A Survey on Sensor Cloud

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Abstract – *Sensor cloud is the integration of WSN and cloud computing. This integration is beneficial for both WSN providers and CSP. WSN information can be kept over the cloud which can be effectively utilized by several applications and thus it provides sensor-as a service. In sensor cloud, there are multiple physical sensor networks which are mapped into virtual sensor networks using cloud to provide effective services to the users. End users are facilitated to execute multiple applications of WSNs through such VSNs with the help of virtualization. This paper focuses on the definition, working, and application of sensor cloud.*

***Key Words*: WSN, Cloud Computing, Virtual Sensor, Virtualization, Sensor Cloud.**

1. INTRODUCTION

WSN is having some applications and being integrated with other technologies. In recent days sensors are essential in different applications. The sensor cloud is a combination of sensor networks and cloud computing which provides the shared processing resources to the end-users. It is a technique that focuses on physical sensors to assemble the data and then transmit it into the cloud to serve multiple applications of the end-users [1] [2] [3] [4]. The sensor cloud provides a scalable and efficient computing infrastructure for various real-time applications.
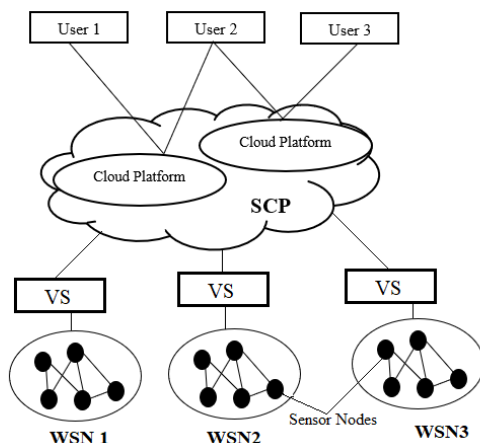

Fig -1: Sensor Cloud Architecture [1]

Fig 1 shows the combination of WSN with the cloud. The main components of this are listed below:

- User: End-user or client who uses receives services from sensor cloud.

- Cloud Platform: Sensor Cloud Servers which provide services to clients.
- VS: Virtual sensor is a logical sensor node that receives data from sensor nodes.
- WSN: A group of sensor nodes.

The above-mentioned model works as follows, WSN, a group of sensors transfers the sensed information to the VS. From VS information is send to the Sensor cloud which often transferred to the end-users.

The remaining part of the paper is formed as follows. Section II gives the basic definitions and preliminaries of the sensor cloud, Section III poses a brief study on sensor cloud, and section IV concludes the paper with some future research objectives.

2. PRELIMINARIES OF SENSOR CLOUD

Some basic terms and preliminaries of sensor cloud are discussed in this section,

A.   Cloud Computing

Cloud Computing is a process of delivering computed resources to users via the internet. [1]. The word 'cloud' can be discussed as a combination of networks, hardware, storage, and interfaces to deliver a service [5]. It provides three services SAAS, PAAS, and IAAS with the addition of new SeAAS.
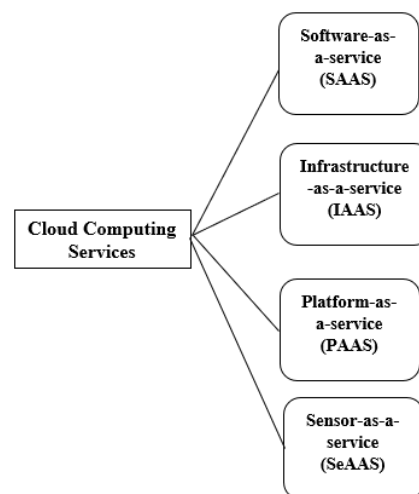

Fig -2: Types of Cloud Services

B. Wireless Sensor Network

A WSN also termed as a group of spatially distributed self-directed sensors. These sensors generally have the low processing power and storage accessibility. Few controlling and monitoring applications accept and evaluate information from the environment and then transmit the data to the user. It can be categorized into two types i.e., structured and unstructured. For the unstructured wireless sensor network, its physical sensor can be deployed in an ad-hoc manner whereas a structured network must be a pre-plan for deploying either one or more of the sensor nodes [1].
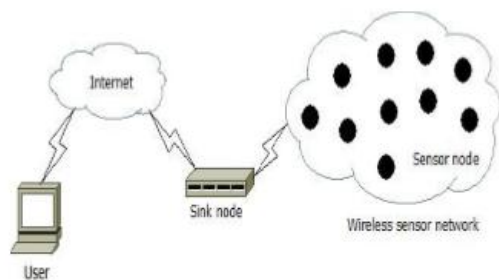

Fig-3: Wireless Sensor Network

Fig. 3 shows the architecture of WSN. WSN is used in many areas like Environmental Monitoring, Health care, etc [13].

C. Features of sensor cloud

The sensor cloud provides an open, extensible, intelligent, and interoperable sensor network. Whenever a request is made, the services are automatically provisioned. Sensors are made free when the requested tasks are completed. The owner of the sensor can track physical sensor usage. End users do not have to think about the precise places of sensors and extended description of the sensors, and they can independently control services. Cloud computing is integrated with WSN to provide a promising solution in many ways such as agility, flexibility, reliability, portability, etc. Advantages of this integration are as follows:

(vii) Quick response time: An immediate response to the users in real-time is achieved with the integration of wireless networks and cloud because of the large architecture of this integration.

D. Applications of sensor cloud

There are various applications of sensor cloud. Fig 4 presents some of them such as transport monitoring, military use, weather forecasting, health care, etc [1]. They are mentioned below:
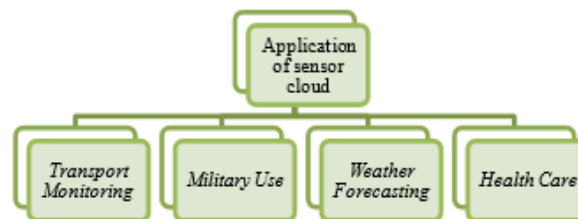

Fig - 4: Application of Sensor Cloud

(i) Transport monitoring: Transport monitoring system involves primary arrangements like traffic signal control, emergency vehicle notification, navigation, toll collection, automatic number plate recognition, dynamic traffic light, etc.

(ii) Military use: The use of sensor networks is used in the military for friendly forces, equipment and ammunition, reconnaissance forces reconnaissance, battlefield surveillance, battle damage assessment and target, nuclear, chemical attack and biological detection.

(iii) Weather forecasting: Forecasting of the weather is forecast for future forecasting systems and weather monitoring, which usually include - data assimilation and data collection, prediction, and forecasting of the Numerical weather.

(iv) Health care: Sensor networks are also widely used in the health care field. In some modern hospitals, the sensor network is built to monitor the patient's physical data so that the drug administration track can be controlled, and patients and doctors can be monitored and inside a hospital.

4. LITERATURE STUDY

Sensor Cloud Infrastructure achieves physical sensors on IT infrastructure [7][8]. This Sensor-Cloud infrastructure consists of virtual sensors that send sensed information to the cloud. Virtual Sensor groups can be formed as and when a user needs [9] [10]. [11] focused on recent advances in industrial WSN for efficient management in IoT. C. Zhu et al. Subarna Chatterjee et al. [12] described that built-in real sensor nodes transmit the information to the cloud via a set of bridge nodes. There are several other research issues and challenges to explore which is discussed in the next section.

CONCLUSIONS AND FUTURE DIRECTIONS

The sensor cloud is an integration of WSN with the cloud which solves several issues and challenges of WSN. Virtualization helps to execute various applications concurrently at the same physical node by creating virtual nodes which are the logical subsets of

appropriate physical nodes from several WSN. Sensor nodes have limited memory, battery, and processing power. So, there are many design issues with this new technology too, which provides us the future direction of research to work upon.

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