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## Healthcare monitoring using smart systems

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Abstract :

With modern technological innovations, every industry is transforming to produce better goods and services to satisfy customers. Healthcare is also an industry that uses modern technology to transform the paradigm of patient care and treatment. In the age of technology, the goal of the medical ecosystem is not only disease management but also the overall health of the patient. Sensor-enabled IoT-based smart healthcare systems, along with integration of artificial intelligence, create healthcare service orchestration and enable healthcare professionals to follow Monitor the patient's regular activities in real time, helping to promptly respond to the patient's health needs. Research explains how artificial intelligence and smart sensor-enabled devices create intelligent systems to continuously monitor patient health and create orchestrated services to benefit patients. patient. The study also generates recommendations based on the literature that can be empirically validated in the future.

Keywords— Artificial Intelligence, Internet of Things (IoT), Smart Medical Systems, Wearable Devices, Patient Health Monitoring.

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### INTRODUCTION

The world is moving towards smart things. Because cities are not just cities, they are smart cities now. Smart cities invest in new ICT (Internet and communication technologies, including IoT (Internet of Things), AI (Artificial Intelligence), cloud computing, mobile Internet-based services, etc. to provide better governance and better services for people's health [1] care is just as important as providing better governance with smart gadgets and smart technology because with an aging population , chronic diseases are now part of daily life [2]. Despite the slow adoption of smart devices, healthcare is gradually transforming towards the digitization of services by slow adoption of smart technologies [3].

People have begun to adopt modern technological innovations in healthcare not only for activity tracking but also for healthcare purposes [4]. People have started using the mHealth platform for online devices to track physical activity. exercise and physical fitness as well as for continuous monitoring of vital physiological markers [6]. On the other hand, healthcare providers have healthcare providers have also adopted smart devices and technologies to create orchestrated services that allow them to be more flexible and agile [7], [8]. consultations with doctors about chronic and acute diseases [5] and wearable sensor-enabled IoT-based . With the increase in the use of smart medical gadgets such as IoT, it is not only possible to monitor health remotely, but also to perform health scans for individual patients as data can be collected in real time. With the integration of artificial intelligence and smart utilities, it is possible to find out unexpected results and warn the patient at the right time [9], allowing treatment at the right time for the patient. The study describes applications of AI when integrated and integrated with smart medical systems and utilities such as IoT-enabled devices or IoMT (Internet of Medical Things) responsible for tracking individuals from far in real time. The study also describes the opportunities and benefits of using these technologies in healthcare scenarios and provides a framework for future healthcare that is organized to produce outcomes. better service.

The rest of the study is presented as follows, part 2 presents the objectives of the study and part 3 presents the theoretical framework and literature review. Sections 4 and 5 present the methodology and results respectively, while Section 6 represents a hypothetical case study and Section 7 presents the development of the proposal, where the proposed theoretical model has been developed. is set. Finally, Section 8 presents the conclusion along with limitations of the study and future scope.

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### OBJECTIVE OF THE STUDY

Documentary study that investigates the future perspective of healthcare services from the prism of healthcare coordination, where networks of healthcare professionals are seamlessly integrated and create services that are coordinated to meet the health needs of patients.

- Understand how artificial intelligence, when is integrated with sensor-enabled IoT-based devices, can create intelligent systems.
- Analyzed how intelligent systems enable remote monitoring of patients and create coordination of services by involving networks of healthcare profession

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## THEORETICAL FRAMEWORK AND LITERATURE REVIEW

### *Change of care time*

The basis for variation in the duration of care evolved with the location and duration of treatment of patients with autoimmune and chronic diseases, primarily involving the heart and kidneys (such as arrhythmias, high blood pressure, diabetes, other heart problems) [10]. With the changing time of care, time-consuming treatment can be replaced by the integration of modern, advanced smart devices that can share information in real time with healthcare professionals are networked. Therefore, early intervention by a healthcare professional is desirable and doable in emergency and life-threatening situations.

With the integration of AI into IoT-enabled smart health monitoring devices, doors of possibilities are opening as different types of data enable analytics to be performed [7]. . With integrated analytics, including supervised and unsupervised learning, emergencies can be predicted to alert patients as well as physicians. In this case, timeliness is the source and value of the health service created by medical institutions by enabling the use of modern infrastructure with intelligent systems created through communication. through integrating ICT and analytic technology at different levels.

In order for healthcare operations to be carried out seamlessly and to ensure good quality, medical facilities need to be equipped with IT systems, software, integrated analytics as well as accurate data, etc. to be able to quantify the time component, type of treatment, cost and effects. Assimilation of information through existing structures requires knowledge to be readily available, collected, and distributed, which expands collaboration among stakeholders [11].

### *Sensor-enabled IoT-based devices*

There are many smart devices available in the market to keep track of important user information and store it in the cloud. Users can log in with the mobile app with their credentials and see the progress of their workouts, steps, runs, cycling, sleep tracking, and more. [twelfth]. With some high-variant smart devices, users will receive notifications on women's health, stress and guided meditation in stressful conditions [13], fitness tracking and evening exercise based on calories burned for the day [14], continuously monitoring heart rate and blood pressure, including electrocardiogram in higher variants with warning to detect hypotension when signs of significant changes significantly by finding outlier patterns [15], [16]. Not only monitor women's heart, blood pressure, exercise, sleep and health, but these smart devices can continuously measure oxygen saturation levels and provide timely alerts when SpO2 levels drop. below 95% [17]. Smart devices are also used for metabolic diseases, such as diabetes. For the measurement of diabetes, routine daily tests are available where the patient must have a daily puncture and check the blood glucose level on a new strip each time. However, the procedure is expensive and painful. But, with the help of intelligent systems, problems can be solved creatively. With a smart blood glucose meter, patients only need to put the sensor into the skin once, then they can regularly monitor their blood sugar in real time, without needing to prick each time or have to use needles and lines. new. each time [18].

### *Artificial Intelligence*

Because emergency rooms and physician-patient contact are often unreliable due to the scarcity of disease and necessary drug information, doctors cannot be sure that treatment will work for them. . Because half of the drugs and treatments used by healthcare professionals had no effect on efficacy or survival in the participants, as these trials involved poor sample sizes such as sample, studies were replicated, and study results were considered averages only. Saying that doctors may not have enough detail at hand to come up with an accurate plan of care for a patient shows incompetence on the part of doctors. However, much of the healthcare they provide is being enhanced with the future goal of including artificial intelligence. The future of healthcare is to provide doctors with intelligent systems, smart technology and intelligence. Artificial intelligence will allow technologies to be applied as a second look in the medical field.

Healthcare sector generates huge amounts of data from EHR (electronic Health Records) and EMR (Electronic Medical Records) from the in-patient data. With the help of the smart healthcare systems and devices data for outpatients can also be collected in real-time to run machine learning algorithms and analytics based on artificial intelligence [19]. With the sophisticated, state-of-the-art smart systems, more detailed and holistic data obtained by the health sector can be used by numerous machine - learning algorithms to anticipate and understand the current and future needs of patients in health-care units. A medical professional would have difficulty analyzing the different number of tests from multiple patients as well as the symptoms of each person. As a consequence, a physician will have a hard time diagnosing illnesses with such a huge number of samples. Faced with a huge number of devices and deep learning algorithms that can manage effectively with lower error rate and higher accuracy than the Technicians of the laboratory, the decision of the optimal choice should be made [20]. Artificial Intelligence (AI) learning algorithms may manage vast quantities of documents collected from such IoT devices over time and then forecast the outcome that the data collected from EHR, EMR and IoT enabled sensor based smart wearables are generated and transmitted for further analysis and feedback to the respective medical partitions [21]. AI machines can think like people, move like humans, and function like supercomputers [22]. It makes the detection of illness more quickly and more reliably. The patient's prior clinical history may help the patient and/or a doctor of present to identify possible diseases and can also advise the patient about how to handle the disease and/or gather other evidence to maintain health over the long term [23].

### *Smart Healthcare Systems*

Because emergency rooms and physician-patient contact are often unreliable due to the scarcity of disease and necessary drug information, doctors cannot be sure that treatment will work for them. . Given that half of the drugs and treatments used by healthcare professionals did not provide efficacy or survival in the participants, suggested that these trials involved sample numbers poor as a sample size, studies were replicated, and the results of the studies were considered simply averages. To say that a physician may not have enough detail at hand to provide an accurate care plan for patient shows

incompetence on the part of the physician. However, much of the healthcare they provide has been enhanced with future goals including artificial intelligence. The future of healthcare is to provide doctors with intelligent systems, smart technology and intelligence. Artificial intelligence will allow technologies to be applied as a second pair of eyes in the medical field.

The healthcare industry generates large amounts of data from EHRs (electronic health records) and EMRs (electronic medical records) from hospital patient data. With the help of, data from outpatient smart healthcare systems and devices can also be collected in real time to run machine learning algorithms and AI-based analytics. [19]. With sophisticated, modern intelligent systems, more than detailed and holistic data obtained by the healthcare sector can be used by a variety of machine learning algorithms to predict and understand needs Current and future needs of patient care units. It would be difficult for a medical professional to analyze the different test numbers of patients as well as the symptoms of each person. Therefore, it would be difficult for a doctor to diagnose diseases with such a large number of samples. Faced with a large number of deep learning devices and algorithms that can effectively handle with lower error rates and higher accuracy of than lab technicians, a decision must be made choosing the optimal [20]. Artificial intelligence (AI) learning algorithms can process a large amount of material collected from these 4044 IoT devices over time, and then predict the outcome that the data collected from these 4044 IoT devices will produce. smart wearable devices based on EHR, EMR and IoT sensors are generated and transmitted for further analysis and feedback to medical subdivisions respectively [21]. AI machines can think like people, move like humans, and act like supercomputers [22]. It makes disease detection faster and more reliable. The patient's clinical history can help patient and/or the current physician to identify possible conditions and can also advise the patient on how to manage the disease and/or obtain medical evidence. other evidence for long-term health maintenance[23].

### ***Smart Health Monitoring***

IoT-based smart devices enabled by sensors and integrated with artificial intelligence are challenging the traditional way of delivering healthcare and disrupting care management health by providing smart services with notifications for what matters. For example, artificial intelligence algorithms for arrhythmias continuously monitor and remember heart patterns over a period of time and perform supervised learning to observe the patterns. In the future, when the pattern changes significantly, it will give an indication of the heart rate change to the user and suggest that they contact a doctor [16], [27]. Samsung active watch 2 monitors heart rate and breathing pattern, which changes with stress level, when the AI algorithm detects sudden and significant changes in heart rate and breathing pattern, it will show signs of stress for you. the user's heart and immediately notify him to perform a guided meditation using the Samsung Health mobile app [13]. Likewise, with the integration of data enabled by sensors and artificial intelligence, the traditional way of health monitoring is changing and bringing about a better way of life.

Wearable healthcare systems based on AI-powered smart sensors will not only allow users to record daily activities and physiological symptoms, but also help healthcare professionals take quick and accurate decisions for the future treatment of hospitalized patients. AI and analytics performed on big lab data and IPD documents with supervised learning based on past patient experiences helping therapists and physicians identify a treatment clearly aimed at reducing the length of hospital stay and the re-examination rate of patients [28]. Check Plagiarism Check Grammar Save Copy Delete Choose File Local storage Dropbox Select Mode:Simple Formal Advance Select Language Plagiarism Remover Google Play Icon.

### ***Care Service Orchestration***

In the digital era of industry 4.0, where all the machineries and instruments relate to each other via sensors, the healthcare sector is also going to disrupt its services. Today, hospitals are one of the crucial pillars of the healthcare system (as hospitals are providing all services to all like consultation, admission, critical care, ambulatory services, lab tests, CT Scan, radiology tests, radiations etc. for all acute as well as chronic diseases and disorders). However, in the near future, hospitals will lose their importance and it will be just a small part of a large healthcare ecosystem [3]. Healthcare sector is fragmenting itself, where all the services will work in silos but are connected to each other. For example, the hospital will have patients requiring major surgery and patients in the intensive care unit, however, consultation, testing, radiography and outpatient services will soon be out of the hospital. hospital. In this day and age where everyone works in silos, they need to be seamlessly connected and integrated with the concept of orchestration where everyone does their own work but in an integrated way.

Care coordination can be defined as the extent to which the portal development technology and processes assist in enhancing the development and synchronized exchange of knowledge and service flows across the institution. connect stakeholders to interact using real-time digital technology is used, to build a favorable atmosphere in which users will participate in a friendly environment [29], [30]. Care coordination follows an integrated approach that connects less centralized systems with a standardized network of connections, allowing healthcare managers and professionals to provide a high-level summary higher for the whole system. This can then be used for a "visual table". In a base network, the base network allows the best capabilities of each facility to be used for the benefit of a larger network.

Care service orchestration postulates itself around the concept of seamless integration with upstream and downstream. Where, data can be shared seamlessly and based on that early intervention of various medical professionals can be achieved [29]. For healthcare organization point of view, healthcare providers need highest degree of integration among them at various levels (as it is critical to share and disseminate the knowledge about latest treatment innovations, protocols, number of beds in hospital, number of tests must be performed under pathology lab, radiology lab etc.), and with the patients also to deliver the service in a satisfactory manner.

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## **RESEARCH METHODOLOGY**

The aim of this study is to investigate the effect of smart systems. The study technique chosen was an exploratory study on healthcare, a popular methodology in many science fields, including earlier experiments on health care 4.0 [31]. Such a method has been selected since it has proved effective in the early stages of the analysis of a phenomenon, throwing light on the interaction between ideas that comprise theories. Additionally, this testing approach

has certain advantages: B. Highly representative, low-effort, standardized triggers for all respondents. By quantifying observational data obtained from respondents, surveys often add predictive meaning to their results.

Respondents working on the integration of healthcare and technology were identified and invited to participate in discussions and surveys. We conducted an initial semi-structured discussion to select the underlined smart system with 10 respondents, after which the respondents ranked smart system technology among high, medium and low impact technologies. were evaluated in three categories. Table 1 shows all relevant technologies and their impact on intelligent systems in healthcare.

## RESULTS

A brief summary of the results of the discussion is shown in Table 1, along with smart system technologies that can be deployed in healthcare. Their impact in medical scenarios is high, low, and moderate.

Table no. 1-Intelligent systems and their impact in healthcare

	Use in health scenarios	Impact
<b>Remote Consultation</b>	<b>Includes eHealth, mHealth services</b>	<b>Low</b>
	<b>Remote patient – physician consultation over any audio, video aid</b>	<b>Low</b>
<b>IoT-enabled monitorig of patients</b>	<b>Includes patient monitor using wearable sensors</b>	<b>Moderate</b>
	<b>Non-Invasive Digital Technology for Home Care</b>	<b>Moderate</b>
	<b>AI-Enabled Algorithm to Predict Fall Detection in Metabolic Disease</b>	<b>High</b>
<b>Orchestratio n service technology</b>	<b>Connected medical staff deliver 360-degree service</b>	<b>High</b>
	<b>AI-enabled algorithms to notify medical professionals of patient emergencies</b>	<b>High</b>

## CASE STUDY

We adopted and developed a case-study-based approach used in [32] to analyze the importance of intelligent systems in a fragmented health scenario. Many case studies are possible as smart systems are used to support diagnosis and treatment, health management, disease prevention, risk monitoring, and transform hospitals into smart hospitals [24]. However, for the purposes of this study, we created a case study of a medical scenario organized using an intelligent system.

Patients with metabolic disorders (diabetes mellitus and heart problems) use wearable sensors (bracelets and glucose biosensors). Sensor-enabled devices continuously measure vital signs and create data storage. AI-enabled intelligent algorithms using machine learning continuously analyze data. One morning, when the patient was engaged in routine exercise, the patient felt sick and had poor cardiac function, and the same was replicated in the sensor-activated data. AI-based algorithms instruct patients to rest and manage their health. Meanwhile, the intelligent system also informs the patient's physician and nursing service network of the current health status. All network partners in the healthcare provider system, including diabetes specialists (because patients also have diabetes), are currently on standby, if sensor-driven data is not up to par. This allows patients to be intervened earlier by health professionals and receive better care.

## PROPOSITION DEVELOPMENT

Figure 1 shows the future of healthcare systems at the full potential of intelligent systems, information technology, machine learning, and artificial intelligence. This diagram clearly shows what the future of healthcare will look like when cutting-edge innovations organize hospitals, patients, data

scientists, databases, ambulatory services, ambulances, and path labs. I'm here. This intelligent system not only tracks the user's daily activities, but also alerts via his mobile app when physiological vital signs are not within normal ranges or when patterns differ significantly from normal patterns. emits These technologically advanced intelligent systems help physicians and professionals find patterns in inpatients and outpatients and use AI/ML (Artificial Intelligence/Machine Learning) algorithms to analyze hidden patterns in data. and enable early intervention in emergencies. When patient health is monitored and that data shared with medical professionals in real time, everyone can take responsibility. These organized services between various healthcare practitioners add value to healthcare and are beneficial to patients.

The combination of IoT-enabled smart devices that track and share vital physiological data with users in real-time and artificial intelligence capabilities will lead to the emergence of intelligent systems that provide users (patients and physicians) with alerts and notifications. Suggest. during emergencies. In emergencies, a network of stakeholders builds, integrates, and delivers coordinated services, while everyone works in silos but integrates to serve patients through intelligent systems. (Figure 2).

#### ***F. Propositions***

- 1) P1: IoT-enabled integration of sensors and AI-based devices will enable smart healthcare systems.
- 2) P2: Smart healthcare system will allow real-time monitoring of patient health.
- 3) P3: Real-time monitoring of patient/user physiological signs enables coordination of care services between providers in the care network.

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## **CONCLUSION**

The study provided a framework for future smart health services powered by IoT and AI. The study explores what the future of healthcare will look like by integrating artificial intelligence and his sensor-enabled IoT-based healthcare device into the , and how both systems will work together to shape the future. Learn how to create an intelligent healthcare system.

A future healthcare services framework was introduced by reviewing the literature on artificial intelligence, machine learning, the use of intelligent systems in healthcare, and IoT. In this study, the use of sensor-enabled IoT-based wearables and artificial intelligence is presented, along with how intelligent systems enable networks of medical professionals to remotely monitor patients and deliver organized medical services. I was. This study provides a detailed and holistic framework for future healthcare services that seamlessly connect patients, physicians, and other healthcare professionals to deliver timely, on-demand healthcare services.

This study describes future intelligent healthcare systems that enable real-time patient monitoring and orchestration of care services across network partners. This research uses literature support only for statement preparation. However, our study lacks the essence of empirical validation backed by large-scale data. The future scope, however, lies in building intelligent healthcare systems and developing appropriate scales of measurement for real-time monitoring of patient health, and translating propositions into testable hypotheses from which data-driven evidence can be selected.

Although this study was limited to literature-based framework development, it provides a holistic framework that enables health professionals to deliver superior health care services. However, the scope of the investigation is limited to the healthcare sector only. On the other hand, this study opens up opportunities for future researchers to translate statements into testable hypotheses and to validate research findings empirically.

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