

Smart Healthcare Systems Using Internet of Things Technologies

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Abstract

Smart healthcare systems using Internet of Things technologies are transforming healthcare delivery by connecting medical devices, wearable sensors, monitoring systems, healthcare professionals, and digital platforms through intelligent communication infrastructures. IoT-enabled healthcare can support continuous patient monitoring, remote healthcare services, clinical data management, preventive care, and real-time decision-making. This study examines the role of Internet of Things technologies in smart healthcare systems, with particular emphasis on connected medical devices, wearable sensors, remote monitoring, data processing, cloud computing, edge computing, artificial intelligence, and healthcare information exchange. A qualitative descriptive and conceptual research design was adopted using secondary academic literature.

The analysis indicates that IoT technologies can improve healthcare monitoring by enabling continuous collection and transmission of patient-related information. Wearable and connected devices can support the monitoring of physiological and activity-related parameters, while intelligent analytics can assist healthcare professionals in identifying abnormal conditions and supporting timely interventions. However, implementation remains affected by challenges involving data privacy, cybersecurity, interoperability, network reliability, data quality, device management, and ethical considerations. The study concludes that IoT-based smart healthcare systems can provide an important technological foundation for connected, responsive, and data-driven healthcare services. Future research should emphasize secure healthcare IoT architectures, interoperable systems, privacy-preserving analytics, edge intelligence, reliable wearable technologies, and intelligent clinical decision-support mechanisms.

Keywords: Smart Healthcare, Internet of Things, Healthcare IoT, Wearable Sensors, Remote Patient Monitoring, Healthcare Informatics, Cloud Computing, Edge Computing, Artificial Intelligence, Connected Medical Devices.

1. Introduction

The healthcare sector is increasingly adopting digital technologies to improve patient monitoring, information management, clinical decision-making, and healthcare service delivery. Among these technologies, the Internet of Things has emerged as an important mechanism for connecting medical devices, wearable sensors, healthcare equipment, information systems, and communication networks. IoT-enabled healthcare systems can facilitate continuous data collection and information exchange,

creating opportunities for more responsive and connected healthcare environments. These developments are particularly relevant to healthcare systems seeking improved monitoring and efficient management of increasing volumes of health-related information.

Internet of Things technologies enable physical healthcare devices to collect, communicate, and exchange information through connected networks. Wearable sensors can monitor parameters such as heart rate, body temperature, blood oxygen levels, physical activity, and other measurable indicators. Connected medical equipment can transmit operational and patient-related information to healthcare platforms. These capabilities can reduce dependence on isolated data collection and enable healthcare professionals to access information through integrated digital environments. Consequently, IoT can support the development of continuous and connected healthcare monitoring infrastructures.

Remote patient monitoring represents an important application of healthcare IoT. Patients can use wearable or connected devices to generate information that can be transmitted to healthcare providers for assessment. Remote monitoring can support healthcare services beyond conventional clinical environments and can provide information between scheduled healthcare visits. Cloud platforms can store and process large volumes of healthcare information, while edge computing can enable selected data-processing activities closer to the point of collection. This combination can support responsive healthcare applications requiring timely information processing.

Artificial intelligence can further strengthen IoT-enabled healthcare systems by transforming collected sensor information into useful insights. Machine-learning techniques can support pattern recognition, anomaly detection, predictive analysis, and decision support. When integrated with connected sensing systems, intelligent analytics can help identify changes in monitored parameters and provide relevant information to healthcare professionals. However, AI-based healthcare applications require careful consideration of data quality, model reliability, transparency, and appropriate clinical oversight because healthcare decisions can have significant consequences.

Smart healthcare systems have applications across hospitals, outpatient environments, home healthcare, elderly care, emergency services, rehabilitation, and preventive health management. Connected devices can support equipment monitoring, patient observation, medication-related processes, and healthcare resource management. Wearable technologies can support continuous monitoring, while connected hospital systems can improve information availability. IoT can therefore contribute to healthcare systems that are more connected, responsive, and data-driven.

Despite these benefits, healthcare IoT introduces important challenges. Medical information can be highly sensitive, making privacy and cybersecurity critical considerations. Healthcare systems may contain devices from different manufacturers that use different communication standards and data formats, creating interoperability problems. Network failures can interrupt data transmission, while inaccurate sensor measurements can affect monitoring quality. Large-scale deployments can also generate substantial amounts of data requiring efficient storage, processing, and management. Addressing these issues is necessary for reliable implementation.

This study examines smart healthcare systems using Internet of Things technologies by analyzing connected medical devices, wearable sensors, remote patient monitoring, healthcare communication networks, cloud and edge computing, artificial intelligence, and intelligent healthcare analytics. The study further evaluates major applications and implementation challenges associated with healthcare

IoT. Particular attention is given to privacy, cybersecurity, interoperability, reliability, data quality, and intelligent decision support. The study aims to provide a structured understanding of how IoT technologies can support future smart healthcare systems.

2. Objectives of the Study

The primary objective of this study is to examine smart healthcare systems using Internet of Things technologies by analyzing connected medical devices, wearable sensors, remote monitoring, healthcare communication, cloud and edge computing, artificial intelligence, and intelligent analytics. The study seeks to understand how IoT technologies can improve healthcare monitoring, information management, responsiveness, service efficiency, and data-driven decision-making.

2.1 Examination of Healthcare IoT Technologies

The first objective is to examine the technologies supporting IoT-based healthcare systems, including wearable sensors, connected medical devices, communication networks, cloud platforms, edge computing, and artificial intelligence. The study evaluates how these technologies collect, transmit, process, and interpret healthcare information. Understanding their integration can support the development of connected healthcare infrastructures capable of providing continuous monitoring and timely information to healthcare professionals.

2.2 Assessment of Smart Healthcare Applications

The second objective is to assess applications of IoT technologies across remote patient monitoring, hospitals, home healthcare, elderly care, rehabilitation, preventive healthcare, and healthcare equipment management. The study examines how connected technologies can support continuous monitoring, information exchange, resource management, and responsive healthcare services. Particular attention is given to the potential contribution of IoT-based systems to accessibility, efficiency, monitoring continuity, and data-driven healthcare management.

2.3 Identification of Healthcare IoT Challenges

The third objective is to identify challenges associated with smart healthcare systems, including cybersecurity, privacy, interoperability, network reliability, data quality, device management, and ethical concerns. The study evaluates how these factors can influence the reliability and acceptance of healthcare IoT technologies. Identifying these challenges can support the development of secure, interoperable, reliable, privacy-conscious, and clinically appropriate smart healthcare infrastructures.

3. Review of Literature

3.1 Internet of Things in Healthcare

Islam et al. (2015) examined the role of IoT technologies in healthcare and identified connected devices, sensors, communication networks, and intelligent platforms as important components of healthcare IoT. IoT can support continuous data collection and remote monitoring while enabling information exchange between patients, devices, and healthcare professionals.

These capabilities provide opportunities to move healthcare services beyond traditional clinical settings and develop more connected approaches to patient observation and healthcare management.

Miorandi et al. (2012) discussed the broader IoT architecture and emphasized the importance of interconnected physical devices, communication technologies, and intelligent services.

Within healthcare, these principles can be applied to medical devices, wearable sensors, hospital systems, and remote monitoring platforms. The integration of connected technologies can improve information availability and support automated data collection. However, effective implementation requires attention to network reliability, interoperability, security, and appropriate management of connected healthcare devices.

3.2 Remote Monitoring and Wearable Technologies

Wearable and connected sensors provide opportunities for continuous monitoring of physiological and activity-related information. Pantelopoulos and Bourbakis (2010) examined wearable sensor-based systems for healthcare and highlighted their potential for monitoring physiological conditions. Such devices can collect information without requiring patients to remain continuously within clinical environments. Remote monitoring can therefore support healthcare professionals by providing additional information between clinical assessments.

The expansion of mobile and wearable technologies has increased the potential for personalized and continuous healthcare monitoring. Connected devices can transmit measurements to healthcare platforms for storage and analysis. Intelligent analytics can subsequently identify patterns or changes that may require attention. However, wearable systems must provide sufficiently reliable measurements and maintain user comfort, connectivity, and data security. Device usability and information quality remain important factors influencing the effectiveness of IoT-based healthcare monitoring.

3.3 Healthcare Analytics and Intelligent Systems

Artificial intelligence and data analytics can strengthen healthcare IoT by processing information collected from connected devices. Machine-learning techniques can identify patterns, detect anomalies, and support predictive healthcare applications. When sensor data are combined with clinical information, intelligent systems can potentially provide more comprehensive decision-support capabilities. However, the usefulness of such systems depends heavily on data quality, appropriate model development, validation, and clinical interpretation.

Edge and cloud computing provide complementary processing environments for healthcare IoT. Cloud platforms can support large-scale storage and computational analysis, while edge computing can process selected information closer to connected devices. Edge processing can be particularly useful when healthcare applications require rapid responses or reduced communication latency. Combining edge and cloud capabilities can provide flexible architectures, although system designers must carefully address security, resource limitations, reliability, and interoperability.

4. Research Methodology

4.1 Research Design

This study adopted a qualitative descriptive and conceptual research design to examine smart healthcare systems using Internet of Things technologies. The study relied on secondary academic literature addressing healthcare IoT, wearable sensors, connected medical devices, remote monitoring, cloud

computing, edge computing, artificial intelligence, and healthcare analytics. The design was selected to synthesize established research and identify technological relationships relevant to the development of smart healthcare systems.

The conceptual framework was organized around six dimensions: sensing, connectivity, data processing, intelligent analytics, healthcare applications, and decision support. These dimensions were examined in relation to healthcare outcomes including monitoring continuity, responsiveness, accessibility, efficiency, information availability, and service coordination. Privacy, cybersecurity, interoperability, data quality, and reliability were considered cross-cutting factors because they influence the successful deployment of connected healthcare technologies.

4.2 Data Collection

Secondary information was collected from peer-reviewed journal articles, academic books, conference publications, and established scholarly research concerning healthcare IoT and digital healthcare systems. The literature included research on wearable sensors, connected medical devices, remote patient monitoring, healthcare information systems, wireless communication, cloud computing, edge computing, artificial intelligence, and healthcare data analytics. Sources were selected according to their relevance to the research objectives and technological scope.

The collected literature was organized into technology-oriented and application-oriented categories. Studies focusing on sensing and connectivity were examined separately from research addressing data processing, analytics, and intelligent decision support. Literature concerning privacy, cybersecurity, interoperability, data quality, reliability, and ethical considerations was also reviewed. This categorization enabled the identification of recurring technological capabilities and challenges associated with IoT-based healthcare systems.

4.3 Data Analysis

The collected literature was analyzed using thematic analysis. Major themes included healthcare sensing, wearable technologies, connected medical devices, remote monitoring, IoT connectivity, edge computing, cloud platforms, artificial intelligence, data analytics, cybersecurity, privacy, and interoperability. Each theme was examined according to its role in supporting smart healthcare functionality and its relationship with healthcare service outcomes.

A comparative synthesis was subsequently conducted to identify relationships between technological components and healthcare applications. Sensors and medical devices were treated as information-generation mechanisms, while communication networks provided connectivity. Edge and cloud computing were examined as processing environments, and artificial intelligence was considered an analytical and decision-support mechanism. Healthcare applications were evaluated according to their potential contributions to monitoring, efficiency, responsiveness, and continuity of care.

5. Analysis

5.1 Core Technologies of Smart Healthcare IoT

Smart healthcare systems integrate sensing, connectivity, processing, analytics, and healthcare applications.

Table 1: Core Technologies Supporting IoT-Based Healthcare Systems

Technology	Primary Function	Healthcare Contribution
Wearable Sensors	Patient-related measurement	Continuous monitoring
Connected Medical Devices	Medical data collection	Device-enabled healthcare
Wireless Networks	Data transmission	Healthcare connectivity
IoT Gateways	Data aggregation	System integration
Edge Computing	Local processing	Rapid data analysis
Cloud Computing	Data storage and analytics	Large-scale healthcare processing
Artificial Intelligence	Pattern and anomaly analysis	Intelligent decision support
Healthcare Platforms	Information management	Coordinated healthcare services

The analysis indicates that IoT-based healthcare depends on the integration of multiple technological layers. Wearable sensors and medical devices generate information, communication networks transmit data, and gateways facilitate integration. Edge computing can provide local processing, while cloud platforms support large-scale storage and analytics. Artificial intelligence can transform collected information into patterns and insights. Healthcare platforms then provide interfaces through which healthcare professionals can interpret and use relevant information.

5.2 Smart Healthcare Applications

IoT technologies can support healthcare services across clinical and remote environments.

Table 2: IoT-Based Smart Healthcare Applications

Application Area	IoT Function	Potential Contribution
Remote Patient Monitoring	Continuous data collection	Monitoring continuity
Hospitals	Connected medical devices	Information integration
Home Healthcare	Remote sensing	Healthcare accessibility
Elderly Care	Activity and condition monitoring	Responsive support
Rehabilitation	Wearable monitoring	Progress observation
Preventive Healthcare	Continuous sensing	Early awareness
Medical Equipment	Device connectivity	Equipment management
Healthcare Management	Data integration	Operational

The analysis demonstrates that IoT technologies can support healthcare applications both inside and outside clinical environments. Remote monitoring can provide continuous information, while connected hospital systems can improve data availability. Home healthcare can use connected devices to support remote observation, and wearable technologies can contribute to rehabilitation and activity monitoring. The effectiveness of these applications depends on reliable devices, secure connectivity, appropriate data processing, and effective integration with healthcare workflows.

6. Discussion

IoT technologies provide an important foundation for smart healthcare because they enable medical devices, sensors, patients, healthcare professionals, and digital platforms to communicate through connected infrastructures. Continuous data collection can provide information beyond periodic clinical assessments and can support more responsive healthcare monitoring. Connected systems can also reduce manual data-entry requirements and improve information availability. These capabilities contribute to the development of healthcare environments that are increasingly connected and data-driven.

Wearable sensors and remote monitoring technologies can extend healthcare observation beyond conventional clinical settings. Patients can generate relevant information through connected devices while healthcare professionals access information through digital platforms. Artificial intelligence can further support this process by identifying patterns and potential anomalies within collected data. Nevertheless, intelligent healthcare systems should complement rather than replace appropriate clinical judgment. Data quality, model validation, transparency, and human oversight remain important considerations for responsible implementation.

The development of smart healthcare systems also requires strong attention to security, privacy, interoperability, and reliability. Healthcare information can be sensitive, and connected devices create additional points of potential vulnerability. Different devices and platforms may also use incompatible standards, making information exchange difficult. Reliable network operation is essential because interruptions can affect monitoring continuity. Future healthcare IoT systems should therefore combine intelligent technologies with secure architectures, standardized interfaces, reliable communication, privacy-preserving data management, and appropriate clinical governance.

7. Challenges

7.1 Data Privacy and Cybersecurity

IoT-based healthcare systems collect and transmit sensitive information through interconnected devices and digital platforms. Unauthorized access, malicious software, communication interception, or compromised devices can expose healthcare information or disrupt healthcare services. The large number of connected devices increases the potential attack surface.

Healthcare IoT architectures therefore require strong authentication, encryption, access control, secure communication, and continuous security monitoring to reduce vulnerabilities while maintaining practical system performance. Privacy is also a major concern because connected healthcare devices can continuously generate information about individuals. Excessive data collection or inappropriate information sharing can create privacy risks.

Healthcare organizations must establish appropriate policies governing data collection, storage, access, and use. Privacy-preserving analytics, data minimization, secure storage, and controlled information exchange can help reduce risks. Building patient confidence requires transparent approaches that clearly communicate how IoT-generated healthcare information is protected and managed.

7.2 Interoperability and Integration

Healthcare environments commonly contain devices and information systems developed by different manufacturers and organizations. These systems may use different communication protocols, data formats, and application interfaces. As a result, connected devices may not exchange information efficiently. Lack of interoperability can create fragmented healthcare information and reduce the effectiveness of IoT-based applications. Standardized communication frameworks, common data structures, and interoperable interfaces are therefore important for integrated smart healthcare systems.

Integration challenges can also occur between IoT devices and existing healthcare information systems. Hospitals and healthcare organizations may rely on established clinical platforms that were not originally designed for extensive IoT connectivity. Integrating new sensor systems without disrupting existing workflows can require significant technical and organizational effort. Modular architectures, standardized interfaces, and carefully planned integration strategies can support gradual adoption. Effective integration should ensure that IoT-generated information becomes useful within existing healthcare processes rather than creating additional complexity.

7.3 Data Quality and Device Reliability

Healthcare decisions can depend on the quality and reliability of information collected by connected sensors. Inaccurate measurements, sensor malfunction, poor calibration, device displacement, or communication errors can produce misleading information. Continuous monitoring systems must therefore distinguish genuine changes from measurement problems. Device calibration, quality assurance, data validation, anomaly detection, and sensor-failure identification can improve the reliability of information generated through healthcare IoT systems.

Device reliability is also important for long-term healthcare applications. Wearable sensors and connected medical devices may experience battery limitations, hardware degradation, connectivity interruptions, or software failures. Such problems can reduce monitoring continuity and create gaps in healthcare information. Reliable hardware, battery-efficient designs, device diagnostics, redundancy, and fault-management mechanisms can improve operational stability. Healthcare IoT systems should be designed to identify device problems promptly and communicate limitations clearly to users and healthcare professionals.

7.4 Scalability and Ethical Considerations

Healthcare IoT deployments can involve large numbers of sensors, wearable devices, medical machines, gateways, and software platforms. As deployments expand, managing devices, data flows, software updates, network traffic, and security policies becomes increasingly complex. Scalable architectures are required to accommodate additional devices without significant performance degradation. Edge

computing, distributed processing, automated device management, and efficient communication protocols can support scalable healthcare IoT infrastructures.

Ethical considerations become increasingly important as healthcare systems rely on continuous monitoring and intelligent analytics. Patients should understand how information is collected and used, while healthcare organizations must establish appropriate responsibilities for automated recommendations. Artificial intelligence may also produce inaccurate or biased outputs if training data are inadequate. Ethical healthcare IoT implementation therefore requires transparency, informed participation, accountability, human oversight, and careful evaluation of intelligent technologies before their integration into healthcare decision-making.

8. Future Research

Future research should focus on secure and interoperable IoT architectures capable of supporting healthcare devices from multiple manufacturers. Research should investigate privacy-preserving analytics, secure authentication, lightweight encryption, standardized healthcare data models, and reliable communication protocols. Greater attention should also be given to edge-based healthcare intelligence, which can support rapid analysis while reducing unnecessary transmission of sensitive information. These developments could improve healthcare IoT security, responsiveness, and integration.

Further research should investigate intelligent wearable systems, adaptive remote monitoring, explainable healthcare analytics, and personalized decision-support mechanisms. Research should examine how artificial intelligence can identify meaningful patterns while maintaining transparency and clinical oversight.

Energy-efficient wearable devices and reliable sensing technologies should also be developed for continuous monitoring. Future studies should evaluate healthcare IoT systems in realistic environments and assess technical performance, user acceptance, privacy, reliability, clinical usefulness, and long-term sustainability.

9. Conclusion

Smart healthcare systems using Internet of Things technologies provide new opportunities for connecting patients, medical devices, healthcare professionals, and digital platforms. Connected sensors and medical devices can collect information continuously and transmit it through healthcare networks. This capability can improve information availability and support more responsive monitoring. IoT therefore represents an important technological foundation for developing connected healthcare environments that extend beyond conventional healthcare delivery models.

The analysis demonstrates that wearable sensors, IoT connectivity, edge computing, cloud platforms, and artificial intelligence can work together to strengthen healthcare monitoring and information management. Edge computing can support local and timely processing, while cloud platforms can provide large-scale storage and analytics.

Artificial intelligence can identify patterns and anomalies within collected information. However, these technologies require reliable data and appropriate clinical interpretation to produce meaningful healthcare benefits. IoT-based healthcare applications can support remote patient

monitoring, hospitals, home healthcare, elderly care, rehabilitation, preventive healthcare, and medical equipment management.

These applications can contribute to monitoring continuity, information integration, healthcare accessibility, and operational efficiency. Nevertheless, successful deployment depends on secure communication, reliable devices, interoperable systems, accurate data, and appropriate integration with healthcare workflows.

Overall, Internet of Things technologies can significantly contribute to the development of future smart healthcare systems. Their long-term effectiveness will depend on balancing technological innovation with privacy, cybersecurity, reliability, interoperability, and ethical responsibility. Future healthcare IoT architectures should emphasize secure and intelligent data processing, explainable analytics, reliable sensing, scalable infrastructure, and appropriate human oversight. Such approaches can support healthcare systems that are more connected, responsive, efficient, and capable of using real-time information effectively.

References

1. Atzori, L., Iera, A., & Morabito, G. (2010). The Internet of Things: A survey. *Computer Networks*, 54(15), 2787–2805. <https://doi.org/10.1016/j.comnet.2010.05.010>
2. Islam, S. M. R., Kwak, D., Kabir, M. H., Hossain, M., & Kwak, K.-S. (2015). The Internet of Things for health care: A comprehensive survey. *IEEE Access*, 3, 678–708. <https://doi.org/10.1109/ACCESS.2015.2437951>
3. Farahani, B., Firouzi, F., Chang, V., Badaroglu, M., Constant, N., & Mankodiya, K. (2018). Towards fog-driven IoT eHealth: Promises and challenges of IoT in medicine and healthcare. *Future Generation Computer Systems*, 78, 659–676. <https://doi.org/10.1016/j.future.2017.04.036>
4. Dhanvijay, M. M., & Patil, S. C. (2019). Internet of Things: A survey of enabling technologies in healthcare and its applications. *Computer Networks*, 153, 113–131. <https://doi.org/10.1016/j.comnet.2019.03.006>
5. Panchatcharam, P., & Vivekanandan, S. (2019). Internet of Things (IoT) in healthcare—Smart health and surveillance, architectures, security analysis and data transfer: A review. *International Journal of Software Innovation*, 7(2), 21–40. <https://doi.org/10.4018/IJSI.2019040103>
6. Yang, Z., Zhou, Q., Lei, L., Zheng, K., & Xiang, W. (2016). An IoT-cloud based wearable ECG monitoring system for smart healthcare. *Journal of Medical Systems*, 40, 286. <https://doi.org/10.1007/s10916-016-0644-9>
7. Catarinucci, L., De Donno, D., Mainetti, L., Palano, L., Patrono, L., Stefanizzi, M. L., & Tarricone, L. (2015). An IoT-aware architecture for smart healthcare systems. *IEEE Internet of Things Journal*, 2(6), 515–526. <https://doi.org/10.1109/JIOT.2015.2417684>
8. Sun, P., Wang, G., Fang, S., et al. (2018). Security and privacy in the Medical Internet of Things: A review. *Security and Communication Networks*, 2018, 5978636. <https://doi.org/10.1155/2018/5978636>
9. Qi, J., Yang, P., Waraich, A., Deng, Z., Zhao, Y., & Yang, Y. (2018). Examining sensor-based physical activity recognition and monitoring for healthcare using Internet of Things: A systematic review. *Journal of Biomedical Informatics*, 87, 138–153. <https://doi.org/10.1016/j.jbi.2018.09.002>

10. Miorandi, D., Sicari, S., De Pellegrini, F., & Chlamtac, I. (2012). Internet of Things: Vision, applications and research challenges. *Ad Hoc Networks*, 10(7), 1497–1516. <https://doi.org/10.1016/j.adhoc.2012.02.016>
11. Kelly, J. T., Campbell, K. L., Gong, E., & Scuffham, P. (2020). The Internet of Things: Impact and implications for health care delivery. *Journal of Medical Internet Research*, 22(11), e20135. <https://doi.org/10.2196/20135>
12. Habibzadeh, H., Dinesh, K., Rajabi Shishvan, O., Boggio-Dandry, A., Sharma, G., & Soyata, T. (2020). A survey of healthcare Internet-of-Things (HIoT): A clinical perspective. *IEEE Internet of Things Journal*, 7(1), 53–71.
13. Qi, J., Yang, P., Min, G., Amft, O., Dong, F., & Xu, L. (2017). Advanced Internet of Things for personalised healthcare systems: A survey. *Pervasive and Mobile Computing*, 41, 132–149. <https://doi.org/10.1016/j.pmcj.2017.06.018>
14. Islam, M. M., Rahaman, A., & Islam, M. R. (2020). Development of smart healthcare monitoring system in IoT environment. *SN Computer Science*, 1, 185. <https://doi.org/10.1007/s42979-020-00195-y>
15. Dang, L. M., Piran, M. J., Han, D., Min, K., & Moon, H. (2019). A survey on Internet of Things and cloud computing for healthcare. *Electronics*, 8(7), 768. <https://doi.org/10.3390/electronics8070768>
16. Javaid, M., & Khan, I. H. (2021). Internet of Things (IoT) enabled healthcare helps to take the challenges of COVID-19 pandemic. *Journal of Oral Biology and Craniofacial Research*, 11(2), 209–214. <https://doi.org/10.1016/j.jobcr.2021.01.015>
17. Razdan, S., & Sharma, S. (2021). Internet of Medical Things (IoMT): Overview, emerging technologies, and case studies. *IETE Technical Review*, 39(4), 775–788. <https://doi.org/10.1080/02564602.2021.1927863>
18. Qadri, Y. A., Nauman, A., Zikria, Y. B., Vasilakos, A. V., & Kim, S. W. (2020). The Internet of Things for healthcare applications: Requirements, attacks, AI-based solutions, and research directions. *IEEE Access*, 8, 148623–148652.
19. Lederman, R., Ben-Assuli, O., & Vo, T. H. (2021). The role of the Internet of Things in healthcare in supporting clinicians and patients: A narrative review. *Health Policy and Technology*, 10(3), 100552. <https://doi.org/10.1016/j.hlpt.2021.100552>
20. Swayamsiddha, S., & Mohanty, C. (2020). Application of Internet of Things in healthcare: A review. *International Journal of Engineering Research & Technology*, 9(5), 1–6.