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IoT based Smart Healthcare Monitoring System: A Systematic Review

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ABSTRACT: Among the various IoT applications, research into health care systems is still in its early stages. Health care applications point to interest in IoT devices due to lower cost, easier to understand, and improved patient satisfaction. In this paper we depict an idea of in what way IoT used into health care monitoring machines. It is one of the most important application of IoTwhich includes sensor, patient, surgeon, system, and supplementarykeen devices online. In a non-functional way, the IoT-based smart HMS provided an opportunity for physicians to evaluate their patients at a consistent distance. The Internet of Things is jeopardizing various developments such as frequency bandwidth, smart mobile intelligence, wireless wiring network (WSN) that integrates with Coap, 6LoWPAN, REST, and other protocols.

Index Terms—HMS (Healthcare Monitoring System), Internet of Things (IoT), Smart healthcare, WSN (wireless sensor networks), radio frequency identification.

INTRODUCTION

In 1999, the word "IoT" was coined by Kevin Ashton as an important integrated infrastructure where multiple services were created. There are various IoT[1] definitions, and depending on the “IoT European Research Cluster (IECR)” definition plan, it is a powerful grid infra-structure capable of organizing itself in the framework of common communication agreements[2].We can say that IoT is a connected infrastructurewhich helps to connects everyone, no matter what, anytime, anyplace, or any facilities. It seems to be aa transformation process that seems to undergo various changes over the years. IoT became like a novel concept for a variety of energy-efficient technologies used to create an intelligent environment[3].

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LITERATURE SURVEY

IoT research is widespread and growing through connectivity and limitations. The key purpose of IoT is to confirm that all devices are usuallyaccessiblethrough electronic sensors[4], Internet connectivity and the transmission and reception of information[5]. In one study, 28.4 billion IoT operatorswere there in 2017 and in 2020, this will influence 50.1 billion. It offers a variety of services depending on technology[6].Connection maintained by wireless network, mobile networks, NFC and GPS etc. Whereas the most widely used sensors are accelerometers, compactor devices[7]. These programs provided "smart" health care, cars, web, car parks, also a "smart" homes. The role of IoT is consequently to integrate different systems with automation so that communication can be provided without interruption. As with all software developments[1], [8]–[10], the first area of the IoT process is divided into requirements, specifications and functionality[3]. The final stage containing the design phase is an important approach. H. Eskelinen presented two questions to understand the needs of each IoT project and included the same in the design phase.

According to authors, the times of construction-based research lead to the following ideas. Adequate research needs to be done before financing construction, a system must be developed that integrates tangible objectives and concepts simultaneously, one must always keep in mind that real-world setting is a research center, project participants should work together without controversy, data obtained should be analyzed as soon as possible[6]. According to Past and present data [11] research methods should be done in a systematic and appropriate manner. Therefore, the design should always be considered for any other functions, and the selected improved designs should be shown to be continuous over time[12].

This study consists of looking at system requirements using a specific design approach, such as typical software development studies. A large part of IoT has WSN, which also plays asignificant role in health care. In 2012, underlinedthat WSN's performance in keeping track of stroke and oxygen level[13]. At other end, in 2016 sensors for ECG and blood pressure fixed into ahandset. As previously described, the wireless systemassistances to use the IoT method in the health model[14]. In 2012, Wi-Fi technology used to transmit information about a variety of bodily utilities such as blood level, heart rate, body temperature, and oxygen saturation in control area. The authors has installed Bluetooth device on smartphone to continue monitoring patients[15].

IoT IN HEALTHCARE

By using internet of things, a major change has made where well-beingfactscan be separated from the health sensory grids in clinical investigationas well as evaluation. The most significantadvantageof IoT in health care is to decrease the charges of care tracked by a growth in probabilities of getting decent health care. The addition of private and online healthcare nets has been a great learning experience and he predicted that future kill programs for mobile information and general technology would have cloud health practices and services. IoT has already been proposed as a platform to monitor primary health care to stimulate the nerves.

By the inaccessibility of active observing instruments, a possibility is there that many higher risks could be caught. This is where technology like IoT is played. Such vigilance benefits

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the patient. Patient details are analyzed by multiple sensors. The caregiver can provide appropriate health care guidelines[16]. IoT devices are widely used for disabled patients who need ongoing care. The observing equipment, through sensors, collects all the facts of the patients referred when caring for caregivers, thus preserving a continuous information flow[17]. This recovers the care quality easily. This ultimately results in the care charges[18]. The following figure illustrates role of IoTin healthcare field.

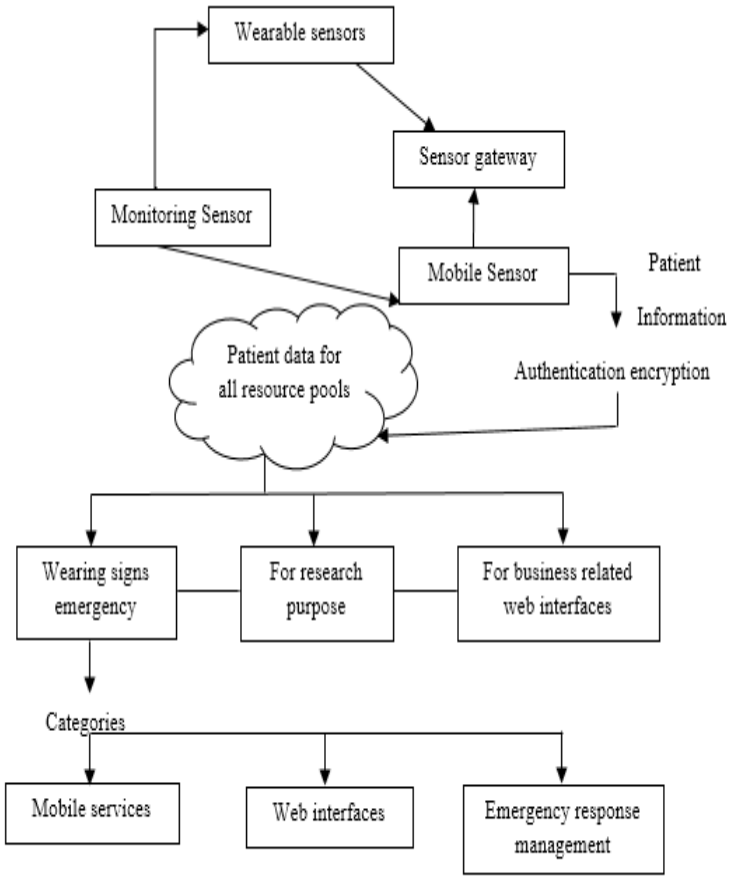

Fig. 1 IoT in Health care Monitoring System based on IOT

1.1 Framework of IoT

It is a network of devices linked to physical articles, which supportto detect, examine, and remote controlled devices. A theoretical framework defined for joining computer hardware to enable communication between sensors and smart sewing tools. IoT applications rely heavily on the middleware layer in the use of IoT architecture data. Other IoT systems live well, “smart grid”, “smart city”, “smart home”, “smart agriculture”, smart communication, so on. The three basic structures of IoT are built on understanding, network and application layer. After that, it expands to continue building and incorporating middleware and business scope[6].

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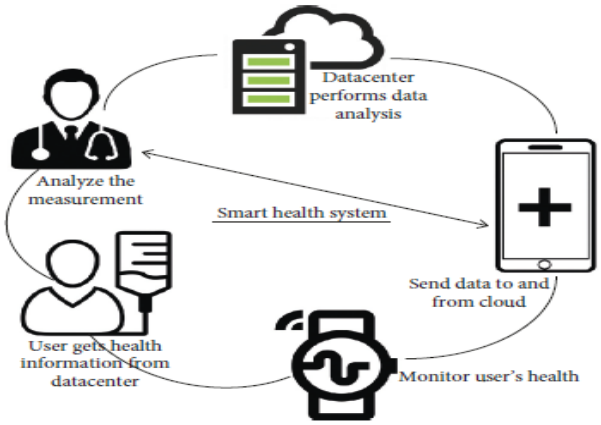

Fig.2 Framework of IoT

- **Observationlayer**: This levelobserves sensory as well as physical devices. The sensor device on the sensor layer points to it and detects the object and collects information about the object. Depending on the type of sensor, the data collected may be about temperature, movement, position, humidity, vibration, location, speed, chemical changes, etc. The information is transferred to the next layer for processing. When a young woman wears clean earrings on her ears and helps to determine the shape of the various organs and find the position of the woman. The view layer transfers the collected data to the object in the processing network layer[19].It is also called "Transmission Layer" and the main function of this layer is to link various servers, "smart devices" and "network devices". This layer Transferfacts, which is collected on sensors.
- **Middle-ware Layer:**This is known as main processing layer, which retains, analyzes the huge data obtained from network layer[20]. It is Responsible for database communication and resource management.
- **Application Layer:**An important function of this layer is to transfer resources focused on using users. It is directly interconnects with end users. If the evidence is collected from the woman'sjewels let her know you have anillness[21]. It communicates withsomebody by transmitting the flu warning to on smart phones.
- **Business Layer:**The business background governs every IoT business model. It helps the end user to make multiple action decisions. For example, if a person has the flu the nearest clinic or hospital may recommend that you show details[22].

1.2 Wear-able Gadgets

These gadgets customized health through items such as bangles, ornaments, shoes, printed clothing (T-shirts), rings, sunglasses[23]. The wearable devices contain three elements: sensors, computer networks connectivity and displaying screen[18]. These gadgets provided natural details like calories, walking steps, heart rate, blood pressure, and time spent on exercising, etc. Various wear-able gadgets are given below:

- ✓ **Pulse Oximetry:**This device used to monitor oxygen level in the human body, following a variance in level of blood pressure associated with the heart cycle[24].

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- ✓ **Electrocardiography (ECG):**The heart tracking format is continuous and provides information over time. Therefore, ECG measurements based on wireless sensor devices are very limited in practicality.
- ✓ **Blood Pressure:** It helps to measure the amount of energy used due to the flow of blood through the blood vessels[25].
- ✓ **Electromyography (EMG):** TheStudy of muscle function by looking at electricindications used by muscles[18]. Therefore, the EMG indication gives an actual way to track human muscle activity.
- ✓ **Electroencephalography (EEG):**It is a reflection of functions of the human brain. Wireless Intelligent Sensor (WISE) that used for low-frequency control and is introduced to detect EEG signal data[26].

1.3 Applications of IoT in Healthcare

Health care applications allow patients and the elderly to livingself-sufficiently. At this stage, IoT sensors are used to diagnose as well as re-evaluate health condition and show alerts of the happening insome illegal situations. If other minor problems are identified, the IoT system itself detect can advise patient accordingly[27].The sections described below covers the several uses of IoT in healthcare.

a. **Single status applications:**These applications intended for a specific illness.

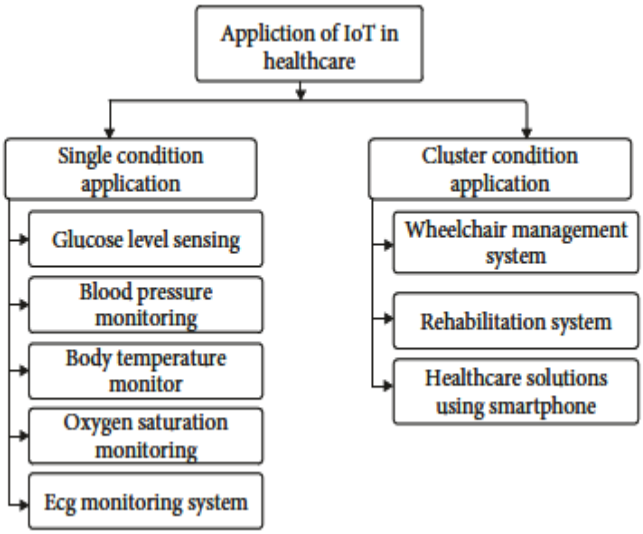

Fig.3 Categories of IoT applications in Healthcare

- **Glucose Sensitivity:**Diabetes is an auto-immune disease in which the level of sugar rises from the normal level over a long time period. The blood sugar monitoring device produces a specific type of glucose in blood and supports to promote a healthy diet, necessary exercises, and medication times[28]. A method of stopping m-IoT glucose that is not basically approved is actually proposed.
- **Blood Pressure Monitoring System:** High pressure of blood strongly indicates that the heart is circulating blood around the body[18]. It is supported by an IoT-based approach to diagnosing and managing health issues such as high blood pressure, hemoglobin, blood sugar levels, as well as abnormal cellular growth.

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- **Body Temperature Monitoring:** ItMonitors temperature of body.

b. **Consolidated status requests:**These applications used to treats certain diseases together.

- **Wheelchair Management System:**To save the lives of the elderly and the disabled, comfortable wheelchairs are recommended by investigators. In this field, IoT plays an important role in accelerating this process[11]. Smart wheelchairs have a variety of sensors that tracks movement of the seat and notice patient status.
- **Rehabilitation System:**IoT can improve the process of rehabilitating problems related to human growth and skills shortages. It improves the skills of people with physical disabilities[29]. The default design of Ontology governs that IoT is the most effective field to provide real-time data integration. Many IoT testing programs include an early childhood education program, an effective urban medical rehabilitation program, and an integrated prison application program[23].

c. **Healthcare Solutions Using Smartphones:**So far, smart phone shows the control over electronic devices throughsensors[29]. A list of most commonly used smartphone applications for general healthcare is given in Table.1.

CONCLUSION AND FUTURE SCOPE

In this paper, IoT is described as a major benefactor of health care distribution systems and how, health care is one of the most widely used IoT products. It helps to play a more active actionfor providing health care to everybody, at all-time and anywhere by take away space, interval and extra barriers simultaneously, increases its attention as well asquality. The IoT evolution in health care is real and as a result persons can getting high superiorityprecaution. Such applications make a large quantity of sensory data that requires to be properly accomplished for monitoring and processing.

Table1: Health care applications in smartphone

Applications	**Depiction**
health assistant	It saves the evidence of health factors such as body weight, blood level, temperature of body and other bodily actions.
healthy children	Help for searching a pediatrician in close place and needs for rapid reactions.
Google fit	Using Sensors, it tracks walk steps, running, as well as cycling activities.
noon walk	This application measures the physical condition similar to pedometer that counts the user's steps.
heart rate monitor	Allow user to measure and check the heart rate at real time and maintain a proof for afterward investigation.
eye care plus	It aids in physically improving vision through testing eyes.
blood pressure watch	It is a wear-able gadget that gathering, monitoring, as well as keep the details of blood pressure facts.

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