Energy efficient algorithm for Neighbor discovery using modify OLSR in wireless sensor network

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Abstract— OLSR is a Proactive table driven routing protocol in which each nodes sends HELLO message periodically to the neighboring nodes as link state routing protocol. Optimized Link State Routing is an extension of link state routing where each node selects MPR (Multi Point Relay) as neighboring node to reduce the overall broadcasting. Proposed work is the modification of HELLO message and TC message with consideration of residual energy. Reserved bits in HELLO and TC message will be placed by the Residual energy of the next hop. All source-destination path will be calculated and stored in topology table. We Provide multiple path from source to destination so if any best path fails due to reduce residual energy of MPR, an alternate path will come into scenario so as to increase throughput of the network system.

Keywords— wireless sensor network, OLSR, MPR, HELLO, TC.

I. Introduction

MANET is a Mobile Ad-hoc Network in which small power wireless sensor network which can freely moves within the network. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic.

OLSR is a Proactive or table driven routing in which each node will broadcast HELLO message to get its neighbor set. From that information we will find the MPR (Multi Point Relay only to 1-hop neighbors) as the neighboring node. Then each MPR sends TC Message (Topology Control Message) to only MPRs which contains the information about the advertising of the neighboring nodes. The significant of this message is to give information to near neighbor node about 2-hop neighbors. And then topology table and routing table is generated and accordingly shortest path is selected.

In order to increase the lifetime and throughput of the network, We modify the OLSR routing protocol by choosing the multiple path for source to destination which provides 2 or more routed from source to destination. And for every node in the routing table we will have 2 entries with respect to residual energy. The lifetime of wireless sensor networks lies in the ability to deploy large number of tiny nodes which are assembled and configure themselves. In WSN most applications are battery powered so it is very difficult to replace the battery or recharge the battery as soon as nodes are deployed. Another constrain that reduce the efficiency of nodes data redundancy based on this constrain each cluster has the Cluster Head which aggregate the data and transmitted it to the base station node. Many routing techniques proposed to increase the network lifetime and optimize the efficient energy. Hierarchical routing protocol is one of the interesting techniques to increase the lifetime of network as well as optimize the efficient energy. In the cluster based network, the networks are partition into smaller clusters. This protocol uses the concept of clustering and assigning the special task to the sensor node to cluster head of each cluster. Hierarchical routing is an efficient technique to reduce the energy consumption by doing the data aggregation and fusion in order to reduce the number of transmission to the Base-Station.

II. Literature Review

A) Performance Improvement of OLSR protocol by modifying the Routing table Construction.

• Performance of OLSR can be improved by some modification of OLSR routing table.

A. Neighbor Sensing:

Hello Message Broadcast

Hello Message is broadcasted in the node by the source node.
B. Construction of Neighbor Table:
Hello message Processing
Based on the message sent Neighbor Table generated
C. Execution of MPR Selection Algorithm at each Node
MPR selection algorithm gets Executed to select MPR in the neighbour
D. Construction of MPR selector table:
Hello message Processing
MPR selector table basically keeps the track of all the MPR

E. Multipoint Relay Information:
Topography control Message Broadcast
TC message is sent in Network by MPRs to provide MPR information

F. Construction of Duplicate Table:
Topography Control Message Processing
Duplicate Table will keep a track of holding time due to processing time

G. Construction of Topology Table:
Topography Control Message Processing
Topography table is constructed

H. Construction of routing Table
Routing table is constructed at the end

B) Energy Efficient algorithm by Modify HELLO and TC Messages in OLSR

Ad-hoc network is one of the emerging trends in wireless communication. In conventional wireless communication there is need of base station for communication between two nodes. These base station leads to more infrastructure and more cost. An ad-hoc network facilitates communication between nodes without the existence of an established infrastructure. Nodes are connected randomly using ad-hoc networking and routing among the nodes is done by forwarding packets from one to another which is decided dynamically. In general, MANET’s are formed dynamically by an autonomous system of mobile nodes that are connected via wireless links without using any centralized administration. Mobile nodes that are within each other’s radio range communicate directly via wireless links, while those that are far apart rely on other nodes to relay messages as routers. Node mobility in an ad hoc network causes frequent changes of the network topology. The scopes of the ad-hoc network are also associated with dynamic topology changes, bandwidth-constrained, energy constrained operation, limited physical security, mobility-induced packet losses, limited wireless transmission range, broadcast nature of the wireless medium, hidden terminal problem, packet losses due to transmission errors.

- In Energy constrained operations, it is important to save energy which results in improvement in network lifetime. For example, in battle fields soldiers are unable to charge node batteries so there is need for them to save battery power in such a way that communication can be possible for longer time. To improve network lifetime there are different methodologies used at different layers of OSI model. Network layer is used for routing of packets from source to destination.
- There are number of routing protocols defined in MANET, for example DSDV, AODV, DSR, OLSR, ZRP etc. The main objective is to design routing protocol in such a way that it work effectively in energy constrained applications. The main focus is on OLSR routing protocol modification in network layer.
- **Proactive routing protocols**
  In proactive routing, each node has one or more tables that contain the latest information of the routes to any node in the network. Each node maintain routing tables and respond to the changes in the network topology by propagating updates throughout the network in order to maintain a consistent view of the network. Many proactive routing protocols have been proposed, for e.g. Destination Sequence Distance Vector (DSDV), Optimized Linked State Routing (OLSR) and so on.
Unlike proactive routing protocols, the reactive routing protocols create routes once a node wants to transmit data to a destination. The source node initiates route discovery process by flooding route query within the network. When the destination is reached, route reply request will be sent back to the source. Once the route has been found, it is maintained until either destination becomes inaccessible or the route is no longer desired then route discovery process will be invoked again. Several reactive protocols have been proposed such as Dynamic Source Routing protocol (DSR), Ad hoc On-demand Distance Vector (AODV), Temporary Ordered Routing Algorithm (TORA), and so on.

Hybrid routing protocols
In such network, hybrid routing protocols, i.e. combining proactive and reactive routing protocols, are used in order to take advantages on these two routing protocols where proactive maintains route in a cluster and reactive maintains route between clusters. Several hybrids routing protocols have been proposed such as Zone Routing Protocol (ZRP), Zone-based Hierarchical Link State (ZHLS) and so on, but the most popular protocol is ZRP.

C) Modify OLSR with Residual Energy
OLSR is proactive in nature, having routes immediately available in each node for all the destinations in the network. OLSR is an optimization of pure link state routing protocol like Open Shortest Path First (OSPF) [4]. This optimization is related to concept of multipoint relay (MPR). A multipoint relay reduces the size of control messages. The use of MPRs also minimizes flooding of control traffic. Multipoint relays forward control messages, providing advantage of reduction in number of retransmissions of broadcast control messages. OLSR contains two types of control messages: neighborhood and topology messages, known as Hello messages and Topology Control (TC) messages. OLSR provides two main functionalities: Neighbor Discovery and Topology Dissemination. With the help of these two functionalities, each node computes routes to all known destinations.
Each node sends Hello message for finding HOP count so each node create neighbor table of one hop count and 2 hop count. Base on this table each node select MPR (multi Point Relay). MPRs are selected nodes which has more than one hope as well as high residual energy. After selecting MPR only MPR Nodes broadcast route_request. For sending route_request MPR nodes send TC (topology control) message. TC message contains MPR list so each node will get idea about whole topology. Over here we modify TC message and also check residual energy of MPR.

### Modified HELLO message format:

```
+----------------------------------+
| Residual Energy | Home | Willingness |
+----------------------------------+
| Link Code | Reserved | Link Message Size |
+----------------------------------+
| Neighbor Interface Address |
+----------------------------------+
| Neighbor Interface Address |
+----------------------------------+
```

### Modified TC message format:

```
+----------------------------------+
| ANSN | Residual Energy |
+----------------------------------+
| Advertised Neighbor Main Address |
+----------------------------------+
| Advertised Neighbor Main Address |
+----------------------------------+
| ... |
+----------------------------------+
```

### IV. RESULT ANALYSIS

#### a) Throughput : OLSR and Modified OLSR

- The Graph shows the performance in terms of throughput is high in modified OLSR.
- The Graph shows values of throughput in OLSR and Modified OLSR at different nodes.

#### b) PDR: OLSR and Modified OLSR

- The Graph shows the performance in terms of PDR is high in modified OLSR.
The Graph shows the performance in terms of PDR is high in modified OLSR.

The Graph shows values of PDR in OLSR and Modified OLSR at different nodes.

c) Energy: OLSR and Modified OLSR

The Graph shows the performance in terms of Energy is high in modified OLSR.

The Graph shows values of Energy in OLSR and Modified OLSR at different nodes.

INTRODUCTION OF ERROR

a) Throughput: Periodic vs Uniform Error

The Graph shows the performance in terms of Throughput is high in Periodic error as compared with Uniform Error.

The Graph shows values of Throughput in Periodic and Uniform Error at different nodes.

b) PDR: Periodic vs Uniform Error

The Graph shows the PDR in terms of Throughput is high in Periodic error as compared with Uniform Error.

The Graph shows values of PDR in Periodic and Uniform Error at different nodes.
c) **Energy: Periodic vs Uniform Error**

- The Graph shows the performance in terms of Energy is high in Periodic error as compared with Uniform Error.
- The Graph shows values of Energy in Periodic and Uniform Error at different nodes.

V. **RESULT ANALYSIS**

After simulation using ns2 we conclude that we improve above three parameters like PDF, Throughput and Residual Energy compared to error introduce with traditional OLSR. In future we proposed multipath concept for further improvement above results.

**Energy consumption:**
- Energy consumption increased when error is introduced.
- Energy consumption by the network will decrease as compared to other routing protocol.
- The results shows the performance in terms of Energy is high in Periodic error as compared with Uniform Error.

**PDR**
- PDR in the output increased when more number of node is introduced.
- The results shows the performance in terms of PDR is high in Periodic error as compared with Uniform Error.

**Throughput**
- Throughput of the system decreased when error is introduced.
- The Results shows the performance in terms of Throughput is high in Periodic error as compared with Uniform Error.

**ACKNOLEDGMENT**

I would like to extend my sincere thanks to Asst. Prof. Dhaval Nimavat. Department of Computer Engineering for their constant support and guidance throughout the research work. As my guide she has constantly encouraged me to keep focused on achieving my goal. I am thankful to them to give me them valuable time and sharing them idea and thought about this research area.

**REFERANCES**


