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Original Research Article

Futurity of Aritificial Intelligence on Remote Monitoring of Patients in E-Healthcare Through Cloud Computing

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Abstract:
People's health is becoming increasingly crucial to track in this 'New Normal' post-COVID-19 modern environment. The need of the hour is for modern technology that uses sensory sensors to track and record critical characteristics while also communicating with others. Keeping track of all of the medical factors is difficult. Collecting post-operative data of persons with non-communicable disorders such as diabetes and heart disease on a regular basis on an ongoing basis The technology we're talking about is intended for those who are confined to their homes. Especially when leaving the house and being exposed to the outside world is forbidden. This paper made a recommendation. For obtaining patient data, a breakthrough health management system based on the Internet of Things (IoT) has been developed. medical characteristics in both urban and rural settings.
Keywords: Remote patient monitoring(RMP) , healthcare delivery, e-health arctitechure, telemedicine.

Introduction

Remote patient monitoring this information to a healthcare clinician to ease clinical rating and resolution.[1]The extensive use of fashionable mobile gadget has appreciably influence the number of patients using clinical systems. The more patients uses mobile gadget has step up from 35,000 in the yr 2013 to 7 million in 2018.[2]Latest data from cloud computing can crucially ameliorate the monitor of patients. Te cloud deliver a strong pathway for doing hard and fundamental computing activities that consists more details on working from brawny and processing to data and device analyze ,and break in high volumes of datasets has inspire more companies and persons to carry cloud computing.[3] Corroborate of healthcare delivery with rpm in the rhythm of covid-19

The COVID-19 epidemic has wreaked havoc on healthcare systems around the world, causing enormous morbidity and mortality. Hospitals have forced to drastically decrease in-person visits to prevent the virus from spreading by cancelling elective treatments and delaying routine patient visits. According to recent polls, patient visits in the United States, the United Kingdom, and other European countries have decreased by 45 percent to 70 percent.[4] RPM (Remote Patient Monitoring) technologies are a type of digital health platform that allows patients to be examined outside of a conventional clinical visit, in their own homes or communities.

RPM programmes use symptom surveys, wearable sensors, and other medical equipment to collect data and deliver it to a healthcare provider for clinical assessment and decision-making professionals . Many studies have shown the effectiveness of RPM in improving the outcomes of people with chronic health conditions throughout the previous decade. RPM programmes could play an essential role in boosting healthcare delivery in the context of COVID-19. In response to the epidemic, various healthcare systems throughout the world created and implemented RPM platforms over the last year .Hospital capacity has been severely taxed throughout the COVID-19 pandemic, and RPM programmes provide a way to alleviate this strain. RPM platforms allow doctors to discharge patients early and follow them remotely after they leave the hospital, allowing for more inpatient beds to be available.

Furthermore, because the SARS-CoV-2 virus(covid-19) is highly transmissible, remotely monitoring patients can reduce the number of required follow-up hospital visits, reducing the infection's spread. Recognizing the potential benefits, the Mass General Brigham healthcare system implemented an RPM programme in which patients with COVID-19 who were being discharged were given a pulse oximeter and thermometer and were asked to self-report their symptoms, oxygen saturation, and temperature on a daily basis via mobile apps.(5)Effects of covid-19 has shown in figure:1

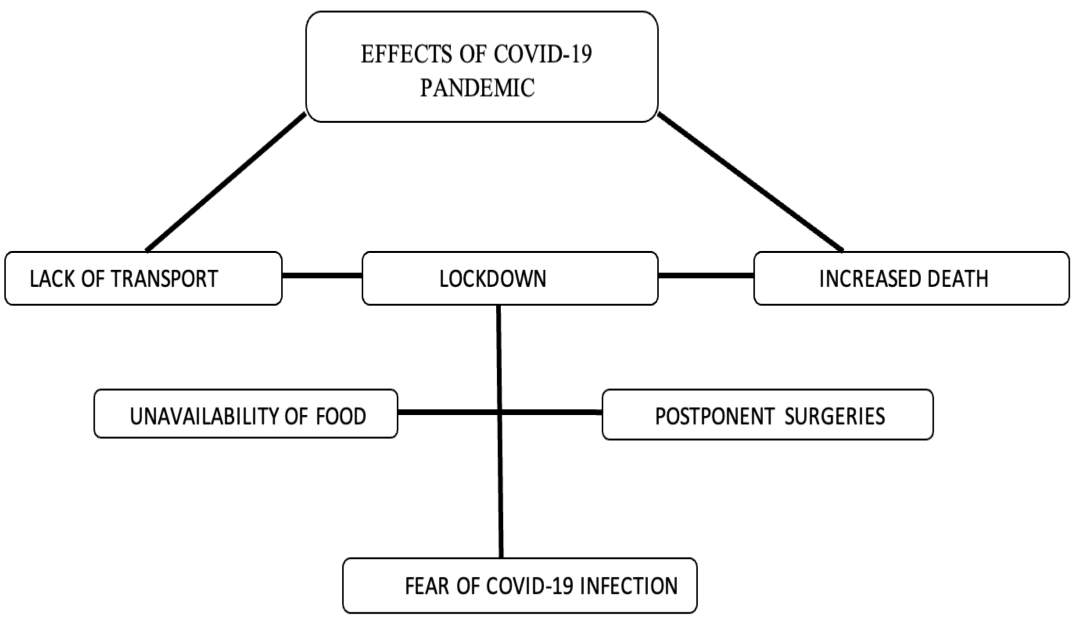

Figure:1,Impacts of covid-19 in human life.

RPM-PETIENT GENERATED HEALTH DATA

Patients can generate their own data with most RPM systems. Data developed, recorded, or acquired by or from patients (or family members or other care givers) to support their health is known as Patient-Generated Health Data (PGHD). Variables linked to health history, biometric data, symptoms, and lifestyle information may be included in this data. The increasing frequency, amount, and types of PGHD available due to the recent spread of RPM has increased the frequency, amount, and types of PGHD available. These advancements in RPM have the potential to empower patients and their caregivers to gather and communicate their health data electronically with clinicians from any location, autonomously and effortlessly. (6)

E-HEALTH MONITORING ARCTITECHURE

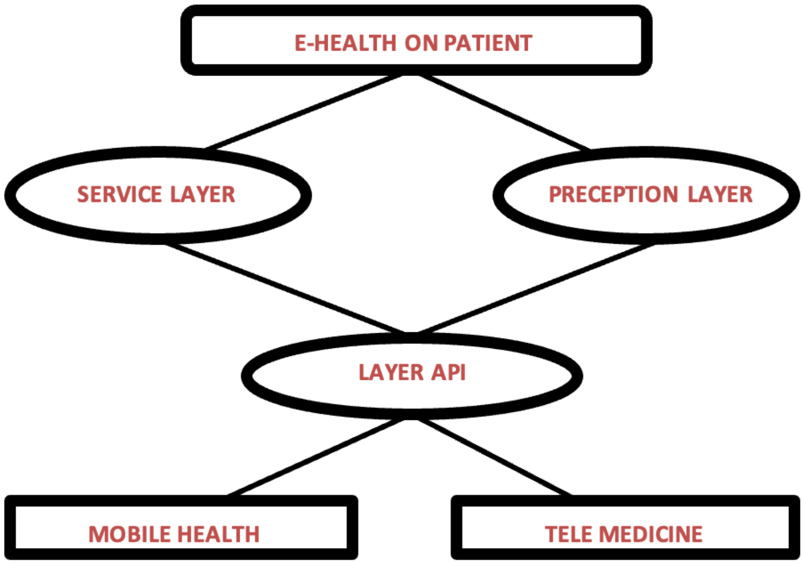

Figure: 2 (Structural outline of e-health system)

Three key layers make up the electronic health management architecture shown in figure:2.In today's society, an electronic health monitoring system is essential. The monitoring systems perform a series of operations to keep the systems running properly, such as monitoring the present state of the systems based on observations, managing the system physical condition, and planning the appropriate preservation and restore operations. Because of the complexities of numerous day-to-day performances and how they differ from one patient to the next, E Health monitoring the patient subject is a difficult task. Even for similar patients, performance differences can occur depending on their state of mind, environment, and health circumstances. Quality of service is the best effort in an E-Health monitoring system.(7)Effort and service technologies The whole performance of the service influences the degree of satisfaction of the user who utilizes it, which is characterized as quality of service. Tele-diagnosis, tele-management, and tele-consultation are examples of these. Telemedicine technology are utilized to keep track of patient information at regular intervals.(8)

MICROCONTROLLER -MOBILE GATEWAY OF REMOTE PATIENT MONITORING

This stage is used to obtain vital indicators such as blood pressure and heart rate (EEG, ECG, blood pressure, heart rate, etc.). In addition to vital signs, devices are utilized to collect other background variables such as temperature and humidity (room temperature, pressure, etc.).Interface with a microcontroller (single node) The microcontroller is used to monitor the sensor parameters and as an interface to convey information from the patient to the mobile gateway (e.g., a smart phone, tablet, or PDA). The process of encrypting and decrypting information using the AES algorithm is examined in the next section .Gateway for mobile devices The encrypted data is then delivered from the microcontroller to the mobile gateway through Wi-Fi or Bluetooth in the next step. One of the features we included with the microcontroller is the ability to communicate data over Bluetooth and Wi-Fi. In some circumstances, the patient's mobile phone is near the patient, and information is transferred to the mobile gateway through Bluetooth. The information is transferred over Wi-Fi when the mobile phone is placed at a great distance.(9)

MAJOR CONSTITUENT OF RPM SYSTEM

The Remote Patient Monitoring System's Main Components Standard RPMs, according to the literature, are designed to continually record a wide range of clinical data from patients and to allow physicians to be continuously monitored using a variety of internal and exterior sensors. The primary steps in creating PMs can be summed up like this:

(1) Data gathering: Invasive and non-invasive,

(2) Data storage and transmission: All data is pooled and sent to the cloud for analysis, sorting, and processing. Data on the cloud can be accessed from a variety of sources, including (laboratory, ambulance, clinics, pharmacy, etc.).

(3) Backend systems: All data is evaluated and then used to assist clinicians in making real-time patient status decisions. The following sections go over the benefits of RPMS in the medical field. Deliver patient assurance: Wearable sensors, which are used to frequently evaluate patient vital signs and provide a real-time recommendation depending on patient state, could allow RPMs to provide (24/7) care from home. Increase patient awareness and responsibility: gathering patient data on a regular basis raises patient understanding of his or her health status .Providing low-cost solutions: relying on RPMs lowers the cost of hospitalization and admissions, lowering the overall cost of healthcare services.(10)

CLOUD COMPUTING ON MOBILE SYSTEM

A chronic disease cloud-based mobile system (CMS). This system was broken down into three sections. The cloud backend service served as a storage server, collecting patient data via HTTP calls that were directly connected to Public Nub. A smart phone application that analyzed data and alerted users to potential dangers. Mobile applications improved communication between patients and their relatives or careers; the authors utilized the influence on the family-scale (IFS) to assess the system's performance and increase the quality of life for both patients and caregivers.(11)Finally, cloud computing aids in the development of healthcare systems by lowering costs and increasing efficiency and effectiveness; never the less, certain problems and limits must be addressed in order to fully benefit from it.(12)

STRATEGY OF SENSORS

The architecture of the suggested model is discussed in this section. Wrist sensors are worn by patients who are hospitalized at home or in the hospital. These sensors gather the required data and deliver it to cloud computing servers. Heart rate sensor, body temperature sensor, blood pressure sensor, blood sugar sensor, stress sensor, consciousness sensor, pulse counter, and accelerometer are among the sensors employed in the suggested design. Wires are used to link the sensors to the microcontroller. Wireless and Wi-Fi connection between the sensors and the microcontroller is also an option. There is no limit to the number of sensors that can be used, and this number can be raised. This study considers a "prioritization system"as an IoT -based interface that recognizes and transfers more sensitive data to the next level (cloud computing). The priority is assigned to the data as a label, which will be used in the following phases. As a result, the data is transferred to an IoT-based priority system, which creates a queue based on the priority of sensitive and non-sensitive data and transmits it to the microcontroller at predetermined intervals. The sensors' characteristics are monitored using a microcontroller.(13)

TELEMEDICINE FOR PANDEMIC PATIENT IN COVID-19

In today's world, when the world is dealing with the world's largest ever epidemic of Covid19, a highly contagious disease with exponentially increasing numbers of cases worldwide, even the world's top healthcare systems face an unprecedented challenge. [14] Telemedicine practices deliver clinical information and allow consultation and discussion between healthcare professionals and patients regardless of where the patient is located, reducing travel expenses, saving time, lowering medical costs, and making specialist doctors more accessible to the general public without interfering with their daily responsibilities.[15] ISRO's telemedicine network has come a long way in recent years. It now connects 45 rural and remote hospitals as well as 15 super specialty hospitals. The islands of Andaman and Nicobar, as well as Lakshadweep, are among the remote nodes. The telemedicine is developed on pandemic condition over market analysis shown in figure :3 as graph.

REMOTE PATIENT MONITORING COUNTRIES

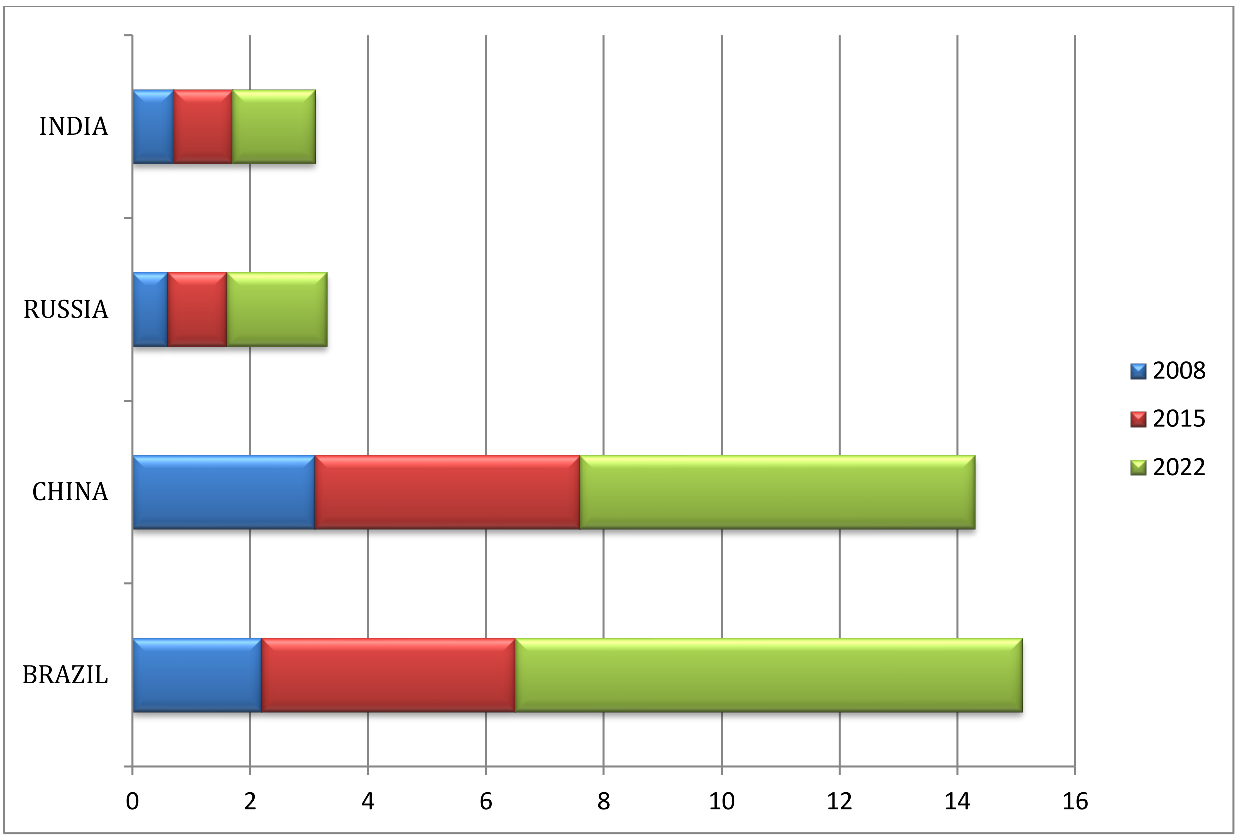

Figure 3: patient monitoring development in few countries databases

APPLICATION

Telemedicine tools include phone, video, devices connected through LAN, WAN, or the Internet, mobile or landline phones, Chat, What's App , Face book Messenger, Mobile App, Skype/email/fax, and so on. According to, there are four basic types of telemedicine applications ,The mode of communication ,The timing of the information sent, and the consultation's purpose ,Interaction between participants: RMP to patient/caregiver or RMP to RMP.

CATEGORY OF DISEASE SPECIFIC REMOTE MONITORING SYSTEM

Heart Disease Monitoring Systems, Fall Detection Monitoring Systems, Mental Health

System, Diabetes Monitoring System, Vital Sign Monitoring System.[19]

ARTIFICIAL INTELLIGENCE ON IMPLEMENTATION AND FUTURE RESEARCH

If AI is used successfully and to its full potential, it has the potential to accelerate huge changes in healthcare delivery. Machine learning algorithms, for example, can identify diseases based on imaging with similar accuracy as doctors[17] and are now being utilized in routine care, raising the possibility that AI will eventually replace radiologists.[18]

LIMITATION

Remote Patient Monitoring is primarily reliant on an individual's will to take control of their health. RPM adoption will most likely fail unless the patient is willing to be an active participant in their own care. Its high cost is also a deterrent to its widespread adoption. RPM services are not covered by any reimbursement guidelines, which may prevent their use in clinical practice. Liability difficulties arise as a result of the shift in accountability related with RPM .There are no clear standards on whether clinicians must intervene every time an alarm is received, regardless of the urgency. The constant flow of patient data necessitates a dedicated team of health care specialists to handle the data, which may actually increase burden. Although technology is introduced with the goal of increasing productivity ,it can be a hurdle for certain healthcare providers who are not technologically savvy. There are some common roadblocks that health informatics technology face, and RPM is no exception.[20]

Conclusion

The goal of Artificial Intelligence is to look at the connections between clinical approaches and patient outcomes. Diagnostics, treatment protocol creation, drug research, personalized medicine, and patient monitoring and care are all areas where AI systems are being used. Quality improvement and augmentation of existing practise, as well as the instigation of new care models, are all possibilities with Artificial Intelligence-enabled telehealth. Many health-related contacts will be done "virtually" utilizing telemedicine technology in the not-too-distant future, ending in a situation where this mode is the norm rather than the exception. Telemedicine is a fascinating technology with the potential to change the way healthcare is delivered for the betterment of all. As the population rises faster than the number of trained doctors and facilities accessible (institutional beds, investigational facilities), this technology will need to be optimally exploited in order to ensure that all persons in need of care are catered to at least to acceptable levels, if not to the best possible levels.

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