

# Applications of IoT in Healthcare Sector

**Divya Singla<sup>1</sup>, Kamna Billus<sup>2</sup>, Arti<sup>3</sup> & Meenakshi Sharma<sup>4</sup>**

<sup>1,2,3,4</sup>Assistant Professor, Department of Computer Science

Sanatan Dharma College, Ambala Cantt

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## ABSTRACT

Nowadays IoT is been implemented in almost every field but it has its massive importance in medical field. IoT has played a very important role in the field of medicine and therefore is an indispensable part of our lives. This paper introduces the various applications of IoT in healthcare sector.

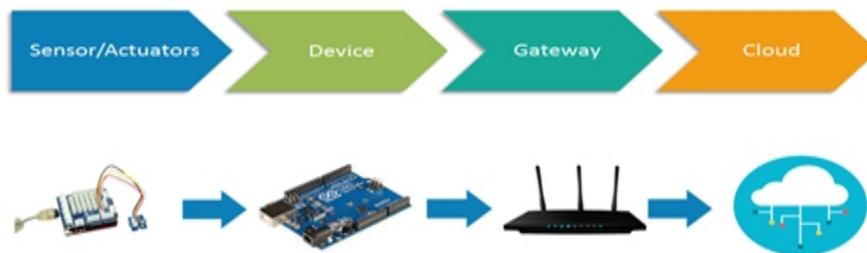
**Keywords:** Internet of Things, Machine Learning, smart devices

## I. Introduction to IoT

IoT(Internet of Things) is the need of the hour and is being used in almost every application these days. It has its utmost importance in the medical field and used for many purposes. IoT is discussed below:

**A. Definition of IoT:** In 1999, the idea of the Internet of Things was put forth. The internet of things is a network in which infrared sensors, and radio frequency identification (RFID), laser scanners, global positioning systems (GPS), and other using an information sensors and the established protocol synchronize in order to connect everything to the internet. After which information is discussed and shared in order to realize intelligent identification, tracking, management and observation. Based on the internet of computers, the internet of things utilizes wireless data connections and RFID to build a network that can reach every corner of the globe. With the IOT, objects can speak to one another without any human involvement. Its main component is the use of RFID (Lu, 2011).

**B. Structure of IoT:** The Internet and the IOT have significant differences on the basis of participation and data flow on the internet. **Figure 1** describes the IOT's structure. The ID is for static characteristics of the objects. Sensory information represents the dynamic data i.e. obtained from the sensor. The gateway device is the read-only device. The Host Information Management System is a regional information processing hub, similar to the smartphone and PC. Wider-area networks are for the communication. The structure of IoT is shown in Figure 1.



**Figure 1: Structure of IoT (Images)**

### **I. Applications of IoT in Medical System**

The internet of things is used to enable a vast array of applications, including those in the health care sector. Concerns with the IOT have grown in importance since they reduce the expense and fatigue of the patients as well as parallel advancements in the results. Health industry with Internet of Things in the care sector would enable effective and simple management and monitoring. Some of the applications in Medical System are:

**A. Clinical Care:** The application possibilities for IOT in medical information management have increased. The following are the primary requirements for hospital information management: Identification, sample identification, and identification of medical records. These include case identification with illness recognition, case identification with patient identity, case identification with doctor identification, sample identification with medication identification, medical equipment identification, testing product identification, and so on. The hospital's needs can be satisfied via IOT(Lu, 2011).

**B. Smart wearable devices for health monitoring:** Patients who need to gather information about their health status, such as their heartbeat, blood pressure, and glucose level, can utilize smart wearable devices, which have sensors and send that data to smart phones. Patients' health statuses can be observed concurrently (Bahar Farahani, 2018). Health service centres give health instruction by extracting the user's

health information, while rehabilitation centres provide remote rehabilitation counselling based on a variety of recovery information. As a result, they should need a way to share network resources and an efficient way to retrieve information.(Liu, 2015)

**C. ECG Signal Analysis and Arrhythmia Detection:** IoT is being used for chronic health diseases like cardiovascular diseases (CVD) which is one of the main reasons for premature death worldwide. A wearable ECG diagnosis device is suitable for 24 hour monitoring of the patient even when the patient is at home and therefore helps in early detection of Arrhythmia detection(Azariadi, 2016).

**D. Telemedicine and 3-D printing technology for medical devices:** There are many medical devices which have been developed during COVID-19 using 3-D printing technology embedded with IoT. For e.g. Surgical and N95 respirator, Respiratory valve of ventilator part, Face shield, Personal Protective Equipment(PPE), Hand sanitizer Holders, 3-D printed quarantine booths, SARS-CoV-2 test swabs etc. Also, IoT is used in the telemedicine field and got more popularity during COVID-19 pandemic which is also used for monitor quarantine compliances, contact tracing, social distancing, diagnosis, monitoring etc(Chandra, 2022).

**E. 5-G Enabled healthcare applications and services:** massive Machine Type Communication (mMTC) offerings offer aid to 5G enabled Medical IoTs (MIoTs) that may be used to display and deal with faraway patients. mMTC will join and allow verbal exchange among heterogeneous gadgets into the 5G community with a view to function in synchronicity. A sensor in a wearable tool of the affected person can without delay ship a sign to the faraway nurse through 5G community in order that the nurse can set off a unique system with inside the affected person's room the use of the cell tool(Siriwardhana, 2021).

**F. Medical Imaging:** Medical imaging refers back to the obtaining inner photos of the human frame for the analysis of the disorder or remedy or research. The clinical imaging is one of the essential necessities inside the hospital. The IoT with inside the clinical imaging permits the sharing, analysis and the retrieval of records with inside the actual time and eludes the hassle of repeated examinations, session problems and the misdiagnosing. Few areas where medical imaging is applied are:

**MRI (MAGNETIC RESONANCE IMAGING):** MRI helps to take high quality images of the internal body which is used in the diagnosis of brain tumors, head or brain injuries, problems in spine, heart joints and bones, abnormalities in the liver, uterine, abdomen and the brain.

**X-RAY (X-RADIATION):** X-Ray is used in the diagnosis of various abnormalities in the body as it helps in capturing clear and precise pictures using the radiation.

**CT (COMPUTED TOMOGRAPHY):** It is generally used for the endoscopic surgery. CT Scan is used for having detailed pictures of human organs taken in very thin slices.

**ULTRA SOUND:** ULTRA SOUND is the acoustic energy in the form of waves used for having a look inside the human body. It is basically used for abdominal problems, kidney & uterus problems, identifying the status of baby in fetus etc(Chandy, 2019).

### **Conclusion**

Modern Medicine is a very wide field to implement latest technologies. IoT has opened new doors for it and is contributing in various ways to ease things and get updated data in real time. The trend is young and quite promising and shows new paths for research in this field. IoT has showed its existence in various application in healthcare. Few of them are discussed above. IoT has helped in creating more personalized approaches for the health analysis and disease monitoring. Proper usage of IoT helps in cope up of various challenges in medical field like price, speed and complexity etc. In future, this digitally controlled health monitoring and health management system will help in enhancing the performance of healthcare.

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