

---

# A PERVASIVE STUDY ON APPLICATIONS AND TECHNOLOGIES OF INTERNET OF THINGS (IOT)

**S. Manoj Kumar**

Professor, Department of Information Technology,  
Karpagam College of Engineering, Coimbatore, Tamil Nadu, India

**K. Mahalakshmi**

Assistant Professor, Department of Commerce,  
PSGR Krishnammal College for Women, Coimbatore, Tamil Nadu, India

**P. Xavier**

Assistant Professor, Department of Mathematics,  
Karunya Institute of Technology and Sciences, Coimbatore, Tamil Nadu, India

## ABSTRACT

*In present era, the Internet of Things (IoT) continues to gain momentum rapidly. The Internet of Things has enormous applications in healthcare Industry from remote monitoring to smart sensor enabled medical device integration. IoT ensures many benefits in healthcare and has potential to improvement of patient outcomes, data management and security in hospital, quality treatment and more. IoT technology has huge impact on Healthcare to transform patient care and improve physician service efficiency. The present study has focused the applications and technologies of IoT in healthcare care sector and how far it benefits to healthcare stake holders.*

**Key words:** Internet of Things (IoT), Medical Instruments, Sensor, Telemedicine.

**Cite this Article:** S. Manoj Kumar, K. Mahalakshmi, P. Xavier, A Pervasive Study on Applications and Technologies of Internet of Things (IoT), *International Journal of Mechanical Engineering and Technology* 10(1), 2019, pp. 1007–1013.  
<https://iaeme.com/Home/issue/IJMET?Volume=10&Issue=1>

---

## 1. INTRODUCTION

### 1.1. Internet of Things (IoT)

The internet of Things (IoT) has played vital role in everywhere. In Internet of Things objects are connected with sensors or can be controlled remotely across existing network and able to create direct integration to computer. IoT is continuously getting momentum rapidly and predicted to be the most significant factor that impacts fundamental business logic in the future in all the industry. Through the Internet of Things, improved efficiency and more

accuracy can be obtained with the result of economic benefit in addition to reduction of human intervention.

Internet of Things (IoT) applications can be evolved between the people, between people and things, between things and things.

Presently there are about 4.6 billion connected devices (excluding phones, tablets and laptops) and also expected to increase to 15.3 billion in next five years according to the Ericsson mobility report. According to Business insider intelligence report, in worldwide 34 billion number of IoT connected devices will be in use by the year 2020. IoT applications can be found in every industry including application for smart homes, smart buildings, transportation, Health and personal care, retailing, smart farming, construction industry and so on. Since the Internet of Things (IoT) continues to gain momentum rapidly, IoT ensures benefits in different horizons in every industry.

## 2. APPLICATIONS OF INTERNET OF THINGS (IOT)

Internet of Things (IoT) is a combination of software and hardware which ensures the technology producing the trillions of data are sensed and connected with multiple devices under the cloud platform with intelligent tools. IoT device can be anything at anywhere which can transmit and receive data over the cloud and designed to process of ultimate task. In present era, IoT application being found every industry and everywhere. It reflects in the form of Smart home, smart transport, smart farming, IoT smart waste management and many more.



Figure 1

(IoT) is a shared network of objects or things which can interact with each other provided the Internet connection. IoT plays significant role as it has witnessed profound changes during successive decades. Internet of Things (IoT) has made tremendous changes and gained prominence role in all entire field.

## 3. INTERNET OF THINGS IN HEALTHCARE

Internet of Things (IoT) in healthcare is a wireless communication system that connects patients and health providers to diagnose, monitor, follow up and store the vital medical information with as apps, system, device and more. The Internet of Things (IoT) healthcare is used to connect the people by collect the data about the patient and the real time information to physicians and make assessment on complete view of patient's health.



**Figure 2**

IoT monitors the patient's health and helps the physician to diagnose and investigate with the complete information in real time system resulting of better connectivity between patients and Health service provider. Smart healthcare helps to assures quality work force and also helps to evaluate their service thereby they can develop and improve the service. IoT healthcare enhances the better quality treatment and also provides awareness and education to the people

#### **4. APPLICATIONS OF INTERNET OF THINGS (IOT) IN HEALTHCARE**

The Internet of Things has enormous applications in healthcare Industry from remote monitoring to smart sensor enabled medical device integration

- Medical consultation and advice through IoT
- Outpatient appointment by mobile phone SMS reminder
- Network based electronic Health record
- Information collection Healthcare alarm
- Remote chronic monitoring intelligent health estimation
- Pregnancy caring and monitoring system
- Monitoring elderliness
- Monitoring patient behavior
- Stress monitoring
- Monitoring social activities
- Preventive health care system and continuous monitoring
- Monitoring the various therapies and treatment using IoT
- Automate hospital management Using IoT.

## 5. IOT SMART MEDICAL DEVICE IN HEALTHCARE

The Internet of Things has myriad applications that ensures benefit to patients, Physicians, families and other stake holders. IoT helps to keep the patients healthy and helps physician to keen assessment, diagnose and to treat. The Internet of Things has significant impact in workflow optimization and other aspect of healthcare. The Internet of Things has brought up the numerous devices in healthcare industry. In present days everything can be possible in even remote distance as connected with the IoT technologies. Besides, Sensors embedded in medical equipment, surgical robots and device implants with wearable technology and many more. IoT enabled wearable medical tech device helps to medication adherence and home monitoring. IoT ensures many benefits in healthcare and has potential to improvement of patient outcomes, data management and security in hospital, quality treatment and more.

## 6. WEARABLE IOT DEVICES IN HEALTHCARE

IoT healthcare solutions and wearable devices are reshaping the healthcare industry. IoT technology in healthcare sensed with as wearable in the form of

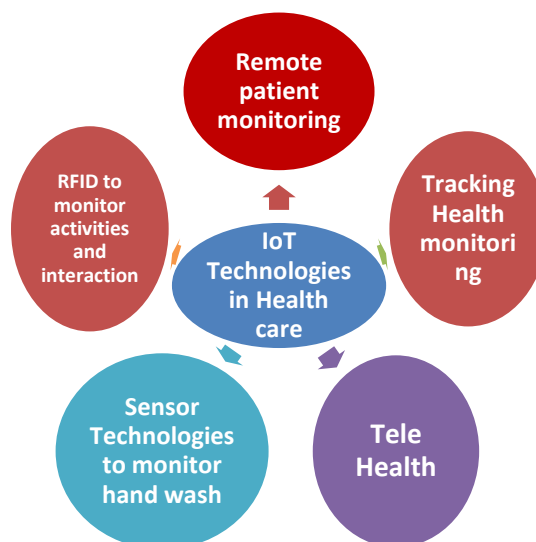
- Activity trackers
- Smart watches
- Smart jewelry
- Interactive shoes
- Smart clothing
- Head phones and more as wearable with comfort etc.

**Table 1**

<b>IoT-HEALTH CARE DEVICES</b>			
<b>Health monitors</b>	<b>Activity related Monitors</b>	<b>Safety related Monitors</b>	<b>Medication Monitors</b>
Weight measuring Device	Walking time measuring device	Fall detection device	Smart pill dispenser
BP measuring device	Step counting device	Personal safety and tracking device	Medication adherence system
ECG	Speed measuring device	Clothing sensed device	
Blood glucose measuring device	Calorie spent device		
Heart rate measuring device	Rest or sleeping measurement device		
Pulse oximeters			
Head set measuring brain waves.			

## 7. IoT TECHNOLOGIES IN HEALTH CARE

Healthcare has dramatic changes with amazing IoT technologies and shaping up the industry witness of accelerate the larger health system. There are many innovations in medical devices, software technologies, services and applications using IoT in healthcare.



**Figure 3**

IoT Healthcare is new paradigm which delivers the services and clinical information connected even remote locations. It provides the better assessment, rendering diagnose, and treat the patients effectively. Collecting the data using IoT assist to health monitoring system includes personalised alerts to patients and health provider. It also enables the surgeon to perform on a patient from distance location by using of IoT robotics technology. Smart Healthcare provides the awareness and medical education about Health status by providing information from time to time. IoT enabled healthcare technologies has more significance for process the Healthcare information to healthcare service providers, Research and development in medical field and government, healthcare service Community and targeted group. IoT ensures monitoring and engagement and activities of elderly people in hospital and nursing homes and also track the wandering patients. IoT Patient monitoring helps to monitor the chronic conditions as well as predictive analysis of patients with the usage of wearable and other devices at home and hospital.

### **7.1. Advantages of the Internet of Things (IoT) in healthcare**

The Internet of Things (IoT) plays a vital role in healthcare as it ensures many benefits in the entire segment.

### **7.2. Improved treatment outcomes**

IoT Healthcare integrated system through cloud computing or virtual infrastructure provides caregiver to access the real time information and can treat time to time with collected data evidence based. Collectively it leads in treatment outcomes are improved.

### **7.3. Reduced costs**

In Internet of Things (IoT) healthcare system, patient monitoring can be done on real time basis which results in significantly cutting down on un necessary visits by doctor. As well as homecare facilities also cut down the cost of hospital stays and re admission. Wearable devices produce the real time data and remote monitoring of patients which has reduced the healthcare cost as do not require to meet patients physically.

#### **7.4. Enhanced patient satisfaction**

Through IoT Healthcare system, timely intervention can be possible by physician and enhanced better treatment outcomes in accountable care with result of highly trusted among the patients.

#### **7.5. Real time Data for healthcare providers**

IoT Healthcare provides the real time data of patients. There are many healthcare wearable devices and IoT enabled apps which ensures patient's real time data for better care and treatment. This helps to bring the data accuracy time to time.

#### **7.6. Better patient Healthcare awareness and timely Health alerts**

With the application of IoT, patient can use app, devices and any other related technologies to assess their own health status and by this way patient can get the awareness and make effective care management on their health. It has resulted in enhancing increased interest in fitness. It also send the alerts to the patient and also available to healthcare provider and can get alerts about the patient's health status and access the data if any critical care patient.

#### **7.7. Enhanced Drugs and medication management**

IoT helps in medication by smart pill camera, smart pill dispensaries, smart wireless pill bottles to track the medicines and auto filled when it is required. Patient also gets alerted by displaying message as reminder. IoT enabled medication management is also providing better chronic care and enhanced better drug management.

### **8. CONCLUSIONS**

IoT ensures many benefits in healthcare and has potential to improvement of patient outcomes, data management and security in hospital, quality treatment and more. IoT enabled wearable medical tech device helps to medication adherence and home monitoring. IoT technology has huge impact on Healthcare to transform patient care and improve physician service efficiency. It also created strategic changes across the healthcare industry resulted in improving patient outcomes, lowering cost and efficient service by smart data gathering for personalized treatment. The internet of Things (IoT) is being transforming the healthcare industry by redefining in apps, devices, people are connected with each other in delivering healthcare solutions. when patients are monitored on a continuous basis, thereby healthcare providers are able to access real time data and can treat accordingly without delay. Thus Internet of Things (IoT) plays predominant role in healthcare care sector in all the aspects.

### **REFERENCES**

- [1] Na Wang and Jiwen Zeng, "All-Direction Random Routing for Source-Location Privacy Protecting against Parasitic Sensor Networks" *Sensors* (Basel). 2017 Mar; 17(3): 614.
- [2] Joanna F. Laikin ; Matthew Bradbury ; Chen Gu ; Matthew Leeke, "Towards fake sources for source location privacy in wireless sensor networks with multiple sources" *IEEE International Conference on Communication Systems (ICCS)*, 2016
- [3] R. Agrawal, A. Evfimievski, R. Srikant, "Information sharing across private databases in.": *Proceedings of the 2003 ACM SIGMOD International Conference on Management of Data*, 2003, pp. 86–97.
- [4] L. Sweeney, "K-anonymity: a model for protecting privacy, *International Journal on Uncertainty, Fuzziness and Knowledge based Systems*" 2 (2) (2002) 557–570. pp. 86– 97.

- [5] Na Li, Nan Zhang, Sajal K. Das, and Bhavani Thuraisingham, "Privacy preservation in wireless sensor networks: A state-of-the-art survey". *Ad Hoc Networks* 7 (2009) 1501–1514.
- [6] Jean-Francois Raymond. *Traffic analysis: Protocols, attacks, design issues and open problems*. In *Proceedings of International Workshop on Design Issues in Anonymity and Unobservability*, pages 10-29. Springer- Verlag New York, Inc., 2001.
- [7] Celal Ozturk, Yanyong Zhang, and Wade Trappe, "Source location privacy in energy-constrained sensor network routing". In *SASN '04: Proceedings of the 2nd ACM workshop on Security of ad hoc and sensor networks*, pages 88-93, New York, NY, USA, 2004. ACM.
- [8] S. Manoj Kumar N.Rajkumar W.Catherine "Dropping False Packet to Increase the Network Lifetime of Wireless Sensor Network using EFDD Protocol" *International Journal SPRINGER - Journal of Wireless Personal Communication* Volume 70, Issue 4 June 2013, Page 1697-1709
- [9] S. Manoj Kumar, N, Rajkumar, "SCT Based Adaptive Data Aggregation for Wireless Sensor Networks", *International Journal SPRINGER - Journal of Wireless Personal Communication* Volume 75, Issue 4 April 2014, Page 2121-2133
- [10] Jing Deng, Richard Han, and Shivakant Mishra. *Intrusion tolerance and anti-traffic analysis strategies for wireless sensor networks*. In *DSN '04: Proceedings of the 2004 International Conference on Dependable Systems and Networks*, pages 637-646, Washington, DC, USA, 2004. IEEE Computer Society.
- [11] Yi Ouyang Zhengyi Le, Guanling Chen, James Ford, and Fillia Makedon., "Entrapping adversaries for source protection in sensor networks". In *WOWMOM '06: Proceedings of the 2006 International Symposium on World of Wireless, Mobile and Multimedia Networks*, pages 23-34, Washington, DC, USA, 2006. IEEE Computer Society.
- [12] Jing Deng, Richard Han, and Shivakant Mishra. , "Intrusion tolerance and anti-traffic analysis strategies for wireless sensor networks". In *DSN '04: Proceedings of the 2004 International Conference on Dependable Systems and Networks*, pages 637-646, Washington, DC, USA, 2004. IEEE Computer Society.
- [13] Y. Jian, S. Chen, Z. Zhang, and L. Zhang, "Protecting receiver-location privacy in wireless sensor networks." *May 2007*, pp. 1955-1963
- [14] Kong, J., Hong, X.:" Anodr: anonymous on demand routing with untraceable routes for mobile ad-hoc networks". In: *MobiHoc 2003: Proceedings of the 4th ACM international symposium on Mobile ad hoc networking & computing*, pp. 291–302. ACM, New York (2003)
- [15] Nezhad, A.A., Makrakis, D., Miri, A.:" Destination Controlled Anonymous Routing in Resource Constrained Multihop Wireless Sensor Networks". In: *Wireless Sensor and Actor Networks*, December 2007. IFIP International Federation for Information Processing, vol. 248, pp. 83–94. Springer, Boston (2007)
- [16] Pfitzmann, A., Hansen, M.: *Anonymity, unlinkability, undetectability, unobservability, pseudonymity, and identity management - a consolidated proposal for terminology*(February 2008)
- [17] S. Manoj Kumar N.Rajkumar W.Catherine "Dropping False Packet to Increase the Network Lifetime of Wireless Sensor Network using EFDD Protocol" *International Journal SPRINGER - Journal of Wireless Personal Communication* Volume 70, Issue 4 June 2013, Page 1697-1709
- [18] S. Manoj Kumar, N, Rajkumar, "SCT Based Adaptive Data Aggregation for Wireless Sensor Networks", *International Journal SPRINGER - Journal of Wireless Personal Communication* Volume 75, Issue 4 April 2014, Page 2121-2133