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ENERGY EFFICIENT FOR LOSSY NETWORK BY AODV PROTOCOL

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ABSTRACT:

The most important issue that must be solved in designing a data transmission algorithm for wireless sensor networks (WSNs) is how to save sensor node energy while meeting the needs of applications/users as the sensor nodes are battery limited. While satisfying the energy saving requirement, it is also necessary to achieve the quality of service. In this paper proposed an energy efficient region-based routing protocol, called AODV, which achieves energy-efficient data delivery without compromising reliability. We propose an Adaptive Region Selection (ARS) scheme to provide an efficient solution for the energy failure problem. A distributed utility-based best relay selection strategy is incorporated, which selects the best relay based on location information and residual energy. In low power and lossy networks, the point-to-point communication is a fundamental requirement. In the proposed paper, only a subset of nodes is participated. So that the energy consumption is less than the traditional routing protocols.

Index terms-- ***low power and lossy networks,AODV routing, ER-RPL, low energy consumption, control overhead, reliable communication.***

I. INTRODUCTION

A wireless sensor network (WSN) consists of sensor nodes capable of collecting information from the environment and communicating with each other via wireless transceivers. The collected data will be delivered to one or more sinks, generally via multi-hop communication. The sensor nodes are typically expected to operate with batteries and are often deployed to not-easily-accessible or harsh environment, sometimes in large quantities. It can be difficult or impossible to replace the batteries of the sensor nodes.

On the other hand, the sink is typically rich in energy. Since the sensor energy is the most precious resource in the WSN, efficient utilization of the energy to prolong the network lifetime has been the focus of much of the research on the WSN. The communications in the WSN has the many-to-one property in that data from a large number of sensor nodes tend to be concentrated into a few sinks. Since multi-hop routing is generally needed for distant sensor nodes from the sinks to save energy, the nodes near a sink can be burdened with relaying a large amount of traffic from other nodes.

Sensor nodes are resource constrained in term of energy, processor and memory and low range communication and bandwidth. Limited battery power is used to operate the sensor nodes and is very difficult to replace or recharge it, when the nodes die. This will affect the network performance. Energy conservation and harvesting

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increase lifetime of the network. Optimize the communication range and minimize the energy usage, we need to conserve the energy of sensor nodes.

Sensor nodes are deployed to gather information and desired that all the nodes works continuously and transmit information as long as possible. This address the lifetime problem in wireless sensor networks. Sensor nodes spend their energy during transmitting the data, receiving and relaying packets. Hence, designing routing algorithms that maximize the life time until the first battery expires is an important consideration. Designing energy aware algorithms increase the lifetime of sensor nodes.

In some applications the network size is larger required scalable architectures. Energy conservation in wireless sensor networks has been the primary objective, but however, this constrain is not the only consideration for efficient working of wireless sensor networks. There are other objectives like scalable architecture, routing and latency. In most of the applications of wireless sensor networks are envisioned to handled critical scenarios where data retrieval time is critical, i.e., delivering information of each individual node as fast as possible to the base station becomes an important issue.

It is important to guarantee that information can be successfully received to the base station the first time instead of being retransmitted. In wireless sensor network data gathering and routing are challenging tasks due to their dynamic and unique properties. Many routing protocols are developed, but among those protocols cluster based routing protocols are energy efficient, scalable and prolong the network lifetime .In the event detection environment nodes are idle most of the time and active at the time when the event occur. Sensor nodes periodically send the gather information to the base station. Routing is an important issue in data gathering sensor network, while on the other hand sleep-wake synchronization is the key issues for event detection sensor networks.

A 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; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

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.

A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. 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.

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The main objective of this paper is to reduce packet loss ratio and improve network throughput, and reduce the energy consumption in Low-Power and Lossy Networks (LLNs). Machine -to-Machine (M2M) communications aimto achieve ubiquitous communication among intelligentdevices for application control and monitoring, whichhave attracted both academia and industry in recent years.

II. ROUTING PROTOCOL

RPL[7] is the routing protocol developed by the ROLL Working Group specifically for the so-called 'Low Power and Lossy Networks. This includes, but it is not limited to, Wireless Sensor Networks. The protocol is based on IPv6. IPv4 is not even considered as an option.

RPL is a proactive IPv6[8] based distance-vector routing protocol. RPL can establish a Destination Oriented Directed Acyclic Graph (DODAG) at a high speed with the trickle algorithm. RPL supports actively three kinds of traffic: Point to Point, Point to Multipoint and Multipoint to Point, with four Mode of Operation (MOP). The root nodeserves as a transit point to bridge the DODAG with the IPv6network. The formation of a DODAG is initiated by the rootnode that periodically originates DODAG Information Object(DIO). RPL is designed to optimize the routing support formultipoint-to-point (MP2P). RPL chooses the best next hopas the preferred parent to the root node given a particularobjective function. The base concept in RPL is the Destination Oriented DirectedAcyclic Graph (DODAG). Assuming that the biggestpart of the node's communication are flowing to or from aroot node (the gateway between the WSN and the Internetusually), it is pretty straightforward that building a DODAGhaving as the destination the root node is equivalent to solvethe routing problem. The whole RPL protocol tries to build,maintain and optimize DODAGs. The base idea is simple;the solution is not so simple.

RPL needs to pre-establish routes and can only route along pre-established DAGs for P2P communication. The source node has to send the packet upwards until it reaches the ancestor node of the destination node. Then
the common ancestor node delivers the packet downwards towards the destination node. In non-storing mode of RPL, the common ancestor has to be the root node. Hence, packets need to travel through many lossy links, resulting in long end to-end delay. Additionally, the root becomes a bottleneck whentraffic load becomes heavy.

A reactive P2P route discovery mechanism based on RPLVis defined as P2P-RPL[7]. The source node originates and disseminates routediscovery messages throughout the whole network. The frequencyof broadcasting route discovery messages is accordingto the trickle algorithm. Once the destination node receivesthe P2P-RDO, it replies a P2P Discovery Reply Object (P2P-DRO)to the source through the discovered route. The reverseroute of P2P-DRO is used for P2P data delivery.

LOADng is a reactive routing protocol derived from Ad hoc On-demand Distance Vector Routing (AODV) for LLNs. The operation of LOADng makes lots of simplifications on AODV. During the route discovery stage, route request (RREQ) messages will be distributed throughout a network. If the destination node receives a RREQ message, it replies a route-reply (RREP) message through the reverse path to the source node. LOADng supports many traffic patterns, such as P2P, point-to-multipoint (P2MP), and MP2P. However, for MP2P traffic pattern, the routing overhead in LOADng is much more than that in RPL. LOADng disseminate route discovery messages throughout the

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Whole network. The route discovery scheme in LOADng is similar to that in P2P-RPL.

Geographic routing relies on the locations of nodes (eitherreal coordinates or virtual coordinates) instead of nodes' IPaddresses to forward data packets in a greedy manner. A node chooses the node, which is the closest one tothe destination from its neighbours, as its next hop to relayits data packets. Geographic routing has the advantage of low routing overhead and scalability support, but it does not take into consideration of the lossy nature of wireless links in the selection of the next hop. Consequently, geographic routing usually cannot cope well with the lossy wireless medium to provide reliable data delivery support for LLNs. Additionally, in some geographic routing protocols, nodes have to exchange the one-hop or even two hop neighbour table periodically to maintain the coordinates. It is very costly in terms of energy consumption for a resource constrained network.

III. ENERGY EFFICIENT ROUTING PROTOCOL

Proposed system implements the energy saving routing protocol in the battery limited Low-Power and Lossy Networks (LLNs) in order the lifetime of the network. The proposed protocol performs a route discovery process similar to the AODV protocol. The propose hybrid of proactive and reactive routing protocol, namely ER-RPL[4], to achieve reliable data delivery in an energy-efficient manner.In order to achieve this requirement, Power-efficient Energy-Aware routing protocol for wireless ad hoc networks is proposed that saves the energy by efficiently selecting the energy efficient path in the routing process.

To find a path to the destination, the source broadcasts a route request packet. The neighbours in turn broadcast the packet to their neighbours till it reaches an intermediate node that has recent route information about the destination or till it reaches the destination. A node discards a route request packet that it has already seen.

In this project, we use the AODV protocol[5] and it have the following features, there are AODV such broadcasts arenot necessary, If a link breakage does notaffect ongoing transmission ->no global broadcast occursOnly affected nodes areinformed, Local movements of nodeshave local effects,AODV reduces the networkwide broadcasts to the extentpossible, Significant reduction incontrol overhead as comparedto DSDV.

A. AODV (Adhoc on demand distance vector routing)

It is a reactive routing protocol, meaning that it establishes a route to a destination only on demand. In contrast, the most common routing protocols of the Internet are proactive, meaning they find routing paths independently of the usage of the paths.

AODV is, as the name indicates, a distance vector routing protocol. AODV avoids the counting to infinity problem of other distance vector protocols by using sequence numbers on route updates, a technique pioneered by DSDV[5]. AODV is capable of both unicast and multicast routing.

B. AODV operation

In AODV, the network is silent until a connection is needed. At that point the network node that needs a connection broadcasts a request for connection. Other AODV[6] nodes forward this message, and record the node that they heard it from, creating an explosion of temporary routes back to the needy node.

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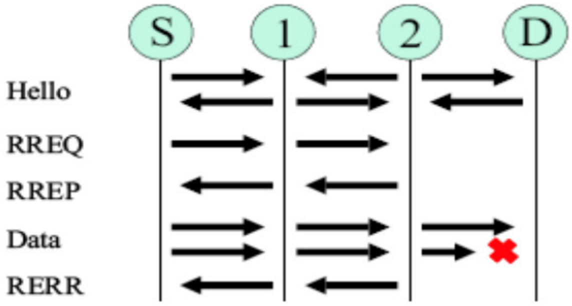

Fig 1: AODV operation

When a node receives such a message and already has a route to the desired node, it sends a message backwards through a temporary route to the requesting node. The needy node then begins using the route that has the least number of hops through other nodes.

Unused entries in the routing tables are recycled after a time. When a link fails, a routing error is passed back to a transmitting node, and the process repeats. Much of the complexity of the protocol is to lower the number of messages to conserve the capacity of the network.

For example, each request for a route has a sequence number. Nodes use this sequence number so that they do not repeat route requests that they have already passed on.

Another such feature is that the route requests have a "time to live" number that limits how many times they can be retransmitted. Another such feature is that if a route request fails, another route request may not be sent until twice as much time has passed as the timeout of the previous route request.

The advantage of AODV is that it creates no extra traffic for communication along existing links. Also, distance vector routing is simple, and doesn't require much memory or calculation. However AODV requires more time to establish a connection, and the initial communication to establish a route is heavier than some other approaches.

C. Technical description

The AODV Routing protocol uses an on demand approach for finding routes, that is, a route is established only when it is required by a source node for transmitting data packets. It employs destination sequence numbers to identify the most recent path.

D. Comparision of DSR and AODV

The major difference between AODV and dynamic source routing (DSR) [5] stems out from the fact that DSR uses source routing in which a data packet carries the complete path to be traversed. However, in AODV, the source node and the intermediate nodes store the next hop information corresponding to each flow for data packet transmission.

In an on demand routing protocol, the source node floods the Route Request packet in the network when a route is not available for the desired destination. It may obtain multiple routes to different destinations from a single Route Request.

The major difference between AODV and other on demand routing protocols is that it uses a destination sequence number (DestSeqNum) to determine an up to date path to the destination. A node updates its path information only if the Destination Sequence Number of the current packet received is greater than the last Destination Sequence Number stored at the node.

A Route Request carries the source identifier (SrcID), the destination identifier (DestID), the source sequence number (SrcSeqNum), the destination sequence number (DestSeqNum), the broadcast identifier (BcastID), and the time to live (TTL) field. Destination Sequence Number indicates the freshness of the route that is accepted by the source.

When an intermediate node receives a Route Request, it either forwards it or prepares a

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Route Reply if it has a valid route to the destination. The validity of a route at the intermediate node is determined by comparing the sequence number at the intermediate node with the destination sequence number in the Route Request packet.

If a Route Request is received multiple times, which is indicated by the BcastID-SrcID pair, the duplicate copies are discarded. All intermediate nodes having valid routes to the destination, or the destination node itself, are allowed to send Route Reply packets to the source.

Every intermediate node, while forwarding a Route Request, enters the previous node address and it's BcastID. A timer is used to delete this entry in case a Route Reply is not received before the timer expires. This helps in storing an active path at the intermediate node as AODV does not employ source routing of data packets.

When a node receives a Route Reply packet, information about the previous node from which the packet was received is also stored in order to forward the data packet to this next node as the next hop toward the destination.

DSR includes source routes in packet headers. Resulting large headers can sometimes degrade performance particularly when data contents of a packet are small; AODV attempts to improve on DSR by maintaining routing tables at the nodes, so that data packets do not have to contain routes.

AODV retains the desirable feature of DSR that routes are maintained only between nodes which need to communicate. Route Requests (RREQ) are forwarded in a manner similar to DSR. When a node re broadcasts a Route Request, it sets up a reverse path pointing towards the source AODV assumes symmetric (bi directional) links.

E. AODV routing

When the intended destination receives a Route Request, it replies by sending a Route Reply (RREP).Route Reply travels along the reverse path set up when Route Request is forwarded. Route Request (RREQ) includes the last known sequence number for the destination.

An intermediate node may also send a Route Reply (RREP) provided that it knows a more recent path than the one previously known to sender. Intermediate nodes that forward the RREP, also record the next hop to destination.

A routing table entry maintaining a reverse path is purged after a timeout interval. A routing table entry maintaining a forward path is purged if not used for active route timeout interval.

When the next hop link [1] in a routing table entry breaks, all active neighbors are informed. Link failures are propagated by means of Route Error (RERR) messages, which also update destination sequence numbers.

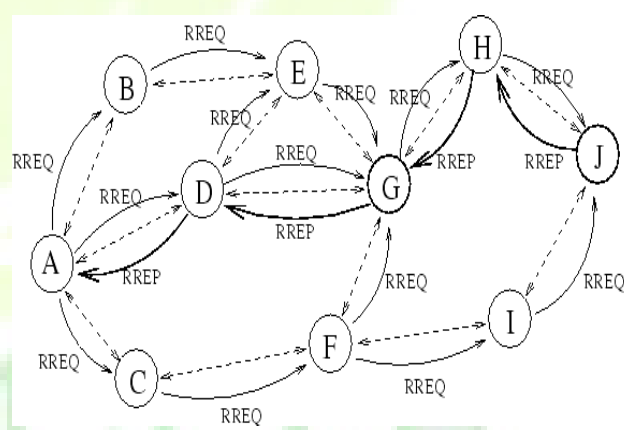

Fig 2: AODV routing

As shown in figure 2, neighbor of node X is considered active for a routing table entry if the neighbor sent a packet within active route timeout interval which was forwarded using that entry. Neighboring nodes periodically exchange hello message.

When node X is unable to forward packet P (from node to node D) on link (X, Y), it generates a RERR message. Node X increments the destination sequence number for D cached at node X.

` The incremented sequence number N is included in the RERR. When node receives the RERR, it initiates a new route discovery for D using destination sequence number at least as large as N.

When node D receives the route request with destination sequence number N, node D will set its sequence number to N, unless it is already larger than N. Routes need not be included in packet headers. Nodes maintain routing tables containing entries only for routes that are in active use. At most one next hop per destination maintained at each node DSR may maintain several routes for a single destination.

Sequence numbers are used to avoid old/broken routes. Sequence numbers prevent formation of routing loops. Unused routes expire even if topology does not change.

F. AODV protocol system design

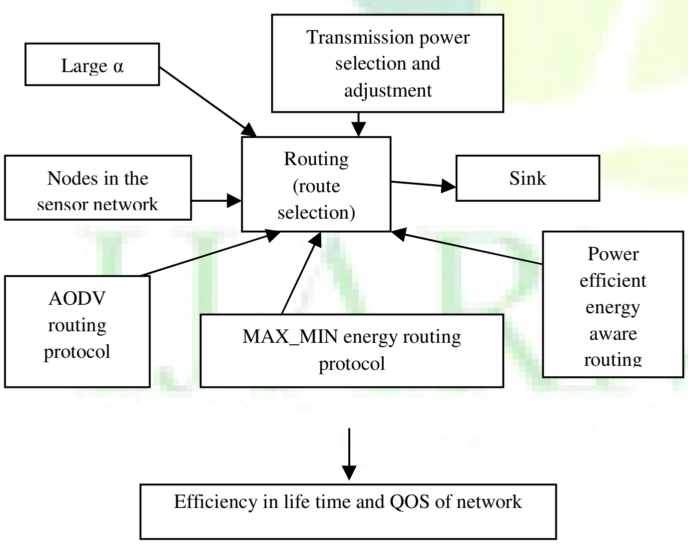

Fig 3: system design in AODV

Large α considers a network of nodes. If the network is large, it has the many routing paths. The wireless sensor networks have large number of nodes so that the selection of routing path is complex.

One large network is created by the large number of sensor nodes. Each node has a detail of the node. The detail of the node consists of source id, destination id, packet number, sequence number, hop count and the residual energy.

In this project uses the AODV protocol for energy efficient delivery of packets. This protocol finds the energy [10] in the each node and also the hop count from the source node to destination node.The MAX_MIN technique is used for finding the maximum and minimum energy in each node. So that the routing path can be easily selected.

The source node selects the maximum energy path to increase the lifetime of the network path. The minimum energy path is quickly dropped out the packet. In this minimum energy path, the life time is very low.

Power efficiency energy aware routing protocol [3] indicates the losing energy nodes. So that only, it will communicate by choosing another alternative path. If it does not indicate the lossy energy nodes, the packets may be dropped out.Transmission power selection [2] and adjustment is a technique to choose the alternative path to prevent the losing energy packets. It chooses the high energy path for delivering the packets. So that the efficiency, life time and quality of service (QOS) can be increased.

IV. SYSTEM IMPLEMENTATION

A. Modules

1. Network design
2. Initializing the timer and list
3. Insert the values in to the list
4. Checking that values and route discovery

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1. Network Design

In our first module, we created the network with no. of sensor node and base node. Each and every sensor placed in specific interval. And each and every sensor capable receiving data from sensors and it can forward to another. That meaning is each sensor can act as parent node as well as child node.

2. Initializing the Timer and List

First we have to enable the timer and the list for the route discovery process. The list is enabled to store the various information about the nodes and packets. Here we are going to enable the timer to send hello message in regular intervals. Hello message is to know about the neighbour nodes, based on the reply we got we will store the neighbour table information. In every regular interval it's going to update the routing table based on the hello message.

3. Insert the Values In To the List

After initializing the list we have to store the various information about nodes and paths like source id, destination id, packet number, sequence number, hop count and the residual energy.

4. Checking That Values and Route Discovery

The values which are stored in the list we have to check them and compare them to find a better path for data transmission. Whenever a node is trying to send a data it initially sends a request message i.e., RREQ in this we include some information like packet type, source id, destination id, sequence number. Based on this information the intermediate nodes check the destination id if it matches it will check about the source information if it is already available it will checks which is the better path based on the hop count and residual energy if it found new path is the better one it will generate route reply and send that in that path otherwise it will stick to old path. If the destination id is not matched means it will store that information in that list and forwards to its neighbours for the next process.

B. Route finding flow chart

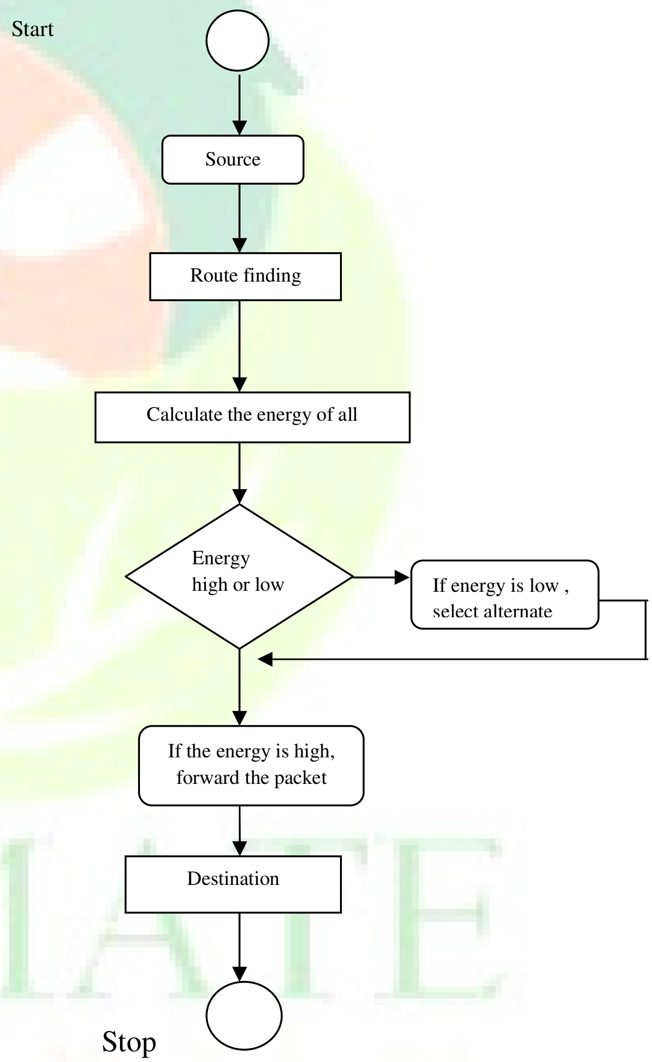

Fig 4: flow chart of AODV

At first the routing path is found by the techniques. Each node has a some amount of information. It calculates the energy in all nodes and selects the maximum energy node. If it selects the lowest energy node, it loss the packets.If the energy is loss [9] in the maximum energy node, it alternates the path to the maximum energy node in the networks. And then the packets are forwarded from the source node to the destination node.

The AODV protocol send the HELLO messages to enquire the node is busy or free. If the node is free, it received the acknowledgement. Then only it can communicate to the destination node.

And then send the route request (RREQ) messages to the destination node through the intermediate nodes. Then the destination node replied to the source node by sending the route reply (RREP) messages.

Now the data is send from the source node to destination node through the intermediate path nodes. If the data is not arrived in a particular time interval, the destination node sends the error (RERR) messages to the source node. This process is repeated for all packets.

Characteristics:

The main characteristics of a WSN include

- Power consumption constrains for nodes using batteries or energy harvesting
- Ability to cope with node failures
- Mobility of nodes
- Communication failures
- Heterogeneity of nodes
- Scalability to large scale of deployment
- Ability to withstand harsh environmental conditions
- Ease of use

C. Network initialization stage

Each RN computes its Coordinates, which is defined as the average distance per hop count.Distance between two arbitrary nodes can be calculated by,

$$d_{IJ} = \sqrt{(x_I - x_J)^2 + (y_I - y_J)^2}.$$

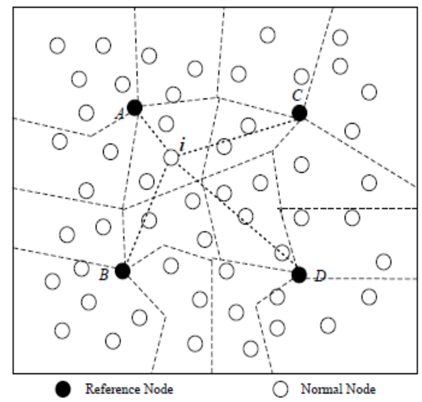

Fig 5. Region separated

Arbitrary RN I has the distance and hop count information of the other (N - 1) RNs, its Coordinates can be calculated through,

$$C_I = \frac{\sum_{J \in \Omega, J \neq I} d_{IJ}}{\sum_{J \in \Omega, J \neq I} h_{IJ}}.$$

The distance between node i to RN I can be obtained through,

$$d_{iI} = C_I h_{iI}$$

Assume that the number of traffic flows is denoted by . In P2P-RPL [7], all nodes participate in the route discovery. When _ traffic flows require the route discovery, where _ <n(n□1)=2, the control overhead of P2P-RPL for time t is

$$O_{p2p-rpl} = n\lambda f_c t = \frac{n\lambda t}{I_{min} 2^{I_{max}}}.$$

The packet delivery ratio can be calculated by the ratio of the number of packets successfully delivered from the source to destination to the number of packets generated in the source.When an RN joins the DODAG rooted by another RN, it records the position information as well as the hop count associated with that RN.

Parameter	Value
Number of nodes	100
Number of reference nodes	4
Retransmission limit	5
Communication range	35m
Packet size	512 bytes
Traffic rate	4 pkt/s, CBR flow
Routing metric	ETX
Transmitter electronics (E_{elec})	50nJ/bit
Transmit amplifier ($_{amp}$)	100pJ/bit/m2
The Minimum time interval size (I_{min})	50ms

D. Evaluation

Packet delivery ratio refers to the ratio of the number of packets successfully delivered to destination nodes to the number of packets generated by source nodes. This metric illustrates the routing reliability. Normalized routing control overhead refers to the ratio of the number of control messages to the number of data successfully delivered to the destination nodes. Energy consumption per data successfully delivered is the ratio of the total energy consumption to the number of data packets that are successfully delivered to the

Destination nodes. The total energy consumption of the network includes the energy spent for all phases of the network during the simulation. Average hop count refers to the average number of hops for the discovered route between the source nodes and the destination nodes. Average end-to-end delay includes all possible delay during data transmission due to transmission time, retransmissionCaused by collision and queuing time.

The energy consumption in transmitting and receiving states are the major components to be considered in this project. In this model, the radio consumes E_{elec} to run the transmitter or receiver circuitry. The transmitting amplifier[6] is $€_{amp}$, which is used to achieve the acceptable signal-to-noise (SNR) ratio. We assume the propagation loss exponent is 2. In this way, the energy consumption for transmitting a 1-bit message with a transmission range R is modelled as $E_{tx}(l;R) = lE_{elec} + lR2€_{amp.}$ The energy consumption of the receiver is modelled as

$E_{rx}(l\ d) = lE_{elec}$

V. EXPERIMENTAL SETUP

In this study, RPL, P2P-RPL and ER-RPL are implemented from scratch on Network Simulator 3 (NS3). Four RNs are used in this study. Each RN has four regions with the distributed Self-regioning[5] algorithm. Both symmetric links ($p_{ij} = p_{ji}$) and asymmetric links ($p_{ij}\quad p_{ji}$) are considered.

The ns3 simulator is worked for the indicating the energy level and constant bit rate and bit error rate. The ns3 only used the tool command language for coding. But the mat lab used the formulas to execute the result. The result executed in the ns3 is data packets sends from the source to the destination. In that execution , data packets may be loss

If the energy is reduced in the node, it will selects the alternate path that selection node should be in high energy and the shortest path to the destination. In that the simulator , the energy reduced node indicated by different colour.

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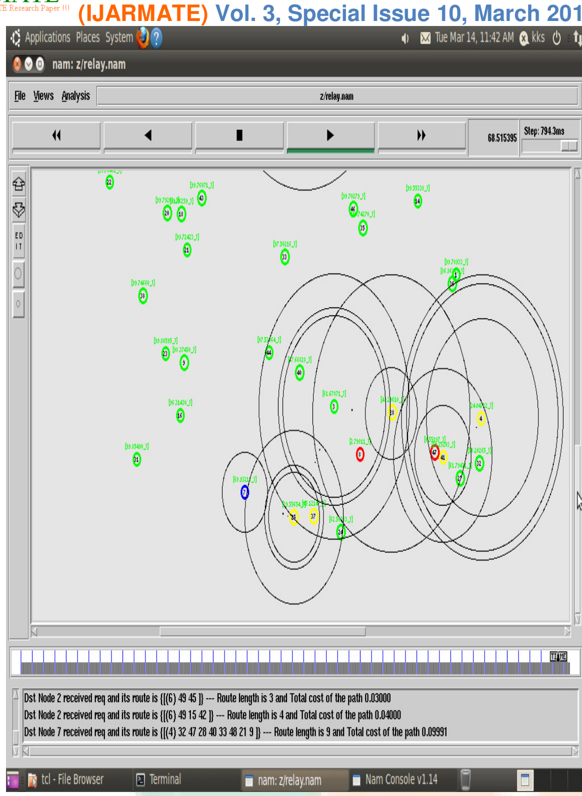

Fig 6: data from source to destination

In this proposed paper, we use the AODV protocol. It selects the shortest path between the source and destination. Other protocols are not select the alternate path, if the path breaks. But it again selects the alternate path from the source to destination.

In that the simulation window indicates that the destination node accepts the request and the route length. How much time exists for delivery the packets or sending the request also indicated. The ns3 have two windows. There are tace and nam window.

Network Simulator (Version 2), widely known as NS2, is simply an event driven simulation tool that has proved useful in studying the dynamic nature of communication networks. Simulation of wired as well as wireless network functions and protocols (e.g., routing algorithms, TCP, UDP) can be done using NS2. In general, NS2 provides users with a way of specifying such network protocols and simulating their corresponding behaviours.

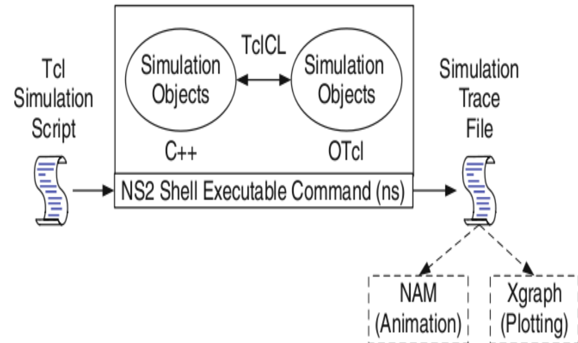

Fig 7: Basic NS2 architecture

A. NS features

1. NS is an object oriented discrete event simulator – Simulator maintains list of events and executes one event after another
2. Single thread of control: no locking or race conditions
3. Back end is C++ event scheduler
   a. Protocols mostly
   b. Fast to run, more control
4. Front end is OTCL
   a. Creating scenarios, extensions to C++ protocols
   b. Fast to write and change

Simulation is a process of designing a model of a real system and conducting experiments with this model for the purpose of understanding the behavior of the system and/or evaluating various strategies for the operation of the system.

Simulation is widely-used in system modeling for applications ranging from engineering research, business analysis, manufacturing planning, and biological science experimentation, just to name a few.

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When the system is rather large and complex, a straightforward mathematical formulation may not be feasible. In this case, the simulation approach is usually preferred to the analytical approach.

The simulation window ns3 is better because of the following advantages. There are Cheap does not require costly equipment, Complex scenarios can be easily tested , Results can be quickly obtained – more ideas can be tested in a smaller timeframe, The real thing isn't yet available, Controlled experimental conditions – Repeatability helps aid debugging. The disadvantages of the system is Real systems too complex to model.

VI. RESULT AND DISCUSSION

In this study, RPL, P2P-RPL and ER-RPL are implemented from scratch on Network Simulator 3 (NS3). Four RNs are used in this study. Each RN has four regions with the distributed Self-regioning algorithm.The ns3 simulator is worked for the indicating the energy level and constant bit rate and bit error rate. The ns3 only used the tool command language for coding. But the mat lab used the formulas to execute the result. The result executed in the ns3 is data packets sends from the source to the destination. In that execution, data packets may be loss.

If the energy is reduced in the node, it will selects the alternate path that selection node should be in high energy and the shortest path to the destination. In that the simulator, the energy reduced node indicated by different colour.

In this proposed paper, we use the AODV protocol. It selects the shortest path between the source and destination. Other protocols are not selecting the alternate path, if the path breaks. But it again selects the alternate path from the source to destination.

In that the simulation window indicates that the destination node accepts the request and the route length. How much time exists for delivery the packets or sending the request also indicated? The ns3 have two windows. There are trace and nam window.

The ns programming has the structures are Create the event scheduler, Turn on tracing, Create network topology, Create transport connections, Generate traffic, Insert errors.

A. Creating network topology (physical layer)

The Physical Layer is the first and lowest layer in the seven-layer OSI model of computer networking. The implementation of this layer is often termed PHY.

The Physical Layer consists of the basic hardware transmission technologies of a network. It is a fundamental layer underlying the logical data structures of the higher-level functions in a network.

Due to the plethora of available hardware technologies with widely varying characteristics, this is perhaps the most complex layer in the OSI architecture.The Physical Layer defines the means of transmitting raw bits rather than logical data packets over a physical link connecting networking nodes.

The bit stream may be grouped into code words or symbols and converted to a physical that is transmitted over hardware.

B. Transport connection (transport layer)

Transport layers are contained in both the TCP/IP which is the foundation of the INTERNET and the OSI model of general networking. The definitions of the Transport Layer are slightly different in these two models.

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IJARMATE
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(IJARMATE) Vol. 3, Special Issue 10, March 2017

This article primarily refers to the TCP/IP model, in which TCP is largely for a convenient application-programming interface to Internet hosts, as opposed to the OIS model of definition interface.The most well-known transport protocol is the (TCP). It lent its name to the title of the entire Internet protocol suite TCP/IP.

It is used for connection-oriented transmissions, whereas the connectionless user datagram suite (UDP) is used for simpler messaging transmissions. TCP is the more complex protocol, due to its design incorporating reliable transmission and data stream services.

C. Generate traffic (application layer)

In TCP/IP, the Application Layer contains all protocols and methods that fall into the realm of process-to-process communications via an Internet Protocol (IP) network using the Transport layer protocols to establish underlying host-to-host connections.

In the OSI model, the definition of its Application Layer is narrower in scope, explicitly distinguishing additional functionality above the Transport Layer at two additional levels: session layer and presentation layer OSI specifies strict modular separation of functionality at these layers and provides protocol for each layer.

D. Model output:

There are two types of outputs

- Nam window
- Xgraph

Simulation is a process of designing a model of a real system and conducting experiments with this model for the purpose of understanding the behaviour of the system and/or evaluating various strategies for the operation of the system

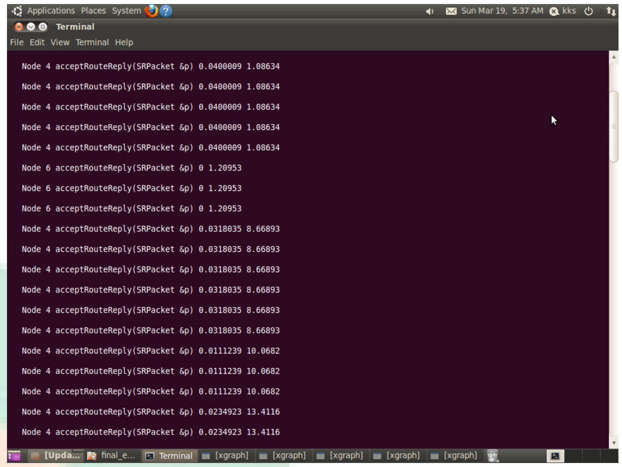

Fig 8: execution of terminal window

Fig shows the terminal window. The terminal window accepts the route request from the source. And it also shows that the time and energy consumption. The request sends from the source and the destination accepts the request. The energy consumption at a particular amount of time is shows that in that window.

The source node sends the packet to the destination through the shortest path. In that execution, energy indicated by the different colour. At the first stage, the energy in the nodes is full. As the time increases, the energy is decreased in the node.

If the node loss half of the energy, it will be indicated by the yellow colour and if the energy is 20% in the node, it will be indicated by red colour.

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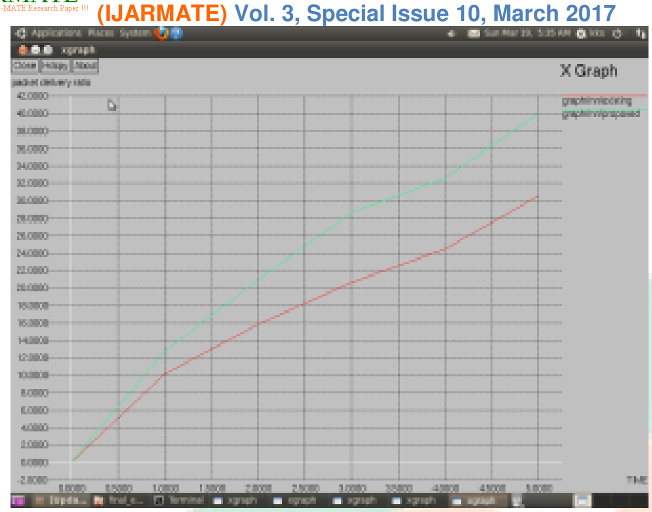

Fig 9: PDR graph

The figure 9 shows the PDR graph. The packet delivery ratio should be equal to one. It is defined as the ratio of the number of packets successfully delivered to the destination to the number of packets generated in the source.

In the graph, the X axis is shown the time and Y axis shown the packet delivery ratio. In the graph, it shows the existing as well as the proposed system. It is indicated by the different colours.

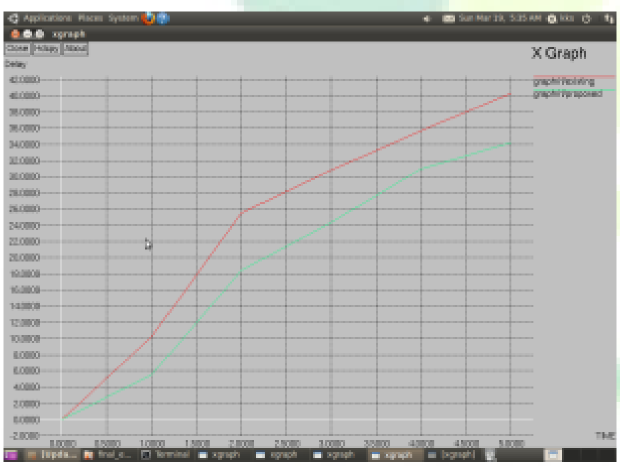

Fig 10: delay graph

The figure 10 shows the delay graph. In the graph, the X axis showed the time and Y axis shown the delay. It also imposes the existing as well as proposed system.

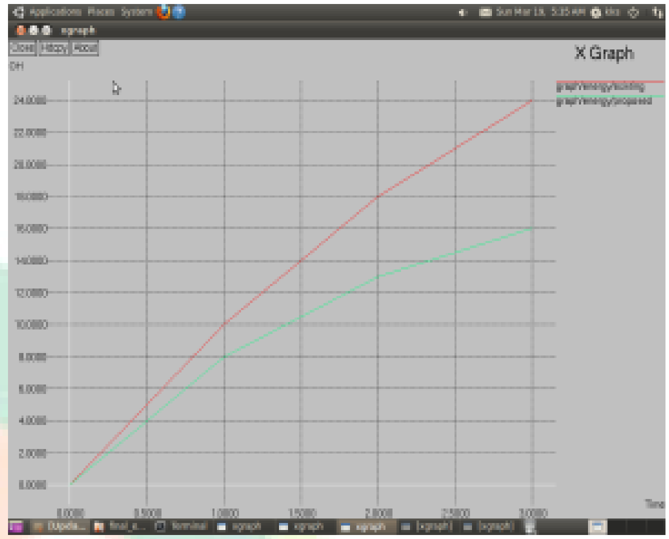

Fig 11: control overhead graph

Fig 11 shows that the routing control overhead for route discovery decreases with the increment of the maximum time interval size (Imax). With a short maximum time interval, the network reaches the convergence stage quickly. So the effect of high frequency during the network initialization stage is negligible. Meanwhile, due to the valid routing entries, the overhead is slightly lower in the simulation than the theoretical results, which regard the number of one-hop neighboursasthe number of valid routes.

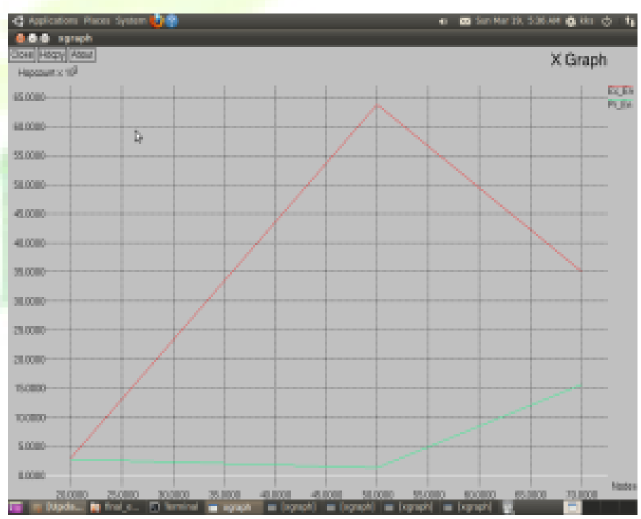

Fig 12: hop count graph

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The figure 12 shows the hop count. In the graph, the X axis shows the nodes and Y axis shows the hop count. The hop count may be small or large depends upon the path and the destination in the nodes. The number of nodes passed from the source to the destination. If the hop count is large, the energy consumption is increases. If the hop count is small, the energy consumption is decreased. The hop count decreases, the nodes in the network is less. If the number of nodes in the network is less, there will be a less hop count.

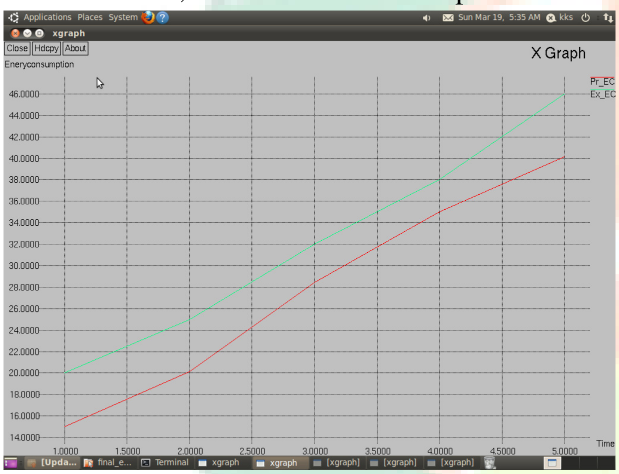

Fig 13: energy consumption graph

The figure 13 shows the energy consumption graph. The longer routes in RPL consume more energy. The impact of the frequency of control message is more significant on P2P-RPL than ER-RPL. P2P-RPL disseminates control messages throughout the network, and the large amount of control messages constitutes a significant portion of the total energy cost.

VII. CONCLUSION

In the Proposed Energy efficient routing protocol for wireless adhoc network invokes the residual energy and hop count as parameters. In the routing process path with largest minimum residual energy and least hop count is chosen. Transmission power of the node is adjusted according to neighbor's range of the node. ER-RPL is a hybrid of proactive and reactive routing protocol, and it makes use of the region information of networks. ER-RPL can support generic traffic patterns and simultaneously achieve reliability and energy-efficiency. Proposed Energy efficient routing protocol is compared with the existing protocols. Proposed protocol achieves the higher energy consumption. This improves the lifetime of the nodes in the network. Quality of Service of the communication network is also improved by achieving the lesser end-to-end delay. Thus proposed routing protocol provides better lifetime and Quality of Service by the AODV and Max_Min energy routing protocol.

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