Volume 4, Issue 4, April 2014 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

A Survey on Wireless Sensor Network based Approaches

Ankita
Scholar, *Department of Computer Science and Applications*
Kurukshetra University, Kurukshetra, India

Abstract:-Wireless sensor network is emerging field because of its wide applications and least cost. It is a wireless network which subsist a group of small sensor nodes which communicate through radio interface. These sensor nodes are composed of sensing, computation, communication and power as four basic elements. But limited energy, communication capability, storage and bandwidth are the main resource constraints. The network should have self-organizing capabilities as the positions of individual nodes are not predetermined. Our survey is based on various aspects of wireless sensor networks. In this paper we also discussed various types of WSNs and their applications.

Keywords:-WSN, Sensor nodes, Applications, Traditional networks, MANET

I. INTRODUCTION

WSN is different from other popular wireless networks like cellular networks, wireless LAN and Bluetooth in many ways.

WNS are proposed for variety of monitoring applications. In these networks (Fig.1 [2]) large number of nodes periodically takes measurements of environmental data and transmits them to a central data sink. The basic step of working of WSN: Sensing-> Computation->Communication->Data aggregation at sink node->various applications. With the development in wireless technology and embedded device technology, the capacity of the sensors is quite improved while their cost is lower. A wireless sensor network composed of hundreds to thousands of sensor nodes with much shorter distance between adjacent nodes and low application data rate.WSN has more opportunities to be deployed in real environments. In recent years WSN becomes emerging field in wide range of applications like health monitoring applications, environmental observation, forecasting system, battlefield surveillance, robotic exploration, monitoring of human physiological data etc. The sensors can be deployed at various places with different usages and each have different capability to sense different attributes like temperature, moisture, pressure humidity etc. But these sensors have limited power sources and also it is not cost effective to recharge the batteries. The batteries are usually irreplaceable. Therefore, there lifetime will depends on respective batteries of sensors. So the life time of wireless sensor network can be prolonged by using effective energy balancing methods.

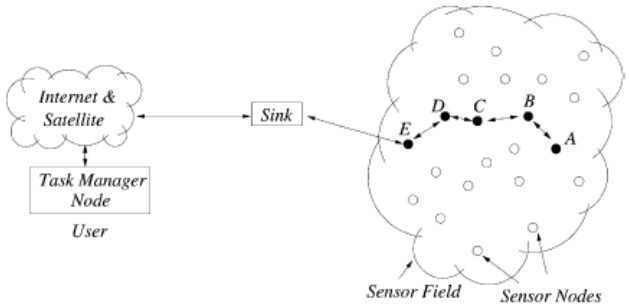

Fig.1 WSN

II. COMPARISON OF WSN WITH TRADITIONAL WIRELESS NETWORK

- Number of sensor nodes in WSN is much larger than any of traditional wireless networks.
- A major difference between WSN and other traditional networks computing devices including PC's, PDA's and other embedded devices is that in WSN main emphasize is on power management.
- WSN is a data centric approach but traditional wireless networks are address centric because of large number of nodes in WSN.
- Sensor nodes are much cheaper than nodes in other wireless networks.
- WSN uses broadcast communication approach but traditional wireless networks use point-to-point communication.
- Traditional wireless network like Mobile ad hoc Networks are designed for distributed computing while WSN are designed to gather information.
- A unique characteristic of WSN is that data collected by adjacent nodes and some consecutive readings sensed by sensors are highly correlated which gives opportunity to develop efficient protocols.

- 802.11-like MAC in traditional wireless networks consumes 2–6 times more energy than S-MAC for traffic load with messages sent every 1-10s [3].

III. ARCHITECTURE OF WIRELESS SENSOR NETWORK

WSN architecture includes both a hardware platform and operating system designed. TinyOS [2] is a component based operating system designed to run in resource constraint wireless device.

The major components of WSN are (Fig.2 [12]):-

- Sensor Field: The area in which sensor nodes are deployed.
- Sensor Nodes: Sensor nodes are the sensors which are responsible for gather information and routing this information back to a sink.
- Sink: It is also a sensor node which performs a special task of receiving, processing and storing data from other sensor nodes. This node is responsible for reduction of messages need to be sent and also reduce the energy requirements.
- Task Manager (Base Station): It is a centralized point of control within the network used to extract information from the network and passes control information back to the network.

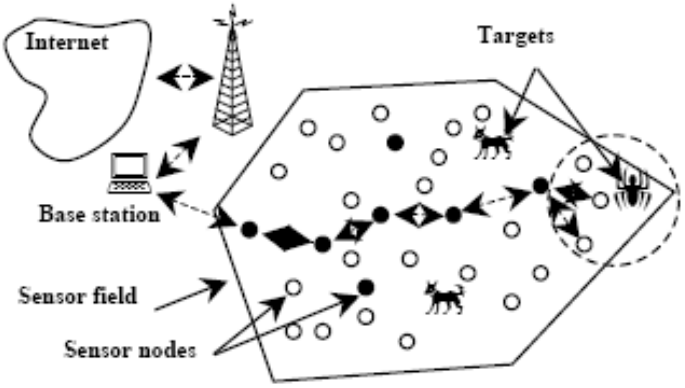

Fig.2 WSN Architecture

IV. ARCHITECTURE OF WIRELESS SENSOR NODE

A Sensor is a tiny device which is based on micro sensor technologies with low signal processing capability, low computation power and low bandwidth.

Main Components of wireless sensor node (Fig.3):

- Sensor Unit
- Processing Unit
- Radio Transreceiver
- Battery
- Analog to Digital Convertor
- Location Finder
- Mobilizer

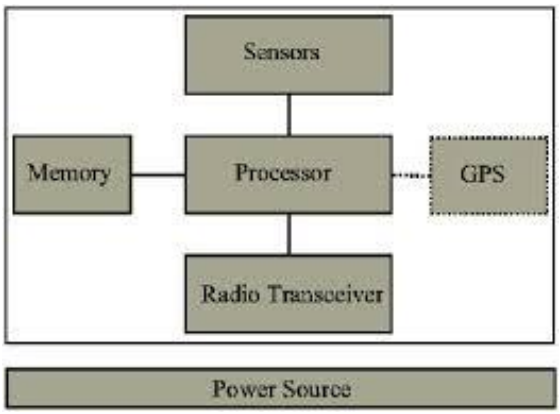

Fig.3 WSN Node Architecture

V. PROTOCOL STACK OF WSN

Sensor network protocol stack is much like the traditional protocol stack with the following layers (Fig.4 [2]):

- Application Layer: three possible application layer protocols, i.e., sensor management protocol (SMP), task assignment and data advertisement protocol (TADAP), and sensor query and data dissemination protocol (SQDDP),needed for sensor networks based on the proposed schemes related to the other layers and sensor network application areas as discussed by I.F. Akyildiz et al [2].

- Transport Layer: It provides communication of network with outside world.
- Network Layer: This node providing internetworking with external networks.
- Data Link Layer: Like traditional network's Data link Layer it provides multiplexing of data streams, medium access and error control.
- Physical Layer: It is responsible for frequency selection, signal detection, encryption and modulation. This layer also minimizes the energy.

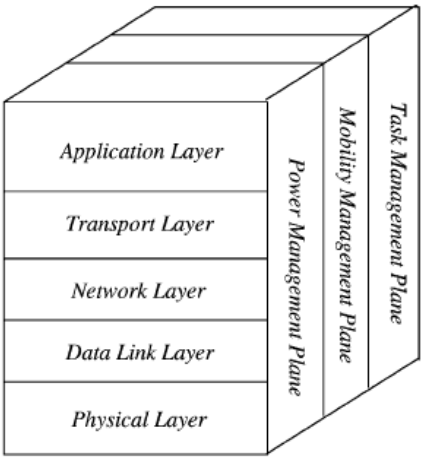

Fig.4 Protocol stack for WSN

VI. TYPES OF WIRELSS SENSOR NETWORKS

Categorization of sensor networks on the bases of interfaces in which nodes are deployed:

A. *Underwater Wireless sensor network*:

In this sensor network sensor nodes are deployed under water. Sensor nodes communicate through acoustic waves. Underwater wireless communication today is expensive, sparsely deployed, typically communicating directly to a base-station over long ranges rather than with each other [4]. This network is difficult to establish due to limited bandwidth, long propagation delay and signal fading problem.

Applications:

- Seismic monitoring: A promising application for underwater Sensor networks is seismic monitoring for oil extraction from underwater.
- Equipment Monitoring and Control**:** Underwater equipment monitoring is a second example application. Ideally, underwater equipment will include monitoring support when it is deployed, possibly associated with tethered power and communications, thus our approaches are not necessary.

B. Underground Wireless sensor network:

This network is basically established under the ground and used to monitor the underground situations. It is a challenge to communicate via this network due to signal loses and high attenuation. In this network communication is carried out through electromagnetic waves. Underground sensors are expensive because the special components should be used for reliable communication through interfaces like soil rocks, water and other minerals. This type of WSN is also very expensive.

Applications:

- Earthquake and landslide monitoring
- Intruder detection
- Environment monitoring
- Assisted navigation
- Infrastructure maintenance
- Sports field maintenance

C. Earthbound Wireless sensor network:

This type of networks also called terrestrial WSNs. This network is cheaper to deploy than the above two. In this thousands of nodes are deployed in ad hoc or in a pre planned manner. In former case nodes are placed randomly into target area while in latter there can be grid, optimal, 2D, 3D placements.

Applications:

- Military applications
- Environmental Monitoring
- Security
- Node tracking system
- Medical applications

- Industrial application
- Monitoring of human physiological data
- Forecasting

Other types of WSNs

D. Mobile Wireless Sensor Network:

In this type of network once the nodes are deployed they move to gather the information. And sensor node has ability to reposition and organize itself in network. Localization, self organizations, navigation and control, coverage, energy, maintenance, data process etc. are main features of mobile WSNs.

Applications:

- Sensors can be attached to people for health monitoring, which may include heart rate, blood pressure etc [5].
- Animals can have sensors attached to them in order to track their movements for migration patterns, feeding habits or other research purposes [6].
- Sensors may also be attached to unmanned aerial vehicles (UAVs) for surveillance or environment mapping [7].

E. Multi-media Wireless sensor networks:

These are used to monitor and track events in the form of multimedia. These networks consist of a number of low cost sensors equipped with cameras and microphones. Main features of multi-media WSNs are high bandwidth/low energy, Quality of service, filtering, data processing and compressing techniques.

Applications:

- Traffic monitoring
- Pollution control
- Smart healthcare
- Disaster/Emergency response
- Smart Environmental sensing

F. Wireless Nano sensor network:

The concept is based on integrated machines at the nano scale, which interact on cooperative basis by means of wireless communications. At the present stage, the design of the protocol suite for wireless nano sensor networks represents a fundamental issue to address for accelerating the deployment process of such a technology [8].

VII. CHALLENGES

A. *Energy Support*-Most important restraint in a WSN is limited energy support of sensor nodes. Since sensor nodes are deployed in adhoc manner and after deployment they left unattended. So initial battery power is the main source of their lifetime survival. Once sensor nodes are deployed they could not be recharged. So today to establish an energy efficient wireless sensor network is a great issue and a challenge.

B. *In Real Time Environment*-WSN deal with real world environments. In many cases, sensor data must be delivered within time constraints so that appropriate observations can be made or actions taken. Very few results exist to date regarding meeting real-time requirements in WSN.

C. Ad-Hoc Deployment-Sensor nodes are distributed randomly in required monitoring field. For example –for monitoring forest activities sensor nodes are dropped from the plane. Then sensor nodes itself create connections with other nodes and form an infrastructure. Hence new standards and protocols should be developed to maintain this type of ad-hoc network.

D. Wireless Channel-The wireless channel is unreliable in nature, and a number of phenomena can prevent a transmitted packet from reaching a receiver. One such phenomenon is interference. If two independent transmitters transmit on the same channel such that their signals overlap, they may corrupt each other's signal at a receiver's radio. This requires the transmitter to re-transmit, at the cost of additional time and energy. So to maintain efficient wireless channel is a great challenge today.

E. Fault Tolerance-Sensor nodes are prone to failure because of unattended environment. A sensor node may fail due to hardware or software problem or energy exhaustion. If a few of sensor nodes fail, working protocol should handle this type of fault tolerance.

VIII. CONCLUSION

Wireless Sensor Network is one of the emerging fields in research area. Wireless sensor network has a remarkable feature to monitor environmental and physical conditions. In this paper we discussed various aspects of wireless sensor networks and also discussed various types of WSNs and their applications .In the future, the wide range of application areas will make sensor networks an integral part of our lives. We also discussed how it is differ from traditional wireless networks. Wireless sensor network has bright future in the field of networking because it continuingly providing us solutions for many monitoring problems. Also we can conclude that to make the Wireless sensor network energy efficient is one of the great areas for future work.

REFERENCES

[1] Jennifer Yick, Biswanath Mukherjee, Dipak Ghosal,"Wireless sensor network survey," Computer Networks Elsevier 52 (2008) 2292–2330.

[2] I.F. Akyildiz, W. Su*, Y. Sankarasubramaniam, E. Cayirci. Wireless sensor networks: a survey. Computer Networks 38 (2002) 393–422.
[3] Wei Ye, John Heidemann, Deborah Estrin. An Energy-Efficient MAC Protocol for Wireless Sensor Networks.In USC/ISI TECHNICAL REPORT ISI-TR-543.
[4] John Heidemann,Yuan Li ,Affan Syed,Jack Wills ,Wei Ye. Underwater Sensor Networking: Research Challenges and Potential Applications. USC/ISI Technical Report ISI-TR-2005-603.
[5] H. Yan, H. Huo, Y. Xu and M. Gidlund. 2010. Wireless Sensor Network Based E-Health System – Implementation and Experimental Results. IEEE Transactions on Consumer Electronics, vol. 56, no. 4, pp. 2288-2295.
[6] S. Ehsan et al. 2012. Design and Analysis of Delay-Tolerant Sensor Networks for Monitoring and Tracking Free-Roaming Animals. IEEE Transactions on Wireless Communications, vol. 11, no. 3, pp. 1220-1227.
[7] B. White et al. 2008. Contaminant Cloud Boundary Monitoring Using Network of UAV Sensors. IEEE Sensors Journal, vol. 8, no. 10, pp. 1681-1692.
[8] G. Piro, L.A. Grieco, G. Boggia, and P. Camarda. Simulating Wireless Nano Sensor Networks in the NS-3 platform.
[9] Eiko Yoneki, J.B., A Survey of Wireless Sensor Network Technologies: Research Trends and Middleware'S Role. 2005, University of Cambridge: Cambridge. p. 45.
[10] I.F. Akyildiz, E.P. Stuntebeck, Wireless underground sensor networks: research challenges, Ad-Hoc Networks 4 (2006) 669–686.
[11] I. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci,A Survey On Sensor Networks, IEEE Communications Magazine, Volume 40, Number 8, pp.102-114, 2002.
[12] Trong Thua Huynh, Anh-Vu Dinh-Duc, Cong Hung Tran. Balancing latency and energy efficiency in wireless sensor networks: A comparative Study. IEEE 978-1-4673-2088-7-2013.

