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Internet of Things Based Health Monitoring System

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Abstract:We are living in Internet age where every physical object is connected to each other for sharing information.Internet of Things (IoT) is a new and rapidly growing technology that connects everything like smart objects and smart devices to the internet for effective communication between these connected things. The Internet of Things acts as a healthcare catalyst and plays a very important role in a wide range of applications for healthcare monitoring. Networked sensor devices, either worn on the body or embedded in living environments, enable rich information to be gathered to evaluate the patient's physical and mental health by collecting body temperature, blood pressure, sugar levels, etc.Communicating this information collected to the doctor, making accurate decisions about the data collected and notifying the patient is a challenging task on the Internet of Things. In this article, the author focuses on evaluating the IoT-based healthcare system and overview Patient Health Monitoring System related on opportunities and challenges for the Internet of Things.

Keywords: Body Area Network, ECG, Healthcare, Internet of Things,RFID, Wireless Sensor Network.

INTRODUCTION

We live in Internet age where every physical object can be linked to each other for the purpose of sharing information. Thanks to improved wireless technologies, such as Wi-Fi, Bluetooth & ZigBee, several devices or items around us have the ability to automatically exchange information. This network of things or objects connected by internet, local area network or wireless sensor networks is called the Internet of Things (IoT)[1].IoT consists of two terms, one of which is Internet and the other of Things. Internet is network of networks that are commonly linked through some standard protocols worldwide. Things refer to any connectivity involving physical object. IoT uses many technologies such as Radio Frequency Identification (RFID) tags, cameras, actuators and support for smart phones and cloud computing, etc. By using IoT we can connect anything; from anywhere and anytime we can access any service and useful information about any entity (Fig. 1).

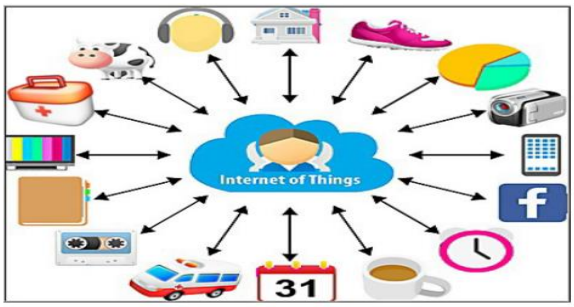

Fig. 1: Internet of Things (IoT)

IOT APPLICATION AREAS

The technologies by which IoT is implemented exponentially are Near Field Communication (NFC), Radio Frequency Identification (RFID)[2], Machine-to-Machine Communication (M2M) and Vehicle-to-Vehicle Communication (V2V). More than 50 billion IoT devices are expected to be connected over the internet by 2020. It will change human life, work style, entertaining ways and much more. IoT has many Applications Areas and daily domain of these applications is increasing (Fig. 2).

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Fig. 2: IoT Application Areas

There are ample of applications of IoT as follow:

- Smart Cities
- Building & Home automation
- Environmental Monitoring
- Automotive Industry
- Smart Agriculture
- Smart Industry
- Energy Management
- Healthcare Monitoring

IoT AND HEALTHCARE MONITORING

Healthcare is one of the booming fields of IoT technology. According to Forbes magazine, the IoT market in the healthcare industry will hit more than $117 trillion by 2020 and a compound annual growth rate (CAGR) of 37.6 per cent will be registered in the healthcare Internet of Things between 2015 and 2020, according to P&S Market Research. IoT has the potential to reduce dependent human healthcare.IoT wearable devices such as medical sensorsrecords patient health related information like blood pressure, body temperature and breathing pattern etc. This data will be delivered to concern hospital or caretaker for further action.

IOT APPLICATIONS IN HEALTH MONITORING

IoT could have various applications for improving quality of life in the medical industry, saving lives and reducing the cost of treatment. By using IoT-based[3] technologies, the medical industry can improve the healthcare system's ability to minimize human error, simplify the process of treatment and the quality of life for caregivers and patients alike. IoT-based monitoring system can assist doctors in treatment and predict a symptom before diagnosis starts.Monitoring system can also alarm in medical emergency situations like falling of old age patient ,patient has abnormal behavior as in the intensive care unit (ICU).There are many IoT based healthcare application area as follows:

- Health Monitoring
- Personal Fitness Monitoring
- Chronic Disease Monitoring
- Safety Monitoring
- Medication Monitoring
- Home Rehabilitation
- Real Time Location Tracking

1. Health Monitoring

Medical sensors and wearable devices can capture vital health sign for health monitoring and personal fitness program. Sensors can capture blood pressure, blood glucose, weight, ECG, heart rate and body temperature etc to monitor pediatric and aged person.

2. Personal Fitness Monitoring

This sensor application class is intended for those who wish to stay fit and healthy. Sensors can also track personal fitness or gym progress[4]. An individual can track many parameters and record them to check his/her performance and workout routine. Weight measuring sensors, activity monitor sensors such as walking time counter, step counter, velocity counter, calorie counter and heart rate and blood pressure measuring sensors are used here.

3. Chronic DiseasesMonitoring

Millions of people are suffering from chronic diseases like cancer, diabetes, asthma, heart diseases, sleep disorders and arthritis. Special care is need in such kind of disease. It required disease specific diet and treatment plans. By using physiological sensors like ECG(electrocardiogram)[5], EMG(Electromyography)and EEG(electroencephalogram) with activity monitor sensors like step counter, speed counter, calorie counter can be used for early detection of symptoms and adverse changes in a patient's health condition that will cause to early and timely medical treatments.

4. Safety Monitoring

There are myriad ofsensors and wearable devices, available to improve healthcare system for aged and pediatric population. Sensor for fall detection, epileptic seizures detection and heart attacks symptom detection

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can be used for safety monitoring of patient. These sensors have a push button that sends alarm signals to caregivers or family members.

5. Medication Management

It is the general human condition of physician-prescribed medication noncompliance. This can threaten the health of patients, as well as financial loss. IoT-based Intelligent Medicine Box packaging method can be used to manage medication. This method of packaging controlled sealing based on delaminating materials and controlled by wireless communication.

6. Home Rehabilitation

IoT based healthcare has the potential to improve rehabilitation. IoT based Sensing technology with Virtual Reality environments[6] and augmented feedback systems can be used for home-based rehabilitation system for aging population and kids. IoT based technologies can be used for remote consultation also.

7. Real Time Location Tracking

Through IoT Tracking is possible for patients and the equipment used for treatments. Through the use of the RFID tag[7] health care providers can monitor real-time location, assigned physician and patient progress etc. Medical devices and equipment such as defibrillators, ECG machines, spirometry and nebulizers etc. can be tagged with sensors and easily tracked with IoT.

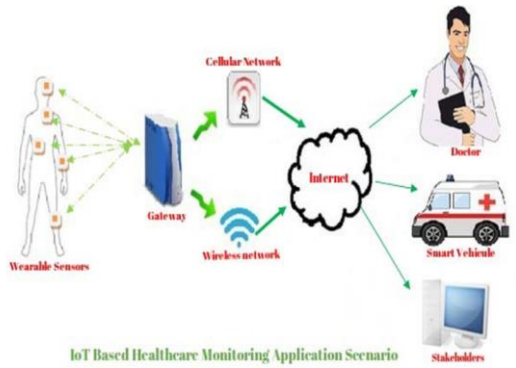

Fig. 3: IoT in healthcare

IoT[8] is an emerging technology where all living & non livingobjects are connect through Internet for data sharing and controlling remotely. Heterogeneous technologies are combined together to enable IoT applications. IoT in healthcare uses the combination of RFID technology, Sensors Networks, wireless Communication Technology & Embedded System Technology. Physical health information gathered by sensor is transmitted to middleware/ gateway. Gateway can handle multiple technologies and multiple sensors together. It analysis and aggregate this health data and send it to internet where connected healthcare service provider and stockholders use this information and take actions accordingly (Fig. 3).

BENEFITS OF USING IOT IN HEALTHCARE

1. Reduction in treatment cost:

Healthcare focused on the Internet of Things offers patient access 24/7, and in real time. Definitely, it will reduce unnecessary visits to hospitals and also transport costs. Patients can have doctor advice at home through online video streaming and only patients can reach hospitals in critical situations. IoT-based healthcare[9] tracking will reduce insurance premiums as well as health check-up for patient working leave.

2. Reduction in human error:

Sensors accurately collect physical health information such as blood pressure, sugar level, etc. in IoT-based healthcare monitoring, and the corresponding decisions are taken by the technique of big data analytics. This helps minimize human mistakes.

3. Remove geographical barriers:

Any patient can take medical advice from any corner of the world because Physicians and patient are connected globally via internet.

4. Minimum paperwork and documentation:

Internet of Things based Internet healthcare monitoring support green technology and minimize paperwork and documentation.

5. Early detection of chronic disorders:

Using large data analytics and data mining techniques on medical sensor-generated physical health information, chronic disorders can be predicted at an early stage and treatment can be performed before it becomes incurable.

6. Enhanced Drug Management:

Making and managing medicinal products for the health industry is a vast challenge. By using RFID (Radio Frequency Identification) technology in the management of the drug supply chain this industry can also have better drug management for producers, suppliers and consumers. It will reduce loss due to drug management by theft, lost, and miss.

7. Immediate medical attention:
IoT based medical devices[10] can alarm healthcare provider or family members in case of medical emergency like rise in blood pressure or fall of a senior family member.

8. Better outcomes of treatment:
24/7 health monitoring and evidence based treatment decisions will help to cure diseases on timely basis. It will also increase treatment outcomes in result.

CONCLUSION

Internet of things technology is in its starting face but it has potential to impact human healthcare and associated market at a massive scale. Due to high speed internet access and advanced sensor technology it is possible to track human and other objects. Researchers have started to discover many technological solutions to improve healthcare system. This paper offers deeper insights of Internet of things based healthcare applications, enablingtechnologies, current challenges and issues of healthcare. An Internet of Thing is nothing but an integration of sensors attached to various objects with the Internet in order to provide data to the Internet along with using the already available data from the Internet. This to and fro relationship can extensively be used for the betterment of human health and life.Early detection of any issues in the human body has been made quite easy. In this paper, we have given priority to both research works and commercial devices to study and investigate the currently available and future technologies.

REFERENCES

[1] A. Soia, O. Konnikova, and E. Konnikov, "The internet of things," in *Proceedings of the 33rd International Business Information Management Association Conference, IBIMA 2019: Education Excellence and Innovation Management through Vision 2020*, 2019, doi: 10.4018/ijhiot.2018010101.

[2] L. Atzori, A. Iera, and G. Morabito, "The Internet of Things: A survey," *Comput. Networks*, 2010, doi: 10.1016/j.comnet.2010.05.010.

[3] G. M. Lee, N. Crespi, J. K. Choi, and M. Boussard, "Internet of things," *Lect. Notes Comput. Sci. (including Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinformatics)*, 2013, doi: 10.1007/978-3-642-41569-2-13.

[4] L. Tan and N. Wang, "Future Internet: The Internet of Things," in *ICACTE 2010 - 2010 3rd International Conference on Advanced Computer Theory and Engineering, Proceedings*, 2010, doi: 10.1109/ICACTE.2010.5579543.

[5] S. Li, L. Da Xu, and S. Zhao, "The internet of things: a survey," *Inf. Syst. Front.*, 2015, doi: 10.1007/s10796-014-9492-7.

[6] A. Lele, "Internet of things (IoT)," in *Smart Innovation, Systems and Technologies*, 2019.

[7] F. Xia, L. T. Yang, L. Wang, and A. Vinel, "Internet of things," *International Journal of Communication Systems*. 2012, doi: 10.1002/dac.2417.

[8] D. Miorandi, S. Sicari, F. De Pellegrini, and I. Chlamtac, "Internet of things: Vision, applications and research challenges," *Ad Hoc Networks*. 2012, doi: 10.1016/j.adhoc.2012.02.016.

[9] F. A. Jørgensen, "The Internet of Things," in *A New Companion to Digital Humanities*, 2015.

[10] A. Al-Fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, and M. Ayyash, "Internet of Things: A Survey on Enabling Technologies, Protocols, and Applications," *IEEE Commun. Surv. Tutorials*, 2015, doi: 10.1109/COMST.2015.2444095.

[11] T Kowshiga, T Saranya, T Jayasudha, M Sowmiya, S Balamurugan, "Studies on Protecting Privacy of Anonymized Medical Data", International Journal of Innovative Research in Science, Engineering and Technology Vol. 4, Issue 2, February 2015

[12] P Andrew, J Anishkumar, S Balamurugan, S Charanyaa, " Investigations on Methods Developed for Effective Discovery of Functional Dependencies", International Journal of Innovative Research in Computer and Communication Engineering , Vol. 3, Issue 2, February 2015

[13] R S Venkatesh, PK Reejeesh, S Balamurugan, S Charanyaa, "Investigations on Evolution of Approaches Developed for Data Privacy", International Journal of Innovative Research in Computer and Communication Engineering , Vol. 3, Issue 1, January 2015

[14] Usha Yadav , Gagandeep Singh Narula, Neelam Duhan , Vishal Jain , B. K. Murthy, "Development and Visualization of Domain Specific Ontology using Protege ",Indian Journal of Science and Technology, Vol. 9, No. 16, April, 2016, page no. 1-7 having ISSN No. 0974-6846.

[15] Usha Yadav, B K Murthy, Gagandeep Singh Narula, Neelam Duhan and Vishal Jain, "EasyOnto: A Collaborative Semi Formal Ontology Development Platform", CSI-2015; 50th Golden Jubilee Annual Convention on "Digital Life", held on 02nd to 05th December, 2015 at New Delhi, published by the Springer under Nature Inspired Computing, Advances in Intelligent Systems and Computing having ISBN 978-981-10-6746-4 page no. 1 to 11.

[16] Usha Yadav, Gagandeep Singh Narula, Neelam Duhan and Vishal Jain, "A Novel Approach for Precise Search Results Retrieval based on Semantic Web Technologies", 10th INDIACom; INDIACom-2016, 3rd 2016 International Conference on "Computing for Sustainable Global Development", 16th – 18th March, 2016 having ISBN No. 978-9-3805-4421-2/, page no. 1357 to 1362.