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Performance Optimization of IOT Networks Using Frequency Hopping

[1]Dr. Parminder Singh, [2]Amanpreet Kaur, [3]Mandeep Singh Devgan, [4]Harpreet Kaur Toor
[1]Associate Professor, [2,3,4]Assistant Professor
[1,2,3]Department of Information Technology, [4]Department of Applied Science
[1,2,3,4]Chandigarh Engineering College, Mohali
[1]singh.parminder06@gmail.com, [2]amanpreet.it@cgc.edu.in, [3]mandeep.it@cgc.edu.in, [4]harpreettoor.appsci@cgc.edu.in

Abstract: Internet of Things- where 'things'- sensors and devices transmit data directly to the internet i.e. these devices only capture the data and send the information to the servers. With multi-hop wireless networks, communication between two end nodes is carried. Multi-hop routing involves sending signals through multiple stops instead of one which leads to frequency overlapping and the data get loss i.e. performance of sensors is not up to mark. So, we are using frequency hopping instead of multi-hopping by which it improves the performance of wireless sensor devices. In this paper, we have to use network simulator tool for evaluating the IOT networks and calculates the metrics like throughput and delay.
Keywords: IOT, AODV, Socket Programming, Frequency hopping, NAT.

I. INTRODUCTION

IOT-enabled objects share and keep the information about surroundings and their condition with people, software system and machine.
The information can be shared in defined or real time. Gradually everything will have a digital identity of every object whether it is a fan, bus, microwave, car parking etc. or many other object. We can identify, track and communicate with objects [1].

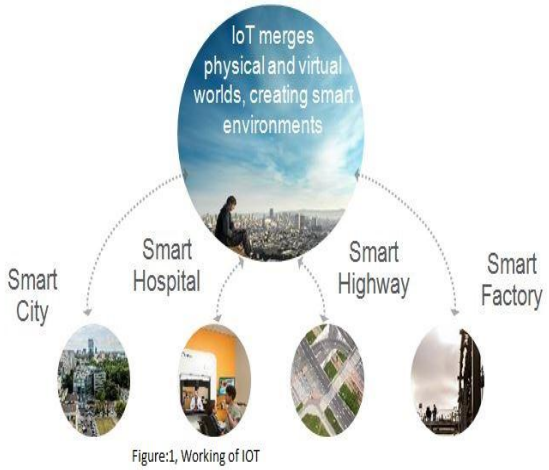

Fig.1. Working of IoT

The data can be small in size and frequent in transmission. T various number of nodes in a network are greater in IOT th traditional PC computing. There is machine-to-machi communication.
IOT provide services with great intelligence and as well as security without depending on cloud based applications

A. Orthogonal frequency division multiplexing (OFDM:

OFDM is a combination of modulation and multiplexing. Multiplexing generally refers to independent signal, those produced by different sources.

OFDM is a technique, method or scheme for digital multi-carrier modulation using many closely spaced subcarriers - a previously modulated signal modulated into another signal of higher frequency and bandwidth. Each of these subcarriers contains numbers of parallel data streams or channels and is modulated conventionally at a low symbol rate; these are groups of bits of data related to (but not the same as) gross bitrate, which is expressed in bits/second or we can say that it is a method of encoding digital data on multiple carrier frequencies. OFDM is used in various popular schemes such as DSL internet access, 4G mobile communication, etc.

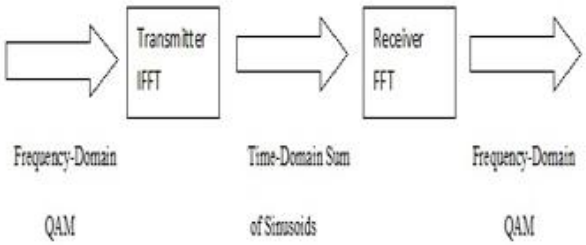

Fig. 2. Simplified OFDM System

This term is also known as coded OFDM (COFDM) and discrete multi-tone modulation (DMT), used for both wireless and physical communication mediums [2].

B. OFDM is more preferable

OFDM is very effective for communication over channels with frequency; different fading can be experienced by different components of signal. It is very difficult to handle frequency selective fading in the receiver, in which case, the design of the receiver is hugely complex. Instead of trying to mitigate frequency selective fading as a whole, OFDM mitigates the problem by converting the entire frequency selective fading channel into small flat fading channels (as seen by the individual subcarriers). Flat fading is easier to combat (compared to frequency selective fading) by employing simple error correction and equalization schemes.

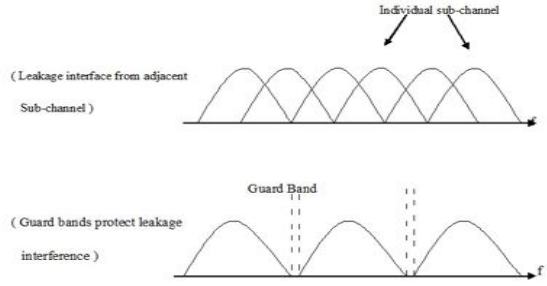

Fig. 3. Guard Band in OFDM

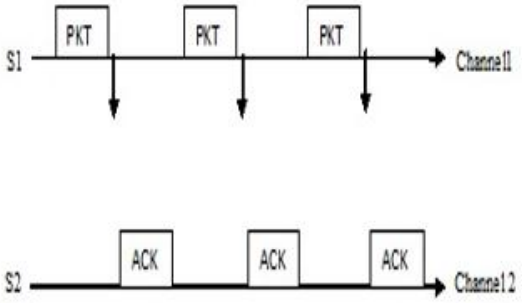

Fig. 4. Concept of Frequency Hopping

II. PROBLEM DEFINITION

There are various issues which affect the design and performance of wireless sensor network such as routing, security, energy consumption as in multi-hoping. Sensor networks are supposed to work at low rate with low duty cycles. Even if energy is an issue, often only transmit power is considered, neglecting the enormous influence of receive energy. Internet of things is IP enabled based sensor technology [3] that improves the performance over wireless sensor devices. These wireless devices only capture the data and send the information to server, So finally new network based sensors come into existence i.e. IP enable based sensor. we uses AODV routing protocol instead of DSDV to route the data through network because it consume more bandwidth as it periodically broadcast routing information whereas in AODV there is no need to maintain routing table which result in less bandwidth consumption [4]. We were using the concept of frequency hopping instead of multi-hoping. Now, the multi-hoping overlooked in many cases because of problem to regulate the different frequency ranges. This recurrence heterogeneity has avoided with this frequency hoping terminology. In those feeble sign issue might have been likewise avoided As opposed to deploying amplifiers. Every terminal need contacted for different terminal and recurrence hole diminished with the appropriation about time slot. Through the Network Address Translation (NAT) we transfer the message from one IP to another IP. It helps improve security by reusing IP addresses. The NAT router translates traffic coming into and leaving the private network.

III. WORKING OF PROPOSED MODEL

The uses of multiple communication channels can impact mitigate the negative effects of interference induced by collected wireless networks [5]. The aim of this research proposal is identifying bad channels and removed from wireless devices.

In the proposed systems, we are examining the packet sent/receive time at first, if the packet completes their process than frequently exchange of packets in granular manner. The whole process we called synchronous hopping that avoid multi-channel related problems.

Tmap is time expire on certain time 16 frequency bands C1-C16 (Orthogonal Frequency) [6].

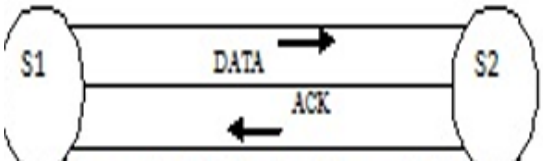

Fig.5. Full Duplex Communication

In a traditional approach S1 and S2 (two communicating nodes) shares the same channels and hopset which is used that selected in random fashion but all selecting same channels that means time slot [7]. Selection process was same, but in our approach we are giving individual time slot to every frequency band so that random selection process of frequency is different for every channel [8].

A. Socket programming

Socket programming was introduced by ARPA (Advance Research Project Agency) in Berkley. It is used to make connection between two computers to communicate through UNIX as similar to the TCP/IP communication. Socket is an abstraction which represent the terminal's connection between two computers. It also represent connection point in TCP/IP. In a given connection every computer has a socket or there is a virtual cable which connects computers through socket [9].

In a socket interface when two computers communicate with each other then they use only one socket, out of both computers one is selected as a server which open one socket and wait for the connection i.e. client's connection can be listen. The other computer can be used as a client and it calls server socket to establish the connection. To establish the connection client needs only servers IP address or port number [10].

Every computer of TCP/IP network has its unique IP address and ports in IP address represent individual connection [11]. To get the incoming data in a computer there are several ports but only that port of computer can listen who have been associated before sending data.

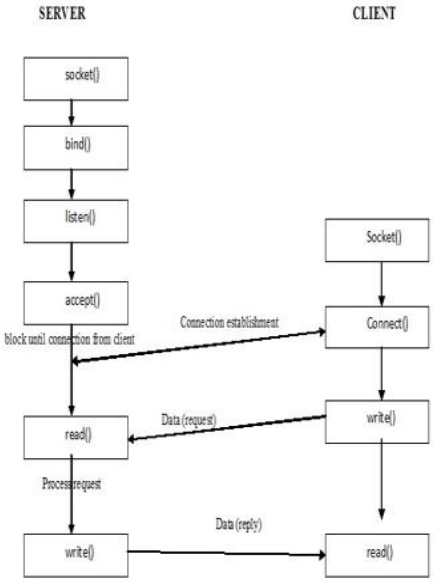

Fig.6. Socket Programming

B. Full duplex pipe:

All the half duplex pipes have one-way flow of data, to make a full duplex connection we can use two half duplex pipes so that both pipes will provide the flow of data in one direction each. We must take care in which order the pipes are opened in client and server otherwise a deadlock may occur.

In order to set up a full duplex channel, the server and client should treat these two named pipes as: server opens the named pipe (pipe-1) for reading the data and pipe (pipe-2) for writing the data. When this set up works correctly the client must open its pipe-1 for writing and pipe-2 for reading. In this way a full-duplex channel can be established.

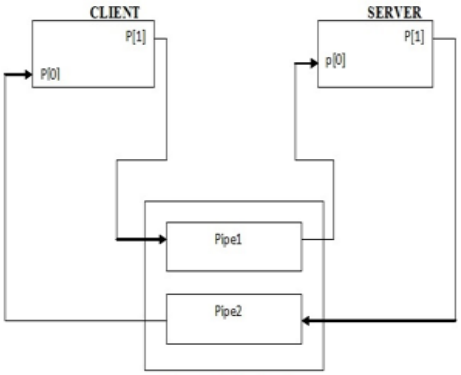

Fig.7. Full Duplex Pipes

IV.EXPERIMENTAL TESTBED AND RESULTS

SBC module provides one 2.4 GHz wireless interface suitable for connection to wireless networks or home gateway [12]. The home gateway has act like a registration server that calculate the values of smart greenhouse. In this simulation scenario, home gateway gathers all the information of clients and IoT devices.

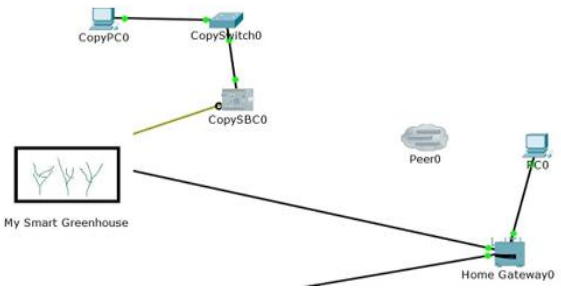

Fig.8. Simulation Test bed of IoT Devices

The new predicted value of temperature in the real environment has shown in figure:

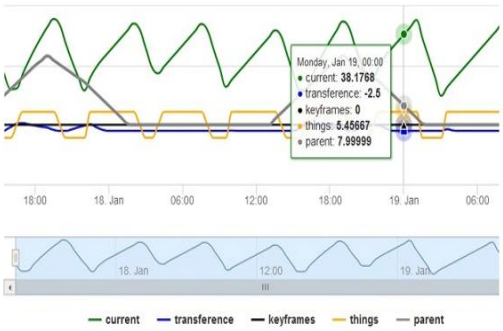

Fig.9. Real Time Temperature Values of current day (smart green house)

A. Throughput

The throughput means that number of sends packet that is equally received by the destination machine; but in the case of normal flow of data if the load increases than it may affect the throughput and packets are not receiving by the destination router correctly. So, in the figure 10, throughput is degraded at every simulation time and correspondingly network load increases.

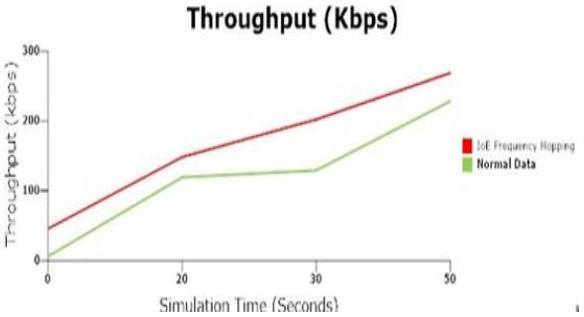

Fig.10. Throughput

B. Delay (ms):

As in this section we are only clarifying whether the number of request that we are sending and that response has been came by acknowledgment or not. But in the figure 11, it is clear that the number of request that send to the another IOT device or destination machine, we equally got the response from it.

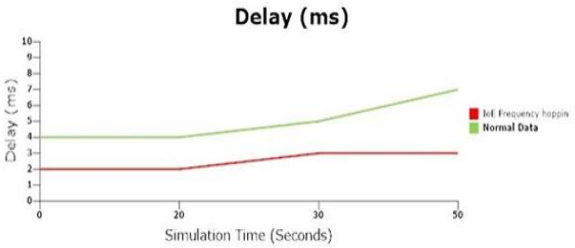

Fig.11. Delay

V. CONCLUSION

We have worked on the IOT devices, especially used generic wireless sensor. These sensor devices are static by nature but we reprogrammed the device. So, that it should work on dynamic in nature (hill areas). These dynamic nature devices transmitting the data to nearest cluster network or base station, before transmitting the data the frequency overlapped related problem was occurred. The frequency overlapped problem has overcome by frequency hopping technique and it is mentioned on section III. Here, in this paper routing table are designed with the help of AODV protocol which is again use the concept of Dijkstra Algorithm. This protocol will help to maintain the routing table in future also. The overall network simulation was investigated and analyzed; throughput of the network is high then existing network. It is also analyzed that the energy consumption of the overall network is lesser then previous approaches.

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