



## REVIEW ON IOT HEALTHCARE

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**ABSTRACT-** Presently a-days, Different items alongside human beings are getting smarter because of the Internet of Things (IoT). IoT has different applications in various areas, for example, smart home, smart city, traffic observing frameworks, healthcare, wearable, Intelligent vehicle leaving and so on. Internet of Things (IoT) has wound up being one of the regular region for different applications. IoT will make mechanical resistance in countless utilizations, for example, wise living, quick home, healthcare frameworks, mind blowing storing up and condition checking and inside these, healthcare framework is one of the most basic test that our general populace faces today. Before long a days there is dependably making energy for healthcare framework to improve human wellbeing. In this paper we have talk about different frameworks got a handle on for healthcare problems in the IoT by various specialists. Most of the examination is in a general sense dependent on the different healthcare procedures utilized in the IoT, for example, Wireless wellbeing checking, cloud based, framework, security and administrations in healthcare frameworks for healthcare applications.

**Keywords -** [Healthcare, Internet of Thing, smart hospital and early prediction.]

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### 1. INTRODUCTION

The huge development in creating technologies can make anything conceivable. The Internet of Things(IoT) is a strategy of interlinked processing devices, mechanical and electronic machines, articles, animals or individuals that are outfitted with one of a kind identifiers. IoT can move information over a system without the assistance of human-to-human or human-to-machiner cooperation. A thing in the IoT, can be an individual with a heart monitor embed, a domesticated animals with a biochip transponder or anyother normal or fake thing that have IP address and capacity to move information over a system. Utilizations of IoT innovation assumes crucial job in

agribusiness, building the board, telehealth, associated vehicle, wearables, smart frameworks, smart retail and transportation. The Iot based advancements serves parcel to the improvement of clinical society and for the patients requiring telemedicine.

### Internet of Things for healthcare

A rising enthusiasm of body wearable sensors has as of late rose as amazing assets for healthcare applications and various gadgets are as of now accessible economically for various purposes including individual healthcare, movement mindfulness and wellness. Analysts additionally have proposed new clinical uses of such advancements for frameworks of remote wellbeing monitoring

which incorporate functionalities for long haul status recording, and clinical access to physiological data of the patient. Most remote wellbeing monitoring proposed frameworks has design of a three level: body sensor arrange level which incorporates a wearable sensors functions as units for data procurement, for example, pulse, heart status and internal heat level, the subsequent level incorporate correspondence and organizing and the administration which collects data from sensors and sent it. The third level incorporates the handling and investigating hubs. The engineering of healthcare framework which incorporates three phases condition monitoring to procure data, this data is then assembled and move for the third phase for data analysis and investigation.

### Advantages of IoT implementation in healthcare:



**Remote monitoring:** 1. Real-time remote monitoring by means of associated IoT devices and smart cautions can diagnose illnesses, treat diseases and spare lives if there should be an occurrence of a health related emergency.

**Prevention:** Smart sensors break down wellbeing conditions, lifestyle decisions and the earth and recommend preventative measures, which will reduce the event of diseases and intense states.

**Reduction of healthcare costs:** IoT reduces exorbitant visits to specialists and hospital affirmations and makes testing progressively moderate.

**Medical data accessibility:** Availability of electronic clinical records permit patients to get quality consideration and help healthcare suppliers settle on the correct clinical choices and forestall confusions.

**Improved treatment management:** IoT devices help track the administration of medications and the reaction to the treatment and reduce clinical blunder.

**Improved healthcare management:** Utilizing IoT devices, healthcare specialists can get significant data about gear and staff adequacy and use it to recommend developments.

**Research:** Since IoT devices can gather and break down an enormous measure of data, they have a high potential for clinical research purposes.

### Problems in IoT Healthcare

There are various challenges as well that come with new technology.

**Varied standards and protocols:** There are a huge amount of healthcare devices that are used in the healthcare framework now that are IoT enabled. Various devices are integrated to monitor a solitary patient now and again. The fluctuation in the standard and conventions of the different devices make it hard to integrate and interpret the information.

**Security and Privacy:** We realize that the data between a specialist and a patient is limited by Doctor-persistent classification. The simple accessibility and access of the data can bargain the security of individual wellbeing information of both the patient and the specialist. There is a chance of cyber criminals abusing this data to make fake IDs to gain admittance to drugs that can be later

utilized for selling or use data to file fraudulent insurance claims.

**Data overload:** Different devices are utilized with technology all of which might not have a similar communication protocols and standards. This can prompt an enormous measure of data to be amassed all of which may not be effective in interpreting sensibly.

### Cloud and Internet of Things Based Healthcare Diagnosis

Both develop advancements Cloud Computing and IoT are in late past concentrated mainly on healthcare related problems. The unification of these two technologies brings up the culmination of the devices that are approved with them. The IoT devices that work on healthcare applications track and record data for every patient. The uses of information technology to healthcare record information like circulatory strain, ECG rate, internal heat level and so forth [10]. The healthcare problems are truly investigated by all nations due to the diseases that are affecting individuals where a couple is even anonymous and yet no cures are found to conquer its seriousness. The records are created in a database with the goal that it is made referable to all doctors around for relating purposes. These records are then reviewed dependent on age or some other seriousness factors.

**1. RAHUL SAHA, GULSHAN KUMAR, MRITUNJAY KUMAR RAI , REJI THOMAS AND SE-JUNG LIM (2019) et.al** proposed Privacy ensured e-healthcare for fog-enhanced IoT based applications. The pertinence of IoT and its related cloud-fog infrastructure frameworks in e-healthcare is tested to provide the most extreme societal benefits. Protection of personal records in ehealthcare system is considered in this investigation. Data aggregator stays away from multiple point cryptographic process and that has eased the planning requirements to some extent. Fuse of the query handler and role-based access control mechanisms have

handled the viewing aspect of the requested queries successfully. The novel consensus-based methodology used in the framework ensured the reliability of the requester to view the EMR. To put it plainly, the experimental and comparative examination affirm the method is efficient and beneficial for e-healthcare in cloud-fog network.

### Merits

1. The proposed approach is efficient and possess the required features for any cloud-fog based e-healthcare.

**2. M.Ganesan and Dr.N.Sivakumar (2019) et.al** built up an effective Cloud and IoT based disease diagnosis model to screen, foresee and analyze the coronary illness. In this examination, an efficient framework is used for coronary illness is made using the UCI Repository dataset and the healthcare sensors to anticipate the individuals who suffer from coronary illness. In addition, classification calculations are utilized to classify the patient information for the identification of coronary illness. At first, the classification calculation executes the preparation procedure which uses the coronary illness dataset to prepare the classifier to identify the nearness of coronary illness or not. At that point, the prepared classifier is prepared to test the approaching patient details to appropriately identify whether the patient suffers from coronary illness. From the broad exploratory outcomes, unmistakably J48 classifier is found to be the suitable calculation for the IoT based healthcare expectation model for coronary sickness appeared differently in relation to MLP, SVM and LR classifiers.

### Merits

1. J48 classifiers shows predominant performance as far as different estimates, for example, exactness, accuracy, review, F-score and kappa value.

### Demerits

1. Secrecy and security are among the most doubtful things in cloud processing.

**3. Asif Mehmood, Faisal Mehmood and Wang-Cheol Song (2019) et.al** proposed Cloud based E-Prescription management system for healthcare services utilizing IoT devices. They propose a framework dependent on android and a web application by which a specialist can endorse patients through an android application utilizing pointer pen and other users, for example, patients, receptionists, pharmacists and admins interact with the system by means of their web accessibility. The proposed system is based on integration of Internet of Things and cloud registering technologies utilizing Arduino and E-Health sensors. The users utilize the registered IoT devices which facilitate the healthcare stakeholders, making the system efficient, user-friendly and less error prone.

#### Merits

1. The proposed system has a better arrangement of dealing with the healthcare data just as provides an easy method to interact with the system.

#### Demerits

1. There are likewise huge dangers that each health care organization must face when transitioning to cloud-based hosting.

**4. Nada Chendeb Taher, Imane Mallat, Nazim Agoulmine, Nour El-Mawass (2019) et.al** proposed an IoT-Cloud based framework for constant and cluster processing of Big Data in the healthcare domain. We execute the proposed arrangement on Amazon Cloud administrator known as Amazon Web Services (AWS) and utilize a Raspberry pi as an IoT device to create data in real time. We test the arrangement with the particular application of ECG monitoring and irregularity reporting. We analyze the performance of the actualized framework as far as reaction time by varying the speed and volume of the analyzed data. We likewise talk about how the cloud assets ought to be provisioned in request to guarantee processing performance for both longterm and real-time scenarios. To guarantee a decent tradeoff

among cost and processing performance, assets arrangement ought to be adjusted to the specific needs and characteristics of the considered application.

#### Merits

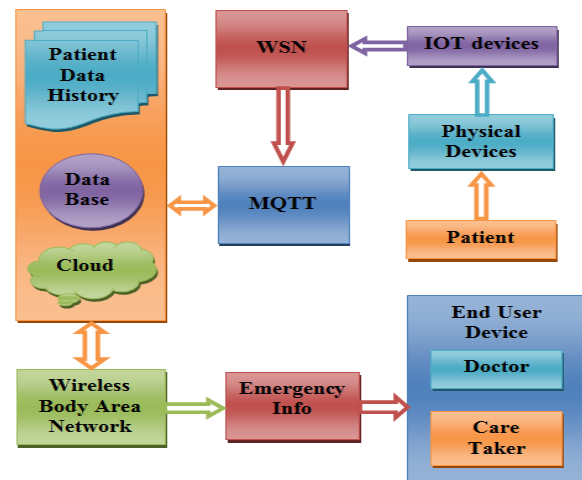
1. The proposed cloud-IoT model can likewise be applied to a progressively broad clinical application including more IoT devices that gather many kinds of signs (ECG, EMR, pulse, temperature, etc...) from many patients.

#### Demerits

1. The proposed cloud-IoT model can cause specialized problems.

#### Health monitoring System

In health monitoring system using IoT, Body wireless sensor Network (BWSN) is used to transmit the patients' health parameters collected through Raspberry Pi microcontroller to the physicians and caretaker wirelessly. Being long range remote technology, emergency circumstance of the patient's wellbeing is immediately recognized and opportune intervention prompts spare the life of the patient.



In Figure 1, overview of health care monitoring system is depicted. Patients' vital parameters such as Heart Beat and temperature is continuously monitored via medical sensors and periodically stored in cloud service. The proposed system collects real time data from the patients and delivers

an updated patients status to the medical professionals and to the caretakers using WSN. This autonomous system replaced the traditional method to collect the parameters regularly by nurse. It avoids the human errors in collecting the patients' data manually. MQTT is light weight protocol used for transfer the messages. The observed vital signs of the patients are analyzed and checked against the standard range to detect the abnormal condition of the patients.

**5. Tamanna Shaown, Imam Hasan, Md.Muradur Rahman Mim (2019) et.al** IoT-based ECG monitoring framework. They have gathered data from various ages' patients by utilizing three electrodes placements in their body and accomplished 80% precision in our framework. The data gathered from our device has been straightforwardly sent to IoT cloud utilizing Wi-Fi. The IoT cloud has been utilized for visualizing the data to clients and store it for future analysis. By utilizing the framework ECG sign can be checked persistently. The normal utilization of device is exceptionally useful for preliminary detection of heart diseases and to reduce severe damage and mortality rate because of cardiovascular diseases. Like this easy to understand ECG monitoring System, extra wellbeing monitoring frameworks, for example, temperature measurement, Blood Pressure, Diabetes, and so forth., can be created utilizing IoT that will significantly help decline existing medicinal services problems to a specific sum.

#### Merits

1. IoT-based ECG monitoring framework is highly efficient, minimal effort device and it reduces the time and cost for normally visiting the specialists at medicinal services organizations.

#### Demerits

1. There is consistently the chance of hackers breaking into the framework and stealing the data.

**6. Wiraphon Manatarinat, Suvit Poomrittigul and Panjai Tantatsanawong (2019) et.al** proposed Narrowband-Internet of Things (NB-IoT) System for Elderly Healthcare Services. NB-IoT-based e-healthcare systems can be applied to a different exhibit of wellbeing related fields, including care for pediatric and old patients, the oversight of chronic diseases, and crisis dispatch. This investigation concentrated on the improvement of a gadget to consequently impart the event of a tumble to parties outside the patient's home, and to naturally convey the area of the patient to EMS dispatchers. This gadget will assist the dispatch of a responder or a clinical unit without the requirement for voice correspondence by the patient, and this will result in earlier treatment and better patient results.

#### Merits

1. Newly created monitoring framework can promptly perceive a fall, and afterward consequently alert up to 4 contacts through the LINE application.  
2. If dispatch of a clinical unit is required, the patient's area is naturally accessible without the requirement for voice contact by the patient.

#### Demerits

1. NB IoT was planned as an unadulterated information transmission innovation for fixed or nomadic devices. It isn't fit for a consistent handover among cells and doesn't bolster application requiring low inactivity – e. g. voice transmission.

**7. Norbahiah Misran, Mohammad Shahidul Islam Gan Kok Beng, Nowshad Amin and Mohammad Tariqul Islam (2019) et.al** present an IoT based wellbeing monitoring framework utilizing the MySignals headway shield for Arduino Uno. Assessing the exhibitions and sufficiency of the sensors and remote stage devices are moreover the point of the endeavor. MySignals empowers different sensors such as temperature, ECG, oxygen immersion and heartbeat rate to gather



the physical data. The point is to transmit the accumulated data from MySignals to a cloud or pc by actualizing a remote framework with LoRa. The results show that MySignals is effectively interfaced with the ECG, temperature, oxygen drenching and heartbeat rate sensors. 36.5-37.50C body temperature, 60-100 bpm beat rate, and 96-99% oxygen immersion have been tried different things with certainty interim guess of 95%, 99% and 99%, separately. he correspondence with the hyper-terminal program utilizing LoRa has been completed and an IoT based wellbeing monitoring framework is being made in MySignals stage with the normal outcomes getting from the sensors.

### Merits

1. The by and large performances of the system are viable as far as collecting human body data that is an appropriate answer for IoT based healthcare.

### Demerits

The primary disadvantage of LoRa however is actually what empowers its strengths, namely the low bandwidth.

**8. Sondes TITI, Hadda BEN ELHADJ, Lamia CHAARI (2019) et.al** proposed An ontology-based healthcare monitoring system in the Internet of Things. This paper presents a healthcare-IoT based system where an ontology is proposed to give semantic interoperability among heterogeneous gadgets and clients in healthcare domain. Our work comprises on integrating existing ontologies identified with health, IoT domain and time, instantiating classes, and establishing reasoning rules. The model made has been approved by semantic querying. The outcomes show the possibility and effectiveness of the proposed ontology and its ability to develop into an all the more understanding and concentrated ontology for health monitoring and treatment.

### Merits

1. It backings the continuous day by day monitoring of their health conditions and their condition.

### Demerits

1. Ontology-based healthcare monitoring system is cost effective.

### IoT Healthcare Services and Applications

IoT-based social insurance frameworks can be connected to a various cluster of ends, including administer to pediatric and elderly patients, the supervision of perpetual a ladies, and the administration of private well-being and tress among others. Applications are separated into two gatherings: single and bunched condition applications. A solitary condition application alludes to a specific illness, though a bunched condition application manages various maladies or, then again conditions together all in all. Take note of that this classification structure is encircled in view of today's accessible social insurance arrangements utilizing the IoT. This rundown is naturally unique in nature and can be effectively upgraded by including extra administrations with unmistakable highlights and various applications covering both single and bunched condition arrangements.

**9. P. Pacea , G. Aloia , G. Caliciuria , R. Gravinaa , C. Savaglioa , G. Fortinoa , G. Ibanez-Sanchezb, A. Fides-Valerob, J. Bayo-Montonb, M. Ubertic , M. Coronac , L. Berninic , M. Gulinoc , A. Costac , I. De Lucac , M. Mortara (2019) et.al.** introduced the principal consequences of the novel INTERHealth use case through which it is conceivable to give, with decreased exertion, new helped living healthcare administrations on account of the interoperability among various and as of now created IoT-based healthcare platforms. The IoT platforms mix has been actualized and tried by following the INTER-IoT approach and all the new parts have been portrayed to feature the simplicity of the combination procedure. The acquired outcomes on genuine gathering of patients

affirmed how the INTER-Health framework conquers the conventional techniques in the connection among specialist and patient creation simpler the communication, expanding the quantity of patients that can be helped and definitely lessening the dropout pace of patients leaving the pilot.

### Merits

1. It gives increasingly responsive and successful nutritional advice administrations broadening preventive activity, continuously, to a bigger populace.
2. INTER-IoT way to deal with offer some incentive included helped living versatile healthcare administrations (regard to the standard "manual" checking performed by customary healthcare habitats) as far as quicker location and revision of wrong ways of life or high hazard basic circumstances.

### Demerits

1. Lack of stage interoperability causes major technologic and financial disadvantages, for example, inconceivability to plug non-interoperable IoT gadgets into heterogeneous IoT platforms.

**10. Bhagyashree Mohanta, Dr. Priti Das, Dr. Srikanta Patnaik (2019) et.al** introduced a fundamental system for displaying healthcare5.0. Its fundamental parameters are AI inserted machines like robot nurture, smart IoT devices and 5G correspondence administrations. Subsequent to experiencing these turns of events, we have given a holistic picture on the smart healthcare system. It incorporates M2M/D2D, human to machine data flow, smart insightful intuitive wearable devices with dynamic sensors, little base stations, fundamental or full scale base stations, distributed storage or healthcare server unit, IoT empowered smart clinic situation and crisis ready administrations. We have presented the idea of smart correspondence foundation for example 5G correspondence innovation that is valuable to cover every region of various range and solid data transmission with high impact shirking or

traffic control; upgrading vitality proficiency and nature of administrations; long battery life; and asset streamlining. We have additionally presented smart wearable devices which is utilized to record and create every day wellbeing report to monitor the wellbeing condition. The AI models is utilized in healthcare5.0 with order ways to deal with dissect immense measure of data and diagnose diseases with high precision.

### Merits

1. 5G correspondence innovation that is helpful to cover every territory of various range and dependable data transmission with high impact evasion or traffic control; upgrading vitality productivity and nature of administrations; long battery life; and asset streamlining.

### Demerits

1. Security factor is the significant worry in 5G cell organize benefits as the data produced and stored might be experienced protection misfortune or robbery. There is a high possibility of data misfortune or robbery issue in remote system correspondence.

**11. Sabyasachi Chakraborty, Satyabrata Aich, Hee-Cheol Kim (2019) et.al** proposed a Secure Healthcare System Design Framework utilizing Blockchain Technology. The proposed framework very well builds up the total oversight of a fix or a continuous treatment or generic healthcare from the earliest starting point as far as possible. The essential idea that is constantly seen on account of healthcare data inquire about is the trust or realness of the data. At the point when the data is created and stored with respect to Blockchain framework then we could generally guarantee that the data is credible as it has been converged to the chain dependent on the agreement of multiple stakeholders and not one single overseeing authority. The progress in remote monitoring and condition control form the manual backup is constantly viewed as to be more guided and compelling arrangement. In the regular system, a tip to tip

monitoring was unrealistic or rather can prompt multiple inconsistencies, therefore a remote network of detecting all the related data and telling the healthcare suppliers or the doctors in the event of an abnormality can be a lot of viewed as one of the ideal arrangements.

### Merits

1. This system can be considered as a huge entire in inspiring the general public with precise and proficient healthcare.

### Demerits

1. Blockchains are not adaptable as their counterpart centralized system.

### IoT Healthcare Security Services

Albeit emerging IoT ideal models in rest tracking have a significant commitment to enhancing current healthcare frameworks, there are a few protection and security contemplations that end-clients need to consider. End-clients can be helpless to noxious dangers when they permit authorization to possibly powerless or defective outsider applications. Taking into account, the complex design of the healthcare IoT, data transmitted from and got by associated devices can be liable to cyber-assaults on various levels, from physical items to applications and cloud databases. Be that as it may, the greatest test lies in the interoperability of devices which can prompt a system being presented to new security vulnerabilities and extra hazard. In addition, there are elective data infringement concerns when the data ventures into the owner's distributed storage office.

**12. Evangelos Markakis, Yannis Nikoloudakis and Evangelos Pallis (2019) et.al** propose the creation of a Security Assessment as a Service (SAaaS) crosslayered framework that can recognize vulnerabilities and proactively assess and mitigate threats in an IT healthcare biological system presented to external gadgets and interfaces, taking into account that most clients are not specialists (even technologically illiterate") in cyber

security and, in this manner, unaware of security tactics or strategies whatsoever. Created as part of the H2020 SPHINX Project, the SAaaS will be demonstrated in an examination including the EDGE eCare platform that joins home and healthcare associated gadgets so as to convey an ambient intelligence platform aware of a patient's health and prosperity. The eCare platform will be integrated in a local hospital condition, in this manner allowing testing the SAaaS in realistic conditions. The SAaaS can be integrated in an IT healthcare condition allowing the observing of existing and new gadgets, the limitation of availability and benefits to new gadgets, assess a gadget's cybersecurity hazard and - based on the gadget's behavior – the assignment and denying of benefits.

### Merits

1. The SAaaS brings a controlled cyber aware condition that assures security, confidentiality and trust, even within the sight of non-trusted gadgets and situations.  
2. The main destinations of the investigation will be to lessen (eventually neutralize) the occurrence of cyberattacks and associated decrease of the damage caused to the patients, as well as improve the security and privacy of exceptionally delicate patient data, so as to increase the degree of trust and acceptance of remote observing services by patients and healthcare professionals for their own advantage.

### Demerits

When working with an external SaaS service supplier to have various apps, there may be an integration issue with the current in-house software. The in-house APIs and data structures probably won't integrate appropriately with the external software.

**13. Ritesh Kumar, Pritam Khan, Sudhir Kumar (2019) et.al** propose a cellular automata (CA)- based encryption strategy for ECG healthcare data. Lightweight CA is reasonable for IoT gadgets since it doesn't



utilize excess data for encryption. This paper presents an effective and lightweight encryption strategy utilizing CA that is utilized for healthcare data security. In the proposed strategy, we utilize the calculation changes over crude healthcare data to explicit arrangement with the goal that we can apply CA governs on it. At that point a uniform CA is applied to the designed data and it is transmitted over the correspondence channel. We utilize symmetric key for encryption and decryption.

### Merits

1. The proposed CA based encryption technique distinguishes and wipes out the need of experiencing the excess NIST tests.
2. CA based encryption and decryption guarantee security of the healthcare data.

### Demerits

A decided individual may marshal overpowering PC assets to decrypt your mystery records.

**14. Ibrahim Alrashdi, Ali Alqazzaz, Raed Alharthi, Esam Alouf, Mohamed A. Zohdy and Hua Ming (2019) et.al** proposed an efficient FBAD framework that recognizes attacks in the haze hub. The proposed framework was examined the significance of IoT social insurance for observing patients based on a dispersed design. The consequences of the trial demonstrated that the proposed conveyed based framework outperforms the centralized-based framework, as it decreases the assault time location in the IoT arrange. The discoveries uncovered that our framework can be successfully proposed to recognize attacks in a mist layer to decrease the constraints in a cloud environment.

### Merits

1. FBAD has high accuracy and low inertness, as it is nearer to the IoT gadgets at the system edge.
2. This methodology empowers the insightful system controller handle the programmability

and the board for intelligently detecting and mitigating the attacks at the mist layer 2.

### Demerits

1. The proposed framework not working in Software Defined Networking (SDN).

## CONCLUSION

In this paper, there are different healthcare problems talked about and some remote monitoring system are examined, some healthcare administrations and application and IoT Healthcare Security Services are talked about. In any case, there are different issue in such application and administrations that are standardization, cost investigation, The application advancement process, Technology progress, the low force convention, Database security, new diseases and turmoil, continuous monitoring. In this paper is just overview related healthcare and referenced about that benefits and bad marks. Different application and framework are talked about in the paper are useful and effective for new researchers to identify current problems for advance research.

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