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# A Fuzzy Based Energy Rich Routing in Manet Using Witricty

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***Abstract:*** ***An infrastructure less environment where there won't be established path between the set of available nodes is called Mobile Adhoc Networks (MANET). The nodes present in the MANET environment are limited in their available energy power. The efficient routing need to be done to ensure the successful transmission of packet from sender to receiver with the concern of energy factor. This work also makes use of wireless charging devices for ensuring the availability of energy capacity. The efficient selection of route paths is done by using a technique called the fuzzification. This fuzzification is used to output a better fuzzy rule where from the set of fuzzy inference rules which are created in terms of three fuzzy linguistic variable low, medium and high of energy, bandwidth, Load and Hop count. The time complexity and computation overhead is reduced considerably by introducing the weighting based pruning technique. The proposed technique is simulated using NS2 Simulator.***

***Keywords: MANET, Witricity, Fuzzification, Weighted Pruning;***

## I. INTRODUCTION

Manet is a collection of mobile devices and routing of packets is a difficult task in the network. Networks transmission range is however limited. If the destination node is located within the source node's transmission range then they can directly communicate else they can communicate through the intermediate nodes. Manet is a network of portable devices that communicates without any dedicated links. Its self-configurable feature and easy deployment has lead to lot of applications like emergency cases, military operations, search and rescue operations.

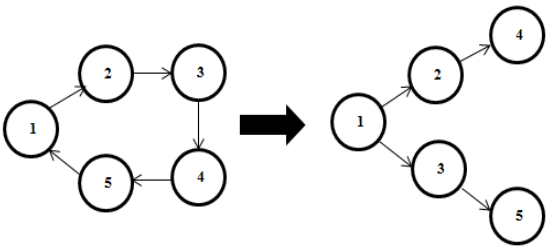


Fig I (a) MANET Changing Topology

In a network, energy constraint is a major issue because during transfer of packets the mobile nodes may undergo drop of energy which may lead to link failure. This will result in packet loss. So, **Witricity** technique has been implemented inorder to energize the sinking nodes. **Route Discovery** is done by generating set of dynamic rules by using fuzzy inference system. Using Backpressure technique, whenever the energy of a node goes below the threshold value the node will be eliminated from the network to perform **Route Maintenance.**

## II. LITERATURE SURVEY

Manish Bharadwaj [1] says a way to conserve the energy of the mobile nodes in a network is to consider the underutilized nodes so that the energy can be balanced among the other nodes. Rajeshkanna et al.[2] says that a node's life is relative to the battery operating at the node. Maximize the use of energy and maximize the network lifetime is a key challenge of Mobile Ad hoc network. Supriya P.Joshi et al. [3] says every node acts as a router and forwards packets. Due to mobility of nodes there may be link failures leading to loss of packets. Amandeep Kaur et al. [4] says that the mobile nodes are powered by batteries, therefore replacement or recharging them may not be possible. Traffic should be done in such a way that power consumption is minimized. Nihad.Abbas et al. [5] says that in this scheme, the node's parameters, such as residual energy, node mobility, and number of hop counts, are given to a fuzzy inference system to compute the value of the nodes, which can be used as a metric to construct an optimal path. M.Karthika et al. [6] identifies that the wirelessly transmitted Radio Frequency (RF) energy can be captured by the receiving antennas and then transformed into DC power, stored in batteries to provide energy to the sensor nodes. Ritu Dahiya et al. [7] proposed a technique to improve routing protocols by considering constraints based on energy and failure. The value obtained indicates the priority of a node and is used in route formation. S. Venkatasubramanian et al. [8] discovers the optimal path for data transmission from the source to the destination by computing QoS parameters.

 

## III. PROPOSED WORK

Network's topology is given as a graph G (W, E), where W and E are the set of nodes and links respectively is set. A unique integer identifier for the node's is set between 1 and N=|W|. Nodes are assumed to be powered by batteries. The remaining battery energy of node $u \in W$ is represented by $C_u$. Whenever the energy of a node falls below a threshold $C_{th}$, the node is considered to be dead. And assume $C_{th} = 0$. A link in the network is denoted by (u, v) in which u is the sending node and v is the receiving node. There could be a link from u to v, if the received signal strength by v is above threshold.

The delimiting factor i.e. flooding of broadcast message to all nodes including the source node is overcome by providing some modifications to the Dynamic Source Routing (DSR) protocol which is known as **Enhanced Dynamic Source Routing (E-DSR)** Protocol. This is used to reduce the Route request packet overhead. Hence multicasting is used in the network for the delivery of packets.

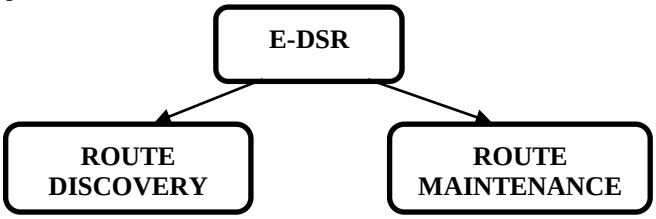


Fig III (a): Phases in E-DSR

In route discovery, when a node receives a RREQ (Route Request) packet, it will perform the following steps:

1. It finds out all of its neighbors from its neighbor table.
2. Selects the addresses of those nodes from neighbor table which are not present in the RREQ
3. Forwards the packets to the nodes found.

The main goal is to select a path that contains the underutilized nodes, so that the energy among all nodes will be balanced because the underutilized nodes will have more energy than that of the utilized nodes. This approach compares not only energy but other parameters like bandwidth, load and hop count for the route selection so it may result in shorter, best and energy-rich routing. Thus, ensuring prolonged network life-time.

To determine if the residual energy of any node goes below the threshold, route maintenance is essential. So after each transmission of packet, the energy factor is determined. If any node tries to send the packet when its energy is below threshold of the required energy, then packet will be lost. Witricity is the acronym for **Wireless Electricity**. It is the technique by which there will be flow of electricity between the Load and the Input without using any connections, whenever the energy of the input i.e. mobile node falls below the threshold value.

Whenever a node has insufficient energy to transmit the packets further it will result in a link failure. So in that condition the sinking node will generate a RERR (Route Error) packet containing the addresses of the nodes to the source node by back tracking the route informing about its link failure due to minimum residual energy. On receiving the RERR packet, it removes all the routes containing the path of the sinking node. This helps to eliminate the delay in the transmission of data packet.

In a fuzzy engine the inference system includes the rule base and input membership functions that are used to fuzzify the input and the output variables. Fuzzification is the process by which crisp input values which are represented in terms of the membership function of the fuzzy sets are transformed. By following the fuzzification process it determines the fuzzy output using fuzzy rules that which are if then rules. Defuzzification is then used to translate the fuzzy output to a crisp value.

## IV. METHODOLOGY

The three kinds of techniques used in this work are listed as follows:

a) Backpressure Technique
b) Witricity
c) Fuzzification using Weighted Pruning.

**Backpressure Technique:**

When node has insufficient energy, RERR packet is generated by sinking node. On receipt by intermediate nodes, sinking node is removed. So, there will be no need for rediscovery and an alternate route is selected. There will be no link failure and time delay in transmission.

**WITRICITY (Wireless Electricity):**

Wireless charging known as Inductive charging consists of two coils: transmitter coil and receiver coil. An Alternating Current is passed through transmitter coil; it generates a magnetic field around the coil which in turn induces a voltage in receiver coil and can power a mobile device or charge a battery. The sinking mobile nodes are identified and are automatically energized by a power source using power receiver and transmitter concept. This technique is very useful in avoiding failure of nodes during the transmission of packets in a network. In practical witricity technique is

 

used in electronic devices like mobiles, laptops and other devices that rely on chemical storage of energy in batteries when the devices require energy.

**Fuzzification Using Weighted Pruning:**

The route from source to destination is selected based on four parameters energy, bandwidth, hop count and load based on the rules inferred from the fuzzy inference system. This is done via. introducing the **fuzzification** methodology which tends to generate the set of fuzzy rules in the dynamic manner. The different fuzzy crisp values are generated in terms of three variable called

- Low
- Medium
- High

Since huge number of rules will be generated, the best rules are given weights and thus eliminate the worst rules. Thus the best path can be found. This approach ensures efficient selection of optimal route path between the sender and the receiver nodes.

## V. RESULTS

A topology of 30 mobile nodes is configured statically using NS2 Simulator and the topology is viewed in the NAM window. The source and destination nodes are differentiated from the rest of the nodes by blue color.

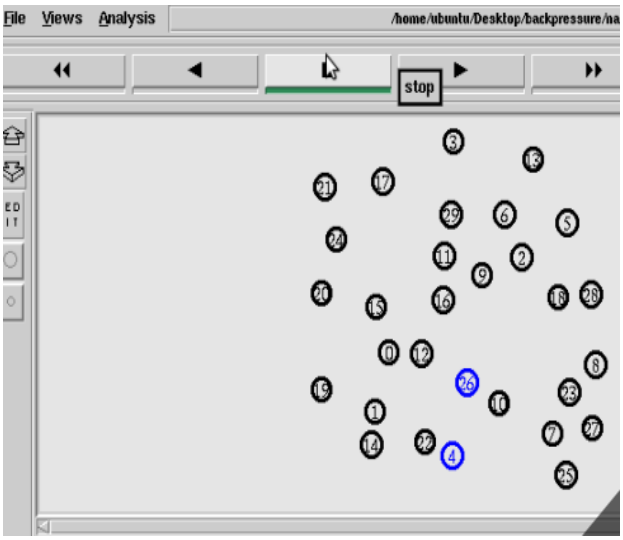


Fig V (a): Network Topology

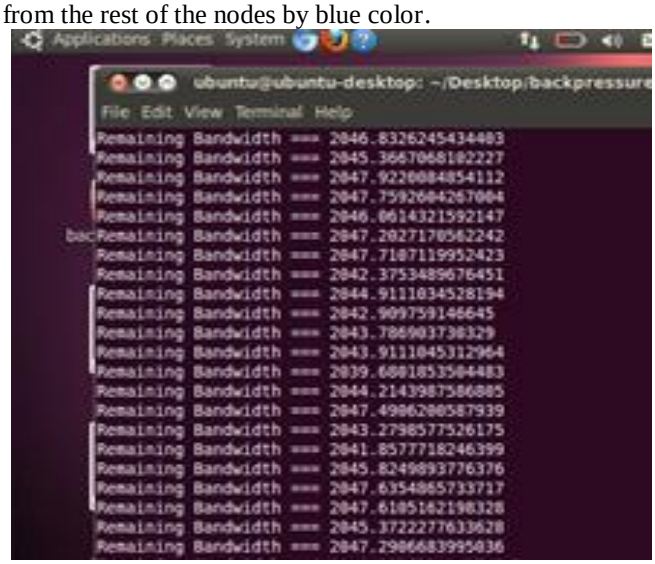


Fig V (b): Bandwidth of each node

After the transmission of packets from the Source to the required destination, the bandwidth used is found and the remaining bandwidth values are shown in the output. Similarly the remaining load in the network and energy are calculated after the transfer of packets between the source and destination which are shown below in the figures V(c), (d) respectively.

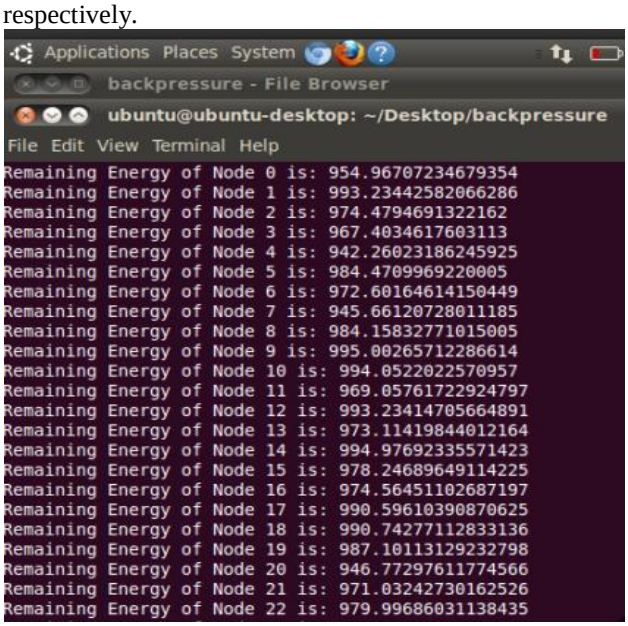


Fig V (c): Energy of the nodes

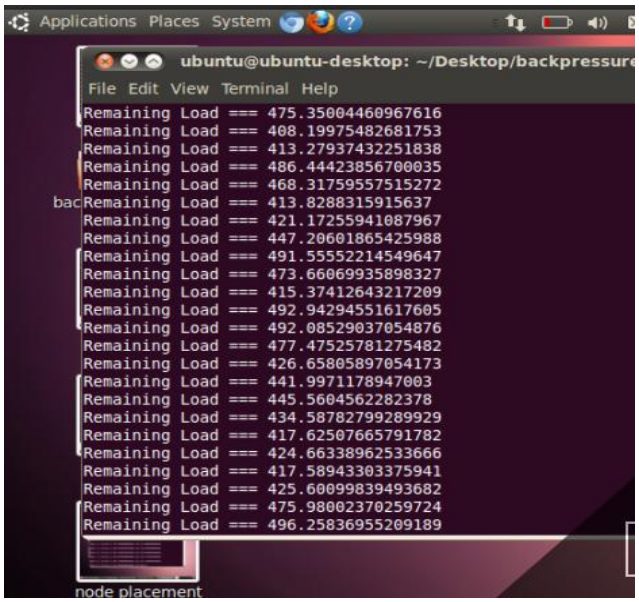


Fig V (d): Load in the network

 

Thus after every transmission of packets the remaining energy, bandwidth and load values are calculated and displayed.

Based on the values calculated and the neighboring nodes found, the shortest paths are calculated by using a set of fuzzy rules [1].

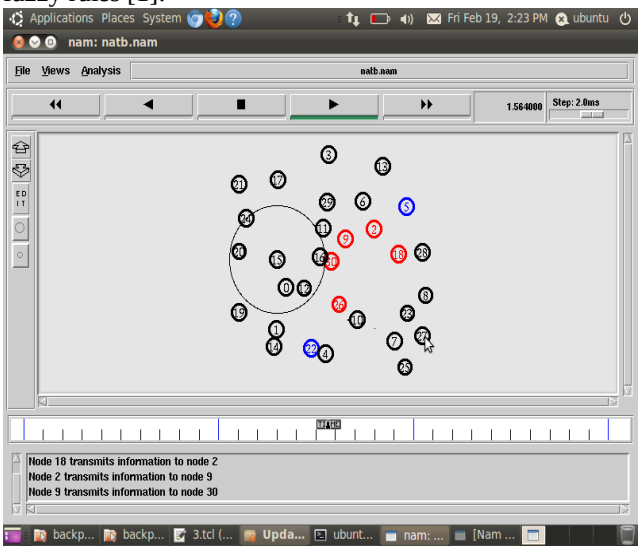


Fig V (e): Node discovery

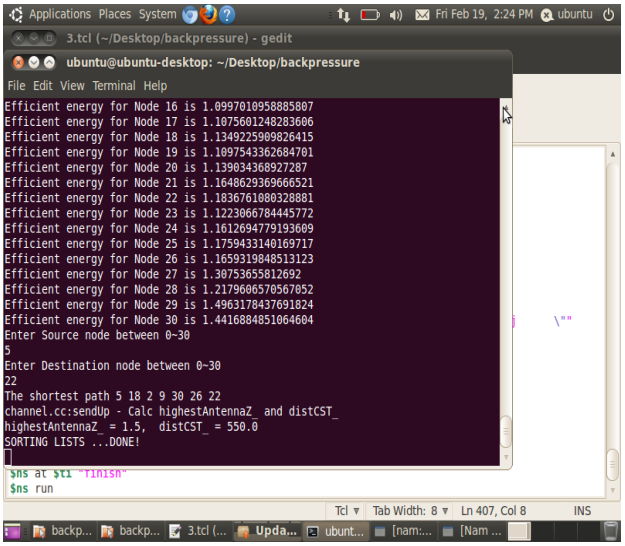


Fig V (f): Path Calculated

## VI. CONCLUSION

Using the network parameters energy, bandwidth, hop count and load the shortest and best path are calculated for the topology that was setup. Further the process of finding out the sinking nodes, energizing it and generating the fuzzy rules rather than using static set of rules for energy rich routing are still in process, which will be shown in future works.

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