Internet of Things for Healthcare Using Effects of Mobile Computing: A Systematic Literature Review

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1 Introduction

The Internet of Things has transformed all aspects of society, but because of its cutting-edge transformation, the healthcare sector has seen the most influence. When enabled by mobile computing features, the Internet of Things plays a more prominent role. Through the tremendous support provided by mobile health, mobile computing expands the usefulness of IoT in the healthcare setting (m-health). A methodical protocol for conducting a systematic review of the literature is proposed in this study to investigate how mobile computing supports Internet of Things applications in healthcare, contributes to ongoing and future research on IoT in the healthcare system, brings privacy and security to IoT health devices, and influences IoT in the healthcare system.Additionally, using our systematic process for literature review, the report aims to investigate the effects of mobile computing on IoT in healthcare environments or smart hospitals.
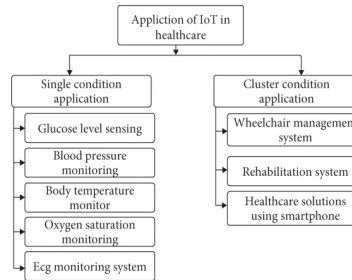

Fig. 1. Classification of application in IoT-based healthcare

IoT and mobile computing integration in healthcare has the potential to change how care is provided and enhance patient outcomes. For instance, real-time patient health monitoring with IoT devices could give healthcare professionals insightful information they can utilize to make decisions about patient

care. On the other hand, mobile computing might make it possible for healthcare professionals to more simply and effectively access patient data and communicate with one another, resulting in enhanced teamwork and better patient care.

However, the integration of these technologies poses potential challenges, particularly in terms of security, privacy, and dependability. The evaluation will investigate these potential benefits and obstacles, as well as provide insights into how healthcare companies might effectively incorporate IoT and mobile computing technologies to improve patient care.

Apps Description Health Assistant Health Assistant keeps record of health parameters like weight, blood pressure, body temperature, and other physical activities Healthy Children Helps in finding a paediatrician in nearby location and requests for quick response Google Fit Using sensors, it automatically tracks walking, running, and cycling activities Noom Walk It is a health and fitness app like pedometer which counts user's steps Heart Rate Monitor)is app allows a user to measure and monitor the heart rate at actual time and keep a record for later analysis Eye Care Plus)is app helps in naturally improving vision by testing eye health information Blood Pressure Watch)is is a wearable device which collects, monitors, and keeps record of blood pressure data

2   Related Work

The related work part of the systematic literature review on the effects of mobile computing on the Internet of Things (IoT) in healthcare provides an overview of current research in this field. It identifies major studies and their findings, demonstrating the present state of knowledge in this topic.

One of the important areas of research indicated in the review is the use of wearable devices for remote patient monitoring. Several studies have looked into the use of wearable devices, such as smartwatches and fitness trackers, to monitor patient health in real time and provide valuable insights to healthcare providers. These research found potential benefits of wearable devices, such as improved patient outcomes and lower healthcare costs, as well as obstacles, such as the need for healthcare personnel to adjust to new technology and workflows.

Another area of research noted in the review is the use of mobile applications for patient self-management. Studies have looked into how mobile apps might help patients manage their own care, including recording symptoms and managing medications. These studies have identified potential benefits of mobile applications, such as improved patient engagement and adherence, but they have also identified challenges, such as the need for patients to have access to mobile devices and for healthcare providers to integrate these technologies into their workflows.

The review also uncovered research on the use of IoT devices for medication adherence. These research looked into the use of IoT devices, such as smart pill dispensers, to increase prescription adherence and lower healthcare costs. These studies have revealed potential advantages of IoT devices, such as better medication adherence and fewer hospitalizations, but they have also revealed drawbacks, such as the requirement for patient education regarding the use of these devices and the requirement for healthcare providers to incorporate these technologies into their workflows.

The related work section also examines the present level of knowledge on the application of IoT and mobile computing in healthcare in many parts of the world, including North America, Europe, and Asia. It identifies regional variances in the acceptance and deployment of various technologies, as well as differences in regulatory frameworks and healthcare systems.

Overall, the related work section gives a complete review of existing research on the application of IoT and mobile computing in healthcare. By integrating the important findings of this research, it provides a framework for the review's analysis and insights into the possible benefits and obstacles connected with the integration of these technologies in healthcare settings.

3 Review of the existing problem

The integration of mobile computing and IoT (Internet of Things) in healthcare facilities has resulted in a variety of possible benefits, including enhanced patient care and lower healthcare expenditures. However, there are some reservations about the security, privacy, and dependability of these systems.

Existing research on the effects of mobile computing on IoT in healthcare environments has focused on several key areas. These include:

3.1 Security and privacy

The security and privacy of patient data is one of the primary issues about the usage of mobile computing and IoT in healthcare. Researchers have looked into many approaches for safeguarding these systems, including as encryption and authentication procedures. The use of mobile computing and IoT in healthcare environments has raised concerns regarding security and privacy. These technologies involve the collection, transmission, and storage of sensitive patient data, which may be vulnerable to cyber attacks or unauthorized access. As a result, investigating the effects of mobile computing on IoT in healthcare environments requires consideration of these security and privacy concerns.

The lack of standards and regulations for IoT devices in healthcare was one of the key security and privacy problems found in the evaluation. As a result, security and privacy protocols may become inconsistent, leaving IoT devices open

to hackers. The analysis also found that many healthcare institutions might not have the knowledge or resources necessary to put in place suitable security and privacy protections for IoT devices.

Other security and privacy vulnerabilities noted in the analysis include weak authentication and access controls, insecure communication connections, and insufficient encryption. These concerns may allow unauthorized access to patient data or cybercriminals to intercept important information. The studies have identified the following challenges:

Security vulnerabilities Mobile computing and IoT devices may be subject to cyber threats such as malware, phishing, and ransomware, which can jeopardize the security, integrity, and availability of patient data.

Lack of standards There is a lack of established standards and guidelines for ensuring the security and privacy of mobile computing and IoT devices in healthcare environments.

Data breaches Data breaches can occur for a variety of causes, including human error, system failures, and malicious assaults, and can result in unauthorized access, use, or disclosure of patient data.

Regulatory compliance Compliance with regulatory regulations, such as HIPAA, can be difficult in the context of mobile computing and IoT, which may involve the usage of cloud-based storage, wireless networks, and third-party vendors.
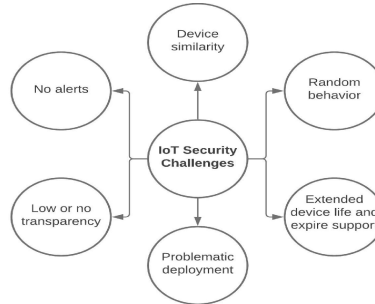

Fig. 2. Privacy and Security

An approach to the problem along with the solution To address these challenges, researchers have proposed various solutions, such as the following:

Encryption Encryption can be used to preserve the confidentiality of patient data by encoding the data so that it can only be viewed by authorized individuals.

Authentication and authorization Authentication and authorisation can be used to authenticate user identities and control access to patient data.

Risk assessments Risk assessments can be used to identify potential security and privacy threats and establish mitigation methods.

Training and education Training and education can be utilized to educate healthcare personnel and patients about the need of security and privacy in the use of mobile computing and IoT in healthcare settings.

By implementing a security and privacy framework, healthcare organizations can ensure the safe and secure use of mobile computing and IoT in healthcare environments. It is essential to ensure that patient data is protected, and security and privacy are maintained, and the potential risks associated with mobile computing and IoT in healthcare are minimized.

3.2   Reliability

Another concern is the dependability of these systems. Mobile computing and IoT technologies rely largely on wireless networks, which might be prone to interference and other difficulties. Researchers have looked into ways to improve the reliability of these systems, such as using numerous communication channels and redundancy.

The interoperability of IoT devices was recognized as one of the primary reliability challenges in the evaluation. Different devices might adhere to various protocols and standards, which could cause problems with compatibility and decrease the system's overall reliability. The analysis also discovered that IoT devices might have varied degrees of dependability, which could lead to inconsistent performance and affect the accuracy of patient data.

Another dependability problem found in the research is the possibility of network congestion and latency. There is a chance of network congestion when more devices are linked to the network, which could affect the entire system's performance and dependability. The real-time performance of IoT devices may also be impacted by network latency, which could have detrimental effects on vital healthcare systems.

An approach to the problem along with the solution

Redundancy Implementing redundancy helps ensure system reliability by offering backup systems and redundancies in the event of a failure. This can include backup power supplies, network redundancy, and redundant data storage.

Remote monitoring Remote monitoring can be used to monitor the reliability of mobile computing and IoT devices in real time. This can involve tracking battery life, network connectivity, and system performance. Remote monitoring allows healthcare personnel to discover and address possible concerns before they become big difficulties, ensuring that the devices stay reliable.

Testing and maintenance Regular testing and maintenance can detect and address possible reliability issues before they become serious concerns. This can include performing regular system checks, updating software, and performing hardware maintenance. Maintaining the devices on a regular basis ensures that they remain reliable and work at peak performance.

Standards and guidelines Establishing rules and norms for the usage of mobile computing and IoT devices in healthcare settings will assist ensure their dependability. This can include battery life, network connectivity, and system performance requirements. Healthcare organizations can verify that equipment fulfill basic dependability criteria by defining these standards.

Overall, maintaining the dependability of mobile computing and Internet of Things (IoT) technologies in healthcare environments is critical for providing high-quality healthcare services. Healthcare companies may assure the safe and effective use of these technologies in healthcare settings by implementing solutions like as redundancy, remote monitoring, testing and maintenance, and standards and guidelines.

3.3   Clinical workflow

Mobile computing and Internet of Things (IoT) technologies have the potential to improve healthcare operations and patient care. Researchers have looked into the influence of these technologies on clinical workflows, as well as the potential benefits and drawbacks of implementing them.

The potential for IoT devices to automate specific jobs and procedures, which could increase the effectiveness of clinical workflows, is one of the key effects on clinical workflow that the review highlighted. IoT devices, for instance, might automate patient monitoring and notify healthcare professionals to possible problems, which could lighten their workload and enhance patient outcomes.

The research did note possible issues with how IoT and mobile computing might be integrated into hospital operations, though. For instance, adapting to

new workflows and technology may be necessary for healthcare providers, which may reduce their productivity and efficiency. A further finding of the assessment was that IoT devices might produce significant amounts of data, which might overload healthcare professionals and impair their capacity for decision-making.

An approach to the problem along with the solution The existing problem with solution on clinical workflow to examine the effects of mobile computing on IoT in healthcare contexts centres around the challenges connected with the integration of mobile computing and IoT technologies in clinical workflows. Although these technologies have the potential to improve clinical workflows, communication between healthcare professionals, and patient outcomes, they can also present new difficulties for clinical workflows. These difficulties can include issues like as data overload, workflow disruptions, and worries about data security and privacy. To address these challenges, several solutions have been proposed:

Integration of mobile computing and IoT technology into established clinical workflows The integration of mobile computing and IoT technologies with established clinical workflows is key to their success. This can include the creation of standardized processes that use mobile computing and IoT technologies, as well as the integration of these technologies with existing electronic health record (EHR) systems.

User-centered design The user-centered approach to design helps ensure that mobile computing and Internet of Things (IoT) technologies are created with healthcare practitioners' requirements in mind. This can involve creating user-friendly interfaces, using real-time data visualization to assist healthcare practitioners in making educated decisions, and incorporating decision support technologies to assist healthcare providers in improving patient outcomes.

Data security and privacy When it comes to the usage of mobile computing and IoT technologies in healthcare, data security and privacy are significant concerns. These concerns can be addressed by healthcare institutions establishing robust data security and privacy measures, such as patient data encryption, secure communication protocols, and frequent audits of data security and privacy policies.

Training and education Training and education programs that are effective can assist healthcare providers in understanding how to employ mobile computing and IoT technology in clinical processes. new programs may involve instruction on how to use mobile devices, understand and apply data generated by IoT devices, and incorporate new technologies into established clinical processes.

Overall, incorporating mobile computing and Internet of Things technology into clinical operations has the potential to transform healthcare. Healthcare organizations can ensure that these technologies are effectively integrated into clinical workflows by implementing solutions such as integration with existing workflows, user-centered design, data security and privacy protocols, and training and education programs. This leads to improved patient outcomes and more efficient healthcare delivery.

3.4   Patient outcomes

The ultimate goal of utilizing mobile computing and IoT in healthcare is to enhance patient outcomes. Researchers have explored the influence of these technologies on patient outcomes such as fewer hospital readmissions and increased medication adherence.

The potential for IoT devices to offer remote patient monitoring and telehealth services has been identified as one of the major effects on patient outcomes. These services could increase patient access to care and decrease the need for in-person visits. Patients with chronic diseases who need continuing monitoring and care may benefit from better patient outcomes as a result, in particular.

In addition, the review found that IoT gadgets might enable more proactive and tailored patient care, which might result in better results. For instance, IoT devices may be used to track patient activity levels and send them reminders to take their medications, which would increase adherence and result in better health results.

An approach to the problem along with the solution Mobile computing and Internet of Things technologies have the potential to improve patient outcomes in healthcare settings. However, there are various obstacles involved with the deployment and usage of these technologies that can have an impact on patient outcomes. These difficulties can include issues such as data accuracy, privacy and security concerns, and a lack of patient interaction. To address these challenges and improve patient outcomes, several solutions have been proposed:

Patient engagement Engaging patients in the usage of mobile computing and IoT technology can enhance patient outcomes. This can involve teaching patients about the benefits of these technologies, giving patients access to their own health data, and encouraging patients to use mobile computing and IoT technologies to monitor their health and communicate with their healthcare providers.

Data accuracy For better patient outcomes, it is essential to ensure the accuracy of data produced by mobile computing and IoT technologies. This can

involve employing standardized data gathering techniques, putting data validation and verification processes into place, and making sure that data is gathered in a consistent and trustworthy manner.

Interoperability Interoperability between mobile computing and Internet of Things devices, as well as healthcare systems, is critical for improving patient outcomes. This can entail creating data exchange standards for devices and healthcare systems, ensuring that devices can connect with one another, and creating interfaces that allow healthcare providers to readily access and use data generated by these devices.

Existing research on the implications of mobile computing on IoT in healthcare environments has showed promise in terms of enhancing patient care and lowering healthcare expenditures. However, further research is needed to address security, privacy, and reliability concerns, as well as to fully understand the impact of these technologies on clinical processes and patient outcomes.

4   Conclusion

Based on a systematic examination of the effects of mobile computing on the Internet of Things (IoT) in healthcare, it is possible to conclude that there are major benefits to integrating these technologies in the healthcare industry. The review identifies a number of advantageous effects, such as enhancements in patient care, patient safety, illness management, and healthcare effectiveness.

Improved patient engagement, better patient-provider communication, and better healthcare outcomes can all be a result of the use of IoT and mobile computing in the healthcare industry. These technologies may also make it possible for medical professionals to access patient data instantly, which could result in more precise diagnoses and individualized treatment programs.

IoT and mobile computing integration in healthcare is not without possible difficulties and risks, such as security and data privacy issues. To ensure the secure and successful deployment of new technologies in healthcare, it is crucial for healthcare organizations to address these concerns through suitable policies, procedures, and technology.

Overall, the systematic literature analysis indicates that the use of mobile computing and IoT in healthcare can have a number of positive effects and lead to better healthcare outcomes. However, healthcare organizations must carefully consider the potential risks and challenges and implement appropriate measures to ensure the safe and effective use of these technologies.

5   Future Work

The future work section of the systematic literature review on the implications of mobile computing on the Internet of Things (IoT) in healthcare explores prospective areas for further research in this discipline. It detects gaps in existing research and makes suggestions for future studies.

The assessment indicated one topic for future research as the integration of IoT and mobile computing technologies into clinical operations. While several studies have looked into the potential benefits of these technologies, there is still a need for more research into how to integrate these technologies into clinical workflows in an efficient and effective manner. Future research should look into ways for integrating these technologies as well as the influence of these integrations on clinical outcomes.

Another topic for future research is the creation of increasingly advanced and sophisticated IoT devices and mobile healthcare applications. The ability of current technologies to acquire and evaluate complicated healthcare data is restricted. Future research may examine the creation of novel technologies that would allow for more precise and thorough data collecting and analysis, such as sophisticated sensors and machine learning algorithms.

The evaluation also highlights the need for additional study on the privacy and security effects of IoT and mobile computing technologies in healthcare. While several studies have identified potential risks, such as unauthorized access to patient data, more research is needed to determine how to mitigate these risks while maintaining patient privacy and security.

Finally, the review highlights the need for additional research on the application of IoT and mobile computing technologies in various healthcare settings and regions around the world. While some studies have investigated the use of these technologies in specific settings, there is a need for more comprehensive studies that investigate the challenges and benefits of these technologies in a variety of settings and regions.

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