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EFFECT OF NODES MOBILITY BY MOVING NODES AT DIFFERENT TRAJECTORIES ON ZIGBEE MESH TOPOLOGY

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ABSTRACT

In this paper the effect of mobility of nodes at different trajectories is analyzed on zigbee Mesh topology. Different Trajectories which are used are Helbert fitting curve, hexagon and square. To analyze the effect opnet 14.5 modeller is used. The effect is analyzed in terms of throughput, packet drop and Media Access Delay. Result shows that with change in trajectory performance change. Result shows that when 64 nodes fixed and other moves then Helbert and Hexagon performs equal and better than square. Result also shows with increase in speed performance increase.

Keywords: OPNET, WSN, ZigBee, 802.15.

I. INTRODUCTION

Zigbee is a wireless sensor network standard which suited for the family of Low-Rate Wireless Personal Area Networks (LR-WPANs 250 Kbps), allowing network creation, management, and data transmission over a wireless channel with the highest possible energy savings [1]. The standard was produced by the ZigBee Alliance to meet the accompanying essential needs like minimal cost, Integrated insight for network set-up and message routing and simple establishment of ultra-low power utilization [2, 3]. The Zigbee is based on the IEEE 802.15.4 standard, which employs a non- persistent Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) Medium Access Control (MAC) protocol and operates in the 2.4 GHz band (similarly to the IEEE 802.11 standard [4].

ZigBee nodes send out data in range of 10-75 meters, which is used the RF communication, to make this communication three types of ZigBee nodes are used i.e. coordinator, router, and end device [5,6].

ZigBee coordinator: In each sensor network only one coordinator node is used, to make a communication for ZigBee. This sensor node is responsible for initializing the network, select the suitable channel and permit other devices to connect to its network [7,8].

ZigBee Router: Router is used to pass a information data in sensor network, and also capable to connect to other router, or an end device. Router functions are only used in a ZigBee topology [7,8].

ZigBee End Device: These nodes utilize the communication in router or a coordinator. An end device connected to the network through either a router, or directly to the coordinator [7,8].

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II. MESH TOPOLOGIES

In a network of mesh topology routers and coordinators shape various connections among one another while having end-devices as their children. While more perplexing in its development and operation, mesh topology is characterized by link/path redundancy which is known to in enhanced robustness and network routing capacity.

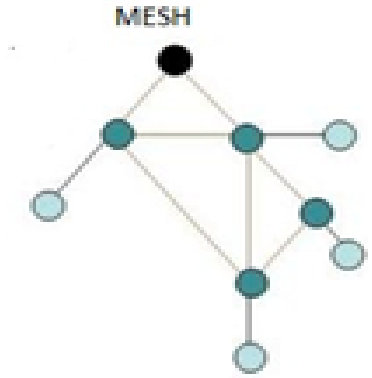

Fig 1: Mesh Topologies

III. EXPERIMENTAL SETUP

In this paper the effect of trajectories is analyzed on mesh topology. To analyze this effect different scenarios are used by using Helbert fitting curve [16], hexagon and outer square trajectory. In each scenarios 1000 nodes are used which are placed randomly over an area of 4000m*4000m. In this area firstly 64 nodes are moving at different speed by using these trajectories and rest is static. In these scenarios nodes move and 16 nodes stoped at each points as shown in fig 2, 3, 4 and rest moves further. In other scenario 64 nodes are static and other nodes are moving at different speed by using different trajectories. In theses scenarios 600 nodes moves and 200 nodes stopped at each point as shown in fig 2, 3, 4 and rest moved for next point. In each scenario 4 mobile coordinator is used which moves at different speed by using different trajectories. These 4 coordinator moves and 1 coordinator stop at each point. in each scenario 40 routers are used which are placed randomly.

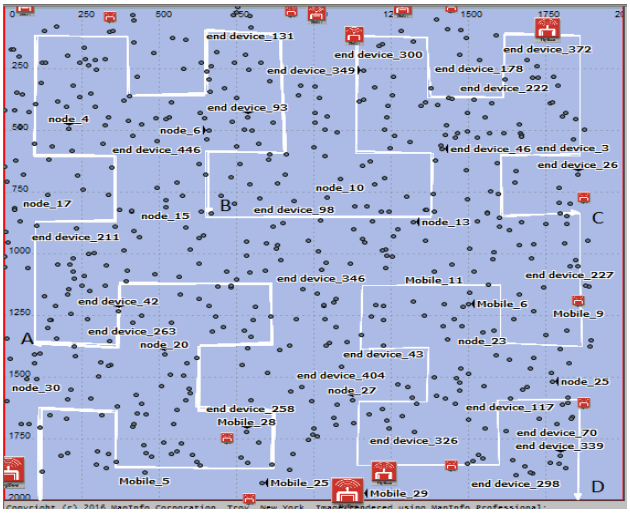

Fig 2: Helbert curve

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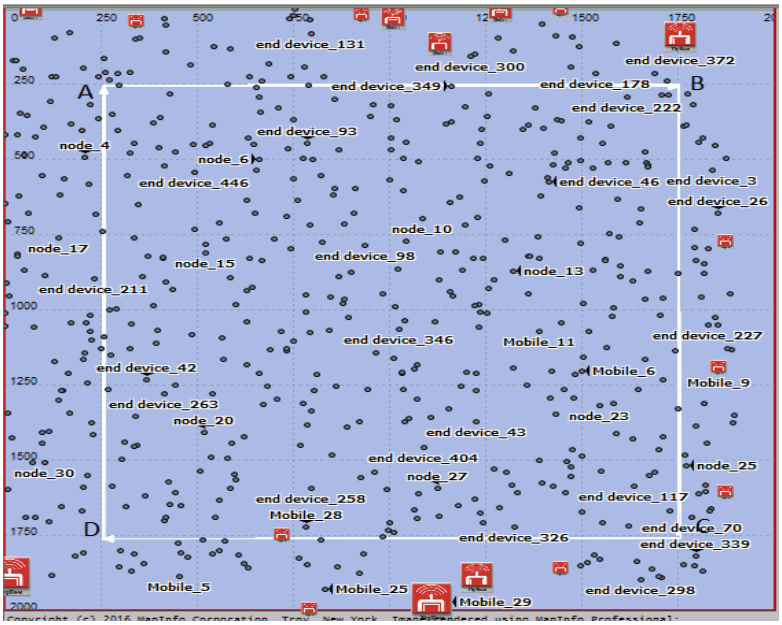

Fig 3: Square Trajectory

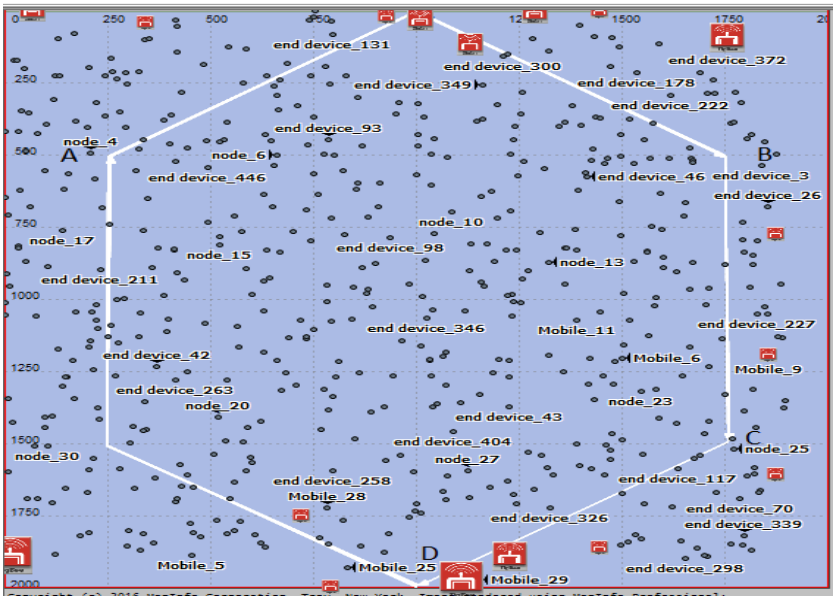

Fig 4: Hexagon Trajectory

IV. RESULTS

Here performance of Mesh is analyzed with the mobility of both ZigBee End Devices and ZigBee coordinator for different trajectories. The result is analysed in terms of Packet drop Traffic Sent.**Packet Drop**

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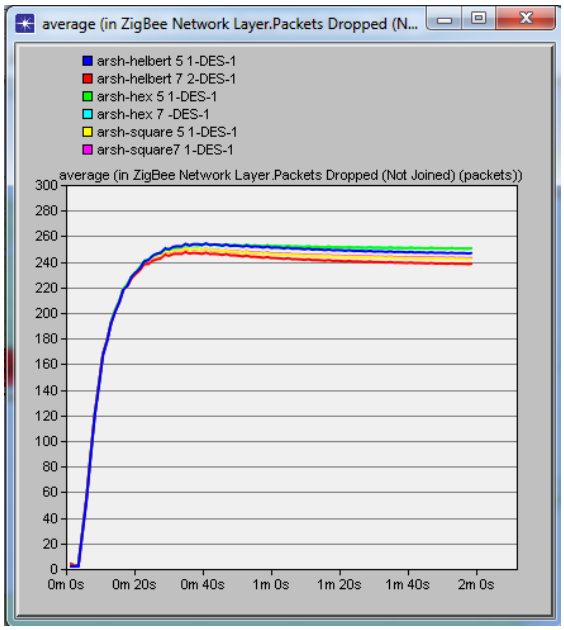

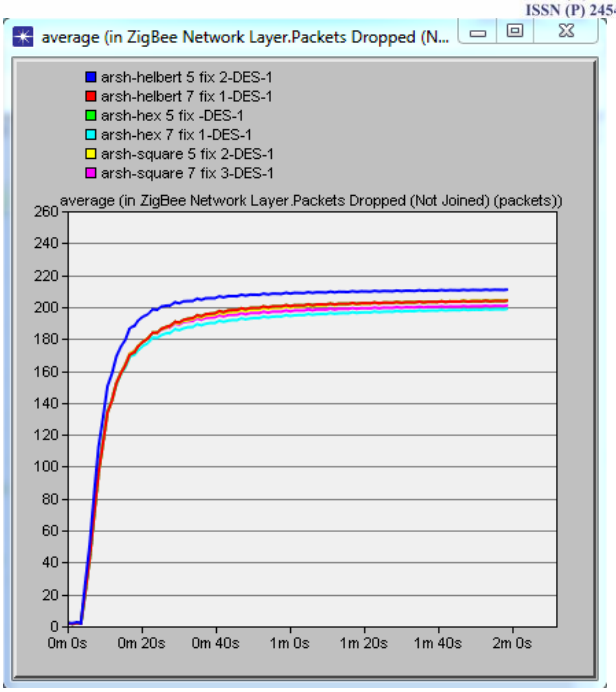

Fig 5: Packet drop when 64 nodes moves **Fig 6: Packet drop when 64 nodes fix**

Fig5 shows that when helbert curve is used then when 64 nodes moves with speed 5m/s than packet drop is 250 packets/sec and when nodes 64 moves with speed 7m/s than packet drop is 240 packets/sec

Fig5 shows that when hexagon curve is used then when 64 nodes moves with speed 5m/s than packet drop is 250 packets/sec and when 64 nodes moves with speed 7m/s than packet drop is 250 packets/sec

Fig5 shows that when Square curve is used then when 64 nodes moves with speed 5m/s than packet drop is 230 packets/sec and when 64 nodes moves with speed 7m/s than packet drop is 230 packets/sec

Fig6 shows that when helbert curve is used then when 64 nodes fixed and other moves with speed 5m/s than packet drop is 210 packets/sec and when nodes 64 fixed and other moves with speed 7m/s than packet drop is 200 packets/sec

Fig6 shows that when hexagon curve is used then when 64 nodes fixed and other moves with speed 5m/s than packet drop is 210 packets/sec and when 64 nodes fixed and other moves with speed 7m/s than packet drop is 200 packets/sec

Fig6 shows that when helbert curve is used then when 64 nodes fixed and other moves with speed 5m/s than packet drop is 200 packets/sec and when 64 nodes fixed and other moves with speed 7m/s than packet drop is 200 packets/sec

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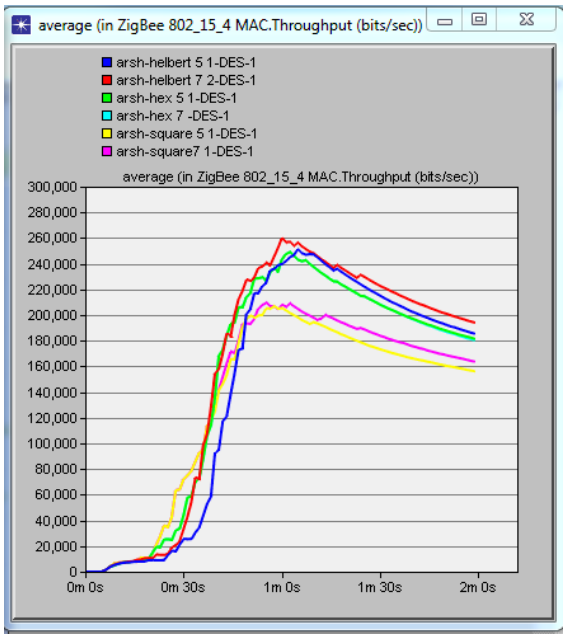
THROUGHPUT



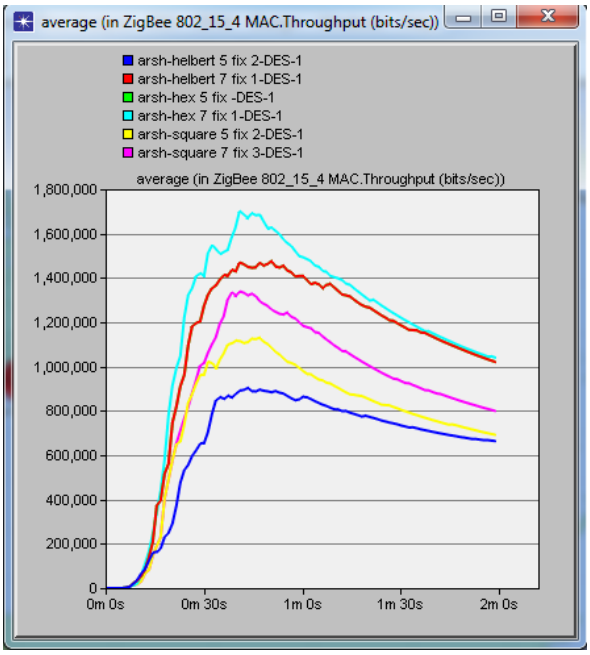


Fig 7: Throughput when 64 nodes move **Fig 8: Throughput when 64 nodes Fix**

Fig7 shows that when helbert curve is used then when 64 nodes moves with speed 5m/s than throughput is 180000 bits/sec and when nodes moves with speed 7m/s than throughput is 200000 bits/sec

Fig7 shows that when hexagon curve is used then when 64 nodes moves with speed 5m/s than throughput is 180000 bits/sec and when 64 nodes moves with speed 7m/s than throughput is 180000 bits/sec

Fig7 shows that when Square curve is used then when 64 nodes moves with speed 5m/s than throughput is 160000 bits/sec and when 64 nodes moves with speed 7m/s than throughput is 170000 bits/sec

Fig8 shows that when helbert curve is used then when 64 nodes fixed and other moves with speed 5m/s than throughput is 700000 bits/sec and when nodes fixed and other moves with speed 7m/s than throughput is 1000000 bits/sec

Fig8 shows that when hexagon curve is used then when 64 nodes fixed and other moves with speed 5m/s than throughput is 1000000 bits/sec and when 64 nodes fixed and other moves with speed 7m/s than throughput is 1000000bits/sec

Fig8 shows that when Square curve is used then when 64 nodes fixed and other moves with speed 5m/s than throughput is 700000 bits/sec and when 64 nodes fixed and other moves with speed 7m/s than throughput is 800000 bits/sec

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Media Access Delay

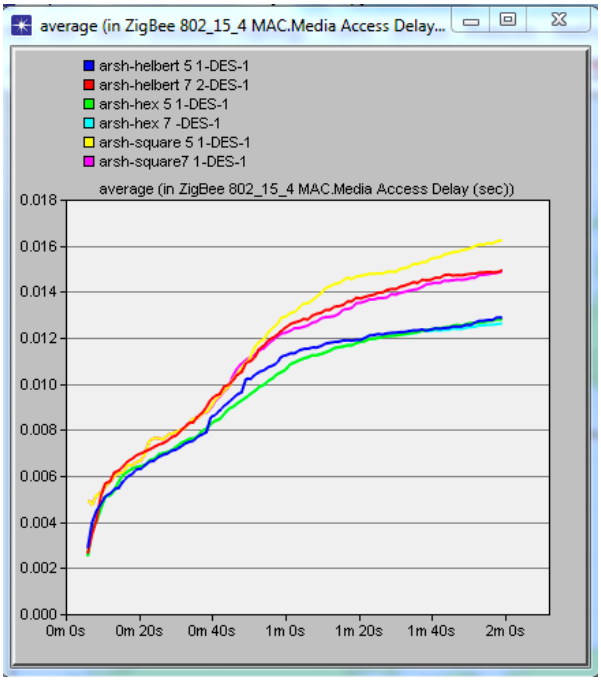

Fig 9: Media Access delay when 64 nodes moves

Fig9 shows that when helbert curve is used then when 64 nodes moves with speed 5m/s than delay is 0.013 sec and when nodes 64 moves with speed 7m/s than delay is 0.015 sec

Fig9 shows that when hexagon curve is used then when 64 nodes moves with speed 5m/s than delay is 0.013 sec and when 64 nodes moves with speed 7m/s than delay is 0.013 sec

Fig9 shows that when Square curve is used then when 64 nodes moves with speed 5m/s than delay is 0.016 sec and when 64 nodes moves with speed 7m/s than delay is 0.015 sec

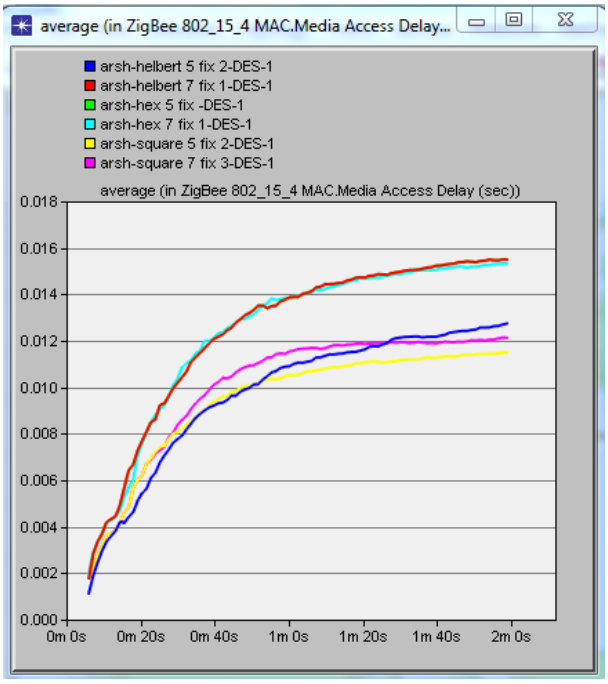

Fig 10: Media Access delay when 64 nodes fix

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Fig10 shows that when helbert curve is used then when 64 nodes fixed and other moves with speed 5m/s than delay is 0.015 sec and when nodes 64 fixed and other moves with speed 7m/s than delay is 0.015 sec

Fig10 shows that when hexagon curve is used then when 64 nodes fixed and other moves with speed 5m/s than delay is 0.013 sec and when 64 nodes fixed and other moves with speed 7m/s than delay is 0.013 sec

Fig10 shows that when Square curve is used then when 64 nodes fixed and other moves with speed 5m/s than delay is 0.011 sec and when 64 nodes fixed and other moves with speed 7m/s than delay is 0.012 sec.

Conclusion and Future Scope

In this paper the effect of trajectories is analyzed on mesh topology by moving nodes at different speed. To analyze the effect1000 nodes are used which are placed randomly and some nodes move by using different trajectories at different speed. Trajectories used are Helbert fitting curve, hexagon and outer square trajectory. The performance is analyzed in terms of throughput, packet drop and Media Access Delay. Result shows that when 64 nodes fixed and other moves then performance of Helbert and Hexagon is nearly equal and better than square. Result also shows with increase in speed performance increase.

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