Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X
IMPACT FACTOR: 6.017

IJCSMC, Vol. 6, Issue. 6, June 2017, pg.357 – 362

E-Health with Internet of Things

Mohd Ibrahim Bhat[1], Shariq Ahmad[2], Asif Amin[3], Suhail Ashraf[4]

[1]Student, Computer Science Engineering, SSM College of Engineering & Technology, Kashmir, India

bhatibrahim7@gmail.com

[2]Student, Computer Science Engineering, SSM College of Engineering & Technology, Kashmir, India

shariqraja3625@gmail.com

[3]Student, Computer Science Engineering, SSM College of Engineering & Technology, Kashmir, India

asifamin.am@gmail.com

[4]Assistant Professor, Computer Science Engineering, SSM College of Engineering & Technology, Kashmir, India

suhibhat@gmail.com

Abstract: - In today's e-life we always have to deal with information which plays a significant role in our lives. One of the major sources of information is obviously the giant internet. When we move our heads around, we can see things that are acting smart, and are thus making the human lives more smart and e-centric. These things act smart only as they are connected with the internet, and are hence called as the 'Internet of Things(IoT)'. In Internet of Things (IoT), devices gather and share information directly with each other and the cloud, making it possible to collect, record and analyse new data streams faster and more accurately. IoT offers a great promise in the field of e-healthcare, where its principles are already being applied to increase the quality of care, improve access to care and most importantly reduce the cost of care. Embedded technologies are being used in applications like e-health systems that deliver care to people in remote locations and monitoring systems that provide a continuous stream of accurate data for better care decisions. Here we study wearable devices for monitoring patients who in one way or the other may be prone to various risks like high blood pressure, which can be due to intense stress, overweight conditions, and family history of high blood pressure.

Keywords: - "Internet of Things (IoT)", "E-Health", "RFID", "EMR", "Sensors".

1. INTRODUCTION

The advantage of today's rapidly growing technology and innovation should be adopted to improve access to quality health care services for patients in their local health centres. Health care service delivery is the management and delivery of health services for comprehensive preventive and curative services, according to the needs of individuals over time and across various levels of health system. Quality health care services are important for increasing everyone's quality of health, gaining quick access into a health care system, preventing disease and disability, detecting and treating health conditions, and thus preventing death due to negligence. Access to health care services comprises of coverage, services, timeliness and workforce. This paper focuses on patients' health care, which is to improve the health and wellbeing of patients through the use of IoT and e-Health solutions.

Internet of Things (IoT) has emerged as one of the recent advances of information and communication technologies, and it is having great impact when integrated with health services, particularly e-Health.

IoT technology links the Internet with different kinds of objects in our daily lives such as everyday sensors and working devices (medical devices, home appliances, etc.) due to their communication and computing capabilities, and this has enhanced the way we interact with our environment. It is anticipated that billions of sensors and actuators will be connected to the Internet via heterogeneous access networks enabled by technologies such as Radio Frequency Identification (RFID), wireless sensor networks, embedded sensing, real-time and semantic web services. IoT is been applied in areas such as smart city, home monitoring and automation, healthcare, manufacturing, energy and utilities, smart grid, intelligent transportation system, and traffic management. The use of this new technology, IoT, in healthcare services brings comfort to patients and physicians because of its various applications such as real-time monitoring, patient information management system, and health management system. In eHealth, medical devices such as wearable devices can be connected to IoT technology for remote monitoring, real-time monitoring and on-line medical consultations.

The Internet of Things is envisioned to allow for the interconnectivity of anyone and anything at any time and in anyplace. This connectivity should ideally be possible using any service over any conduit, path or network. This is popularly referred to as The IoT Connectivity Concept. The IEEE IoT Community defines the Internet of Things as: "… a self-configuring and adaptive system consisting of networks of sensors and smart objects whose purpose is to interconnect "all" things, including every day and industrial objects, in such a way as to make them intelligent, programmable and more capable of interacting with humans''. This definition of IoT and an understanding of the IoT Connectivity Concept are the premise on which this study is based.

2. OBJECTIVE

Developing a system for the users to achieve the following objectives:

- To develop gathering patient medical data that was never before available for analysis and delivering care to people for whom care wasn't previously accessible.
- To develop IoT-driven systems for making it possible to radically reduce costs and improve health by increasing the availability and quality of care.
- To develop and manufacture embedded technologies for use throughout IoT-driven healthcare systems, including:
  - Sensors that collect patient data.
  - Microcontrollers that process, analyse and wirelessly communicate the data.
  - Microprocessors that enable rich graphical user interfaces.
- To develop Healthcare-specific gateways through which sensor data is further analysed and sent to the cloud.
- To execute queries that can arrange data of tables in the form ascending order and descending order.

3. PROPOSED SYSTEM

Integration of the IoT technology with e-Health solutions is the main focus here, that is, to show how IoT's main technology (RFID) is incorporated with patients' Electronic Medical Records (EMR) to enable each patient have secured and easy access to his or her medical records in various health centres. The patients' EMR is an e-Health solution that is used to manage the health information of patients. Each patient will be issued a Radio Frequency Identification (RFID) tag to access his or her medical records that is stored in the database server of the health centre.

3.1 RFID Technology:

IoT technology enables the information discovery about a tagged person or a tagged object by browsing database entry or internet addresses that is connected to a specific active RFID tag with sensing capability. RFID is a wireless non-contact system that stores sensitive data and uses radiofrequency waves to transfer data from an RFID tag attached to a person or an object, for automatic identification and tracking. RFID is a superior technology compared to the traditional barcode system because it provides both read or write capability, it requires no line-of-sight contact with RFID readers and can read many RFID tags simultaneously. In e-Health, RFID technology is being used within IoT for tracking of medical assets and patients' medical records, new-born and patient identification, medical treatment tracking and validation, and surgical process management.

The RFID technology comprises of the following three main components:

RFID Tag: It consists of a microchip, an antenna and a dedicated hardware for cryptographic operations. The information about the tag is stored electronically in terms of bits and it communicates with the RFID reader. The tag is also called a transponder,

which is read as soon as it is in the coverage area of the reader, and its details are listed out in the computer system. Depending on the type and application requirements, the RFID tag may be: passive tag or active tag. Passive tags derive their power when they are within the field of the reader. They are less expensive than active RFID tags. An active tag has a small battery and a radio transceiver, and can be read from distances of several hundred feet depending on the antenna type and its environment.

RFID Reader: It transmits an encoded radio signal to interrogate and activate the RFID tag. The reader is composed of a radio transmitter, a radio receiver, a control unit, and a memory unit. The main function of the reader is to enable the RFID tag and the server to exchange messages and achieve mutual authentication.

Server: It is a trusted entity that is used to achieve the purpose of mutual authentication. The server stores all the RFID tag's identification information in its database and uses the stored information to determine the validity of the tag.

3.2 Patients' EMR:

EMR is a digital version of paper-based medical file records of an individual. EMR systems help to provide quick access to health care information remotely, at anytime and anywhere with the availability of IoT technology. EMR takes away the process of structured or unstructured paper form, which could be cumbersome to access at a glance. In this paper, a patient's medical information is entered into an EMR system of health centre in the first instance. The EMR of the patient will be updated continuously throughout his or her stay in the health centre, and linked to an RFID tag. The EMR of the patient includes the following stored information: patient's bio-data, diagnostic information (from medical devices such as ECG device), medical history, prescriptions, laboratory results, blood pressure results, vital signs and medical bills. Whenever a patient seeks medical care in the health centre, the doctors will retrieve the health information of the patient from the EMR system through the use of RFID technology. Then, the retrieved information would help in to analyse and diagnose the patient's illness. Doctors can further take expert advice by sharing the information with consulting specialists if the need arises. This system ensures structure, efficiency and security because no other patient can use another's medical file.

4. ARCHITECTURE OF THE SYSTEM

The Architecture framework for IoT enabled e-health, can be best understood by visualising the lifecycle of the various entities and their interactions. The life cycle of the device data is critical to understand and can be summarized as:
Connection: The focus for this function is related to how the device is connected to the ecosystem.
Collection: The focus of this function is related to how data is collected from the sensor. The data can be pushed our pulled from the sensor.
Correlation: The focus of this function is related to mapping the data to a context and does correlation to create meaningful and concise data that can be processed and be used to make decisions.
Collaboration: The focus of this function is to enable the collaboration between the patient and the care teams.

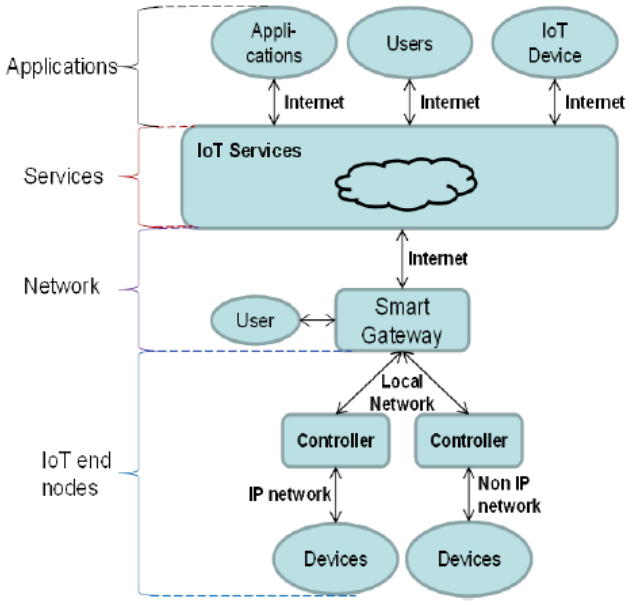

Figure 1: E-Health IoT Architecture

Architecture for e-health must consider the needs of each step in this life cycle and must address the effective and efficient execution of each function. The key to e-health architecture is to support an interoperable system of different types of devices, applications, and backend systems to enable the free flow information for precise and timely decision-making. The data flow architecture focuses on the source of the data, the destination the data and path the data. The source of the data is typically the sensor. The data can be either locally cached or is sent to the upstream systems without storing in the sensor. The path taken by the data includes a gateway, which can also cache some of the data and do distributed processing.

5. METHODOLOGY

To achieve the above mentioned objectives some methodology has been followed and it is given below:

First and foremost, our goal is to establish the communication, which is done by the information service bus between the layers and thus supporting multiple protocols. The device layer must consist of a flexible registry-based model that enables plug-and-play of devices. Given the number of devices and the information they generate; it is critical to get the information filtered. The challenge with filtering is to identify the right information at the right time and eliminate false alarms yet not miss any critical information. The clinical decision support systems are used to process this information to make conclusions and the action that needs to be performed based on the information received from these devices. The co-relation requires data from multiple systems and hence the architecture must support seamless interoperability between the systems that houses the information. The data includes the real-time data as well as historic data that are stored in the system. The data flow architecture focuses on the source of the data, the destination the data and path the data. The source of the data is typically the sensor. The data can be either locally cached or is sent to the upstream systems without storing in the sensor. The path taken by the data includes a gateway, which can also cache some of the data and do distributed processing. Intermediate hubs can also store and process the data to filter out or make certain decisions. A distributed rules engine is used to make distributed decisions at the closest point of care. This enables data traffic to be filtered and processed efficiently without having every data being processed by the cloud service. The data finally enters the data store in the cloud where it is stored, further processed and archived. The conclusion could be that a care team member needs to contact the patient to understand further why there is a deviation from the expected readings from the device. This approach is critical to identify problems early in the cycle thereby reducing considerable amount of cost and complexity in dealing with health care issues at the emergency room stage. Once the conclusion has been made that the care team needs to interact with the patient. Different methods can be used to enable collaboration, which can range from basic text messages to real time video enabled collaboration.

6. ADVANTAGES

- ✓ Wireless networking removes the physical limitations on networking imposed by traditional wired solutions like Ethernet and USB.
- ✓ Microcontroller based wireless devices based on popular wireless standards such as Bluetooth and Wi-Fi and Bluetooth in clinics or hospitals.
- ✓ Gateways designed by Medical device designers can provide the platform to create remote-access devices for remote monitoring.
- ✓ Smart Sensors with low-power operation are essential to keep device footprint small and extending battery life, that help make IoT devices as usable as possible.
- ✓ Graphical user interfaces (GUIs) improve usability by enabling display devices to deliver a great deal of information in vivid detail and by making it easy to access that information.

7. CONCLUSION

The long-predicted IoT revolution in healthcare is already underway. This paper has addressed the need for integrating IoT technology with e-Health solutions and wearable devices to improve patients' health care. Thus providing quick and secure access to patients' EMR. We are seeing the IoT building blocks of automation and machine-to-machine communication continue to be established, with the addition of the service layer completing the infrastructure. Moreover, the proposed system of e-Health based on IoT would not only provide a smarter approach toward health services but also makes the decision making process intelligent. On a whole this system could address several health issues as a mass. Since the foundation of the proposed eHealth model is based on Internet, it would be easier to transform the outputs to second screen and mobile devices.

8. ACKNOWLEDGEMENT

Words are not just enough to express our gratitude but we take this opportunity to express our profound sense of gratitude and respect to all those who helped us throughout. We acknowledge the effort of those who have contributed significantly to our work.

First of all, we are very thankful to Allah then to our Parents for their regular support and guidance. We feel privileged to offer our sincere thanks and deep sense of gratitude to Mr. Suhail, our Guide, for expressing his confidence in us by letting us work on a paper of this magnitude and using latest technologies and providing their support, help & encouragement in implementing this work.

Last but not the least, we are grateful to all our friends for providing critical feedback & support whenever required. There are times in such paper works when clock beats you time and again and you run out of energy, you just want to finish it once and forever, Parents and Friends made us endure such times with their unfailing humour & warm wishes.

REFERENCES

[1]. C. Waddington. (2008). Integrated Health Services – What and Why? World Health Organization Technical Brief No.1. [Online]. pp. 1–8. Available: http://www.who.int/healthsystems/service_delivery_techbrief1.pdf

[2]. C. Wang, M. Daneshmand, M. Dohler, X. Mao, R. Q. Hu and H. Wang, "Guest Editorial - Special Issue on Internet of Things (IoT): Architecture, Protocols and Services." IEEE Sensors Journal, vol. 13, issue. 10, pp. 3505–3510, Oct. 2013.

[3]. A. P. Renold and R. R. Joshi "An Internet Based RFID Library Management System." in Proc. IEEE Conf. Information and Communication Technologies, Jeju Island, 2013, pp. 932–936.

[4]. C. Perera, "The Evolution of e-Health – Mobilte Technology and mHealth", http://articles.journalmtm.com/1.1.1-2%20Perera.pdf

[5]. "An Architecture for Secure e-Health Systems" - http://www.tsb.upv.es/eventos/workshophealthcare/documentos/C2-2.pdf

[6]. Ashly Mathew1, Farha Amreen S.A2, Pooja H.N3, Aakriti Verma4 "Smart Disease Surveillance Based on Internet of Things (IoT)"

[7]. Ashok Khanna Business Head UK, EU and Major Accounts, Life Sciences (EIS) Global Head, Presales and Solutions for Life Sciences (EIS) Prateep Misra Research Area Manager, TCS Innovation Labs ,"The Internet of Things for Medical Devices Prospects, Challenges and the Way Forward".

[8]. Lei Yu School of Computer and Information, Hefei University of Technology, Hefei, China 2 School of Medical Information Technology, Anhui University of Traditional Chinese Medicine, Hefei, China Email: fishstonehfut1006@163.com Yang Lu, XiaoJuan Zhu School of Computer and Information, Hefei University of Technology, Hefei, China Email: luyang.hf@126.com, xjzhu@aust.edu.cn "Smart Hospital based on Internet of Things" ,10 October 2012.

[9]. Z. Guangnan and L. Penghui, "IoT (Internet of Things) control system facing rehabilitation training of hemiplegic patients,"

Chinese Patent 202 587 045 U, Dec. 5, 2012.

[10]. H. Viswanathan, B. Chen, and D. Pompili, ``Research challenges in computation, communication, and context awareness for ubiquitous healthcare, "IEEE Commun. Mag., vol. 50, no. 5, pp. 92-99, May 2012.

[11]. E. Agu et al., "The smartphone as a medical device: Assessing enablers, benefits and challenges," in Proc. IEEE Int. Workshop Internet-Things Netw. Control (IoT-NC), Jun. 2013, pp. 48-52.

[12]. D. Y. Lin, "Integrated Internet of Things application system for prison, "Chinese Patent 102 867 236 A, Jan. 9, 2013.

[13]. V. M. Rohokale, N. R. Prasad, and R. Prasad, ``A cooperative Internet of Things (IoT) for rural healthcare monitoring and control," in Proc. Int. Conf. Wireless Commun., Veh. Technol., Inf. Theory Aerosp. Electron. Syst. Technol. (Wireless VITAE), Feb./Mar. 2011, pp. 1-6.

BIOGRAPHIES

Mohd Ibrahim Bhat, is pursuing B.E Degree from SSM College of Engineering & Technology in Computer Science Engineering from University of Kashmir, J&K, India. His field of interest is ASP.Net Networking & SQL.

Shariq Ahmad, is pursuing B.E Degree from SSM College of Engineering & Technology in Computer Science Engineering from University of Kashmir, J&K, India. His field of interest is ASP.Net & SQL.

Asif Amin, is pursuing B.E Degree from SSM College of Engineering & Technology in Computer Science Engineering from University of Kashmir, J&K, India. His field of interest is ASP.Net & SQL.

Suhail Ashraf, is the Assistant Professor at SSM College of Engineering & Technology in The Department of Computer Science Engineering. His area of interest is Theory of Automation, Microprocessor and Software Engineering.

