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Detection and Tracking Infected using IoT in Covid-19 Pandemic

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Abstract - *The unprecedented outbreak of the 2019 novel coronavirus, which the World Health Organization (WHO) has called COVID-19, has placed various governments around the world in a precarious position. The impact of the outbreak of COVID-19, which had previously been observed solely among Chinese citizens, has now become a serious matter. Precisely every nation in the world is concerned. The lack of resources for control of the outbreak of COVID-19, in combination with the fear of overburdened healthcare systems, a number of these countries have switched to a partial or complete lockout situation. Digital technologies such as Artificial Intelligence, Big Data Analytics, and the Internet of Things (IoT) will play an important role in preventing and blocking the transmission of COVID-19. In this research, we proposed a smart edge surveillance system that would be effective in remote monitoring, warning, and identification of a person's pulse, heart rate, cardiac condition, and some of the radiological features to identify an infectious (suspected) person using wearable smart gadgets. The proposed system offers an up-to-date map/pattern of the contact chain of infected COVID-19 individuals that may be present in our country's population. Research is designed to help public health officials, researchers, and clinicians control and manage this disease through the smart edge*

***Key Words*: CoVID-19, IoT, Tracking, Cloud Computing, Distributed Computing, Edge Computing.**

1. INTRODUCTION

The COVID-19, the acronym for Corona Virus- 2019 is a respiratory disease caused by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), a contagious virus that belongs to a family of single-stranded, positive-sense RNA viruses known as coronavirus. SARS-CoV-2 affects the respiratory system similar to the influenza virus, causing symptoms such as cough, fever, weakness, and breath-lessens. Although the exact source of the virus is unidentified, scientists mapped the SARS-CoV-2 genome sequence and found it to be a member of the coronavirus family's β-CoV genera, which usually derives its gene sources from a bat. In December 2019, the COVID- 19 was first reported to affect a person's life in Wuhan City, in China's Hubei province. The COVID-19 has since spread like wildfire all over the world, marking its existence in 213 countries and separate territories. The official global count of confirmed cases of coronavirus stands at 26,198,238 while the death toll has reached 867,755, according to WHO as of August 2020. This pandemic disease prevails in the human body for up to 14 days, according to the World Health Organization. In addition to this, there were no clear coronaviruses (Covid19) in its preliminary stage[1], which is the most challenging task. Therefore we need to monitor the person's condition up to 14 days to identify the person suspected to be CoVID19 and also to ensure the person is restricted during a quarantine period in self-isolation. Social distance, home isolation, and home quarantine might slow the infection's spread, disrupt transmission, and reduce cases to a low level[2]. Terminologies such as the Internet of Things (IoT)[3][4], Edge Computing[5][6], and Artificial Intelligence (AI)[7]) have been taken into account to mitigate the gigantic impact of this massacre tragedy. By implementing these vital concepts, we can track, monitor, and analyze the suspicious human-to-human (H2H) chain. This monitoring process could be made more efficient by using parallel computing technologies[8],[9] as well. Also, the suspected virus of the infected person is one of the key problems in the current situation. As this deadliest virus often spreads from H2H, so today's prime concern is to keep the virus away from healthy people.

IoT is one of the most efficient paradigms in the smart world. With this idea, we can link billions of devices to one another with the help of internet architecture[10]. Also, the edge computing system enhances to reduce the total energy consumption of the device's power and back up resources. It also uses virtual data storage anywhere in the world. Instead of storing all the data on the central cloud, we can create numerous edge servers inside the cloud to get a faster and more robust response. It also reduces total cloud computing by distributing activities around multiple edges. The health and social effects of our research are to help public health agencies, researchers, and clinicians control this disease by designing smart edge surveillance systems. Our intended research approach is a five-step monitoring and surveillance system for suspected persons with an infection through which we examine the specific person CoVID'19 tentative symptoms right from the beginning of the journey to the destination point and identify every

suspicious checkpoint during their journey. The system is fitted with a wearable smart device that is effective in remote monitoring, early warning, and detection of a person's temperature, heart rate, cardiac conditions, and certain radiological features to identify an infected or suspected individual. The research results of this project will include an up-to-date map/pattern of the contact chain of infected persons for COVID-19 that can span through our national population. It will make a major contribution to a deeper understanding of pandemics, patterns of spreading, and the development of diagnostics.

2. LITERATURE REVIEW

Due to the devastating outbreak of the global pandemic COVID19, gadgets enabled by the Internet of Things (IoT) are on the trend[11]. Early identification of contagious people is one of the key targets of all nations. For example, temperature detector smart thermometers are used. Detection of respiratory systems The WHOOP Wearable Wrist Health Monitoring System[12] is proposed by Central Queensland University Australia. They proposed a self-identified system that would collect patient data, but this method is specifically concerned with the analysis of improvements in the patient's respiratory system. In our proposed method, we primarily deal with more symptoms, such as heartbeat, temperature, and respiratory systems. A similar device is also introduced for raspberry Pi flu sense[13] that uses Artificial intelligence to get the number of people in a room. After that, it compares coughing and other symptoms to diagnose flu, but it is lacking from other symptoms of COVID-19, e.g. respiratory system, etc. A lot of vaccine manufacturing laboratories work day and night to find the right formula for this crisis, but it's a time-consuming operation. Vaccination needs time so that we can rely on other HI-TECH IT strategies to reduce the rate of transmission of the disease and save human lives as much as possible.

With the rapid integration of artificial intelligence technology in epidemiology and health logistics, it is important to investigate how and what importance remote processing and computing technology can be reconfigured for the practice and field of global health[14]. Other governments of all countries are looking for devices that can collect reliable information, e.g. Smart thermometers [15] that can collect data sent to a server are being used to detect fever. Besides, AI-enabled fever detection cameras are also used but there is a shortage of literary devices that can cover the highest possible symptoms of COVID-19. Also, data from COVID-19 patients is collected around the globe and many datasets are available for analysis. However, these datasets help obtain some reliable results after applying machine learning algorithms. To make an analysis, a cloud-based platform is needed that can be further extended with edge computing to perform an analysis efficiently.

Edge computing [16] is very effective when the proposed system has to monitor contagious or quarantine people at a geographically different location. To improve performance, edge-based analysis is carried out in the proposed model to achieve results efficiently. Google and APPLE are releasing Bluetooth-based applications [17]. But these kinds of systems will rely on Bluetooth, which could have problems with ranges. To resolve these concerns, we suggest GPRS-based identification and group alerting of suspicious individuals. In [18] the authors present an IoT-based smart edge framework for remote health monitoring. The system has been implemented with some wearable vital sensors to transmit data to two new software engines called Rapid Active Summarization for effective prognosis (RASPRO) and Criticality Measurement Index (CMI). The system was reviewed with precision (0.87), recall (0.83), and F1-score (0.85). Alibaba Cloud has made accessible AI computing power for public research institutions to develop new drugs and vaccines. Hence cloud-based solutions are the fundamental building block for epidemic monitoring.

To implement this idea, the proposed model implements cloud-based pandemic surveillance and tracking solution. Furthermore, the cloud-based solution is extended with edge computing to make the proposed model more responsive, effective, and rapid. Many methods for QR bases for the identification of infectious persons have been proposed in the literature. eg, the Travel and Health Declaration System is a Singapore application used to monitor the visitor via a QR scan. Similarly, a request to verify the status of workers has also been included in the Wuhan QR codes. And that application has become an integral part of the Chinese authorities to check the status of users. This application has been deployed, but it has also raised several privacy concerns for users. In this paper, the proposed model will maintain a record of the user so that, with less privacy, the data can be shared with the community. As a result, current models in the literature have some issues with patient management and analysis. This could be dealt with in the proposed framework, as it will include the monitoring of the COVID-19 individual at a wider level. In the first step, the suspected individual is analyzed using IoT gadgets, e.g. smartwatch, etc. After that, the

proposed model would keep track of the user's history using edge-enabled platforms. It would also help to evaluate the patient's past using a social graph. Also, the QR-enabled mobile application will allow the community to get any warnings if the suspected person is near them. The proposed model may therefore help to stop the spread of the CoVID 19 pandemic in the community.

3. PROPOSED WORK

Proposed CoVID'19 suspected people Surveillance mechanism receives real-time sensors through wearable and non-wearable devices. It will be used to be aware of the health condition and to track the chain of all hotspots in which the CoVID'19 suspected victim travels. The microcontroller collects data from the sensors and sends information to the Multi-Edge layer nodes by following the Internet of Things (IoT) architecture, where rule base analysis is performed to match the predetermined conditions with the current state of the suspected person captured by the sensors. After computing the edge and cloud layer data, the appropriate action activates a module that enables notifications in the android application and the development of a track chain hierarchical structure on the webserver. This helps us to track the suspects of CoVID 19 and keep others from that person as safe as possible.

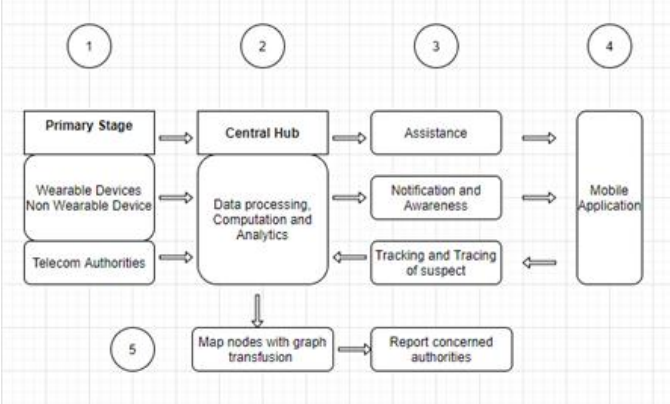

Fig -1: Proposed System Framework

3.1 System Framework

3.1.1 Primary Stage

In the preliminary stage, CoVID'19 suspected health statistics were transmitted by several sensors integrated into wearable and wearable devices into the edge/cloud layer.

3.1.2 Central Hub (Data Processing, Computation, and Analytics)

At this point, local and remote computing processes are performed on multiple computers. Moreover, these two computation approaches reduce the overall response time of the system which is the dire need of this scenario. Also, these computed data will be routed to activating action and graph mapping units to alert nearby and the authorities.

3.1.3 Triggering Action

This part is responsible for the real-time action caused by the broadcast of CoVID'19 suspicious person notifications, monitoring, and mapping the victim's case nodes to the graphical hierarchy. Also, these acts warn and inform the local community and the authorities.

3.1.4 User Interface

This stage is responsible for providing an end-user interaction that is an android application. Also, through this display option, CoVID'19 suspected users will assist, be aware of, and recommend, if necessary.

3.1.5 Graphical View

At this stage, suspected user events are transformed into a graphical user view chain. Also, this graphical hierarchy will help trace the suspected origin of CoVID'19 along with all its intermediate locations, nodes that act as hotspots to save other lives.

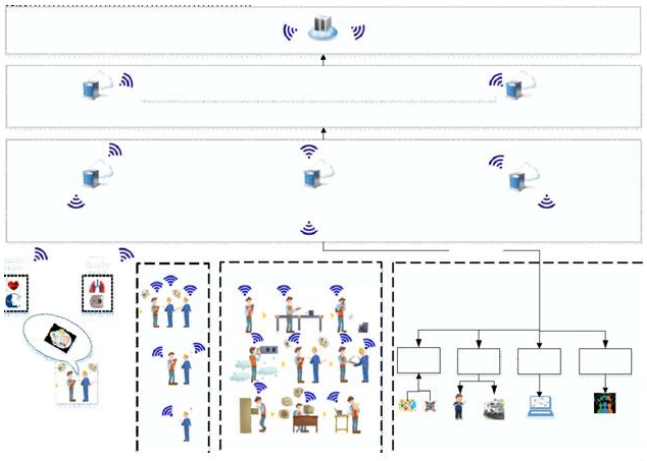

Fig -2: Multi-layer framework of the proposed system

3.2 Multi-Layer Framework

Also, we defined the proposed framework to track and identify suspected individuals who may have been the

victims of the current CoVID 19 pandemic. However, this should be done in multiple layers, i.e. Device layer, Edge layer 1, Edge layer 2, and Cloud layer. Besides, the proposed Layer wise CoVID'19 surveillance method implements a multilevel Edge computing strategy to distribute multi-stage computational tasks and cloud-based features selection, as shown in Fig 2.

3.2.1 Device Layer

This layer consists of two main modules (wearable and non-wearable). These two modules are capable of detecting the suspected individual of CoVID'19 with the help of various factors such as body temperature, pulse rate, breathing rate, and Blood pressure, as indicated by the WHO, descriptions of the precautionary symptoms.

3.2.1.1 Wearable Device

This module consists of two sensors, i.e. The temperature and the pulse sensor. Also, the human body's temperature and pulse rate can be measured in real-time. According to WHO guidelines, irregular changes in body temperature (fever) are the essential symptom of the patients affected by CoVID19. Besides, we also consider the pulse rate of the individual, which is also a crucial factor in the identification of the suspected population of CoVID'19. These two factors provide specifics of the preliminary CoVID'19 suspected person's real-time medical condition. At least we can recognize the suspects and take precautions. As this viral disease is transferred from one human to another, there is a serious need to identify and track the suspected person to protect them from healthy ones.

3.2.1.2 Non-Wearable Device

This non-wearable module will connect to the main gate of the airport's main gates, or even in the shopping centers where large human mobs are expected. This module will also provide the same functionality as the wearable module.

3.2.2 First Edge/Distributed Layer

In edge layer 1, we select features such as body temperature and pulse rate from smart wearable to compute for local processing. The edge 1 device is available from where the raw data is produced. It significantly reduces the latency factor that is the biggest issue in cloud computing. Also, it helps to minimize the response of the time-triggered real-time sensor. So, by computing the early features of CoVID'19 suspected person on edge layer 1, we're going to get a very robust response compared to having to wait for the appropriate decision from the cloud.

3.2.3 Second Edge/Distributed Layer

After computing the edge layer 1 data, we can choose another edge layer to measure the remaining features, i.e. the non-wearable gadget output. This multi-edge layer technique significantly reduces the system's delay factor and to get a quick response to take timely decisions that are the main priority of the CoVID 19 surveillance environment. Also, data processing from multi-layer layers eventually moves to the cloud layer to track the suspected individual using GPS and event graph mapping terminology.

3.2.4 Cloud Layer

This layer uses a multi-edge layer approach to process the information. In this way, rather than the entire raw data it measures, the cloud layer becomes less burdened with the response factor. Finally, the general user's health status of the android device modules is provided in this layer.

3.2.5 Application Layer

It consists of multiple modules such as notifications and QR scans. The suspected CoVID'19 individuals are therefore required to scan the QR code before accessing any shopping center or public location. Also, the QR tag contains the information of the suspected individual, and GPS is also monitored live and its medical condition is checked for CoVID'19 factors in edge and cloud servers to provide real-time precautionary steps. This module also uses a notification layer which broadcasts through application or SMS to the beacon message of the CoVID'19 victim in his surrounding areas. It also warns the authorities involved to take the necessary steps to save others as much as possible.

3.2.6 Events/Graph Mapping Layer

This is another special aspect of surveillance in our proposed CoVID'19 system. The basic aim of this method, however, is to map the Suspected User tracking details that we get from the cloud server to the Graphic Hierarchy notation. Also, with the aid of this user graphical chain representation, we can very effectively monitor the origin or even in-between locations of suspected CoVID'19 affected hotspots.

4. FUTURE SCOPE

We have been unable to do the experimental work for the proposed System in such a tough time in which the whole World has been busy battling the pandemic and everything is closed because of COVID-19. But to carry out this study successfully, we will establish an edge and cloud layer communication framework as seen in figure 1. Besides, the adoption in current times of two viral technologies, i.e. We are creating a hybrid system for detecting and monitoring CoVID'19 suspected victims using IoT and Edge computing. For CoVID'19 viral victims to be identified and tracked, the proposed method would yield fruitful results. In 2020 there is a broad range of Emerging innovations that can be applied to improve these public health initiatives as the world depends upon traditional public-health interventions to counter the COVID-19 pandemic.

5. CONCLUSION

As the world continues to focus on classic steps to protect public health for the pandemic COVID-19 in 2020, several new technologies are available that can be used to improve global strategies for human health. To address the pandemic challenges of COVID-19 by emerging technology, the current study proposes a new smart edge surveillance device capable to address the pandemic challenges of COVID-19 by emerging technology, the current study proposes a new smart edge surveillance device capable of (a) diagnosing coronavirus infection in the body with the help of a health monitoring gadget. (b)identify the suspected H2H chain of the virus with the support of deep edge computing and IoT and (c) monitor and track the follow-up of the suspected person via the application. The proposed model also includes a Warning and Alarm System Module for the safety of healthy persons if an infected / suspected person enters any public place. As a consequence of these issues, we have introduced the proposed framework and also the layered architecture of the system. From a future viewpoint, we will build a communication system with edge and cloud layers. We need to consider the implementation of two viral technologies at present, i.e. IoT and Edge computing, to develop a hybrid system to identify and monitor suspected CoVID'19 victims. While working on the proposed model in the future, protection and privacy will still be crucial issues that can be resolved by the use of advanced techniques[19].

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