Prominence of IoT and Cloud in Health Care

R.Babu, Dr.K.Jayashree

Abstract - **Internet of Things is the unification of devices that are networked together to execute the processes and services that support the basic requirements, finance, health and surroundings. Cloud computing is an archetype, in which robust, extensible and quasi resources are provided as services via internet. Cloud computing together with the Internet of Things will improve the performance capabilities and resource utilization to the maximum. Hence, cloud computing is used as an interface to access Internet of Things. The consumerization of the healthcare industry is growing expeditiously which enable people to live healthier lives by using connected devices such as tablets, wearable and hand-held devices. Internet of Things is a conquering technology that bridges interoperability challenges to radically change the manner in which healthcare will be delivered, demanding better outcomes, multiplying efficiency and making healthcare affordable. Internet of Things supplements people with technology to deliver magnified results. This survey presents the importance of Internet of Things and Cloud in the HealthCare Industry.**

Index terms – Cloud Computing, Health Care, Internet of Things and Interoperability.

I. INTRODUCTION

Cloud computing offers services that can be accessed anywhere across the globe with the help of an internet connection. The Internet of Things (IoT) as a platform captures real time information, facilitates examination and analyses gathered information and thus provides a inter dependent atmosphere to be shared with various stakeholders. Cloud and IoT are conjointly dependent on each other. On the one hand, IoT can benefit from the virtually unlimited capabilities and resources of Cloud to neutralize its technological limitations. On the other hand, the cloud can gain from IoT by continuing its scope to deal with things in real world and for delivering variety of new services in a distributed and dynamic manner.

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Sensors and actuators encapsulated in physical objects are coupled through wired and wireless networks as shown in Figure 1. , often using the similar Internet Protocol that links the Internet forms the IoT. These networks enable huge volumes of data to flow to the computers for analysis. When objects have the ability to sense the environment and communicate, they become tools for understanding complications and acknowledge to it promptly [1]. The progressive thing in all this is that these tangible information systems work predominantly without human intervention.

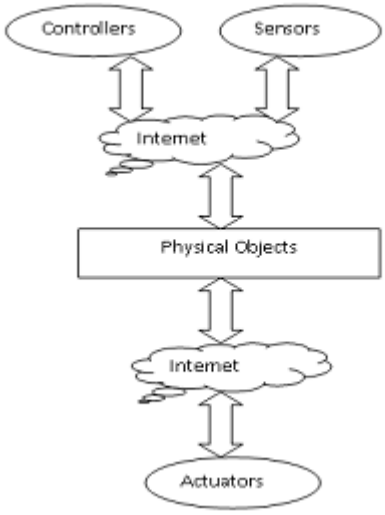

Figure 1. Base of IoT

II. BACKGROUND STUDY

The IoT saves time and enhances the quality of life to a great extent. Primary healthcare systems around the world are stretched to a critical moment. A good evidence of this is the 'waiting time' for medication [2]. The causes for this are the overgrowing population and an ever increasing demand for healthcare services. This situation is changed by a public-private partnership-driven concept called Telemedicine. It not only improves the value of care but also raises the capability of consulting physicians [3]. This is very important aspect in developing countries as they have very high patients-per-doctor ratios. Telemedicine grants the usage of a wearable or portable device at home and on the move [4].

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In the health care, Internet-connected devices have been introduced to patients in various forms. Fetal monitors, temperature monitors, electrocardiograms or blood glucose level monitor requires follow-up interaction with a healthcare professional [5]. This creates an opening for smarter devices to deliver more valuable data on a timely basis, lessening the direct patient-physician interaction.

Daily visits become uncommon while treatment can still be adjusted with the knowledge from the telemedicine systems, giving patients more liberty to enjoy their life. Telemedicine is a rapidly emerging area, and applications and devices are offered on pay per use basis for the private user, but only a few are linked to the healthcare system. For the integration of telemedicine with the healthcare system, a high degree of maturity is required from both parties: the Information and Communication Technology (ICT) and the Health societies. The ICT community requires developing applications and services that should exhibit in digital space, enabling electronic patient records. The accepted consumers will choose their products as per their need, and that choice makes the world an acceptable place to live. The "Continuous Care" as shown in Figure 2 is an essential action for the realization of new technology in a very personal and intimate part of people's lives. It is an iterative process of end user involvement in observational living labs that get us to the point where good products are produced. Understanding what the user needs is an important issue for IoT.

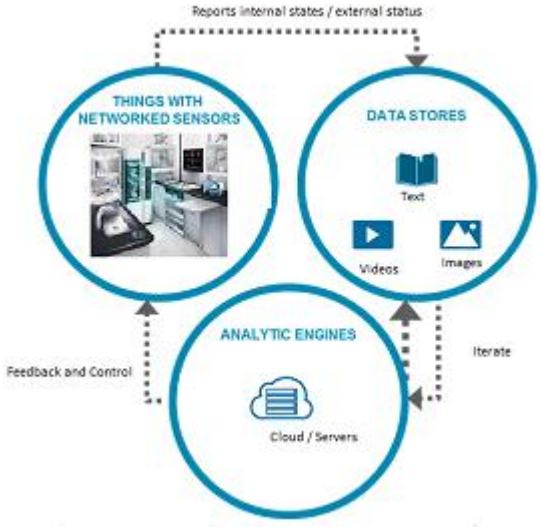

Figure 2. Interaction between Components of IoT

Nowadays Health-IoT ecosystems are based on a group of devices that are connected directly with each other to acquire and share significant data, and vital context information, through a secure service layer that connects to a central command and control server in the cloud [6]. With the use of IoT technology, medical consultations among rural patients, health workers, and urban city specialists are carried in the same way. The support of M-health concept with IoT enables medical sensors, mobile computing, and communication technologies for healthcare, which fascinates more and more researchers to apply mobile communication technology and IoT in healthcare service [7].

The personalized investigation of our health will become the standard in the near future. Individuals will be supplied with tailor-made scheme to fight illness and social technologies will enable us to maintain our own health [8]. From the data generated, we will gain knowledge on how to improve our wellbeing and be persuaded to take control. The incredible power of the IoT will be fully attained – an immeasurable array of smart connected solutions designed to enhance our health, productivity and environment through proficient use of data. This empowers us to examine and control our domestic air quality, or catering medics with cloud-based tools that grant them to 'consult' with patients who aren't even in the same block or room, or even the same city.

III. SYSTEM ARCHITECTURE

Data from real world and contingency information supplied by wearable medical devices with associated electronic health records can be highly valuable for caregivers and an important source for researchers, since they have the chance to easily acquire patient data and contingency information outside the facility walls [8]. This can be effectively done by specifying medical devices that can continuously analyze and securely store health related information to a cloud, which provide unending flows of information for extended periods of time, in order to achieve real predictive healthcare and also for discovering possible unhealthy habits. In the connected health systems, it is significant to know how health data is transmitted by a Personal Health Devices (PHD), how the data are being stored by the use of Personal Health Record (PHR) and how the data is securely carried over the internet by Personal Health Managers (PHM).

A. Personal Health Devices

Personal Health Devices, wearable or not, are tools with constrained resources permits you to securely gather, store, maintain and divide your own and your

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family's health information to a gateway for the purpose of collection, display, and further transmission [9]. Low-power communication technology like Bluetooth should be a natural choice for deployment of personal e-Health systems and devices. A gateway can transmit data for the purpose of additional analysis to a healthcare service center for teleassistance and use information from different domains such as health and fitness, disease control or an independent age measuring device as shown in the Figure 3. [10]. The communication path between a PHD and the gateway is assumed to be a virtual point-to-point connection. Generally, a PHD communicates with a single gateway at a specific point when essential. Gateways can interact with a plurality of PHDs simultaneously using separate point-to-point connections [11].

Figure 3. PHD Wireless Transmission

B. Personal Health Record

The PHR is a device that is used to gather, track and share past and current information about health or the health of the person in your care. Sometimes this information will save the money and difficulty of repeating routine medical tests. Even when the regular procedures need not to be repeated, PHR can give medical care providers more acuteness into your personal health history. The specific content of health record depends on the type of healthcare you have received. Listed down are documents conventional to most health records and additional documents that associate with hospital stays or surgery [12].

IV. Role in Health Care

The pivotal enablers of the IoT are smart devices, that makes real-time monitoring and remote tracking possible and cloud-based services, which power communities. There are many applications that communicate verbally with the patients regarding their health regimen [13]. The app sends out notifications to the patients. There are particular group of patients who practices these tools quite often, one such group is those with regular age-related illnesses like blood pressures and blood sugars and another group is obesity patients [14]. Some examples of what each could with the IoT do to support proactive healthcare.

A. Infant Monitors

Infant monitor will send to parents the real-time information on their baby's breathing, skin temperature, sleeping position, and activity level. It will also send baby's sleep data straight to parents' smart phones.

B. Smart Diapers

Smart diapers analyze patient's urine to check hydration levels and identify signs of Urinary Tract Infections (UTIs). The data sensed from the diaper is then automatically sent to a caretaker's smart phone after he scans a QR code on the front of the diaper. This diaper is very useful for infants as well as elderly patients with memory loss.

C. Insulin Injection Trackers

Smart insulin injection tracker helps diabetic patients to manage their health. The injection tracker is a computerized cap that suits most insulin pens on the market. It wirelessly transmits a diabetic's insulin injection data to a smart phone app.

D. Prescription Pills

Prescription medications have also joined the IoT. An ingestible sensor that is part of the pill you swallow every day is developed which tracks whether a patient is taking his medication on schedule. When the pill reaches the patient's stomach and is unveiled to stomach fluid, it transmits a signal through the own body tissue of the user to a patch on the patient's skin. The patch then broadcasts its data to a smart phone, where it can then be shared with physicians and caregivers.

E. Asthma

Nitric Oxide (NO) monitor is a tiny, hand-held device that takes continuous measurements of NO in a patient's breath, which can boost the management of asthma and other inflammatory airway conditions. When a patient inhales into the mouthpiece of the device, the levels of NO in their breath are measured to decide if there is airway inflammation and the best

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medication to treat it. The data that is collected can be synchronized with electronic medical record systems.

F. Hypothermia

Hypothermia detector is a smart fluid management device which automatically measures urine output and Core Body Temperature (CBT) for patients whose bladder is inserted with a urinary catheter. By monitoring the vital signs, care can be commenced early for heart failure, kidney injury, infectious disease, sepsis, prostate tumors, diabetes, and burn patients. Measuring CBT can also signify infection or hypothermia. When used in hospitals, this device provides fill level and CBT data directly to a nursing station or to a monitor wirelessly.

V. CONCLUSION

The future is concentrating more on networked devices and the health care is adopting many of such devices with an intention to improve the future healthcare as a whole. It is also notorious that IoT integrated with cloud is getting deep rooted with wide adoption of connected devices in the health care industry. Hence it is very much clear that the game is going to be two-sided as the IoT featuring medical devices and applications, and vice versa. This model of healthcare, which majorly depends on patient participation and consequent data analysis by microprocessors and microcontrollers, is set to alter the way health services are delivered. The customer centric transfiguration is being fuelled by the requirement for innovation and disruption in healthcare. IoT will continue to emerge fast, progressing to impactful and positive turnaround for all stakeholders in the healthcare industry.

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