

IoT in the Face of COVID - 19

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Abstract—The present universal challenge of COVID-19 pandemic has exceeded the regional, essential, theoretical, mystical, communal, and pedagogical boundaries. The enhanced spread of COVID-19 has increased many operational problems in the governments' health response systems. All these problems point to an incapability to scale the solution with the growth of the outbreak. Presently, IoT is used to accomplish some features of the COVID-19. Drones are used for public observation to confirm quarantine and the wearing of masks. IoT can be used to trace the cause of an occurrence.

Internet of Things empowered health-care system for appropriate observation of COVID-19 patients, by engaging an interconnected network. This network helps to expand patient gratification and reduce re-admissions in the hospital. IoT is useful for COVID-19 patients to determine the symptoms and gives better medication immediately. It will be very helpful to the surgeon, physician, patient, and hospital management system.

IoT application is effective in reducing the cost of health-care and also could improve infected patients. In this paper, remarkable applications of IoT are recognized and analyzed. It has enforced the scientists, researchers and academicians to suggest creative solutions to vanquish or challenge this pandemic. Hence, this study explores the idea of overall applications of IoT by presenting a road-map to challenge the COVID-19 pandemic.

Keywords—COVID-19; Internet of Things; health-care; insert (key words)

I. INTRODUCTION

The Internet of Things (IoT) is a system where it deals with technology-based computing devices which includes mechanical devices and it takes control of all the capabilities of statistics and figures over the defined structure of network in the absence of any human participation. All these analyzed tools or devices are now linked with their specific unique recognition numerals or cipher (codes). IoT has become a very well authorized and proven technology which enforces as a bond to the considerable approach, rapid growth in data, outlook of machine learning, visual device, etc. Besides, IoT commonly identifies daily working as the service for the products or the tool presents the implicit essentials for individual about many means like, surveillance system in

household, smart fulmination preparations and so on which can govern the working of smart speakers, smart phones, etc.

During this current outbreak condition, entire world, including India, are combating with COVID-19 but still it is in search of a practical and economical solutions to deal with the complexity issuing by certain methods. Analyst into substantial research domain as well as technology are trying to handle corresponding objections, to expand latest ideology specify latest research complications, to develop user-centered cause and also to uplift ourselves and the comprehensive citizen. This compact analysis have anticipated to contribute insight about such inventive technology also their important functions for COVID-19 outbreak.

IoT in health-care suggests life compatible aids and is a key adopter of technology. Due to sudden growing number of chronic diseases, IoT has now initiate its mode in the health-care, with plentiful applications, such as imaging, telemedicine, connected health, inpatient monitoring, medication management, connected ambulance, connected worker, along with various others. The current outburst of the COVID-19 has directed IoT health-care help providers to rapidly condense solutions to oppose the growing request for best services to guard against the corona virus. The outspread of the COVID-19 has taken the complete health-care ecosystem from COVID-19 vaccine inventors, drug makers, medical companies, to hospitals and health insurers. Applications such as telemedicine include inpatient monitoring, interactive medicine and remote patient monitoring, is predictable to advance resistance during this time.

IoT offers some steps which permits public-health activities approach towards the data for monitoring the COVID-19 pandemic. For example, world meter delivers the information immediately about the number of infected patients affected by COVID-19 across the globe, with everyday recent situation with this virus, spreading through countries also stringency of virus such as cured, serious condition or death.

Health-care systems must plan to practice cyber skill. For example, virtual clinics might be configured to use telemedicine meetings with imaging data such as X-ray, CT uploaded from exterior sites and read vaguely. This would assure that patients can get excellent clinical care though decreasing physical gathering of patients in hospitals. Virtual e-learning platforms would also eliminate physical meetings for further important clinical action such as survey as well as education.

II. IOT BACKGROUND FOR COVID-19

IoT is an ingenious technology; it allows the devices to be connected over a network in the hospital and strategic location to strengthen the fight against COVID-19 pandemic. IoT applications will help doctors, patients, health-care workers, and hospital management systems to discover the symptoms of infectious disease and manage COVID-19 cases globally. It will help in decreasing the complexity and time taken for productive management of the pandemic [1].

IoT provides smart exclusive access to contend with the Covid-19 epidemic. For this, IoT uses a strong integrated network. Consequently, health-care monitoring devices are connected to the internet. All the data is monitored at the health-care center instantly. In emergencies, it automatically sends a message to the doctors at the hospital/health-care centers. IoT applications are helpful to maintain real-time information on the cloud in health-care. With this data, different statistical analysis can be done to predict upcoming situations of Covid-19[2].

IoT yields a vast integrated network for health-care to confront the COVID-19 pandemic. All medical devices are connected to the internet, and at grave circumstances, it spontaneously reports the medical staff. This technology is advantageous to sustain a standard administration with real-time information in health-care. By analytical-based method, IoT helps to forecast looming situation of this disease [3].

Authors proposed that the applicability of Cognitive Internet of Medical Things (CIoMT) technology for smart health-care, to challenge the COVID-19 pandemic, presents the consequential exploits and scope of accomplishment[4]. CIoMT is the category of Cognitive Internet of Things (CIoT) particularly for the medical service which performs a major task in smart health-care. CIoT is the technology which validates all the physical entities in this world to communicate and exchange information diligently assuring certified Quality of Service (QoS) demands. CIoMT is a rising technology for tracking, dynamic monitoring, better treatment, fast diagnosis, and controls the spreading of the virus.

An abundance of new technologies through IoT is receiving global attention and expanding the availability for preventing, predicting and monitoring the emerging infectious diseases. IoT in the infectious disease epidemiology is an arising field, nevertheless, smart technologies are available extensively and increasing threats of infectious disease spread across the development and reciprocity of the world entails its use by preventing, controlling and predicting arising infectious diseases [5].

Authors Wang et al, 2020 and Haleem et al.2020 discoursed problems rising in the current situation is due to ineffective accessibility to the patients, which is the major problem for vaccine development [6].

IoT is basically the anxious system that issues the influence of machine learning artificial intelligence, cloud computing and data analytics solutions [7].

By evolving a well-versed collection of an associated network, the cluster can be identified remarkably. Some specific smart phone-based application can be established in case the deprived ones can be made appropriate for use[8][10].

III. SIGNIFICANCE OF IOT IN THIS PANDEMIC SITUATION

As per WHO, the spread of COVID-19 started in Wuhan, China. This disease spreads from person to person via tiny droplets from mouth or nose. COVID-19 spreads if people breathe these droplets from an infected person. These droplets can stay on objects or surfaces surrounding the person and get infected when that person comes into contact.

IoT is an inventive technology which makes sure that the infected people are quarantined and can fulfill crucial challenges in the course of lockdown. It is essential to have an appropriate monitoring system. Infected patients are tracked using the internet-based network. This technology helps in tracking and monitoring infected people, capture the data, contact tracing, location, and handles all the data using a virtual management system. IoT provides clarity and accuracy in treatment so there will be no uncertainty in the system.

Using IoT, there is an enhancement in the coherence of medical staff with a less amount of work. It helps to predict situations from the data and reports captured by the devices. It also facilitates proper planning by the doctors, academicians, government, etc. for a healthier working environment during and post COVID-19 epidemic. Fig. 1 shows the major benefits of IoT for the COVID-19 pandemic.

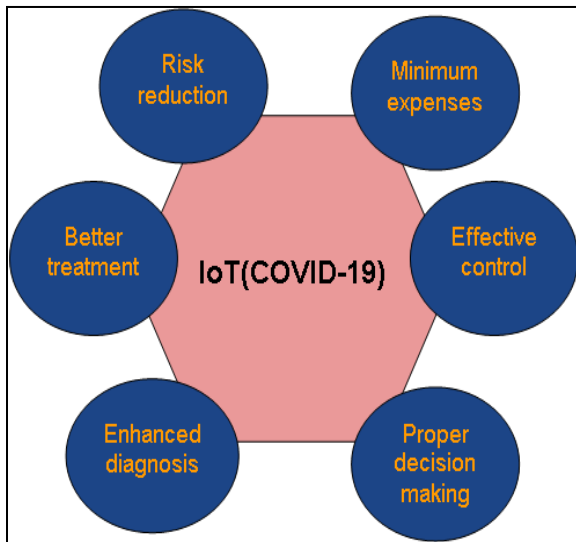


Fig. 1. Major benefits of using IoT to fight against COVID-19 pandemic. IoT allows the application of interconnected devices over a chain for efficient progress and exchange of input. The applications of IoT in the fight against corona virus will empower in occupying for real-time data of an infected patient and area vaguely. Fig. 2 shows the system involved in the application of IoT to fight against COVID-19.

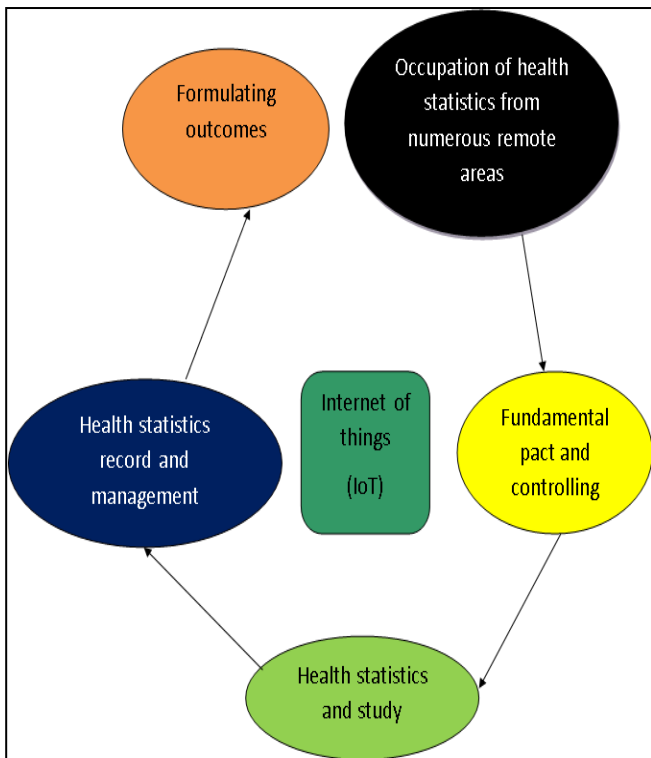


Fig. 2 system involved in the application of IoT to fight against COVID-19.

IoT occupies health statistics from numerous areas from the affected patient and handles each and every statistics with the fundamental management system. By enhancing a well-acquainted association of a linked network, recognition,

capturing and management of affected people and areas will be done adequately. The system involved are

- *Occupation of Health Statistics from numerous remote areas*
The statistics of affected patients are occupied from various areas remotely using digital based utilization. Data such as symptoms, evolution and areas can be easily occupied using IoT secure real time data distributing to manage cases effectively.
- *Fundamental pact and controlling*
Victim and stake holders are involved practically for sensitization by specialist and session with health care traders on their health condition through video transmission, meetings and virtual reality thereby ignoring the need for a hospital inspection and thus encouraging the social distancing estimate, reducing person-to-person connection and disease transmission while hospital call will be based only records and emergency.
 - *Health statistics and study*
The statistics captured are studied for valid formulating outcomes. The study of health statistics will encourage to record areas or locations, affected patients and appreciate design of diseases outcomes.
 - *Health statistics records and management*
The statistics records will regulate in developing the important activities towards the avoidance of disease transmission, action, health controlling, and avoidance system. Desirable recognition of the affected people and detecting of patients through IoT will benefit the health care traders and government to manage the records or cases more logically.
 - *Formulating Outcomes*
Based on statistics and figures record, formulating outcomes for doctors and health care traders is appreciated as treatment process become more valuable and take care the relevant handling of the records. Also, the higher authority government and organization will have superior trading system in anticipating the pandemic position and outlining for post COVID-19.

IV. APPLICATIONS OF IoT DURING COVID-19 PANDEMIC SITUATION

The Internet of Things proves to be the growing technology that helps in the discovery of new drugs and also in medical treatments. IoT uses substantial amount of interconnected devices to design a smart network for a thorough health-care management system. It alerts and tracks the disease to enhance safety of the patient. Its tasks and

services are needed to treat the patients during the pandemic COVID-19 period. IoT evolves networks of devices such as sensors and boards which result in a health-care management system. The data uploaded on the cloud are secured. The

captured information of the patient is recorded avoiding human contact. This data is useful to decide the treatment of patients in emergencies. Table 1 explains the major roles of IoT in providing services for the COVID-19 pandemic.

TABLE I: MAJOR ROLE OF IOT IN PROVIDING SERVICES FOR COVID-19

<i>Applications</i>	<i>Description</i>
Internet connection in hospitals	IoT implementation needs a fully integrated network to help pandemic like COVID-19 in hospitals.
Telemedicine	The patients who cannot consult health-care experts in remote locations through IoT devices will be able to connect with them.
Informing medical staff during emergencies	This smart integrated network helps the hospital staff to function efficiently and quickly.
Patient data records in the cloud	Patient health and personal data will be automatically uploaded on the cloud for quick access.
Availability of the Ambulance	By tracking the location of the patient, the ambulance will be made available from the nearest hospital.
Automated treatment process	The implementation of IoT will emphasize the selection of treatment methods and be effective and help in handling the cases appropriately.
Smart phone apps and wireless health-care network	The application can be installed on smart phones for identification and tracking of infected people and locations.
Health Care System	IoT devices can be developed which will guide the people about proper diet in this pandemic situation.
Red, green and orange zone	Receiving cloud data and analyzing to decide the zone.
Smart tracking of infected patients	Using IoT devices, live location of the Self-quarantining persons can be tracked to activate the alert system if they leave their home. The service providers can handle the cases smartly by tracking the patients.
Real-time information	Immediately sharing information will be enhanced through the interconnection of devices. As the locations, channels, devices, etc. are up-to-date and connected, timely sharing of the information is completed, and cases are handled accurately.
Drug Management	As IoT copes with the connected channel of devices all along, storing of medicines and consumption is accessed.
Predicting the virus	Based on available data reports, statistical methods can be used to predict the situation of things and events for decision making. It will help the doctors to provide immediate treatment to the patient.

V. CONCLUSION

IoT is a pioneering technology; it can allow devices to be connected over a network in the hospital and planned location to fight against COVID-19 pandemic. The application of the internet of things (IoT) will benefit patients, physicians, health care worker and hospital management system to recognize symptoms of the transmittable disease and manage infected case of COVID-19 worldwide. It will also help in

reducing complexity as well time taken for effective management of the pandemic.

In health-care, this technology is supportive to uphold standard management with real-time information. By means of a statistical-based process, IoT helps forecast a forthcoming condition of this disease. With appropriate application of this technology, academicians, doctors, government and researchers can produce an improved situation to fight with the disease.

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