International Journal of Emerging Research in Management &Technology ISSN: 2278-9359 (Volume-3, Issue-9)

Research Article | **September 2014**

Technical Session Management through Wireless Networks

Rakesh Ranjan
Department of Computer Science & Engineering
MACET, India

Abstract—

This paper presents a new application namely efficient management of technical session like conference/workshop etc. of wireless network/ Wireless Sensor Networks (WSN).

Keywords— Sensor Node, WSN, Access Point, Wireless Network, Management

I. INTRODUCTION

This There are enormous numbers of applications of Wireless Sensor Networks (WSNs) ranging from small scale to large scale for military, agriculture, education, health, structural monitor, surveillance etc. Size of sensor nodes enables many more applications. Advancement in nanotechnology, mechanical engineering, electrical engineering, communication engineering, and computing engineering help in designing a new device which is known as sensor nodes. These devices do computation, communication and sensing. Sensor nodes have resource constraint in nature that is these devices have limited computation capability, short range of sensing & communication and limited battery power. Small in size creates opportunity to develop many applications but also gives the opportunity for new research problem due to their resource constraint nature. These resource constraints have allow rethink for almost all domain of research like Hardware design (decrease in size), software design (requirement of new operating system, new programming language etc.), new coverage problem, new clustering protocol, new routing protocols, new security problem etc. In most of the applications, sensor nodes are self battery powered operated so it becomes one of the most important and challenging issue is to prolong the life of individual battery power so as to prolong the life of wireless sensor networks. Applications of WSNs may be divided into two broad categories: 1. applications based on static deployment and 2. applications based on dynamically/randomly deployment. There are many applications where human being cannot reach to the target area as environment may not be conducive for human life like near volcano, in dense forest, under the sea bed etc.

These sensor devices make wireless sensor networks in collaboration, autonomously. Once topology is being defined, all or few sensor nodes of WSN sense the respective parameter(s) of eco system. Now it is responsibility of ether individual or group to send the sensed data to Base Station (BS) either in one hop or multi-hops [2, 3].

Now, following paragraphs present some of the important applications:

Smart parking: Smart parking is latest application of WSN, which help the detection of vehicles in parking area by using magnetic sensor along with ultrasonic sensors. WSNs are widely used in smart parking. Magnetometer which is used in this application detects inaccurate value and it effects by environmental factor.

Vehicular Telematics: This application uses heterogeneous WSN. This application focuses on radio link control, congestion control, routing, security aspects. This application supports transmission of multimedia and Quality of Service (QoS).

Security of Intra-Car: Weight of car, one of the factors for fuel efficiency, can be reduced by using sensor nodes connected in wireless mode. But this increases the security problem in communication in intra-car [10].

Event Detection: In most of the applications of WSN, event detection and tracking is most important. This becomes more challenging in the case of array of sensors and heterogeneous environment. Authors [11] try to provide the solution for the same.

Structural Health Monitoring:

Such application is meant for detecting of damage for civil, aerospace and other engineering systems, known as Structural Health Monitoring (SHM). Every mechanical or physical materials get weak due to continuous wear and tear processes resulting in damage. Sometimes this may be a life threatening also. So, manual monitoring of structural is not feasible and sometimes not possible. So this process may be automated using WSNs [12, 13, 14] .

Greenhouse Monitoring

It is very important to monitor the eco parameters at different coordinates of greenhouse. This can be done by wired network with all difficulty of installation and maintenance as the complete system results in meshed up. The same thing can be done using WSN with low cost of implementation and maintenance. Authors [15] present the same.

Healthcare Applications: Today, WSNs are used in day-to-day applications. There are many applications in healthcare domain. Like Memory loss patient, remote patients monitoring by physicians and caretakers without affecting the patients' activities, continuous monitoring of suger level, Blood pressure etc [17].

Tracking and monitoring observer and participant inside conference: Each chair has small and light weight sensor nodes attached to them. Each sensor node has its specific task. For example every sensor node may be detecting the pressure rate. Observers carry a sensor node which allows locating every information.

Smart environment: The architecture of smart environment can have two different perspectives; i.e human-centered and technology-centered. For human-centered, a smart environment has to adapt to the needs of the end users in term of input/output capabilities. The sensor nodes can be embedded into furniture and appliances, and they can communicate with each other and the room server. The room server can also communicate with sink or base station (BS).

Section II presents the proposed problem of this paper. Section III explains the proposed algorithm of the proposed problem. Section IV discusses the results of the implementation. Section V concludes the paper.document is a template. An electronic copy can be downloaded from the Journal website. For questions on paper guidelines, please contact the conference publications committee as indicated on the conference website. Information about final paper submission is available from the conference website.

II. PROPOSED PROBLEM

Wireless sensor networks has a wide range of applications in every sphere of life that is biological applications (Biological Task Mapping [5], Biomedical Signal Monitoring[6]); commercial applications (Smart Parking [7,8], Vehicular Telematics [9], Security of Intra-Car [10], Event Detection [11], Structural Health Monitoring[12,13,14]); environmental applications(Greenhouse Monitoring, Habitat Surveillance [15]; vehicle tracking [16]), health applications [17]etc. These applications used in real-life activities for smooth conducting of the activities. In the same line, this paper proposes a problem for efficient and smooth organization of any technical conference/workshop using wireless sensor network. Further, this problem also formulates dissemination of information towards the registration desk. This problem also takes care of handling the queries of participants/organizers throughout the technical activities at the venue. easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

III. PROPOSED SOLUTION

This section proposes the solution for the application proposed in the Section II using WSN. The concept of routing and data aggregation for WSNs serves as the backbone of the propose solution.

The algorithm can be divided into three phases as initialization phase, periodic active scan phase, and reassociation phase. Following notations are used in the proposed algorithm:

TH :- Handoff threshold
TP :- Periodic threshold
maxChanAllowed :- Maximum number of channels allowed to be scanned
ScanPeriod :- Periodic scan interval
channelList:- Array of prioritized channels
channelIndex:- Index of channel scanned from the channelList array

Algorithm 1 The Proposed Algorithm

//First Phase: Initialization
1. *initialize channelList=1,2,3,4,5,6,7,8,9,10*
2. *channelIndex = 0*
   //Second Phase: Periodic Active Scan:
3. *monitor received power of all frames*
4. *if (receivedPower < TP && receivedPower > TH)*
5.   *start active scan for channel with channelList index = channelIndex*
6. *if(AP is detected till the minChannelTime)*
7.   *collect probe responses till the maxChannelTime and*
8.   *store entries for each AP in cache, sorted according to received power*
9.   *associate back with previously associated AP*
10. *else*
11.   *shift the channel to end of the channelList*

12. associate back with previously associated AP
13. channelIndex = channelIndex + 1
repeat steps 4-13 at an interval of ScanPeriod
/Third Phase: Reassociation
14. else if(receivedPower < TH)
15. stop periodic active scan and check cache
16. if(any entry present in cache for current AP)
17. try to reassociate with 1st AP
18. if(succeeded)
19. handoff completed
20. else
21. try to reassociate next AP until all entries are tried
22. else
23. start complete active scanning
24. continuously receive beacon frames and keep updating TP .

The algorithm can be divided into three phases, viz. initialization phase, periodic active scan phase, and reassociation phase. In the initialization phase, each MS initializes a channelList for each AP, wherein the channels are arranged in order of preference. Initially the channelList contains all the channels with channel 1, 5, and 10 as the first three channels (as there are more chances of an AP present there). When the MS moves away from AP, the received signal strength of frames decreases. The MS continuously monitors the received power of all frames (data and beacons). When it falls below TP, MS starts periodic channel scan by scanning first channel from the channelList. This channelList array is updated at every channel scan. If a channel is found idle during the minChannelTime, it gets shifted at the end of the list. Thus it builds a list of channels in the channelList, arranged in the order of preference.

In the active scanning mode, the MS starts scanning a channel by sending probe request packet on it. The MS expects probe response by the minChannelTime. The minChannelTime is the time for which the MS waits, to determine whether any AP is present on that channel or not. If no probe responses are received by the minChannelTime, the MS moves to the next channel and repeat the same procedure. But if probe responses are received by the minChannelTime, it waits till the maxChannelTime, expecting more probe responses as more than one AP may be present on that channel. After the maxChannelTime has elapsed, the MS stops collecting probe responses and it tunes its transceiver to next channel for scanning.

After all channels are scanned, the received probe responses are processed to elect an AP to be associated with. The IEEE 802.11 standard does not specify any criteria for choosing an AP, so different vendors uses different criteria for AP selection commonly based on SSID, signal strength, and signal-to-noise ratio [2].

The MS stores the positive results of periodic channel scan in cache. For each probe response received, the MS marks an entry in the cache. If an entry for that AP already exists, it is updated by overwriting the old entry. The AP cache consists of a table which uses current MAC address as the key as shown in table I.

TABLE I: STRUCTURE OF CACHE

Current AP MAC	*New AP MAC*	*Channel*	*SSID*	*Signal Strength*
AP1	AP2	5	Default	-84
AP1	AP3	10	Default	-84.225

Corresponding to each entry in the cache, the MAC address of adjacent AP along with the channel is stored. Other fields are the channel, received signal strength and SSID. The entry per AP in the cache is limited to eight, meaning that for each AP it can store details of eight adjacent APs. The cache entries are invalidated as soon as a handoff occurs. After the minChannelTime or the maxChannelTime, depending on presence of an AP on that channel, the MS again associates back to the previously associated AP, thus resuming the communication from where it had stopped. The breakage of communication due to this periodic channel scan is either the minChannelTime or the maxChannelTime plus the reassociation delay, needed to associate back to previous AP. The suggested optimal values, deduced from previous experiments, are approximately 6.5ms for the minChannelTime and 11ms for the maxChannelTime [1]. The simulation result shows that the time taken to reassociate is approximately 3-4ms. Thus the latency generated from this would be less than the jitter bearable by most jitter critical applications like VoIP. (The maximum unnoticeable jitter for VoIP is

40ms [3]). The above procedure is repeated periodically until specified numbers of channels (MaxChanAllowed) are scanned one by one or the handoff threshold TH has reached. When the received power level of beacons or data packets falls below TH, the MS makes use of the cache to find an AP with maximum power level and tries to reassociate with it.
If reassociation is successful, the to and fro traffic will be routed through the new AP. In case of failure to reassociate, the MS tries to look for next best AP and try reassociating with it. This procedure is repeated until all APs in the cache are tried.

IV. IMPLEMENTATION AND RESULT

The proposed solution uses OMNeT++. This implementation uses three access points namely, AP1, AP2 and AP3. Movement specification file defines the movement pattern of the Mobile device. The Mobile device is initially associated to AP1 and hence all the packets initiated from the mobile device sent to base station is via AP1. For simulation purpose, Mobile device is migrated from communication range of AP1 into communication range of AP2. This process is known as handoff. Again this mobile device migrates from communication range of AP2 into communication range of AP3. Finally, handoff occurs between AP3 and PA1. During these three handoffs, the mobile device send all the packet towards base station via attached AP at that time. The parameters used for the simulations are summarized in Table II.

TABLE II: SIMULATION PARAMETERS

Parameter	*Value*
minChannelTime	5.5 ms
maxChannelTime	10 ms
maxChanAllowed	10
Transmitted Power	25 dBm
Threshold Power	-90 dBm
Handoff Threshold Power	-90.476 dBm
pathLossExponent	2.3

Transmitted power is the power consumed by an AP or mobile device with which a packet will be transmitted in the air interface. Threshold power is the minimum power level required for any packet to be accepted by an AP or mobile device. Handoff threshold power is the power level after which mobile station should start executing handoff process.
When mobile device boots up, it associates with an AP using complete active scan. During the movement, it may initiate a handoff. The Handoff time is difference between the time at which received power of the mobile device falls below Threshold Power and the time at which reassociation response from new AP is received. During this time the mobile device retrieves best AP entry from the cache, authenticates and reassociates with the found AP.
The channels are scanned periodically at a fixed period of ScanPeriod. The channel scan delay is measured as the difference in time between the time at which probe request is sent on the channel and expiring of minChannelTime or maxChannelTime, added with the time taken to associate back with the old AP.
This implementation measures the packet delay by using PING command which uses Internet Control Message Packet by sending data from the mobile device to the base station while it moves from one AP to another. The Round Trip Time (RTT) of response packets were traced to find out the packet delay due to periodic channel scan and handoff.

V. CONCLUSIONS

This paper has proposed a preemptive and adaptive handoff algorithm for management of technical event like conference/workshop etc. This paper has measured, analyzed and suggested means to reduce the MAC layer handoff latency by using periodic channel scan and caching the results, instead of every time scanning channels actively. The algorithm used periodic scan to find possible APs for future handoff and stored the list of APs in cache.

From the results we can see that cache access and associating with AP, found from cache, is very fast resulting into very small handoff latency. By properly choosing values for minChannelTime and maxChannelTime, the channel scan delay can also be controlled.

Also by taking periodic threshold TP as function of speed and number of channels to be scanned periodically, the algorithm is made adaptive to the situation.

REFERENCES

[1] Waharte, S., Ritzenthaler,K, And Boutaba, R. Selective active scanning for fast handoff in WLAN using sensor networks.
[2] Gast, M. 802.11 wireless networks, the definitive guide. O'Reilly and Associates, USA, 2002.

[3] Miras, D. A survey on network qos needs of advanced internet applications. INTERNET2 - QOS WORKING GROUP (November 2002).

[4] M. J. Handy, M. Haase and D. Timmermann, "Low Energy Adaptive Clustering Hierarchy with Deterministic Cluster-Head Selection", in Proc. of 4th International Workshop on Mobile and Wireless Communications Network, 2002.

[5] Y. E. M. Hamouda and C. Phillips, "Biological task mapping and scheduling in wireless sensor networks," in Proceedings of ICCTA, pp. 914-919, 2009.

[6] T. Camilo, R. Oscar, and L. Carlos, "Biomedical signal monitoring using wireless sensor networks," IEEE Latin-American Conf. on Communications, pp.1-6, 2009.

[7] S. Lee, D. Yoon, and A. Ghosh, "Intelligent parking lot application using wireless sensor networks," Intl. Symposium on Collaborative Technologies and Systems, pp. 48-57, 2008.

[8] S.V. Srikanth, P. J. Pramod, K. P. Dileep, S. Tapas, M. U. Patel, S. C. Babu, "Design and implementation of a prototype smart PARKing (SPARK) system using wireless sensor networks," Intl. Conf. on Advanced Information Networking and Applications Workshop, pp. 401-406, 2009.

[9] E. Hussain, G. Chow, V. C. M. Leung, R. D. McLeod, J. Misic, V. W. S.Wong, and O. Yang, "Vehicular telematics over heterogeneous wireless networks: A survey," Computer Communications, vol. 33, pp.775-793, May 2010

[10] H. Lee, H. M. Tsai, and O. K. Tonguz, "On the security of intra-car wireless sensor networks," IEEE 70th Vehicular Technology Conf, pp.1-5, 2009.

[11] K. P. Shih, S. S. Wang, H. C. Chen, and P. H. Yang, "CollECT: Collaborative Event detection and tracking in wireless heterogeneous sensor networks," Computer communications, vol. 31, pp. 3124-3126, September 2008.

[12] Q. Ling, Z. Tian, Y. Yin, and Y. Li, "Localized structural health monitoring using energy efficient wireless sensor networks," IEEE Sensors Journal, vol. 9, no.11, pp.1596 – 1604, 2009.

[13] D. D. L. Mascaranes, E. B. Flynn, M. D. Todd, T. G. Overly, K. M. Farinholt, G. Park, and C. R. Farrar, "Development of capacitance based and impedance based wireless sensors and sensor nodes for structural health monitoring applications," Journal of Sound and Vibration, vol. 329, pp. 2410-2420, June 2010

[14] C. C. Song, Y. C. Hsu, C. F. Feng, and Y. K. Chen, "Construction of a wireless sensor networking platform with vibration sensing and GPS positioning," ICROS-SICE Intl. Joint Conf, pp. 5570-5575, 2009.

[15] T. Ahonen, R. Veirrankoski, and M. Elmusrati, "Greenhouse monitoring with wireless sensor network," IEEE/ASME Intl. Conf. on Mechtronics and Embedded systems and Applications, pp. 403-408, 2008.

[16] G. Y. Ming and J. Rencheng, "A novel wireless sensor network platform for Habitat surveillance," Intl. Conf. on Computer Science and Software Engineering, pp. 1028-1031, 2008.

[17] H. Yan, Y. Xu, and M. Gidlund, "Experimental e-health applications in wireless sensor networks," Intl Conf. on Communications and Mobile Computing, pp. 563-567, 2009.

