EUROPEAN UNIVERSITY OF BANGLADESH
WE SHAPE YOUR DREAM

European University Of Bangladesh

Topic: Internet of things (IoT) in HealthCare

STUDENT DETAILS:

Program : B.S.c in CSE
Semester: 9th (Fall-23)
Section : (A)

SI	Name	Id
1	Arun Chandra roy	210122010
2	Shemol Chandra roy	210122009
3	Shohrab Hossen	210122037
4	Md. Ahashan Kabir	210122019

COURSE DETAILS:

Course Name : Internet Of Things
Course Code : CSE -459
Course Lecturer/ Tutor Name: Md. Harun Or Rashid

Signature:

Submitted Date:

December 8, 2023

An Implementation Effect of IoT for Healthcare

Arun Chandra Roy,Shemol Chandra Roy,Shohrab Hossen ,Md. Ahashan Kabir
Department of Computer Science Engineering
European University of Bangladesh,
2/4, Gabtoli, Mirpur, Dhaka-1216
Email: info@eub.edu.bd

Abstract: Internet of Things (IoT) refers to the collective network of connected devices and the technology that facilitates communication between devices and the cloud, as well as between the devices themselves. The Internet of Things (IoT) has a powerful domain where embedded devices and sensors can connect and exchange information over the Internet. The Internet of Things (IoT) is going to have its presence in all the essential sectors of human lives.It can provide both mainstream as well as the value-added services in almost all the sectors. Healthcare is an important service sector for overall development.

In healthcare, the Internet of Things (IoT) offers many benefits, including being able to monitor patients more closely, remote observation and emergency proceedings in the hospital, and using data for analytics. Coordinated sensor networks can provide even better services. IoT can provide all these coordinated services.
When it comes to IoT for medical device integration, the focus is shifted towards the consumer end, such as glucose meters, blood pressure cuffs, and other devices designed to record data on patient vital signs.

Due to the various kinds of requirements in healthcare, Nowadays every developed country can use IoT can make it easier to make the healthcare sector. so In this article, we can provide the effect of Iot in healthcare.

Keyword: Artificial Intelligence (AI), Healthcare, Internet of Things (IoT),Sensor, Security, Effects, IoMT etc.

1. Introduction: We are living in the age of technology, where about 80 percent of people worldwide use it in some way. This is mainly because of something called the Internet of Things (IoT), which makes things like smart cities, smart homes, and wearable technology possible.Think about it like this: all over the world, people are creating and improving applications that help us in our daily lives. These apps are like helpers that make our tasks easier. For example, there are apps that update every day, integrate with other things, and are really smart. All of this is happening because of IoT.

Now, IoT is not just about making life convenient; it's also helping in important areas like healthcare. In healthcare, we use IoT through something called the Internet of Medical Things (IoMT).

IoMT is like a network of smart devices that collect information in real-time. This is super helpful in healthcare and can make a big difference. As technology gets better,

IoMT is changing how doctors and patients connect, making it easier for them to talk and share information.

IoMT is like a superhero for your health. It not only helps to prevent illnesses but can also help cure ones that have already started. Imagine wearing smart devices, like a special watch, that can easily keep track of your health.

So, in simple words, IoT and IoMT are like friendly tools that make our world smarter and healthier, making life better for everyone!

The Internet of Medical Things (IoMT) is like a superhero for health. It has different parts that help with health problems.
One part is about wearing health gadgets, like cool smart watches (like Fit bit or Apple Watch). Another part helps us at home, with gadgets that check our health and even emergency systems. In public places, there are special machines, services for sick people, and clever devices for emergencies. For doctors, there are smart devices in their offices to help take care of patients. In big places like hospitals, IoMT helps keep track of important things like where medical tools are and if the environment is good.
Now, think about the people involved:

- For People: Wearable devices, like superhero gadgets, help you know about your health and tell your family if something is wrong.
- For Doctors: Smart devices help doctors know more about your health, so they can take care of you better.
- For Hospitals: Smart devices help hospitals keep track of important things and make sure everything is in the right place.

IoMT is like a superhero team for health, making sure everyone is okay and fixing problems. It helps with things like making sure you get the right care, keeping track of important tools in hospitals, and even helping people in faraway places get medical help.

2. IoT in Healthcare and Application: The Internet of Things, or IoT, is a technology that is getting bigger every day all around the world on the Internet. This means we need to keep making our Internet-connected devices better. Nowadays, IoT devices connect instantly, all at the same time, with other connected objects. In health, IoT has been used for a long time to watch over people's health, keep track of patient information, and plan for future medical services.

Now, think of IoT Sensors as superhero gadgets. They keep an eye on everything inside a person's body, like a temperature sensor or a pacer sensor, and send that information to an IoT device. After that, a network of people collects and stores this data in the cloud. They use this information to help hospitals, doctors, and patients make decisions.

So, IoT is like a team of helpers for health, making sure everyone has the information they need to stay healthy and get the right care. Here IoT healthcare networks, sensors, and cloud-to-graphical UI to end users are connected. This image is shown below [Fig: IOT in healthcare Architecture]

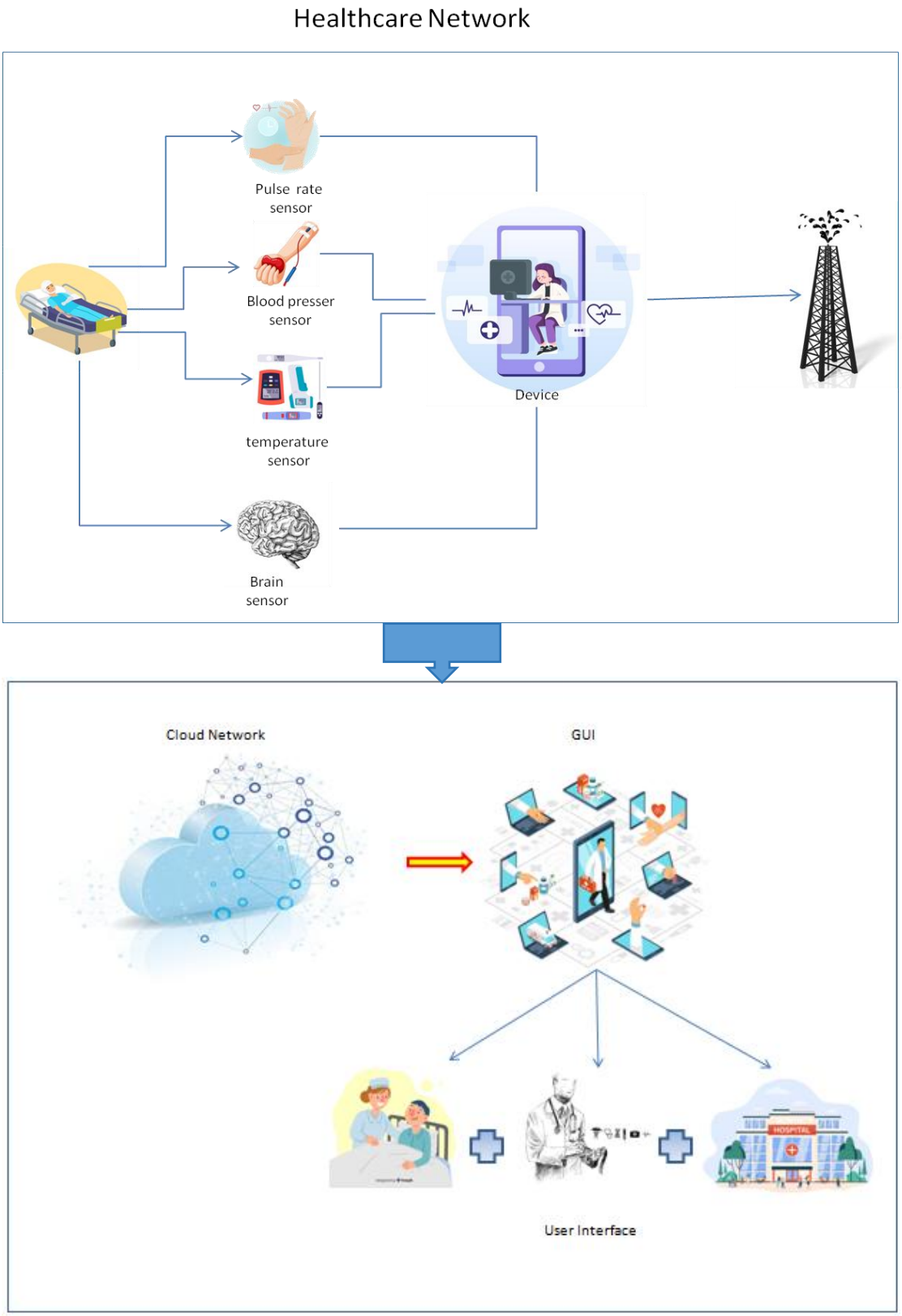

Fig: IOT in Healthcare Architecture

If we can make (IoMT) devices properly using (IoT) then it will be a breakthrough for us. Because it can easily catch all kinds of diseases of our human body and can easily accept what the doctor can do or take about that disease. Following are some (IoMT) healthcare applications: They work in smart healthcare.

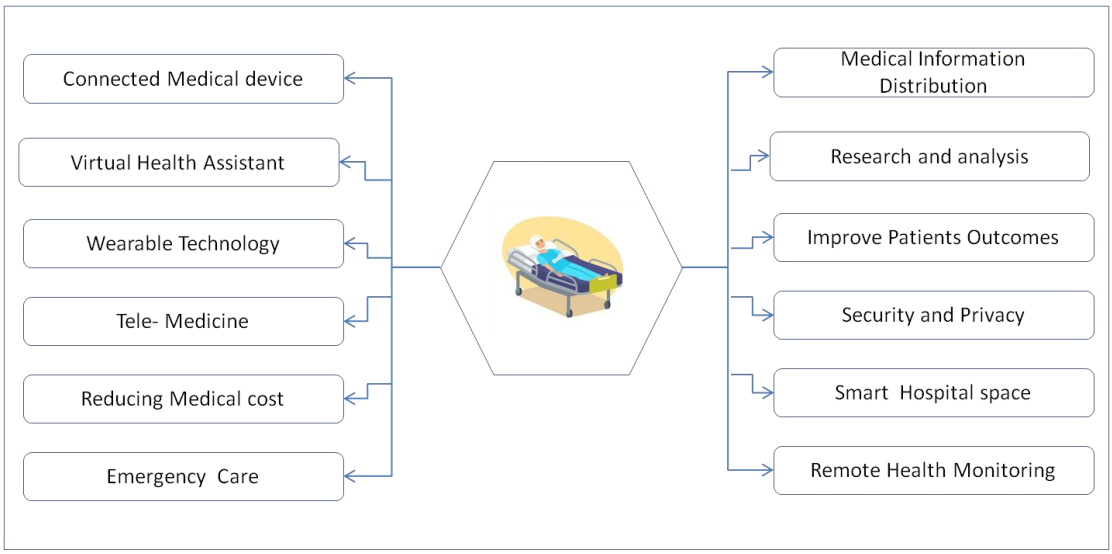

Fig: Healthcare Application

3. Materials and Method and Hardware component: In smart healthcare, we use special materials and ways to understand how patients are doing. We did a big study on something called IoT-enabled healthcare. This is like a special network of smart tools (IoMT-based - IoThNet) that help doctors and healthcare workers take care of people.

In our research, we have investigated how patients use these smart tools. To our surprise, more than 70% of them shared that not many of their patients use these tools frequently. Additionally, 42% mentioned that only a few of their patients are very interested in them. In this smart healthcare system, we made a special tool to keep an eye on basic things like oxygen level, heart rate, and body temperature. It uses cool things like sensors for oxygen, heartbeat, eye blinking, and temperature, with a special computer called Arduino UNO doing the thinking part. Even though we have this system, we don't have clear ways to see how well patients are using it.

We also made a kit that can check your heartbeat, body temperature, ECG (like heart electricity), and how you breathe. We use things like a temperature sensor, blood pressure sensor, ECG sensor, pulse sensor, and a mini-computer called Raspberry Pi. The information from these sensors goes to the smart healthcare system.But, there's a problem – we can't see the information. To fix this, we introduced a way to check your pulse rate without hurting you. We use special lights and cameras to check the blood flow in your finger and tell us about your heart.

Another cool thing is a health check system that uses a small computer called Arduino and a mobile phone. It turns special information from sensors into digital data. However, there's a limit to how far it can send this data.In making sure homes are smart and checking heartbeats, we use something called a wireless sensor network. It's like a team where a computer shows us the results and sensors talk to each other. Even though these methods are cool, there are still some problems we need to solve to make them work better in smart healthcare.

In smart healthcare, we use special tools like body temperature sensors, ESP32 brain helpers, and heartbeat sensors to take care of patients. The ESP32 helps these tools talk using WiFi and Bluetooth. We can change how the sensors work with a special adjuster. Tools like the MQ-135 gas sensor check the air by finding different gases. The heartbeat sensor watches the pulse by noticing changes in blood. Temperature sensors like LM35 measure how warm things are, and the MQ-9 sensor quickly finds gases.

Scientists make sure these tools share information safely, stressing how important it is to keep data safe in smart healthcare.

4. Analysis: Designing smart healthcare solutions involves using advanced tools and methods, especially in the Internet of Things (IoT). We delved into various healthcare tools to understand how patients use these technologies.

One important design is an IoT health system that monitors smart devices using sensors like heartbeat and temperature, along with a smart processing device. A healthcare kit in the IoT world includes measures like heartbeat and body temperature, using various sensors. However, we realized the need for a simpler way to display this information.

We introduced a safe method to measure pulse rates without discomfort, using light and cameras on mobile devices. Another smart system uses a monitor and mobile device to track health parameters, but we found some challenges to overcome. A special wireless network was created to monitor houses and heartbeats, using advanced technology. Still, we identified some issues that need attention. We also prioritize security, ensuring information shared among these tools remains private. This careful balance between innovative tools and security measures is crucial for creating effective smart healthcare solutions.

5. IoT Effect in Healthcare Benefits: Smart healthcare uses modern technology to make taking care of patients better. They use special devices that you can wear, and these devices talk to each other using something called IoT technology. This helps gather lots of information quickly and can even communicate between people or places. With this technology, healthcare has become more accurate and faster.This smart technology helps in many ways, such as:

- **Real-time monitoring:** Keeping an eye on patients all the time.
- **IoT smart pills:** Special pills that are part of this technology.
- **Controlling diabetes:** Helping people manage their sugar levels.
- **Smart watches for curing major depressive disorder (MDD):** Watches that can help people feeling really sad.
- **Monitoring blood pressure:** Checking how strong the heart is working.
- **Reduced waste time**: In healthcare, using smart technology like IoT helps make patients wait less by making check-in faster and optimizing how people move around the hospital, making patients happier.
- **Identification of Chronic Diseases:** IoT finds diseases by tracking signs and using health devices.

This technology is making healthcare better and faster. It helps doctors keep a close watch on patients, and it can even suggest ways to prevent getting sick. The information collected by these devices helps doctors understand and predict illnesses.

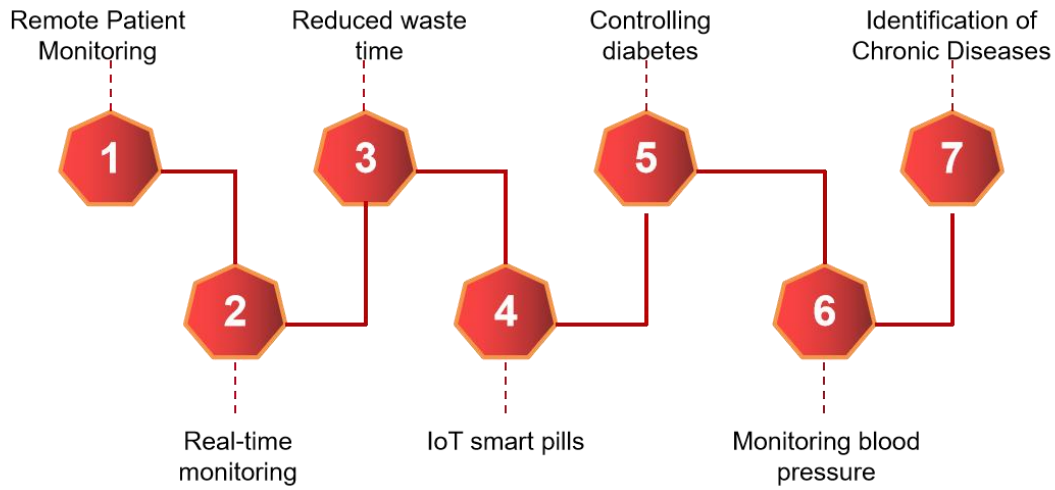

Fig: Benefits of Healthcare

In simple words, smart healthcare is like having superheroes in technology that help doctors take care of people in the best way possible.

6. Challenges in IoT- Based Healtcare System: It has Limitation and Challenges, this are like:

- **Privacy Concerns:** IoT in healthcare faces challenges with data privacy and security, posing a risk of hacking and misuse.
- **Integration Complexity:** The complex IoT landscape, with various devices and protocols, makes it challenging to integrate into existing healthcare systems.
- **Overloading Issues:** Storing massive patient data from IoT devices can lead to decision fatigue and incorrect diagnoses, requiring careful consideration of data management.
- **Cost Challenges:** Although IoT costs are a concern, it aims to reduce treatment expenses over time, creating potential for cost-effective healthcare solutions.
- **Medical Tourism Impact**: IoT and healthcare are working towards making treatments more affordable, creating a situation where people travel to developing countries for cost-effective healthcare.

7. Future in IoT- Based Healtcare System: In the future, IoT in healthcare will revolutionize how doctors and patients connect through smart devices, making treatments more efficient and cost-effective. Major companies like Google and Apple are actively contributing to advancements in this field, promising exciting developments for the medical industry.

Conclusion: The Internet of Things (IoT) is transforming healthcare, offering benefits like real-time patient monitoring, smart pills, diabetes control, and improved mental health support through devices like smart watches. Despite challenges such as privacy concerns and integration complexity, IoT promises to make healthcare more efficient.

Our research explored the Internet of Medical Things (IoMT), which acts as a superhero for health, connecting wearable's, home devices, and hospital equipment. It ensures everyone, from individuals to doctors and hospitals, has the right information for better healthcare.

Reference :

(Ravi Kishore Kodali, 2015)

[1] Kodali, R. K., Swamy, G., & Lakshmi, B. (2015, December). An implementation of IoT for healthcare. In 2015 IEEE Recent Advances in Intelligent Computational Systems (RAICS) (pp. 411-416). IEEE.

[2] Kashani, Mostafa Haghi, et al. "A systematic review of IoT in healthcare: Applications, techniques, and trends." Journal of Network and Computer Applications 192 (2021): 103164.

[3] Kodali, Ravi Kishore, Govinda Swamy, and Boppana Lakshmi. "An implementation of IoT for healthcare." In 2015 IEEE Recent Advances in Intelligent Computational Systems (RAICS), pp. 411-416. IEEE, 2015 https://ieeexplore.ieee.org/abstract/document/7488451

(Mustafa Abdullah Azzawi, 2016)

[4] Azzawi, Mustafa Abdullah, Rosilah Hassan, and Khairul Azmi Abu Bakar. "A review on Internet of Things (IoT) in healthcare." International Journal of Applied Engineering Research 11.20 (2016): 10216-10221.

[5] Azzawi, M.A., Hassan, R. and Bakar, K.A.A., 2016. A review on Internet of Things (IoT) in healthcare. International Journal of Applied Engineering Research, 11(20), pp.10216-10221.

[6] Azzawi, M. A., Hassan, R., & Bakar, K. A. A. (2016). A review on Internet of Things (IoT) in healthcare. International Journal of Applied Engineering Research, 11(20), 10216-10221.

https://www.researchgate.net/profile/Mustafa-Azzawi/publication/309718253_A_Review_on_Internet_of_Things_IoT_in_Healthcare/links/581e46e008aea429b295c6eb/A-Review-on-Internet-of-Things-IoT-in-Healthcare.pdf

(Mathew, Prabha Susy, Anitha S. Pillai 2018)

[7] Mathew, Prabha Susy, Anitha S. Pillai, and Vasile Palade. "Applications of IoT in healthcare." Cognitive Computing for Big Data Systems Over IoT: Frameworks, Tools and Applications (2018): 263-288.

[8] Mathew, P. S., Pillai, A. S., & Palade, V. (2018). Applications of IoT in healthcare. Cognitive Computing for Big Data Systems Over IoT: Frameworks, Tools and Applications, 263-288.

[9] Mathew, P.S., Pillai, A.S. and Palade, V., 2018. Applications of IoT in healthcare. Cognitive Computing for Big Data Systems Over IoT: Frameworks, Tools and Applications, pp.263-288.

https://link.springer.com/chapter/10.1007/978-3-319-97016-5_2

(Sureshkumar Selvaraj, 2020)

[10] Selvaraj, S., Sundaravaradhan, S. Challenges and opportunities in IoT healthcare systems: a systematic review. SN Appl. Sci. 2, 139 (2020). https://doi.org/10.1007/s42452-019-1925-y

[11] Selvaraj, Sureshkumar, and Suresh Sundaravaradhan. "Challenges and opportunities in IoT healthcare systems: a systematic review." SN Applied Sciences 2.1 (2020): 139.

[12] Selvaraj, S. and Sundaravaradhan, S., 2020. Challenges and opportunities in IoT healthcare systems: a systematic review. SN Applied Sciences, 2(1), p.139.

https://link.springer.com/article/10.1007/s42452-019-1925-y

(Anil Chacko, 2018)

[13] Chacko, A., & Hayajneh, T. (2018). Security and privacy issues with IoT in healthcare. EAI Endorsed Transactions on Pervasive Health and Technology, 4(14).

[14] Chacko, Anil, and Thaier Hayajneh. "Security and privacy issues with IoT in healthcare." EAI Endorsed Transactions on Pervasive Health and Technology 4, no. 14 (2018).

[15] Chacko, A. and Hayajneh, T., 2018. Security and privacy issues with IoT in healthcare. EAI Endorsed Transactions on Pervasive Health and Technology, 4(14).

https://eudl.eu/doi/10.4108/eai.13-7-2018.155079

(Alessandra Belfiore, 2022)

[16] Belfiore, A., Cuccurullo, C., & Aria, M. (2022). IoT in healthcare: A scientometric analysis. Technological Forecasting and Social Change, 184, 122001.

[17] Belfiore, Alessandra, Corrado Cuccurullo, and Massimo Aria. "IoT in healthcare: A scientometric analysis." Technological Forecasting and Social Change 184 (2022): 122001.

[18] Belfiore, A., Cuccurullo, C. and Aria, M., 2022. IoT in healthcare: A scientometric analysis. Technological Forecasting and Social Change, 184, p.122001. https://www.sciencedirect.com/science/article/pii/S0040162522005224

(Trayush, T., Bathla, R., Saini, S., & Shukla, V. K, 2021)

[19] Trayush, T., Bathla, R., Saini, S., & Shukla, V. K. (2021, March). Iot in healthcare: Challenges, benefits, applications, and opportunities. In 2021 International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE) (pp. 107-111). IEEE.

[20] Trayush, Trayush, Ruchika Bathla, Sonia Saini, and Vinod Kumar Shukla. "Iot in healthcare: Challenges, benefits, applications, and opportunities." In 2021 International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), pp. 107-111. IEEE, 2021.

[21] Trayush, T., Bathla, R., Saini, S. and Shukla, V.K., 2021, March. Iot in healthcare: Challenges, benefits, applications, and opportunities. In 2021 International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE) (pp. 107-111). IEEE. https://iacis.org/iis/2018/3_iis_2018_33-41.pdf

(Singla, 2020)

[22] Singla, S. (2020). AI and IoT in healthcare. Internet of things use cases for the healthcare industry, 1-23.

[23] Singla, Sonia. "AI and IoT in healthcare." Internet of things use cases for the healthcare industry (2020): 1-23.

[24] Singla, S., 2020. AI and IoT in healthcare. Internet of things use cases for the healthcare industry, pp.1-23. https://link.springer.com/chapter/10.1007/978-3-030-37526-3_1

(Anand, 2017)

[25] Routray, S. K., & Anand, S. (2017, February). Narrowband IoT for healthcare. In 2017 International Conference on Information Communication and Embedded Systems (ICICES) (pp. 1-4). IEEE.

[26] Routray, Sudhir K., and Sharath Anand. "Narrowband IoT for healthcare." In 2017 International Conference on Information Communication and Embedded Systems (ICICES), pp. 1-4. IEEE, 2017.

[27] Routray, S.K. and Anand, S., 2017, February. Narrowband IoT for healthcare. In 2017 International Conference on Information Communication and Embedded Systems (ICICES) (pp. 1-4). IEEE. https://ieeexplore.ieee.org/abstract/document/8070747

(Ángeles Verdejo Espinosa, 2021)

[28] Verdejo Espinosa, Á.; Lopez Ruiz, J.; Mata Mata, F.; Estevez, M.E. Application of IoT in Healthcare: Keys to Implementation of the Sustainable Development Goals. Sensors 2021, 21, 2330. https://doi.org/10.3390/s21072330

[29] Verdejo Espinosa, Ángeles, Jose Luis Lopez, Francisco Mata Mata, and Macarena Espinilla Estevez. "Application of IoT in healthcare: keys to implementation of the sustainable development goals." Sensors 21, no. 7 (2021): 2330.

[30] Verdejo Espinosa, Á., Lopez, J.L., Mata Mata, F. and Estevez, M.E., 2021. Application of IoT in healthcare: keys to implementation of the sustainable

development goals. Sensors, 21(7), p.2330. https://www.mdpi.com/1424-8220/21/7/2330