Provide Connectivity and Efficient data transfer mechanism in Wireless Network through IoT

A Project Report

Submitted in fulfillment of the requirements for
the award of the degree of

MASTER OF SCIENCE

In

COMPUTER SCIENCE

Submitted by

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July-Dec-2018

Declaration by the Candidate

I am Avi Tomar hereby declare that the project entitled **Provide Connectivity and Efficient data transfer mechanism in Wireless Network through IOT** submitted for the M.Sc. Computer Science degree is original work conducted under the guidance of Dr. Aitha Nagaraju.

I further declare that to the best of my knowledge the project does not contain any part of any work that has been submitted for the award of any degree either in this university or any other university without proper citation.

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This is to certify that the statement made above by the candidate is true to the best of my knowledge.

Dr. Aitha Nagaraju

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Abstract

In the upcoming networking technology, 5G is expected to be operated by 2020; the proposed mini project will focus on one of the main issues is low latency and efficient data transfer. To maintain the urban network integration of existing wireless sensor network with MANETs is essential for ubiquitous communication. A sensor used for IOT will sense the environment and send it to the nearest gateway, which sends the collected data to the wireless node. In which there were several challenges and issues are an Internet of Things(IoT), is an innovative technology which allows the connect physical things with the digital world through the use of heterogeneous networks and communication technologies. The interaction between the wireless sensor and mobile ad-hoc networks with the internet of things allows the creation of the new MANET-IoT system. Such a system give the user greater mobility and reduce cost. At the same time challenging issues are opened in the networking aspect.

The mini project proposed work will try to understand the basics of IoT and necessary routing protocols for efficient data transfer mechanism in WSN and MANETs, simulate the existing routing protocols in NS-2 Simulator. An analytical study will be doing through routing algorithms in WSN.

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Introduction:-

The internet of things combines the different variety of technologies into a network to provide connectivity among portable devices — the network connected to software and services that analyze the data collected by connected device and use that data to make a decision and initiate action from the same or another device. With the increase of portable device and progress in wireless communication, ad-hoc networking gaining importance because of its widespread application. MANET (Mobile Ad-Hoc Network) is a collection of mobile nodes which have the autonomous self -configuring a network. In MANET, the nodes are mobile, and at any time it can connect to other different nodes. Mobile nodes have the bandwidth restricted, dynamic topologies, Limited Energy operation, capacity links & variable infrastructure.

Routing protocol performs an important function in any network. Routing protocol finds the routes between the nodes and share information which chooses the routes between any two nodes on a network. A hybrid network is the one in which communication can take place between a wired and wireless connected node which is achieved by gateway node.

Internet of things:

Internet of things refers to the stringent connectedness between digital and physical world. [Atzori et al.,2010]. Physical here represent any quantity which needs to be measured or monitored. Digital represents the world of Binary. Connecting these two makes the Internet of Things. IoT can be studied by dividing into functional blocks.

Device - An IoT system is based on the device that provides sensing, control and monitoring activities.

Communication- Perform communication between device and remote server.

Service- An IoT system serves various type of functions such as service, data analytics, device discovery, etc.

Security- Provide function such as authentication, data security.

Application - Interface that allows the user to visualize and analyze the system status at present state of action, sometimes prediction of futuristic prospects.

MANETs:

MANET stands for Mobile Ad-hoc Network also called as an ad-hoc wireless network or ad-hoc wireless network that have a routable networking environment ad-hoc network.. They consist of the set of mobile nodes connected wireless in a self-configured, self-healing network without any fixed infrastructure. MANET nodes move randomly as the network topology changes frequently. Each node behave as a router as they forward traffic to other specified node in the network. Some characteristics of the MANETs are dynamic topology; Bandwidth constrained, Autonomous behavior, energy constrained operation, limited security, and less human intervention.

Routing protocols:

A routing protocol specifies how nodes communicate with each other, sharing information that helps them to select a route between any two nodes on a network. Routing is mainly categorized into three category:

Proactive routing: Maintain fresh list of destination and their routes by periodically distributing routing tables throughout the network. Example of proactive routing protocols is Destination Sequenced Distance Vector

Reactive routing: Route finding is done on demand by flooding the network with Route Request packets. Example of the reactive protocol is AODV, DSR

Hybrid Routing: Routing is initially established with some proactive prospected routes and then serves the demand from additionally activated nodes through reactive flooding. Example of hybrid routing is Zone Routing Protocol

Integration of Internet –MANET Architecture:- Since MANETs do not have centralized administration or established infrastructure. Nodes are limited to the limit within the network domain formed. There may be a need for global connectivity to the device to communicate outside the Ad-hoc network formed. In order to achieve the goal Mobile IP concept appears. Mobile Internet protocol provides one-hop connectivity to mobile nodes. In which node that is connected is Internet Gateway, and other nodes send the packet to that particular node in order to connect to the Internet.

Issues in Integrating Mobile Ad-Hoc Networks With Internet:- there are several challenges in integrating the internet, and mobile ad hoc network are as follows :

1. Efficient Gateway discovery: The node that needs to connect to the internet needs to discover gateway and then register. One of the traditional methods is gateway advertisement(GWADV). The task achieved in three ways: proactive, reactive and hybrid.

2, Efficient routing mechanism in the MANETs: Usually, MANETs use hop count metric for route selection. Another metric can be the load on the path which needs to take care. Mechanism of routing must take into account the type of packets transmitted in order to perform Quality of Service and specified constraints.

3. Gateway load balancing:

Gateway node in mobile ad hoc network are very few, and these are entry points to the internet. Therefore it is likely to get more traffic at these nodes which in turn lead to the problem of congestion. To address this problem, we use a load balancing of the packet among the gateway node.

4. Gateway single point failure:

A gateway is the point where many nodes are registered and depends on it. This point needs to be taken care of, or alternative to this point is needed. There are several mechanisms to achieve it. Multi-homing is one of the networking concepts that allow a host to identified by multiple IP addresses.

Usefulness of Integration of MANET in 5G Networks: -

The 5G network aims to deliver the quality of services. In order to achieve the quality of service and other constraints, we can integrate MANETs in the scenario. High user mobility can be achieved using MANETs in 5G considering an example of a group of the mobile node needs to connect to reliable internet in a fast moving train. So they can be treated as one node and data generated may be buffered and transmitted to the fixed internet when the gateway is discovered. Another example can be health application, smart sensor network, Lifeline communication.

Literature Survey:-

Dave Cavalcanti et.al described challenges and issues seamless integration of wireless such as cellular networks, WLAN and MANETs. Efficient Integration and various multi-mode communication mechanisms play a key role in ubiquitous communication mechanism to improve the data transfer. The authors proposed heterogeneous architecture to connect different kind of networks WLAN (e.g., IEEE 802.11a/b/g and HiperLAN/2) and Wireless WAN (e.g., 1G, 2G, 2.5G, 3G, GSM, the proposed IEEE 802.20). The basic components in Wireless Networking system are Mobile Station (MS), Base Station (BS), Accesses Points (AP) and Core IP Network. The connections between one MS to BS may not be single hop in all the situations; it may be multi-hop when BS is outside communication range of MS. In multi-hop communication there may be chance of multiple paths exists from MS to BS. In this situation there may be various kinds of challenges such as load balancing, Quality of Service (QoS), routing, multi-mode operations, co-channel interference and inter-operability and many more.

Sankar Mukherjee et.al proposed protocol architecture for IOT and described two applications which are hospital information system (HIS) and IOT network connection for soccer Game. The authors proposed architecture consisting of four different kinds of hierarchies H1, H2, H3 and H4. In the proposed hierarchy the above components are interconnected with gateways to the internet. The authors also proposed protocol architecture of IoT network. In the conventional IOT , Wireless Sensor Nodes are directly interconnected with Gateway nodes. There is a huge gap between the energy levels. So to reduce the energy gap authors have been introduced a MANETs in between WSN and Gate Way nodes to improve the parameters which are Delay of data packet, Design cost, energy and internet traffic. The author explained

theoretically proposed model will consume less energy consumption when it is compared with conventional architecture.

Methodology :

In order to meet the complex specifications presented by modern, sophisticated networks, network simulation provides a reliable alternative to calculate the performance of a given wired or wireless network. The NS2, which is an open source simulation software predicts the behavior of either a wired or wireless network which is spread over a range of kilometers. NS2 checks the functioning of any given network virtually and presents the performance characteristics of the network, which is a better alternative to the tedious calculation of performance characteristics such as throughput, end to end delay and average number of packets received at each node.

NS2:

Ns is a discrete event simulator targeted at networking research. Ns provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks.
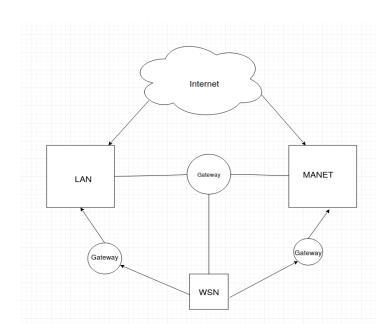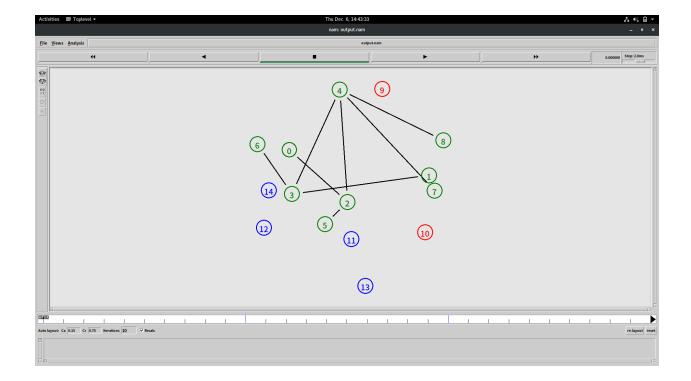
Otcl:

Ns is an object-oriented simulator, written in C++, with an OTcl interpreter as a frontend. The simulator supports a class hierarchy in C++ (also called the compiled hierarchy in this document), and a similar class hierarchy within the OTcl interpreter (also called the interpreted hierarchy in this document). The two hierarchies are closely related to each other; from the user's perspective, there is a one-to-one correspondence between a class in the interpreted hierarchy and one in the compiled hierarchy. The root of this hierarchy is the class TclObject. Users create new simulator objects through the interpreter; these objects are instantiated within the interpreter and are closely mirrored by a corresponding object in the compiled hierarchy.

Design of the proposed work:

The work mainly focused in studying IoT and basic routing protocol in a wireless network and in doing these task an architecture of the network is proposed for effective communication where a node can be connected to the internet using another node.

The basic design proposed can be visualized in the figure where integration of different type of device and networks are connected. A mobile node can be connected to the non-mobile node when in range. MANETs connected to the internet, LAN is connected to the Internet, and Wireless sensor network is connected to LAN and MANETs using gateways which help them to connect to the Internet.
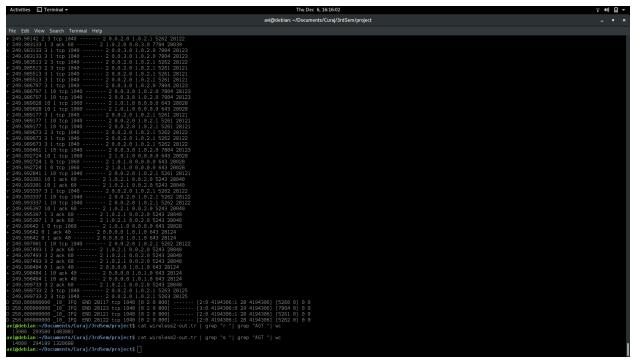
In order to set up communication between wired and wireless node hierarchal addressing is used in which wired node have formed two cluster and wireless node form other. A green colored node indicates wired node and blue indicate wireless and red ones are gateways using which communication is being set up.

Implementation Details :

Parameter	Value
Radio-propagation model	TwoRayGround
Network interface type	Wireless/playground
MAC type	Mac/802_11
Interface queue type	PriQueue
Antenna model	Omni Antenna
Number of mobile nodes	4
Routing protocol	DSDV
x coordinate of topology	670
y coordinate of topology	670
Number of Wired node	9
Number of Base Station	2

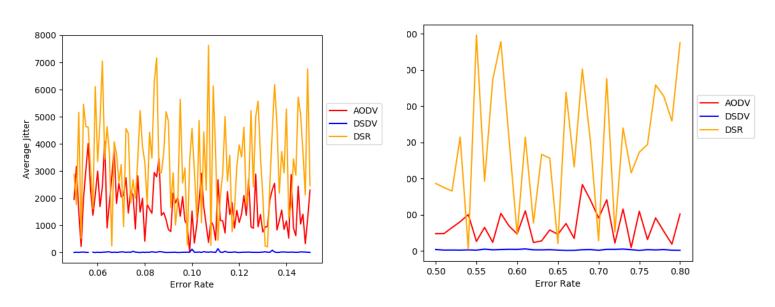# Results and Evaluation:

To calculate the performance of any network on the need to see how many packets dropped, how much time communication takes place. It is observed that after setting up TCP connection and using DSDV protocol in wireless in total only 29 packets are lost out of 1409 packet in time

frame of 169 sec using 2mb line. Priority queue is implemented when ever buffer of any of the node is full.

Comparision between DSR, DSDV and AODV is also been done. This analytical study is done . Uniform

error model and two state Markov model. Jitter represents the variation in end to end delay for a packet. It is observed that when the network has little or no mobility DSDV clearly outperforms the other two protocols irrespective of the error rate in the network.

Conclusions & Future Scope of the Work

In this project, we have created a framework for working in the direction to create routing protocols for MANET-IoT system for efficient transmission of data from wired to the wireless node and wireless node serve as the backbone of the network as a gateway node. Studied basics of IoT, MANETs and routing protocols in order to create the environment for future work. Gateway routing and design can be the future work.

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