

# Management of IoT with help of Wireless Sensor Network in Cloud

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**Abstract:** This Internet-of-things (IoT) became very popular in today's research. IoT means all devices of a particular system should be connected with each other through internet. Cloud Computing and Wireless Sensor Networks (WSN) are integrated for efficient management in IoT. This integration is known as Sensor Cloud. This technology has a lot of applications due to the continuous development of information and communication technology. Although sensor cloud has several advantages still it has many research challenges like energy efficiency, security, QoS etc. Wireless sensor network is the network of sensors which operate on battery. Reducing energy consumption and communication overhead are the important issues of wireless sensor networks.

**Keywords:** IoT, Cloud Computing, WSN, Sensor Cloud, Virtualization

## 1. Introduction

IoT, Cloud computing and WSN are the latest technologies which can optimize an application with help of each other. Integration of WSN with cloud is called sensor cloud. Fig 1 shows the architecture of sensor cloud. At lowest layer there are physical sensors which are mapped with virtual sensors at middle layer with help of cloud. The upper layer consists of end users who can run multiple applications at a time with same WSN. End users can also use more than one WSN at a time within the same application with help of virtualization managed by cloud. Thus, cloud can provide sensor-as-a-service. This integration helps not only the cloud but also helps WSNs to store and effectively manage the sensor data at cloud. Other advantages of cloud include low cost of maintenance, flexibility of services, fault tolerant communication, backup and recovery etc. Cloud computing also enables on-demand sensor networks that can be released with minimal management efforts. Several IoT applications are based on sensors. Therefore, this integration can also help IoT for its efficient management. Now-a-days, many researches are being carried out in this field.

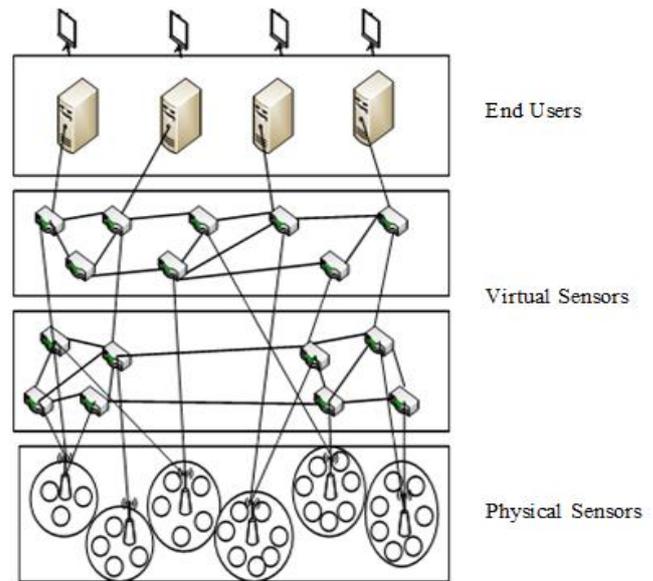


Fig1: Architecture of Sensor Cloud

## 2. Basic Terminologies:

Few preliminaries and basic terminologies are discussed below:

### Wireless sensor network

Wireless sensor networks are popular because of their capability of build its own network for several environment monitoring as well as military applications. They have small size, processing capability and memory. WSNs are created to sense various physical phenomenons like light, temperature, humidity, radiation, sound etc. Wireless sensor network helps to provide a bridge between the physical and virtual world. It has a very large range of applications in industries, transportations, infrastructures, military etc. Wireless sensor network can be explained as a self-configured framework. Its various applications monitor physical or environmental conditions to collect the sensed data. This network also has several constraints such as power, memory, processing capability etc. Global positioning system and local positioning algorithms are used to get location and position information.

### Cloud computing

Cloud computing is the delivery of computing services such as server, storage, software, platform, database, networking

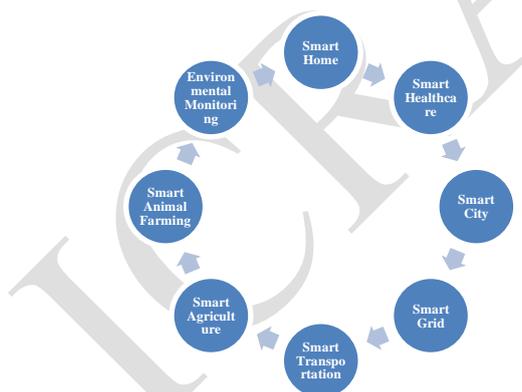
etc. It is based on pay-per-use technique. This computing method provides various on-demand computer services available over the internet. Cloud computing is approaching to experience direct cost and it is expected to transform a data center from a capita-intensive set up to a variant price environment. The cloud computing modifies the equivalent traditional concepts of grid computing and distributed computing. It is a pool of abstracted, extremely scalable and control computing infrastructure capability of host end client request and billed by a managed process.

### Internet of Things

Most of the applications of IoT are based on sensors which monitor the physical and environment conditions. A cloud also helps to store and process a bulk of data generated by an IoT application. In IoT at remote a command is given which controls the capabilities of the device. IoT devices are often mobile and can be deployed at various locations. They need to be connected to server side from a lot of different places. Internet of things is a network of physical devices which are based on internet. The internet is not only a network of computers it has spread into a network of device of all types and sizes such as smart phone, medical instrument and industrial system etc. All such devices are connected, communicate and share information based on some protocols in order to obtain smart reorganizations, positioning, tracing, safety and control.

### 3. Applications of IOT:

IoT is the need of today's life. There can be many IoT enabled applications such as smart parking, smart animal farming, smart waste management system etc. Some of the applications of this technology are shown in Fig 2 and discussed below:



**Fig 2: Major applications of IoT**

#### Smart Home

Our life-style at house are enhancement by making it must be convert and very easy to monitoring and operator house system. Good for the seasons give informed a smart house can automatic low the blinds of window and close the window.

#### Smart Healthcare

The applications of healthcare performance is gaining by the actuators and embedded sensor in patients and monitoring and medicine track for instance by store and analysis patient's body data for sensor and before delivered analysis data. The patients in suitable action in real-time and making needed.

#### Smart City

Good quality of life in the smart city is improved by providing comfort and ease to the residents. Interest for information receive according to people's necessary different interconnect system understand offer the suitable services (like transport, utilizes health etc.) to people.

#### Smart Grid

Smart grid is techniques that provide electricity from supplier to consumer through digital technology for saving energy and reduces cost and increase reliability. The network operator it is all about extension of grid observation improved reliability, wide are measurement and self-healing properties. The system integrated it all about integration of it and automation application.

#### Smart Transportation

The smart transportation were generally develop by govt. or transportation authority, successfully examples given real time traffic signal and public transportation, would information sharing, smart traffic control system. Various progressive programs regulate transportation. The large promotion of electric vehicle and charging facility and dedicate short range communication enable vehicular communication system etc.

#### Smart Agriculture

Smart agriculture is a computing based agriculture that helps to change and reorient the agriculture systems. It efficiently supports the development and guarantees of food security during and ever changing climate. The main focus of smart agriculture is to enhance agriculture productivity and incomes.

#### Smart Animal Farming

Smart animal farming became very popular these days. It provides proper diet care and environment required for animals. Smart farming is required to monitor the animal farms remotely. This intelligent system should also do surveillance of the entire farm. A good care of animals is very important.

#### Environmental Monitoring

Use of cloud and IoT can change the development of high speed information system between the entities. Sensors are deployed in any monitoring area to sense some environmental conditions such as temperature, pressure, movement of objects etc. Some monitoring can be continuous and long term such as level of water, gas concentration in air, soil humidity and other characteristics, inclination for static structures, position changes, lighting condition of infrared radiation for fire and animal detection. A cloud based data access is able to structure the potential energy requirements of

low energy communicative segments and presents fast access to the data for end user. It accepts to manage and process the complex events given by the real-time data flow of sensors.

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**Table 1: IoT area, utilization, requirements and challenges**

IoT area	Utilization and requirements	Challenges
Smart Home	Industrial consolidation, Development of multi-power saving and cross application.	The core component, security, private protection.
Smart Healthcare	Medicine, treatment of remote virtual, The sharing and management and information of patient for treatment and drug.	The industrial clear are no planning, limited manufactured abilities sensor, medical and biomedical largest scalability of data
Smart City	Efficient delivery of public utilities such as water, electricity as well as associated government service.	It requires smart people
Smart Grid	The power generated in sensor monitoring , the power supply in automatically management	The core lack technology, communication including reliable, electromagnetic security and capabilities.
Smart Transportation	The RFID technology in development on intelligent transport system	The transportation management from various administration department.
Smart Agriculture	Real-time access and information sharing of agricultural resources, intelligent management of products circulation and safety.	Lack of low cost sensing technology and devices, lack of communication infrastructure in country side.
Smart Animal Farming	This smart system will operate from remotely for monitor animal farm	It will detect the any misshaping and protection or such type of like as fire

#### 4. Related Work:

In this section, a survey on various techniques for efficient management of IoT with sensor cloud is presented. The analysis is discussed as follows:

*S. R. Madden et al. [1]* described the industrial vision correctly. The intermittently connected are limit by server energy constraints, and typical sample periodic and immediately punch keep not recording of history inform. These limited show tradition database instrumentation unsuitable for queries over sensor. The present of the fiords architecture from the decision multiple queries over many sensor and should be limited sensor resources demand get through maintain high query throughout.

*O. Gnawali et al. [2]* discussed CTP report a variable rating protocol from the wireless sensor networks CTP usually three techniques to give effective, robust and reliability routing high equilibrium network condition. CTP's link estimator accurate platform independent interface. Second CTP usually the algorithm to time to manage traffic, sending few visual signal in stability topology yet quick adapted to changes. Finally CTP active the technology with data traffic quick discover and fixed routing failures.

*Sudarshan et al. [3]* demonstrated that mobile sensor is an rising technology being research large in the past decade. This research survey paper study the conceptually o mobile sensor integrated with the cloud service. It information the different mobile sensor availability and their classification. It studies the necessary and limited of mobile sensor network in terms of store computed power efficiency and scalable.

*Estrin Deborah et al. [4]* explained that the condition of sensing is the process whereby single and community usually ever where capability mobile phone and cloud service collective and analyse system systematically data for usually the discovery. The approach of technologies and analytical creation with a citizen that is modification using mobile phones and online social network sets the stage for this technology to dynamic effect much expectation of daily lives. Present data capture leveraged data processing and personal data overlap are the essential component for these emerging system.

*Botta Alessio, et al. [5]* described that IoT has now become part of our life. They explained that cloud and IoT are merged together to serve a varied number of application scenarios.

*Gopalakrishnan Nair [6]* explained that WSNs are used broadly in different areas. They discussed a model for power aware scheme.

*Dash et al. [7]* presented wide ranges of critical applications that get and process data of remote sensor systems from the real world.

*Dinh et al. [8]* told that a volatile increase of the mobile application and environment communication in mobile computing is the cause of the evolution of sensor cloud.

*Dashet al. [9]* explained that there is an expanding pattern of utilizing distributed computing circumstance for capacity of information process. Cloud computing gives applications, platforms and foundation over the internet. It is another

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mechanism to get the shared assets. Remote sensors have been viewed as the most fundamental innovation for the 21st century which are spatially distributed in the sensor network for information transmission. Secure and easygoing access of information in distributed computing is very expansive.

## 5. Conclusion & Future Work

Today, IoT has become the part of human life. Many IoT enabled devices are available in market and still, in future, there is a large scope for researches related to IoT. Several IoT applications are based on sensors and cloud. Therefore, for efficient management of IoT, sensors and cloud should also efficiently manage. This paper provides a review on efficient management of IoT using sensor cloud which is the result of integration of WSNs and cloud.

There are several other research issues and challenges to work upon such as security, QoS, cost control and pricing etc. These challenges provide future directions to the research.

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