

INTERNET OF THINGS FOR PHYSICIANS TO SMART CARE PATIENT MONITORING

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Abstract-

Healthcare IoT is not without challenges. IoT-enabled connected devices capture huge amounts of data, including sensitive information, giving rise to concerns about data security. Implementing security measures is crucial. IoT explores new dimensions of patient care through real-time health monitoring and access to patients' health data. This data is a goldmine for healthcare stakeholders to improve patient's health and experiences while making revenue opportunities and improving healthcare operations. IoT has a different application to create innovation during COVID-19 Pandemic. It is the best technique to track patients and staff, thereby reducing the waiting time. It introduces several devices to make the patient comfortable. With smart devices like blood-gas analysers, thermometer, smart bed, glucose meter, ultrasound, and X-rays, there is an improvement in inpatient care. IoT technology keeps patients better connected to doctors via remote monitoring and virtual visits; it helps hospitals track staff and patients; IoT healthcare devices facilitate the care of chronic disease; IoT automates patient care workflow; it reduces inefficiency and errors; it optimizes the pharmaceutical manufacturing process, which can result in lower drug prices; it maintains quality control and manages sensitive items while they're in transit; it can even lower healthcare costs by streamlining the overall process.

Introduction

Before Internet of Things, patients' interactions with doctors were limited to visits, and tele and text communications. There were no way doctors or hospitals could monitor patients' health continuously and make recommendations accordingly.

Internet of Things (IoT)-enabled devices have made remote monitoring in the healthcare sector possible, unleashing the potential to keep patients safe and healthy, and empowering physicians to deliver superlative care. It has also increased patient engagement and satisfaction as interactions with doctors have become easier and more efficient. Furthermore, remote monitoring of patient's health helps in reducing the length of hospital stay and prevents re-admissions. IoT also has a major impact on reducing healthcare costs significantly and improving treatment outcomes. The spread of infections is a major concern for patients in hospitals. IoT-enabled hygiene monitoring devices help in preventing patients from getting infected. Healthcare IoT is not without challenges. IoT-enabled connected devices capture huge amounts of data, including sensitive information, giving rise to concerns about data security. IoT opens new applications in medicine when the device/instruments are being connected to the Internet. For patients, internet-connected devices are being introduced in different forms, to monitor patient health more effectively. It alerts about public health problems by tracking climate change. This technology gives way for the proper management of the hospital during COVID-19 Pandemic. It plays a significant role in monitoring the drug by providing validated information. This information can also help the proper distribution process of the right patient's right equipment/device. With the right information system, this technology is helpful for the reduction of waste in the hospital. With the help of adequately recorded information, it reduces the chance of the hospital's accidents and controls all the problems. This technology can also prevent the theft of expensive medical devices.

Vision and concept

IoT is undoubtedly transforming the healthcare industry by redefining the space of devices and people interaction in delivering healthcare solutions. IoT has applications in healthcare that benefit patients, families, physicians, hospitals and insurance companies.

IoT for Patients - Devices in the form of wearable like fitness bands and other wirelessly connected devices like blood pressure and heart rate monitoring cuffs, Glucometer etc. give patients access to personalized attention. These devices can be tuned to remind calorie count, exercise check, appointments, blood pressure variations and much more.

IoT has changed people's lives, especially elderly patients, by enabling constant tracking of health conditions. This has a major impact on people living alone and their families. On any disturbance or changes in the routine activities of a person, alert mechanism sends signals to family members and concerned health providers.

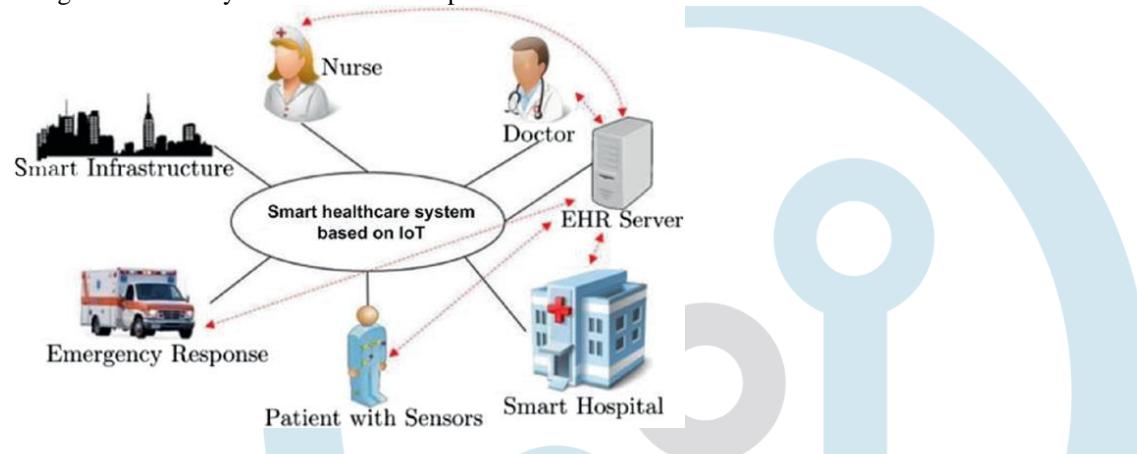
IoT for Physicians - By using wearable and other home monitoring equipment embedded with IoT, physicians can keep track of patients' health more effectively. They can track patients' adherence to treatment plans or any need for immediate medical attention. IoT enables healthcare professionals to be more watchful and connect with the patients proactively. Data collected from IoT devices can help physicians identify the best treatment process for patients and reach the expected outcomes.

IoT for Hospitals - Apart from monitoring patients' health, there are many other areas where IoT devices are very useful in hospitals. IoT devices tagged with sensors are used for tracking real time location of medical equipment like wheelchairs, defibrillators, nebulizers, oxygen pumps and other monitoring equipment. Deployment of medical staff at different locations can also be analyzed real time.

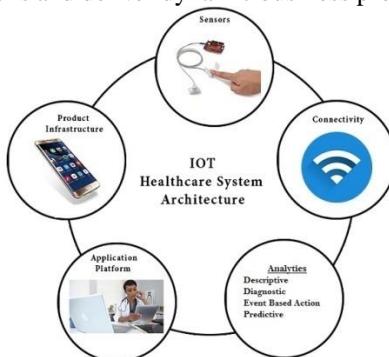
IoT devices also help in asset management like pharmacy inventory control, and environmental monitoring, for instance, checking refrigerator temperature, and humidity and temperature control.

Discussion

IoT for Health Insurance Companies – There are numerous opportunities for health insurers with IoT-connected intelligent devices. Insurance companies can leverage data captured through health monitoring devices for their underwriting and claims operations. This data will enable them to detect fraud claims and identify prospects for underwriting. IoT devices bring transparency between insurers and customers in the underwriting, pricing, claims handling, and risk assessment processes. In the light of IoT-captured data-driven decisions in all operation processes, customers will have adequate visibility into underlying thought behind every decision made and process outcomes is shown below.



Integrated values in the process bring intuitions and deliver dynamic business prospects.

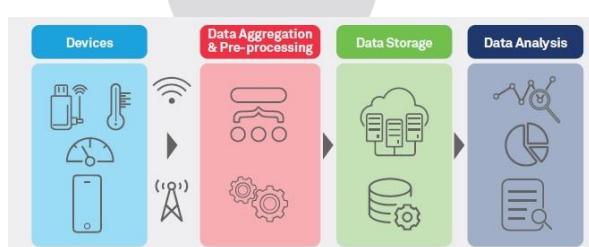


Step 1: First step consists of deployment of interconnected devices that includes sensors, actuators, monitors, detectors, camera systems etc. These devices collect the data.

Step 2: Usually, data received from sensors and other devices are in analog form, which need to be aggregated and converted to the digital form for further data processing.

Step 3: Once the data is digitized and aggregated, this is pre-processed, standardized and moved to the data centre or Cloud.

Step 4: Final data is managed and analyzed at the required level. Advanced Analytics, applied to this data, brings actionable business insights for effective decision-making.



The major advantages of IoT in healthcare include:

Cost Reduction: IoT enables patient monitoring in real time, thus significantly cutting down unnecessary visits to doctors, hospital stays and re-admissions.

Improved Treatment: It enables physicians to make evidence-based informed decisions and brings absolute transparency.

Faster Disease Diagnosis: Continuous patient monitoring and real time data helps in diagnosing diseases at an early stage or even before the disease develops based on symptoms.

Proactive Treatment: Continuous health monitoring opens the doors for providing proactive medical treatment.

Drugs and Equipment management: Management of drugs and medical equipment is a major challenge in a healthcare industry. Through connected devices, these are managed and utilized efficiently with reduced costs.

Error Reduction: Data generated through IoT devices not only help in effective decision making but also ensure smooth healthcare operations with reduced errors, waste and system costs

Conclusion and future work

IoT is for better managing chronic disease, medical emergencies, better patient-care, fitness, blood pressure monitoring, health check system, measurement & control system, heart rate checking system, and hearing aids. It can continuously & reliably monitor COVID-19 patients and provide a better personalisation experience in the medical field. IoT-enabled devices can facilitate digital storing of COVID-19 patients' personal health information and connect to different databases. This technology can help to minimise the manual record keeping. With the help of a well-informed decision, it reduces errors and provides results on time. By using this technology, healthcare devices and networks become smarter and efficient during COVID-19 Pandemic. Thus, these technologies give immediate information and extend communication to improve the patient's quality of life. In the future, this technology will create advancement for the better treatment of the patient to stay healthy and will be used to any COVID-19 type pandemic.

In the future, IoT will monitor vital signs of the patient in a real-time environment. This technology will digitally collect all detailed information to prevent ongoing issues regarding treatment of the COVID-19 patient. There will be a major enhancement in healthcare practice, using the latest technologies, and doctors would have to use them. IoT is a sophisticated developing technology with extensive applications in providing precise medical care that opens up an effective way to analyse valuable data, information, and testing. The future has applications in managing inventories used in the medical field and the medical supply chain for getting the right item at the right time and location. IoT intelligent device would be performing autonomously. There will be data storage with private and public cloud, and even software would also be on the cloud, thus disease identification and follow up could be made efficient. This disruptive innovation of the information system will facilitate intelligent healthcare service in the Medical 4.0 environment.

Future uses of IoT in Healthcare

Remote Monitoring:

Customized software and devices will read data from medical cards of patients in real time and help doctors in conducting a better analysis of patient's health.

Wearable

Different gadgets that can continuously monitor daily activities of the patients and store the data are available in the market. These devices inform patients about their physical activities. They can also help in preventing emergency, as patient's information would be sent to the doctor immediately.

Asset Monitoring

IoT can help in providing functions and controllers to various essential equipment in the hospital. As the equipment are critical while treatment, any defect in them can be fatal. Connecting these devices will enable the staff to monitor their working easily. Defects in the devices can also be figured out in real time; thus, reducing the chances of improper treatment.

Better Supervision and Reporting

Real-time supervision through IoT devices can save lives in medical emergencies such as asthma attacks, heart failures etc. The connected device can collect essential data on patient's health and transfer it to the physician in real time. A study conducted by Centre for Connected Health policy suggests that there was a 50% reduction in re-admission rate of patients due to remote supervision.

End-to-End Connectivity

IoT can automate the workflow of patient care with the help of healthcare mobility solutions. Different connectivity protocols in the devices allow hospital personnel to spot early signs of illness in the patients.

Data Analysis

IoT devices can collect report and analyze the extensive data collected in short time, cutting the need of its storage. This will allow healthcare providers in focusing on relevant data required to treat the patient. The data-driven insights will speed up the decision-making process of the doctors.

Alerts and Tracking

Timely alerts can be crucial in case of life-threatening circumstances. IoT allows medical devices to gather essential data and transfer it to doctors in real time. The reports provide perfect opinion on the patient's condition, irrespective of location or time.

Lower Costs

The connected devices and wearable will allow patients to connect with doctors from their homes. The regular visit for different tests and checkups will be minimized. This will save cost and time of patients on a daily basis.

Medication Management

With the help of smart wireless pill bottles, tracking medication schedule will become easy. This will help people who forget to take their medications on time. The IoT enabled medication management processes will also provide doctors with analytics for offering better care to the patients.

Future Challenges of IoT in Healthcare

With the increase in the market for healthcare IoT, the challenges are bound to increase. Storing mountains of data collected by many devices will pose a challenge to the healthcare institutions. As this data will also be exchanged amongst other devices, the security issues will also rise. Unauthorized access to connected devices can cause harm to the patient's safety. Thus, proper authentication and authorization will be necessary to achieve success with IoT.

IoT technology keeps patients better connected to doctors via remote monitoring and virtual visits; it helps hospitals track staff and patients; IoT healthcare devices facilitate the care of chronic disease; IoT automates patient care workflow; it quickly culls, analyzes data and disseminates data to keep everyone on the same page; it reduces inefficiency and errors; it optimizes the pharmaceutical manufacturing process, which can result in lower drug prices; it maintains quality control and manages sensitive items while they're in transit; it can even lower healthcare costs by streamlining the overall process.

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