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Study on Wireless Powered Virtual Sensor Networks

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Abstract

The researchers and scientist are developing various models of sensor networks that can help vide range of services in a lone heterogeneous sensor network frameworks, owing to the current development in wireless sensor technology and immense need of scalable use. In such efforts we study the virtual sensor network (VSN) design architecture, service provisionings, principles, cloud sensor architectures and vide variety of application which are commonly used in different application of VSNs. We put forward a latest model for VSN that can help various serviced and can produce a new way to wireless sensor network (WSN) communities.

Keywords—WSN, VSN, Network Virtualization, Service provisioning, Overlay network

I. INTRODUCTION

One of the developing technologies in research community is wireless Sensor Network (WSN). Sensors are thickly installed throughout the area under use because it offers low computing power, limited storage capability and cost. Framework of WSN offers single service to the user at the end that leads to limited operating power in WSN. Because of this, the service is improves with the deployment of sensors in target area. To solve this issue, researchers designed a VSN framework, which gives multiple services in single framework of WSN.

Current timeline of research in WSN leads to the discovery some of the characteristic of WSN which has an extra direction of its age old applications [1], [2]. By efficient utilization of resources, various performing devices can be operated by efficient utilization of resources, low cost, manageability, increased flexibility, interoperability and improved administration, through virtualization. Enrichment of WSN with aspects of virtualization resulted in the evolution of Internet of Things [3]. Few of research [4], [5] increasesvalue to virtualization with following aspects same as like Network Virtualization, OS Virtualization, Link Virtualization, and Sensor Node Virtualization. Concentrating

on protocols and algorithms with a shared physical framework where, the adaptation, formation usage and maintenance of probably dynamic varying sensors subset cooperating on specified jobs assisted and being ordered as a VSN using shared physical infrastructure resources.

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A VSN with a set of WSN nodes can be built, with the set devoted to a specific job oruses at a given time. Normal design of WSN proposesthat all nodes should take part in participating to achieve the outcome, but, VSN put forward the concept that a nodes subset collaborates to execute a given application program. A Physical WSN may consist of many VSNs at the same time.VSN membership may vary after some period of time. As they are distributed over the physical network, VSN nodes may be capable of communicating directly with one another.

In the 21st century, wireless and mobile communication success is too high. The different WSN merge with various wireless network to impart universal approach change ad achieve a dynamic scheduling algorithm which solves the throughput issues. For real time performance it is easier to alter the checking point cost depending on the energy level available in sensor system. It has long running computation scarce and low power Internet of Things (IoT) devices intermittent energy source [2]. A good device from independent energy supplies are IoT operations including medical transplant and sensors applicable in military which are prominent and hugely in demand [6], telemetry [7], intelligent building [8], and remote sensing usages [9]. Check pointing ranking is to determine maximum and minimum energy calculating the residual energy resource allocation. IoT is also known as Internet of Everything it is the amalgamation of various techniques which contains web-based segments that collects, transmission and compute the data what they obtained from their ecosystem using embed sensors, processors and communication hardware. The next big revolution in the world of communication is predicted to be IoT [10].

As a significant innovation for Internet of Things, Wireless Sensor Networks (WSN's) have been gaining far and wide consideration. Conventional WSN allocates the resources for the particular applications, which creates an issue of low resource usage. Moreover, the energy utilization will be different for the different application requirements creates an additional burden on each sensor node. Consequently, in view of the wireless energy transfer technology, this research suggests the resources distribution technique for virtualized WSN's. In particular, physical resources are pooled through the means of WSN service providers. After that, virtual sensor networks will be constructed by using network slicing techniques to give one-to-one services depending on the application requirement and the present state of the each sensor node. Besides that, so as to limit the total WSN energy consumptions, a system-friendly resource assignment methodology is optimize to altogether of configuration of sensing frequencies, time allotments and transmitting power.This methodology, not only save the energy requirements of WSN's in an effective manner, but also satisfy the personal needs of each application.

II. SENSOR NETWORK OVERVIEW

Different network sensor's models along with different types of sensor network is described in this section .

2.1. Sensor Networks

As the development in sensor network and wireless technologies are reaching new heights leading to the development of low powered, low cost, multifunctional sensor nodes that are capable of communicating on smaller distances are commonly used recently to provide the solution for real life issues like in military, industrial automation, critical infrastructure monitoring, gaming development, smart home appliances, health care, agriculture and environment monitoring.

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Such small sensor nodes are equipped with intelligence to perform the operation like as processing, data communication and sensing with one another. Each node is capable of processing the raw information locally to perform simple computation for transmitting only necessary and partially processed information.

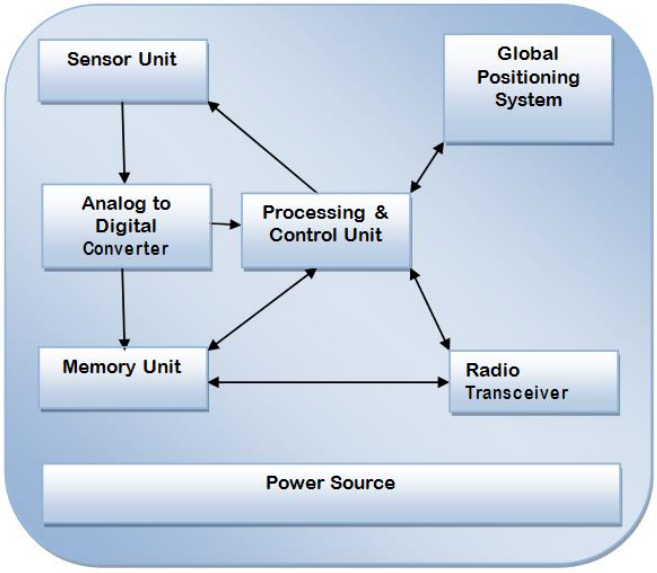

Fig. 1. A typical Sensor Node Model

The sensor field is scattered with densely deployed sensor nodes. These sensor nodes are either close or inside the phenomenon. The collection of micro electro mechanical systems that can communicate, sense and compute is called a WSN. Every nodes [20] is capable of collecting the data, processing it partially and then transmitting it to sink node which can communicate through satellite or internet with the end users. A sensor node constitutes of various components like transceiver unit, power unit, processing unit and sensing unit. Figure 1 shows the block diagram of sensor node. Sensor network is well equipped with various protocols stack such as application layer, physical layer, network layer, data link layer, transport layer, mobility management and power management. These are responsible for communication of data mobility management and so on [1]. Low computation, low memory capacity, sources of power supply and low communication facilities are some of major restriction as provided by the WSN . A Network of sensor might constitutes of many sensor nodes that can communicate with one another to observe an area and collect the information about surrounding. Self-regulated sensors that forms a part of WSN that collaboratively perform operation on environmental observing conditions like pollution, temperature, vibration, sound, pressure and motion. Microphone sensor, thermal sensor, accelerometer and camera sensors are some of the sensor devices which are deployed in WSN as sensor nodes [11], [12].

2.2. Overlay Sensor Network (OSN)

Network of various sensors that are built on top of other physical sensor network is called OSN. Virtual topology is created by such network on top of WSN physical topology. Virtual links connects nodes in an OSN that corresponds to WSN physical paths and are deployed in application layers. Various distributed network like cloud computing supports OSN as they execute on the top of internet [13].

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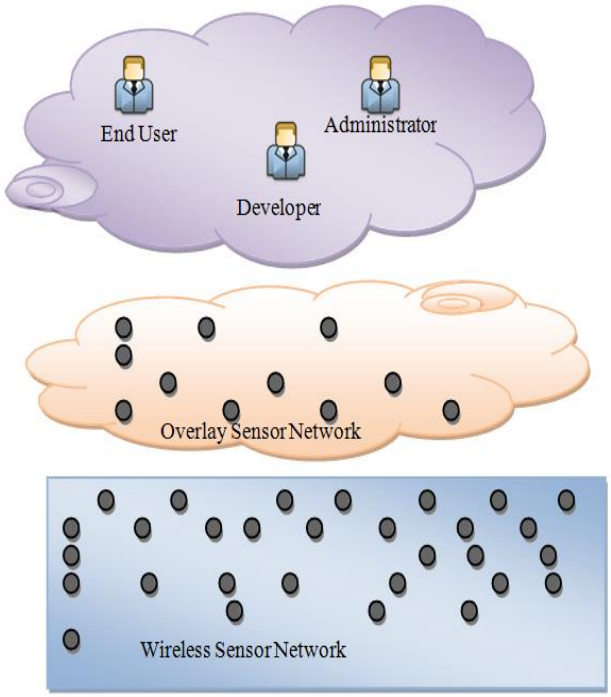

Fig. 2. OSN model

2.3. Virtual Local Area Networks(VLANs)

The logically connected networks called VLAN hosts a single broadcast domain irrespective of their connectivity. VLAN is based on logical connections Instead of physical connections VLAN" depends on logical connection [5].

2.4. Virtual Private Networks (VPNs)

A devoted network known as VPN is attached to multiple sites utilizing private and secured tunnels on a public or shared networks as like Internet. Geographically separated sites connected into a single organization is done by VPN .

III. VIRTUAL SENSOR NETWORKS (VSNs)

VSN contain various subset of sensor network .These subset is devoted to perform certain task or application. Vendor remain same for providing service and infrastructure in WSN.Separation of services from infrastructure is possible because of rapid enhancement of technology which helps us to provide multiple services in infrastructure of sensor networks. Combination of many heterogeneous sensor networks from various sensor infrastructure provider (SIP) forms a VSN. One or more SIP resources is used by each and every service provider from VSN and implements services on the hired resources of VSN [13-15]. Figure 3 shows the architecture of VSN.

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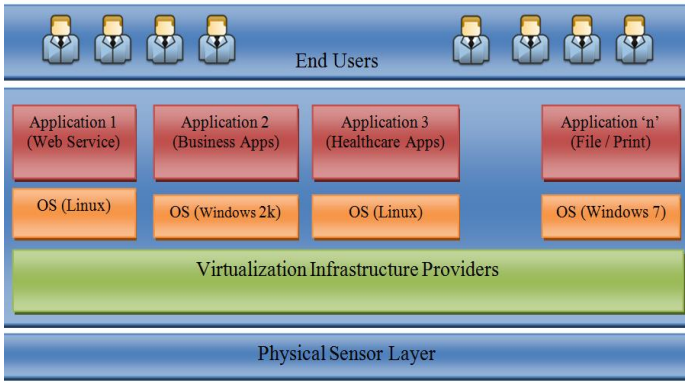

Fig. 3. VSN Architecture

To separate the roles of traditional WSN service provider virtualization on sensor network can be used. Separation into two parts like the SIP, which manages the physical sensor framework and sensorvirtualization network service provider (SVNSP), providing many services [3] .

VSN is being latest developing technology that helps to separates the physical sensor deployment out of application that runs on it and providing multi services on application to the user at the end. Many logical networks on a single physical network infrastructure is supported by VSN [5].

3.1. VSNs Design Principle

Deployed sensors from one organization can be used by other organization in form of their application or services. Due to this, designers had developed a framework that supports many application and services. We put forth VSN architecture that can give many services in a single physical framework.

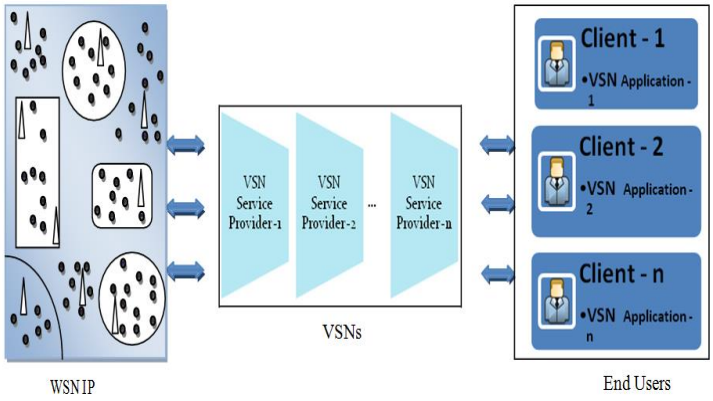

Fig. 4. Proposed Architecture for VSN

Figure 4 shows the proposed architecture mainly categorized into three layers.

Wireless Sensor Network Infrastructure Provider (WSNIP): Physical infrastructure of sensor nodes is managed by it. Random deployment of sensors in the air can be achieved using helicopter. This forms the wireless sensor islands (WSI) that contains a group of sensor nodes which isolates themselves from the other network. Every WSI works independently in administrative domain which gives at least one application or service to the user are the end.

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Virtual Sensor Network: The grouping in logical extension of sensor nodes from physical sensor nodes is known as VSN. Every sensor node'slogical grouping came to be known as Virtual Sensor Islands (VSI) is devoted to provide one service to the end user. More than a single VSI services are mixed to provide new VSN services".

End users (EU): Client and their concerned application is the end user. Many users desires to have the access from services from various clients. Such layers offers users of various platforms to have access and use the sensor services without having any issues.

3.2. VSN Service Provisioning

When they are deployed in the sensor network [15], sensors are limited and so does the application or services. Hence very few of service provider organization can offer limited services or sensors. Numerous services can be offered to the user for various application like in battlefield surveillance, environmental monitoring, and industrial automation and so on.

Infrastructure provider in VSN, starts to establish the sensor infrastructure, service templates are created subsequently by the service provider and end users can ask by generating new sensor services by use of service templates with currently existing sensors by using the instances of services. End users can utilizes the services [12] as per their requirements . By deleting the service templates the end user must unregister from the services. Service provisioning layered architecture is shown in the figure 5.

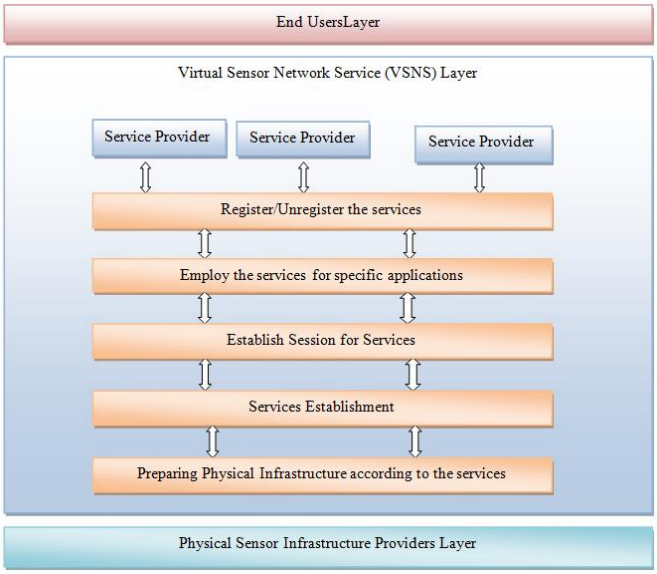

Fig. 5. Layered Architecture for Service Provisioning

IV. SENSOR CLOUD ARCHITECTURE

The infrastructure [14] of cloud deals with large amount of data analysis, having high processing power, software and mass storage unit as service in scalable and virtualized manner at low cost .

Large number of sensor nodes that perform together in a sensor network monitors a region and collect the information about the surroundings. Self-controlled sensors [14] in a sensor network can monitor and control the surrounding situations such as pressure, sound, vibration, temperature, motion, movements etc.

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Sensor network principles of design are based on controlled surrounding from where network is mentioned. For monitoring a tiny area, very small number of nodes are needed, but for monitoring the bigger area, a huge amount of sensors are installed.

The users in cloud computing are permitted to utilize platform as a service (Paas) and software as a service (SaaS) at minimum cost which are offered by many cloud service providers like Amazon, Microsoft, Google and so forth depending on pay per use services. The servers are dynamically configured and reconfigured by the cloud computing platform as and when required by the end users. Such servers can be virtual or physical machine in cloud. Cloud computing main advantages are the end-users as they need not be worried about the position of servers and service offered by servers. For monitoring the application, sensors gathers the information from the surrounding and sends them to the cloud computing infrastructure .The end users are offered services automatically by the sensor –cloud systems with the help of virtual sensors concept. This related sensor information and their services can be used by the end user through user interface using web services.

V. VSN's APPLICATIONS

As the development grew by leaps and bounds in the field of WSN so does their application. Recently they are used in vide variety of application like traffic control, smart home, healthcare applications, environmental monitoring battlefield surveillance, and so on so forth [17-19].

5.1. Surveillance in Battlefield

The battlefield surveillance [21] application in VSN is to categorize and identify multiple targets to detect different categories like enemies, soldiers, civilian and animals. Virtualization of sensor network in such conditions plays an eminent role to detect the surrounding for identifying enemies, soldiers, civilian and other animals. This results in only targeting enemies without disturbing other living creature not concerned. For achieving this, VSN offers services to detect various surrounding parameters as like civilian, vibration, sound etc, in one sensor network implementation. Supervising the battlefield by soldiers by sensing sound, animal movement, and civilians and to target the enemies by using various services of VSNs.

5.2. Environmental Monitoring

Natural calamities and catastrophe like flood, explosion of volcano, earthquake and cyclone environmental monitoring is needed in emergency conditions. Continuous monitoring of environment is needed to gather the information in advance about the disastrous hazards. This is achieved by implementation of various sensors like light, temperature, camera sensors, sound sensors, etc from the VSNs services [15].

5.3. Health Care Monitoring

Monitoring [15] of health care can be achieved with the help of wearable sensors like accelerometer sensors, andtemperaturesensors etc. Such sensors are needed to gather information concerning patient's health like tracking heartbeat count, body temperature, blood sugar control, and pulse rate etc. Home or hospital are deployed with set of sensors to monitor the movement of nurse, doctors and other people. Patient's details like body temperature, heartbeat count, pulse rate, and blood sugar control *etc.*, can be track for record keeping and also set off an alarm if any deflections in patient's healthparameterstakes place.

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5.4. Industry Monitoring

VSN provides services for monitoring of industry [15] VSN offers vide variety of services. Services such as these are accountable for various uses like safety, production, operation and services. In production unit different varioussensors are deployed in the unit of production toenable the system autonomous and to improve production quality and quantity. Sensors to monitor the devices can also be implanted in operation unit. The workers can be alerted by giving alarms in case of hazardous conditions like uncontrolled speed or sound by making use of these services.

VI. CONCLUSIONS

The concerned review article shows that we have done survey of virtualization on wireless sensor network that offers a platform of serving various applications in one framework of sensor infrastructure thereby decreasing different parameters such as cost of implementation, sensors quantity etc of sensor infrastructure. With the help of this research, we try to propose a model which will provide the solution for problem concerning sensor network and offers the many services in installed infrastructure of sensor.

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