

Advanced Metering Infrastructure Using ITCD in Mobile Ad-Hoc Network

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ABSTRACT: The major constraint when Mobile Adhoc Networks is considered is the energy consumption. Since the sensor nodes are deployed in a rough terrain with unpredictable environment conditions the nodes fail mainly due to battery drain, and in most cases it is impossible to replace the batteries. So it will be wise to use an appropriate routing algorithm for finding the best available path that consumes lesser energy and reduces the delay. One such type of routing protocol is AMI Routing. In this type of routing each packet, each hop and the next relay node is found dynamically by selecting the node that captures the packet transmission. Here each node maintains a group of next hop nodes called as the forwarder list and next relay node is selected from that list according to the type of AMI routing used. The energy consumption was tested in two different scenarios of 100 and 500 packets, while each packet was having a size of 512 KB. FJP is much better with lower data loads of 100 and 500 packets in this case. The comparison for the average energy consumption of nodes shows improvement in FJP compared to E-AOMDV, Dynamic Channel Allocation. The FJP achieved a real improvement as compared to AOMDV, Dynamic Channel Allocation for the consumed energy which was one of the objectives of this work. The Energy Efficient interference Topology Control with Fast Join Process Routing, reduces the size of the forwarder list by including only the nodes that are nearer to the destination. In the next step the list is arranged according to their distance from the destination, the node that has the highest priority will act as the next relay node that is the selected relay node will be the one that is nearer to the destination. It also routes the acknowledgement using the AMI routing this is done to balance the energy spend by the nodes for transmission and reception. It provides better results than many existing AMI routing protocols in terms of end-to-end delay, and network lifetime.

KEYWORDS: Operating System, Front end, Back End.

I. INTRODUCTION

Mobile ad-hoc networks can turn the vision of getting connected "anywhere and at any time" into reality. Recent advancements such as Bluetooth introduced a mobile ad-hoc networks, known as new type of wireless systems. A "short live" networks or Mobile ad-hoc networks operate in the absence of fixed infrastructure. Nodes in mobile ad hoc networks are constrained by limited battery power for their operation. Hence, energy efficiency is an important issue in adhoc networks. The characteristics of mobile networks are summarized as follows: An advanced metering infrastructure (AMI) consists of a meter data management system, a concentrator, and a meter. Each and every component can communicate with all other components, through either wired or wireless connections. This work proposes Interference-Based Topology Control fast join process (FJP) and enhanced FJP to shorten the time of Zigbee network construction.

Using these methods, the time of network construction can also be improved not only can message flow be managed



easily.

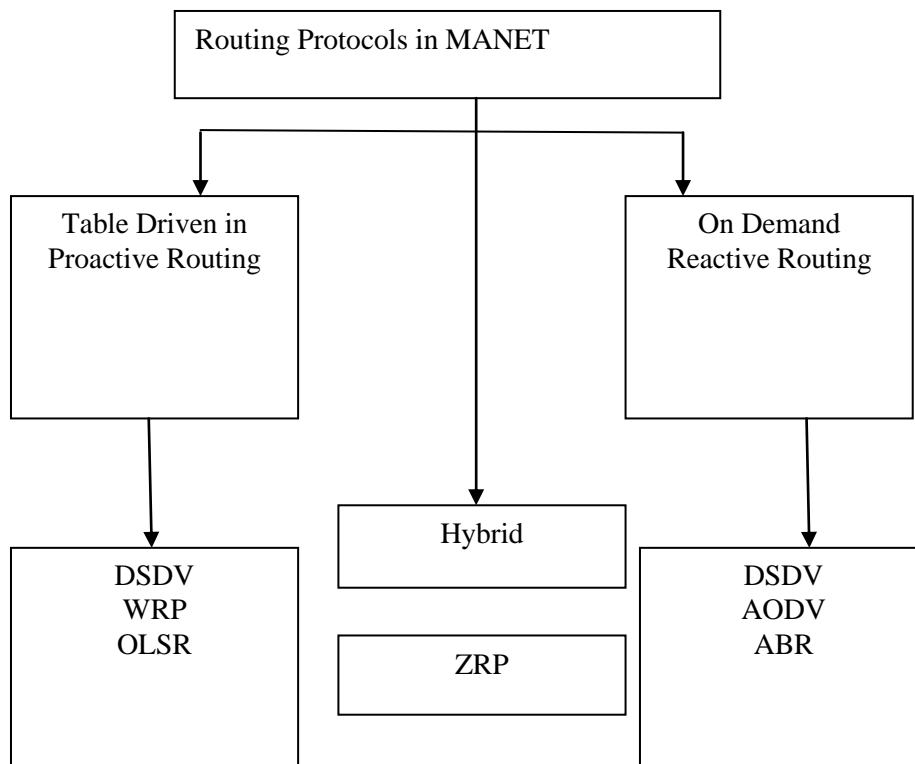
- Communication via wireless means.
- Nodes can perform the roles of both routers and hosts.
- No centralized controller and infrastructure.
- Dynamic network topology. Frequent routing updates.
- Autonomous, no infrastructure needed.
- Can be set up anywhere.
- Energy constraints
- Limited security

ROUTING PROTOCOLS

Several routing protocols have been proposed for routing in MANET with the goal of achieving efficient routing. These algorithms differ in the approach used for discovering a new route and maintaining a identified route when node moves. The mobile ad hoc routing protocols may be categorized as proactive (table driven), reactive (On-demand) and hybrid routing protocols.

- Military or police exercises.
- Disaster relief operations.
- Mine site operations.
- Urgent Business meetings
- Robot data acquisition

II. RELATED WORK



APPLICATIONS OF MOBILE ADHOC NETWORKS

Development of MANETs was primarily motivated by their need for military surveillance. With the availability of low cost sensors, these networks are no longer limited to military applications but are used in a wide array of applications including habitat monitoring, industrial process monitoring, traffic control, etc.

Military Applications

Military missions often involve high risk to human personnel. Thus, unmanned surveillance missions using MANET have wide applications for military purposes such as surveillance, enquiry of opposing forces, targeting, damage assessment, etc. MANETs developed for military purposes should be rapidly deployed in an ad-hoc fashion such as by an aircraft. They should also be energy-efficient, fault tolerant, disposable and support network dynamics. Destruction of a few nodes by enemy forces should not hamper the operation of such networks.

Habitat Monitoring

Monitoring plant and animal habitats on a long-term basis is widely employed by researchers in Life Sciences. However, human presence in such monitoring often causes disturbances in plant and animal conditions, increases stress, reduces breeding successes, etc. MANETs provide a non-invasive and economical method of long-term monitoring of habitats. Such a network was used to monitor the Storm Petrel seabirds in the Great Duck Island in Maine. Mobile Adhocs were used to measure temperature, pressure, humidity was used to track zebra and other animals in Kenya.

CHALLENGES IN MOBILE ADHOC NETWORKS

Some of the major challenges that prevent the wide spread adoption of MANETs are listed below:

Energy Constraint

Mobile Adhoc nodes are battery-powered and often deployed in remote and inhospitable locations. As such, battery replacement or any other human intervention is either not possible or extremely difficult. Therefore, these nodes are required to function for months or years at a time on the same power source to maintain the application Quality of Service (QoS). As a result, energy conservation is of the utmost importance in MANETs, and much research has been done on the development of energy efficient protocols and hardware for MANETs. 6

Fault Tolerance

Often a sensor node may be destroyed or stop functioning, such as when a sensor node is destroyed in a forest fire or by the enemy in a battlefield. The remaining nodes must adapt dynamically in real time and convey the data to the base stations or sinks. Thus, MANET protocols for the MAC and routing layers must have a certain level of robustness.

Working of MANETs

MANET mechanism is quite easy, simple and applicable to a variety of fields. It is based on smaller nodes, controller, radio transceiver, and battery. The system is totally dependent on the nodes and the harmony established between them through proper frequency. These nodes are of different sizes according to the function they perform. To activate the monitoring or tracking function of these nodes a radio transmitter is attached to forward the information signals in the form of waves. They are controlled by the microcontroller according to the function and device in which they are used. All the system remains in working condition with the help of energy supply which is in the form of battery. The MANETs perform function concurrently where nodes are autonomous bodies incorporated in the field spatially for the accurate results. The information transmits through proper channel taking the information collecting it in the form of data and send to the base. Figure 1.2 shows the working of MANET

Depending to their types MANETs are used by different organizations and fields to monitor a specific task. MANET are incorporated at different point to monitor a specific area a common known example is that of military communication either land or water. Major issues which are becoming a possible threat to life are environmental and industrial issues. MANETs are doing great job in the relevant fields to sense to temperature for greenhouse gasses and similarly earthquake detectors are implanted to detect the land sliding phenomenon for precautionary measurements etc. Ad-hoc on demand Distance Vector Routing (AODV) Ad-hoc on demand Distance Vector Routing (AODV) is a reactive routing algorithm, improvement over DSDV routing protocol algorithm. It minimizes the number of broadcasts by creating routes on-demand as opposed to all possible routes as in DSDV. This protocol checks the route table when source needs to transmit data. AODV is a loop- free, single path, distance vector protocol based on hop-by-hop routing approach.

AMI ROUTING

Biswas and Moris,(2005) proposed Exclusive AMI Routing (ExOR), to describe an integrated routing and MAC protocol that increases the throughput of multi-hop wireless networks. The protocol chooses each hop destination of a packet's route after the completion of the hop. It gives the choice to decide which of the neighboring nodes receives the packet. ExOR protocol gives a better throughput compared to traditional routing with the same network capacity.

Chachulski et al (2007) presented, a MAC-independent AMI protocol (MORE) that randomly mixes packets

before forwarding them. This protocol runs directly on top of 802.11, without the need for any special scheduler. MORE is found to be better than ExOR, with respect to throughput and gain, when there is spatial reuse, both for unicast and multicast.

Zeng et al (2008) gives a comprehensive study on the impacts of multiple rates, interference, and prioritization on the maximum end-to-end throughput and capacity of AMI routing. It shown that AMI routing has a higher potential to improve end-to-end throughput.

Wei et al (2009) discussed Assistant AMI Routing (AsOR) protocol that is a unicast routing protocol for multi-hop Mobile Adhoc networks. The authors provided a method for the optimal value for the number of nodes in one transmission segment for multi-hop networks

Mao et al (2011) focused on selecting and prioritizing the forwarder list of a node to minimize energy consumption by all the nodes by designing Energy Efficient AMI Routing (EEOR). The network is analyzed for energy consumption, average delivery delay and packet loss ratio.

III. EXISTING SYSTEM

In existing system the AMI routing protocols are a rather recently devised class of routing protocols for wireless multi-hop networks. What separates AMI routing protocols from fixed-route routing protocols is the fact that a packet's route is not pre-determined by its source before the packet transmission. EEOR is a multi-hop routing protocol for mobile adhoc networks. It makes use of the forwarders list of the node to choose the forwarding node to transfer the data towards the target. Priorities are assigned for the neighbors of a node to choose the forwarding node. Energy consumption, packet loss ratio, and delivery delay parameters in a mobile adhoc network are measured.

Efficient protocols are required to reduce delay in transmission and to prolong the network lifetime. EEOR protocol gives better results compared to ExOR protocol in terms of packet loss ratio, average delivery delay and energy consumption. EEOR allows one of the neighbors to participate in the forwarding of the data packets, from source to destination in multi-hop transmissions in a mobile adhoc network. The forwarding node is chosen depending on the cost assigned to each of the nodes. To handle the network traffic efficiently, congestion is controlled in the network dynamically adjusting the flow from each source node in the network.

DISADVANTAGES:

1.The network topology can be highly dynamic due to node movements. Therefore, techniques that are designed for static networks are not applicable.

2.The network may not always be connected.

3.The limited resources (computation, communication and battery life) demand that node failure detection must be performed in a resource conserving manner.

IV. PROPOSED SYSTEM

Smart grid has modernized the way electricity is generated, transported, distributed, and consumed by integrating advanced sensing, communications, and control in the day-to-day operation of the grid. Electricity is a core utility for the functioning of society and for the services provided by information and communication technologies (ICTs).The objective of the topology control algorithm is to minimize the power consumption while satisfying both the interference constraint and the delay constraint. We need to control the transmission power of a node to satisfy the delay requirement according to the delay information provided by delay model. Then, interference-based topology control algorithm is represented in the following part and the delay constraint is appropriately added.The source node generates a packet with delay constraint. It estimates a hop number to the destination node. Then it executes ITCD Algorithm for compute end to end delay.Then it inserts maximum delay constraint to the RREQ Packet header. It Broadcast the RREQ Packet to its neighbor.Each neighbor receives the RREQ Packet it call ITCD Algorithm. Then compute end to end delay.Finally Destination Node send RREP Packet to source node with all neighbors end to end delay.Now source node computes valid path based on least end to end delaythe proposed system ITCD-FJPR protocol is similar to EEOR protocol but it makes itself efficient by reducing the size of the forwarder list by applying the condition that forwarder node is a one that is nearer to the destination. It also increases the reliability by using the acknowledgement packets and balances the energy for transmission and reception by routing the acknowledgement packets also AMI ally. The major objective of ITCD-FJPR protocol is, to reduce the size of the forwarder list and to use different paths for data and acknowledgement packets so as to balance the energy consumption. The working of ITCD-FJPR protocol can be divided in to two steps, formation of routing table and updating the routing table whenever there is a change in the network. Sending a packet from source to target in a network can be considered to include three parts,

(1) The source sending the packet to one neighbor node and that node is the target node;



(2) If the target is more than one hop away from the source, then there is at least one node in the neighbor list to relay the packet to target;

(3) Agreement on choosing the actual relay node, among the neighbor of the transmitting node. The time and effort incurred achieving the part 1, is constant. The same for part 2 depends on the distance between the source and the destination. It is very hard to find the cost on coming to an agreement as to choose the relaying node. It is assumed that the overall cost of communication is represented by the distance between the nodes to be communicated in the mobile adhoc network. Thus, all nodes in a MANET basically function as mobile routers participating in some routing protocol required for deciding and maintaining the routes. Since MANETs are infrastructure-less, self-organizing, rapidly deployable wireless networks, they are highly suitable for applications involving special outdoor events, communications in regions with no wireless infrastructure, emergencies and natural disasters, and military operations. Routing is one of the key issues in MANETs due to their highly dynamic and distributed nature. In particular, energy efficient routing may be the most important design criteria for MANETs since mobile nodes will be powered by batteries with limited capacity.

Power failure of a mobile node not only affect the node itself but also its ability to forward packets on behalf of others and thus the overall network lifetime. For this reason, many research efforts have been devoted to developing energy aware routing protocols. Based on the aforementioned discussions, this work surveys and classifies numerous energy efficient routing mechanisms proposed for MANETs. They can be broadly categorized based on when the energy optimization is performed. A mobile node consumes its battery energy not only when it actively sends or receives packets but also when it stays idle listening to the wireless medium for any possible communication requests from other nodes.

Thus, energy efficient routing protocols minimize either the active communication energy required to transmit and receive data packets or the energy during inactive periods. For protocols that belong to the former category, the active communication energy can be reduced by adjusting each node’s radio power just enough to reach the receiving node but not more than that. This transmission power control approach can be extended to determine the optimal routing path that minimizes the total transmission energy required to deliver data packets to the destination.

For protocols that belong to the latter category, each node can save the inactivity energy by switching its mode of operation into efficient-down mode or simply turns it off when there is 3 no data to transmit or receive. This leads to considerable energy savings, especially when the network environment is characterized with low duty cycle of communication activities. However, it requires well-designed routing protocol to guarantee data delivery even if most of the nodes sleep and do not forward packets for other nodes. Another important approach to optimizing active communication energy is load distribution approach. While the primary focus of the above two approaches is to minimize energy consumption of individual nodes, the main goal of the load distribution method is to balance the energy usage among the nodes and to maximize the network lifetime by avoiding over-utilized nodes when selecting a routing path.

While it is not clear that any particular algorithm or a class of algorithms is the best for all scenarios, each protocol has definite advantages/disadvantages and is well-suited for certain situations. However, it is possible to combine and integrate the existing solutions to offer a more energy efficient routing mechanism. Since energy efficiency is also a critical issue in other network layers, considerable efforts have been devoted to developing energy-aware MAC and transport protocols. Each layer is supposed to operate in isolation in layered network architecture but, as some recent studies suggested, the cross-layer design is essential to maximize the energy performance. In fact, many routing protocols introduced in this work use the same concept, i.e. they exploit lower layer mechanisms such as transmission power control and sleep mode operation in their routing layer algorithms.

The distance d between two nodes $A(x_1, y_1)$ and $B(x_2, y_2)$ is calculated by the Euclidean distance equation, here the distance refers to the geographical distance in meters. The Table 4.1 shows the network parameters or the algorithm In the network considered, the source node forms the set of neighboring nodes to forward the packet, when the destination is more than one hop away from the source. The set of neighbors is sorted according to its distance from the destination, and normally the first of these nodes in the forwarder list relays the packet towards the destination. The procedure continues till the destination node receives the packet.

ITCD-FJPR Algorithm finds the minimal path between the source and destination pairs specified in the network. The fields used in the packet to be communicated are source, packet length, packet sequence number, x coordinate, y coordinate, z coordinate, distance, data.

source	Packet length	Seq.no	X	Y	Z	Distance	Data
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Figure 4.1 Packet Structure Used in ITCD-FJPR protocol

In the Figure 4.1 the first field source represents the node that originated the packet. Packet length represents the number of bytes contained in the packet. Packet sequence number is the index of the packet in the overall simulation of the network. x and y coordinates represents the position of the node, and z represents the speed of movement of a mobile node in number of steps per second. As the nodes in our network are static, z coordinate is always 0. The distance field of the packet represents the geographical distance between the node and the source. The last field is the data to be communicated between the source and the destination nodes. The acknowledgment packet has the same fields, except the data field.

MANET ROUTING PROTOCOLS

Routing protocols in mobile ad hoc networks can be classified as table-driven and on-demand. On-demand protocols include ad hoc on demand distance vector routing (AODV) and dynamic source routing (DSR).

A. DSR This routing protocol uses packet forwarding via source routing and aggressively uses route cache to store full paths to the destination. Thus in DSR the sender knows the complete hop-by-hop route to the destination. DSR makes packet routing trivially loop-free. It also avoids the need for up-to date routing information at the intermediate nodes and also allows nodes to cache routes by overhearing data packets.

B. AODV It shares DSR's on-demand characteristics and discovers routes as needed on demand basis via similar route discovery process. AODV uses traditional routing tables and maintains one entry per destination. Being a single path protocol, it has to invoke a new route discovery, whenever the path from source to destination fails. AODV uses destination sequence numbers to prevent routing loops and to determine freshness of routing information. AODV also uses a timer-based route expiry mechanism to promptly remove stale routes.

C. Performance Analysis Metrics The following metrics were used to evaluate the performance analysis of routing protocols under consideration. Data packet delivery ratio: The data packet delivery ratio is the ratio of the number of packets generated at the source to the number of packets received actually by the destination. This metric is used so that we can analyze that network capacity is not reduced by the use of energy extensions to MAC protocol.

D. Random Waypoint Mobility Model. The performance analysis of routing protocol for MANET includes its evaluation under realistic conditions and this includes movements of mobile users (i.e. mobility model). In our work we consider the random waypoint mobility model. The random waypoint mobility model is considered as one of the most widely used .

ADVANTAGES:

1. Proposed Algorithm-ITCD-FJPR(Energy Efficient Breath first Search Routing).It is compact routing support for MANET Environment.
2. It reduces the size of forwarder list by applying a condition that the forwarding node is nearer to the destination.
3. Low Packet Loss Ratio.
4. High Throughput and Packet delivery ratio.

V. MODULE DESCRIPTION

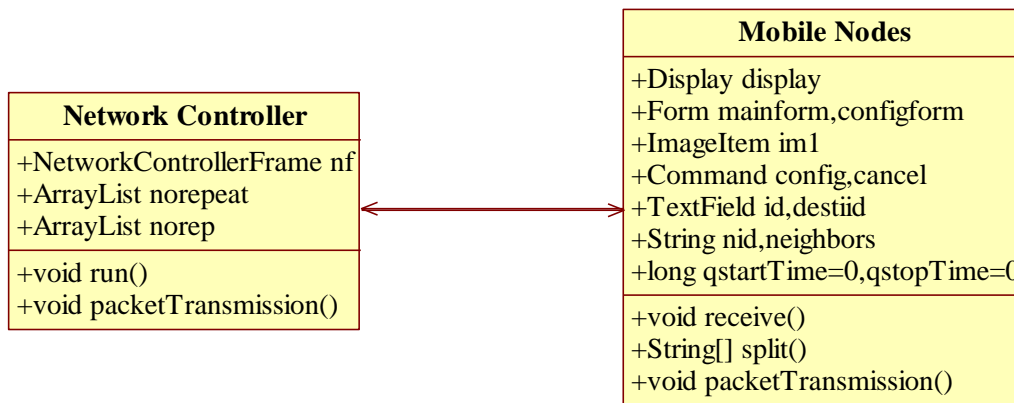
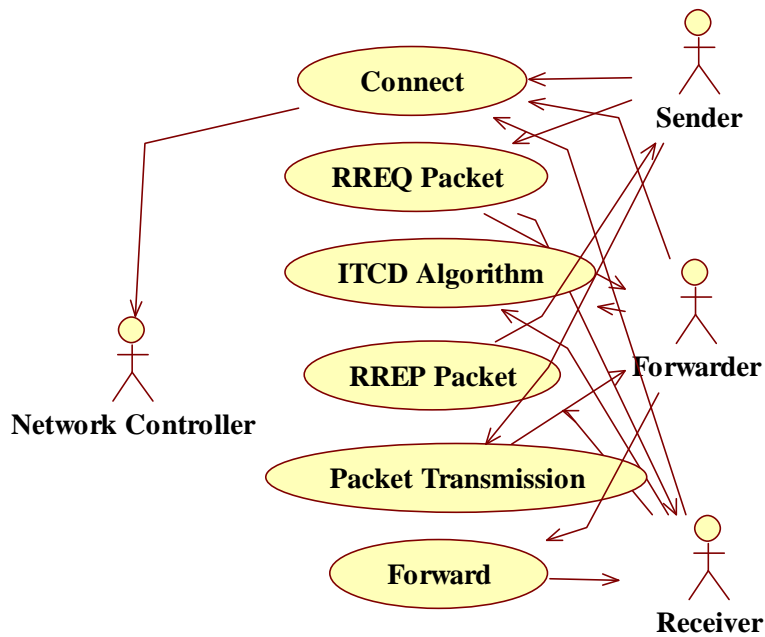
The Proposed ITCD-FJPR routing has the following modules:

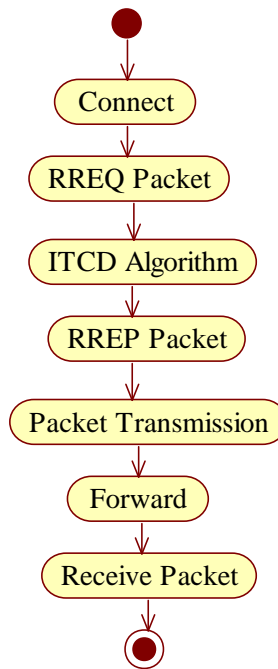
1. Creation of routing table
 - Sending HELLO packets
 - Form the forwarder list
2. Updating the routing table
 - Sort the forwarder list
 - Sent the packet to the first node in the list
3. Sending acknowledgment 20
 - The routing table of a node consists of the following fields: Destination, Next Hop, Packet Sequence Number and Distance from the node to destination. Each node has a routing table of all its neighbors, consisting of all the required fields. Distance between node and target node is used in updating the routing table entry of the node during multi-hop transmission. The Figure

Describes the ITCD-FJPR algorithm.

- Smart grids are a type of IoT applications that distribute electricity each component of a smart grid can communicate with every other component through communication modules.

- An advanced metering infrastructure (AMI) differs from traditional automatic meter reading (AMR) in that it enables two-way communications with the meter. AMI is an architecture for automated and two-way communication between a smart meter with an IP address and an utility company. The goal of AMI is to provide companies with real-time data and allow customers to know the energy usage based on the price at the time of use





VI. TECHNOLOGIES USED

1. Features Of Software

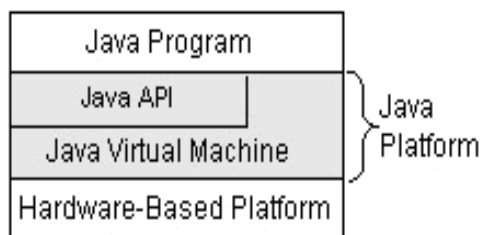
Android studio is an Android centered IDE, structured particularly for the Android advancement. Android studio utilizes java and xml. Java is considered best for the development of mobile applications based on the Android platform. It is so because Android consists of its APIs and Java libraries. Thus, it is easy using java for Android applications, both android APIs and Java is used to write code for Android apps. Xml assists with planning the application design, how it will look, how parts like catches, content view, and so forth will be put and their styling.

2. Features Of Java

Java platform has two components:

- ✓ The Java Virtual Machine (*Java VM*)
- ✓ The Java Application Programming Interface (*Java API*)

The Java API is an immense combination of moment programming portions that give various supportive limits, for instance, graphical UI (GUI) devices. The Java API is assembled into libraries (bundles) of related parts. The accompanying figure portrays a Java program, for example, an application or applet, that is running on the Java stage. As the figure appears, the Java API and Virtual Machine protects the Java program from equipment conditions. The following figure portrays a Java program, for example, an application or applet, that is running on the Java stage. As the figure appears, the Java API and Virtual Machine protects the Java program from equipment conditions.



As platform-independent environment, Java can be a piece more slow than local code. In any case, shrewd compilers, all around tuned mediators, and in the nick of time byte code compilers can bring Java's presentation near that of local

code without undermining transportability.

3.FACTORY METHODS:

The InetAddress class has no visible constructors. To create an InetAddress object, user use one of the available factory methods. Factory methods are merely a convention whereby static methods in a class return an instance of that class. This is done in lieu of overloading a constructor with various parameter lists when having unique method names makes the results much clearer.

Three commonly used InetAddress factory methods are:

1. Static InetAddress getLocalHost () throws
UnknownHostException
2. Static InetAddress getByName (String hostName)
throws UnknownHostException
3. Static InetAddress [] getAllByName (String hostName)
throws UnknownHostException

The getLocalHost () method simply returns the InetAddress object that represents the local host. The getByName () method returns an InetAddress for a host name passed to it. If these methods are unable to resolve the host name, they throw an UnknownHostException.

On the internet, it is common for a single name to be used to represent several machines. In the world of web servers, this is one way to provide some degree of scaling. The getAllByName () factory method returns an array of InetAddresses that represent all of the addresses that a particular name resolves to. It will also throw an UnknownHostException if it can't resolve the name to at least one address. Java 2, version 1.4 also includes the factory method getByAddress (), which takes an IP address and returns an InetAddress object. Either an IPv4 or an IPv6 address can be used.

4.TCP/IP CLIENT SOCKETS:

TCP/IP sockets are used to implement reliable, bidirectional, persistent, point-to-point and stream-based connections between hosts on the Internet. A socket can be used to connect Java's I/O system to other programs that may reside either on the local machine or on any other machine on the Internet.

There are two kinds of TCP sockets in Java. One is for servers, and the other is for clients. The Server Socket class is designed to be a "listener," which waits for clients to connect before doing anything. The Socket class is designed to connect to server sockets and initiate protocol exchanges.

The creation of a Socket object implicitly establishes a connection between the client and server. There are no methods or constructors that explicitly expose the details of establishing that connection. Here are two constructors used to create client sockets:

Socket (String hostName, int port) - Creates a socket connecting the local host to the named host and port; can throw an UnknownHostException or an IOException.

Socket (InetAddress ipAddress, int port) - Creates a socket using a preexisting InetAddress object and a port; can throw an IOException.

A socket can be examined at any time for the address and port information associated with it, by use of the following methods:

- InetAddress getAddress () - Returns the InetAddress associated with the Socket object.
- int getPort () - Returns the remote port to which this Socket object is connected.
- int getLocalPort () - Returns the local port to which this Socket object is connected.

Once the Socket object has been created, it can also be examined to gain access to the input and output streams associated with it. Each of these methods can throw an IOException if the sockets have been invalidated by a loss of connection on the Net.

InputStream getInputStream () - Returns the InputStream associated with the invoking socket.

OutputStream getOutputStream () - Returns the OutputStream associated with the invoking socket.

VIII. CONCLUSION

The presented ITCD-FJPR algorithm is found to reduce the average end-to-end delay and maximum End-to-End delay lifetime since it includes only the nodes that are nearer to the destination in to the forwarder list so the decision for selecting the next relay node can be done quickly. Smart grid provides two-way communication to achieve real-time responses. In order to achieve two-way communication, we must construct ITCD AMI. We can choose suitable communication protocols at different layers for AMI. In this work, we focus on the improvement of the AMI LAN. Even more than other protocols, Zigbee offers features that are suitable for AMI, such as ease of installation, reliability, configuration, self-repair, low costs, and safety. Consequently, we select Zigbee as our AMI LAN

communication protocol

It also increase the network since the acknowledgement is also being routed AMI ally, as well as the reliability of packet delivery increases.

The future enhancements that can be done to ITCD-FJPR algorithm are

- (1) To add mobility to the nodes;
- (2) To analyze the network for parameters like throughput and turnaround time;
- (3) To add a Route Failure Notification Packet.

CONFLICT OF INTEREST

The authors declare here that they have no conflict of interest.

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