



A Survey of Applications of Wireless Sensor Network

Prabhjot Kaur

CSE Department

Guru Nanak Dev University, Regional Campus Jalandhar, INDIA

Email: prabhjotbhullar22@gmail.com

Abstract – Wireless Sensor Network consist of thousands of lower power, low cost, multifunctional sensor nodes which are densely deployed either inside the system or very close to it. Sensor nodes have ability to sense the environmental conditions like pressure, temperature, acoustic, humidity. This paper can presents an overview of the various WSN based applications.

Keywords – Wireless Sensor Network (WSN), Wireless Body Area Sensor Network (WBAN)

I. INTRODUCTION

WSN consists of a number of sensors spread across a geographical area, each sensor node densely deployed which have capability of collecting, sensing, processing and communicate real time information. WSN includes small cameras as vision sensors, microphones as audio sensors and have capability of sensing ultrasound, infrared, pressure and noise [5]. Although individual sensor node have a limited range where as many sensors can cover large space. WSNs are deployed in rough natural environment where no human intervention take place so network will perform its tasks without any disturbance. Otherwise, it affects the processing and sensing capabilities as well as the protocol coordination [3].

WSNs have another interesting feature that sensor nodes can cooperate with each other. Sensor nodes have an intermediate node where raw data are processed before transmission that reduces the wastage of energy and bandwidth. Therefore nodes can send relevant data only. These features facilitate wide range of applications of WSNs ranging from Environmental Monitoring, Habitat Monitoring, Healthcare, Volcano Monitoring, Water Treatment and many more [4].

II. APPLICATIONS OF WSN

A. HealthCare Applications:

Sensor Networks are widely used in monitoring human activities like heart beats, body temperature, body position examine patient behavior by recording the frequency by which they touch certain objects. It also

helpful in human vision restoration by retina prosthesis. Sometimes this area referred as Wireless Body Area Sensor Network [12].

Some of major projects that used around us are:

1. Health Gear is a Microsoft Research Product. It consist set of physiological sensors connected through Bluetooth to cell phones, which examines physiological signals.
2. CodeBlue is researched at Harvard University. It can work across various network densities from a small sensor node to more powerful devices such as PC.
3. eWatch provides audio or video notification while recording light, sound, temperature and motion.[15].

B. Habitat Monitoring:

WSN can be deployed for wildlife research activities. With the help of sensors we can examine location, migration patterns, of birds, food habits, breeding, population, and hunting behavior which helping in preserving endangered species. Examples are Great Duck Island, Maine [1]

It was the first application of sensor networks in habitat monitoring. In 2002, the Intel Research Laboratory Berkley deploys WSNs on Great Duck Island, Maine. These sensor networks can monitor the microclimates around nesting burrows used by the Leach's Storm Petrel. Three major questions in monitoring Leach's Storm Petrel:

- What environmental factors responsible for a good nest?
- What is the occupancy pattern of nesting burrows?
- What environmental changes occur in the burrows during breeding season?

One sensor node per burrow is sufficient for data sampling. Each Burrow monitors air temperature and humidity inside and outside of the burrow.

In addition, research suggests that seabird colonies are notorious for their sensitivity to human disturbance. That even 15mins visit to a colony can result up to 20% mortality among eggs and chicks in given breeding year. Researchers at University of Florida and University of Missouri, Colombia using DeerNet which based on WSN for analyzing wildlife behavior by tracking deer's actions[7]. Finally, sensor networks may represent a more economical method for conducting long-term studies.

C. Environmental Monitoring:

Environmental Monitoring includes the atmospheric parameters, forest fire and flood detection, pollution monitoring and agricultural environment.

1. **Cattle Monitoring:** In cattle monitoring we deploy sensor nodes over large farms to recording the soil moisture and to examine the position of cattle's we can deploy sensors around their necks. We added sensor nodes with cameras that transmitted images of locations such as water troughs. This deployment raised challenges for network topology routing maintenance. For this monitoring we developed fleck series of nodes. Fleck-1 includes battery voltage, charging current, power supply, sensing on-board temperature. It used battery, solar cell which just connected using screwdriver. Fleck-2 node carried by the animal specialized for animal tracking [2].
2. **Water Environmental Monitoring:** This system is suitable for large-scale water environment monitoring like lakes, rivers, shallow and deep groundwater. Water quality monitoring technology was used to measuring sensitivity of aquatic organisms to the presence of poisonous substances in water bodies. Basic measuring methods include Fish Measuring and Beach Louse Measuring. It measures the pH level and water temperature of various water bodies. Water monitoring system can be divided into three parts data monitoring nodes, data base station and remote monitoring center. In data monitoring each node can measure parameters as pH level amount of dissolve oxygen, temperature the collected parameters memorized and routed to the base station. Then the base station transferred data from monitoring nodes to a remote monitoring centre via GPRS network. The monitoring centre analyzes the water quality parameters any sudden changes in water quality gives alarm for water contamination.
3. **Pollution Monitoring:** WSNs can be deployed for monitoring the level of pollutant in

atmosphere. The sensor nodes measure amount of poisonous gases [9]. Millions of sensor nodes are deploy in forests to detect the origin of forest fires. The Forest Fires Surveillance System (FFSS) in South Korean was developed to prevent the forest fires. The system senses smoke, temperature, early detection of heat is possible and have an early alarms when the forest fires occur to alerting people before it grows [8]. It helpful in saving economical loss and from environmental damage. WSNs control the amount of pesticides present in drinking water also, it measures level of soil erosion [13].

4. **Military Applications:** WSN can provide variety of military applications like battlefield surveillance, information collection, attack detection and intrusion detection. Few challenges faced by WSNs in the battlefields as during attack many of the sensor nodes can destroy or damage but nodes failure in WSN does not affect the whole network. WSNs have very critical applications such as enemy detection and tracking. As the object with metallic content can be detected by using specially designed sensors. Battlefield and borders can be closely monitored with the help of sensor network. Sensor networks also very helpful in a Nuclear, Biological and Chemical attacks. Sensors can also embedded in weapons to locate exact information like angle, distance about target. Other Military Application of WSNs OTW that stands for Other Than War it alert about the areas at risk of natural disaster. Mostly we use acoustic and seismic sensors with IR cameras, radars [14, 16].

III. RELATED WORK IN VARIOUS APPLICATIONS

Th. Arampatzis⁶, J. Lygeros, Senior Member, IEEE, and S. Manesis, Member, IEEE in 2005 gave a paper on various applications of wireless sensor networks. This paper gave information about recent research in various applications of WSNs.

Carlos F. Garica-Hernandez, Pablo H. Ibaruengaytia, Jesus A. Perez-Diaz in 2007. In this research paper a survey on WSNs and their technologies, their applications, standards was carried out.

Guillermo Barrenetxea, Francois Ingelrest, Gunnar Schaefer, and Martin Vetterli in 2005. This paper focused on particularities of Environmental Monitoring through sensor networks. Environmental Monitoring includes melting of ice, various types of pollution in atmosphere.

Peng Jiang, Hongbo Xia, Zhiye He and Zheming Wang in 2009. They purposed a water environmental monitoring system based on a wireless sensor network. This paper was devoted to the explanation and illustration for new water environment monitoring

system design. This system can monitors water temperature and pH level in artificial lakes.

Kavi K. Khedo, Rajiv Perseedoss and Avinash Mungur in 2010 purposed an innovative system named Wireless Sensor Network Air Pollution Monitoring System (WAPMS) to monitor air pollution. With the increasing number of vehicles and rapid urbanization air pollution has increased so this system can monitors poisonous air pollutants present in atmosphere.

Tomasz Naumowicz, Robin Freeman, Holly Kirk, Ben Dean, Martin Calsyn, Achim Liers in 2010. Tis paper presents Habitat monitoring by deployment of sensors on Skomer Island and Great Duck Island. It gave information about the behavior of seabirds.

M. Pejanovic Durisic, Z. Tafa, G. Dimic and V. Milutinovic in 2012 has purposed a paper on Military Monitoring through WSNs. They gave information that how sensor networks are helpful in battlefield, in detection of enemy and even now senor nodes are deployed in weapons also to measure distance from enemy's area.

Edwin Prem Kumar Gilbert, Baskaran Kaliaperumal, and Elijah Blessing Rajsingh in 2012. This paper presents detailed information about the various research issues like HealthCare, Military Monitoring, Environment Monitoring, Habitat Monitoring and Industrial Monitoring.

IV. CONCLUSION

In this paper, a survey on Wireless Sensor Networks

(WSN) and their standards, technologies and applications were carried out. Low cost small sensor nodes, flexibility, fault tolerance and robustness of the network allow the use of sensor network in various fields. The low-level energy constraints of the sensor nodes give economical benefits. The application of WSNs is not limited to the areas mentioned in this paper. In future, WSN applications are highly promising to revolutionize our everyday lives.

REFERENCES

- [1] Julia Ambagis. Census and monitoring techniques for Leach's Storm Petrel (*Oceanodroma leucorhoa*). Master's thesis, College of the Atlantic, Bar Harbor, ME, USA, 2002.
- [2] By Peter Corke, Fellow IEEE, Tim Wark, Member IEEE, Raja Jurdak, Member IEEE, Wen Hu, Member IEEE, Philip Valencia, Member IEEE, and Darren Moore, Member IEEE: "Environmental Wireless Sensor Networks".
- [3] Alan Mainwaring¹ Joseph Polastre, Robert Szewczyk, David Culler¹, John Anderson Intel Research Laboratory, Berkeley Intel Corporation.
- [4] Daniele Puccinelli and Martin Haenggi" Wireless Sensor Networks: Applications and Challenges of Ubiquitous Sensing" IEEE Circuits and Systems Magazine third quarter 2005
- [5] Proceedings of the 13th Mediterranean Conference on Control and Automation Limassol, Cyprus, June 27-29, 2005. A Survey of Applications of Wireless Sensors and Wireless Sensor Networks Th. Arampatzis, J. Lygeros, Senior Member, IEEE, and S. Manesis, Member, IEEE.
- [6] IJCSNS International Journal of Computer Science and Network Security, VOL.7 No.3, March 2007. Wireless Sensor Networks and Applications: a Survey. Carlos F. Garcia-Hernandez, Pablo H. Ibarguengoytia-Gonzalez, Joaquin Garcia-Hernandez.
- [7] DeerNet, Available from: <http://blog.xbow.com/xblog/2007/10/deernet---caught.html>, Date Accessed: 27 August 2009.
- [8] B. Son, Y. Her, J. Kim, "A design and implementation of forest-fires surveillance system based on wireless sensor networks for South Korea mountains", International Journal of Computer Science and Network Security (IJCSNS), 6, 9, 124-130, 2006.
- [9] Y. Ma, M. Richards, M. Ghanem, Y. Guo and J. Hassard, "Air Pollution Monitoring and Mining Based on Sensor Grid in London", Sensors 2008, Vol. 8(6), 3601-3623.
- [10] A. Mainwaring, D. Culler, J. Polastre, R. Szewczyk, and J. Anderson, "Wireless sensor networks for habitat monitoring", Proceedings of the 1st ACM International workshop on Wireless sensor Networks and applications, Atlanta, Georgia, USA, 88-97, 2002.
- [11] International Journal of Information and Electronics Engineering, Vol. 2, No. 5, September 2012. Research Issues in Wireless Sensor Network Applications: A Survey Edwin Prem Kumar Gilbert, Baskaran Kaliaperumal, and Elijah Blessing Rajsingh.
- [12] A. Milenkovic, C. Otto, and E. Jovanov, "Wireless sensor networks for personal health monitoring: Issues and an implementation," Computer Communications, vol. 29, pp. 2521-2533, 2006.
- [13] J. Wang, X. Ren, Y. Shen, and S. Liu, "A remote wireless sensor network for water quality monitoring," Intl. Conf. on Innovative Computing and Communication, pp.7-12, 2010.
- [14] N. Alsharabi, F. Zing, and M. Ghurab, "Wireless sensor networks of battlefields hotspot: challenges and solutions," Sixth Intl.

- Symposium on Modeling and Optimisation in Mobile adhoc and Wireless Networks and Workshops, April 2008, pp.192-196.
- [15] L. Xuemei, J. Liangzhong, and L. Jincheng, "Home healthcare platform based on wireless sensor networks," in Proc. of the Fifth Intl. Conf. on Information Technology and application in Biomedicine, pp. 263-266, 2008.
- [16] Bar, Montenegro, June 19, 2012A Survey of Military Applications of Wireless Sensor Networks
- [17] M. Pejanovic Durisic, Z. Tafa, G. Dimic, and V. Milutinovic Department of Electrical Engineering, University of Podgorica, Montenegro.

