Covid-19 solutions to Healthcare using IoT and AI

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Abstract— With the development of information technology, the concept of healthcare using IoT and AI has gradually come to the fore. The healthcare uses a new generation of information technologies, such as the internet of things (IoT), big data, cloud computing, and artificial intelligence, to transform the traditional medical system in an all-round way, making healthcare more efficient, more convenient, and more personalized. With the aim of introducing the concept of healthcare using IoT and AI.

Index Terms— Internet of Things, Artificial Intelligence, Covid-19 Solutions, Healthcare, Virtual assistant, Remote Patient Monitoring.

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1 INTRODUCTION

Healthcare consists of multiple participants, such as doctors and patients, hospitals, and research institutions. It is an organic whole that involves multiple dimensions, including disease prevention and monitoring, diagnosis and treatment, hospital management, health decision-making, and medical research. Information technologies, for example, IoT, mobile Internet, cloud computing, big data, 5G, microelectronics, and artificial intelligence, together with modern biotechnology constitute the cornerstone of healthcare using IoT and AI. These technologies are widely used in all aspects of healthcare. From the perspective of patients, they can use wearable devices to monitor their health at all times, seek medical assistance through virtual assistants, and use remote homes to implement remote services; from the perspective of doctors, a variety of intelligent clinical decision support systems are used to assist and improve diagnosis. Doctors can manage medical information through an integrated information platform that includes Laboratory Information Management System, Picture Archiving and Communication Systems (PACS), Electronic Medical Record, and so on. More precise surgery can be achieved through surgical robots and mixed reality technology. From the perspective of hospitals, radio-frequency identification (RFID) technology can be used to manage personnel materials and the supply chain, using integrated management platforms to collect information and assist decision-making. The use of mobile medical platforms can enhance patients' experiences, From the perspective of scientific research institutions, it is possible to use techniques such as machine learning instead of manual drug screening and to find suitable subjects using big data.4 Through the use of these technologies, healthcare can effectively reduce the cost and risk of medical procedures, improve the utilization efficiency of medical resources, promote exchanges and cooperation in different regions, push the development of telemedicine and self-service medical care, and ultimately make personalized medical services ubiquitous.

2 REMOTE PAITIENT MONITORING

2.1 Problems

30 percent of medical patients re-admit into the hospital after surgery. Question is why? The straight answer is lack of monitoring patient. Tackle an emergency is still a challenge. Remote patient monitoring can be possible with the collaboration of IoT. Wearable devices with embedded sensors can monitor patient condition whole day long and can notify the doctor.

2.2 Insights

•Helps underprivileged rural people with extent reach of the doctor so that proper guidance can reduce the death rate in rural are.

•Reduce travel and hospitalization costs overall.

•Timely access to data by medical personnel increases the potential of this application.

•Increasing demand for this type of IoT applications in healthcare as anytime anywhere access is possible.

•Sends notification to doctors if the patient does not take medicine regularly.

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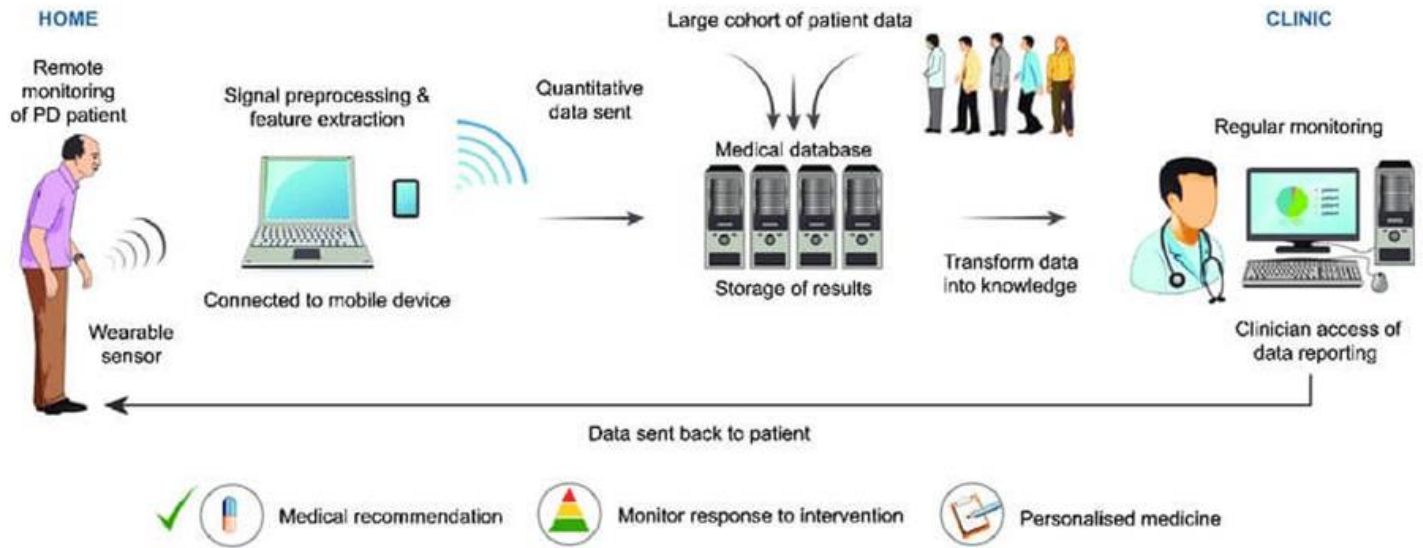
3 INTEROPERABILITY

Different healthcare organizations started collecting a massive amount of data produced by IoT devices. Collecting those data to store at cloud that data will be responsible for creating new methods of treatment and prediction of chronic disease. Healthcare organizations use artificial intelligence and natural language processing to organize this data.

3.1 INSIGHTS

•Well, organized data will start a new era of forward-thinking technology.
•Historical data will help doctors to find out the exact need of the patient.
•An IoT device sends and receives data via cloud storage. As a result, the same data can be reachable by multiple devices that are actually impossible with the current system.
•Data management by IoT technology leads to better patient care.
•Each hospital management system could be a research sector for data science.

4 PATIENT MONITORING

We need to be observed at every moment. IoT applications in healthcare provide a solution. Research results like "Movement disorder API" can detect abnormal footstep, instability of stride length in patients to draw a graph pattern. The doctor analyzes and checks data from the cloud and suggests relatives of those patients what to do.

4.1 INSIGHTS

•Analyzes every pattern of the patient and notify physicians who are impossible for real life.
•The procedure is continuous and automatic, that reduces pressure.
•Early detection is possible by analyzing symptoms.
•FOG (freezing of gait) is a condition of patients when then they experience a sudden lack of movement. Researchers are working to detect the FOG stage in a more accurate way possible.
•One of the promising examples of IoT healthcare solutions is the monitoring application. It can bring a revolution.
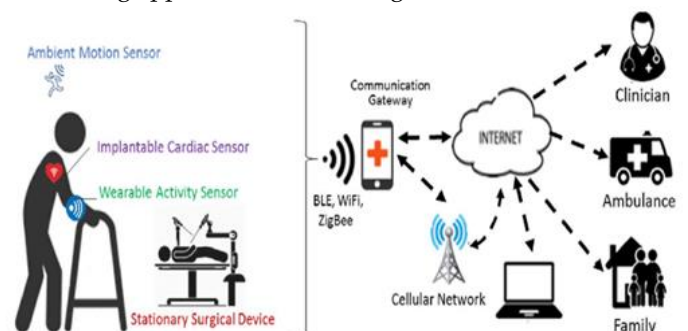
5 HAND HYGIENE MONITORING

Hand hygiene is an essential normal practice. But it is more important for the staff of the Hospital. Study says that poor hand hygiene practice can spread COVID-19 fastly. Internet of things in healthcare applications provides a solution. The idea is to use hand-sanitizer dispensers with sensors to monitor the exact time of when that was used.

5.1 INSIGHTS

•The regular workflow of the clinic increases.

•It sets a degree of cleanliness among all the stuff.

•Real-time communication of hand hygiene monitoring systems.

•It makes a beep sound if medical stuff comes close to patients without handwashing.

•Increases the practice of hand wash among medical stuff.

•This application uses foot traffic sensors and hand sanitizer dispensers to collect data and sends it to Microsoft Azure, a cloud-based computing service.
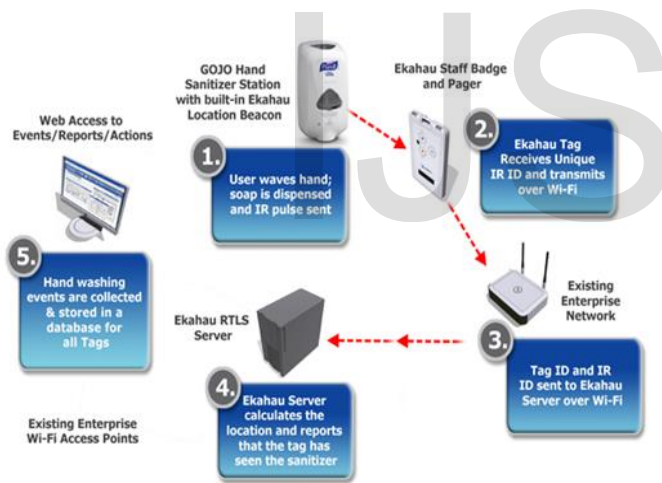
6 DISEASE PREVENTION AND RISK MONITORING

Traditional disease risk prediction is based on the initiative of the health authorities to collect patient information, compare that information with the guidelines of the authoritative organization, and finally release the prediction results. This method has a certain lag in time and does not provide accurate advice to individuals. Disease risk prediction under healthcare is dynamic and personalized. It enables patients and doctors to participate, proactively monitor their disease risk, and conduct targeted prevention based on their own monitoring results. The new disease risk prediction model collects data through wearable devices and smart apps, uploads them to the cloud through a network, and analyzes the results based on big data-based algorithms to feed back the predicted results to users in real time via short message service. These

measures have been proven to be effective. They help doctors and patients adjust their medical behaviors and lifestyles at any time and also help decision-makers to develop regional health strategies to achieve the goal of reducing disease risk. For example, in a study aimed at preventing diabetes by predicting the postprandial blood glucose response, after monitoring the blood glucose response of 800 people for 46,898 meals per week, researchers used algorithms that integrated blood glucose parameters, eating habits, anthropometry, physical activity, intestinal microbiota, and other factors to successfully predict changes in glycemic response and reduce the risk of diabetes through a personalized diet.
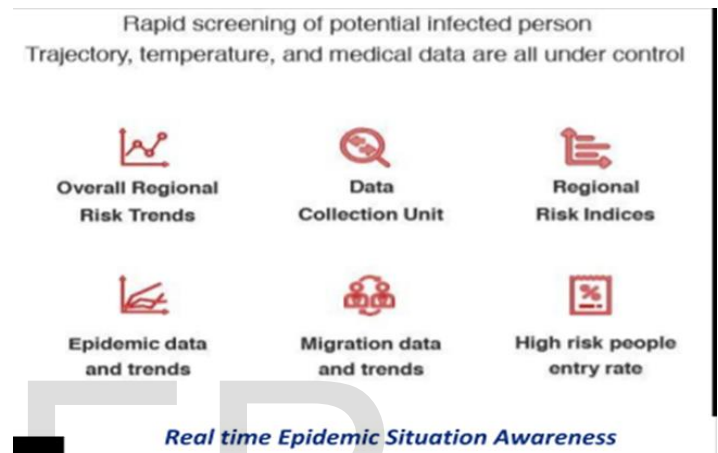
7 VIRTUAL ASSISTANTS

A virtual assistant is not an entity, but an algorithm. Virtual assistants communicate with users through techniques such as speech recognition, rely on big data to obtain information sources, and respond according to user's preferences or needs after calculations. Microsoft Cortana (Redmond, WA, USA), Google Assistant (Mountain View, CA, USA), and Apple Siri (Cupertino, CA, USA) are all virtual assistants. Virtual assistants use session experience and language-understanding technology to help user complete various tasks, from reminder creation to home automation. In smart healthcare, virtual assistants mainly assume the role of a bridge to communicate with doctors, patients, and medical institutions. They make medical services more convenient. For patients, the virtual assistant can easily convert common, everyday language into one using medical terminology through the smart device, so as to seek the corresponding medical service more accurately. For doctors, the virtual assistant can automatically respond to relevant information based on the patient's basic information, helping doctors to manage patients and coordinate medical procedures more conveniently, so that doctors can save more time. For medical institutions, the application of virtual assistants can greatly save manpower and material resources and respond to the needs of all parties more efficiently. Nuance technology can also be used to achieve dialogue between different virtual assistants, especially between general assistants

and highly specialized assistants, thereby greatly improving the experience of medical service participants. Virtual assistants can also be used to aid in the treatment of diseases, such as the use of virtual assistants to improve the mental health of humans, which can improve the state of inadequate supply of human psychotherapists and bring spiritual health to more patients.


8 PROBLEMS AND SOLUTIONS

Since the arrival of healthcare using IoT and AI, mature concepts and systems have been formed. However, with the emergence of new technologies and new problems, there is still considerable room for development, and many challenges are now emerging. Currently, healthcare lacks macro guidance and programmatic documents, which leads to unclear development goals and ultimately a waste of resources. Furthermore, medical institutions, lack uniform standards among different regions and different organizations, and improvements are needed in ensuring data integrity. The amount of data is too complicated and too large, which leads to difficulties in data sharing and communication. There are also problems with compatibility between different platforms and devices. From a patient's perspective, healthcare lacks relevant legal norms, and there are risks with regard to personal information and privacy breaches. Some users even have difficulty using the technology. Technically speaking, some tech

nologies related to healthcare are still in the experimental stages and require a large amount of funding to be maintained and upgraded. There is also an unknown risk if applied rashly.

Therefore, to solve the above-mentioned problems, we need to focus on two aspects: technology and regulation. Firstly, in terms of technology, we can accelerate the maturity and stability of related technologies through upgrades. Improving the ability to analyze information from big data is also important. Secondly, establishing a unified technical standard to achieve maximum compatibility between different devices and platforms is important. In this way, we can improve data integrity and remove barriers to information exchange. Finally, data security and transmission stability are to be ensured as much as possible by applying techniques such as blockchain. In terms of regulation, professionals from relevant fields can work together to clarify the development goals of the industry. Legislation is a practical road to guarantee the privacy of relevant personnel and make healthcare more secure.
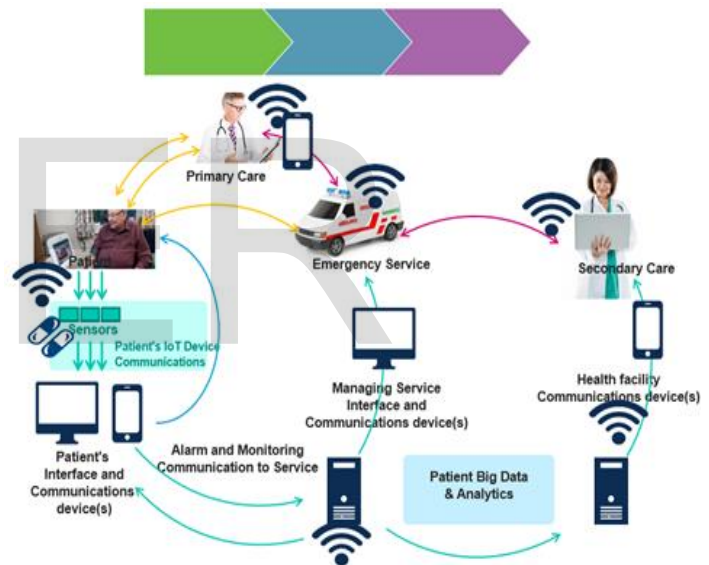
9 CONCLUSION

This paper proposes the applicability of IoT and AI disruptive technology for smart health care and to tackle the COVID-19 pandemic and introduces the major benefits and application areas. IoT is a promising technology for rapid diagnosis, dynamic monitoring and tracking, better treatment and control without spreading the virus to others. Further, the emergency strategies can be implemented cost-effectively, mitigating the stresses of the shortage of medical devices, maintaining a systematic database for modeling and predicting the disease activity for better decision making, preparedness, and online consultation.

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