iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** VI **Month of publication:** June 2019

DOI: http://doi.org/10.22214/ijraset.2019.6262

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VI, June 2019- Available at www.ijraset.com

Internet of Things in Healthcare

Rahul Bhikoji Garale[1], Prof. Roshan Jaiswal[2]
[1, 2]*Department of Computer Science, MET College, Bandra (W), Mumbai Maharashtra, India*

Abstract*: *Internet of things (IOT) has gained a lot of attention in recent years for its use in various sectors like healthcare, agriculture, automobile, Retail, Finance, Transportation and many more. IOT redesigning the modern healthcare sector in terms of economic, social and technological prospects. Use of IoT changing the healthcare industry. Both providers and patients getting benefits from IoT .some uses wearables IoT devices or IoT based mobile application to get health-related data. Hospitals and medical facilities use IoT for assets tracking, monitoring patients or to control the climate of laboratories. This paper surveys use of IoT in healthcare industry and reviews network topology architecture of IoT based healthcare and their healthcare trends. This paper also analyses the challenges and benefits of IoT in healthcare.
***Keywords*: healthcare, Internet of things (IoT), applications, Services, Challenges.**

I. INTRODUCTION

Healthcare is a critical part of life, the steadily aging population and the number of chronic diseases is rising, and it puts a strain on healthcare systems. The healthcare industry is looking for some new solution that reduces the pressure and provides high-quality service to patients and medical facilities.

Before IOT, patient's interactions and communication with doctors were very much limited to visit, text or telecommunication but because of IoT devices, remotely monitoring and maintaining of various healthcare related things are possible.

IoT can also use in hospitals and medical facilities [1].

Pathology department in the hospital is a place, which requires climate-controlled environment, meaning the temperature, and humidity in the room must be maintained within a specific range. The temperature and humidity must, therefore, be monitored first in order to be maintained.

The use of IoT devices can be made to monitor such parameters.

IoT is without a doubt changing the healthcare industry by rethinking the space of the device and human interaction in providing healthcare related solutions.

This Paper surveys the use of IoT based healthcare technologies and in addition, this paper analyses the benefits and challenges of IoT in the healthcare industry.

II. IOT HEALTHCARE NETWORK

Networks play a very important role in IoT. the transmission and reception of data are done with the help of network it also plays an important role in the communication of IoT devices.

As shown in the figure-2 this section discusses the topology. However, the proposed architectures mentioned in [7] and [8] is a good starting point for building insights into network of IoT.[2] - [3]

A. IoThnet Topology

The topology of IoThNet (IoT Healthcare Network) is the arrangement of various elements or component of an IoT network in healthcare and indicates representative eventualities of seamless health care environments. Fig. three describes how a heterogeneous computing grid collects huge amounts of important signs and detector information like pressure level (BP), blood heat, electrocardiograms (ECG), and gas saturation and forms a typical IoThNet topology.

It converts the heterogeneous computing and storage capability electronic devices like laptops, smartphones, and medical terminals into hybrid computing grids [2] - [6].

©IJRASET: All Rights are Reserved

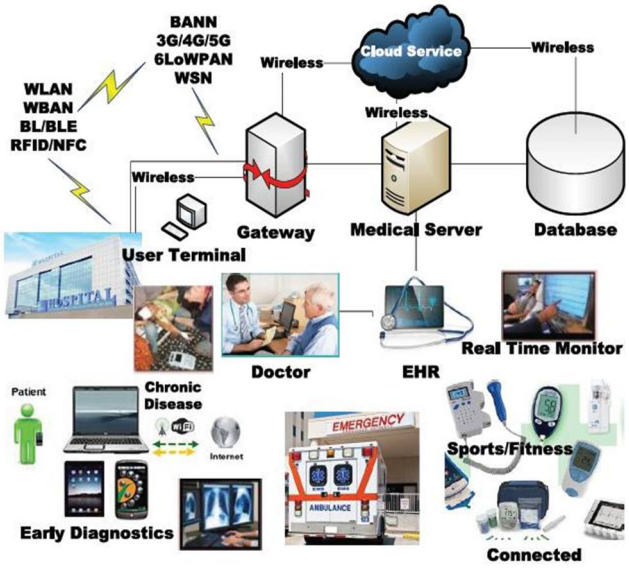


Fig-:1: Healthcare Trends.[2]&[3]

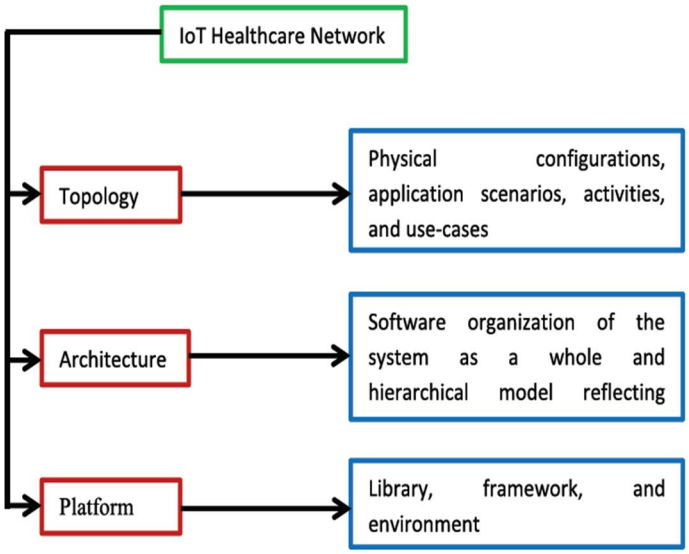


Fig-2: IoT healthcare network (IoThNet) issues.[2]&[3]

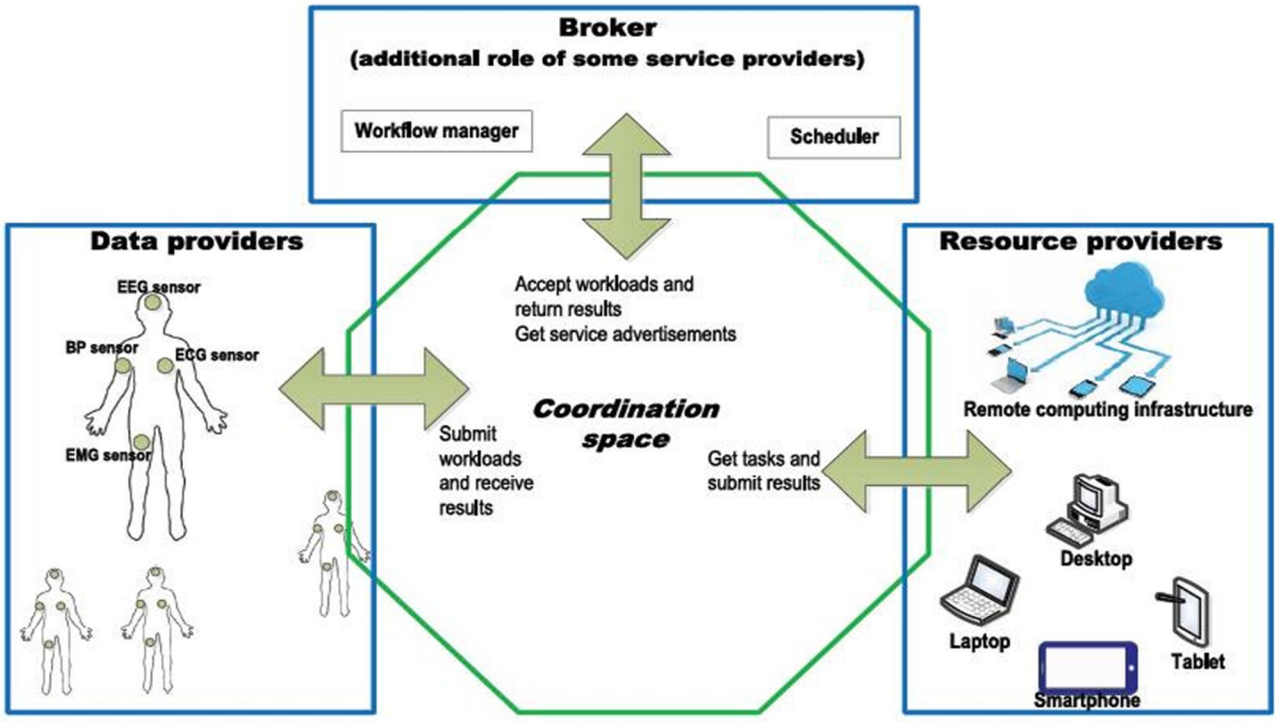


Fig-3: A conceptual diagram of IoT-based ubiquitous healthcare solutions.[2]&[3]

Fig- 4, States the scenario in which a patient's health-related data are gathered using portable devices and sensors attached to their body. The collected data are then inspected and stored which is collected from different sources useful for grouping. Based on the inspection and grouping of data, the doctor can treat patients from any location. In addition, the topology also includes the network structure for streaming of medical videos.

For example, in Fig.4 describe the topology that supports the streaming of ultrasound videos through an associate interconnected network with the global ability for microwave access (WiMAX), an internet protocol (IP) network, and GSM network. Similar structures are found in [7]-[10].

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VI, June 2019- Available at www.ijraset.com

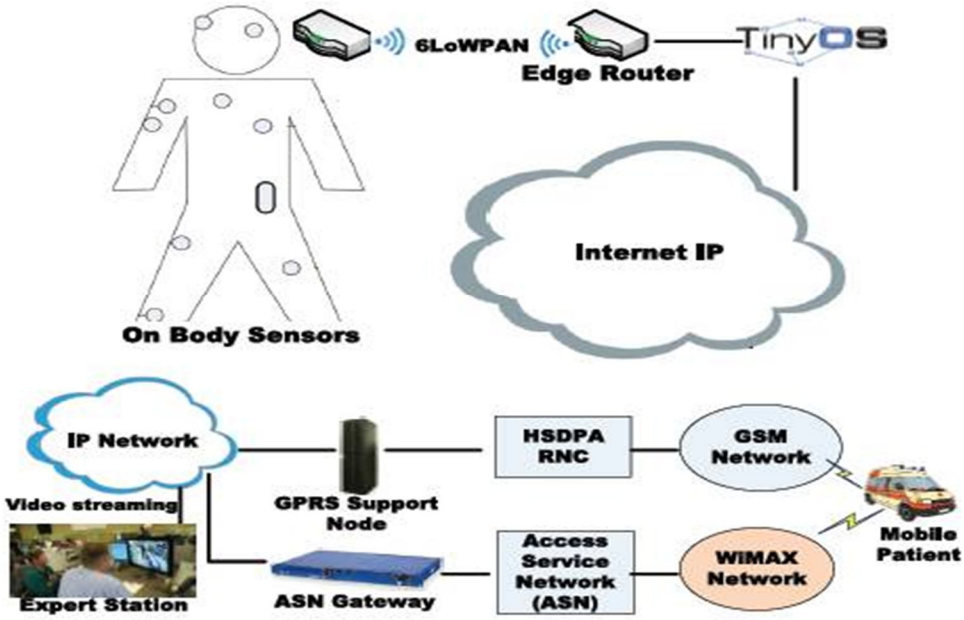


Fig -4 remote monitoring in wearables and personalized health care.[2]&[3]

III. INTERNET OF THINGS AND HEALTHCARE

IoT consists of web-enabled smart devices that contain an embedded processor, sensors and actuators. that are used to collect, send and perform actions on data, which they gather from the environment. IoT devices communicate with IoT gateway and share collected data, then that data is shared to the cloud and analysis is done and reports are generated based on that analysis.
In various parts of healthcare, IoT helps for providing better treatment to patients, monitoring patients remotely and used in Medical facilities and hospitals for monitoring and maintaining various things.

A. IoT for patients and Physician

various IoT devices, wearables devices like fitness band are commonly used by many people and other wireless devices like blood pressure and heart rate monitoring cuffs, glucometer, etc.
These devices can remind patient or user about calorie count, exercise, blood pressure variations and variations in heart bit rate and much more.
IoT makes a life of physician easier. By using the IoT devices the physician can remotely monitor and can keep track of the patient's health

B. IoT for Hospitals and Medical Facilities

Pathology department in the hospital is a place that requires climate-controlled environment means the temperature and humidity in the room must be maintained within a specific range. The temperature and humidity first need to monitor in order to maintained.
Before IoT or without IoT this task of managing and maintaining the climate of such department was done manually, the person himself goes to that, room measures the temperature and humidity and lists down the parameters, then later changes the temperature, humidity, and other things and then the person reports the temperature and humidity fluctuations manually.
But with the help of IoT devices, the scenario changes, IoT devices are kept in such a room that needs to maintain and monitor the climate change, Then that these devices which have sensors and actuators that sense the current climate conditions and then maintain and monitors that environment and also, generate the report that was sent to the end user so that end user and also, keep track of the environment status. In hospitals the major problem is to keep real-time tracking of medical equipments like wheelchair, defibrillators, nebulizers, oxygen pumps and other monitoring equipment, so with the help of IoT hospitals can keep track of the inventory
Another problem in Hospitals is spreading infection so that IoT enabled hygiene monitoring devices to help in preventing patients from getting infected.

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VI, June 2019- Available at www.ijraset.com

C. Four stage IoT Solutions

The proliferation of healthcare-specific IoT product generates huge opportunities. and also a large amount of information generated by these connected devices holds the potential to remodel health care.

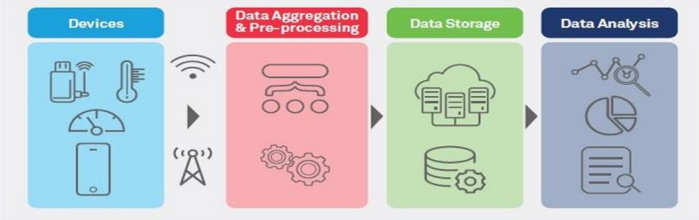


Fig-5 Four-Stage of IoT Solution.[11]

IoT has a four-stage architecture that is basically staged in the process. All four stages are connected in such a manner that data is captured in one stage and yields the values in the next stage.

Stage 1: this step consists of the deployment of all IoT based devices like the actuators, sensors, monitor, etc. This devices are interconnected and collect data from end users and send that data to the next stage for processing.

Stage2: This stage performs the data aggregation and pre-processing, The data which comes from various wireless devices are combined together and the data is converted from analog to digital form.

Stage 3: this stage performs the storing of data-to-data center or cloud once the data is received in the digitized form.

Stage 4: this is the last stage of IoT solutions, which performs data analysis on data, which is stored in the data center, collected from the end user with the help of IoT devices. Advanced Analytics, applied to this data, brings actionable business insights for effective decision-making.

IV. BENEFITS OF IOT IN HEALTHCARE

A. Simultaneous Reporting And Monitoring

IoT in the healthcare industry has enabled doctors to monitor the real-time conditions of a patient which can prevent any emergency situations like heart failure, diabetes, asthma attack, cardiac arrest, etc[12]

With the help of IoT, doctors can handle multiple patients at a time.

With the real-time monitoring, smart medical devices connected to the smartphone can collect health-related data of patient and with the help of the internet that data can be sent to doctors.

Centre of Connected Health Policy conducted a study that indicates that there was a 50% reduction in 30-day readmission rate because of remote patient monitoring on heart failure patients.[13]

The health-related data of patients collected by IoT device stored in cloud and access to this data is given only to authorized person like a physician, insurance company, etc.

B. End-to-End Connectivity

IoT enhances connectivity and data sharing in healthcare applications with the help of latest technology. Technologies like Bluetooth and Wi-Fi tracking and identifying the illness becomes very easy and less time-consuming. By using such technologies cost of treatment reduces by huge sum and it allows to treat the patient so easily.

C. Real-Time Tracking and Alerts

Many lives will be saved if they get immediate medical help in the emergency with IoT it is possible. IoT devices gather important health-related data and transfer to doctor or physician at real time so that in case of any emergency or threat doctor will be informed immediately and help or assist patient.

D. Data Assortment And Analysis

IoT device collects a huge amount of health-related data of the patient and these devices also send data to other devices. Manually handling and analysing such massive data is impossible but the IoT devices can do it.

Data which is collected by IoT devices cannot be stored on a single server so that analysing, tracking, sending and receiving of data done with the help of the cloud.

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VI, June 2019- Available at www.ijraset.com

V. CHALLENGES OF IOT IN HEALTHCARE

A. Privacy And Data Security

IoT in healthcare has a lot of benefits but it also faces some challenges. The biggest challenge faced by IoT is privacy and data security [15]. As IoT, devices in healthcare gather or collect very sensitive and important information about patient health or hospital-related data. In addition, many IoT devices lack data protocols and standard. In addition to that, there is significant ambiguity regarding data ownership regulation.[13]

All these factors make the data highly susceptible to cybercriminals who can hack into the system and compromise Personal Health Information (PHI) of both patients as well as doctors. [13]

Cybercriminals can misuse of that data to buy drugs or medical equipment that they can sell later. Hackers can also file a fraudulent claim for insurance in a patient's name.

B. Integration

Everyone owns different devices made by various manufacturers and these device cause hindrance in the implementation of devices in the healthcare sector. The reason behind hindrance is the difference in the devices communication protocol and standard because of that problems occurs in data aggregation and processing. The Internet of medical things has not found any solution regarding the compatibility of different devices with IoT network. Data transmission and processing speed slows down due connectivity of different devices

C. Data Overload and Accuracy

Data aggregation is a major problem in IoT in the medical network due to different communication protocols and standard.

IoT collects a huge amount of data and that data is used to gain insights into patient health. However, the data that is used to gain insights is in huge range so that sometimes it is also difficult for doctors to make the decision.

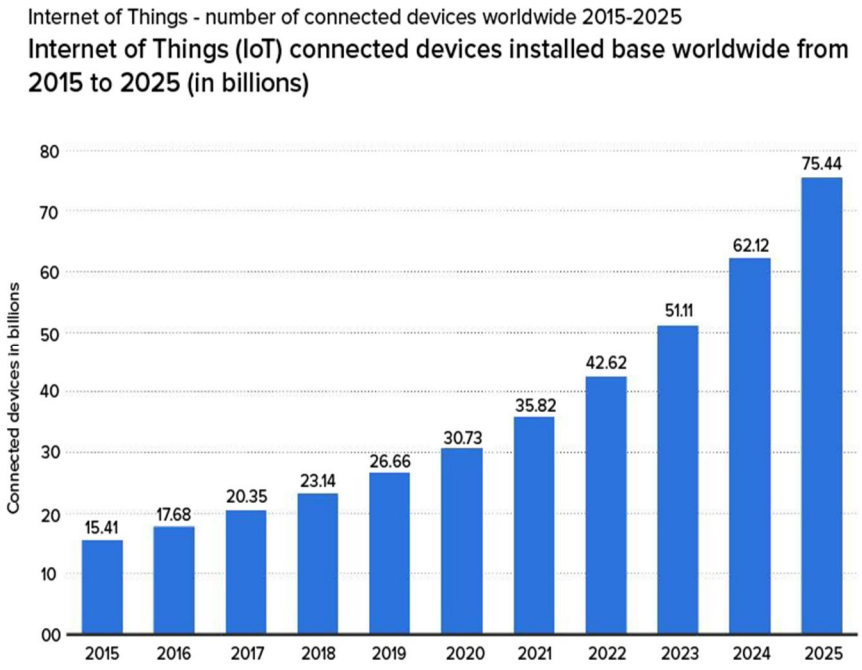


Fig 6- IoT connected devices worldwide. [12]

VI. CONCLUSION

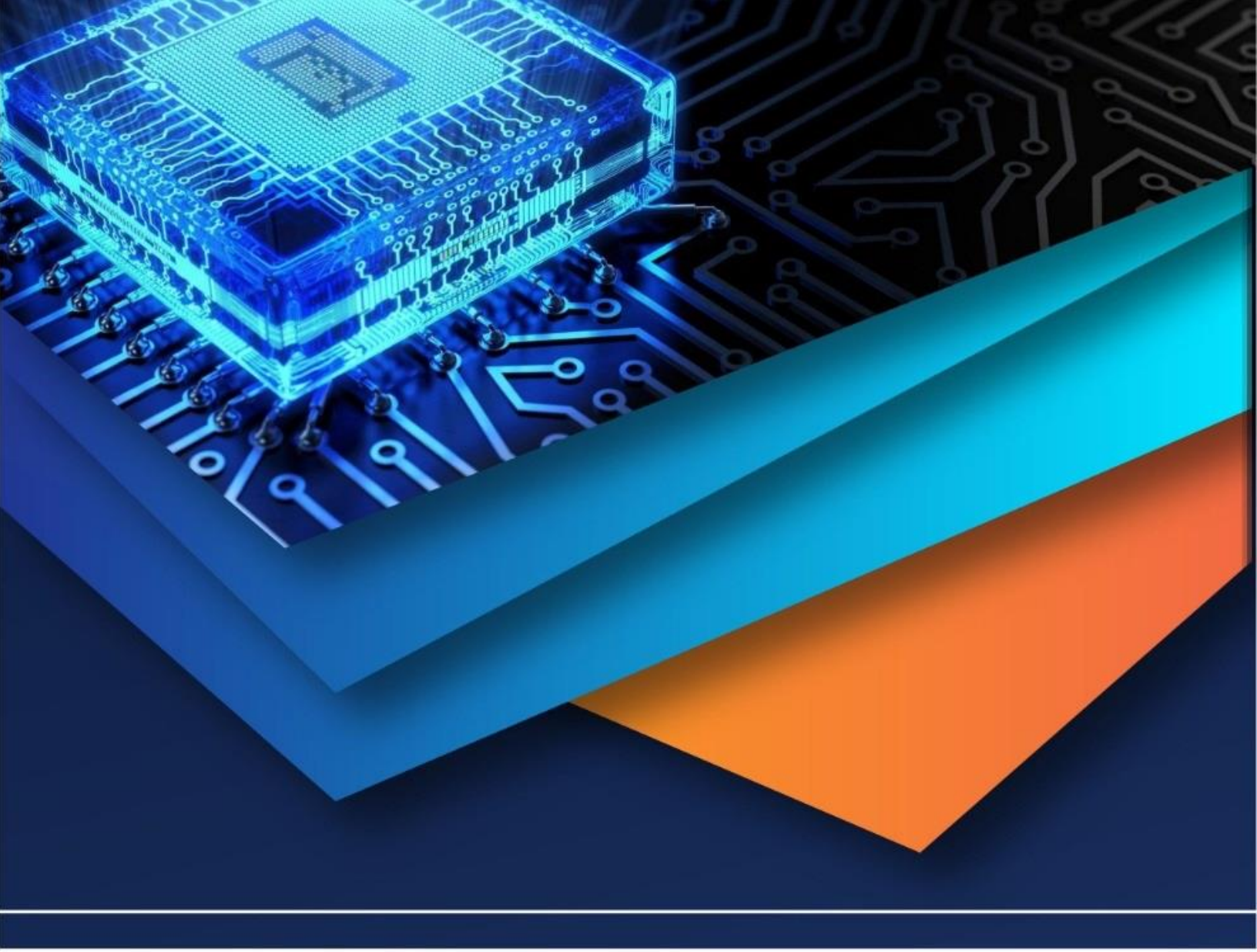
In this work, we survey the use of IoT technology in the healthcare industry along with that we also discussed the challenges and a benefit comes from the use of IoT in the healthcare industry. This paper also presents health care network architectures topology that support access to the IoT backbone and transmit and receives the medical data.

©IJRASET: All Rights are Reserved

REFERENCES

[1] iotforall.com. N.p., n.d. Web. 14 Jun. 2019.< https://www.iotforall.com/exciting-iot-use-cases-in-healthcare/ />.
[2] S. M. Riazul Islam, Daehan Kwak, Md. Humaun Kabir, Mahmud Hossain, And Kyung-Sup Kwak, „˝The Internet of Things for health Care: A Comprehensive Survey˝ date of publication June 1, 2015,Doi.10.1109/ACCESS.2015.2437951.
[3] Gapchup Akshay. "Health Care Systems Using Internet of Things." ijircce.com. International Journal of Innovative Research in Computer and Communication Engineering, 12 Dec. 2016. Web. 14 Jun. 2019.
[4] Q. Zhu, R. Wang, Q. Chen, Y. Liu, and W. Qin, "IOT gateway: Bridging wireless sensor networks into Internet of Things," in Proc. IEEE/IFIP 8th Int. Conf. Embedded Ubiquitous Comput. (EUC), Dec. 2010, pp. 347_352.
[5] I. Gronbaek, "Architecture for the Internet of Things (IoT): API and interconnect," in Proc. Int. Conf. Sensor Technol.Appl., Aug. 2008,pp. 802_807.
[6] H. Viswanathan, E. K. Lee, and D. Pompili, "Mobile grid computing for data- and patient-centric ubiquitous healthcare," in Proc. 1st IEEE Workshop Enabling Technol. Smartphone Internet Things (ETSIoT), Jun. 2012, pp. 36_41.
[7] W. Zhao, W. Chaowei, and Y. Nakahira, "Medical application on Internet of Things," in Proc. IET Int. Conf. Commun.Technol. Appl. (ICCTA), Oct. 2011, pp. 660_665.
[8] N. Yang, X. Zhao, and H. Zhang, "A non-contact health monitoring model based on the Internet of Things," in Proc. 8th Int. Conf. Natural Comput. (ICNC), May 2012, pp. 506_510.
[9] S. Imadali, A. Karanasiou, A. Petrescu, I. Sifniadis, V. Veque, and P. Angelidis, "eHealth service support in IPv6 vehicular networks," in Proc. IEEE Int. Conf. Wireless Mobile Comput., Netw.Commun. (WiMob), Oct. 2012, pp. 579_585.
[10] R. S. H. Istepanian, ``The potential of Internet of Things (IoT) for assisted living applications," in Proc. IET Seminar Assist. Living, Apr. 2011, pp. 1_40.
[11] https://www.wipro.com/en-IN/business-process/what-can- iot-do-for-healthcare-/
[12] https://appinventiv.com/blog/iot-in-healthcare/
[13] https://www.peerbits.com/blog/internet-of-things- healthcare-applications-benefits-and-challenges.html
[14] https://en.wikipedia.org/wiki/Internet_of_Things
[15] Blog.cipher.com. N.p., n.d. Web. 14 Jun. 2019. http://blog.cipher.com/the-5-biggest-challenges-in-%20global-data-privacy-and-data-protection.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)