

# **Improvement of Traffic System of Distributed Architecture in Wireless Sensor Networks by Entropy Calculation**

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**ABSTRACT:** An emerging class of Wireless Sensor Network (WSN) applications involves the acquisition of large amounts of sensory data from battery powered, low computation and low memory wireless sensor nodes. The topology of the WSNs can vary from a 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. In computer science and telecommunications, wireless sensor networks are an active research area with numerous workshops and conferences arranged each year.

**KEYWORDS:** Topology, Acquisition, wireless sensor network, routing, flooding.

## **I. INTRODUCTION**

The data gathered from wireless sensor networks is usually saved in the form of numerical data in a central base station (Server). If a centralized architecture is used in a sensor network and the central node fails, then the entire network will collapse, however the reliability of the sensor network can be increased by using distributed control architecture. This architecture uses the concept of packet switching. This architecture has a drawback that there may be a lot of traffic jam via nodes forwarding the packet towards the base station. It leads to a lot of propagation time and energy consumption during the propagation of data.

Many protocols were proposed to competently use the optimum path to minimize the propagation time and to extend the data rate of the wireless sensor architecture. Once wireless sensor architecture is deployed in disaster areas, polluted environments or high radiation region, battery recharge or replacement is impossible for human and wireless sensor architecture works until battery power of the entire sensor node get die. Hence the power consumption by the poor planned routing algorithm needs to be uninvolved. I would like to create an idea which would be successful in this type of situation. This will help to transmit the data through wireless sensor network whenever time management is the primary goal. I want to also give the idea for increasing the transmission rate.

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## II. WIRELESS SENSOR NETWORK



Fig 1: Monitoring in Indian – Pakistan Border

Wireless Sensor Network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions such as temperature, sound, Pressure etc. and to cooperatively pass their data through the network to a main location (2). The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance. In Indian – Pakistan border there is a problem associated with the illegal entries of the terrorists and army of enemy, that's why I have decided this dissertation for my country. Today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring and so on.

## III. ARCHITECTURE OF WSN

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting (3).

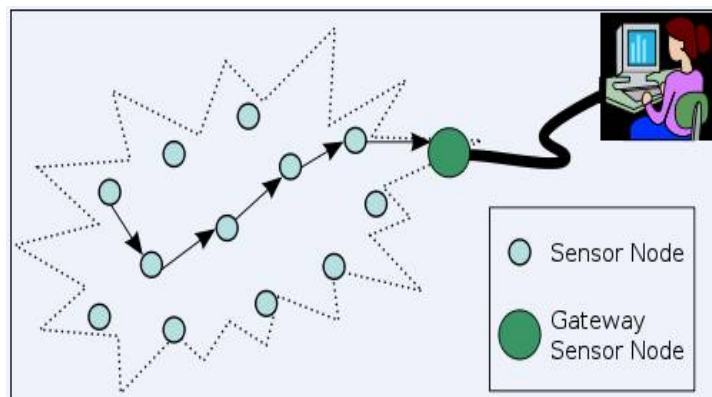


Fig 2: Typical multi-hop wireless sensor network architecture

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## IV. ROUTING MODELS IN WSN

The entire existing routing algorithm and data delivery model is based on the various models. Every model have different data delivery algorithms and used for specific purpose. Various routing mechanism is used to design a new routing protocol [9]. Every model has its own advantage and characteristics. Main Types of communication model in wireless sensor network are:

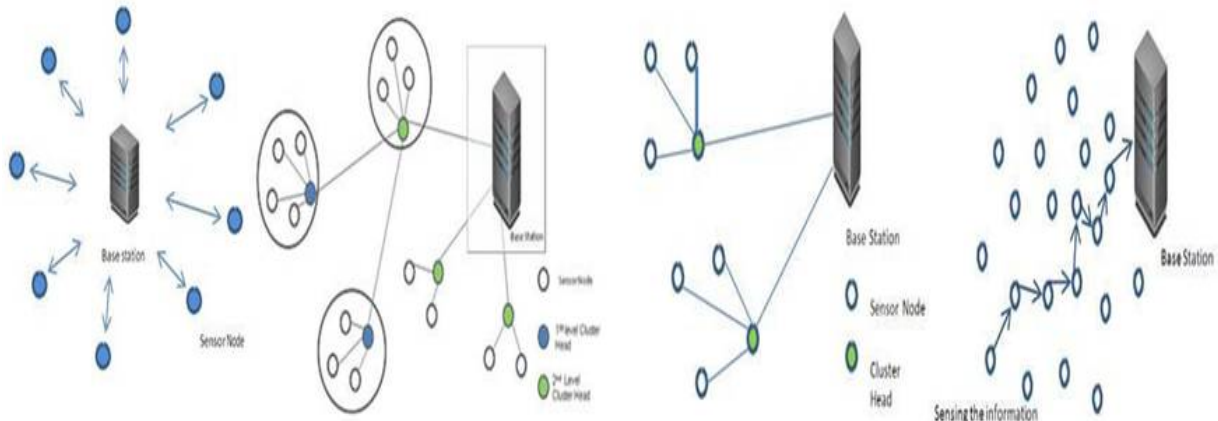


Fig 3 (a): Direct communication and Clustering model of WSN

Fig 3 (b): One hop and Multi hop model of WSN

## V. DESCRIPTION

Wireless Sensor Network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions such as temperature, sound, Pressure etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance. In Indian Pakistan border there is a problem associated with the illegal entries of the terrorists and army of enemy, that's why I have decided to make this dissertation for my country. Today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring and so on.

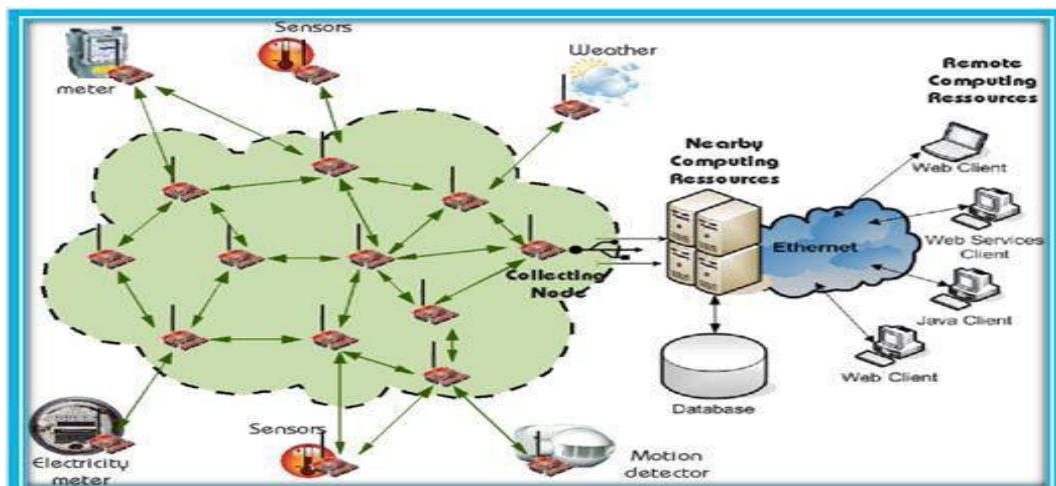


Fig 4: Typical multi-hop wireless sensor network architecture

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## VI. PROPOSED WORK

For improving the battery power of the sensor architecture, various energy effective routing strategies are applied. In this report study and review of modern routing protocol LEACH (Low Energy Adaptive Clustering Hierarchy) has been done as it uses its own algorithm for energy efficiency. It uses the concept of probability based cluster head selection, as a result, the nodes having low battery power may be selected as cluster head and the nodes having high battery power may not be selected as cluster head. This is because all the nodes transmitting the data consume more power to deliver a more number of information, but cluster head delivers the composite signal alone towards the base station. This concept of pure probability based cluster head selection creates unbalancing condition in wireless sensor hierarchy for traffic system management point of view. To address this limitation, my dissertation proposes a new routing method. A communication system not only dealing with a single node, but with all possible nodes.

Hence a WSN may be described in average message per individual node, called Entropy.  
Let M= total number of nodes

Then entropy is maximum if all the nodes have equal load.

$$H_{max} = - \sum_{k=1}^M \frac{1}{M} \cdot \log_2 \frac{1}{M} \text{ message / node}$$

For example if there are 2 nodes then P=1/2 and Q=1/2. Now entropy is-

$$H_{max} = - \left[ \frac{1}{2} \cdot \log_2 \frac{1}{2} + \frac{1}{2} \cdot \log_2 \frac{1}{2} \right]$$

$$H_{max} = -\log_2[2].$$

$$H_{max} = 1 \text{ message / node}$$

It means to increase the efficiency of propagation, routing should be such that all the nodes have handled equal traffic load. If this method of routing is used then there is no problem due to traffic jam.

## NODE SELECTION CRITERIA

There are a number of parameters to be considered when selecting wireless sensor measurement devices.

- I. Type of Measurement: The wireless transmitters of sensor which incorporate process of measurement and process control typically have a unique function. Sensors are specifically designed for measuring temperature, pressure, humidity, light, radiation, motion, flow, etc.
- II. Accuracy and Response Time: Most wireless sensors are as precise as the wired devices; however the recorded readings are generally transmitted every few seconds to preserve battery power backup.
- III. Environmental Condition: While selecting a wireless sensor node device, the environmental and physical condition is observed because sometimes wireless sensor nodes are deployed in such region where human staying or manipulation is not possible for short or long time.
- IV. Functionality: A wireless sensor may have only one function like only one physical condition detection such as temperature measurement or it may have multifunction like temperature detection as well as humidity detection.
- V. Range: The range of wireless sensors varies widely according to the applications. Some sensors are designed usually for indoor, short-range applications of a few twenty meters, whereas other sensors

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can transmit information to a receiver located so far away.

- VI. Repeatability: Some wireless sensors can be reused after long time duration with replacing some components of the sensor node. For further use in future, as an electromechanical device, damage or non-working wireless sensors can be recycled.
- VII. Frequency: The frequency of radio transmission is also important factor to be considered. Laws and standards vary by country and areas. From 800 MHz to 2.4GHz in case of Wi-Fi are the major frequencies factories which can be used to transmit signals.
- VIII. Cost: Cost is a major factor for selection of a wireless sensor. Cost of the wireless sensor varies according to their functionality, as the multifunctional wireless sensor devices are more costly compared to uni- functional wireless sensor. Cost also depends on the type of applications where wireless sensors are deployed. These parameters help to observe the business of all the nodes regarding its traffic handling capacity. This dissertation analyzes and compares the results of selection of the root and the path to forward the data towards base station. Simulation result will show that performance of proposed method gives significant more traffic handling capability compared to other methods.

## VII. CONCLUSION

### Entropy Calculation for non-uniform load distribution

Node	Proabability of Load		log(Pk)	PK * log(Pk)
Node 1	P1	0.25	1.999983085	0.499995771
Node 2	P2	0.25	1.999983085	0.499995771
Node 3	P3	0.125	2.999974628	0.374996828
Node 4	P4	0.125	2.999974628	0.374996828
Node 5	P5	0.0625	3.99996617	0.249997886
Node 6	P6	0.0625	3.99996617	0.249997886
Node 7	P7	0.0625	3.99996617	0.249997886
Node 8	P8	0.0625	3.99996617	0.249997886
<b>TOTAL</b>		<b>1</b>	<b>H (X) = - PK * log(Pk) =</b>	<b>2.749976742</b>

### Entropy Calculation for uniform load distribution

Node	Proabability of Load		log(Pk)	PK * log(Pk)
Node 1	P1	0.125	2.999974628	0.374996828
Node 2	P2	0.125	2.999974628	0.374996828
Node 3	P3	0.125	2.999974628	0.374996828
Node 4	P4	0.125	2.999974628	0.374996828
Node 5	P5	0.125	2.999974628	0.374996828
Node 6	P6	0.125	2.999974628	0.374996828
Node 7	P7	0.125	2.999974628	0.374996828
Node 8	P8	0.125	2.999974628	0.374996828
<b>TOTAL</b>		<b>1</b>	<b>H (X) = - PK * log(Pk) =</b>	<b>2.999974628</b>

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