Extensive Literature Review on Routing Algorithm for Wireless Sensor Network

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Abstract – Wireless Sensor Networkstranquil from a large number of sensor nodeswith the ability to sense and process data in the physical world in a timely manner.The sensor nodes contain a battery constraint which limit the network lifetime. Dueto energy constraints, the deployment of WSNs will required advance techniques tomaintain the network lifetime. A clustering based routing algorithm called Low-Energy Adaptive Clustering Hierarchy (LEACH) has been reviewed as a solution for lowpower consumption. The implementation of LEACH algorithm could be doneMATLAB simulator to analyze theperformance of this algorithm in term of network lifetime. LEACH algorithmshows some drawbacks that need improvements to overcome it as to improve theperformance. Then, the modified LEACH algorithm would be proposed where theimprovement for cluster head selection based on LEACH. In cluster headselection, adapted LEACH taking into account the residual energy of each node forcalculation of the threshold value for next round. LEACH perform better performance achieved by modified LEACH depends on theresults obtained.

Keywords: Energy efficient, routing, Low- Energy Adaptive Clustering Hierarchy (LEACH), WSN(Wireless Sensor Network).

I. INTRODUCTION

Wireless Sensor Networks (WSNs) are widely used to create a smart environment that relies on sensory data from real world. The application of wireless sensornetworks provides an enormous wirelessly connected infrastructure facilitating thefunction of monitoring physical and environmental conditions, such as temperature,sound, vibration, pressure, humidity, acidity, motion and pollutants. The advent ofsmart environments relies heavily on sensor network for data acquisition anddissemination whether in building, shipboard, intelligent transportation system,habitat monitoring, healthcare monitoring, home automation, traffic control, orelsewhere [4]. A smartsensor used in Wireless Sensor Networks is a combination of sensing, processing and communicationtechnologies.

The basic architecture of smart sensor is shown in Figure 1.1 Sensing unit isused to detect the changes of parameters in the network, signal conditioningresponsible for smoothing the analog electrical signal before it is converted to digitaldomain. The resultant digital signal is used as the input to the application algorithmor processing unit and then cached in the memory. The transceiver is used tocommunicate with other sensors or base station (BS) which may act as an internetgateway in Wireless Sensor Network(WSN).

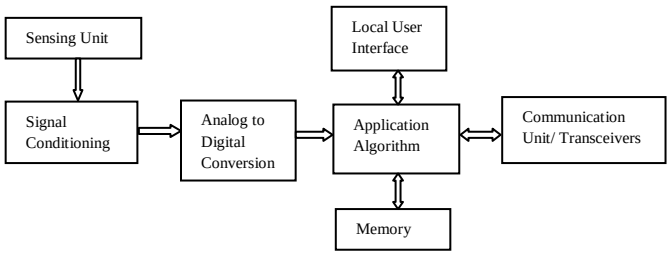

Figure 1: Smart Sensor Architecture

The effectiveness of Wireless Sensor Networks depends (WSNs)on the functionality of all sensors in the network. If the sensor node is active, itproceeds to perform a duty to sense, communicate and process information (temperature,humidity etc). There are two major factors that affect the network lifetime: howmuch energy it consumes over time and how much energy is available for the particularnode. The proposed technique to deal with network lifetime called clustering,which is an important method. Additionally, a good performance WSNs is highlydependent on energy-efficient clustering routing algorithm [3]. Thedevelopment involve a clustering-based hierarchy protocol that optimizes the energyefficiencyin WSNs is called Low-Energy Adaptive Clustering Hierarchy (LEACH)[2].

Wireless Sensor Networks (WSNs)

According to definition given in,“A WirelessSensor Networks (WSNs) consists of densely distributed nodes that support sensing,signal processing, embedded computing, and wireless connectivity; sensors arelogically linked by self-organizing means. WSN [5] typically transmit information tocollecting (monitoring) stations that aggregate some or all of the information. WSNhave unique characteristics, such as, but not limited to, power constraints and limitedbattery life

for the wireless networks, redundant data acquisition, low duty cycle, and, many-toneflows." Although the development of this kind of networks was initially formilitary applications, but nowadays they are used in many different industrial andcivilian application areas, including industrial process monitoring and control, healthcare applications or traffic control. WSNs are composed of a set of sensornodes, typically equipped with some sensors, a radio transceiver or other wirelesscommunications device, a small microcontroller, and an energy source, usually abattery. Therefore, these devices make up a network with sensing, data processingand routing capabilities.

II. ASPECTS OF WIRELESS SENSOR NETWORK

The benefits of Wireless Sensor Networks (WSNs), it is enough to be conscious of the widevariety of applications where WSNs are present. Typically, WSN's applicationsinvolved in some kind of monitoring, tracking, or controlling. Some of the numerousapplications and the benefits that WSNs bring are:

a) Environmental Monitoring:watershed management, forest fire predictionor irrigation management. It helps to preserve and maintain the naturalresources.
b) Structural Health and Industrial Monitoring: machinery failure detection.It reduces the maintenance costs and prevents from catastrophic failures.
c) Civil Structure Monitoring: health monitoring of large civil structures, likebridges or skyscrapers. It prevents from human catastrophes.
d) Medical Health-care: telemedicine, remote health monitoring. Allowsdoctors in remote and rural areas to consult with specialists in urban areas,remote handling of medical equipment (telesurgery).

III. SYSTEM MODEL

Wireless Sensor Networks (WSNs) consist of a set of many sensors with sensing, wireless communication andcomputation capabilities. These sensors are scattered in the preserved environmentand located far from users. The architecture of WSNs includes three entities [3]. There are:

- Sensors which make up the network: its function is based on taking localmeasures through a discrete system, creating a wireless network in an unattended environment, gathering data and sending them to the final userthrough the BS.
- Base station or gateway node: it is located near the sensor field. The data orinformation gathered by the sensor field is sent to the base station through amultihop infrastructure less architecture, which communicates with the uservia Internet or satellite communication.
- User: it is the entity interested in obtaining the information about a specificphenomenon by means of measuring or monitoring the environment.

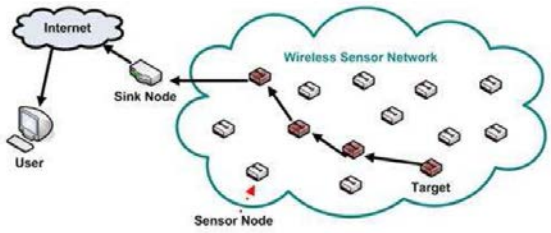

Figure 2: Wireless Sensor Network Architecture

Protocol Architecture

Protocol architecture is the layered structure of hardware and software that supportthe exchange of data between two systems. When communication is desired amongcomputers from different vendors, the data must be transmitting in the specific formatbecause different vendors use different data format and data exchange protocols.The key functions normally performed by a protocol include encapsulation,segmentation and reassembly, connection control, ordered delivery, flow control,error control, addressing and multiplexing. There are two protocol architecture haveserved as the basis for the protocol standards which is TCP/IP and OSI model[13]. Figure 2.2 indicates the different between TCP/IP and OSI model.

<table>
<tr><th>TCP/IP</th><th>OSI</th></tr>
<tr><td rowspan="3">Application</td><td>Application</td></tr>
<tr><td>Presentation</td></tr>
<tr><td rowspan="2">Session</td></tr>
<tr><td rowspan="2">Transport (host-to-host)</td><td>Transport</td></tr>
<tr><td>Internet</td><td rowspan="2">Network</td></tr>
<tr><td rowspan="2">Network Access</td></tr>
<tr><td>Data Link</td></tr>
<tr><td>Physical</td><td>Physical</td></tr>
</table>

Figure 3: A comparison of the OSI and TCP/IP Protocol Architecture

TCP/IP Protocol Architecture

The TCP/IP model organizes the communication task into five relatively independentlayers:

Physical Layer: Physical interface between a data transmission device (e.g.computer) and a transmission medium or network. This layer concerned withthe characteristics of transmission medium, signal level and data rates.

Network Access Layer: Perform the data exchange between end systems.The destination addresses provision so that the network can send the data to theappropriate destination.

Internet Layer: Provides the routing function across multiple networks. These functionsunimplemented in the end system and routers.

Transport Layer: This layer concerned on end-to-end data transfer. TheTransmission Control Protocol (TCP) is the most commonly used protocol toperform this functionality.

Application Layer: Support user application for example http, SMTP and FTTP.

IV. LITERATURE REVIEW

Wireless Sensor Networks (WSNs) are increasingly deployed in a variety of applications, initially for military application and currently used in monitoring of medical conditions inside human body, monitoring the climate change and also used in reporting the mechanical stresses in building and bridges. A standard WSNs consists of a set of sensors that communicates to the external world via base station (BS) or sink. The sensors are autonomous small devices with several constraints like the battery power, computation capacity, communication range and memory. They include transceivers to gather information from its environment and pass it on up to a certain base station, where the measured parameters can be stored and available for the end user. Sensor networks are also energy constrained since the individual sensors, which the network is formed with, are extremely energy-constrained as well. The communication devices on these sensors are small and have limited power and range.

Alshowkan, M. andElleithy, K.; Alhassan, H. investigated the current security mechanisms in wireless sensor networks as well as reducing power consumption. LEACH protocols provide an energy routing protocol. The improved secure and more energy efficient routing protocol called Lightweight Secure LEACH has been adopted. Authentication algorithm has been integrated to assure data integrity, availability and authenticity. This investigation provides the improvement over LEACH protocol which makes it more secure and extra energy efficient for reducing the effect of the overhead energy consumption from the added security measures [6].

Haneef, M.; Zhou Wenxun and Zhongliang Deng presented the deployed redundant nodes in to account which cover major fraction of energy depletion in the network which is efficient routing algorithm based upon the frame work of LEACH. A many of redundant data is present in wireless sensor network due to widely deployed nodes. For checkingthe presented methodology simulation has been done using Matlab. Results show that MG-LEACH had performed better LEACH on the basis of Network life time [7].

Yu Miao; BaiGuang-wei and Shen Hang had proposedthe performance analyses of classical low-energy adaptive clustering hierarchy routing algorithm. Investigation has been done on the limitations of the LEACH in terms of energy balance and networks scalability. The proposed work is that the cluster-heads are elected by a probability based on the ratio between residual energy of each node and the average energy of the network. Outcomes show that DEEC efficiently decreases energy consumption, it provides balance energy consumption in the whole networks and achieves longer lifetime [8].

Saravanakumar, R.,Susila, S.G.and Raja, J. have analyzed the basic distributed clustering routing protocol LEACH, then proposed a routing protocol and the data aggregation method in which the sensor nodes form the cluster and the cluster-head elected based on the residual energy of the individual node calculation without re-clustering and the node scheduling scheme is adopted in each cluster of the WSNs. ACTIVE and SLEEP mode, the energy efficiency has been increased about to 50% than LEACH protocol. The proposed routing protocol significantly reduces energy consumption and increase the total lifetime of the WSN [9].

Muhamad, W.N.W. and Naimanalyzed theWireless sensor networks lifetime is either superficial or impractical, which can prevents us from thoroughly understanding the efficiency of these proposed routing protocols. This workhas been done to maximize the lifetime of the WSN. LEACH routing protocol is increased the network lifetime by 65.2% compared to DC and MTE [10].

Wei Bo, Hu Han-ying and Fu Wen improved LEACH protocol for data gathering and aggregation in wireless sensor networks. LEACH includes distributed cluster

formation, local processing for reducing global communication, and randomized alternation of the cluster-heads. Thisresearch work protocol uses multi-hop routing instead of 2-hop routing in LEACH, and related algorithm was proposed. Results show that improved protocol is more energy-efficient than conventional LEACH [11].

Islam, M.J.; Islam, M.M.; Islam, M.N., performed a solar-aware, programmed clustered routing protocol A-sLEACH which is an extension to sLEACH for routing and MTE for radio model. Outcomes of applying thisproposed scheme gives better performance compared to MTE and sLEACH [12].

V. CONCLUSION

In this review paper we have analyzed and study the Wireless Sensor Networks (WSNs)that consist of a number of sensing nodes which are distributed in a wide area. They sense an event occurring in the environment and these sensing nodes are distributed or placed according to the requirements of the application. The base station (sink), which collects data from other nodes, interacts with a user (someone interested in monitoring the activity). Energy dissipation is a major factor in WSNs during communication among the nodes. Energy should be saved, so that the batteries do not get depleted or drained quickly as these are not easily replaceable in applications such as surveillance. Also some aspects likewise Quality of service ensures the effective communication within the given or bounded delay time. Protocols should check for network stability, redundant data should be transmitted over the network for any type of traffic distribution. It also needs to maintain certain resource limiting factors, such as bandwidth, memory buffer size and processing capabilities.

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