Wireless Sensor Network Applications: A Survey

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ABSTRACT

This paper describes the thought of sensor networks that has been created by the representation of wireless communications, micro-machined devices, and digital electronics. First, the potential sensor networks applications and therefore the sensing tasks are search, and after the review of things influenced to the planning of sensor network. Wireless Sensor Network (WSN) consists of the many distributed devices spatially, using sensors to watch various conditions at various points, including temperature, sound, vibration, pressure, motion or pollutants. Most of the many applications of Wireless Senor Networks are described during this paper.

KEYWORDS: Applications, Sensor, Wireless sensor network

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I.   INTRODUCTION

Wireless sensor network are a category of network where the nodes are sensor node which have Capability to sense the physical phenomena that occur around them. These sensing could be of various kind like:

➢ Color
➢ Pressure
➢ Humidity
➢ Vibration
➢ Background level
➢ Temperature
➢ Presence and absence of sort of Objects
➢ Current Characteristic like Speed, Direction and size

These sensor network collectively form a network called a wireless sensor network. Now a days Sensor network are very fashionable thanks to this sensing reason they will be utilized in many application. Wireless sensor network are key to the formation of internet of things (IOT) and Internet of things Wireless Sensor Network are vital component for building smart cities which became popular for previous couple of years in our country and abroad. WSN are software based and Dependent on the applications. Fig.1 illustrates the various applications of wireless sensor network.

Fig.1 Applications of WSN

II. APPLICATION OF WSN

1. Military Application

Wireless sensor networks are an important part of military command, control, communications, intelligence, surveillance, mission and targeting (C4ISRT) systems. The rapid deployment, and fault tolerance characteristics of sensor networks which make them a fully promising sensing technique for military C4ISRT.A number of the military applications of sensor networks are equipment and ammunition; battleground surveillance; reconnaissance mission of opposing forces and terrain; targeting and target structure; and nuclear, biological and chemical (NBC) attack detection and reconnaissance mission.

Equipment and ammunition: Each equipment and its significant ammunition may be connected to sensor which give the report of each and every equipment status.

Reconnaissance mission of opposing forces and terrain: Sensor network is deployed in very important terrain so that if it detect any attack occur from opposition force terrain may be meet before the opposition force can intercept them.

Targeting and target structure: Sensor network can be fixed on proper terrain so that it hit on the specific target.

Nuclear, Biological and Chemical (NBC) attack detection and reconnaissance mission: Sensor network accordingly use so that Reconnaissance mission after and NBC attack is detected.

Battlefield surveillance: Sensor network closely watched the activities of the opposing forces. As its continuous operation new operation plan are prepared so that new sensor network are deployed any time for the battlefield surveillance. [19]

2. Health Applications

Wireless sensor network are capable for interacting with the environment through sensor that why it is used for healthcare monitoring. [1].In medical science different wireless technology are used like WBAN, WPAN, WSAN, etc. WBAN (wireless body area network) is a technology which continuously operate the sensor and widely used in medical science. It measure the patient physiological signal like heart rate , blood pressure and sugar level etc.[3] In wireless sensor network there performance can be analysis by their work in that particular field. Sensor node monitoring chronic and serious such as cardiovascular disease and diabetes. Sensor network can be deployed in aged person and grownup children for continuously monitoring there daily activities. Facilities of tele-Healthcare in rural areas has been researches in many countries India, Nepal and china but in urban areas have not been yet researches. Due to vastly increasing number of patient emergency room in hospital are almost full all time to overcome this problem to facilitate doctor's opinion at their home without the need of physical presence of doctor, a wireless sensor network that monitor patient vital sign and continuously communicate the recorded information in the doctor office is a better solution. If a patient is physically challenged can't be able to move from their place then a sensor is fixed to their body so that their requirement and need can be easily detected. [4] Wireless sensor network can also monitor and detect the old age people behavior like fall [7].

Tele-monitoring of patients and their physiological information: The physiological data collected by the sensor networks may be kept for an extended amount of time, so that it might be used for medical research .These small sensor nodes permit the subject a larger freedom of movement and permit doctors to spot predefined symptoms earlier and facilitate a better quality of life for the subjects compared to the treatment centers.

Drug administration in hospitals: If sensor nodes may be connected to medications, the probability of obtaining and prescribing the wrong medication to patients may be reduced, because patient will have sensor nodes that may determine their allergies and their type of needed medications.

3. Environmental Applications

The capabilities of wireless sensor network are utilized in the realization of wide variety of environmental applications. some application of wireless sensor network in environment include tracking the movement of birds, Insects ,small animal; monitoring environment condition that effect on crops and livestock; irrigation; chemical/biological detection; Precision Agriculture, earth and environment monitoring in marine, soil; forest fire detection, some environment condition like Tsunamis, Storm and hurricane and flood detection.

Forest fire detection: By using radio frequency lots of sensor node element may be deployed in area where precise origin of the fire to the end users before the fire is spread uncontrollable.

Precision Agriculture: The ability to observe the pesticide level the extent level of soil erosion, drinking water and level of air pollution in real time observation.

Tsunami Detection and Response: Due to geographical change altering the face of the earth tsunami become more frequent. The intensity of tsunami can cause enormous financial as well as human loss. Whenever a tsunami strikes an area their major infrastructure like bridge, road and hospital etc. are most affected which delay the rescue mission and increase the probability of greater number of mortality rate. To overcome from this problem a semantic sensor has been proposed that perform service like generating alarms so that users can get knowledge of actual time changes. [4]

Volcano monitoring: Continuous human access to the environment is impossible so sensor network is used in that environment .Volcano monitoring is an example, where sensor node can be easily deployed near to the active volcano to continuously monitor their activities and provide at a scale and resolution not precisely possible with existing tool .The main goal of the node is to collect the information based on the earthquake that occur near the volcanoes.

Flood Detection: It require a large area to be covered with sensor. Due to limited communication range of each individual sensor node, A network topology sensor node is used having different types of node are used having different function in the system these sensor node are Computation node, Sensing node Government office interface node and community interface node.[10]

4. Home application

As technology advances, smart sensor nodes and actuators can be buried in appliances, such as vacuum cleaners, micro-wave ovens, refrigerators, DVD player and VCRs. These sensor nodes inside domestic devices can interact with one another and with the external network via the internet or Satellite. They all end users to manage home devices locally and remotely. Wireless sensor network provides interconnection of various devise at residential places with control of various application at home.

Water Monitoring: The nonintrusive Autonomous water monitoring system (NAWMS) for home is recently been developed by using wireless sensor network. The main aim of NAWMS is to control the wastage in water usage and inform tenants about more efficient usage. The operating principle of NAWMS is based on the fact that the water flow in a particular pipe can be estimated by measuring the vibrations of that pipe because of the proportional relationship between the two. [10]

Smart environment: By two different views we can design the Smart environment first one is human centered and second one is technology-centered. For human-centered, a smart environment needs to adapt according to the requirement of the end users in terms of input/output capabilities.[23]For technology-centered, new hardware technologies, networking solutions, and middleware services have to be compelled to be developed. How sensor nodes may be used to produce a smart environment, creates such circumstances. The sensor nodes can be embedded into appliances and furnishing, so that they will communicate with each another and also with the room server. {The room /the space/the area} server also can communicate with other room servers to find out about the services they offered, e.g. printing, scanning, and faxing. These sensor nodes and room servers may be integrated with existing embedded devices to become self-organizing, self-regulated and Adaptation-al systems. The sensing and computing environment must be reliable, persistent, and transparent. [1][25]

Gas meter monitoring: Due to day by day development of urban areas, Natural gas parameter is installed at each house which minimize the amount of time wasted.[4] natural gas parameter are installed at each shop ,house or industries so that the billing procedure is depending on the amount of gas consumed by each user.[33]

5. Industrial

Wireless sensor network have long being used in industrial sensing, access control, control application and building automation. The applicability of these system is limited by cost associated due to the deployment of sensor node. Moreover, for upgrading this system if sensor are deployed in and industrial plant then this system would cost almost as much as a new system.in addition to sensor based monitoring system, manual monitoring has been used in industrial application for preventing maintenance. [10] Manual monitoring is performed by using handheld analyzers that collected from central location for analysis. Wireless sensor network provide an alternative solution due to their high accuracy, high granularity, ease of deployment through battery power wireless communication system. [16]
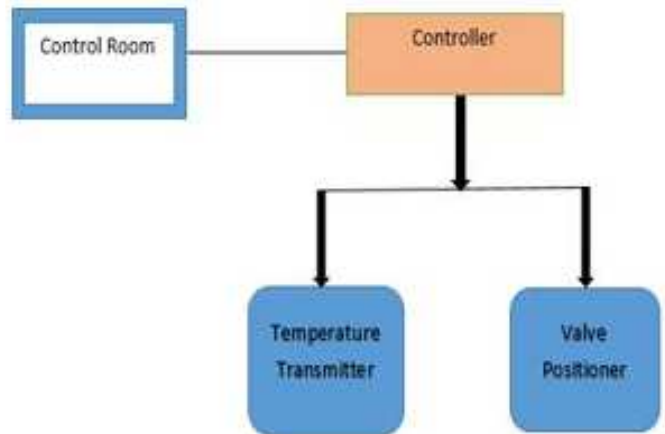

Fig.2 Industrial use control system

Preventive maintenance: since it provide profitable solution for long term operation of expensive equipment's preventive maintenance has been utilized in many large industrial plants. The accelerometer sensor attacked to the equipment that monitor the health through vibration analysis technique. Based on the established science that maps a particular signature for proper functioning device a semiconductor fabrication hundred-thousand of sensor track the vibration of various equipment, the machine are monitor continuously.

Structural health monitoring: Wireless sensor network is used in structural health monitoring (SHM) application where the distributed sensor track the temporal pattern of vibration induced throughout the structure.

6. Traffic Monitoring

Traffic monitoring systems generate huge amount of understanding where the systems must process these useful information, especially those systems that involve historical information to perfectly estimate current state of traffic. A system that monitors and reports the physical condition of roads such as slipperiness factor, humidity and road works etc.; Information generated from this system could be integrated with SMS based services that alert users about congestion, automatic traffic light timers, geographic information systems that suggest less congested paths or roads which are less damaged, systems that trigger road maintenance work and analysis tools that help to manage traffic and plan extensions to the road network ,which will enhance the efficiency of traffic circulation , minimize risks and time to take corrective actions both on design and management levels.

7. Marine Monitoring

In wireless sensor network various kind of sensor are used to monitor and measure different physical and chemical parameter like water temperature, pressure, wind speed, wind direction ,pH, oxygen density, chlorophyll levels and salinity so that we can easily collect data. Marine environment system are vulnerable effect of human activities related to industries, tourism and urban development [6]. Marine environment is monitor by using oceanographic research vessels which is very expensive and time consuming process. For marine environment wireless sensor network based approach is access the real-time data covering large geographical area and for a long time period.[29] The marine environmental monitoring system

generally consists of two major parts: Wireless Underwater Acoustic Networking and Wireless Aerial Networking

A. **Wireless Underwater Acoustic Networking:** This part consists of underwater sensor nodes and autonomous underwater vehicles, which are deployed to bear out cooperative surveillance during a given area. [30]

B. **Wireless Aerial Networking:** This consists of a number of wireless sensor nodes deployed on the water surface that provide a proper communication between a base station and sensor node without any loss of data.[31][32]

III. CONCLUSION

The comprehensive survey of wireless sensor network program has been experienced in this paper. Wireless sensor network consists of sensor node with sensing data processing with wireless component the wireless sensor network area monitoring, military applications, Environment applications, Health detection (how people could benefit from home using wireless sensor technology for the betterment of life) and the Home application has been briefed here. The traffic network with the distrusted parameter will become more measurable and controllable. Monitoring of the marine environment is become a highly promising technique of wireless sensor network. Due to easy deployment ,actual-time monitoring , low cost with automatic operation wireless sensor network for marine environment monitoring including oceanographic sensor protection, energy harvesting system design and system stability and reliability.

REFERENCES

[1] Ajaz Ahmed Khan 1, Mrs Himani Agrawal 2 Associate Professor, Dept. of Electronics and Telecommunication Engineering, Shri Shankarcharya Group of Institutions Bhilai, Chhattisgarh, India2-A Survey Paper on Applications and Challenges in Wireless Sensor Network International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 5, Issue 1, Januray 2016

[2] Abhishek Pandey Indian Institute of Information Technology, Allahabad R.C. Tripathi Indian Institute of Information Technology, Allahabad- A Survey on Wireless Sensor Networks Security International Journal of Computer Applications (0975 – 8887) Volume 3 – No.2, June 2010

[3] B. P. Sreeja, 2L.Jayakumar, 3G. Saratha Devi 1,2 Assistant Professor, Department of Information Technology, Karpagam college of Engineering, Coimbatore, India 3Department of Computer Science and Engineering, VFSTR, Vadlamudi, Andhra Pradesh, India- WIRELESS SENSOR NETWORK APPLICATIONS: A STUDY International Journal of Pure and Applied Mathematics Volume 118 No. 11 2018, 385-389

[4] Bushra Rashid, Mubashir Husain Rehmani Institute of Information Technology, Wah Cantt, Pakistan-Applications of wireless sensor networks for urban areas: A survey, Journal of Network and Computer Applications Article history: Accepted 28 September 2015

[5] Gang Zhao Digital Technology Laboratory Davis, CA, 95618, United States- Wireless Sensor Networks for Industrial Process Monitoring and Control: A Survey, Received: February 6, 2011

[6] Guobao Xu 1 , Weiming Shen 2,* and Xianbin Wang 2 Lab of Ocean Remote Sensing & Information Technology, Guangdong Ocean University, Zhanjiang 524088, 2 Department of Electrical and Computer Engineering, The University of Western Ontario, London, Applications of Wireless Sensor Networks in Marine Environment Monitoring: A Survey,Sensors 2014, 14, 16932-16954; doi:10.3390/s140916932

[7] K. Premkumar1, S. Padmapriya2 R. Priyadharshani3, Kapaganti Priyanka4 1,2,3,4 Department of Computer Science Engineering, SMVEC - a survey on healthcare monitoring system using wireless sensor networks (wsn),International Journal of Pure and Applied Mathematics Volume 118 No. 14 2018, 485-492

[8] Poonam Prasad CSIR-National Environmental Engineering Research Institute, Nagpur, India- Recent trend in wireless sensor network and its applications: a survey, Sensor Review 35/2 (2015) 229 –236 © Emerald Group Publishing Limited [ISSN 0260-2288] [DOI 10.1108/SR-08-2014-683] Accepted 8 December 2014

[9] Applications of Wireless Sensor Networks in Marine Environment Monitoring: A Survey Guobao Xu 1 , Weiming Shen 2,* and Xianbin Wang 2 Lab of Ocean Remote Sensing & Information Technology, Guangdong Ocean University, Zhanjiang 524088, China; E-Mail: xuguobao@126.com 2 Department of .Electrical and Computer Engineering, The University of Western Ontario, London, Ontario N6A 5B9, Canada - Survey on application of wireless sensor networks for traffic monitoring, International Conference on Transportation Engineering 2007 (ICTE 2007)

[10] Wireless sensor network- Ian F. Akyildiz, Georgia Institute of Technology, USA

[11] Padmapriya, V., Amudhavel, J., Gowri, V., Lakshmipriya, K., Vinothini, S., PremKumar, K., "Demystifying challenges, opportunities and issues of Big data frameworks", (2015) ACM International Conference Proceeding Series, 06-07- March-2015

[12] Karthikeyan, P., Deepika, P., Amudhavel, J., Saranya, M., Infanta, E., Nandhini, C., "Impact on self-organization in Mobile AdHoc Networks: An comprehensive review", (2015) ACM International Conference Proceeding Series, 06-07-March-2015

[13] Jaiganesh, S., Jarina, S., Amudhavel, J., Premkumar, K., Sampathkumar, S., Vengattaraman, T., "Performance analysis of collision avoidance frame works in VANETS", (2016) Indian Journal of Science and Technology.

[14] W. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "An application-specific protocol architecture for wireless microsensor networks," IEEE Transactions on Wireless Communications,

[15] Yunus, E. A.; Ibrahim, K.; Özgür, U. A framework for use of wireless sensor networks in forest fire detection and

monitoring. Comput. Environ. Urban Syst. 2012, 36, 614–625.

[16] Silva, I.; Guedes, L. A.; Portugal, P.; Vasques, F. Reliability and Availability Evaluation of Wireless Sensor Networks for Industrial Applications. Sensors 2012, 12, 806–838.

[17] Zhao, G. Wireless Sensor Networks for Industrial Process Monitoring and Control: A Survey. Netw. Protoc. Algorithms 2011, 3, 46–63.

[18] Li, X.; Deng, Y.; Ding, L. Study on precision agriculture monitoring framework based on wsn. In Proceedings of the 2nd International Conference on Anti-counterfeiting, Security and Identification (ASID 2008), Guiyang, China, 20–23 August 2008; pp. 182–185.

[19] Qian, H.; Sun, P.; Rong, Y. Design Proposal of Self-Powered WSN Node for Battle Field Surveillance. Energy Proced. 2012, 16, 753–757.

[20] Padmavathi, G.; Shanmugapriya, D.; Kalaivani, M. A Study on Vehicle Detection and Tracking Using Wireless Sensor Networks. Wirel. Sens. Netw. 2010, 2, 173–185.

[21] Tacconi, D.; Miorandi, D.; Carreras, I.; Chiti, F.; Fantacci, R. Using wireless sensor networks to support intelligent transportation systems. Ad Hoc Netw. 2010, 8, 462–473.

[22] Tubaishat, M.; Zhuang, P.; Qi, Q.; Shang, Y. Wireless sensor networks in intelligent transportation systems. Wirel. Commun. Mob. Comput. 2009, 9, 287–302.

[23] Lee, H.; Wu, C.; Aghajan, H. Vision-based user-centric light control for smart environments. Pervasive Mob. Comput. 2011, 7, 223–240.

[24] Bangali, J.; Shaligram, A. Energy efficient Smart home based on Wireless Sensor Network using Lab VIEW. Am. J. Eng. Res. 2013, 2, 409–413.

[25] Handcock, R. N.; Swain, D. L.; Bishop-Hurley, G. J.; Patison, K. P.; Wark, T.; Valencia, P. Monitoring Animal Behaviour and Environmental Interactions Using Wireless Sensor Networks, GPS Collars and Satellite Remote Sensing. Sensors 2009, 9, 3586–3603.

[26] Nadimi, E. S.; Jørgensen, R. N., Blanes-Vidal, V.; Christensen, S. Monitoring and classifying animal behavior using ZigBee-based mobile ad hoc wireless sensor networks and artificial neural networks. Comput. Electron. Agric. 2012, 82, 44–54.

[27] Bahrepour, M.; Meratnia, N.; Poel, M.; Taghikhaki, Z.; Havinga, P. J. M. Distributed event detection in wireless sensor networks for disaster management. In Proceedings of the 2010 2nd International Conference on Intelligent Networking and Collaborative Systems (INCOS), Thessaloniki, Greece, 24–26 November 2010; pp. 507–512.

[28] Lacono, M.; Romano, E.; Marrone, S. Adaptive monitoring of marine disasters with intelligent mobile sensor networks. In Proceedings of the 2010 IEEE Workshop on Environmental Energy and Structural Monitoring Systems (EESMS), Taranto, Italy, 9 September 2010; pp. 38–45.

[29] Albaladejo, C.; Sánchez, P.; Iborra, A.; Soto, F.; López, J. A.; Torres, R. Wireless Sensor Networks for Oceanographic Monitoring: A Systematic Review. Sensors 2010, 10, 6948–6968.

[30] Thiemo, V.; Fredrik, O. S.; Niclas, F. Sensor Networking in Aquatic Environments-Experiences and New Challenges. In Proceedings of the 32nd IEEE Conference on Local Computer Networks, Dublin, Ireland, 15–18 October 2007; pp. 793–798.

[31] Tateson, J.; Roadknight, C.; Gonzalez, A.; Khan, T.; Fitz, S.; Henning, I. Real World Issues in Deploying a Wireless Sensor Network for Oceanography. In Proceedings of the Workshop on Real-World Wireless Sensor Networks, Stockholm, Sweden, 20–21 June 2005; pp. 20–21.

[32] Boonma, P.; Suzuki, J. An Adaptive, Scalable and Self-Healing Sensor Network Architecture for Autonomous Coastal Environmental Monitoring. In Proceedings of the IEEE Conference on Technologies For Homeland Security, Woburn, MA, USA, 16–17 May 2007; pp. 1–8.