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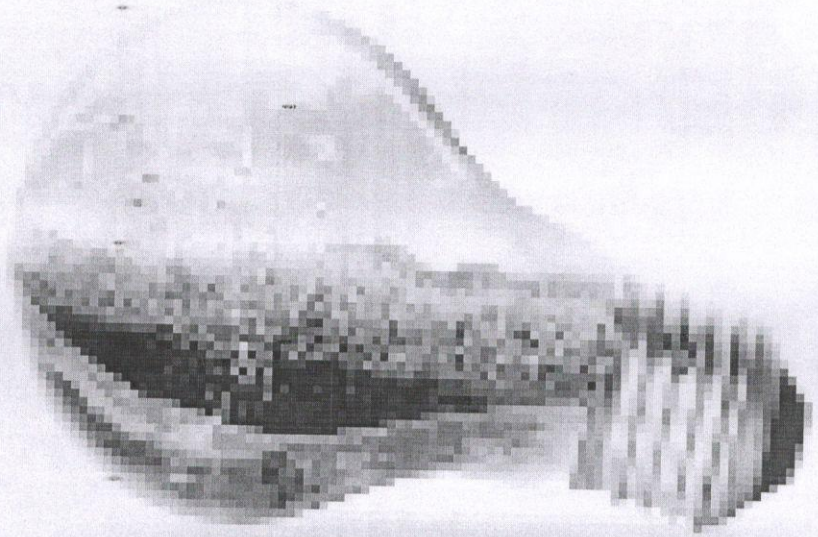

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# Innovation of Internet of Things (IoT) in Medical and Health Care

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**Abstract** – Now Days billion of devices are connected through the IOT. Internet of Things, a revolutionary invention, is always transforming into some different kind of hardware and software making it inescapable for whole world. The type of communication that we see today is human-to-device, but the Internet of Things (IoT) promises a great future for the internet where the type of communication is machine-to-machine (M2M). The Internet of Things (IoT) is defined as a paradigm in which computers, sensor, network and control devices processors communicate with each other to serve a meaningful and smart system to the all domain in our daily life. In this paper we discussed different application of IoT to make tings smarter and more automated for easier use. Internet of Things (IoT) technology has become the essential part of healthcare industry. This has improved the patient safety with reduced cost and enhanced accessibility to the medical services. This technology uses various sensors and devices to continuously monitor the health condition of patient. This collected information of the patient is then analysed so that disease can be predicted earlier. This early detection of disease helps doctor for the treatments.

**Keyword: IOT, Internet of Things, Sensor, Actuators, Wi-Fi, Zigbee, RFID**

## I. Introduction

- The Internet of Things (IoT) defined as the network of physical objects—"things"—that are embedded with sensors, actuators, hardware circuit, software's and other technologies like Wi-Fi, Zigbee, RFID for the purpose of connecting and exchanging data with other devices over the internet. These Smart devices could be smartphones, laptops, smart electric appliances, smart office equipment or any device tagged with sensors. Data generated by these smart devices is then shared with servers located on cloud or on-premise, where it is processed to gain insights that help in taking decisions. The IoT system can be established not only within small areas like our homes or office but over larger areas like gated organization, university campus and smart cities. These devices range not only for ordinary household objects but also sophisticated industrial tools. Today more than 10 billion connected IoT devices today and experts are expecting this number to grow to 22 billion by 2025. Before internet of things technology, patients need to visit the hospital and then doctor can check the health condition of patient. IoT provides various devices which can be use by patient himself at home. Remote monitoring of patient's health can help in reducing the length of hospital stay and prevents re-admissions. IoT has also reducing healthcare costs significantly and improving treatment outcomes. It assures for the affordable, low-cost, reliable, and handy devices to be carried. Even when the doctor is not available, this analysis enables the today's machines to predict the health issues. Not only prediction, but machines can

also be able to come out with the medicines from the systematic study of the medicinal databases.

## II. Use of IoT in Healthcare

1. ***IoT for Patients***: IoT devices like fitness band, Blood pressure and heart rate monitoring gives patient efficient way to check and maintain their health. Diabetic patient can check their sugar level using these devices by themselves at home. IoT has changed people's medical lives, especially older patients. By using IoT devices we can track their health conditions regularly and can avoid the possible health issues. Major advantage of using these devices is to the people who are living alone in home, because these devices can send all the details of the patient to Physicians or their family member on regular interval.

2. ***IoT for Physicians***: By using IoT devices , Physicians can keep track of patient's health also can decide the treatment plan for them. This technology gives physician a good way to keep watch on patient's health even if the patients are at home.

3. ***IoT for Hospitals***: The spread of infections is a major concern for patients in hospitals. IoT-enabled hygiene monitoring devices that help in preventing patients from getting infected. IoT devices helps hospital in asset management like pharmacy inventory control, and environmental monitoring like instance checking of temperature and humidity.

4. ***IoT for Health Insurance Companies***: Data captured through health monitoring devices is very useful for Insurance Companies for their underwriting and claims operations. This data can be used to detect fraud claims and identify prospects for underwriting. IoT devices bring transparency between insurers company and customers in the underwriting, pricing, claims handling, and risk assessment processes.

## III. Technologies of IoT for the healthcare during COVID-19 pandemic

IoT uses devices, sensors, and machines to collect the health condition data as per the individual patient requirement. Depending upon the change in collected data from the patient, doctors can decide the best treatment plan for the patient. There is important role of IoT during the COVID-19 pandemic. Following are the different technologies of IoT useful for healthcare during COVID-19 pandemic.

1. ***Big data***: In medical, the records of patients and their information is stored in files. This requires extra time and cost for maintaining records. Also, if we need to check some information in these files it takes lot of time. Big data gives solution for this process. Big data stores the information of patient, bills, clinical record in digital form. This is stored systematically which quickly provides the best solution to health care.

2. ***Cloud computing***: By using computer system resources, it stores data with the help of internet. It quickly shares the covid-19 patient information. This helps doctors and surgeon to do their job efficiently and effectively. It increases data quality with reduced cost of data storage.

3. ***Smart sensors***: These smart sensors can easily monitor the blood pressure, temperature, oxygen concentrator, sugar level of COVID-19 patient and shares this information over internet. This is also useful to obtain information on health status, defective bone, and surrounding biological tissue.

4. ***Software***: This is capable to store the medical history of COVID-19 patient, confidential details and disease of patient is identified and managed by software.

5. ***Artificial intelligence***: This is very useful to perform, evaluate and analyse the data with predefined environment. It provides the capabilities to predict and control infections of the virus. It measures the pain of the COVID-19 patient with changes in medication.

6. ***Actuator***: This is a mechanism used for the movement of physical machines. It helps to design the hospital bed that can raise or lower its height as per COVID-19 patient's need.

## IV. Wearable Devices

This equipment has been used to contact the person who monitors the disease, personal health and the information gathered which has been sent to the central observation centre and internal research canter. Three elements are wearable devices such as cameras, machine buildings and exhibits. Wearable devices may provide natural statistics, including calories, steps, heart rate, blood pressure; time spent exercising, and so on. The effect on these devices is enormous and of course very strong, which has a good focus on monitoring the physical health of our users.

Various wearable devices as given below:

1. ***Pulse Oximetry***: The unit tests the oxygen saturation level of the human body and monitors the difference in the skin blood flow associated with the cardiac cycle. The pump oximeter, containing an image detector and light-emitting diodes (LEDs), is connected to the finger or ear. The red light sent or carried back into the human body tests infrastructure. The distinction between the level of the installation and the amount of deoxygenated haemoglobin helped to measure oxygen saturation. It is used to calculate the heart rate as Photoplethysmogram (PPG).

2. ***Electrocardiography (ECG)***: A waveform that monitors the heart continues to function and provides time information. There is also restricted readiness for automation for ECG calculation based on wireless sensor devices.

3. ***Blood Pressure***: The energy used by blood pumping into the blood vessels helps to quantify it. The oscillometric approach is used to calculate these types of sensors for the hand frame and systolic readings.

4. ***Electromyography (EMG)***: The muscle research works by looking at the muscle's electrical signals. For all electric signals EMG is the spatio-temporal DRM. The EMG signal therefore provides an efficient way to monitor human muscles' activities.

5. ***Electroencephalography (EEG)***: EEG is used to represent of human brain functions. Wireless Intelligent Sensor (WISE) is a sensor which use for low-frequency control device equipped for EEG data acquisition, wireless communication and analogue signal synchronization applications, and low-level real-time signal processing.

## IV. Challenges of IoT based Healthcare System

As the Technology in IoT is increasing, various challenges also increasing. So, it is necessary to tackle or handle the challenges arising in IoT based health care system. It must be taken into consideration that IoT is not here to take place of heath care system, but to provide the collected and analysed data for the diagnosis and treatment. Following are the few challenges listed,

1. ***Handling and managing the data***: The IoT based health care system is formed by connecting various IoT devices. Hence the data collected from these devices is also huge. Therefore, managing huge amount of data exchange with other devices is also a critical task for healthcare system. Also, this data should be access by authorized person. Unauthorized access to this data can lead to the possible harm of patient's health and safety. Authentication and encryption can solve these challenges. The ability of healthcare organizations to turn the data collected by IoT into meaningful insights will influence the future of IoT.

2. ***Data Privacy***: In Healthcare System the great concern is data privacy. It is expected that any patient's personal health record should remain confidential. But in IOT based Healthcare System the patient's health information is mostly stored in cloud storage or being shared over the network which can lead towards loss of data privacy.

3. ***Accuracy of system***: Because of complexity of system the gathered data may not lead to the wrong information. This can directly affect the patient's health and life. Therefore, maintaining accuracy during the collection and conversion of data is very important in IoT based health care system.

4. ***Managing variety of devices***: Managing different types of IoT devices can be challenge in health care. There are number of IoT devices which are connected to each

other and having different operating system, construction, and services. So sometimes it is complicated to maintain coordination and communication within these devices. To convert the data obtained from all devices to a meaningful data is also one of the challenges.

5. ***Connectivity***: As all the IoT system is based on internet, it is not useful for the areas where there is no internet.

6. ***Cost***: The important challenge is to make this system affordable for the common man. This system is not that much affordable till now. Future scope of IoT in health care system

## VI. Future scope of IoT in health care system

1. ***Healing at home***: Few years back, monitoring and healing of patients at home was limited or restricted resources due to the care of family members. On the other hand, if a patient admitted in hospital, then regular monitoring is possible. But with the passage of time and the introduction of IoT health monitoring tools, the choice of healing at home becomes easy. Integration of real-time monitoring and other definite automated modules, patients do not necessarily require to be under the hospital roof.

2. ***Independent health observation by IoT monitoring devises***: In medical emergencies, people of any age require immediate help from any source of help. The need for monitoring and sending the alert to the concerned person to the doctor, IoT home health monitoring devices are increasing levels of independent health monitoring of the patient. Apart from that, the device is a boon for those who are alone. Seeing how beneficial these IoT monitoring devices are-in future, the number of homes will have a sensor network. These networks will monitor every activity of a patient with the sensor of sending in alerts in an emergency.

## VII. Conclusion

This technology is useful for managing the chronic disease, medical emergencies, better patient care. It can continuously monitor COVID-19 patients and provide a better treatment plan. IoT enable devices can store health information of patient and connect to different database. This technology gives effective way to store the medical history and records of patient in database so that we can easily use this information later for treatment. With the help of well-informed decisions, it reduces errors and provides result on time. By using IoT technology healthcare devices and network becomes smarter and efficient. Thus, these IoT technologies give immediate required information and extend communication to improve the patient's quality of life.

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