

# Role of IoT and Cloud in Healthcare a Survey

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**Abstract:** Internet of Things is the group of devices that are connected to the internet to perform the processes and service that support our basic needs, economics, health and environment. Cloud computing is an archetype, in which dynamical, scalable and virtualized resources are provided as services via internet. Cloud computing along with the Internet of Things will enhance the performance capabilities and resource storage to the maximum. Hence, cloud computing is used as a front end to access Internet of Things. The consumerization of the healthcare industry is developing rapidly which empowers people to live healthier lives by using connected devices such as tablets, wearables and hand-held devices. Internet of Things is an advancing technology that bridges interoperability challenges to radically change the way in which healthcare will be delivered, driving better outcomes, increasing efficiency and making healthcare affordable. Internet of Things equips people with technology to deliver enhanced results. Here we present a survey on how Internet of Things and Cloud play a vital role in health care.

**Keywords:** Cloud Computing, Internet of Things, Resource Pooling, Rapid Elasticity.

## I. INTRODUCTION

Cloud computing converges new technologies and existing ones to offer as services with all capabilities of a computing system to different kinds of users. These services can be accessed from anywhere with the help of an internet connection independent of their physical location. The Internet of Things (IoT) is a platform that enables the capturing of real time information, facilitates examination and analysis of this information and provides a connected environment by sharing it with various stakeholders [1]. Cloud and IoT are mutually dependent on each other. IoT can benefit from the virtually unlimited capabilities and resources of Cloud to compensate its technological constraints (e.g., storage, processing, and energy). Cloud can benefit from IoT by extending its scope to deal with real things in real world and for delivering large number of new services in a distributed and dynamic manner [2].

Increased health awareness has led to the emergence of 'self-care' and 'healthcare advisor' disciplines. The benefits of a healthy lifestyle have fueled innovation that plays a key role in moving the point of care from the hospital or the physician's office to the patient's home. Delivering on this vision with the help of enabling technologies requires regularly capturing information related to a person's health, lifestyle, and other vital parameters and sharing it with caregivers. Internet connected devices have been introduced to patients in various forms. Whether data comes from fetal monitors, electrocardiograms, temperature monitors or blood glucose levels, tracking health information is vital for some patients. Many of these measures require follow-up interaction with a healthcare professional. This creates an opening for smarter devices to deliver more valuable data, lessening the need for direct patient-physician interaction. Some hospitals have begun implementing "smart beds" that can

detect when they are occupied and when a patient is attempting to get up [3]. It can also adjust itself to ensure appropriate pressure and support is applied to the patient without the manual interaction of nurses. Another area where smart technology could be an asset is coupled with home medication dispensers to automatically upload data to the cloud when medication isn't taken or any other indicators for which the care team should be alerted. The personalized analysis of our health will become the norm in the near future.

Individuals will be provided with tailor-made strategies to combat illness and social technologies will enable us to manage our own health. From the data generated, we will learn how to improve our wellbeing and be motivated to take control. The awesome power of the IoT will be fully realized – an infinite array of smart connected solutions designed to improve our health, environment and productivity through intelligent use of data [4]. Whether that means empowering us to monitor and control our domestic air quality, or equipping medics with cloud-based tools that allow them to „consult“ with patients who aren't even in the same room, or even the same city.

## II. RELATED WORK

Guigang Zhang, Chao Li, Yong Zhang et.al., [5] proposed the monitoring of users/patients health information by using specific rules to process the massive IoT medical sensors information. When some events occur, the rule engine will automatically execute the rules and send some alarm information to managers. But, unfortunately, Users can not able to set rules for themselves. With the development of web 2.0, IoT and cloud computing technologies, most of users/patients can set some medical rules by themselves. In the real world scenario, massive

numbers of IoT sensors will accept the massive sensor data every time. These data are classified into semi-structured and structured IoT sensors data. When the users or patients health indicators data accepted from the IoT sensors is beyond the normal data range, the medical rule engine will send the alert information to the users or patients. Charalampos Doukas and Ilias Maglogiannis [6] presented a unique solution for managing patient – related data.

Based on the wireless technology employed, the data acquired using both wearables and mobile sensors can be forwarded to a mobile phone or directly to the Cloud infrastructure by utilizing the established techniques that assist IoT communication. Cloud computing through its elasticity and facility to access shared resources and common infrastructure in a ubiquitous and pervasive manner facilitates a promising solution for efficient management of pervasive healthcare data.

Boyi Xu, Hongming Cai et.al., [7] summarized the functions involved in accessing the ubiquitous data (UDA-IoT) for IoT in medical service. They are 1) support to access data in heterogeneous formats; 2) usefulness in building real-time application system; and 3) able to access big data. They reported the use of UDA-IoT in emergency medical services in which heterogeneous IoT data are encapsulated in unified format of resources with unique URI so as to be accessed ubiquitously.

Danilo F. S. Santos and Angelo Perkusich et.al., [8] pointed out the important factors to build IoT services namely Gateways, Health Managers and Health Service. A Gateway is the entity that forward health data to a different destination. A Health Manager will have an internal database with information about device specializations. A Health Service receives Personal Health Information from a user, and shares it to other healthcare actors. All these three factors are essential in building a flexible connected health scenario.

Rajesh Vargheese, Dr. Yannis Viniotis et.al., [9] described a cloud management structure for e-health that creates an efficient, secure, seamless model in provisioning, processing, protecting, enforcing policies and predicting the risk of complications. They also defined 5 P's namely prediction, processing, policy management, provisioning and protection of cloud management for IoT enabled ehealth. By enabling such a platform, operational efficiencies are increased to a great extent and the cost of healthcare is reduced. Felipe Fernandez and George C. Pallis [10] analyzed the existing system engineering decisions, to build cost-effective Health-IoT platforms that will correspondingly enhance services like medical, clinical care and remote monitoring. IoT is a major phenomenon that plays a crucial role in achieving efficiencies and improvements to meet diverse healthcare demands. Apart from facilitating a reliable flow of patient it is also necessary to secure the information and protecting patient privacy.

### III. BASIC CONCEPTS OF IoT CLOUD COMPUTING

All The services addressed through the IoT Cloud Computing must possess the following characteristics.

**A. On-Demand Self Service** IoT Cloud Computing is readily available to all when you need it. As Cloud Computing resources are web-based service, it can be accessed without any help or permission from others. But the most primary need for establishing communication is by internet, because internet is everything in the world.

**B. Broad Network Access** IoT Cloud Computing provides a lot of connectivity options. Cloud computing resources can be accessed via tablets, mobile devices and laptops with internet connection. This makes the user to easily access the devices that they mostly like. Without the help of IoT, cloud computing can't be access and not function, that's why network are most significant nowadays.

**C. Resource Pooling** Resource Pooling means that it can be shared for those who know where resources address. Resource pooling will make that people are know the address can access anytime and anywhere as they want. It makes the user to access what they want and when they have a free time to access. In IoT context, an IP address can be easily assigned to every "thing" on the planet as they want like computing IP address accessing.

**D. Rapid Elasticity** In IoT Cloud computing Rapid Elasticity you get what you need, because of its rapid elasticity nature. This cloud computing provides the freedom to suit with what you need. You can be easily and quickly edit your software features and to add or remove user inside your cloud computing.

**E. Measured Service** IoT Cloud Computing is a Measured Service in the meaning that you get what you pay for. This cloud computing will measure your usage about their service such as storage, processing, bandwidth and active user accounts inside your cloud computing. The meter will increase as much you utilize the resources. This system is known as Pay Per Use (PPU).

### IV. CONCLUSION

The healthcare industry is predominantly moving towards affordable, accessible and quality health care. All organizations are striving hard to build communication compatibility among the wide range of devices that have operated independently. IoT and adopt IoT driven systems and processes have the potential to model this kind of healthcare, which heavily relies on patient participation. This will subsequently improve the way health services are being delivered. IoT is here to stay, and will continue to evolve fast, leading to impactful and positive changes for all stakeholders in the healthcare industry.

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