A Survey Paper on Wireless Sensor Network

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Abstract— Wireless Sensor Network stands as one of the most emerging technologies combining together sensing, computational capability and communication into minute devices proceeding towards whole new world of simplicity. The design of a WSN depends significantly on the application, and it must consider factors such as the environment, the application's design objectives, cost, hardware, and system constraints. There is a necessity of an intermediate software layer between the sensor hardware and the sensor network applications that may be termed as middleware. In wireless sensor network, a collection of small sensor nodes communicates through radio interface. Generally Wireless Sensor Network (WSN) consists of many distributed devices spatially, using sensors to monitor various conditions at various points, including temperature, sound, vibration, pressure, motion or pollutants. WSN acts as a mediator between the real physical world and the virtual world.

Key words: Wireless Sensor Network (WSN), Sensor Node, Temperature, Sound, Vibration, Pressure, Motion or Pollutants

I. INTRODUCTION

A wireless sensor network (WSN) is a collection of spatially distributed autonomous sensors to examine present atmospheric and physical such as temperature, pressure, etc. and to cooperatively pass the data gathered through the network to a main centralized point [1]. A wireless sensor network is a collection of large number of sensor nodes and at least one base station. The sensor node is an autonomous small device that consists of mainly four units that are sensing, processing, communication and power supply[2]. Sensors can be passive omni-directional, passive narrow-beam or active sensors. Sensors that sense the data and do not process them are known as passive sensors[3]. In Wireless detector network, the nodes are power-driven with batteries. The restricted power of battery has constraints an enormous challenge, particularly wherever the network is employed for long run watching of associate events[4]. Wireless Sensor Networks are networks composed of a number of sensor nodes that communicate wirelessly[5].

II. ARCHITECTURE OF SENSOR NODE

Advancement in wireless communication has made possible the development of wireless sensor networks comprising of devices called sensor nodes. Sensor nodes are low power, small size & cheap devices, capable of sensing, wireless communication and computation. As soon as the sensors are deployed in the network they configure themselves and connect with each other for data collection and thereby forwarding the data to the Base Station[6].

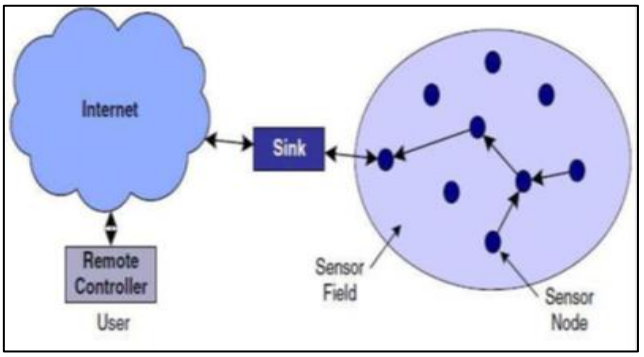

Fig. 1: Architecture of a sensor Node[6]

The main components of sensor node consist of a sensing unit, a processing unit, a transceiver and a power unit as shown in the Figure2[7]. In sensor networks the different types of sensors such as seismic, thermal, visual, and infrared are used to monitor a variety of ambient conditions such as temperature, humidity, pressure and characteristics of objects and their motion[2].

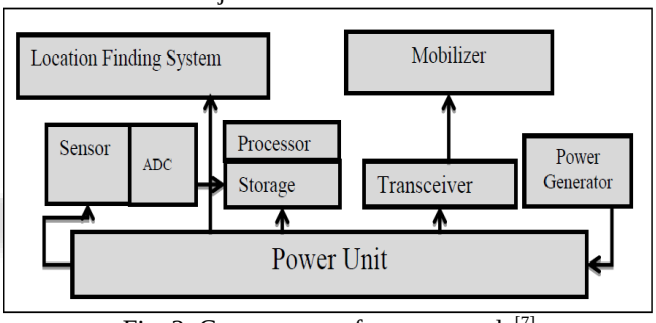

Fig. 2: Components of a sensor node[7]

A. *Sensing Unit[3]*

It consists of an array of sensors that can measure the physical characteristics of its environment.

B. *Processing Unit[3]*

A sensor node uses a microcontroller which performs task, processes information and controls the working of other parts in the sensor node. Since a microcontroller is characterized by its small price, ease to attach other devices, simplicity of programming, and low power utilization, they are used in sensor nodes. Memory requirements depend on application type.

C. *Transceiver[3]*

Transceiver is used to send and receive messages wirelessly. The functionality of both transmitter and receiver are combined into a single device known as a transceiver.

D. *Power source[3]*

Energy required for all components of a WSN is obtained from a power supply. Since the wireless sensor node is frequently positioned in an unfriendly locality, changing the battery regularly can be expensive and problematic.

III. TYPES OF WSN

Presently many WSNs are deployed on land, underground and underwater. They face different challenges and constraints depending on their environment. We present five types of WSNs:

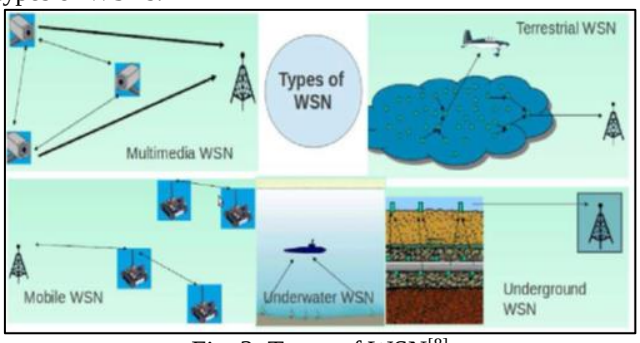

Fig. 3: Types of WSN[8]

A. *Terrestrial WSN:*

Consists in a large number (hundreds to thousands) of low-cost nodes deployed on land in a given area, usually in an ad-hoc manner (e.g. nodes dropped from an airplane)[9].

B. *Underground WSN:*

Consists of a number of sensor nodes deployed in caves or mines or underground to monitor underground conditions[10,11] .

C. *Underwater WSNs:*

consists of sensors deployed underwater, for example, into the ocean environment such nodes being expensive, only a few nodes are deployed and autonomous underwater vehicles are used to explore or gather data from them[12,13].

D. *Multi-media WSN:*

consists of low cost sensor nodes equipped with cam-eras and microphones, deployed in a pre-planned manner to guarantee coverage. Multi-media sensor devices are capable of storing, processing, and retrieving multimedia data such as video, audio, and images[9].

E. *Mobile WSN:*

Consists of mobile sensor nodes that can move around and interact with the physical environment[14].

IV. CHARACTERISTICS OF WSN[15]

- Dynamic network topology
- Scalability to large scale of deployment
- Wide range of densities
- Re-programmability
- Maintainability
- Power consumption constrains for nodes using batteries or energy harvesting
- Ability to cope with node failures
- Mobility of nodes
- Heterogeneity of nodes
- Ability to withstand harsh environmental conditions
- Ease of use

V. APPLICATIONS OF WSN

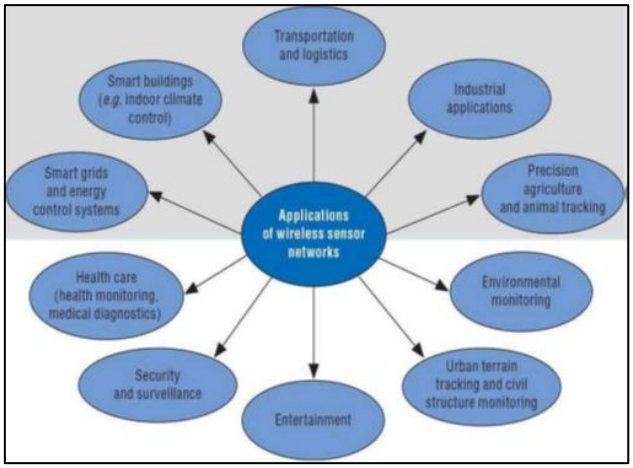

Fig. 4: Application of WSN [16]

A. *Military applications*

Wireless sensor networks are often an integral part of military command, control, communications, computing, Intelligence, surveillance, reconnaissance mission and targeting (C4ISRT) systems[16].

B. *Environmental applications*

Some environmental applications of sensor networks embody following the movements of birds, insects, and tiny animals, observing environmental conditions that have an effect on livestock and crops, irrigation, flood detection, chemical/ biological detection, precision agriculture, biological, Earth, and environmental monitoring in marine, soil, and atmospheric contexts, meteorological or geophysical research, forest fire detection, macro instruments for large-scale Earth monitoring and planetary exploration bio-complexity mapping of the environment[17].

C. *Health applications*

Many of the health applications for sensor networks are providing interfaces for the disabled; telemonitoring of human physiological data; diagnostics; drug administration in hospitals; integrated patient observation; and pursuit, monitoring the movements[18].

D. *Home applications*

Home automation: As technology advances, smart sensor nodes and actuators may be buried in appliances, like vacuum cleaners, micro-wave ovens, refrigerators[19].

E. *Alternative commercial applications*

Some of the commercial applications are building virtual keyboards, monitoring material fatigue; constructing smart office spaces; managing inventory; vehicle pursuit and detection; monitoring product quality; robot control and guidance in automatic manufacturing environments; environmental control in office buildings[18] .

VI. CONCLUSION

This paper introduced the architecture of WSN, their types and application of WSN. In comparison with the traditional Mobile Ad hoc Network, WSNs have different characteristics. The flexibility, fault tolerance, high sensing

dependability, low cost, and swift deployment characteristics of sensor networks have made their use in many new applications such as artificial intelligence, remote sensing etc.

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