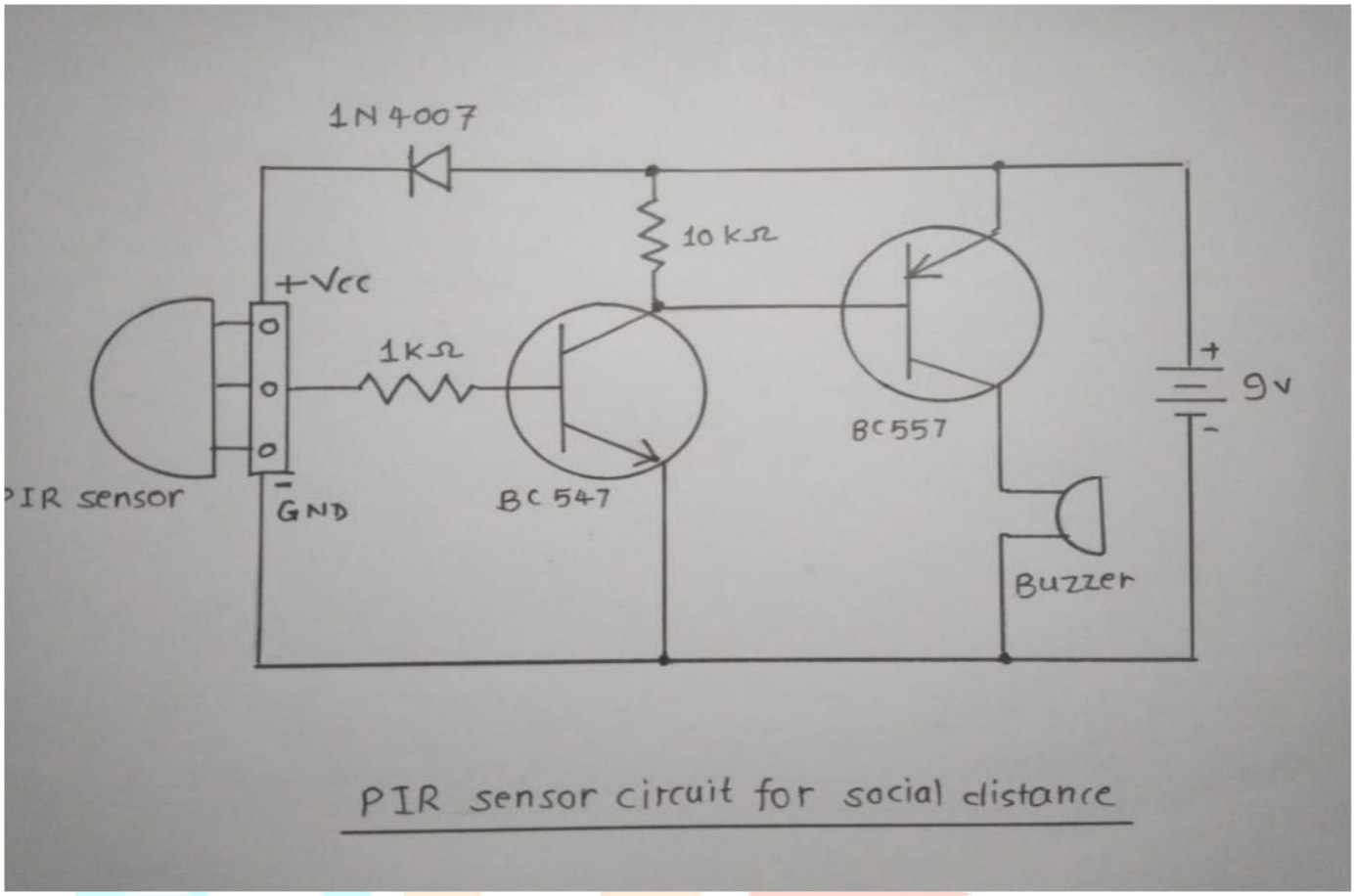

Fig. 1: Diagram of a proposed AI smart device

The diagram above shows a circuit of how my smart device will look like. Some of the components that will be included in this device are the sensors, buzzer, display, and microcontroller. My device will involve the use of thermal effects and motion detectors to identify Covid-19 measuring temperature and measure the distance between two people who are not 6 feet apart. This, therefore, means that my smart device should be able to read the data by using sensors. The thermal effects detector will determine measure temperature of an individual and display data on the screen of the device. Any temperature reading that goes beyond 37 degrees will activate the thermal effects alarm. I am looking at creating a mobile device that will include an alarm that will alert each individual whenever they are close enough. The first step in making an economically smart device that can minimize the spread of Covid-19 is calibration. The sensor will be able to measure the spatial relationship between two frames in terms of velocity, rotational and translational position, and acceleration. The value of the parameters will be provided with each measurement of the follower frame concerning the base frame. The main components of AI smart devices will include a Passive Infrared (PIR) sensor,

a displayer, and a micro-controller. Pyroelectric infrared (PIR) sensors are commonly regarded as thermal detectors. When the temperature of a person changes, thermal sensors will monitor their temperature by measuring incident radiation. If the detector element surface is equipped with a proper absorbing substance, a selected range of wavelengths will respond. The wavelengths of concern are therefore generally inside the IR window where the IR emissions of bodies are also at peaks of 37 degrees Celsius. PIR sensors have been designed to detect human bodies and the radiation signals can be converted into temperature or distance reading. When applied correctly, social distancing measures have proven to be successful. Social distancing measures may have varying degrees of effectiveness in determining the transmission levels of the disease.

A. How it works

My AI smart device can be fitted into the hand like a wristwatch. It is Passive Infrared sensor is important in detecting two people who are closer by calculating the distance between two people on its measurement frames. Before the device is implemented, calibration must be done to make sure that it captures the rules of a 6 feet alert between two people which is the wearer of the device, and a person next to them. A passive IR detector is the most important component of this device in capturing data from very slowly moving people to those who are walking faster or running. A high signal-to-noise ratio will be achieved by using an increased number of detection zones or a large number of pyroelectric sensors to force the creation of a complex optical system. The optical system will continue capturing the detection zones without leaving any blind areas by using its mirror concentrators and one lens made of germanium. I will equip the PIR detector with a channel of RS 485 standard transmission. To record the captured measurements, I will integrate a special software that will allow the registration of signals coming from different detection zones. Stage two of the process includes capturing data using a sensor on the device. The final step is to determine the distance between each pair of persons and compare the differences by the approximate scaling factor.

If the moving object's body is wide or the object reaches the sensor, the PIR reacts faster and the response time will become longer. The sensor will ignore or send zero response or a very limited response if the moving person is too small or far off from the sensor. Moreover, the sensor gives a longer response whenever the movement produces more heat. Additionally, the direction of movement generates a highly non-pattern response to the sensor. As the pace of a movement increases, the response time decreases, though the sensor is not able to differentiate the object from its context

if the object moves very slowly. Besides, there are different effects in the path of the object moving. So, we get various kinds of responses, as we think about some simple directions like perpendicular to the sensor or sensor, capturing the data. The parallel response is like increase the sinusoidal activity at first, and then decrease sinusoidal activity, but will have a more complex sinusoidal response in the direction of the sensor.

Fig. 2: Image of how the smart device will look like.

The image above shows the sketches of how the AI smart device will look like. This device is designed to look like a wristwatch which will not have a problem for the user. The device will have two features for alerting the user on the likelihood that a person they interact with has Covid-19 and when they break the 6 feet social distance rules. This device will count the number of times the user breaks the rules every day. When they get closer to other people in public, the device will vibrate to notify the user to move away from other people. The image shows the readings for the past 24 hours and 72 hours respectively to warn the user of their behavior when they are outdoors. The two readings can be accessed on the same device by pressing the buttons which will be marked for each duration the user has interacted with others. Every time a user fails to maintain social distance, it will be counted on the system of the device and all the data for the last 72 hours stored. As explained above, the device will be using sensors that will measure the temperature of a person to determine their distance.

More specifically, hospitals, patients, and health practitioners can wear this AI smart device to collect early COVID-19 symptoms like their body temperature and to store them at edge data centres, thereby preventing latency and safety issues. Such data will be significant in building models to increase the intelligence of AI applications and could be used for training purposes to create models using Deep Learning (DL). These trends improve the intelligence of data-assisted apps which can be used by hospital practitioners and staff to avoid early signs of coronavirus disease. Hospital personnel not only can gather valuable data with minimal person-in-person interaction by using smart device sensors and wearable devices, but they can even reduce the risk of cross-infection in patients. Data can usually be sent to the cloud system via encrypted data sharing tunnels, due to the limited storage space on the edge. These tunnels form an encrypted connection between the edge and central cloud devices or gateways. The encrypted data system can be substituted by simply using an encryption system to boost the protection of data and support multi-clients.

V. SIGNIFICANCE OF THIS RESEARCH TO THE UNITED STATES

This research is important to the U.S in addressing the rising cases especially for people who are still waiting to receive their first vaccines. The device that I have proposed will assist many people to follow the health protocols that will minimize the spread of the pandemic. They will be alerted every time they get closer to maintain the required 6 feet distance in public places to avoid contracting or spreading the disease. If everyone has such a smart device, the number of cases will reduce. This will mean that the pressure and burden that had been put on health care workers will be reduced. With time, these cases will reduce significantly, and normalcy will return in most places.

VI. CONCLUSION

Predictive computing methods have recently become more useful in providing capturing data that can translate to improved health policies and strategies. Since these innovations are still at their development, there is slow progress in their implementation at the national and international policy level to take serious account of them. A recent case, however, has shown that the reliability of the algorithms powered by Artificial Intelligence (AI) is growing. Coronavirus (COVID-19) was predicted in China by AI modeling led by firms such as BlueDot and Metabiota before it shocked the world through scouting both its effects and spread in late 2019. To achieve this enhanced data sharing operation, it is important to implement efficient data protocols to ensure that information is exchanged across networks and systems while protecting data and avoiding surveillance, particularly in the case of health information. This will allow improved AI predictive tools that impact future urban health policies worldwide. Undoubtedly, technological change is critical and essential in the war against Covid-19. Conventional models are preferable in certain respects to Artificial Intelligence (AI) models due to the lack of data, unwanted data and lack of experience render AI less reliable.

Nevertheless, AI can battle from all angles, to promote awareness-raising and protection initiatives for individuals from different disciplines, to handle resources effectively, and to assist the authorities in enforcing strict regulations. AI alone can support all sectors to tackle natural disasters effectively, as they demonstrate from the scientific perspective. The role of artificial intelligence in the early detection of the new coronavirus (COVID-19) is described through the works of 2 firms BlueDot and Metabiota and shows how AI-driven algorithms could, through improved data sharing, provide more accurate predictions and observations in the future. The document supports the need for improved practices of data sharing in the field of health while maintaining the data protection and security aspects due to the sensitivity of knowledge in the industry. In this respect, AI processes, combined with wearable technology, focused on Smart data sources can and should be encouraged because they make more comprehensive datasets and, therefore, more predictive and improve the detection of diseases. Health protocols have to be streamlined to facilitate connectivity between devices without jeopardizing data protection or preventing data surveillance. The technological transition will lead to increased use of computing systems and better management practices, as in the case of a pandemic, which will also contribute to its prominent position in urban health policy.

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