



COMPARITIVE STUDY ON INTERNET OF MEDICAL THINGS

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Abstract

Internet of Medical things (IoMT) is taking part in very important role in health care trade to extend the accuracy, responsibility and productivity of electronic devices. Researchers square measure conducive towards a digitized health care system by interconnecting the accessible medical resources and health care services. As IoT converge various domains however our focus is said to analysis contribution of IoT in health care domain. This paper presents the researchers contribution of IoT in health care domain, application, advantages, disadvantages and future challenges of IoT in term of medical services in health care.

Keywords: *IoT, IoMT, Healthcare, Sensors, Medical Services*

INTRODUCTION

The first principle of IoT (Internet of Things) is to attach sensible objects - things- to the web in an exceedingly clear approach. This results in an exchange of information between all things, and conveys users' data in an exceedingly safer approach. Cisco Systems estimates that IoT can encompass fifty billion devices connected to the net by 2020 and it's certain that a lot of physical objects, like computers, sensing element actuators, are distributed with distinctive addresses and therefore the ability to transfer information, from the common daily activities to restricted medical records, in an exceedingly secure approach. This technology, named as net of Things (IoT), provides associate degree integration approach for of these physical objects that contain embedded technologies to be coherently connected and permits them to speak and sense or move with the physical world, and conjointly among themselves . The net of Things (IoT) is a thought that's reflects a connected set of anyone, anything, anytime, anyplace, any service, and any network

One of the foremost engaging applications fields for IOT is that the medical field , M-health offers an elegant answer to a problem ordinarily featured within the medical field:how to access the correct data once and wherever required in extremely dynamic and distributed attention organizations [1]. These health applications will guide totally different form of spectators like guardians of patients, patients itself, doctors, nurses and healthy peoples too. These m health give higher medical services, efficiency, a lot of effectiveness of health set up and services thus this scale back the value of health maintenance.

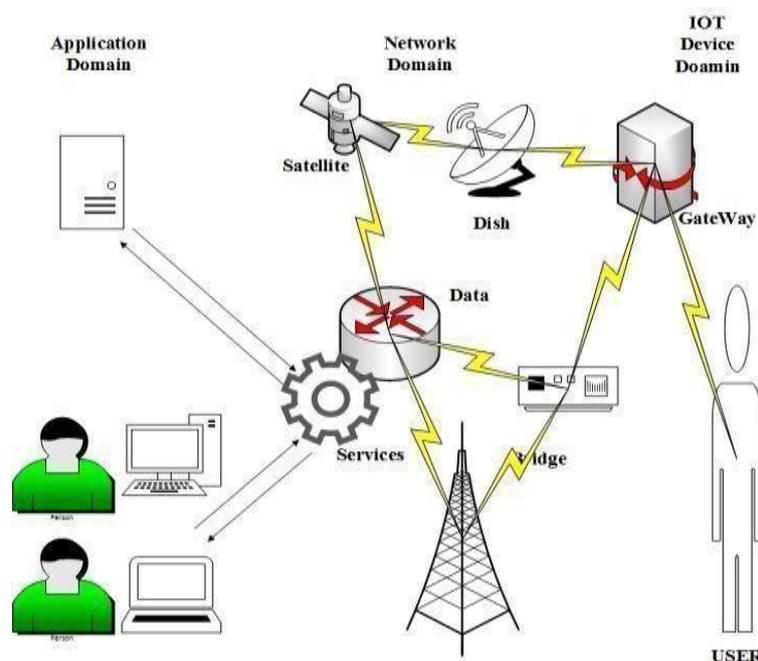


Fig 1 Communication of IOT

Above Figure one shows however IoT will communicate with different network devices. Doctors, patients and remainder of the networking system are connected to every Different systems. All record is digital and save within the databases that is accessible by the doctors and

clinical employees as well[1]. By this mobile health service Doctors reach simply the quality of medical services and quality of medication as per patient desires [1]. The IoT primarily based system is answerable for the complete care of the patient and these systems are versatile to the patients conditions and there parameters will be set as per patient sickness. With this approach, this paper will be able certain regarding present and future health states of patient. In this analysis paper, it providing mainly about the applications, advantages and future challenges of web of things (IoT) supported the work done by completely different researchers within the field of IoT. The most aim of this paper is to produce associate overall plan of what internet of Things is, the various type of applications it's adopt, and the way it's providing an answer for the issues two-faced by the worldwide health care business [1].

LITERATURE REVIEW

Willian D. de Mattos et. al. portrayed the linkage of m-health domain with m2m (machine to machine) and 5G technologies. According to him new technologies can open gate ways that to solutions of m-health. Iuliana Chiuchisan et. al. within the literature for Parkinsons's infection check, given associate intelligent system. He mentioned observance system for home and support system for higher cognitive process that not only support additionally assist the physicians in medical treatment, prescriptions, diagnosis, rehabilitation and patient progress . Robert S .H. Istepanian et. al. in his analysis he introduces a novel construct of IoT in medical health. according to him his construct is incredibly useful by mean of functionalities of IoT and medical health for future applications of 4G health, which is able to base on IPV6 connection[1].

Gupta et al. planned a model that measures and records graph and different very important health parameters of the patient mistreatment Raspberry Pi and may be of an excellent use for the hospitals and patients moreover as their members of the family.

Gupta et al. present an approach mistreatment Intel Galeleo development board that collects the varied knowledge and uploads it to the information from wherever it will be employed by the doctors and additionally reduce the pain born by the patients to go to hospital every and each time to visualize their health parameters.

Ahn et al. enforced a system for activity the physiological signals in sitting position like graph and BCG by employing a sensible chair that senses the non-constrained bio-signals and may be monitored employing a observance system like the one that they had developed providing a classic example of the applying of IoT in care[3].

APPLICATIONS OF IOT IN HEALTHCARE AND ITS ADVANTAGES AND DISADVANTAGES

Table 1 Shows range of applications researched within the field of IoT from year 2016 up to 2018. There are five columns every represents some attribute, serial number, application, author name, published year and reference of the paper from wherever we researched. All the applications we have a tendency to researched are from the medical health care systems. Most of the applications are from the analysis papers that are printed in 2017 and 2018. So, our researched applications are up to this point.

Table 1 Application in medical domain and its advantages and disadvantages

SI. NO	AUTHORS	APPLICATION	ADVANTAGES	DISADVANTAGES
1	Farshadfiouzi et. al.2017	<p>Mhealth</p> <p>2.Deep as brain stimulation(DBS) systems that are Known as pacemakers[4]</p> <p>3.Cloud-based Electronic Health Record(EHR) [14]</p>	<p>Collins narrated his successful experience from a voluntary participative study where cell phones with sensors were used to monitor participants' health with respect to chronic diseases like diabetes, hypertension, and other medical conditions such as heart rate and rhythm, and even recording and transmitting EKG.</p> <p>Decreased Medication Needs[4]</p> <p>Data Encryption Easy to access anytime anywhere[15]</p>	<p>Loss, theft and replacement Off-site data storage Network access outside your control.</p> <p>Not All Symptoms Address[4]</p> <p>Security issues are faced by both providers and customers of a Cloudbased EHR system.[15]</p>
2	Victor chang et. al-2017	<p>1.Ambient Assisted Living[4]</p> <p>2.Smart gloves for deaf people[4]</p> <p>3.Cochlea implants [4]</p>	<p>Home Automation: Many solutions developed to convert the ordinary homes into smart homes are available. Health Monitoring: Applications from this area are developed generally for the aged people.[12]</p> <p>Enables deaf people to communicate easier with others[16]</p> <p>That stimulate electrodes placed inside the inner-ear to</p>	<p>Loneliness: The independent living many times raises the level of loneliness. Privacy: Many times the data are collected without awareness of a person and it raises privacy issues of the provided solution.[12]</p> <p>Costly-\$400 pair Prototype 90% accuracy[16]</p> <p>Leaks of the fluid around the brain[4]</p>

			store hearing functions[4]	
4	Mustafa Badaroglu et.al.- 2017	<p>1.Smart pill bottle technologies[4]</p> <p>2.IoT systems are built in smart cities for improving the access for wheelchair users[4]</p> <p>3.Hierarchical Temporal Memory (HTM)</p>	<p>Smart pill bottles, Internet-linked devices aimed at reminding people to take their pills.[14]</p> <p>Fall detection are fixed with this chair for elder people using pi camera[17]</p> <p>It can quickly identify temporal anomalies which might be a sign of severe problems such as heart attack, and stroke[4]</p>	<p>Recent research suggests that actually changing that behavior may take more than an electronic nudge[14]</p> <p>Smart wheelchairs are complicated for many users[17]</p> <p>Sometimes there must be issues in protocol[4]</p>
5	BaharFarah a ni et. al.- 2017	Pacemakers[4]	That stimulate the heart muscle to help regulating its rhythm[4]	Like any surgical procedure, there can be downsides or risks involved[4]
6	Nicholas Constant et. al.-2017	The Wireless Nano Retina Eyeglasses for blinds[4]	Recording 4k cameras are presented[17]	Issues in battery life[17]
7	Stephanie B. Baker et. al.-2018	<p>1.Pulse oximetry[5]</p> <p>2.Tri-axial accelerometer [5]</p>	<p>This sensors Measures the level of oxygen in the blood[5]</p> <p>A tri-axial accelerometer inside a smartphone is used to classify the user's posture[5]</p>	<p>Incorrect sensor applications are available[5]</p> <p>Triaxial accelerometer would be vulnerable by the working environmental disturbances[5]</p>
8	Wei Xiang et. al.-2018	<p>1.Electroenceph alogram(EEG) sensor</p> <p>2.Gait detection[5]</p>	<p>EEG sensor Measure brain activity[5]</p> <p>Gait detection with foot warm can also be useful in monitoring the elderly[5]</p>	<p>EEG/ERP is that it's hard to figure out where in the brain the electrical activity is coming from.[5]</p> <p>Sometimes uncomfortable because of marker attachment with body[5]</p>
9	Ian Atkinson et. al.-2018	1.Fall detection can be useful for monitoring elderly people[5]	It can be useful for monitoring elderly people[5]	Smartphones are not devices initially intended for fall detection or any other

		2.Glucose-level monitoring[5]	Glucose-level monitoring provides individual patterns of modifications in glucose levels[5]	safety critical application[5] Failed in accuracy[5]
10	Sourau Kumar Dhar et. al.2018	1.Airflow sensor[6] 2.Electromyogram(EMG) sensor	Airflow sensor is breathing sensor which measures patterns of changes in the respiratory rate[6] Electromyogram(EMG) sensor measures the electrical activity of the skeletal muscles during rest and during contraction[6]	The disadvantage of using this sensor is that long time use is also uncomfortable.[6] EMG has limitations that can reduce the clinical yield in some cases [6]
11	SumanSankarBhunia et. al.-2018	Spygmomanometer sensor[6]	Spygmomanometer sensor measure the pressure of the blood in the arteries[6]	It's a fairly delicate and complicated mechanism. [6]
12	Nandini Mukherjee et. al.-2018	Galvanic skin response(GSR) sensor[6]	Galvanic skin response(GSR)sensor measures the Electrical conductance and resistance of the skin which changes the moisture level of the skin[6]	Very slow to show the results[6]
13	K.Dhivya Krishnan-2016	IoT based Kidney abnormality detection[1]	IoT based Kidney abnormality detection system using ultrasound Imaging[1]	Training.Ultrasound techniques require improved an atomical knowledge and a formal educational program.[1]

14	K.B.Sundhara Kumar2016	Autistic patient monitoring medical health care system using IoT[1]	Allows sending data from patients to health professionals in real time[1]	Is not accessible for everyone. For example: RPM requires good broadband connectivity, which is hard to achieve for small healthcare institutions and rural hospitals.[1]
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BENEFITS OF IoT IN HEALTHCARE

IoT has several benefits to people, society, the surroundings, customers and business, like each technology there are some benefits with some drawbacks. Following table give the list of major benefits It get from IoT. Though, IoT is incredibly helpful within the domain of the medical health care. IoT primarily based applications and systems have remodelled the planet into an imagined world that human of 90's thought of. Because of IoT there's revolutionary modification within the field of net communication; this includes a ton of contribution within the growth of the many difficult domains however particularly within the field of medical things. This is often the one among major reasons to shut the gap between doctors, patient and health care services by its ease, accuracy and adaptability. IoT alter the doctors and hospital workers to try and do their work additional exactly and actively with less effort and intelligence. Proof of this is often above mentioned table 1 of applications. This integration of IoT within the field of medical has provided unimaginable benefits to patients; IoT is incredibly simple to use.

BENEFITS IN MEDICAL DOMAIN

The benefits in Medical domain are decreased costs, improved outcomes of treatment, improved disease management[1], reduced error, enhanced patient experience, enhanced management of drugs[7], monitoring and reporting, connectivity and affordability, system alerts, better management of medicine[8], remote patient monitoring and telehealth, health information and healthcare automation[9].

CHALLENGES OF IoT IN HEATHCARE

After a quick analysis this paper tends to list some vital challenges within the domain of IoT. It tend to believe that if these challenges square measure met within the field of IoT, this can able to improve IoT normal within the field of medical aid. IoT will offer additional reliable and higher services within the field of medical health care. Due to IoT there's revolutionary modification within the field of net communication; This incorporates a ton of contribution within the growth of the many difficult domains however particularly within the field of medical things. This is often the one amongst major reasons to shut the gap between doctors, patient and care services by its ease, accuracy and suppleness. IoT alter the doctors and hospital workers to try and do their work additional exactly and actively with less effort and intelligence.

CHALLENGES IN MEDICAL DOMAIN

The challenges in Medical domain are data overload, accuracy and Integration: multiple devices and protocols[8], security challenges are computational limitations, memory limitations, energy limitations, mobility, scalability, the multiplicity of devices, communication media and data confidentiality[2]. The future challenges in Medical domain are Loss of privacy, security challenges[1], security, trust[10].

The above paragraph explains the Challenges on the premise of contribution totally different (of various) researchers within the field of IoT from different resources. On the premise of choice and rejection criteria it got content from elect papers from totally different authentic repositories like ACM, IEEE and Elsevier etc. This paper consists of challenges that were most up-to-date within the field of IoT with context of tending. The aim was to list challenges of IoT in medical healthcare domain.

In this analysis paper, It mentioned primarily the applications, future challenges and advantages of internet of things (IoT) supported the work done by completely different researchers within the field of IoT. All the applications are researched from the medical healthcare systems. Most of the applications are from the analysis papers that are revealed in 2017. Really there are several challenges that must be counter however this paper have in short known a number of the numerous challenges within the file of IoT in context of healthcare that are elaborated mentioned in section III.

This paper have a tendency to believe that if these challenges are met within the field of IoT, this paper able to improve IoT normal within the field of medical aid. IoT will offer additional reliable and higher services within the field of medical health care. As a result this paper are able to say that IoT primarily based applications and systems have remodeled the planet into a imaginary world that human of 90's thought of. IoT modify the doctors and hospital employees to try and do their work additional exactly and actively with less effort and intelligence. That's mentioned on top of within the section 3.

CONCLUSION

In this paper, tendency to provide a summary associated with IoT services and technologies in healthcare. Variety of analysis challenges are known, that are expected to become major analysis trends within the next years. The foremost relevant application fields are given, and variety of use analysis advantages known. We have a tendency to hope that this work are helpful for researchers and practitioners within the field, serving to them to know the massive potential of IoT in medical domain and identification of major challenges in IoMT. This work will facilitate the researchers to know applications of IoT in healthcare domain.

REFERENCES

1. GulraizJ.Joyial et. al., Internet of Medical Things (IoMT), Article in Journal of Communications,2017.
2. Goncalo J et. al., An overview of IoT and healthcare, Article in Conference Paper, 2019.

3. Shubham Banka et. al., Smart Healthcare Monitoring using IoT, Article in International Journal of Applied Engineering Research, Vol.13, 2018.
4. Bahar Farahami et. al., Towards Fog-Driven IoTeHealth , Article in The University of Rhode Island, 2017.
5. B. Baker et. al., Internet of Things for smart Healthcare: Technologies, Challenges, and Opportunities, Stephanie, IEEE, Dec 2017.
6. Sourau Kumar et. al., Interference Aware Scheduling of sensors in IOT Enabled Health-Care Monitoring System, Article in Conference Emerging Applications of Information Technology, 2014
7. <https://readwrite.com/2016/07/18/top-6-benefits-internet-things-IoT-hospitals-healthcare-facilities-ht1/>
8. <https://www.jmark.com/4-big-benefits-of-the-internet-of-things-in-healthcare/>
9. <https://theIoTmagazine.com/internet-of-things-IoT-healthcare-benefits-2aae663c5c79>
10. Philip A. Laplante et. al., The Internet of Things in Healthcare potential applications and challenges, IT Trends, 2016.
11. Mohammad Bajwa, mHealth Security, Pakistan Journal of Medical Sciences Online, 2014.
12. Ashish D Patel, Ambient Assisted Living System: The Scope of Research and Development, , Conference EECCMC, Jan 2018.
13. <https://www.ukessays.com/essays/information-technology/advantages-and-disadvantages-with-ehealth-system/information-technology-essay.php>
14. <https://www.npr.org/sections/health-shots/2017/08/22/538153337/smart-pill-bottles-arent-enough-to-help-the-medicine-go-down>
15. Joel JPC Rodrigues, Analysis of the Security and Privacy Requirements of Cloud-Based Electronic Health Records Systems, JMIR.ORG, 2013
16. http://carl.sandiego.edu/itmg100/presentations_sp_2013/section9/WHEELER_ITMG_Powerpoint.pptx
17. Al Sibai, A Study on Smart Wheelchair Systems, Project of Smart Wheelchair, Dec 2015.

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