International Journal of Electronic Devices and Networking

**E-ISSN:** 2708-4485
**P-ISSN:** 2708-4477
IJEDN 2022; 3(2): 22-27

www.electronicnetjournal.com
Received: 04-05-2022
Accepted: 05-06-2022

**Sanya Garg**
School of Computer Science and Engineering, Vellore Institute of Technology, Chennai, Tamil Nadu, India

**Correspondence**
**Sanya Garg**
School of Computer Science and Engineering, Vellore Institute of Technology, Chennai, Tamil Nadu, India

# The role of internet of things in e-healthcare sector

**Sanya Garg**

**Abstract**
The Internet of Things (IoT) is a global network that connects millions of computers and different devices to enable electronic communication between systems. It is the interconnection of uniquely identifiable embedded computing devices. This interconnection generates a lot of data and more efficient services with a minimal amount of human interaction. When multiple devices come together to create a coherent system that can act with its own intelligence without the need for human interaction and interpretation is called IoT. It combines a variety of technologies into a semi-autonomous network, making the network the backbone of IoT. IoT is considered to be the next building block in revolutionizing various sectors like agriculture, healthcare, transportation, smart cities, etc. The infusion of smart connected technology into the world of medicine is changing the view of the healthcare sector for the better. With self-monitoring medical devices, barcode prescription tracking, interconnected devices in hospitals, automated medical diagnosis, cloud-based medical recordkeeping, etc IoT has improved accuracy, reduced human error, and improved efficiency in this sector.

**Keywords:** Internet of things, internet, health, healthcare, smart technology

## 1. Introduction
The Internet has been evolving continuously from a simple network of computers to a larger and more complex network of multiple devices connected together. Internet of Things (IoT) serves as a network for a device to be connected with other multiple devices at any time or anywhere sing any network, path, or service. It is an interconnected system of devices sharing their capabilities to interoperate and communicate through the internet as a common platform. IoT offers a virtually limitless supply of opportunities in various fields like business, research, healthcare, data, consumer electronics, etc. And with a growing rate of success, the technology revolution has been largely scaled and we have been able to accomplish smart reorganizations, tracing, positioning, control, real-time monitoring, and process control through IoT [1]. In addition to these, the Internet of Things has numerous other potential applications which are diverse and merge into daily life activities of individuals, institutions, and society. The Internet of Things (IoT) has grown in popularity throughout the years, with only 1, 00,000 people utilizing it in 1992. The population reached a half-billion people in 2003. In 2009, the Internet of Things (IoT) was launched; by 2012, the number of individuals utilizing IoT had increased to 8.7 billion, and there were 8.7 billion people sing IoT. Over the years, the number of users has grown tremendously, reaching 28.4 million. In 2017, the total revenue was $1 billion. By 2020, the fig re is predicted to reach 50.1 billion [2].
According to [3], IoT applications reach a wide range of industries, including man fact ring, healthcare, agriculture, smart cities, security, and disaster relief, to name a few. According to [5], IoT has led to transitioning of places from ‘cities’ to ‘smart cities and living has now become ‘Smart Living’. The Internet of Things has enhanced daily h man lives through its capabilities of intelligent transportation systems, traffic systems, waste management, health monitoring, air and water quality monitoring, smart homes, etc. Contributions like soil examination, moist re control, regulation of microclimate conditions, cattle health monitoring etc. through the internet of things have strengthened and enhanced the agricultural sector which was proved by [6]. Existing IoT applications in this sector are SiSviA, GBROOS, and SEMAT.
IoT has also made important contributions to the h man healthcare sector. The increased consistency in the Healthcare system is a result of the Internet of Things. Most countries had healthcare systems that were inconsistent, slow, prone to error, and disorganized.

Health being a very essential part of life, it was necessary to improve and manage the healthcare sector and their data better. This vision was supported, achieved, and backed by the Internet of Things. IoT enabled the tracking of patients, employees, and items, as well as the identification and authentication of individuals, as well as the automatic collection of data and sense. Authentication and identity help to prevent potentially dangerous situations for patients. Furthermore, process automation, form processing timeline reduction, automated procedure auditing, and medical inventory management all benefit from automatic data gathering and transfer [4]. Additionally, the Internet of Things can facilitate various operations like report sharing to multiple individuals and locations, record-keeping, and dispensing medications are feat res that would advance the healthcare sector further.

## 2. Healthcare system in the 1980s before IoT

According to [7], from limited doctor visits and text communications to zero capabilities of monitoring a patient's health, costly healthcare services, aging of the global population, the number of rising chronic diseases, and other multiple issues made the healthcare system in the 1980s before IoT. [9] Proves that the healthcare system back in the day was inconsistent, slow, prone to error, and inefficient. The system had a tendency to delay quality care for those who are most in need of it. This contributes to avoidable healthcare disparities for people who were discriminated against on various basis like color, religion, nationality, and other disadvantaged groups. Even healthcare policies like insurance offered by various companies were misdirected. Many health insurance companies restrict expensive medications, tests, and other services by declining coverage until forms are filled o t to justify the service to the insurer. This disco rages the right care needed by the person.

Before IoT could contribute to the healthcare system, the system was all about 'delayed' treatment d e to irregular monitoring and diagnosis of the patients. [10] Calls the preceding system of healthcare management a dizzying array of highly decentralized sectors. Despite the fact that physician groups were growing in size, 37% of practicing physicians were still working in their own practices (Center for St dying Health System Change, 2002). With the market share of health maintenance organizations (HMOs) falling and preferred provider organizations (PPOs) becoming more popular, the health plan sector moved away from structures that can facilitate integration and coordination (Kaiser Family Foundation and Health Research and Educational Trust, 2002). The hospital industry had been consolidating in many markets—more than 3,500 of the 5,000 community hospitals are part of a network or system—the majority of these agreements focused on administrative rather than clinical integration.

The lack of systems, or the poorly designed systems that do exist, and the resulting lack of integration can be seen across sectors as well as within individual healthcare organizations. Such systems have the potential to harm patients or fail to deliver what they require. The fail re to apply human factors knowledge in system design and the fail re to incorporate well-accepted safety principles into health care (such as standardizing and simplifying equipment, supplies, and processes) are key contributors to the unacceptably high n umber of medical errors that occur, according to a [10] IOM report. [11] Tells patients to spend a lot of time consulting with a never-ending stream of doctors, nurses, therapists, social workers, home care workers, nutritionists, pharmacists, and other specialists, all of whom are often unaware of previous medical histories, medications, or treatment plans and thus work at odds. When patients are moved from one setting to another, care results in overlapping or conflicting treatment that is costly, conflicting and confusing, and, worst of all, detrimental to the patient due to incapability of storing medical data and histories.

## 3. How IoT has improved the Healthcare System?

[12] Shows Scholars from all over the world have grad ally invested in smart health research based on the Internet of Things since 2003. As a result, some academics have created smart wearable systems to address health issues. With its endless applications in the structure, the Internet of Things has reshaped the healthcare industry.

For all intents and purposes, this change occurs when existing medical devices are connected together like devices in the intensive care unit, emergency room, operation room, wearable devices, monitors, etc. are connected wirelessly to the IoT, and then to each other and to a central database. Instead of reporting independently, these devices send data in real-time to an automated or a doctor-monitored service that can make immediate sense of all the readings and the, initiate actions based on that analysis.

Additional IoT-fueled change comes from the centralization of medical records which has reduced errors and chaos made d ring emergencies for past medical records. Physical records are being digitized, and new records are entered into centralized computer databases. Data is stored in the cloud for multiple doctors to view and add their contributions. Now, since one doctor can see other doctors' prescriptions, it eliminates cross-diagnoses and dangerous drug interactions resulting in a more coordinated, effective, and efficient treatment. This will also reduce medical costs over the long run and will make preventive medicines more common. Therefore, cobbling together the IoT in the healthcare environment, some real and significant benefits are involved:

- Decreased cost of care
- Improved patient outcomes – patients get faster, better, efficient, and more effective treatment.
- Real-time disease management – constant monitoring improves treatment plans, helps keep a better track of health, and reduces the number of doctor visits saving time for both the patient and the doctor. The doctor can now attend more number of patients.
- Improved quality of life – with more effective treatments and more preventive treatments, IoT has helped people with transitory and chronic diseases lead normal lives.
- Improved user experience – IoT helps to cut the workload of doctors, nurses, and staff resulting in better treatment decisions and a better healthcare experience for the patient which further benefits the healthcare providers.

According to [8], one of the first and the most important steps to smarter healthcare is the se of remote monitoring devices leading to preventive care and readmission prevention. These smart medical devices enable patients to

receive the same level of monitoring from the comfort of your home, enabled by wireless communication over the internet, that enables your healthcare facility to track your health stats, physical activity, and drug consumption in real-time and alert the necessary personnel if a medical emergency occurs. Data from individual devices can be integrated into larger systems. Manipal Health Services is one such example of a large system of medical data. They provide pregnant mothers with a wearable fetal monitoring system that ties into a corresponding smartphone app. This system provides the mothers with real-time data about fetal heart rate patterns and labor progress. This data is also shared with their physician to keep track of their health and make more informed decisions. Once the data is collected, the software looks for trends in the statistics, and anomalies are noted which adds value in detecting long-term changes in the patient's health. This ongoing monitoring and analysis help in keeping from emergency care and situations. The vast amount of data is a huge opportunity for those companies that can fig re o t and offer solutions to hospitals and other healthcare providers. One example of such companies is free scale Semiconductor which has developed a reference platform called 'Home Health Hub' that enables application developers to create 'telehealth' applications that collect and share patient data and also provide medication reminders. [13] Shows some IoT discoveries that have taken the healthcare system to the next level:

### A. Smart Monitoring for seniors

Medical IoT holds the capabilities of real-time monitoring and assisted living facilities for seniors. Newer wireless monitors and reporting systems will enable seniors to receive quality care from the comfort of their homes. Such monitoring is accomplished by wearable devices and specialized sensors which can be installed in homes to monitor health and physical activities. With the goal of wanting to improve the quality of life for seniors to keep them safe and healthy, there are many companies getting into connected senior care like 'Healthsense' which offers eNeighbor monitoring systems which can detect falls sing wearable sensors and has an emergency call pendant, 'BeClose' system places smart sensors to keep track of normal routines and 'Independa' offering remote care technology used in assisted living facilities.

### B. Smart Medicines

Every year, more than a million people suffer from medication errors by taking wrong medicines or wrong quantities of medicines, and such errors should be completely preventable. IoT has numerous approaches that will help ensure that people take only prescribed medicines and in the correct dosages. Barcode-based-medication administration system is one such approach that cuts the error rate substantially by sing barcodes on all medicine containers. An alternative approach is to make the whole process wireless. Medication containers have embedded radio-frequency identification (RFID) tags which are read sing smartphones. This approach is portable, more efficient, and offers potential for additional tracking if the given drug was beneficial or not. Another approach includes Vitality's GlowCap which is an electronic cap that can fit any prescription drug bottle and it uses light and sound reminders to signal when it's time to take a particular medication. When the pill bottle is opened, a chip inside GlowCap wirelessly relays information to the physician, and a push bottle at the bottom orders a refill when the bottle empties.

### C. Ingestible Sensors

There's a lot of data that could be gathered by smart pills. The 'Digital Health Feedback System' from Proteus feat res an ingestible sensor placed within a smart pill. The sensor is powered by contact with your stomach and transmits information not only about when the pill was swallowed, but also provides metrics regarding heart rate, body position, and activity. In this instance, the smart pill beams its data to a micro-electronic patch on the user's stomach. The patch then transmits data via Bluetooth to the patient's smartphone, and from there to the doctor or other healthcare provider.

### D. Smart Medical Records

One of the major challenges in today's healthcare system involves your patient records. The goal is that all medical records should be centralized so that every healthcare provider can easily access but it hasn't happened yet because major medical records are paper records that cannot be easily shared and consolidated, and centralizing data from all the wearable devices is even tougher. The key to more effective and efficient medical recordkeeping is to go all electronic. This means keeping new records digitally in computer databases that can be accessed from multiple providers and then storing them in cloud-based storage. That would reduce paperwork, speed p processing, and provide faster and more accurate diagnoses. Such a centralized electronic health record is called a Personal Health Record (PHR), on which many hospitals and companies are working. Several big companies and organizations are trying to create PHR databases and applications that span multiple facilities and providers.

### E. Smart Hospitals

Hospital error is the sixth leading cause of preventable death. More than 50,000 people get killed every year d e to h man error. C e the Internet of Things and related smart technology. Connected devices and systems, along with intelligent data distribution and analysis, promise a revolution in the way hospitals work and paves way for unique and efficient advancements in medical technology. For a long time, the medical fraternity believed that continuously monitoring patients drastically improved outcomes and IoT gave shape to this belief with the placement of ECG monitors, pulse oximeters, and multi-parameter monitors in every hospital room. These monitors keep track of patients, help maintain records, and alert in case of an emergency. All the devices used by a given patient are connected to each other and a central monitoring station, which makes these devices smarter, and more effective and reduces the amount of time that staff spends dealing with them.

Another important step in creating smarter hospitals is establishing smarter standards that will enable different types of devices, from man factures, to communicate with one another. That's being done with Integrated Clinical Environment (ICE) standards which define the necessary control, data logging, and supervisory functionality to create intelligent connected healthcare systems. The ICE standard is identified as ASTM F2761-2009. ASTM International is a

non-profit organization that develops and publishes voluntary technical standards in a variety of industries. The key elements in the ICE standard include The Network Controller generates alarms if a connected device malfunctions and also provides historical data logs, the Network Supervisor is the programming that provides intelligence in the system and the Network Interface connects medical devices with the network controller. The connections and communications between devices are standardized to ensure interoperability. The goal is to ensure the safe integration of medical devices to help hospitals operate better.

## 4. Redefining HealthCare

The proliferation of healthcare-specific IoT products opens p immense opportunities. And the huge amount of data generated by these connected devices holds the potential to transform healthcare. IoT has a four-step architect re that is basically staged in a process. All four stages are connected in a manner that data is captured or processed at one stage and yields the value to the next stage. Integrated values in the process bring intuitions and deliver dynamic business prospects. The first step consists of the deployment of interconnected devices that includes sensors, actuators, monitors, detectors, camera systems, etc. These devices collect the data. s ally, data received from sensors and other devices are in analog form, which needs to be aggregated and converted to digital form for further data processing. Once the data is digitized and aggregated, this is pre-processed, standardized, and moved to the data center or Cloud. 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 redefining healthcare by ensuring better care, improved treatment outcomes and reduced costs for patients, and better processes and workflows, improved performance, and patient experience for healthcare providers.

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 apt 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 patients' health and experiences while making revenue opportunities and improving healthcare operations. Being prepared to harness this digital power would prove to be the differentiator in the increasingly connected world.

## 5. Future IoT Possibilities in Healthcare

The long-anticipated IoT revolution in healthcare is already underway, though the current applications are only the tip of the iceberg. The new applications that are emerging to address the need for improvement are likely to leave their mark through ground-breaking innovations and ideas. Advancements in sensor technologies, improvements in data collection and processing systems, and the integration of artificial intelligence technologies in healthcare are just a few of the highly anticipated aspects of IoT in healthcare [8]. Smart sensors, which are a combination of sensors and microcontrollers, help to harness the power of the Internet of Things in healthcare by allowing for accurate measurement, analysis, monitoring, and assessment of a wide range of parameters. On the other hand, advances in sensor technology are being complemented by advances in the ability to collect and gather data, which eliminates man al data entry and reduces the risk of errors.

In order to improve current implementations, research studies are currently underway to improve the usability and connectivity capabilities required in various areas of healthcare. Researchers trying to use energy-harvesting systems with the help of ultra-low-power voltage converters are focusing on low-power operation as one of the most important characteristics. More straightforward and user-friendly graphical user interfaces, on the other hand, are being developed to improve usability and allow users to explore system options. Integrating precise analog control operations, such as high-resolution analog to digital converters, will also aid efficacy and output. On the contrary, rising smartphone adoption and wireless connectivity, as well as lower sensor prices, are expected to help the industry grow. Furthermore, one of the most important aspects of the digital transformation in modern healthcare is the rise of artificial intelligence (AI) and its integration with the Internet of Things (IoT). The central pairing is likely to speedup complicated procedures and data functionalities that would otherwise be time-consuming and tedious. IoT sensor technologies, combined with AI, can lead to better decision-making. Artificial intelligence advances in connectivity are expected to improve therapy understanding and enable preventive care, paving the way for a brighter future [10].

## 6. Companies and Organizations contributing to Medical Internet of Things

As [8] says, several big companies and organizations are sing their enormous potential to transform the healthcare model. A few examples of companies who have made their IoT contributions to the world of healthcare are:

- **Apple Health Kit:** This health kit service acts as a repository for patient-generated health information and then shares that information with your physician and hospital. The data is collected from the health app that r ns on the company's iPhone and Apple Watch Devices which includes blood pressure, heart rate, weight, and other information. Apple has signed 14 of 23 top-ranked hospitals in the U.S. for a program that would help physicians monitor patients with chronic conditions such as diabetes and hypertension.
- **Dossia:** AT&T, Intel, and Walmart have banded together to create the Dossia PHR service for the se of their employees. The Dossia system enables individuals to gather copies of their medical records, in digital form, from multiple sources. They can create their own personal portable electronic health records and enable access by the healthcare providers of their choice. The Dossia Health Manager is an app that provides health information personalized for your family which prepares a feed with all the family activities and alerts and recommendations to better manage your own personal health. The Health Manager taps into your personal health record, keeping track of medication, allergies, immunizations, doctor's visits, and test results.
- **Follow My Health:** Follow My Health is a patient portal offered by multiple healthcare providers and facilities. It enables patients to review their medical

records, view lab, and test results, update their medical information, request prescription refills, communicate with physicians via sec re messaging, schedule appointments, and more. Users access the portal via a computer, smartphone, or tablet app.

- **MediConnect:** MediConnect is a web-based PHR service that assembles most of your data. Fill o t an online medical record request and a specialist at MediConnect contacts your doctors, pharmacists, clinics, and hospitals to request copies of your medical records on your behalf. MediConnect then digitizes, uploads, and organizes your records to create your MyMediConnect account. MyMediConnect PHR includes all pertinent medical data, medical conditions, allergies, procedures and surgeries, vaccinations, medications, doctors, and insurance plans, all presented in one central location presented in an easy-to-read and easy-to- understand format.
- **Microsoft Health Vault:** It is a web-based platform used to store and maintain health and fitness information. It's targeted at both individuals and healthcare professionals. One's Health Vault account can be authorized to access records for multiple individuals. Each record contains medical information for a given individual. You can specify types of information to be shared with individuals and healthcare providers. You can also upload data collected by various medical devices, like fitness band and blood pressure devices, sing the Health Vault Connection Center. This way your healthcare providers can see personal fitness information or any other data you collect on your own.

In the last, researchers are suggested to refer articles [8-32] for knowing more about IoT and its importance in several sectors (including issues and suggested challenges) in this smart era.

## 7. Conclusion

There are limitless predictions about the revolution that can be brought through the Internet of Things (IoT) in healthcare by improving the quality of healthcare and dramatically reducing healthcare costs. Taking a closer look at the technical aspects, the role of IoT in healthcare is yet to be explored at greater depths to improve gateways for information accessibility and analysis. IoT in healthcare is expected to bloom and overcome its challenges to revolutionize the conventional healthcare models of the future. Implementing apt 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 patients' health and experiences while making revenue opportunities and improving healthcare operations. Being prepared to harness this digital power would prove to be the differentiator in the increasingly connected world.

## 8. References


1. Sai org, Paper_11-Internet_of_Things_IOT_Research Challenges, IOSRJEN, Conf.ICMPIR. 2019;4/8:43-48
2. Patel KK, Patel SM, *et al*., Internet of things IOT: definition, characteristics, architect re, enabling technologies, application future challenges, International journal of engineering science and computing. 2016;6(5):6122-6131.
3. Mano Y, Faical BS, Nakamura L, Gomes PG, Libralon R, Meneguete G. Krishnamachari, and Joueyama. Exploiting IoT technologies for enhancing Health Smart Homes through patient identification and emotion recognition. Computer Communications, 2015;89.90:178-190. DOI: 10.1016/j.comcom.2016.03.010.
4. Jain R. A Congestion Control System Based on VANET for Small Length Roads, Annals of Emerging Technologies in Computing (AETiC). 2018;2(1):17-21. DOI: 10.33166/AETiC.2018.01.003.
5. Sundareswaran V, Null MS. Survey on Smart Agriculture sing IoT, International Journal of Innovative Research in Engineering & Management (IJIREM). 2018;5(2):62-66.
6. Wipro, business process, what-can-iot-do-for-healthcare.
7. Health Harvard, is-our-healthcare-system-broken-202107132542
8. Jayaprakash V, Tyagi AK. Security Optimization of Resource-Constrained Internet of Healthcare Things (IoHT) Devices sing Asymmetric Cryptography for Blockchain Network. In: Giri D, Mandal JK, Sakurai, K., De, D. (eds) Proceedings of International Conference on Network Security and Blockchain Technology. ICNSBT 2021. Lecture Notes in Networks and Systems, Springer, Singapore. 2022. 481. https://doi.org/10.1007/978-981-19-3182-6_18
9. Kute S, Shreyas Madhav AV, Tyagi AK, Deshmukh A. Authentication Framework for Healthcare Devices through Internet of Things and Machine Learning. In: S ma V, Fernando X, D KL, Wang H. (eds) Evolutionary Computing and Mobile S stainable Networks. Lecture Notes on Data Engineering and Communications Technologies; c2022. p. 116. Springer, Singapore. https://doi.org/10.1007/978-981-16-9605-3_27
10. Shruti Kute, Amit Kumar Tyagi, Rohit Sahoo, Shaveta Malik. Building a Smart Healthcare System sing Internet of Things and Machine Learning, in Big Data Management in Sensing: Applications in AI and IoT, River Publishers; c2021. p. 159-178.
11. Meghna Manoj Nair, Amit Kumar Tyagi, Richa Goyal, Medical Cyber Physical Systems and Its Issues, Procardia Computer Science. 2019;165:647-655, ISSN 1877-0509, https://doi.org/10.1016/j.procs.2020.01.059.
12. Shruti Kute, Amit Kumar Tyagi, Meghna Manoj Nair. Research Issues and Future Research Directions Toward Smart Healthcare sing Internet of Things and Machine Learning, in Big Data Management in Sensing: Applications in AI and IoT, River Publishers, 2021, 179-200.
13. Kumari S, Muth lakshmi P, Agarwal D. Deployment of Machine Learning Based Internet of Things Networks for Tele-Medical and Remote Healthcare. In: S ma, V., Fernando X, D KL, Wang H. (eds) Evolutionary Computing and Mobile S stainable Networks. Lecture Notes on Data Engineering and Communications Technologies, 2022, 116. Springer, Singapore. https://doi.org/10.1007/978-981-16-9605-3_21
14. Rekha G, Tyagi AK, Anuradha N. Integration of Fog Computing and Internet of Things: An useful Overview. In: Singh P, Kar A, Singh Y, Kolekar M, Tanwar S. (eds) Proceedings of ICRIC 2019. Lecture

Notes in Electrical Engineering, 2020, 597. Springer, Cham. https://doi.org/10.1007/978-3-030-29407-6_8
15. Sheth HSK, Tyagi AK. Mobile Cloud Computing: Issues, Applications and Scope in COVID-19. In: Abraham, A., Gandhi, N., Hanne, T., Hong, TP., Nogueira Rios, T., Ding, W. (eds) Intelligent Systems Design and Applications. ISDA 2021. Lecture Notes in Networks and Systems, 2022, 418. Springer, Cham. https://doi.org/10.1007/978-3-030-96308-8_55
16. Amit Kumar Tyagi Aswathy SU, Aghila G, Sreenath N. AARIN: Affordable, Accurate, Reliable and INnovative Mechanism to Protect a Medical Cyber-Physical System using Blockchain Technology IJIN, 2021 October;2:175-183,.
17. Shamila M, Vinuthna K, Tyagi Amit. A Review on Several Critical Issues and Challenges in IoT based e-Healthcare System. 2019, 1036-1043. 10.1109/ICCS45141.2019.9065831.
18. Mishra S, Tyagi AK. The Role of Machine Learning Techniques in Internet of Things-Based Cloud Applications. In: Pal S., De D., Buyya R. (eds) Artificial Intelligence-based Internet of Things Systems. Internet of Things (Technology, Communications and Computing). Springer, Cham. 2022. https://doi.org/10.1007/978-3-030-87059-1_4
19. Amit Kumar Tyagi, Meghna Mannoj Nair. Deep Learning for Clinical and Health Informatics, in the book Computational Analysis and Deep Learning for Medical Care: Principles, Methods, and Applications, 2021 July 28. DOI: https://doi.org/10.1002/9781119785750.ch5
20. Kumari S, Vani V, Malik S, Tyagi AK, Reddy S. Analysis of Text Mining Tools in Disease Prediction. In: Abraham A, Hanne T, Castillo O, Gandhi N, Nogueira Rios T, Hong TP. (eds) Hybrid Intelligent Systems. HIS 2020. Advances in Intelligent Systems and Computing; c2021. p. 1375. Springer, Cham. https://doi.org/10.1007/978-3-030-73050-5_55
21. Gudeti B, Mishra S, Malik S, Fernandez TF, Tyagi AK, Kumari S. A Novel Approach to Predict Chronic Kidney Disease sing Machine Learning Algorithms, 2020 4th International Conference on Electronics, Communication and Aerospace Technology (ICECA), Coimbatore; c2020. p. 1630-1635. Doi: 10.1109/ICECA49313.2020.9297392.
22. Amit Kumar Tyagi, Dr. Meen Gupta, Aswathy SU, Chetanya Ved. Healthcare Solutions for Smart Era: An useful Explanation from user's Perspective, in the Book Recent Trends in Blockchain for Information Systems Security and Privacy, CRC Press, 2021.
23. Tyagi, Amit Kumar, Nair Meghna Manoj, Niladhuri, Sreenath, Abraham Ajith. Security, Privacy Research issues in Vario s Computing Platforms: A Survey and the Road Ahead, Journal of Information Assurance & Security. 2020;15(1):1-16. 16p.
24. Nair MM, Tyagi AK, Sreenath N. The Future with Industry 4.0 at the Core of Society 5.0: Open Issues, Future Opportunities and Challenges, 2021 International Conference on Computer Communication and Informatics (ICCCI); c2021. p. 1-7. Doi: 10.1109/ICCCI50826.2021.9402498.
25. Kute SS, Tyagi AK, Aswathy S. Industry 4.0 Challenges in e-Healthcare Applications and Emerging Technologies. In: Tyagi AK, Abraham A, Kaklauskas A. (eds) Intelligent Interactive Multimedia Systems for e-Healthcare Applications. Springer, Singapore. 2022. https://doi.org/10.1007/978-981-16-6542-4_1
26. Kute SS, Tyagi AK, Aswathy SU. Security, Privacy and Trust Issues in Internet of Things and Machine Learning Based e-Healthcare. In: Tyagi AK, Abraham A, Kaklauskas A. (eds) Intelligent Interactive Multimedia Systems for e-Healthcare Applications. Springer, Singapore. 2022. https://doi.org/10.1007/978-981-16-6542-4_15
27. Madhav AVS, Tyagi AK. The World with Future Technologies (Post-COVID-19): Open Issues, Challenges, and the Road Ahead. In: Tyagi A.K., Abraham A., Kaklauskas A. (eds) Intelligent Interactive Multimedia Systems for e-Healthcare Applications. Springer, Singapore. 2022. https://doi.org/10.1007/978-981-16-6542-4_2
28. Nair MM, Kumari S, Tyagi AK, Sravanthi K. Deep Learning for Medical Image Recognition: Open Issues and a Way to Forward. In: Goyal D, Gupta AK, Piuri V, Ganzha M, Paprzycki M. (eds) Proceedings of the Second International Conference on Information Management and Machine Intelligence. Lecture Notes in Networks and Systems. Springer, Singapore; c2021. p. 166. https://doi.org/10.1007/978-981-15-9689-6_38
29. Sai GH, Tripathi K, Tyagi AK. Internet of Things-Based e-Health Care: Key Challenges and Recommended Solutions for Future. In: Singh, P.K., Wierzchoń, ST, Tanwar S, Rodrigues JJPC, Ganzha M. (eds) Proceedings of Third International Conference on Computing, Communications, and Cyber-Security. Lecture Notes in Networks and Systems; c2023. p. 421. Springer, Singapore. https://doi.org/10.1007/978-981-19-1142-2_37
30. Tyagi AK. (Ed.). Data Science and Data Analytics: Opportunities and Challenges (1st ed.). Chapman and Hall/CRC; c2021. https://doi.org/10.1201/9781003111290
31. Tyagi AK, Abraham A. (Eds.). Recurrent Neural Networks (1st ed.). CRC Press; c2022. https://doi.org/10.1201/9781003307822
32. Tyagi AK, Fernandez TF, Mishra S, K mari S. Intelligent Automation Systems at the Core of Industry 4.0. In: Abraham A, Piuri V, Gandhi N, Siarry P, Kaklauskas A., Madureira A. (eds) Intelligent Systems Design and Applications. ISDA 2020. Advances in Intelligent Systems and Computing. Springer, Cham; c2021. p. 1351. https://doi.org/10.1007/978-3-030-71187-0_1