Artificial Intelligence For Remote Patient Monitoring In IoT-Based Healthcare Applications – An Overview

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Abstract: Through m-Health and e-Health, a number of services are provided remotely, including avoiding illnesses and treatment, evaluation of risk, medical monitoring, learning materials, and treatment. The popularity of mobile health and electronic health care in society is due to this. For mobile health and electronic health, the development of modern Internet of Things (IoT) devices and systems can be particularly beneficial. There are several IoT electronic health care and mobile health designs that have been developed that can manage an emergency situation well. However, traditional electronic health and mobile health systems don't use smartphone sensors to gather and communicate crucial patient health data. In this study, we investigated m-Health and e-Health, which use body sensors and smartphone sensors to gather, analyse, and transmit client information regarding health for standardized cloud storage. Patients and other participants may later be able to access the data that has been kept. The findings of the current research revealed the trending classical machine learning models in AI-based RPM, yet, with a note-worthy absence of the latest generation deep learning techniques such as Transformers. The noted advantages of applying AI-based RPM include amongst others; enhancing medical care, accelerating treatment, and lowering expenses. We have made suggestions for offer the AI, IoT and mobile technologies that could be applied to achieve improved RPM solutions.

Keywords: AI, IoT, Healthcare, Mobile Technology

1. Introduction

Digital technology advancements, particularly in mobile smartphone technology, have sparked a wide range of creative approaches aimed at enhancing patients with chronic conditions' capacity for self-management. In fact, overall self-management programs have proven effective in enhancing outcomes for significant chronic conditions, including diabetes and hypertension. Using a conceptual model to measure vital parameters like electrocardiogram (ECG), temperature, etc. with an artificial intelligence-based health monitor, this research will concentrate on the uses of sensors for designing patients' self-management tools. These tools will help patients manage their own health problems, or those of their family members, from outside the walls of institutional structures.

2. Literature review

The study evaluated the use of IoT-based medical applications, and it suggests an IoT-Tiered Infrastructure (IoTTA) as a means of turning information from sensors into useful clinical data. This approach considers a variety of elements, such as quarrying, detecting, transferring, analysing, storing, and interpreting [1]. Proposed using smart contracts that are built on top of block chains to make it easier to track and evaluate embedded devices securely using a private block chain based on the Ethereum protocol, an infrastructure wherein the instruments communicate with an intelligent device that executes intelligent agreements and tracks all events on the block chain was constructed. Real-time tracking of individuals and medical care would be possible by sending notifications to patients and medical professionals and preserving a secure record of who initiated these measures [2]. The World Wide Web, the Internet of Things, also known as IoT, and smartphone and tablet advancements have made remote patient monitoring considerably more practical. Wearable technology is already being embraced by healthcare professionals to expedite diagnosis and treatment. Patients benefit from an inherent ease of service. As needed, patients can maintain contact with medical professionals. Also, it lowers medical expenses and raises the standard of care [3]. Remote health monitoring systems (RHMS) use telecommunications technology to provide quick medical treatments in remote areas. RHMS is becoming a useful aspect of modern medicine as a result of considerable technological advancements, particularly in wireless internet, the use of cloud computing, and information storage. RHMS contributes significantly to the sustainable delivery of exceptional healthcare services to individuals with multiple chronic diseases (MCDs). [4]. Telecommunications technology is used by systems for remote health monitoring (RHMS) to deliver prompt medical care in remote locations. Due to significant technical improvements, notably in wireless internet, cloud computing, and data storage, RHMS is becoming a vital component of contemporary medicine. RHMS makes a substantial contribution to the sustainable provision of outstanding healthcare services to people with multiple chronic illnesses (MCDs) [5]. An algorithm was suggested to forecast patients' present health state in conjunction with ongoing monitoring in contact with their medical providers [6]. IoT is being used as an accelerator to increase the efficacy of AI uses in the medical industry. IoT sensors are used to collect health information, which is then evaluated using methods based on machine learning. The created healthcare paradigm will practitioner in making an early illness detection [7]. The block chain-assisted safe information management system has been suggested to increase flexibility and data availability in the field of healthcare and safeguard the exchange of patient data. Secure information interchange between private servers and cloud servers, as well as between private servers and embedded medical devices, is made possible. Block chain technology is used by the IoMT-based security architecture to provide data management and transmission security between devices connected [8]. To look into the literature, five databases were chosen (science Simple, IEEE-Explore, Springer, PubMed, and science.gov). It applied the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology, which is the accepted method for systematic reviews and meta-analyses. Presented the tracking system for chronic illnesses as a case study to provide better remote patient monitoring. [9]. Initially investigated the difficulties with data acquisition for privacy protection. Later, with the aim of preventing these kinds of assaults, present a useful framework called Security Protector, patient privacy protected data collecting. Privacy Protector integrates the ideas of confidential sharing with share-mending (in the case of data loss or breach) for the security of patient data) [10]. The research makes it possible to find and continuously monitor the health of soldiers who get separated or harmed on the field of battle. As a result, army control unit search and rescue operations require less time and effort. The technology enables the army control unit to follow soldier movements and check their health by utilizing satellite and body-part networked sensors like thermometers and heart rate monitors. For further data analysis and clustering using the K-Means method computations, the collected data will be transferred to the cloud [11]. IoT technology may be utilized to boost the efficacy and user satisfaction of health care services, including monitoring patients remotely, real-time medical issue diagnosis, and beyond. The proposed research aims to forecast heart illness using machine learning (ML) methods for categorization. IoMT-based cloud-fog diagnostics for heart disease have been proposed. ML classification techniques are used with the fog layer to quickly analyse health data [12]. The article reviews the latest developments in the field of peripheral and cloud computing, how it works with the Internet of Things, and the benefits and challenges of applying the fog framework to applications related to healthcare. It also covers various edge and fog computing architectures and how they may be used to improve new IoT applications, as well as potential future research paths in cloud computation and AI within the perimeter layer of Internet-based applications [13]. More than ever, healthcare delivery may be sped up by merging cloud services with cutting-edge technologies such as big data statistical analysis, AI, and the Internet of Medical Interventions. It increases capacity, raises compatibility, and brings down prices [14]. This work has demonstrated the modelling and building of a synthetic intelligence-based health care tracking (PM) platform to measure important parameters for the prediction of diabetes mellitus. The study conducted a brief analysis of diabetes and an artificial intelligence (AI) model based on a fully connected neural network's machine learning (ML) algorithm (FNN). The way the suggested system operates allows for a very straightforward yet appropriate solution to the diagnosis of diabetes mellitus while still reducing computing complexity. [15]. It is important to look at low-power, high-efficiency alternatives to compression that enable the gathering, delivery, and evaluation of electrocardiogram (ECG) data on a linked home or other distant server. The proposed method addresses the growing need for enhanced remote health monitoring by providing an advantage for the speedier and more efficient immediate delivery of ECG values [16]. It is important to look at low-power, high-efficiency alternatives to compression that enable the gathering, transfer, and subsequent examination of electrocardiogram (ECG) data on a linked home or other distant server. The suggested technique offers an advantage for the quicker and more effective real-time transmission of ECG readings, which satisfies the rising need for improved remote health monitoring. This research proposed a fitness band with a biological recognition facial mask to measure a patient's pain level using a face electromyogram (sEMG). The study demonstrated scalable IoT systems for real-time biological dynamic tracking and wearable sensors for automatic pain rating using facial expressions. [17]**.** Chronic illness situations, psychiatric, emotional health, economics, and encompassing situations are the five key subcategories of parameters that are examined. In order to find any potential connections between variables in various categories, they are examined in the context of states and regions within the United States [18]. The aim is to develop a stochastic framework to predict important patient management issues based on current and historical values of a number of physiological indicators. People with chronic diseases living alone at home often die from various diseases because there is no effective computational approach to predict abnormalities in physiological parameters. The temporal behaviour of six biological signals is used to drive the Hidden Markov Model (HMM) used to predict various clinical events [19]. Using a cloud-based approach, the technology enables the anaesthesiologist to disseminate and monitor the mobile application concurrently.You can keep an eye on many patients at once. This technology's main advantage over more traditional approaches is that it is secure and requires fewer resource. The Android software assists many patients simultaneously, making it straightforward for the surgeon to monitor various treatments at once [20]. A unique method of ECG monitoring was created using the Internet of Things, or IoT, concepts. ECG data is gathered by a wearable monitoring node and transferred directly via Wi-Fi to the IoT cloud. Both the Hypertext Transfer Protocol (HTTP) and MQTT protocols are used in the Internet of Things cloud to provide customers with quick and obvious ECG data. [21]. Demonstrated a ubiquitous monitoring system that may instantly transmit a patient's vital signs to distant medical applications. Researchers assess the danger to patients, the requirements for medical analysis, the needs of communication, and the demands on computing resources before presenting four data transmission strategies. Eventually, a sample prototype is put into use to give a conceptual model [22]. The home gateway's issues with data overload and network congestion are handled using an ECG compression approach. According to a system demonstration, the ECG signals and movement signals of the elderly may be monitored. Reviewing the compression technique indicates that it has an excellent proportion of compression, little distortion, and is quick, making it ideal for residential gateways. The suggested solution is easy to use and has strong scalability. It provides an opportunity to offer elderly people ongoing, long-term home health monitoring services [23]. Doctors will be able to help patients make the best decisions by continuously monitoring patients with chronic conditions. Patients can also lead regular lives as usual. The patient does not need to stay in the hospital, which also saves money. We believe that the novel design that has been proposed is feasible and that it will significantly improve the patient's standard of living while also substantially reducing spending on healthcare. [24]. Globally, diabetes is becoming more common. Diabetes patients require ongoing surveillance, and in order to accomplish this goal, they must participate in the process of managing their healthcare. A technology-driven movement called mobile health (MH) aims to provide chronically sick individuals more control over their lives in modern settings. To address the limits of MH innovations, it is necessary to talk about their present condition. A comprehensive examination of the research from this angle is beneficial for both intellectual and practical advancement. The limitations that have not yet been entirely overcome are critically analysed in this work, and future research paths that can increase the application of MH are also highlighted [25]. Described in depth a number of current RPMS with an emphasis on their use, architecture, technologies used, and difficulties they encountered. At last, a summary of quality of performance (QoP), one of RPMS's challenges, is provided. Also carried out a statistical assessment of the available literature. The studied requirements for quality of service based on traffic type, data quality, device quality, and network metrics are offered with the intention of giving the most recent knowledge for academics and enterprises to adapt to when creating quality-aware RMPS [26]. The study includes the relationship between big data attributes and remotely comprehensive health care monitoring is discussed in the context of patient ranking. The spotlight is focused on the unresolved problems and difficulties with large data employed in patient prioritization. As a suggested remedy, selecting the huge data of chronically ill patients based on the most critical instances involves making decisions using several criteria, such as vital signs and primary issues [27]. A computer Innovation system for remotely monitoring the health of CVD patients is proposed. The system includes a variety of health sensors for detecting the heart rate, temperature of the body, cardiac output, and composition of the body. A virtual assistant also does a general medical examination. All of the patient's current health-related data is acquired by the Microprocessor (processing unit) using these sensors and a Chabot, and using the highest-accuracy Machine Learning (ML) algorithm, it automatically diagnoses the data and recommends medications to the patient. The final health report is then transferred to the doctor's device for evaluation [28]. Reviewed the already known research and discusses the best ways to employ Internet in the realm of medical and intelligent healthcare. Second, a fresh semantic framework for client electronic health care was proposed. The sensing layer, the layer of networks, the web layer, as well as services layer are the four components that make up the 'k-healthcare' paradigm. All Levels must effectively interact in order to develop a platform that will allow people with mobile devices to access medical information about patients. [29]. Mobile technology' apparent difficulties have prevented their wide usage in clinical studies. Studies utilizing mobile technology continue to be supported by the same scientific standards that underlie the clinical trials industry. These suggestions offer a structure for incorporating mobile technology into clinical trials, which may facilitate a more thorough evaluation of potential novel treatments for patients [30]. With regard to performance, acceptability, accessibility, practicality, cost, and efficacy in dengue, Zika, and chikungunya monitoring, the goal of this scoping review is to examine the evidence of the use of mobile phones as intervention tools [31]. The suggested hardware comprises of a single-chip microcontroller (RFduino) that has Bluetooth low energy integrated, which reduces space and increases battery life. In a lab setting, the "smart case" system has undergone testing. Also created a 3-D-printed smartphone cover to verify the system's viability. The outcomes showed that the suggested system may be on par with high-caliber medical equipment [32]. In the area of healthcare for persons with chronic diseases, such as diabetes, wearable technology has gained a lot of scientific interest. They have the power to lessen the effects of diabetes and its consequences, as well as help control the disease. Moreover, these gadgets have enhanced the quality of life and disease management. [33] The results showed that a perceptron with several layers may detect diabetes effectively from the individual's data collected from sensors after machine learning-based classification algorithms were tested on a diabetes dataset. Additionally, the results demonstrate that, utilizing the information from the present sensor, extended selective memory may accurately predict the blood glucose level in the future. To further enhance patient health and prevent serious diseases in the future, the suggested diabetes categorization and BG prediction might be integrated with recommendations for a patient's overall diet and level of physical activity [34]. In order to better understand how customers, particularly the elderly and caregivers, perceive wearable gadget technologies, research was conducted. The investigation was carried out using a survey method that was delivered to older people and their caregivers. The anticipated outcomes of this study may be used in the development of product and service offerings by technology entrepreneurs so that they meet consumer expectations and improve consumer well-being in an older population [35]**.** In the upcoming years, it is projected that the forthcoming generations of continuous glucose monitors will incorporate advanced algorithms due to the recently proven effectiveness of a number of recently proposed methods for improving sensor performance. Due to the increased accessibility and dependability of current and contemporary CGM devices, a sizable amount of data will be produced in the upcoming years that will eventually be accessible for offline analysis. Since CGM usage is cyclical, it is reasonable to assume that some recently suggested methods, like retroactive testing and maximizing diagnostic dimensions based on historical data, will be very beneficial for continuous glucose monitor outcomes throughout their lifetime, enabling their evaluation and enhancement over time. [36]. The approach lessens the need for calibrations while maintaining (and occasionally improving) CGM sensor precision compared to that of the equipment designer. Reduced calibration requirements make CGM technology easier to use and less expensive to deploy, which is a necessary condition for using it to replace conventional blood glucose measurement sensors [37]**.** Compared to the static, non-updating calibration technique, the updating approach demonstrated a relative improvement in CGM accuracy, although it was not statistically significant. It is anticipated that the sensor's performance would gradually increase with the utilization of data gathered over a longer duration [38]Hopkins, a state-of-the-art mobile phone monitoring platform, was developed to assess symptoms both actively (data are obtained when a set of tests are begun by the user at specific times during the day) and quietly (data are continually gathered in the background). During data collection, take note of traits that may be used to assess the voice, balance, gait, flexibility, and response time that are associated with PD symptoms. Measurements recorded after a dosage of medicine (treatment) vs. before the dose are distinguished using a random forest classifier (baseline) [39]A small handheld instrument was developed that can monitor the temperature of the body and the amount of blood sugar in diabetics in order to validate the proper operation of this system. This technology is used to determine whether a variable has exceeded a threshold and may or may not be included in the proposed architecture. To establish a wireless connection with the mobile device, a secure technique was designed [40]. Presented a thorough MH framework with integrated CDSS capabilities. Its cloud-based technology keeps tabs on and controls type 1 diabetes. The quality of any CDSS's knowledge and the extent to which it can interact meaningfully with multiple data sources determine how effective it is. The goal of this project is to do this by developing a conceptual clinical decision support system based on the suggested FASTO taxonomy. A variety of patient data may be gathered, formalized, integrated, processed, and otherwise manipulated using the practical ontology. It provides clients with thorough, customized, and scientifically understandable care plans that include everything from insulin regimens to diets to exercise habits to training sub-plans. These plans are based on the whole patient's information. The recommended CDSS furthermore offers wireless body area networks for patients that collect vital signs for real-time monitoring at home [41]. Metabolic biomarker profiling that is quick, precise, portable, and quantifiable is crucial for the diagnosis and prognosis of diseases. For the purpose of metabolism monitoring, current advancements in optical and electric biosensors based on smartphones are promising due to their benefits of speed, dependability, accuracy, affordability, and multi-analyse analysis capacity. Electrochemical bio sensing systems, including wired and wireless communication, as well as optical bio sensing platforms, including colorimetric, fluorescent, and chemiluminescent sensing have been discussed. The difficulties and expected future scenarios for multifunctional, dependable, accurate, and affordable mobile phone bio sensing devices were also explored [42].

3. IoT in Medical Applications

The characteristics of IoT devices, and applications that have been used in m-Health and e-health have been analysed in this section.

Table 1: Summary table of data extracted from reviewed papers, showing the sensor types, measured parameters, disease and device types

Ref	Type of sensor	Parameters	Type of disease	Iot monitoring type	Devices an apps used
[1]	(IoTTA)	ECG, Oxygen Saturation (SpO2), pulse rate, heart rate, and weight	Chronic diseases	IoTTA architecture	IoT healthcar applications
[2]	medical sensors	HealthContractCaller, heartrate Monitor (),	high blood pressure, diabetes	Wireless Body Area Networks (WBANs)	Oracle
[3]	Accelerometer, Pulse Oximeter, Heart Rate Monitor Device	N/A	Chronic disease and mental health disorders.	blockDAG (block chain system)	GHOSTDAG block chair based smar contracts, wearable devices, Oracl smart devices c smartphones.
[4]	N/A	N/A	chronic diseases heart rate and blood pressure, fever, high BP and diabetes	patient monitoring using mobile ad-hoc network	N/A
[5]	Wearable sensors	QoS (Quality of Service) parameters,	heart diseases,	ECG monitoring system	N/A

		Air Quality Indicators (AQIs)	chronic disease		
[6]	YL69 moisture sensors and DHT11 (Temperature & Humidity sensor), body sensor network (BSN)	(AI-IoT)	heart diseases,	Patients data storage (PDS) Health Data Allocating Policy (HDAP) Cloud Middleware (CM)	raspberry p Arduino
[7]	IoT Body implanted sensors	N/A	Temperature, heartrate, heart disease, diabetes breast cancer, hepatitis, liver disorder, dermatology, surgery data, thyroid blood pressure.	DT, SVM, NB, AB, RF, ANN and K-NN	Automatic Multi-Layer Perceptron (Auto MLP application fo the prediction c diabetes.
[8]	IoMT devices such as smart watch and mobile devices.	BSDMF, (PPEOTF)		IoMT-SAF, (MDPAC)	(BIoMT)
[9]	pulse oximeter, gyroscopes, a spirometer, a global positioning system (GPS), and electrooculography (ECO)		cancer, diabetes	Cloud health monitoring system	pulse oximete gyroscopes, spirometer, (GPS), (ECO)
[10]	IoT sensor	Privacy Protector, SW-SSS	N/A	(PDAC)	
[11]	(WBASNs), GPS, Heartbeat sensor, ECG module	GSM	heartbeat, body temperature	LoRaWAN	IED,LoRaWAN ZigBee
[12]	Temperature sensor, heart rate sensor, ECG, SPO2	N/A	heart disease		(FAHP)
[20]	(WBSN)	ZigBee, GSM and SMS	heart rate, blood pressure, temperature	ECG, EMG monitoring	Android app
[9]	infrared sensor	GSM	heart rate, blood pressure for	automatic saline monitoring system	Android app

			coma patients		
[21]	ECG sensor	Wi-Fi module, server,	heart diseases, the arrhythmia Drug toxicity.	ECG monitoring	N/A
[24]	(WBAN)	electro cardiogram (ECG), electroencephalogram (EEG), body movement, temperature, blood pressure, blood glucose, heartbeat, and respiration rate levels)	(Blood pressure, fatigue level (EEG), heart rate, respiratory rate, SPO2 saturation)	galvanic skin response (GSR), Electrocardiogram (ECG)),	N/A
[27]	medical sensors GPS	(MCDM)	heart, diabetes, and BP)	N/A	N/A
[15]	wearable blood pressure sensor, temperature sensor, and ECG sensor	N/A	diabetes,	blood pressure Electrocardiogram (ECG) temperature	Patient Monitoring (PM) prototyp device
[40]	glucose motion temperature	Bluetooth	diabetes,	continuous glucose monitoring (CGM)	smartphone
[29]	smartphone sensors	3G or Wi-Fi	Blood pressure, ECG	N/A	Samsung Note / S4
	temperature sensor (DSB18B20), blood pressure sensor (sphygmomanometer), heart rate sensor (pulse sensor) and ECG sensor (AD8232)		measuring heart rate, Blood Pressure (BP), ECG, Body Mass Index (BMI), body temperature		MedX' bot

Table 2: Summary of performance analysis of IoT sensor-based disease diagnosis with AI models

#	Model / algorithm Used	Health Application	Reported accuracy
[1]	IoTTA architecture	Self-care.	96.4%
[7]	DT, SVM, NB, AB, RF, ANN and K-NN	Heart disease, diabetics, breast cancer, hepatitis, liver disorder, dermatology, surgery data, thyroid.	93.32%
[12]	IoMT-based	Mechanism for tracking medical conditions to detect cardiac disease.	(97.32%).
[8]	block chain and IoMT	Dynamical assembly of patients' sensor data and running on smartphones and wearables, with focus on Privacy and security of healthcare data.	97.2%,
[19]	(HMM)	Hidden Markov model is used to learn and categorize different clinical occurrences based on the behaviours of many different vital signs. Using the knowledge gained from the changes in several physiological markers, this approach is also appropriate for continuous patient's monitoring.	97.8%
[11]	K-Means Clustering algorithm	Using a LoRaWAN transceiver to send data from the squad leader to the control unit and a ZigBee transceiver to provide data from a faraway soldier to the squad leader and other troops. The K-Means algorithm for machine learning and a range of sensors are used by the system to help in forecasting the warzone scenario, tracking soldier health data, and identifying nearby weapons..	N/A

[40]	naïve Bayes, J48, ZeroR, random tree, SMO, and OneR	In addition to monitoring patient health data like glucose levels to help with analysis and diabetes diagnosis, the system also offers cutting-edge capabilities like compatibility, local storage, and information processing.	99.17%,
[29]	k-Healtcare model	Uses four phases that closely cooperate to offer effective data storage, processing, and retrieval.	N/A
[23]	ECG compression algorithm	It can provide elderly people continuous, long-term monitoring. The compression algorithm's test results demonstrate the viability of using the method to compress with a real-time monitoring system.	N/A

This work has presented a thorough analysis of the advantages of smartphones as RPM sensors in this study. Modern smartphone-based mobile bio sensing devices have the ability to bring medical testing into non-clinical settings for the best and most individualized treatments of metabolic illnesses. These devices will enable daily and thorough metabolic monitoring. The period for these studies was from 2016 to 2023. The researches reveal various advantages, including the capability of ongoing remote patient monitoring and the availability of real-time online patient health data based on algorithms, provides precise detection. High accuracy in diagnosis capabilities, outstanding performance in home medication management, and early clinical aggravation detection are all provided. Offers individualized diagnoses and very precise prediction algorithms. The classification accuracy is described as an assessment metric to contrast the outcomes of various methods used in the dataset. A table provides measurement accuracy in research studies varies from 96 to 99 percent. An exciting prospective issue is the use of sensing for monitoring patients from afar using cell phones. This idea has significant promise for acquiring trustworthy, accurate, and affordable diagnoses from a large number of analysts in resource-constrained and non-clinical circumstances. For this research on the use of devices for remote patient monitoring, I assessed important data from specialized wearable devices as well as data from specialized embedded or passive sensors. Additionally, recent advancements in mobile and portable testing for individual health care at home have highlighted difficulties in acquiring a variety of analytical diagnoses in non-clinical settings that are trustworthy, accurate, and reasonably priced. Some studies, such as Monitoring without

Follow-Up, have some flaws. Some systems are manual; for instance, patients take measurements and report results. Most systems are not flexible enough to allow for the addition of new sensors while they are running. Not enough clinically proven guidance and instructions are offered. There is still little patient engagement in the delivery of care. Algorithms for clinical assistance are not used enough. - Effective data mining for high level outcomes is lacking.

4. Conclusion

In this work, we performed a thorough evaluation of RPMs. We focussed our study on RPMs from a software viewpoint (i.e., kind of sensors, monitoring type, parameters employed, algorithm, and level of accuracy). Our research showed that multiple models using machine learning have been developed specifically for RPM, showing good accuracy levels between 97% and 99%.Despite the extensive application of Machine learning models, we noted the absence of the latest technologies of deep learning such as Attention mechanisms and Transformer models applied for training models in the domain of RPM. This constitutes an open ground for research, considering the ground-breaking accuracies achieved by these models in other domains.

This study may help researchers plan future research to address issues and limits, as well as assisting future researchers interested in RPMs in understanding the degree of evidence that is now accessible in the literature. RPMs include the complete lifespan of monitoring systems, including the briefly covered backend systems, cloud systems, and wireless sensors and devices. Like every research method, the one employed in this study has limits as well as a number of potential applications in medical care field.

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