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Overview of Wireless Sensor Network: A Survey

Sanjeev Kumar Gupta[1], Poonam Sinha[2]

Dept. Of Electronics & Communication, Scope College of Engineering, Bhopal, INDIA [1]

Dept.of CS & IT, Barkatullah University, Bhopal, INDIA [2]

Abstract: This paper provides the background of wireless sensor network. In the beginning an architectural overview of a sensor node, networking standards, protocol stack, communication protocol architecture, the performance modelling of wireless sensor network through radio energy model is provided. In the following, advantages, applications, challenges of wireless sensor networks have been described

Keywords- Sensor node, Networking Standard, Protocol, Energy Model.

I. Introduction

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. These sensors are used to collect the information from the environment and pass it on to base station. A base station provides a connection to the wired world where the collected data is processed, analyzed and presented to useful applications. Thus by embedding processing and communication within the physical world, Wireless Sensor Network (WSN) can be used as a tool to bridge real and virtual environment.

II. ARCHITECTURE OF SENSOR NODE

A sensor node is a tiny device that includes four basic components. A sensing or actuating unit, a processing unit, transceiver unit and power supply unit [1, 2]. In addition to this, the sensor node may also be equipped with location detection unit such as a Global Positioning System (GPS), a mobilizer etc. 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. Fig.1 shows the basic overview and important components. Fig 2 shows a typical senor node.

A. Sensing Unit

Each sensing unit is responsible for gathering information from the environment as an input like temperature, pressure, light etc. and produces a related output in a form of electrical or optical signal. The analog signals produced by the sensor are converted to digital signals by the analog to digital communication (ADC) and fed into the processing unit. Sensors are classified according to the type of phenomenon they detect such as thermal, mechanical, optical, electromechanical or acoustic sensors. Recent advances in Micro Electro Mechanical Systems (MEMS) technology has facilitated the development of tiny sensors. These sensors are small, with limiting processing and computing resources, and they are inexpensive compared to traditional sensor maintaining the integrity of the specifications.

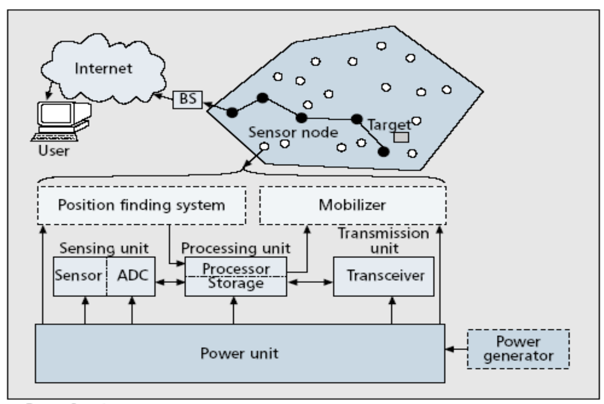

Fig. 1 Architecture of a sensor node.

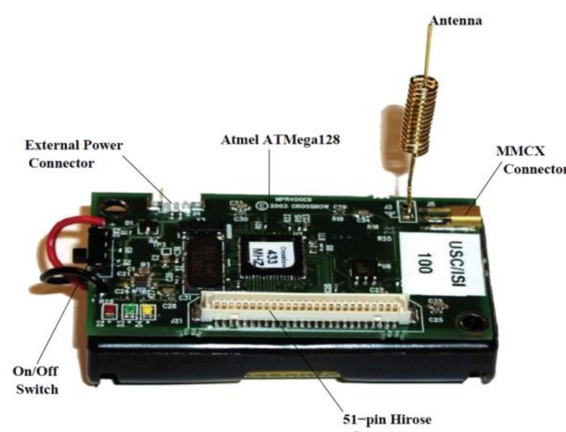

Fig. 2. A typical sensor node.

B. Sensing Unit

The miniaturization of sensor node requires special processors which are small in size and have low processing power. The controller performs tasks, process as data and

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controls other functionality of a sensor node. The most common controllers used as a micro controller are ATMEL Atmega 128L and MSP430. An important feature of these microcontrollers is power saving capability. For example MSP 430 has six different power modes, ranging from fully active to fully powered down. These power saving modes help to design efficient network protocols to extend network lifetime by keeping nodes in a sleep node. Table 1 shows the properties of various microcontrollers.

TABLE I
PROPERTIES OF VARIOUS MICROCONTROLLERS.

Microcontroller	Voltage (V)	Frequency	Efficiency (nJ/instruction
Cygnal C 8051	3.3	25 MHz	0.5
F300	3.3	32 kHz	0.2
IBM 405LP	1.8 1.0	380 MHz 152 MHz	1.3 0.35
TMS320VC5510	1.5	200MHz	0.8
Xscale PXA 250	0.85	130MHz	1.9

C. Tranreceiver

The transmitter and receiver are combined in to a single device called transreceiver. Sensor nodes often use ISM (Industrial, Scientific and Medical) band. The ISM bands are defined by ITU-R (International Telecommunication Union-Radio communications). The use of these bands in individual countries may differ due to variations in national radio regulations. This give free radio, spectrum allocation and global availability. Radio frequency based communication is the most relevant that used by most applications in wireless sensor networks. Wireless sensor network uses license free communication frequencies 173, 433, 868 and 915 MHz and 2.4 GHz. The examples of transreceivers are chipcon CC1000 (433-915 MHz) and Bluetooth TI CC 24020 (2.44MHz).

D. Memory

Small size of a sensor node results in corresponding constraints on memory also. Sensor nodes have very simple memory architecture. Sensor nodes use flash memories due to their cost and storage capacity. There are two categories of memory based on the purpose of storage as user memory used for storing application related data and program memory used for programming the devices.

E. Operating System

A sensor node is a small, highly portable, multitasking system developed for use as a resource constrained networked system. The mostly used operating system in sensor node are tiny OS (Operating System) developed by university of California, Berkeley, 2007 and Lite OS is a newly developed OS which provides UNIX-like abstraction and support for the C programming language. Tiny OS is a free and open source component based operating system and platform targeting wireless sensor networks. Tiny OS provides a list of services for applications and also facilities for creating new services for sensor networks. Such facilities help researchers to design and build various sensor network related protocols or algorithms.

F. Power Supply Unit

One of the most important components of a wireless sensor node is the power supply. The former technique employs a variety of tiny batteries made up of thin films of vanadium oxide and molybdenum oxide. These are fabricated using micro-machined cavities containing an electrolyte, in addition to chemical energy storage. The latter technique employs energy scavenging from the environment in order that the sensor node can operate uninterrupted.

The battery forms the heart of the sensor system as it decides the lifespan of the system. The battery lifespan needs to be prolonged to maximize the network lifespan. The requirement is that the size of the battery should be as small as possible and energy efficient. Two AA sized batteries of 1.2V each are employed in the battery subsection. A comparison of various node energy consumptions are shown in table 2.

TABLE II
COMPRRISON OF VARIOUS NODE ENERGY CONSUMPTION

Platform	Active mode	Sleep mode	Transmit
Mica 2	75mW	33µW	42mW
Telos	3mW	15µW	38mW
Mote2	50mW	20µW	4317nj

III. WSN NETWORKING STANDARD (IEEE 802.15.4 AND ZIGBEE)

The ZigBee alliance was formed in 2002 as association of companies, with the motive of developing, monitoring and controlling products that are reliable, low cost, low power and can be wirelessly networked using an open global standard. The standard specifies two Direct Sequence Spread Spectrum (DSSS) physical layers and the use of three license free frequency bands. One is at 868/915MHz and uses the 868-870MHz band with one channel and the 902-928MHz band with ten channels. That enables data rates of about 20kbps in the 868-870MHz band and 40kbps in the 902-928MHz band. The other is at 2.4GHz and uses the 2.4-2.48GHz frequency band with sixteen channels and data rates can be achieved of about 250kbps. Table III shows the different IEEE 802.15.4 frequency bands and its characteristics [3,4].

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TABLE III
IEEE 802.15.4 FREQUENCY BANDS.

Physical layer	Band	Channel No.	Chip rate	Modulation
868/915 MHz	868-870MHz	00	300	BPSK
868-915MHz	902-928MHz	1-10	600kchip/sec	BPSK
2-4GHz	2.4-2.4835GHz	11-26	2Mchip /sec	QPSK

IV. WSN COMMUNICATION PROTOCOL ARCHITECTURE

Energy consumption of one sensor node is influenced by the structure of protocol layers and the way each layer manages the sensing data. The protocol layers stack used by the sensor nodes and base station within the network includes the application layer, transport layer, network layer, data link layer, physical layer, power management, plane mobility management plane and task management plane [5]. Fig. 3 shows the protocol stack and cross layer services.

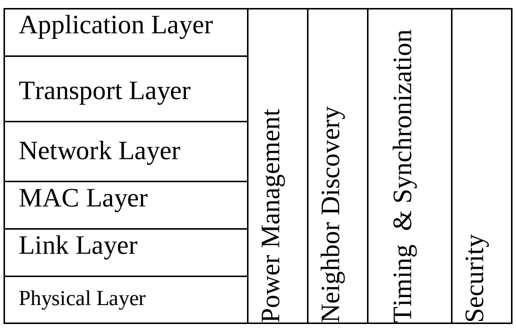

Fig 3. The protocol stack and cross-layer services.

- **Application Layer**

This layer supports different software for applications depending on the sensing task. The three types of protocols are defined for this layer.

a) SMP- Sensor Management Protocol

b) TADAP-Task Assignment and Data Advertisement Protocol

c) SQDDP- Sensor Query and Data Dissemination Protocol

- **Transport Layer**

Transport layer helps to maintain the data flow when the application layer is in need. The protocol development on this layer is a real challenge because sensors are influenced by many parameters and constraints such as limited power supply and memory.

- **Network Layer**

This layer allows routing of data through the wireless communication channel. There are several strategies to route data such as routing power cost with available energy based on the energy metric and data centric routing based on interest dissemination and attribute based naming.

- **Data Link Layer**

Data link layer is responsible for the multiplexing of data stream, data frame detection, Medium Access Control (MAC) and error detection and correction. The design issues of the layer protocol must take into account the different constraints such as power conservation, mobility management and recovery failure strategies.

- **Physical Layer**

Physical layer is the lower-most layer and is responsible for frequency selection, carrier frequency generation, signal detection, modulation and data encryption.

V. SIMULATION MODELS

To compare different wsn protocols it is important to have efficient models for all aspects of communication. This section describes two models that were used for channel propagation and communication energy dissipation as radio energy model. The lifespan of an energy constrained sensor depends on how fast the sensor consumes energy. Sensors use energy to run circuitry and send radio signals to transmit the signals usually a function of distance and takes a large portion of the energy [6,7].

- **Channel Propagation Model**

To transmit the signal in a wireless channel, the propagation of electromagnetic waves can be considered as falling off as a power law function of the distance between the transmitter and receiver. It is also considered that if there is no direct line of sight path exists between the transmitter and the receiver, the waves will bounce off objects in the environment and arrive at the receiver from multiple paths at different times. It causes multi path fading, which again can be roughly modeled as a power law function of the distance between the transmitter and receiver.

The friss free model is used $d^2_{attenuation}$, if the distance between the transmitter and receiver is less than a certain cross-over distance $d_{refer\ ence}$, and the two ray ground model is used $d^4_{attenuation}$, if the distance is greater than $d_{cross\ over}$. The cross-over point is defined as below:

$$d_{referenc\ e} = \frac{4\pi\sqrt{lh_r h_t}}{\lambda} \quad 1$$

where

h_r is the height of receiving antenna above ground,

h_t is the height of transmitting antenna above ground,

$L \geq 1$ is the system loss factor, and

λ is the wavelength of the carrier signal.

The transmitted power is attenuated according to the friss free space equation

(if $d < d_{reference}$) as follows.

$$P_r(d) = \frac{p_t G_t G_r \lambda^2}{(4\pi d)^2 L} \quad 2$$

Where

$P_r(d)$ is the receive power as the separation of transmitter receiver of d,

p_t is the transmit power,

G_t is the transmitting antenna gain,

G_r is the receiving antenna gain,
λ is the carrier signal wavelength,
d is the transmitter receiver distance and
$L \geq 1$ is the system loss factor not related to propagation.
The equation (2) models the attenuation when the transmitter and receiver have direct, line-of-sight communication. This will only occur if the distance between transmitter and receiver is close to each other (d < $d_{reference}$).
The transmitted power is attenuated according to the two-ray ground propagation equation $\left(if\ d > d_{reference} \right)$ below:

$$P_r\,(d) = \frac{p_t G_t G_r h_t^2 h_r^2}{d^4} \qquad 3$$

Where
$Pr(d)$ is the received power as the separation between the transmitter-receiver of d,
P_t is the transmitted power,
G_t is the transmitted antenna gain,
G_r is the receiving antenna gain,
h_r is the height of the receiving antenna above ground,
h_t is the height of the transmitting antenna above ground, and
d is the distance between the transmitter and the receiver.
In this case, the received signal arrives from both the direct path and a ground-reflection path. Due to interference when there is more than one path through which the signal arrives, the signal is attenuated as d^4.

- **Radio Energy Model**

For the analysis of protocols in wireless sensor networks, a simple model has been assumed wDhere the transmitter dissipates energy to run the radio electronics (circuit), power amplifier and the receiver dissipates energy to run the radio electronics [7].

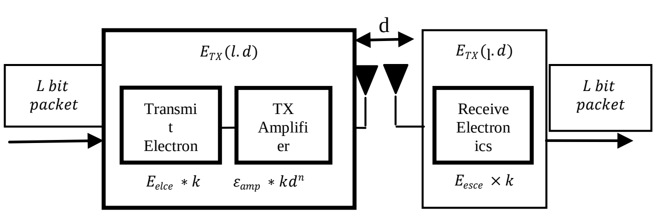

Fig.4. Radio energy dissipation model.

The attenuation of power depends on the distance between transmitter and receiver. The propagation loss can be modeled as inversely proportional to d^2 for relatively short distances and propagation loss can be modeled as inversely proportional to d^4 for longer distance. Thus, to transmit l-bit message a distance$d$, the radio expends:

$$E_T(l,d) = E_{T-elec}\,(l) + E_{T-amp}\,(l,d) \qquad 4$$

$$E_T(l,d) = \begin{cases} lE_{TX} + l\epsilon_{fs} d^2 & : d < d_{reference} \\ lE_{TX} + l\epsilon_{mp}\, d^4 & : d \geq d_{refe\ rence} \end{cases} \qquad 5$$

and to receive this message, the radio expends :

$$E_{RX}\,(l) = E_{RX-elec}\,(l)$$

$$E_{RX}(l) = lE_{elec} \qquad 6$$

As shown in fig. 4 the electronics energy, E_{elec} depends on factors such as modulation, digital coding and filtering of the signal before sending to the transmit amplifier.
The parameters ϵ_{fs} and ϵ_{mp} will depend on the receiver sensitivity and the noise figure, as the transmit power needs to be adjusted so that the power at the receiver is above certain threshold, $P_{r-thresh}$. The receiver threshold $P_{r-thresh}$ can be determined by using the estimation for the noise at the receiver.

$$P_t = E_{TX-amp}\,(1,d) R_b \qquad 7$$

Putting in the value of $E_{TX-amp}\,(1,d)$ gives:

$$P_t = \begin{cases} \epsilon_{fs} R_b d^2 & : d < d_{reference} \\ \epsilon_{mp}\, R_b d^4 & : d \geq d_{reference} \end{cases} \qquad 8$$

Using the communication channel models [7] the received power is :

$$P_t = \begin{cases} \frac{\epsilon_{fs} R_b G_t G_b d^2}{(4\pi)^2} & : d\ <\ d_{cross\ over} \\ \epsilon_{mp}\ R_b G_t G_r h_t^2 h_r^2 & : d\ \geq\ d_{cross\ over} \end{cases} \qquad 9$$

The parameters ϵ_{fs} and ϵ_{mp} can be determined by setting Eq. 3.9 equal to $P_{r-thresh}$:

$$\epsilon_{fs} = \frac{P_{r-thresh}(4\pi)^2}{R_b G_t G_r\, \pi^2} \qquad 10$$

$$\epsilon_{mp} = \frac{P_{r-thresh}}{R_b G_t G_r h_t^2 h_r^2} \qquad 11$$

Therefore, the required transmit power, Pt, as a function of the receiver threshold and the distance between the transmitter and receiver is:

$$P_t = \begin{cases} \alpha_1 P_{r-thresh} d^2 : d\ <\ d_{cross\ over} \\ \alpha_2\, P_{r-thresh} d^4 : d\ \geq\ d_{cross\ over} \end{cases} \qquad 12$$

Where:

$$\alpha_1 = \frac{(4\pi)^2}{G_t\ G_r\ \lambda^2}\ and\ \alpha_2 = \frac{1}{G_t\ G_r h_t^2\ h_r^2}$$

The receiver threshold $P_{r-thresh}$ has been determining using estimates for the noise at the receiver. If the thermal noise figure is 99 dBm2 and the receiver noise figure is 17 dB2, and receiver require a signal-to-noise ratio (SNR) of at least 30 dB to receive the signal with no errors, the minimum receive power $P_{r-thresh}$for successful reception is:

$$P_{r-thresh} \geq 30 + (-82) = -52dBm \qquad 13$$

Therefore, the received power must be at least –53 dBm or 6.3 nW for successful reception of the packet, putting the values that will be used in the experiments (Gt = Gr = $1, h_t = 1.5$ m, $\lambda = 0.328\,m$, and Rb = 1 Mbps) into equation 10 and 11 gives:

$$\epsilon_{fs} = \frac{10pJ}{bit}/m^2 \qquad 14$$

$$\epsilon_{mp} = \frac{0.0013\,pj}{bit}/m^4 \qquad 15$$

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These are the radio energy parameters that will be used for the simulations in wireless sensor network.

VI. ADVANTAGES OF WIRELESS SENSOR NETWORKS

As the variety of applications, WSNs have revolutionized the world around us. They are becoming integral part of our lives. Following is a list of the advantage of wireless sensor networks.

- **Robustness to Withstand Rough Environmental Conditions**

As shrinking size of sensor nodes they have the ability to communicate through a lot of materials and also designed to withstand in harsh weather conditions. WSNs can be used in a huge variety of applications in environment like forest fire detection or seismic monitoring.

- **Ease of Deployment**

In a sensor network hundreds or thousands of nodes can be deployed in remote or dangerous environment. Since these nodes are small in size and economical, throwing of hundreds or thousands of sensors from a plane over a remote or dangerous area allows extracting information is such a way that could not have been possible otherwise.

- **Fault Tolerance**

In wireless sensor networks several sensor nodes are deployed close to each other. They are able to overcome node failures, resulting of destroyed or dead nodes by simply using another routing path. For example during war, if an enemy destroys a surveillance sensor node, this will not affect the whole network.

- **Ability to Cover Wide and Dangerous Areas**

In many areas, infrastructure and economic conditions prevent wired networks from being used. For example, setting-up of a wired network on a battlefield would not be possible. Wireless sensor network can fill this gap due to their lack of infrastructure and their low setup costs.

- **Self Configurable**

When sensor nodes are deployed in the sensing field, they have the ability to self configure in network discovery and multihop broadcast in small amount of time.

- **Mobility of Nodes**

In the last few years, mobility of nodes has been used to trace the event for permanent tracking. Recently developed protocols and architectures are able to handle these real shifting to maintain further routing.

- **Unattended Operation**

WSNs are able to work unattended which will result in reduced working time and minimize the effort that has to be done to administrate these systems. This is beneficial to control home appliances, industrial monitoring and control etc.

- **Improved Lifetime**

The sensor nodes are located close to each other. They can be grouped together. From this group only one node can be used in a round robin fashion to collect data and send to base station. It will enhance the lifetime.

- **Improved Accuracy**

In WSNs, the closely located sensor nodes sensing and collecting the data about the same event will result in better accuracy and reduced uncorrelated noise.

VII. APPLICATIONS OF WIRELESS SENSOR NETWORK

Wireless sensor networks enable a paradigm shift in the science of monitoring, and constitute the foundation of a broad range of applications related to security, surveillance, military, medical, and environmental monitoring. They can significantly improve the accuracy and density of scientific measurements of physical phenomena because large numbers of sensors can directly be deployed where experiments are taking place. In wireless sensor network the concept of micro sensing and wireless connection of sensor nodes constitute the foundation of a broad range of application related to military surveillance, security environment monitoring, medical, home and other commercial application areas. They can significantly improve the accuracy and density of scientific measurements of physical phenomena because large number of sensor can directly be deployed at places where experiments are failing. Some existing real life applications are given below.

- **Military Applications**

Sensor network research was initially driven by military applications such as surveillance and enemy tracking. Since sensor networks are based on the dense deployment of sensor nodes, destruction of some nodes by hostile actions does not affect a military operation as much as destruction of traditional sensor, which makes sensor networks concept a better approach for battle fields.

To monitor friendly forces, equipment and ammunition leaders and commanders can constantly monitor the status of friendly troops, the condition and the availability of equipment and ammunition in a battle field by the use of sensor networks. In battle field surveillance, critical terrains approach and paths can be rapidly covered with sensor networks and closely watched for the activities of the opposing forces.

- **Environment Observation**

Environment monitoring networks span large geographic areas to monitor and forecast physical processes such as environment pollution, forest fire detection and flood detection etc. In forest fire detection, sensor nodes may be strategically, randomly and densely deployed in forest. Sensor nodes can relay the exact origin of the fire to the end uses before the fire is spread. Several types of sensors are deployed for rainfall, water level and weather sensor. The sensors supply information to the centralized database in a predetermined way.

- **Precision Agriculture**

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In agriculture sensor networks are used to monitor the pesticides level in the drinking water, the level of soil corrosion and the level of air pollution. They are also helping in strategic planning and counter measures to increase the yield of the crop.

- **Medical Applications**

In medical, sensor networks are used for tracking and monitoring doctors and patients inside a hospital. Each patient has small and light weight sensor nodes attached to them. Doctor may also carry a sensor node which allows other doctors to locate them within a hospital. Sensors are extremely useful in decease diagnosis and monitoring. Bio-sensors are implanted in the human body to monitor the patient's physiological parameters such as heart beat or blood pressure. The data so collected is sent regularly to alert the concerned doctor on detection of an anomaly. Such an arrangement provides patients a greater freedom of movement instead of being constantly confined to the hospital bed. Rapid advancements in MEMS technology has made bio-sensors so sophisticated as to enable correct identification of allergies and associated diagnosis.

- **Habitat Monitoring**

Researchers in the life sciences are becoming increasingly concerned about activities of birds, small animals and insects. WSNs therefore can be used to gather information on the habitat of animals without disturbing them.

- **Home Automation**

As technology advances, smart sensor nodes and actuators are used in applications, such as vacuum cleaners, microwave oven and refrigerator. These sensor nodes inside the domestic devices can interact with each other and with the external network via the internet or satellite. They allow end users to manage home devices locally and remotely more easily.

- **Other Commercial Applications**

Sensors can be used in building for detecting and controlling of fire and smoke. In case of a fire in building, the deployed sensor network can track and scan the direction in which fire is expanding. Also sensors can be used to monitor the vibration in the building that can damage the structure.

- **Disaster Management**

The early warning system based on WSN can be reliably deployed in areas with high risk of disasters. The use of WSN promises to provide real time information of the disaster area to rescue teams making coordination and planning more effective. Location information of victims, rescuers and objects in the disaster is vital for the rescue operations. It has been known that, for an operationally effective disaster management sensing, monitoring and decision-making should be integrated seamlessly. Timely and updated disaster information is extremely important for efficient response and effective actions, it will help disaster managers to make better decisions and take actions in time. Fig. 5 shows the application of wireless sensor network

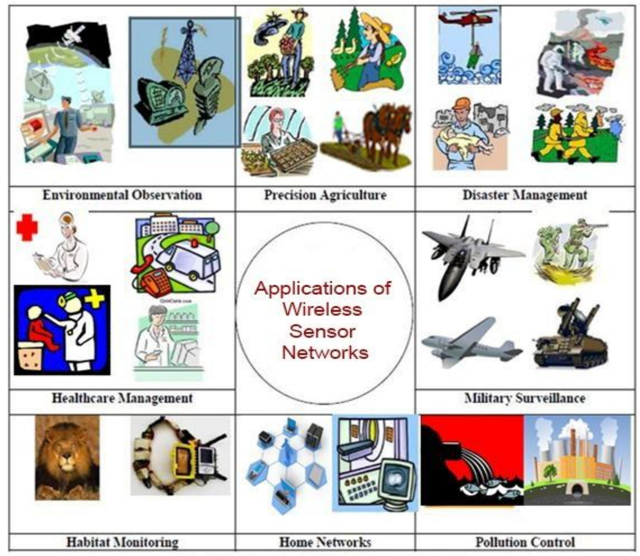

Fig. 5: Applications of wireless sensor networks.

VIII. CHALLENGES OF WIRELESS SENSOR NETWORK

With the continued advancement in micro electro mechanical systems the miniaturization and increased communication capabilities of sensors has enabled their ubiquitous and invisible deployment anywhere at any time. A sensor network is an infrastructure comprised of sensing (measuring), computing and communication elements that give a user the ability to observe instrument and react to events and phenomena in a specified environment. To design and develop protocols or algorithms some challenges are needed to be understood [5]. These major challenges are summarized below:

- **Limited Functional Capabilities**

A sensor node has low end processor, small memory and small amount of stored energy. This limits many of the functional capabilities in terms of processing and communication. A good algorithm should make use of shared resources within an organizational structure, while taking into account the limitation on individual node abilities.

- **Limited Energy**

A sensor node has limited energy storage. For this reason, efficient use of this energy will be vital in determining the range of application for these sensor networks. In most cases, renewing energy is not feasible or even impossible. Sensors are usually unattended in the field. The limited energy in sensor nodes must be considered as proper consumption or utilization that can reduce the overall energy uses in a network.

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- **Network Lifespan**

Limited resources and energy in sensor nodes results in limited lifespan in a network. Ideally, a network should become ineffective only when all nodes become exhausted. In reality, the lifespan of a sensor network is the minimum time upto which the network is functionally effective. A network is functionally effective, if it can monitor the entire sensor field and collect the sensed data with a predefined quality of service (QOS). Proper techniques should attempt to reduce the energy usage and thereby increase network lifetime.

- **Scalability**

Sensor nodes deployed in a sensing area should be optimal. To accommodate some more nodes in the future, network scalability is one of main hurdles to achieve this objective. Scalability in the sensor network indicates the ability to handle growing amounts of work in a effective manner and be readily enlarged.

- **Redundancy**

Due to the frequent node failures and inaccessibility of failed nodes, WSNs are required to have high redundancy of nodes so that the failure of new nodes can be negligible.

- **Lack of global identification**

Due to large number of sensor nodes in a sensor network the global identification (GID) is generally not possible. Although in some cases, the Global Positioning System (GPS) provides positioning information to sensor nodes but it requires line of sight to several satellites, which is generally not available inside of building, beneath dense foliage, underwater, when jammed by an enemy or during MARS exploration etc.

- **Storage, Search and Retrieval**

The sensor network can produce a large volume of raw data such as continuous time-series of observations over all points in space covered by the network. Since the data source is continuous traditional database are not suitable for WSNs.

- **Production Cost**

The cost of a single node is very important to justify overall cost of the network; since the sensor networks consist of a large number of sensor nodes therefore cost of each sensor node has to be kept low.

- **In- network Processing**

In general transport protocols used in wired and wireless networks have assumed end-to-end approach guaranteeing that data from the senders have not been modified by intermediate nodes until it reaches a receiver. However, in WSNs data can be modified or aggregated by intermediate nodes in order to remove redundancy of information. The previous solutions did not accommodate concept of in-network processing, called data aggregation or diffusion in WSNs.

- **Latency**

Latency refers to delay from when a sender sends a packet until the packet is successfully received by the receiver. The sensor data has a temporal time interval in which it is valid, since the nature of the environment changes constantly, it is therefore important to receive the data in a timely manner.

- **Fault tolerance**

Sensor nodes are fragile and they may fail due to depletion of batteries or destruction by an external event. Realizing a fault-tolerant operation is critical, for successful working of the WSN, since faulty components in a network leads to reduced throughput, thereby decreasing efficiency and performance of the network.

IX. CONCLUSION

In this paper, the basic parts of sensor nodes, the technology used with the wireless sensor network have been explained. This is followed by the advantages, applications and challenges of wireless sensor network. The applications provide some key attributes that determines the diving force behind WSN research. There are many challenges but due to the scarce energy resources of sensors, energy efficiency is one of the main challenges in the design of protocols for WSNs. The ultimate objective behind the design is to keep the sensors life time as long as possible.

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