International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2017 IJSRCSEIT | Volume 2 | Issue 3 | ISSN : 2456-3307

An Environmental Monitoring System Using LEACH and GPSR Technique In Wireless Sensor Networks

R. Arun Kumar, K. Suresh
PG Scholar, Department of Information Technology, Sri Venkateswara College of Engineering, Chennai, Tamil Nadu, India

ABSTRACT

Wireless sensor network is an effective approach for a wide variety of applications such as environmental monitoring, scientific exploration, and target tracking. HEAL method for Structural Health Monitoring can be used in bridges and railway tracks. HEAL is Hole detection and Healing used to detect the abnormalities around the sensor location and system connectivity which affects system performance. It searches the nodes that reaches the threshold level in clusters and replaces it by a set of backup sensors at those points before it gets failed. It is also an efficient scheme for restoring the network connectivity in partitioned.

Keywords : Low Energy Adaptive Clustering Hierarchy(LEACH), Greedy Perimeter Stateless Routing (GPSR), Neighbor Assisted Connectivity Recovery protocol (NACRP).

I. INTRODUCTION

A wireless network is any type of computer network that uses wireless data connections for connecting network nodes. Wireless networking is a method by which homes, telecommunications networks and enterprise (business) installations avoid the costly process of introducing cables into a building, or as a connection between various equipment locations. Wireless telecommunications networks are generally implemented and administered using radio communication. This implementation takes place at the physical level (layer) of the OSI model network structure. Examples of wireless networks include cell phone networks, Wireless local networks, wireless sensor networks, satellite communication networks, and terrestrial microwave networks.

During past decades WSNs have witnessed a relentless research activity to leverage the deployment of low cost, easy to maintain and energy efficient solutions to monitor natural phenomena and men-made activities. Recently, the surge of packet data traffic over the cellular network has leveraged IoT and Machine-Type Communications, thus making sensors part of an omnipresent communication network. Standardization bodies started several activities on WSN technology and its subsequent amendments at both PHY and Medium Access Control (MAC) layers is one exemplary case of such ongoing effort We consider in this work the latest for professionally installed star topology WSNs (STP-WSN).

In STP-WSNs temporary obstructions might clutter the LOS connection between sensors deployed over a wide survey area and the central coordination point or AP. When this occurs, sensors will be unable to report sensed data although they function properly. Depending on the particular monitored phenomena, faulty sensors might trigger unnecessary human intervention or safety alarms. Network connectivity is an important topic, by the critical transmission radius of a node The NACRP developed for the first time in this work tackles the same general context of but it provides a completely different solution since NACRP is a new protocol solving lack of connectivity under the centralized control of the AP.

They usually consist of a processing unit with limited computational power and limited memory, sensor MEMS (Micro-Electro Mechanical Systems) (including specific conditioning circuitry), a communication device (usually radio transceivers or

alternatively optical), and a power source usually in the form of a battery. A WSN is a group of specialized transducer with a communications infrastructure for monitoring and recording conditions at diverse locations.

II. METHODS AND MATERIAL

A. Properties of Wireless Communication Network

General

In a general sense, wireless networks offer a vast variety of uses by both business and home users. "Now, the industry accepts a handful of different wireless technologies. Each wireless technology is defined by a standard that describes unique functions at both the Physical and the Data Link layers of the OSI model. These standards differ in their specified signaling methods, geographic ranges, and frequency usages, among other things. Such differences can make certain technologies better suited to home networks and others better suited to network larger organizations."

Performance

Each standard varies in geographical range, thus making one standard more ideal than the next depending on what it is one is trying to accomplish with a wireless network. The performance of wireless networks satisfies a variety of applications such as voice and video.

The use of this technology also gives room for expansions, such as from 2G to 3G and, most recently, 4G technology, which stands for the fourth generation of cell phone mobile communications standards. As wireless networking has become commonplace, sophistication increases through configuration of network hardware and software, and greater capacity to send and receive larger amounts of data, faster, is achieved.

Space

Space is another characteristic of wireless networking. Wireless networks offer many advantages when it comes to difficult-to-wire areas trying to communicate such as across a street or river, a warehouse on the other side of the premises or buildings that are physically separated but operate as one.

Wireless networks allow for users to designate a certain space which the network will be able to communicate with other devices through that network. Space is also created in homes as a result of eliminating clutters of wiring. This technology allows for an alternative to installing physical network mediums such as TPs, coaxes, or fiber-optics, which can also be expensive.

Home

For homeowners, wireless technology is an effective option compared to Ethernet for sharing printers, scanners, and high-speed Internet connections. WLANs help save the cost of installation of cable mediums, save time from physical installation, and also creates mobility for devices connected to the network. Wireless networks are simple and require as few as one single wireless access point connected directly to the Internet via a router.

Wireless Network Elements

The telecommunications network at the physical layer also consists of many interconnected wireline network elements (NEs). These NEs can be stand-alone systems or products that are either supplied by a single manufacturer or are assembled by the service provider (user) or system integrator with parts from several different manufacturers. Wireless NEs are the products and devices used by a wireless carrier to provide support for the backhaul network as well as a mobile switching center (MSC).

B. Applications of WSN

Applications of wireless communication involve security systems, television remote control, Wi-Fi, Cell phones, wireless power transfer, computer interface devices and various wireless communication based projects.

Advantages

- Any data or information can be transmitted faster and with a high speed
- Maintenance and installation is less cost for these networks.

- The internet can be accessed from anywhere wirelessly
- It is very helpful for workers, doctors working in remote areas as they can be in touch with medical centers.

C. Types of WSN

Wireless PAN

Wireless personal area networks (WPANs) interconnect devices within a relatively small area that is generally within a person's reach. For example, both Bluetooth radio and invisible infrared light provides a WPAN for interconnecting a headset to a laptop. ZigBee also supports WPAN applications. Wi-Fi PANs are becoming commonplace (2010) as equipment designers start to integrate Wi-Fi into a variety of consumer electronic devices. Intel "My WiFi" and Windows 7 "virtual Wi-Fi" capabilities have made Wi-Fi PANs simpler and easier to set up and configure.

Wireless LAN

Wireless LANs are often used for connecting to local resources and to the Internet. A wireless local area network (WLAN) links two or more devices over a short distance using a wireless distribution method, usually providing a connection through an access point for internet access. The use of spread-spectrum or OFDM technologies may allow users to move around within a local coverage area, and still remain connected to the network.

Products using the IEEE 802.11 WLAN standards are marketed under the Wi-Fi brand name. Fixed wireless technology implements point-to-point links between computers or networks at two distant locations, often using dedicated microwave or modulated laser light beams over line of sight paths. It is often used in cities to connect networks in two or more buildings without installing a wired link.

Wireless mesh network

A wireless mesh network is a wireless network made up of radio nodes organized in a mesh topology. Each node forwards messages on behalf of the other nodes. Mesh networks can "self-heal", automatically re-routing around a node that has lost power.

Wireless MAN

Wireless metropolitan area networks are a type of wireless network that connects several wireless LANs. WiMAX is a type of Wireless MAN and is described by the IEEE 802.16 standard.

Wireless WAN

Wireless wide area networks are wireless networks that typically cover large areas, such as between neighbouring towns and cities, or city and suburb. These networks can be used to connect branch offices of business or as a public Internet access system. The wireless connections between access points are usually point to point microwave links using parabolic dishes on the 2.4 GHz band, rather than omnidirectional antennas used with smaller networks.

A typical system contains base station gateways, access points and wireless bridging relays. Other configurations are mesh systems where each access point acts as a relay also.

When combined with renewable energy systems such as photovoltaic solar panels or wind systems they can be standalone systems.

Global area network

A global area network (GAN) is a network used for supporting mobile across an arbitrary number of wireless LANs, satellite coverage areas, etc. The key challenge in mobile communications is handing off user communications from one local coverage area to the next. In IEEE Project 802, this involves a succession of terrestrial wireless LANs.

Space Network

Space networks are networks used for communication between spacecraft, usually in the vicinity of the Earth. The example of this is NASA's Space Network.

B. Existing System

The IEEE 802.15.4k standard defines PHY and MAC layers specifications to support Low Energy Critical

Infrastructure Monitoring networks. Channel time is organized in super frames, with each divided in several sub-beacon intervals (BIs) plus an optional inactive period delimited by the transmission of beacon frames transmitted by the AP.

Beacons carry out general network information, as well as time synchronization for networked devices. The transmission of a beacon is followed by a Contention Access Period (CAP) and a Contention Free Period (CFP). During the CAP, carrier sense multiple access with collision avoidance (CSMA-CA) is used to transmit command frames for association and resource reservations inside the CFP. The CFP is TDMA based and is divided into guaranteed time slots (GTSs). During one GTS, only one sensor is allowed to communicate with the AP.

NACRP, a new protocol to automatically restore connectivity in an STP-WSN when obstructions clutter the communication link between sensors and the AP. The contribution of our work is twofold: i) we detail NACRP that, to the best of our knowledge, provides a clean slate solution to the problem of connectivity and ii) we investigate connectivity and the tradeoffs that arise from the adoption of the NACRP in the STP-WSN, relying on stochastic geometry and in particular on Poisson Point Processes (PPPs).

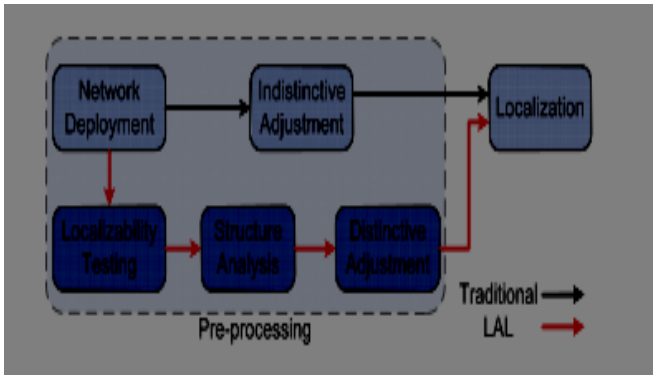

Figure 1. Block Diagram

C. Proposed System

Depending upon network structure, routing protocols in WSNs can be coarsely divided into two categories.1. Flat routing 2. Hierarchical routing. In a flat topology, all nodes perform the similar tasks and have the similar functionalities in the network. Data or information transmission is performed hop by hop usually using the flooding. The typical flat routings in WSNs include Flooding and Gossiping, Sensor Protocols for Information via Negotiation (SPIN), Directed Diffusion (DD), Greedy Perimeter Stateless Routing (GPSR), Trajectory Based Forwarding (TBF), Energy-Aware Routing (EAR), Gradient- Based Routing (GBR), Sequential Assignment Routing (SAR).

In small-scale networks flat routing protocols are relatively effective. However, in large-scale networks it is undesirable because resources are limited, but every sensor node generates more data processing and bandwidth usage In a hierarchical topology, nodes perform various tasks in WSNs and are organized into many clusters according to specific metrics.

Each cluster comprises a head referred to as cluster head (CH) and other member nodes (MNs) and the CHs can be organized into further levels. In general, nodes with higher energy act as CH and perform the work of processing the data and information transmission, while nodes with minimum energy act as MNs and perform the work of information sensing.

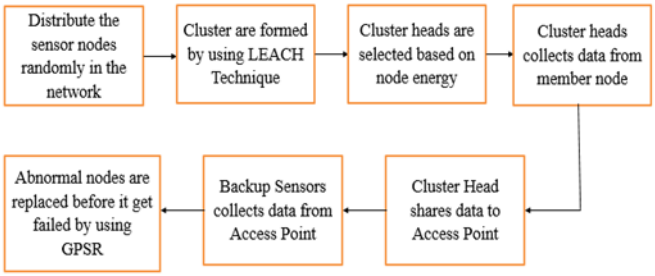

Figure 2. Block diagram of proposed system

D. Methodology

MODULE DESCRIPTION

1. Network Formation
2. Low Energy Critical Infrastructure Monitoring (LECIM)
3. Neighbor-assisted connectivity recovery protocol (Nacrp)
4. Low-Energy Adaptive Clustering Hierarchy(LEACH)
5. Greedy Perimeter Stateless Routing (GPSR)

1. Network Formation

Star topology WSNs (STP-WSN). In STP-WSNs temporary obstructions might clut- ter the LOS connection between sensors deployed over a wide

survey area and the central coordination point or AP. When this occurs, sensors will be unable to report sensed data although they function properly. Depending on the particular monitored phenomena, faulty sensors might trigger unnecessary human intervention or safety alarm.

2. Low-Energy Critical Infrastructure Monitoring(LECIM)

Channel time is organized in superframes, with each divided in several sub-beacon intervals plus an optional inactive period delimited by the transmission of beacon frames transmitted by the AP. Beacons carry out general network information, as well as time synchronization for networked devices.

The transmission of a beacon is followed by a Contention Access Period and a Contention Free Period. During the CAP, carrier sense multiple access with collision avoidance is used to transmit command frames for association and resource reservations inside the CFP. The CFP is TDMA based and is divided into guaranteed time slots. During one GTS, only one sensor is allowed to communicate with the AP.

3. Neighbor-Assisted Connectivity Recovery Protocol(NACRP)

Start transmitting local beacons in order to create sub networks. The AP shall inform the selected sensors whereby a new Information Element embedded in its beacon referred to as SubNet Information Element. The SN-IE will carry the identification of the selected sensor(s) and the time offset required to schedule the transmission of sub beacon frames to avoid collisions between multiple s-beacon transmissions.

An s-beacon shall provide synchronization locally and carry the ID of the parent AP, the ID of the transmitter and a bit field denoting whether the device is an AP or not. For a sensor coordinating a sub-network such a bit shall be set to zero. Thus, each sub-network should take place during the inactive period within the superframe of the AP. When sensors located inside the cluttered region start receiving s-beacons, they have to select the sub-networks they receive with the strongest power, carry out association and reserve resources during the CFP using CSMA-CA within the CA+P period. After collecting data from the associated cluttered sensors, each beaconing sensor will do the relay to the AP using the reserved GTS.

4. Low-Energy Adaptive Clustering Hierarchy:

LEACH is a hierarchical protocol in which most nodes transmit to cluster heads, and the cluster heads aggregate and compress the data and forward it to the base station (sink). Each node uses a stochastic algorithm at each round to determine whether it will become a cluster head in this round. LEACH assumes that each node has a radio powerful enough to directly reach the base station or the nearest cluster head, but that using this radio at full power all the time would waste energy.

5. Greedy Perimeter Stateless Routing (GPSR)

Greedy Perimeter Stateless Routing, GPSR, is a responsive and efficient routing protocol for mobile, wireless networks. Unlike established routing algorithms before it, which use graph-theoretic notions of shortest paths and transitive reachability to find routes, GPSR exploits the correspondence between geographic position and connectivity in a wireless network, by using the positions of nodes to make packet forwarding decisions. GPSR uses greedy forwarding to forward packets to nodes that are always progressively closer to the destination.

In regions of the network where such a greedy path does not exist (i.e., the only path requires that one move temporarily farther away from the destination), GPSR recovers by forwarding in perimeter mode, in which a packet traverses successively closer faces of a planar subgraph of the full radio network connectivity graph, until reaching a node closer to the destination, where greedy forwarding resumes.

III. EXPRIMENTAL RESULTS AND DISCUSSION

NS2

Network simulator (NS) is an object–oriented, discrete event simulator for networking research. NS provides substantial support for simulation of TCP, routing and multicast protocols over wired and wireless networks. The simulator is a result of an on-going effort of research and developed. Even though there is a considerable confidence in NS, it is not a polished

product yet and bugs are being discovered and corrected continuously.

NS is written in C++, with an OTcl interpreter as a command and configuration interface. The C++ part, which is fast to run but slower to change, is used for detailed protocol implementation. The OTcl part, on the other hand, which runs much slower but can be changed very fast quickly, is used for simulation configuration. One of the advantages of this split-language program approach is that it allows for fast generation of large scenarios.

1) Screen shots

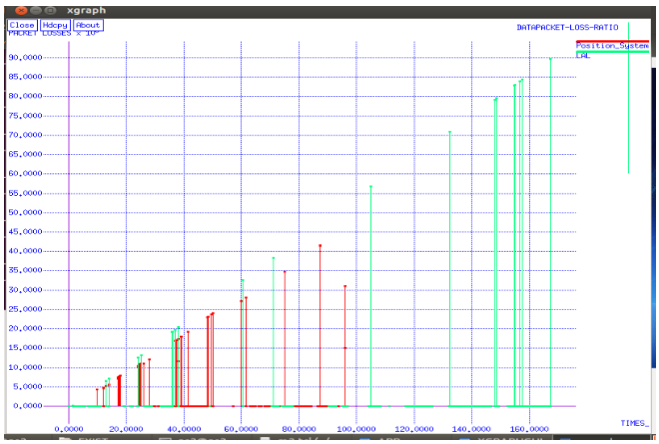

Figure 3. Packet loss Ratio

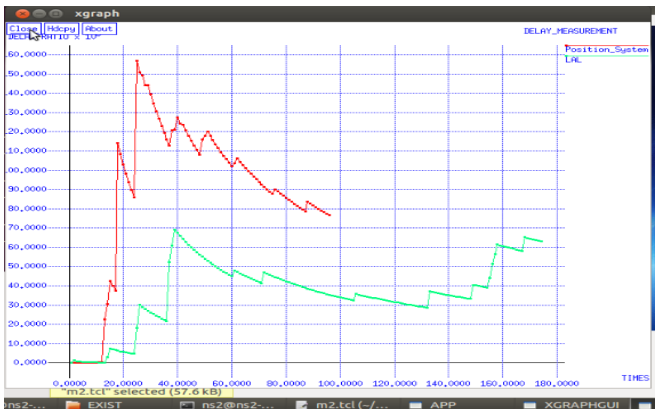

Figure 4. Delay Ratio between existing and proposed system

Figure 5. Throughput Graph between existing and proposed system

IV.CONCLUSION AND FUTURE ENHANCEMENT

We have presented the NACRP, a novel protocol to recover from connectivity loss when the direct link between one or more sensors and the AP is cluttered by the sudden appearance of temporary obstructions. We have analyzed the protocol resorting to the tool of stochastic geometry to characterize the spatial process of sensors scattered over a survey area. Whereby our analysis we managed to identify the set of tradeoff points between the power that sensors have to spend to transmit s- beacon frames and the topological change due to the fact that the star topology morphs into local mesh networks. Here we have presented the access point which could process many failure nodes at the same time.

V. FUTURE WORK

In future NACRP can be improved by providing backup to each node in the network. The authentication can also be improved by providing unique id to each node. By these we can improve efficiency, security and also reduces the data loss during transmission of data.

VI. REFERENCES

[1]. C. Buratti , A. Conti, D. Dardari, and R. Verdone, “An overview on wire- less sensor networks technology and evolution,” J. Sens., vol. 9, no. 9, pp. 6869–6896, Jul. 2009.

[2]. IEEE Draft Standard for Local and Metropolitan Area Networks—Part 15.4: Low-rate Wireless Personal Area Networks (LR-WPAN), IEEE P802.15.4REVi/D09, April 2011 (Revision of IEEE Std 802.15.4-2006), Apr. 2013, pp. 1 311.

[3]. IEEE Draft Standard for Local and Metropolitan Area Networks— Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPAN) Amendment 5: Physical Layer (PHY) Specifications for Low Energy, Critical Infrastructure Monitoring Networks IEEE Std 802.15.4k-2013, Aug. 2013, pp. 1 149.

[4]. P.-J. Wan, C.-W. Yi, and W. Lixin, "Asymptotic critical transmission radius for k-connectivity in wireless ad hoc networks," IEEE Trans. Inf. Theory, vol. 56, no. 6, pp. 2867–2874, Jun. 2010.

[5]. F. Baccelli and B. Laszczyszyn, "Stochastic gometry and wireless net- works, Vol. I— Theory," Found. Trends Netw., vol. 3, no. 4, pp. 249–449, Jul. 2009.

[6]. M. Khanafer, M. Guennoun, and H. T. Mouftah, "A survey of beacon- enabled IEEE 802.15.4 MAC protocols in wireless sensor networks," IEEE Commun. Surveys Tuts., vol. 16, no. 2, pp. 856–876, May 2014.

[7]. L. Goratti, J. Haapola, and S. Kato, "Highly reliable star and sub-mesh hybrid sensor network for smart grid monitoring," in Proc. GC Workshop Globecom, Dec. 2013, pp. 1480–1485.

[8]. T. Baykas, L. Goratti, T. Rasheed, and S. Kato, "On the spectrum effi- ciency of mesh and star topology wide area wireless sensor networks," in Proc. IEEE Int. Symp. Pers. Indoors Mobile Radio Commun. (PIMRC), 2014, pp. 1819–1823.

[9]. D. Stoyan, W. S. Kendall, and J. Mecke, Stochastic Geometry and Its Applications, 2nd ed. Hoboken, NJ, USA: Wiley, 1995.

[10]. Mohammad Hammoudeh, Fayez Al-Fayez, Huw Lloyd, Robert Newman, Bamidele Adebisi, Ahcène Bounceur and Abdelrahman Abuarqoub "A Wireless Sensor Network Border Monitoring System: Deployment Issues and Routing Protocols",2016.