International Journal of Latest Research in Engineering and Technology (IJLRET)
ISSN: 2454-5031
www.ijlret.com ǁ PP.24-27

Reliability and Energy Management Issues in Cognitive Wireless Sensor Networks: A Literature Review

Arunkumar B R [1], B. Muthuramalingam[2],
[1]*Prof. & Head, Dept. of MCA, BMS Institute of Technology & Management, Bangalore and Research Supervisor, V.T.U-RRC, Belagavi, India,arunkumarbr@bmsit.in*
[2]*Asst.Professor, Dept. of MCA, Sir M V Institute of Technology, Bangalore and Research Scholar, V.T.U-RRC, Belagavi, India*
Bmuthuraman75@gmail.com

Abstract: The most important requirements in many wireless sensor networks are reliability and energy management issues. In WSN, more energy is consumed during data transmission than sensing. Reliability is reduced due to increase in energy consumption by redundant data. Therefore it is essential to support energy efficient reliable data transport in WSN. Due to scarcity of resources and majority of these resources are utilized by urban areas, it is important to make cities greener and more sustainable. Hence smart cities are introduced recently. Automation process within a city will play a key role in smart cities. Energy consumption takes place when sensors sense the data and transport the same as part of automation. So wherever sensors are used, energy related issues in turn reliability should be considered. In this paper, we review some of the reliability and energy management issues in wireless sensornetworks.

Key words*:* Advanced sensing, Cognitive approach, , Energy management, Reliability, Smart city.

I. Introduction

Wireless Sensor Network (WSN) refers to a group of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions such as temperature, sound, pressure etc. The development of WSNs was motivated by military applications such as battle field surveillance. Today WSN is used in many industrial process monitoring, commercial applications, healthcare, agriculture and smart city construction.

The WSN is built of nodes from a few to several hundreds or even thousands, where each node is connected to one or several sensors. Each sensor network has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a micro controller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. The topology of WSN can vary from simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

Wireless Sensor Networks are basically resource constrained. Some of the key issue in WSNs are reliability, energy efficiency, deployment, self- configuration, routing, security , quality of service and etc. This paper is concern about reliability and energy management issues. There are number of protocols have been proposed to address the reliability issues in WSNs. Due to the convergent number of traffic in WSNs, all sensor nodes in the network tends to inject their captured data towards the sink. With the increase of traffic flow, the network starts getting congested; this becomes the cause of packet loss, because there is not enough buffering space in sensor nodes. Besides losing packets through congestion, packets are also lost due to transmission error, packet collision, interference, node failure or any other unforeseeable reasons. Thus to ensure reliability, the lost packets need to berecovered.

Sensor nodes are generally battery powered devices; the critical aspect is how to reduce the energy consumption of nodes, so that the network life time can be extended to reasonable times. This power source often consists of a battery with a limited energy budget. It could be impossible or inconvenient to recharge the battery, because nodes may be deployed in a hostile or unpractical environment.

Therefore, in the resource constrained wireless sensor networks, reliability and energy efficiency issues are the primary concern .This research work is to investigate reliability and energy efficiency issues in Wireless Sensor Networks using cognitive technology.

II. Literature Review

The literature survey has been carried out to review the two key component issues of the research work namely: Reliability and Energy Management.

2.1 Reliability

The applications of sensor networks have influenced all areas of automation. The extensive applications of sensors will be found in the prospective areas. Sensors are being used for monitoring temperature, occupancy, smoke, fire and security. Applications of wireless sensor networks includes building automation, industrial control, home automation, environmental monitoring, health care, smart city construction, agriculture sector, commercial applications, biological applications etc.[1]. Such several applications rely on reliability of sensors which are working collectively.

In WSNs, there will be several sensor nodes and a sink node. The sensor nodes continually sense data from the environment and send them to the sink node, in turn the sink node process it and sends them to the end user. Given the nature of error prone wireless links, ensuring reliable transfer of data from resource constrained sensor nodes to the sink is one of the major challenges in WSN. In WSNs, the reliability can be classified in to different levels: Packet or event reliability, hop- by- hop or end to end reliability level. Packet reliability requires all the packets carrying sensed data from all the sensor nodes to be reliably transported to the sink. Event reliability ensures that the sink only gets enough information about a certain event happening in the network instead of sending all the sensed packets.

In hop-by-hop, the next hop is responsible for ensuring the reliable transmission of information to the destination. In end- to- end reliability, only the end points i.e. source and destination nodes are responsible for ensuring the successful transmission of information.Retransmission based loss recovery can also be either end to end or hop by hop. In end to end , the source performs retransmission. In hop by hop , an intermediate node that intercepts loss notification searches its local buffer. If it finds the lost packet, it will triggertransmission.[3]

Protocols for reliability issues are STCP, ESRT, RMST, RBC, GARUDA, PSFQ and etc. [3]. A number of protocols have been proposed to address the reliability in WSNs. Here data comes from the entire sensor node to the sink node. With the increase of traffic, the network starts getting congested, causes packet loss. Also there is not enough buffering space in sensor nodes [2]. The existing transport protocols for WSNs basically assume that single-path routing and do not consider multipath routing[3].

In wireless environment, both congestion and link level bit error can cause packet loss, which affects end to end reliability. Other factors which can result in packet loss include node failure, wrong or outdated routing information and energy depletion [3]. Communication is a major source of energy consumption in WSNs. MAC protocols directly controls the radio of the nodes in the network. MAC protocols should be designed for regulating energy consumption. Making some of the nodes to transmit data directly to the base station will reduce energy consumption [7].

2.2 Energy Management

Sensor nodes usually have limited energy. As a result, it is important for transport protocols to maintain high energy efficiency in order to maximize system lifetime. Congestion in WSNs has a direct impact on energy efficiency and application's quality of service. First, the congestion can cause buffer over flow, longer queuing time and more packet loss. The packet loss not only degrades reliability, but also wastes limited energy and lowers energy efficiency. Therefore congestion in WSNs must be efficiently controlled. There are three mechanisms which deals this problem: congestion detection, congestion notification and rate adjustment [3].

Transport protocols for wireless sensor networks addresses issues like energy efficiency, quality of service, congestion control problems.Several works have shown that energy consumption is mainly due to data transmission, consequently energy conservation schemes have been proposed to minimize the energy consumption of the radio interference [4]. Social issues in wireless sensor networks with health care perspective has introduced a new field called wireless body area network. In this using wearable and non-wearable sensor devices, humans can be tracked and monitored [5].

To reduce the overall energy consumption of the network, research community has been tackling power management techniques on different levels- sensing, communication, computation and energy harvesting [16]. As sensor nodes are generally battery-powered devices, the critical aspects are how to reduce the energy consumption of nodes, so that the network life time can be extended. Efficient data acquisition is one such technique to reduce the energy consumption[17].

In recent years, particularly with the proliferation in Micro-Electro-Mechanical System technology which facilitated the development of smart sensors. These sensors are small with limited processing and computing resources [6].

2.3 Conventional Wireless SensorNetworks

Wireless sensor network communications are event driven. Wireless sensor nodes generate busty traffic whenever an event triggers. During an event, wsn nodes deployed in the same area try to access a channel. Self-organizing ability and life time of wireless sensor nodes are important because of the heterogeneity nature of the

network and deployment of sensors in inaccessible terrain[19]. In a conventional WSN scenario, hundreds of WSN nodes are deployed throughout the sensor field and the distance between two neighboring wsnodes are limited to few meters[19]. Collecting the data from the ws node is done by sink node or base station through single or multihop manner. The collected data is sent to the user via gateway, often using the internet or any other communication channel [19]. In recent years, to achieve the required network performance, hardware and software enhancement, power aware MAC, cross layer design technique, etc., has been implanted, but these techniques have their own limitations[19].

2.3 Adopting Cognitive Approach in WSN

To overcome the limitations imposed by conventional wsns, cognitive techniques have been used. The cognitive technique is the process of knowing through perception, planning, reasoning, acting and continuously updating and upgrading with a history of learning [19].

Sensor networks will play a fundamental role in future intelligent building. There are two basic areas that has to be addressed are reliability and energy conservation. However the application of cognitive technology in wireless sensor networks has got importance in recent years. This technology not only provides access to new spectrum but also provides better propagation characteristics. The concept of adding cognition to WSNs provides following advantages such as higher transmission range, fewer sensor nodes required to cover specific area, better use of the spectrum, low energy consumption, better communication quality, lower delays, better data reliability[8].

Table1. Prospective capabilities of wireless sensor with cognitive technique [19].

Function- Cognitive capabilities	Action
Spectrum Sensing	Detect unused spaces by the incumbents in the spectrum bands.
Spectrum Sharing	Use the unused white spaces of incumbents and share the white space information with cognitive users.
Prediction	Predict the arrival of incumbents on the channel.
Fairness	Distribution of spectrum utilization opportunities fairly among cognitive users.
Routing	Route the packet to the destination efficiently considering the network life span, load balancing, shortest route and delay in multi-hop C-WSN
Reconfiguration Capability	Reconfigure and adjust according to the environment out comes.
Environment Sensing	Sensing the environment factors as in conventional wireless sensors.
Trust and Security	Building a trustable environment and secure networks.
Power Control	Control transmission power considering the legal boundaries and requirements.

III. Smart City and Sensors

City which functions in a consistent and intelligent way by integrating all its infrastructures and services in a most effective way is called smart city. Increase in population, shortage of resources, climate change directs in search of greener and more energy efficient urban areas. Recent prediction is, the global economy will be disproportionate due to tremendous growth of cities. This faster growth challenges the existing energies and climate change. To handle these challenges, resource efficient, technology driven smart cities are introduced[21].

Sensing is the heart of smart infrastructure. Services like traffic monitoring, public infrastructure such as bridges, roads, and buildings which enables a more efficient use of resources. Sensing the data, information and resource sharing will play a key role in creating a smart city [21]. Therefore, wherever there is an exchange of information, loss of information cannot be tolerated. Hence in the sensing environment reliability and energy management will play a vital role.

IV. Conclusion

Researchers and industry are working to improve the performance of WSNs in terms of cost, energy consumption, data rate, robustness, networks throughput, Qos and security, etc.[19]. This cognitive technology not only provides access to new spectrum but also provides better propagation characteristics. The concept of adding cognition to WSNs provides following advantages such as higher transmission range, fewer sensor nodes required to cover specific area, better use of the spectrum, low energy consumption, better communication quality, lower delays, better data reliability [8].

References

[1]. Edwin premkumar gilbert, Baskarankaliaperumal,et.al- Research issues in wireless sensor network applications: Asurvey-International Journal of Information and Electronics Electronics Engineering, vol.2, No.5, September2012

[2]. Chonggangwang, Mahmoud daneshmand , Bo Li, kazemsohrabt- A survey of transport protocols for wireless sensor networks.-AcceptedtoappearinIEEENetworkMagazinespecialissueonWSNs

[3]. Giuseppe Campobello, Alessandro leonardi, Sergio palazzo- Energy saving and reliability in wireless sensor networks using a CRT- based packet splitting algorithm- IEEE/ACM Transactions on Networking volume 20 Issue 1, February2012

[4]. Moshaddique al amen and kyung-sup kwak- Social issues in wireless sensor networks with health care perspective- TheInternationalArabJournalofInformationTechnology,vol8,no,1,January2011

[5]. Neelamsrivastava - Challenges of next-generation wireless sensor networks and its impact on society-Journal of Telecommunications,volume1,issue1,February2010

[6]. Gowrishankar.S, T.G.Basavaraj,et.al- Issues in wireless sensor networks- Proceedings of the world congress on Engineering 2008, Vol 1,London,U.K

[7]. Md. Alimulhaque, Md.Faizanuddin, N.K. Singh - A study of cognitive wireless sensor networks : Taxonomy of attacksandcountermeasures-WorldAppliedProgrammingVol2,Issue11November2012

[8]. I.F. Akyildiz, w.Su, Y.Sankarasubramaniam and E.Cayirci- Wireless sensor networks:Asurvey- The International journalofcomputerandTelecommunicationsNetworking,vol4,15March2002

[9]. Giuseppe anastasi, Marco conti, Mariodi Francesco, Andrea prassarella- Energy conservation in wireless sensor networks-AdhocNetworks,ElsevierSciencepublishers,vol7,Issue3,May2009-

[10]. Lance Doherty, Jonathan simon and Thomas watteyne.- Wireless sensor network challenges and solutions- Microwave journal, August2012

[11]. Yih-chuanlin, Kai-weijiang Adaptive concentric chains protocol for energy efficient routing in WSNs-Journal of wirelesscommunicationsandMobilecomputing,volume12,p.631-651,May2012.

[12]. Aqueelurrehman, Abuzafarabasi, Noman islam, Zubairahmadshaik- A review of wireless sensors and network's applicationsinagriculture-ComputerstandardsandInterfaces,volume36,issue2,p263-270,February2014

[13]. Guirkan tuna, V.cagrigungar, Kayhangulez- Wireless Sensor Networks for smart Grid applications: A case study on link reliability and node life time evaluations in power distribution systems-International journal of distributed sensor networks, January2013

[14]. Noorazaman, Law tang jung, Fawaz and Turkialghamdi- Wireless Sensor Network: Routing security, reliability, and energy efficiency – Journal of Applied sciences- 19thjune2012

[15]. Shivprasadkori, R.k. Baghel - Reliability analysis of the energy efficient cluster technique for WSN-International Journal of Computer Applications vol. 82- November2013.

[16]. Van Jelicic- Power management in Wireless Sensor Networks with High Consuming Sensors- JELICIC Qualifying doctoral examination- April2011.

[17]. Giuseppe Anastasi, Marcoconti, et.al- Energy conservation in wireless sensor networks: Asurvey – ELSEVIER- ADHOC Networks, volume 1, May2009.

[18]. Sandra sendra, JaimeLloret, et.al- Power saving and energy optimization techniques for Wireless Sensor Networks- Journal of communications, Volume 6, September2011

[19]. Gyanendra Prasad Joshi, seungyeobnam, et.al- Cognitive Radio Wireless Sensor Networks; Applications, Challenges and Research Trends- Sensors2013.

[20]. Santarpalsingh, S.C.Sharma – A Survey on Research Issues in Wireless Sensor Networks – Open Transactions on Wireless Sensor Networks, Volume2, Number 1, March2015.

[21]. Gerhard P Hancke, Bruno decarvalho e silva, et.al- The Role of advanced sensing in Smart Cities-Sensors (Basel) 2013 – Published online 2012.