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A NOVEL ALGORITHM IN 2 LEVEL AGGREGATIONS FOR WSN IN MULTI INTERFACE MULTICHANNEL ROUTING PROTOCOL

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Abstract— Energy efficiency is an important metric in resource constrained wireless sensor networks (WSN). Multiple approaches such as duty cycling, energy optimal scheduling, energy aware routing and data aggregation can be availed to reduce energy consumption throughout the network. This thesis addresses the data aggregation during routing since the energy expended in transmitting a single data bit is several orders of magnitude higher than it is required for a single 32 bit computation. Therefore, in the first paper, a novel nonlinear adaptive pulse coded modulation-based compression (NADPCMC) scheme is proposed for data aggregation. A rigorous analytical development of the proposed scheme is presented by using Lyapunov theory. Satisfactory performance of the proposed scheme is demonstrated when compared to the available compression schemes in NS-2 environment through several data sets. Data aggregation is achieved by iteratively applying the proposed compression scheme at the cluster heads. The second paper on the other hand deals with the hardware verification of the proposed data aggregation scheme in the presence of a Multi-interface Multi-Channel Routing Protocol (MMCR). Since sensor nodes are equipped with radios that can operate on multiple non-interfering channels, bandwidth availability on each channel is used to determine the appropriate channel for data transmission, thus increasing the throughput. MMCR uses a metric defined by throughput, end-to-end delay and energy utilization to select Multi-Point Relay (MPR) nodes to forward data packets in each channel while minimizing packet losses due to interference. Further, the proposed compression and aggregation are performed to further improve the energy savings and network lifetime.

Keywords— Data Aggregation, Data Fusion, Congestion Control, Buffer Overflow, End to End Delay.

I. INTRODUCTION

With the advancement of technology we are able to develop distributed sensing devices known as sensors which are capable of collecting information from its environment and these sensors are very small in size and also cost effective and able to perform various functions as per our desire. Wireless sensor network (WSN) is a network of sensor nodes. The main constituents of the WSN nodes are the communication devices (i.e. receiver and transmitter), a small Central Processing unit (CPU), a sensing device and a battery. The sensor node senses and gathers information from the surroundings; the CPU executes some control instructions and the communication unit sends the information to the base station through the network of such a large number of nodes.

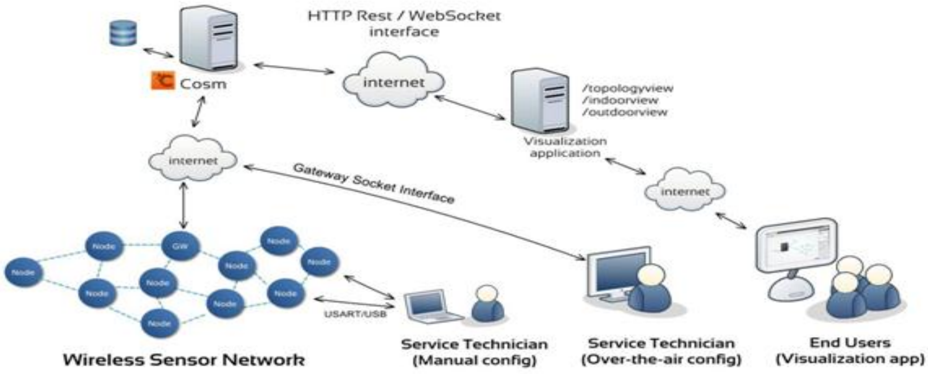

Fig1.1 Architecture of Wireless Sensor Network

When compared to local processing of data, wireless transmission is extremely expensive. Researchers estimated that sending a single bit over radio is at least three orders of magnitude more expensive than executing a single instruction. With the new developments in the hardware of the motes, increasing memory size is giving us the chance to process the data, perform buffer management operations, so as to reduce the number of transactions over the radio. For Scalability and flexibility of WSN applications, we need to consider this data aggregation as this results in energy saving and optimized performance. Indeed, several research efforts have been proposed in different forms of aggregation to achieve energy efficiency [4, 5, 6, 7].

II. LITERATURE SURVEY

A WSAN [19] is a kind of heterogeneous WSN composed of a large number of sensors and a small number of resource rich actors. The recent technological advances have lead to the emergence of wireless sensor and actor networks. The sensors gather information regarding an event and actors perform the appropriate actions. In case of emergency, the system should take automatic action on the basis of gathered information rather than waiting for manual intervention; therefore the role of actors is becoming very important. The requirement of real-time, efficient and fault tolerant communication is extremely important in emerging applications. Supporting real-time communication in sensor networks faces severe challenges due to their wireless nature, limited resource, low node reliability, distributed architecture and dynamic network topology. In emerging applications based on WSN therefore there is a trade-off between energy efficiency and delay performance depending upon applications requirement. Recent advances in wireless sensor networks have led to rapid development of real-time (RT) applications. The researchers have proposed some real time delivery schemes for WSNs. A comprehensive review of the challenges in providing real-time communication in sensor networks can be found in [20][21]. To the best of our knowledge, RAP [23] is the first RT routing approaches for WSN. Admittedly, the SPEED protocol [24] is one of the most important RT routing protocols and has been an inspiration for many other RT routing protocols [25][26]. Chenyang Lu et al. develop real-time architecture and protocols (RAP) based on velocity [23]. RAP provides service differentiation in the timeliness domain by velocity-monotonic classification of packets. In order to facilitate, delivery of a high velocity packet before a low velocity one, velocity of the packet is calculated and its priority is set on the basis of packet deadline and destination, in the velocity-monotonic order. The architecture of RAP is shown in Figure 2

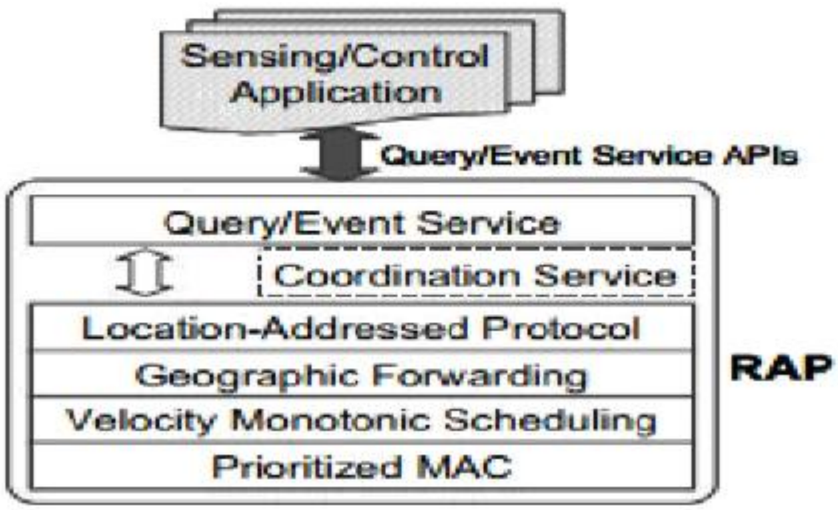

Fig2. RAP communication architecture [23]

III. METHODOLOGY/PLANNING OF WORK

Different statement of our model is discussed. Initial order radio model is being used.

- BS is located far away on or after the sensing ground and the sensor nodes are motionless once they are deployed.
- Sensor node is uniform; the entire sensor node has same initial energy, a battery.
- Radio channel is symmetric means the energy consumed for transmitting a message is the same for receiving it.
- Sensor node has understanding of its location and energy.

The main and most important improvement in this proposed solution is based on the concept of selection of Cluster Head and which node sends the information when redundant data are detected. On the other hand, by combining features of MMCR protocols is allowed not to send the redundant data within a cluster and among different iterations, i.e. redundancy is eliminated first among nodes in the same cluster, and later from the same nodes among consecutive iterations, thus we eliminate 100% redundancy. In our model, all nodes maintain a neighbouring table to accumulate the data to neighbours. All nodes to absent in the radio range r of the distribution node are neighbours of the node. All nodes receive the data communication in the radio range and update its neighbourhood table. Then each node calculates it distances from its neighbour nodes.

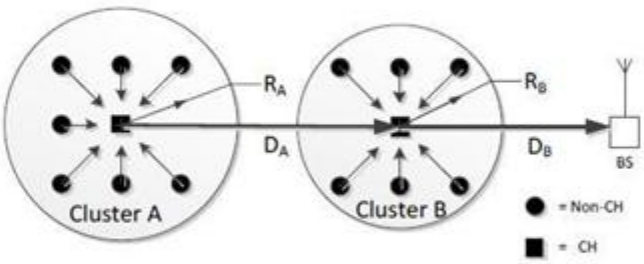

Fig3. Communication of Cluster

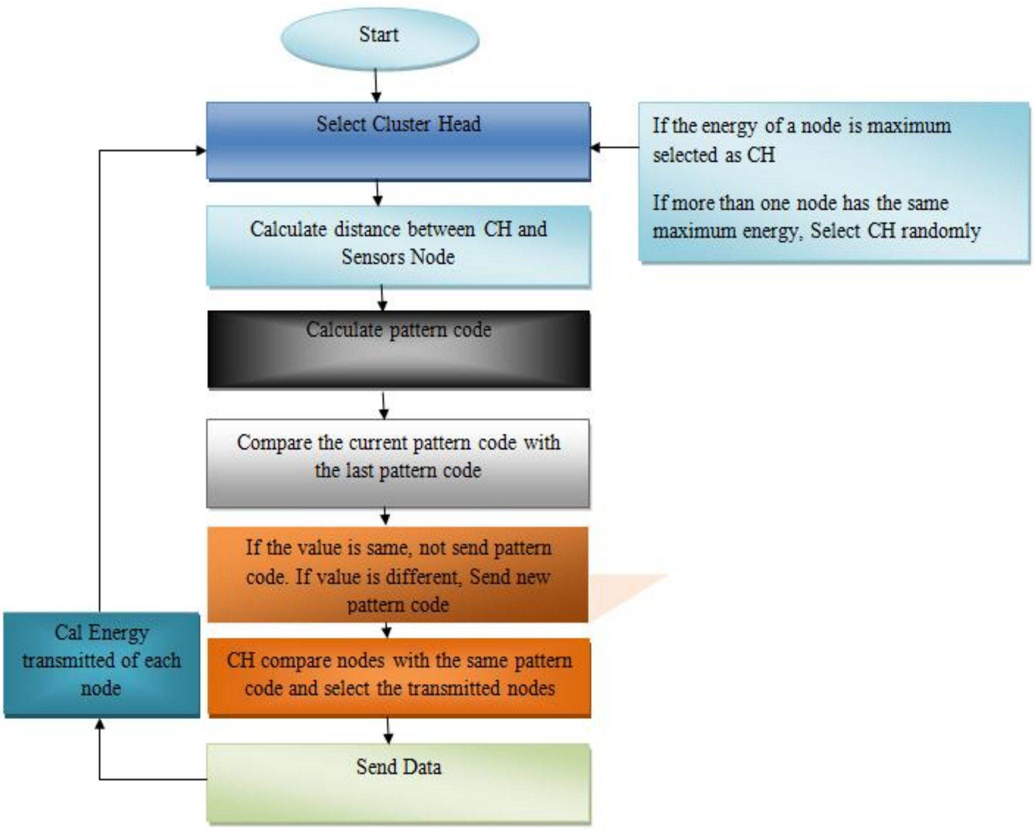

Fig4.Working Process of Methodology

IV. RESULT

Software NS-2

We use NS-2 (v-2.35), a network simulation tool to simulate wireless communication network. NS2 is discrete event simulator developed. It provides a good platform for wsn simulation. We simulate our model for 50, 100, 150 and 200 nodes. The random way point model is selected as a mobility model in a rectangular field (2000 x 2000 m2). RP-MMCR is used for simulation at network layer. Nodes send constant bit rate (CBR) traffic at varying rates. We have repeated the experiments by changing the number of node 50, 100, 150, 200, to see the performance of network under attacks.

The performance of Energy Efficient based Cluster protocol in Wireless Sensor Network (WSN) is being estimated with the help of simulation on network simulator-2.

Following are the results, calculated by using performance .awk script. Using the output we plotted the bar graphs of following parameters .The result is carried out by NS-2 Simulator using following Parameters.

- Throughput
- Packet Delivery Ratio
- Energy Consumption
- Average End to End Delay

Packet Delivery Ratio (PDR): **-** It is defined as the ratio of the number of data packets received by the CBR sink at the final destinations to the number of total data packets originated by the application layer at the CBR sources.

Throughput: **-** It is one of the dimensional parameters of the network. It provide fraction of the channel capacity used for useful transmission selects a destination or final path at the beginning of the simulation i.e., information whether or not data packets correctly delivered to the destinations.

The simulation parameters are given in Table I

Parameter	Parameter's value
Bit Rate	2048 bit/second
Deployment distribution	Uniform
Frequency	2.4 GHz
Number of node	50, 100, 150 , 200
Source node	1
Sink node	1
Protocol	AODV, MMCR
MAC layer	IEEE 802.11
Simulation duration	100s
Traffic sources	CBR
Simulation area	2000m x 2000m
Simulation Time	50 sec

Energy Consumption: **-** The energy consumption comparison graphs between calculate the total energy using in whole scenario, Cluster head choosing according to remaining energy after a rounds.

Delay: **-** Number of rounds vs. Delay graph shows the comparison between the reading of cluster-head selection and choosing a new cluster head.

Data Aggregation Energy cost	50pj/bit j

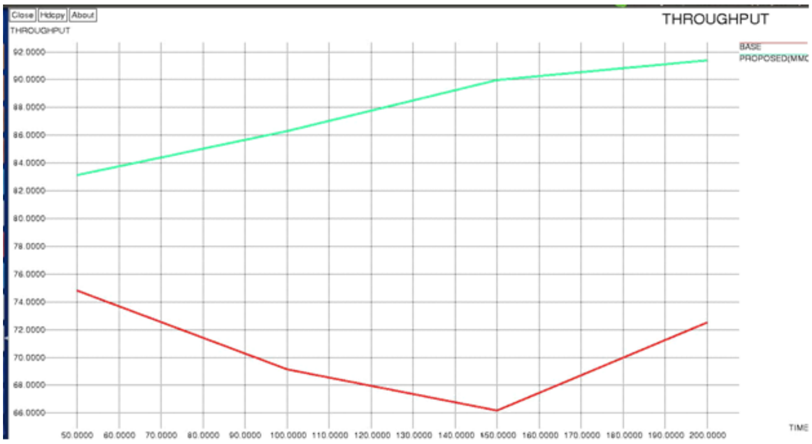

Fig5. Throughput

The number of nodes is varied as 50, 100, 150, and 200 with throughput up to 90kbps. Throughput of proposed M-MMCR protocol perform better all the 200 nodes up to 83kbps throughput and exiting protocol perform same as the proposed protocol up to 100 nodes after 100 nodes it perform 68kbps throughput up to the 200 nodes. So throughput of all the 200 nodes proposed protocol perform better of as compare to the exiting protocol.

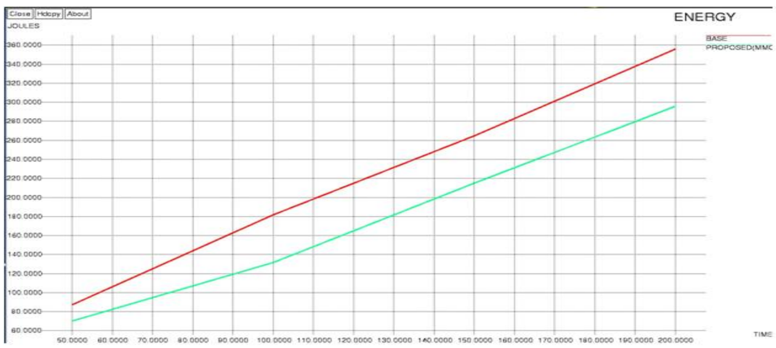

Fig6. Energy Consumption

The network energy consumption includes entire energy consumed at the time of data transmitting and receiving. The number of nodes is varied as 50, 100, 150, and 200 with average energy consumption up to 400 joules. Energy consumption of proposed M-MMCR protocol is performing better result comparison than Exiting to the 365 joules energy consumption.

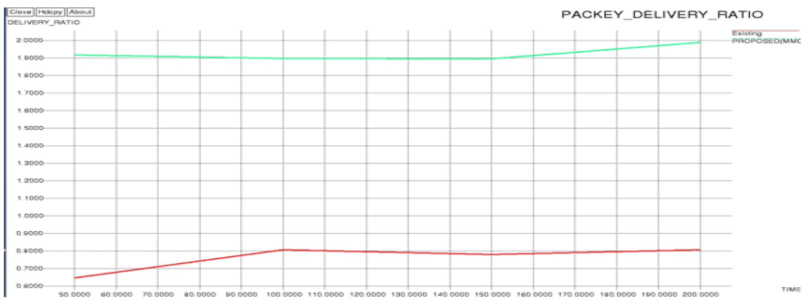

Fig7. Packet Delivery Ratio

Packet Delivery Ratio is the ratio of the number of data packets delivered to the BS to the number of packet generated by the source nodes. The number of nodes is varied as 50, 100, 150, and 200 with packet delivery ratio up to 90%. Packet delivery ratio of proposed M-MMCR protocol perform 70% up to the 100 nodes and 100 nodes to 200 nodes it perform better as compare to the exiting protocol up to the 72%. Exiting protocol performs better up to the 80 nodes. And after 80 nodes it decreases up to the 200 nodes 99%. So proposed protocol Packet delivery ratio of overall nodes perform better of as compare to the exiting protocol

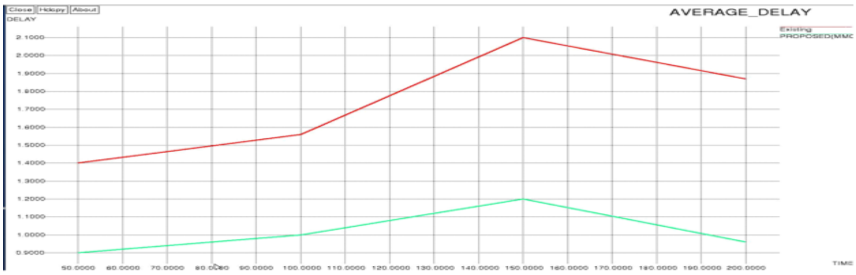

Fig8. End to End Average Delay

End 2 End delay is mean or can say average over all existing data packets from sources to the destinations. In this scenario, nodes are placed in a flat grid topology of size 2000m x 2000m. The number of nodes is varied as 50, 100, 150, and 200 with the value of average end to end delay from 0 to 0.9. Delay of proposed method M-MMCR protocol performs better up to 50 to 200 nodes as compared to Existing protocol. At node 150 and 200 Existing protocol perform is very low compared of proposed protocols. Existing protocols have the entire node in the cluster form that's why it showing low performance till node 200 with the comparison of proposed method.

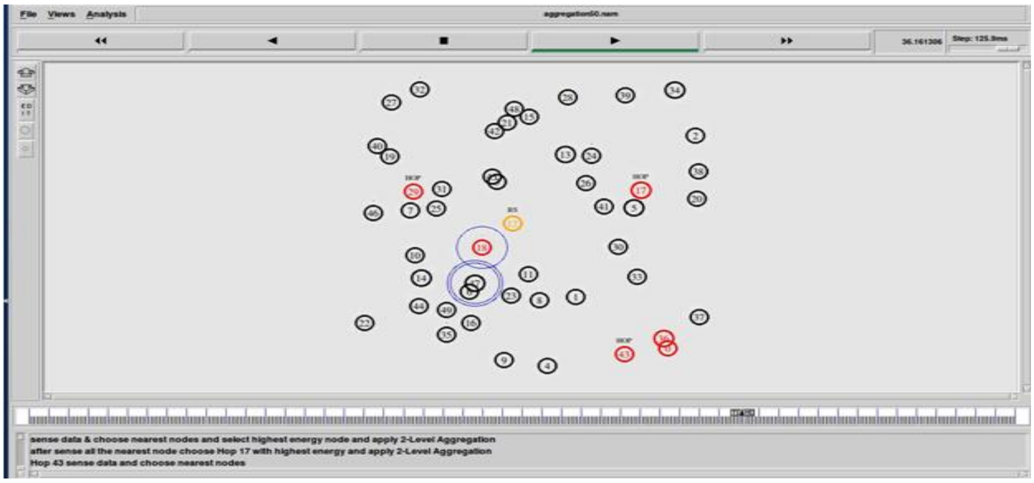

Fig9. Snapshot of showing neighbours node of node 17

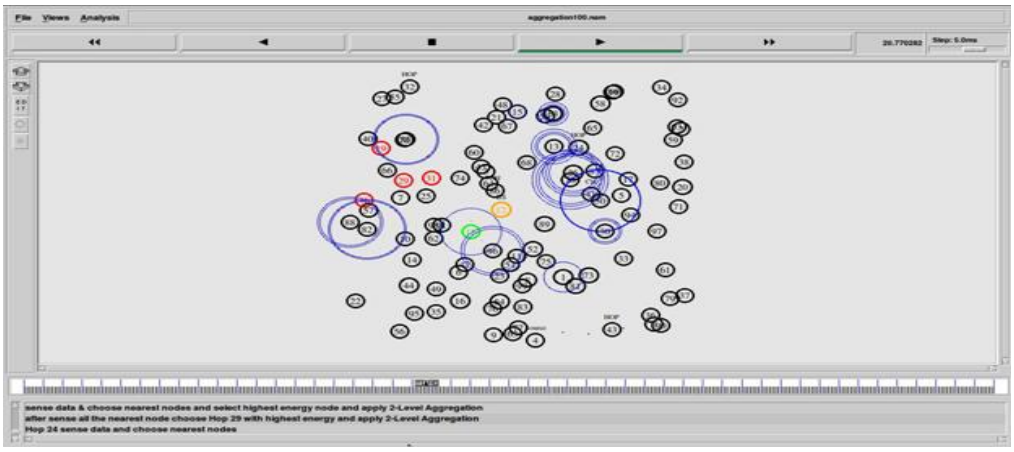

Fig10. Cluster is formed and node ready to make communication with Base Station

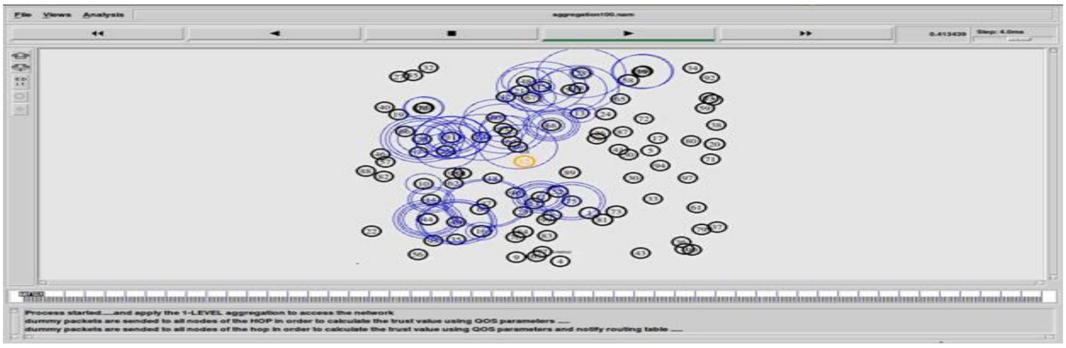

Fig11.Shows all node searching for the next hop

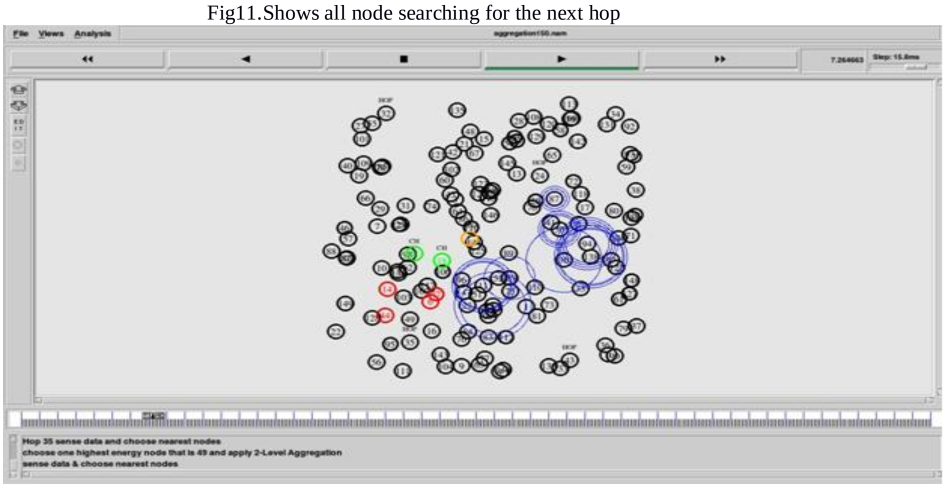

Fig12. Node 18 has been chosen as the highest energy node and start 2-level Aggregations

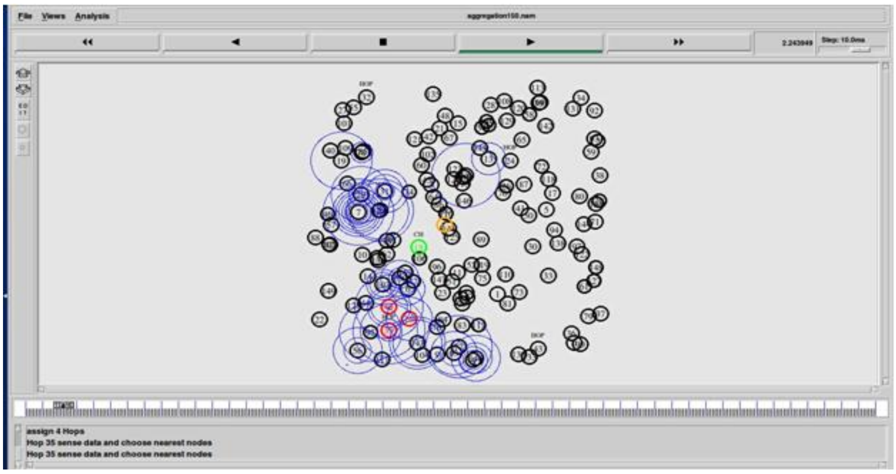

Fig13. Sensing second hop in the simulation with 100 nodes

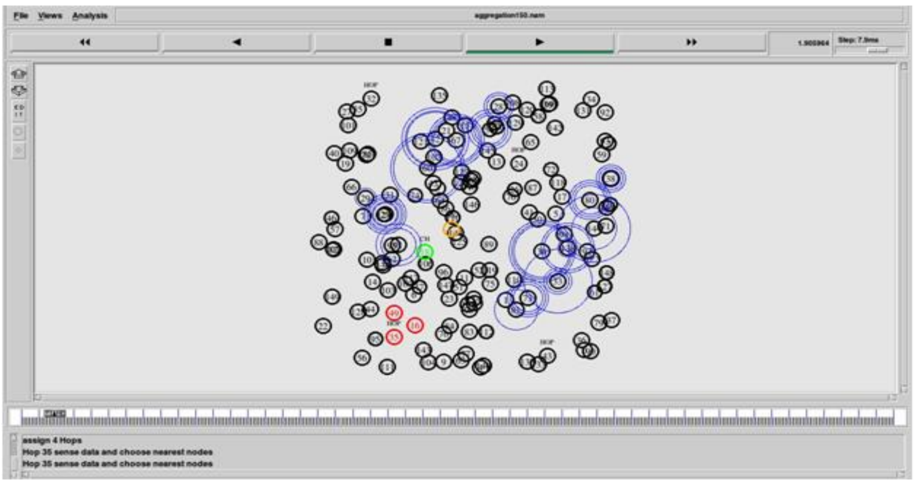

Fig14. Showing selected hop for routing table.

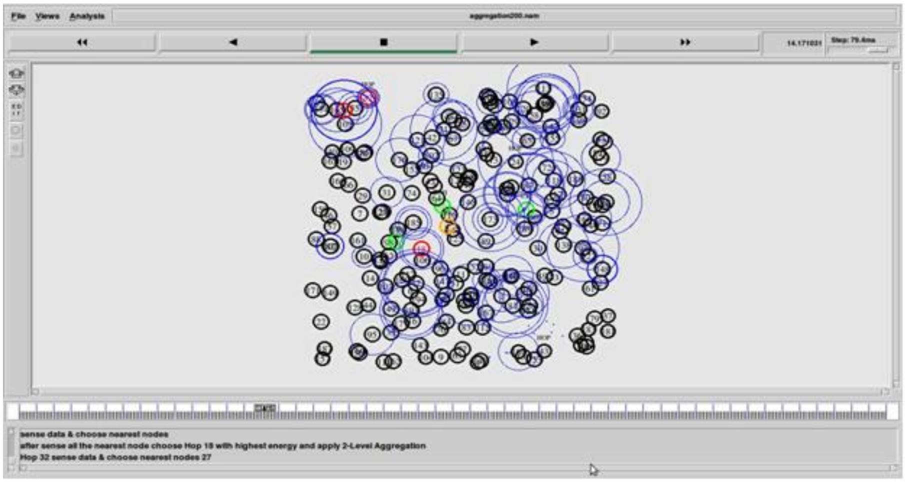

Fig15. Cluster-head is active to send the information to nearest node communication with Base-station

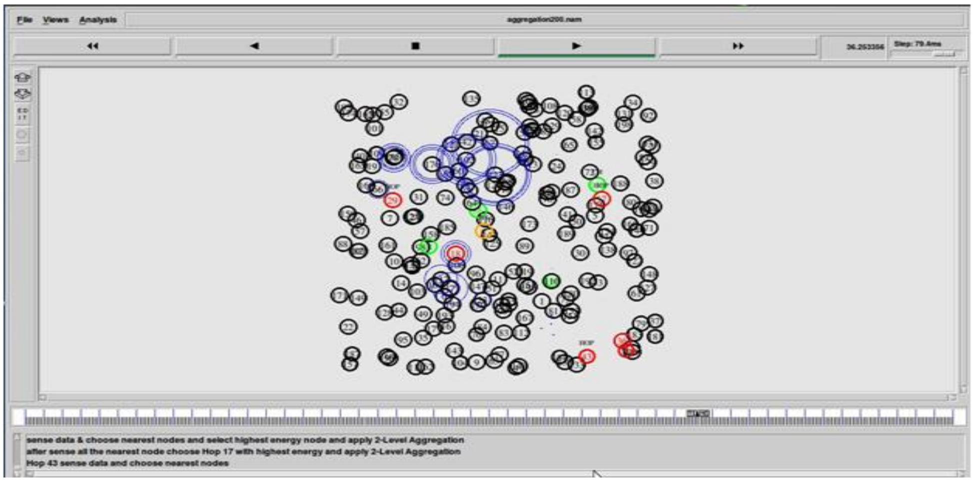

Fig16. Forming All Clusters and number of hops

V. **CONCLUSION**

The ideas enlightened in the project, such as the selection of the Cluster Head and the selection of the transmitting nodes, lead to have a more energetically balanced network, and furthermore a secure network which ensure a notification of danger in case of emergency. In this project, a new data aggregation protocol has been successfully developed and implemented. This protocol contributes to decrease the main problems in wireless sensor systems, as energy consumption, especially in Cluster Head nodes, that nowadays is considered as one of the biggest problems in WSN. In addition, the proposed protocol not only reduces power consumption of each sensor, but also achieves a more energetically balanced network, by choosing the sensor nodes with more energy consumption that are always sensor nodes with more level of energy.

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