

A Survey of Health Care Monitoring System for Maternity Women Using Internet-of-Things

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Abstract: *Internet of Things, in short IoT, is now increasingly being used in the field of Health Care Systems, especially in monitoring vital health issues of pregnant women and fetuses. Women who are uncertain about their pregnancy will have a confidential health care report system developed from the data of the previous medical reports. The research problem chosen here proposes an efficient Monitoring System for enhancing the confidentiality of confirmation of pregnancy or otherwise as it is an important emotional and decisive factor in a married woman's life. This paper gives an all-inclusive survey of the various kinds of applications including the Healthcare Management System experimented and implemented via IoT in recent years.*

Keywords: *Internet of Things (IoT); maternity issues; healthcare monitoring system; data set (clinical samples).*

I. INTRODUCTION

As per the general definition of an IoT, it can be defined as a model using which objects can communicate with each other as they are equipped with processors, sensors, and actuators. IoT has been a force that has been merely regarded as a communication between the digital and physical worlds. In other words, IoT can be considered as a network of physical objects which could be used to spread out the internet connectivity above the usual devices like PC, Laptops, tablets, and smartphones to any non-enabled physical devices along with daily objects which could be facilitated to transfer and gather data as well as the task assigned by the user. These aforementioned devices have been given the capacity to interact over the internet with a possibility to remotely control and monitor them.

IoT plays a vital role to create the interface between users to IoT and it creates communication and manages end-to-end message delivery in the network area, although it maintained a centralized manner in a wireless network. Users can easily be controlled and convey the message through the gadgets in a secured and authenticate way in web-based applications, and the sensors send the alert message based on the actions recorded and notified in the environment, that thing automated in the infrastructure. [4] The followed devices are concluded in the IoT architecture, are sensors, protocols, actuators, cloud services, and three layers. In the future, IoT-based

technology will be capable of providing advanced levels of services. The presence of IoT can easily be felt in medication, power, cistron therapies, agriculture, smart cities, and average homes. About nine billion 'Things' (physical objects) are presently connected to the net and the number will increase amazingly.

Characteristics of IoT:

- It is well-organized and also very scalable.
- In the future IP-based addressing may be outdated.
- IoT can penetrate even those physical objects that don't use science and its efficacy is stronger.
- Devices usually consume less power and automatically shut off when not in use.
- A device, connected to a different device, may not be connected to another at a time.
- Intermittent property—IoT devices remain disconnected when not in operation, and as a result power is saved and unnecessary information doesn't overload the system. So it ensures more efficiency of the system.

A. Components of IoT

i. Sensors/Devices

IoT Framework forms the core infrastructure by use of Sensors, actuators, computer servers, and the communication network. Sometimes other technological devices like middleware are required. An operating system or database backend storage, and applications connected through the middleware, it can be used to create the interface and handle the components in the automatic behavior. Sensors and actuators are fundamental devices that facilitate interface with the current world. Sensors are the source of IoT data. Sensor technology provides increased accuracy with the advantages of its size of the compact level, easy to buy and assemble in the design, due to in which this desired facility not available in the existing methods and technologies. Sensor devices contribute a major part in the digital world, and needy of the IoT is mandatory that every year witnesses millions of new sensors deployed. The transducer is a physical device in the sensor, it converts physical occurrence into a form of electrical energy. It can understand by the interpret operation. For instance, a sensor of the microphone that converts the sound waves into

another form invaluable method additional apparatus presents in the IoT system performs the reverse function, again once gets back to the original sound. Extra elements attached in the actuator, it's widely involved in the transducer part. An actuator works as a reverse pattern, it transforms the electrical energy into physical activity as in the case of an electric motor.

A sensor device in a certain IoT is used to gather the information, respond to the actuator signals, and send back the valuable reply through managed and authorized input. The entirety of this gathered information compared with the various degrees of complexities going to check the minimum level of temperature points to a complicated video streaming. A widget is attached to different sensors that are associated with a group to bring about impressive other than detecting systems. Even though our Smartphone device is a widget to contain various sensors, for example, GPS, accelerometer, camera, and it's has a problem to detect things alone. In an IoT system, there can be several different types of sensors like flow sensors, temperature sensors, voltage sensors, humidity sensors, and so on.

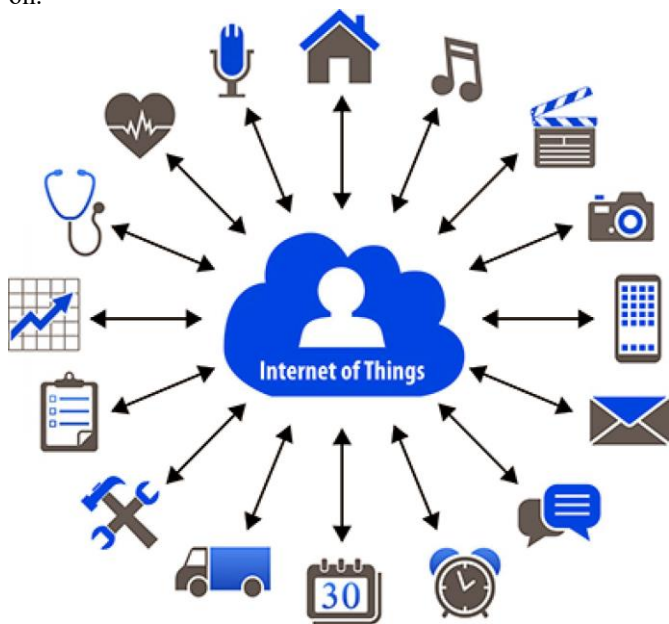


Fig.1: IoT working Environment

ii. Connectivity

Later, the gathered data is appropriated in the foundation of the cloud however it requests a mechanism for transport in the IoT. [5] The sensors might be associated with fitted devices and communicate through cloud storage. Geopatial system is incorporated with the device in the correspondence, and transports like smartphones, satellite organizations, wide range Bluetooth, overseas-region organizations (WAN), and considerably more. Every picked decision might be having little information and cooperation, which does convey between data measure, utilization of power. So, it is very important to select the simplest property choice within a certain IoT system.

iii. Data Processing

Even though the data is gathered and shipped off the cloud, the product continues to handle the accessible information. There can be a wide scope of utilizations. It can be very simple like checking the temperature reading on devices such as AC. It can likewise be intricate like distinguishing outsider articles. Maybe, it can be an intruder into one's residential place or an unwanted and obtrusive computer video clip or footage. In such contexts, the user ought to come into the picture. So user intervention or interaction becomes indispensable in a critical and emergent situation, for example, when the temperature is too high or if someone trespasses on your privacy furtively.

iv. User Interface

After that, the data that should be shipped off the end-client concerned is made accessible to him/her here and there. This can be accomplished by the method of setting off cautions on their cell phones or by the method of advising something fundamental through writings or messages.[12] Next, users sometimes may make use of the interface facility in the course of IoT device framed the structure, its managed, and data. For example, clients or applicants are interested in introducing his home and check every video storage through web server applications even in the context of his unavoidable absence at home when he is far away from home. Consequently, the end-user can get alerted and avert a tragedy or disaster through a timely action through an online server.

v. Base Station

The base station assumes much importance and occupies a superior position in the wireless network hierarchy. It serves as a bridge and helps to establish the bridge path between the applicant, and the network.

vi. End-User

Numerous applications are possible with the help of the accessible data in a sensor network. Of the previous popular applications, the network data is a well-known and widely used application.

B. Challenges and Issues in IoT

The data collection entails many challenges like data collection, process, and progress to the specific destination point. An amount of information can be transferred n source to destination by the use of an IoT system, where the data storage, pre-processing of data, and the connection between the users and gadget. The above discussed the operations performed by the edge of the network through a remote server.

If the IoT needs to grow, in this area major parts are covered and controlled by three classes: security, connectivity, compatibility & longevity. First, as very numerous new nodes are added to networks step by step the Internet passes the information vindictive entertainers with innumerable assault vectors and impending outcomes to carry out their insidious

deeds, mostly as an impressive number of them knowing the ill effects of security gaps.

Second, today the applicants recommend the valuable and worthy things in the digital world, and they verify and validate the proposed model. Most of the proposed models are included hundreds and more gadgets. All our desires, with the progression of time when organizations are designed and developed to join various levels of gadgets, integrated IoT frameworks will convert into restricted access.

Third, IoT requires well organized and easy to assemble with the coordination of enhanced gadgets. Other issues emerge from clients carry out together cloud administrations, absence of normalized M2M conventions and range in firmware and working infrastructure along with IoT gadgets.

A segment of these innovations set in the long run become out of date soon, adequately delivering the gadgets executing them futile. The major challenge faced by the researchers for a longer period is providing security to the connected devices. The recent cloud service providers make use of threat intelligence methodologies in identifying the security issues in the cloud. There are also other related methods like Artificial intelligence related monitoring tools.

The techniques which are used in IoT are found to be complex one as the processing of data has to be done instantly. As the system is found to contain personal information of the customers they have to pay a ransom amount in terms of bitcoins to recover the information.

Securing the data becomes a tedious approach as data is found to be disseminating between the devices within a few minimum seconds. The instant it is present on the mobile it is established on the web and also in the cloud environment. The data which is transferred over the public network internet is found to have a data breach. The devices among which the data transmitted is not found to be secure. When the data breach is found by the hackers they sell the data to other companies.

Many devices lack to get updates even a single one. The products at the time of purchase are found to be more secure but it is found to be a vulnerable one at the later stages when the attacker is found to identify the weakness in the system. When these security issues are not concentrated and it has to be checked for frequent updates for hardware and software it is found to create a way for more vulnerability.

The IoT companies which sales the devices with default credentials like admin usernames and passwords. The hacker will make use of this type of default credentials to exploit the systems. We are worried about the guarantee of weak data and resources and almost certainly, our very lives and safety can turn into the intention of IoT hack assaults. So, we need to update the devices periodically in tune with arising challenges and demands.

Objectives of an IoT system:

- Scalability
- Facility to treat divergent data types
- Minimal requirements for domain knowledge
- Capable of concluding input parameters
- Talented to the treaty with sound and outliers
- insensible to an order of input records
- Incorporation of user-specified constraints
- Interpretability and usability.

II. IOT AND MONITORING IN PREGNANCY SYSTEM

In the maternity healthcare system, the essential need at present is to enhance the existing monitoring process during the maternity period. In this connection, the IoT system helps to effectively ensure women's health and childcare during the maternity phase.

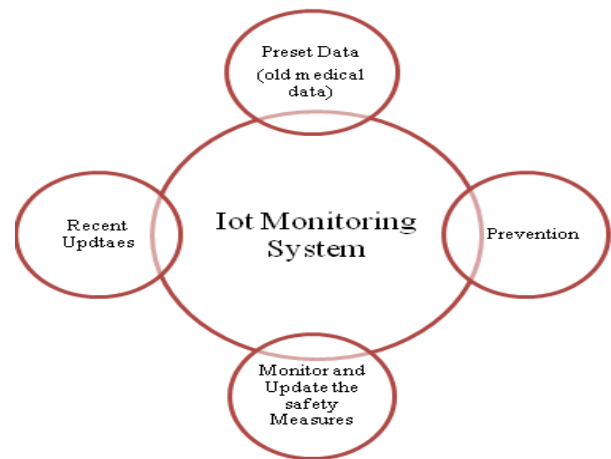


Fig: 2.IoT Monitoring System

The Pregnancy Monitoring System comprising an IoT-enabled integrated model consolidates the pregnant women's data relating to the four attributes, namely preset data, recent updates, prevention and monitor, and proceeds to update the safety measures in a woman's health system.

Preset data: Preset data consists of pre-defined and result-oriented results in the previously tracked patients' record-based data collection. [7] The preset data collection increases the monitoring scalability and saves time by providing the predefined results helping to take a clear decision on knowing the patient's condition at a given point of time.

Recent Updates: It takes care of every new update and saves the analysis of the patient's dataset by making a clever decision.

Prevention: In this part alert the precautionary thing based on the patient information. Prevention constraints in healthcare will lead to a superior level of care in maternity. Monitoring is done with an objective so that the preset data will trace the pregnancy women's situation.[8]The monitoring

of a pregnancy system with IoT provides an effective way of prevention for pregnant women and children.

III. PREVENTION METHODS TO IMPROVE MATERNITY CARE IN THE HEALTHCARE SYSTEM.

The patient's activity is closely monitored by health care systems. This information are been sent to the smart devices of the authorized users through the cloud server. All the information which is possessed can be stored and analyzed which serves the purpose of decision making. By utilizing the parameters the patient's vital information can be retrieved in terms of temperature, oxygen, and heart rate which serve the purpose during the period of emergency.

IoT is found to be a pioneer in the field of health care systems in monitoring and analyzing the health of the patients. As IoT makes all objects to be interconnected, pregnant women can use some of the IoT applications like healthcare and home automation, etc. In two ways we can enhance the monitoring process in pregnancy healthcare through reliable IoT devices: one, monitoring and comparing with preset data, and the other, preventing health issues through successive updates. By monitoring and updating the preset data techniques efficiently, we can take decisions in a critical situation earlier than usual in the normal course. Among the many existing methods to increase the monitoring process in pregnancy, the focus here is laid on the method of updating the preset data with a precaution technique coupled with safety mechanisms.

IV. A SURVEY OF MONITORING METHODS TO IMPROVE MATERNITY CARE IN THE HEALTHCARE SYSTEM.

The monitoring process can be prolonged in healthcare using the IoT device. The proposed model is identified as an improvement upon the performance of the attributes and their workability with preset data, precaution management, updates and automatic updating with safety measures, etc. Later, this pregnancy monitoring system is compared with those of the existing works to prove its better efficiency in the medical domain.

Saturno-Hernández, P.J *et al.* [15] discussed the pregnancy monitoring process by analyzing only the basic monitoring approaches, specifically motherhood care, childcare, prevention of health issues, and safety measures of a monitoring process. The model proposed here proceeds to add some more positive and reactive algorithms to theirs.

Cortés *et al.* [16] discussed Securing Personal Health Records in Clouds with regard to some basic concepts involving pregnancy time precautions and healthcare management and advantages. They have concluded that the monitoring and updating the pregnant women's information using IoT devices will enhance the implementation of safety precaution during pregnancy.

S. R., (2020) [1] used IoT and cloud computing service in a period of pervasive aid watching systems by studying the temperature, pressure, fall detection, breath activity, and associate degree graph through the Personal Health Devices (PHD). The prototype system model can further be used to detect any abnormality accurately.

Iman Azimi, *et al.* (2019). [2] employed a personalized pooling methodology to spot the missing knowledge resilient decision-making approach pooling the data resources in IoT systems. They monitored real human subject trials on the maternity healthcare system.

George E. Gomes, *et al.* (2017) [3] the authors made use of variables in developing devices which is potential enough in safeguarding the parameters.

Fritz Allhoffa, *et al.* (2018) [4] adopted the Ethical Analysis process such as military ethics and security studies and analyzed them in consonance with the healthcare system using IoT's.

S. Shiny Amala, *et al.* (2018) [5] point out that regular monitoring of the vital parameters of fetuses and women in rural areas reduces infant mortality like temperature, pressure for women, and heart rate by using different monitoring sensors with IoT.

Mustafa Sayed Ali Ahmed, *et al.* (2019) [6] proposed an IoT application for smart environments as they tend to face different challenges related to identifications, data management, security, etc.

Mir Sajjad Hussain Talpur, *et al.* (2014) [7] proposed an IoT-based health monitoring system that provides a strong rationale for a durable, medical trial to determine whether this pregnant women's healthcare system improves pregnant women's healthcare control among pregnant women with uncontrolled health complications.

V. Santhi, *et al.* (2017) [8] used a cost-effective system and the results are also accurate and precise by assessing the health condition of the patient through continuous monitoring.

Balaji, V R., *et al.* (2017) [9] devised a method for automating the agriculture work using IoT and thereby made it clear that IoT also plays a major role in management of the environmental pollution, natural and non-natural disasters.

Table 1 discusses the various pregnancy healthcare systems tested on different monitoring parameters. However, the work which is proposed here is found to be an improvement upon, and more effective than, the works covered in the survey.

Table.1: Summary of the existing Monitoring Methods in Healthcare

<i>Author Name /year</i>	Paper Title	Methodology	Outcome
S, R., (2020).	A Survey on Healthcare Monitoring System Using IoT	IoT with cloud computing service used to mitigate the The pervasive healthcare system in the medical domain.	Temperature, pressure, fall detection, breath activity, an ECG through the Personal Health Devices (PHD). Prototype model as well as to detect any abnormality accurately.
Iman Azimi, et al. (2019).	Missing Data Resilient decision-making for healthcare IoT through personalization: A Case Study on maternal health.	A personalized pooling method is used to identify data resources with missing data resilient decision-making approach matched in IoT.	To monitor real human subject trial on maternity health
Jeorge E.Gomes, et al. (2017).	IoT for environmental variables in an urban area.	IoT for environmental Variables in an urban area.	To display the parameter, collecting and ensuring the result.
Fritz Allhoffa, et al. (2018).	Internet of Things: Foundational ethical issues.	Ethical Analysis	Military ethics and security studies.
S.Shiny Amala, et al. (2018).	IoT-enabled Healthcare Monitoring System for Rural Pregnant Women.	Regular monitoring of the vital parameters of fetuses and pregnant women in rural areas reduces infant mortality.	The temperature, pressure for women, and heart rate of the fetus are measured by using different sensors.
Elmustafa Sayed Ali Ahmed et al. (2019).	Internet of Things in Smart Environment: Concept, Applications, Challenges, and Future Directions.	IoT in smart environment applications may face different challenges related to identifications, data management, security, and Interoperability between different kinds of aspects of the environmental system.	IoT system management of environmental pollution, natural and non-natural disasters, as well as controlling the management of vegetation in the environment.
Mir Sajjad Hussain Talpur, et al. (2014).	Internet of Things as Intimating for Pregnant Women's Healthcare: an Impending Privacy Issues.	The proposed system provides a strong rationale for a durable women's care, healthcare control, health complications.	To control and guarantee the privacy and self-respect of pregnant women healthcare.
V.Santhi, et al. (2017).	IoT-Based Wearable Health Monitoring System for Pregnant Ladies Using CC3200.	CC3200 of TI Company is used for a complete process that is cost-effective; the results are accurate and precise.	To analyze the health condition of patients continuously. The results are accurate and precise.
Balaji, V R., et al. (2017).	IoT-Based Smart Security And Monitoring Devices For Agriculture.	The proposed design is automated for agricultural work	IoT plays a major role in the management of environmental pollution, natural and non-natural disasters.

V. CONCLUSION

In sum, IoT is a vast expanse of associated things giving key physical information and further handling of that information in the cloud to convey business experiences. It presents a ton of chances for some major parts in all organizations and enterprises including the Health Management System. This paper dwelt upon the usage of IoT in various domains of human life including the health care system. As a prelude to the proposed experimental research, a survey of some researches undertaken in IoT-based applications in recent years has been done. The IoT-enabled existing pregnant women monitoring methods are considered effective but still, there is the hope of improving the monitoring system further. So an improved version is desirable with the help of the latest inputs in science and technology and the monitoring services need to be enhanced to make them more efficient and fool-proof to give better healthcare to patients.

The main aim of the proposed monitoring system is to adopt the latest trends and technologies that come into operation from time to time in the field of the healthcare system to better the monitoring system and plug the loopholes in the existing systems. The model proposed here aims at improving the efficiency of the system used to monitor pregnant women and make precaution alerts accessible to the patients concerned in time before much harm is done to either the expectant mother or her fetus.

This model is believed to be user-friendly and cost-effective. There is also a provision in the proposed system to update the system automatically as and when more advanced technologies surface in this arena in the future. So this proposed model based on certain reliable IoT devices will be of much assistance to pregnant women and children too before and after birth.

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