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# Shortcut Tree Routing In ZigBee Based Wireless Sensor Network

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**Abstract -** *Wireless Sensor Network (WSN) is the best solution for quick capturing, processing and transmission of critical data. Sensor nodes can be deployed in hostile environment but nodes suffer from low battery power. So, energy efficiency and network lifetime are main concerns in WSN. ZigBee have low cost, low power consumption and is useful in wireless sensor networks by selecting adequate communication protocol. Routing protocols such as AODV (Ad-hoc on demand distance vector routing), ZTR (ZigBee tree routing), and STR (Shortcut tree routing) are compared on the basis of different performance metrics such as end to end delay, routing overload, throughput, packet delivery ratio (PDR). The mathematical analysis and performance evaluation shows that STR achieves better performance as compared to other two routing protocols.*

***Key Words***: Processors, Receivers, Transmitters, Computer Systems Organization, Computer Communication Network, SMTP , ZTR, STR, Protocol architecture (OSI model), Protocol verification, Routing protocols, Distributed Systems, Client/server, Distributed databases.

## 1. INTRODUCTION

The basic idea behind our this project to find the most energy efficient routing protocol among the routing protocols.
As most of the Wireless Sensor Networks use their own power supply i.e. Batteries and this WSNs connected to different nodes in the networks and hence while transferring the data within the nodes it consumes more energy. To overcome this problem proper selection of routing is important hence an optimal path is selected.
Hence we are trying to find energy efficient routing protocol which will reduce energy consumption with efficient routing.

## 2. BRIEF REVIEW OF EXISTING TECHNIQUES

In the existent system there are various routing management algorithms and they are described below.

### 2.1 General Routing Techniques in Wireless sensor network

There are many paths for the delivery of data packets from source to destination routing is the method of selecting the best path among them. Routing is performed for many kind of networks. But mostly we are concerned about packet switching networks. In this network packet is forwarded from the source to the ultimate destination through the intermediate nodes. Intermediate node refers to the hardware devices like –routers, bridge, gateway, switches or firewalls etc. In routing process the packets are forwarded using the routing table in which a record of routs to various network is maintained.

Mobile Ad hoc Networks (MANET) has become an exciting and important technology in recent years because of the rapid proliferation of wireless devices. A mobile ad-hoc network consists of mobile nodes that can move freely in an open environment. Communicating nodes in a Mobile Ad-hoc Network usually seek the help of other intermediate nodes to establish communication channels. A Mobile Ad-hoc Network is a group of wireless mobile computers in which nodes cooperate by forwarding packets for each other to allow them to communicate beyond direct wireless transmission range.

MANET routing protocols are divided into two categories:-

- Proactive Routing Protocol
- Reactive Routing Protocol
- Hybrid Routing Protocol

### 2.2PROACTIVE ROUTING PROTOCOL

Proactive routing protocols periodically updates the topology information as well as the changes in the link connection throughout the network. It always has an up to date optimal routing path.

Proactive protocols maintain routing information about the available paths in the network even if these paths are not currently used. The main disadvantage of these protocols is the maintenance of unused paths may occupy an important part of the available bandwidth if the network topology changes frequently. However, proactive protocols may not

always be suitable for highly mobile networks such as MANETs

### 2.3 REACTIVE ROUTING PROTOCOL

This protocol employs a lazy approach whereby mobile nodes only discover routes to destinations on-demand. These protocols maintain only the routes that are currently in use, thus reducing the burden on the network when only a few of all available routes is in use at any time. Reactive protocols often consume less bandwidth than proactive protocols, but the delay in determining a route can be substantially large. In reactive protocols, since routes are only maintained while in use, it is typically required to perform a route discovery process before packets can be exchanged between nodes. Therefore, this leads to a delay for the first packet to be transmitted. Another disadvantage is that, although route maintenance is limited to the routes currently in use, it may still generate a significant amount of network traffic when the network topology changes frequently. Finally, packets transmitted to the destination are likely to be lost if the route to the destination changes.

### 2.3 HYBRID ROUTING PROTOCOL

Hybrid Routing Protocol combines both proactive and reactive approaches to achieve a higher level of efficiency and scalability. However, even a combination of both approaches still needs to maintain at least those network routes that are currently in use. Therefore, limiting the amount of topological changes, that can be tolerated within a given amount of time. However, MANET differs from other networks by its highly dynamic topology. Many simulation result showed that most of the topology based routing protocols suffer from highly dynamic nature of vehicular node mobility because they tend to have poor route convergence and low communication throughput. Position based routing protocols has been identified as a more suitable routing protocols for MANETs to give better performance and exhibit scalability and robustness against frequent topological changes.

## 3. THE PROPOSED ROUTING TECHNIQUES

ZigBee Routing is more efficient routing, it contains number of routing protocols. The motive behind system design is comparative study of some routing protocols and implementation of most energy efficient routing protocol in ZigBee WSN.

### 3.1 ZIGBEE ROUTING PROTOCOLS

The protocols which are discussed above solve the problem of routing overhead but they have not solved the problems of detour path and traffic concentration problems. The various ZigBee routing protocols are working on it.
They are:-

- ZigBee Tree Routing (ZTR)
- Shortcut Tree Routing (STR)

#### 3.1.1 ZIGBEE TREE ROUTING

ZTR is designed to choose the multihop routing path without route discovery procedure. In ZTR the distributed block addressing scheme is used. In ZTR each node is given a hierarchical address with the hierarchical addressing scheme whether the destination is descendant or ascendant of source or intermediate node.
The node that may be a source node or an intermediate node forwards the data packets to either parent node or any of the children node by comparing its address to the destination address. In ZTR each source or intermediate node sends data to parent if the destination is ascendant and sends the data to children node if the destination is descendant.

The routing method of ZTR is explained in fig. 3

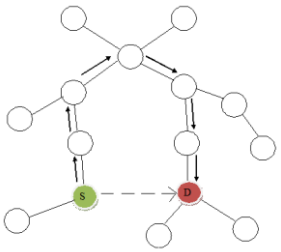


Fig. 3 ZigBee Tree routing

Here the packets are routed through several hops from source to destination because of tree routing topology even though it is within the range of 1hop from source to destination. This problem is called detour path problem .Other problem of ZTR is the traffic concentration problem. In ZTR all the data packet pass through the same root node, so there happens congestion which causes collision of data packets.

#### 3.1.2 SHORTCUT TREE ROUTING

STR algorithm solves these two problems of the ZTR by using 1-hop neighbor information. It solves detour path problem completely but traffic concentration partially. The STR algorithm basically follows ZTR, but chooses one of neighbor nodes as the next hop node when the remaining tree hops to the destination can be reduced. For example, in Fig. 4, STR computes the remaining tree hops from the next hop node to the destination for all the neighbor nodes, and selects the N4 as the next hop node to transmit a packet to the destination D2.

## 4. ARCHITECHTURE OF PROPOSED SYSTEM

BLOCK DIAGRAM OF SYSTEM :-

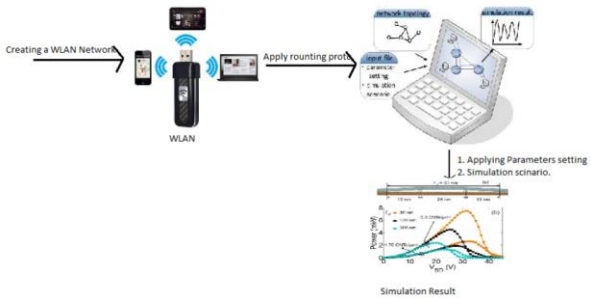


Figure 4 : Architecture diagram

The main idea of STR is that we can compute the remaining tree hops from an arbitrary source to a destination using ZigBee address hierarchy and tree structure as discussed in previous section. In other words, the remaining tree hops can be calculated using tree levels of source node, destination, and their common ancestor node, because the packet from the source node goes up to the common ancestor, which contains an address of the destination, and goes down to the destination in ZTR.

STR has the limitation that the routing path is not always optimal in an aspect of the end-to-end hop distance, because the next hop node is selected based on the local information like 1-hop neighbor table.

For example, in Fig. 4, the optimal path from S to D2 is S-N5-D2, but, it requires 2-hop neighbor information in order for the source S to know that N5 is within 1-hop communication range of theD2. It is obvious that maintaining 2-hop neighbor information incurs high protocol overhead in the network with high node density; thus, we selected to provide a resource efficient routing protocol in a view point of memory consumption and routing overhead.

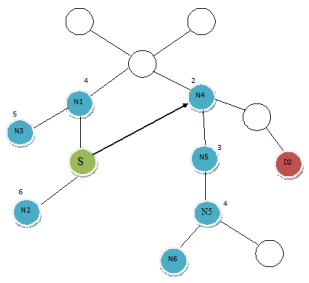


Fig (4):- Shortcut Tree Routing

## 5. ALGORITHM

Initialization
S = U —- where U is source node
For all nodes V
if V adjacent to U
D(V) = c(U,V)—– current cost of node for all node v adjacent u
else D(v) =
LOOP
Find w not in S with the smallest D(w)
Add W to S

Update D(v) for all V adjacent to W and not S
D(v) = min D(v),D(w)+c(W,V)—- continually update D(v) as shorter paths learned
Until all nodes in S.

## 3. CONCLUSIONS AND FUTURE SCOPE

In this system we overcome the Problem of ZigBee routing protocols like AODV, ZTR. We propose STR that uses the neighbor table based routing, originally designed for ZigBee standard and STR provide efficient routing path, ie most power efficient protocol.

• Agricultural Fields
To measure the Moist in the agricultural field and quality of soil STR can be
efficient.
• Global Temperature Measurement Technique
To determine the temperature remotely Routing protocols can be used.
• Seismic waves Detection from various Position
To predict the seismic waves to avoid measure loss.
• Node Discovery
To find the energy efficient protocol in minimum cost this techniques can be
used.

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