

A Survey of Internet of Things-Based Smart Health Care Systems

Parul Srivastava

Lecturer

Department of CSE

Shri Shankaracharya Engineering College, Bhilai

Corresponding Authors' Email: - ps234156@gmail.com

Abstract

The Internet of Things (IOT) is the sophisticated networking, transportation, and technological connectivity. Diagnosis and health monitoring are critical duties in the healthcare business. Smart IoT devices are utilised to access remote health monitoring and emergency alerting systems. People do not attend hospitals for minor ailments because of time constraints, which might lead to serious health problems later on. As a result, healthcare systems have arisen to assess and forecast the health of patients, allowing those who don't have time in their hectic schedules to monitor their health at regular intervals while sitting at home. Many studies demonstrate that early diagnosis is the greatest strategy to treat, assisting and alerting individuals to their health situation. This survey report discusses how IOT might benefit various healthcare systems. IoT-based healthcare is an emerging technology that excludes traditional healthcare and the whole medical system. As a result, patients may see their medical records; the system provides Better HealthCare to everyone through error-free and noise-free contact with patients.

Keywords: *Smart healthcare, Internet of things (IOT), Smart devices, Surveillance, Health monitoring*

INTRODUCTION

Healthcare is an essential aspect of life. Unfortunately, an ageing population and an increase in chronic sickness are putting

enormous strain on current healthcare systems, and the demand for resources ranging from hospital physicians to beds to nurses is exceedingly high. Unfortunately, an alternative is needed to relieve the load

on healthcare systems while still providing high-quality care to at-risk individuals. The healthcare industry is still among the early adopters of the Internet of Things. The reason for this is that incorporating IoT into medical devices improves the quality and effectiveness of care, bringing especially high value to the elderly, patients with chronic conditions, and those who require constant supervision. Prior to the Internet of Things, patients' interactions with doctors were restricted to visits, as well as teleconferences and text messages. There was no means for doctors or hospitals to regularly assess patients' health and make appropriate suggestions.

Remote monitoring in the healthcare industry has become feasible thanks to Internet of Things (IoT)-enabled devices, unlocking the potential to keep patients safe and healthy while also allowing clinicians to provide exceptional care. Patient involvement and satisfaction have also grown as contacts with doctors have gotten easier and more efficient. Furthermore, remote monitoring of a patient's health helps to shorten hospital stays and avoid re-admissions. IoT also has a huge influence on lowering healthcare expenses and increasing treatment results. The Internet of Things (IoT) is undeniably revolutionising the

healthcare business by rethinking the space of devices and human contact in delivering healthcare solutions. In healthcare, IoT applications assist patients, families, clinicians, hospitals, and insurance companies. IoT in Healthcare - Wearable gadgets such as fitness bands and other wirelessly linked equipment such as blood pressure and heart rate monitoring cuffs, gluco-meters, and so on provide patients with access to individualised care. These gadgets may be programmed to remind you of calorie counts, activity checks, appointments, blood pressure fluctuations, and a variety of other things.

IoT has transformed people's lives, particularly those of elderly patients, by allowing continuous monitoring of health issues. This has a significant influence on those who live alone and their families. When a person's usual activities are disrupted or changed, the alarm system sends signals to family members and worried health providers. IoT for Physicians - By utilizing wearable's and other home monitoring technology embedded with IoT, physicians may more efficiently monitor their patients' health. They can monitor patients' compliance with treatment regimens as well as any need for rapid medical assistance. IoT helps healthcare providers to be more

vigilant and proactive in their interactions with patients. Data received from IoT devices can assist clinicians in determining the appropriate treatment method for patients and achieving the desired outcomes. IoT for Hospitals - Aside from monitoring patients' health, IoT devices are extremely beneficial in a variety of other areas in hospitals. Sensor-enabled IoT devices are used to track the real-time position of medical equipment such as wheelchairs, defibrillators, nebulizers, oxygen pumps, and other monitoring devices. The deployment of medical personnel at various places may also be tracked in real time.

Infection propagation is a big problem for hospital patients. IoT-enabled hygiene monitoring devices aid in the prevention of

infection in patients. IoT devices also aid in asset management, such as pharmaceutical inventory control and environmental monitoring, such as checking refrigerator temperature and controlling humidity and temperature. The growth of IoT goods for healthcare creates enormous opportunity. Furthermore, the massive volumes of data created by these linked devices have the potential to revolutionize healthcare. The Internet of Things features four-step architecture, which is essentially, steps in a process (See Figure 1). All four steps are linked in such a way that data is recorded or processed at one level and yields value at the next. An integrated value in the process generates intuition and provides dynamic commercial opportunities.

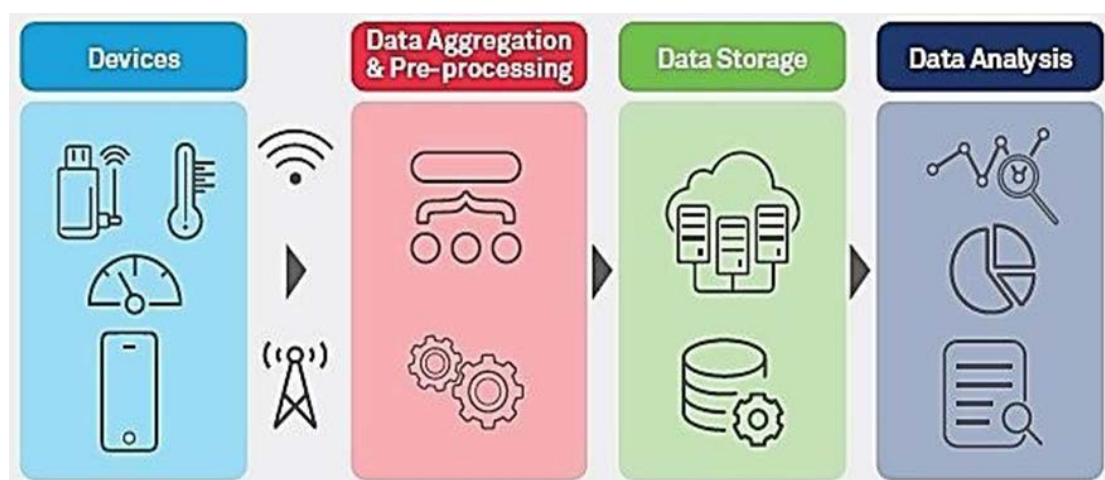


Figure 1: The Four Stages of IoT Solutions

Step 1: The first stage is to deploy networked equipment such as sensors, actuators, monitors, detectors, video systems, and so on. These gadgets gather 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.

IoT is transforming healthcare by assuring better care, improved treatment outcomes, and lower costs for patients, as well as enhanced processes and workflows, performance and patient experience for healthcare professionals.

The major advantages Of IoT in healthcare include:

1. **Cost Reduction:** IoT monitors patient health condition real time, thus significantly cutting down unnecessary visits to doctors, hospital stays and cost also.
2. **Improved Treatment:** It makes physicians evidence-based informed decisions and brings absolute transparency in health monitoring.
3. **Faster Disease Diagnosis:** Continuous monitoring the patient and real time data helps in diagnosing diseases at an early stage or even before the detection of disease, which have developed base earlier.
4. **Proactive Treatment:** Continuous monitoring of patient health opens the doors for providing proactive medical treatment.
5. **Medicines and Equipment Management:** Management of medical equipment and Medicines are major challenge in a healthcare industry. Through connected devices, these are managed and utilized efficiently with cost effective.

6. **Error Reduction:** Data developed by IoT devices helps in effective decision making also ensure smooth healthcare operations with reduced errors, waste and system costs.

IoT in healthcare is not an easy undertaking. IoT-enabled linked devices collect massive volumes of data, including sensitive information, raising concerns about data security. Adequate security measures must be implemented. IoT opens up new avenues for patient care by providing real-time health monitoring and access to patients' health information. This data is a treasure for healthcare stakeholders looking to enhance patient health and experiences while increasing income and enhancing healthcare operations. Being ready to exploit this digital power will be the difference in an increasingly linked society. Overall, IoT has made many applications in healthcare easier to work with, and there are several reasons to do so:

1. Making healthcare more accessible to all people who do not have access to healthcare providers or to public transportation to get to hospitals;
2. Giving medical staff more time to attend to patients who require more care;

3. Avoiding delays in the arrival of patients' medical information to healthcare providers, particularly in accident or emergency situations; and
4. Reducing manual data entry for patients.

LITERATURE SURVEY

Everyone has a basic need for healthcare. However the physicians are not genuine in terms of care and money with each patient. Another issue with the healthcare system is the scarcity of medical facilities to trace the patient's history in order to give proper treatment. As a result, the healthcare system must be optimized to become more efficient. This study presents a survey of the literature on various works done in the healthcare field utilizing IoT.

The system architecture is shown in Paper , and patient health parameters may be monitored in real time. A sensor captures patient health values and sends them to the Arduino 328P, which then sends them to the MySQL database server. This MySQL database server handles the data and makes it available. The patient can access this data via an Android app. Which one may be installed on an Android phone or tablet? If information about the patient is incorrect, the patient will be notified, and

caregivers will get an emergency alert. Decisions may be made fast and anyone can access the database based on the coordination of multiple decision making algorithms. The patient may access their medical record, resulting in improved healthcare for everyone and error-free and timely contact with patients.

This suggested smart health care monitoring system is being installed and tested on a patient whose personal information has been submitted into a web portal. The patient is linked to a smart health monitoring system that includes a heart rate sensor, blood pressure sensor, and temperature sensor. On a Wamp-based database server, a live graph of the patient's heart rate, blood pressure, and temperature is being watched.

This study focuses on an IoT-enabled healthcare system that not only enables the depiction and analysis of healthcare concerns, but also ensures enhanced health care services. The suggested system's goal is to give patients with efficient and smooth health services by incorporating networked information so that experts and physicians may use this data and deliver a smooth and rapid solution. Thus, this technology solves healthcare problems and connects patients across the country, as

well as clinicians, to monitor, track, and record patients' vital data and medical information in real time, so that the system may deliver continuous and effective solutions to patients on a regular basis.

The primary goal of paper is to incorporate IoT architecture to emphasis smart healthcare systems for real-time hospital system monitoring. In keeping with the Internet of Things vision, they propose a smart hospital system (SHS) that is built on complementary technologies such as RFID, WSN, and smart mobile that communicate with one another via a Constrained Application Protocol or Internet Protocol version6 (CoAP)/IPv6 over low-power wireless personal area network (6LoWPAN)/representational state transfer (REST) network infrastructure. In a healthcare automation setting, patient and environmental monitoring would be treated as a separate application system. In hospitals, there is no integration of environmental and patient monitoring. In a hospital, a doctor must create a patient report. In the event of an emergency, the doctor must be present in the hospital to generate a prescription. If a doctor is not at the hospital, he or she may send a report through text message or phone call, which may cause disagreements. As a result, a patient's

mobile-based application is required for the doctor, so that the doctor may deliver prescriptions from any place.

The suggested solution would be an IoT Smart Healthcare System. Smart Healthcare Systems for autonomous monitoring of hospital ambient factors and patient health problems. Various sensors are used to detect environmental conditions, including as (temperature, humidity, ambient light, etc.) The hospital's personnel is in charge of monitoring the ward's environmental conditions. RFID (Radio Frequency Identification Technique) is used to identify the sensors. Sensor identification may be validated using an RFID reader to assure authenticity and integrity. The Nurse is in charge of following or monitoring the patient's health state. The patient id will be updated for the nurse based on the patient description. Patients' monitoring data include their temperature and heart rate. The Nurse begins monitoring the patient's information, such as (temperature and heart rate), which are updated in the nurse page and shown in a dynamic graphical chart. Following that, the monitored data will be submitted to the doctor. Based on the patient's information, the doctor will create a graphical chart and provide the prescription. The graphical

chart and prescription will be saved as a PDF document and emailed to the patient.

This paper depicts the design and implementation of a smart health monitoring system. A patient can be monitored in this setting employing a collection of lightweight wearable sensor nodes for real-time sensing and analysis of numerous critical data. The gadgets effortlessly receive and communicate information with one another, as well as retain it, allowing data collection, recording, and analysis. As a result, patients will receive high-quality services since the support system medical staff will receive real-time information collection, eliminating manual data collection and enabling the monitoring of large numbers of patients. Designing a home-based vital sign monitoring system to acquire, display, record, and send physiological data from a human body to any place is feasible. This technology may be used to broadcast real-time patient vital parameter information to a remote location where the caretaker can view it. The Arduino Fio transmitter board is attached to the sensors. The detected values are wirelessly transferred to the Arduino Fio receiver, which is linked to the central station computer.

Because of rising life expectancy, society is getting older. As a result, Paper [8] focuses on a critical topic for ensuring life quality and safety. Existing and developing technology can give solutions that help support senior persons in their everyday lives, making it easy and safe. This work discusses the design approach of such instruments primarily for indoor and outdoor location health monitoring, which failed of detection and behavioural recognition and categorization. The authors suggest a design strategy for an IoT-based home care data system designed for usage in both indoor and outdoor environments. The present Design Methodology [DM] approaches the Smart Healthcare Systems problem not only from the designer's perspective, but also considering the contracting authority's and potential users' requirements, which means that apart from the technical constraints, the design procedure considers the multifunction constraints, including the lifetime, energy issue, usage comfort and even the price.

The suggested DM was validated using a case study of real-life situations in which senior individuals, particularly those with restricted mobility who live alone, require assistance. The objective indicated by the stakeholders and future users required the

system for recognizing people's position and their key function, but also to be able to recognize fundamental moments, and to categories them as risky, suspicious and normal or. The output of the completed design approach is IMU the system based, with a built-in three-axis accelerometer, gyroscope, magnetometer and altimeter. It is also allocated with heart rate, GPS, Wi-Fi and modules. For indoor-apartment localization with four room-zone level resolution, the IMU with PDR algorithm is utilized. For in-building localization with floor level precision, the BarFi algorithm based on pressure and Wi-Fi finger prints is presented.

The GPS module and PDR algorithm are used for outdoor localization with an accuracy of at least 10 meters. The IMU and thresholding algorithms are utilized to identify behaviors such as falling, laying, standing, sitting, and walking. The scientists created a six-element behavior vector and utilized it in conjunction with a decision tree algorithm to classify actions as risky, suspicious, or normal. The validation procedure for the most critical requirement soft the four room-zone level indoor apartment localization, fall detection, activity recognition, and classification as dangerous, suspicious, and normal situations demonstrates that

the system works in accordance with the required functionalities and constraints.

The suggested system in is a transportable physiological monitoring system that can continually monitor the patient's blood pressure, heart rate, and other most essential metrics at the hospital. They propose a continuous monitoring and control mechanism to monitor patient status and save patient data in server utilizing Wi-Fi Module based wireless connection, as well as smart storage system, data collection, and remote health care. The future component of the project is critical in order to progress the intended system. The progress in the intended system would be connecting more sensors to the internet, which would measure many other health metrics and be advantageous for patient monitoring, i.e. connecting all things to the internet for quick and seamless access. Create a Wi-Fi mesh network to extend the communication range.

The paper examines the use of IOT to build a real-world scenario of smart autonomous hospital administration. This paper aims to explain in detail the technology drivers behind IOT and health care, including data modeling of medical devices, data validation of critical

incidents, data mapping of existing IOT data into various other associated system data, the process flow behind the technical operations of remote device coordination, network architecture, middleware, databases, and application services. The use case discusses the issue related with the solution in this sector. This study focuses on four important parts of the smart hospital management system integrated with IOT medical devices: data models, architecture, workflows - process flows, and database decisions. All IOT medical devices may be classified as medicine monitoring, vital sign monitoring, activity monitoring, safety sign monitoring, patient identity, and laboratory monitoring. Among them, this effort concentrated solely on Vital Sign Monitoring.

The approach and procedure for the IOT enabled autonomous smart hospital management system with the following technological avenues: device selection, data modeling, interoperability, data mapping & data transformation, data validation & data cleansing, process flow configuration for event driven workflows, architecture and infrastructure selection details The problem of limited battery capacity in devices necessitates regular battery check-ups or replacement by the

power management framework connected. The quality executions specified a regular or method to assess the validity of the device's operating principles. Some of the future use cases that will be implemented as part of the system include lab management, out-of-hospital patient management, operational care, outpatient treatment, doctor appointments, room allocation, staff administration, and interdepartmental operations. The information created by real-time devices generates a vast volume of data, necessitating the use of a cloud and big data analytics platform.

CONCLUSION

The Internet of Things (IOT) has altered the way we think about and care for the less fortunate in our daily lives. It has evolved into a link between smart items, paving the way for the goal of anytime, anywhere, any media, any communication. The use of IOT is not only beneficial to physicians, but it is also beneficial to patients or the elderly in avoiding hospitals for minor inquiries, especially in a mobile environment with real-time IoT application systems. IoT has improved the features of smart health care systems. Work intelligence has been gathering data on a single point; many gadgets and front end views are offered by viewing the

aforesaid survey. All of the predictions we obtained from the survey are the many ways in which IOT is used in human monitoring on a regular basis. The problem is solved by fully utilizing updated and new generation technologies. Evolving smart health care devices is a viable method of manipulating present healthcare. There is also an increase in knowledge of smart illnesses and the adoption of government programmers to enhance quality of life.

REFERENCES

1. Perrier E., Positive Disruption: Healthcare, Ageing and Participation in the Age of Technology. Sydney, NSW, Australia: The McKell Institute. 2015.
2. Australian Institute of Health and Welfare. Australia's Health. [Online].2014.Available:<http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129548150>
3. Ravi Kishore Kodali, Govinda Swamy & Boppana Lakshmi. An Implementation of IoT for Healthcare. Conference Paper. 978-

-
- 1-4673-6670- 0/15/\$31.00 2015, IEEE. Methodology Approach. Appl. Sci. 2017; 7: pp. 596.
4. S. Sivagami, D. Revathy, L. Nithyabharathi. Smart Health Care System Implemented Using IoT. In International Journal of Contemporary Research in Computer Science and Technology (IJCRCST). March '2016; 2(3): e-ISSN: 2395-5325.
 8. Ahmed Abdulkadir Ibrahim & Wang Zhuopeng. IOT Patient Health Monitoring System. In Sangeetha C.N. Int. Journal of Engineering Research and Application. January 2018; 8(1): pp.77-80. ISSN: 2248-9622, (Part - III), Application www.ijera.com.
 5. Durga Amarnath M. Budida, Dr. Ram S. Mangrulkar. Design and Implementation of Smart HealthCare System Using IoT. In 2017 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), IEEE, 2017.
 6. Vikas Vippalapalli & Snigdha Ananthula. Internet of things (IoT) based smart health care system. In International conference on Signal Processing, Communication, Power and Embedded System (SCOPE)- 2016, 2016 IEEE.
 7. Damian Dziak, Bartosz Jachimczyk & Wlodek J. Kulesza. IoT-Based Information System for Healthcare Application: Design