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IoT in Medication Management and Adherence

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ABSTRACT

The Internet of Things (IoT) uses smart devices to increase medication adherence. Medication non-adherence continues to plague healthcare, resulting in poor outcomes and higher costs. Wearable sensors, smart pill dispensers, and real-time monitoring help patients take medications (Aldeer et al., 2018). Such devices track intake and alert caretakers or physicians about missed doses. Safe data storage, predictive insights, and remote monitoring are achieved via cloud computing, mobile apps, and AI-driven analytics. The gadgets assist patients in following treatment plans. Healthcare workers may provide more personalized and efficient treatment using IoT technologies. IoT will improve medication adherence, improve health, and cut expenses.

Keywords: IoT, medication adherence, smart pill dispensers, healthcare software, cloud integration, AI in healthcare, embedded systems.

Introduction

The Internet of Things (IoT) improves healthcare by collecting, sharing, and evaluating data in real time. Non-adherence to medication adversely impacts patients and raises healthcare costs (Hassan et al., 2019). Unfortunately, forgetfulness and poor monitoring lead to failing manual reminders and pharmacy consultations. Smart pill dispensers, wearable sensors, and mobile apps alert patients and caregivers immediately to drug usage. These devices use software, real-time data processing, and AI to ensure timely drug use. IoT tracks and provides personalized medicine adherence and wellness reminders. Thus, IoT-powered solutions effectively and technologically tackle a long-standing healthcare issue, benefiting patients and providers.

IoT Devices and Sensors in Medication Management

IoT sensors and devices increase medication management and adherence. According to Aldeer et al. (2018), smart pill dispensers provide medication at set times and alert patients and caregivers via mobile apps. Wearable sensors evaluate heart rate and exercise for pharmacological effects. These devices handle microcontroller and embedded system real-time data well. Cloud solutions allow healthcare providers to monitor patient adherence remotely (Kang et al., 2018). If a medicine is missed, the smartphone may warn the patient immediately. This system provides personalized healthcare data and increases medication compliance. With IoT,

medication delivery is automated, accurate, and patient-friendly, improving health outcomes.

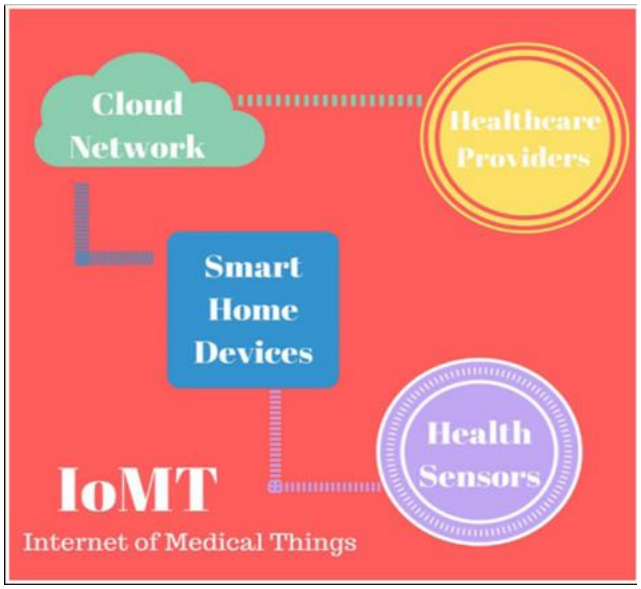

Figure 1. The Internet of Medical Things sensors and medical monitoring (Basatneh et al., 2018).

Software Architecture in IoT-Based Medication Adherence

Cloud computing allows remote access to real-time data analysis of IoT-based medication adherence systems. Masdani and Darlis (2018) found that MQTT (for low-power devices) and HTTP (secure internet access) convey drug intake data well. Mobile and Internet apps provide reminders, adherence tracking, and missed-dose notifications. Healthcare providers may remotely monitor compliance using these technologies. AI can predict missed doses and evaluate patient behavior to improve adherence (Koesmahargyo et al., 2020). AI may recognize non-adherence patterns and personalize reminders. In this software architecture, cloud computing, secure data transfer, and AI-driven insights enhance medicine delivery, patient outcomes, and individualized therapy.

Data Security and Privacy in IoT Healthcare Systems

The security and privacy of patient data in IoT healthcare systems are critical. Security is essential since data breaches may lead to identity theft or unauthorized access. AES and TLS encrypt data during transmission, while biometric scanning and multi-factor authentication control IoT device access. HIPAA and GDPR compliance boost patient trust and legality (Theodos & Sittig, 2020). For security, only authorized individuals may alter prescription data in blockchain-based medication adherence records. Blockchain guarantees dosage tracking and prevents illicit modifications. Encryption, authentication, legislation, and blockchain protect patient privacy and medication administration. It safeguards health data and builds confidence in IoT healthcare solutions.

Future Trends and Innovations in IoT-Enabled Medication Adherence

Using AI and machine learning, IoT-enabled medication adherence will evaluate patient behavior to modify reminders and predict missed doses. These smart devices will connect with EHRs to provide doctors with real-time medication data and change therapies (Basatneh et al., 2018). Edge computing and 5G networks will expedite data processing for faster monitoring and decision-making. However, data security risks, system compatibility issues, and high costs limit widespread use. Future developments should focus on cybersecurity, cost, and AI algorithms to address these restrictions. By fixing these shortcomings, IoT medicine systems may become more reliable and accessible, helping patients take their pills and giving doctors better care management tools.

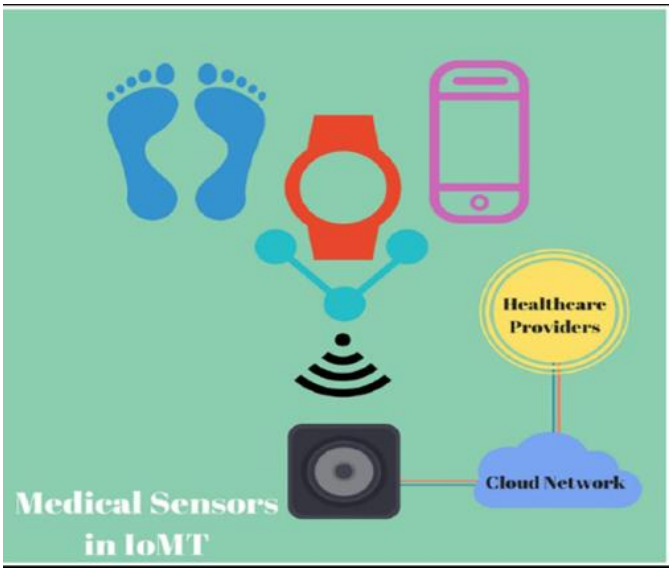

Figure 2. Future direction for IoMT in the care of the diabetic foot (Basatneh et al., 2018).

Conclusion and Future Scope

IoT, cloud, and AI analytics improve medicine adherence. Smart pill dispensers, wearable sensors, and mobile apps help patients take medicines on time, while cloud computing offers secure remote monitoring. These innovations improve health by reducing medication non-adherence. Improved medicine delivery and AI-powered coaching that tailors reminders to habits are feasible. Additional research is required on data security, system interoperability, and real-time tracking. Improved cybersecurity, device compatibility, and AI will make IoT-based medication management more reliable and accessible. These technologies will enable patient-centered, effective healthcare solutions that simplify drug regimens and improve treatment results.

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