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SECURE AND ENERGY EFFICIENT MOBILE COORDINATED WIRELESS SENSOR NETWORK TO IMPROVE QUALITY OF SERVICE IN WSN

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Abstract: The conventional SENMA network with Mobile Access points are composed of multiple MA points which travel along the pre-specified path. They gather the data from each sensor node. This resulted in large delay and low throughput as the information exchange is restricted because of velocity of the MA point and distance to be covered by mobile access point. In order to find a solution, Mobile Access Coordinated-WSN system is introduced. The proposed work is a secure and reliable energy efficient Mobile Coordinated Wireless Sensor Network to improve Quality of service in WSN. The nodes are clustered and the Cluster Head collects data from the cluster members. The Mobile Sink collects data from the cluster head of all the clusters. Thus resulting in increased throughput, reduced delay, restricted number of hops and increased energy efficiency. The effectiveness in terms of energy is enhanced for all the sensor nodes. The sensor nodes being not a part of routing process, and need not receive radio beacon from the MA, results in the energy effective performance of the system. MC-WSN is advantageous over previous conventional SENMA network in that it increases the throughput, reduces the delay in data transmission and the number of hops can be limited to a predefined value. Experimental results demonstrate the superior performance of MC-WSN in comparison with existing systems with MA points in terms of real-time communication, energy-efficiency, throughput and number of hops.
Keywords: Wireless sensor networks, mobile access coordinator, N-hop network, throughput, energy efficiency

I. INTRODUCTION

A wireless sensor network is a group of wireless sensing devices. These devices can be widely placed in the network for surveillance purpose. Sensor nodes detect events, process and transmit the event data to the nearest base station. They send or receive data to or from other sensor nodes. Also the interaction happens with the base station as well. Wireless sensor network is used for data gathering by sampling surroundings and reporting to predefined data sinks. MCWSN system is proposed for time-critical and efficient energy applications. Here the most favorable way of arrangement of nodes is designed. This helps in reduced mean hops from nodes to MA point. The throughput is examined for single path routing. By reducing the number of hops, it is possible to achieve better system performance. In the MC-WSN system, the hop number can be restricted to a number specified before using active network deployment and network design. WSNs are used in applications such as live tracking and observations. For time-sensitive applications, greater importance is given for the real-time interaction. The proposed system is a trustworthy and well-organized MC-WSN architecture. This system is proposed for applications with time-sensitive data communication.

Existing Systems:
Existing technique is SENMA. In this technique, the MA points travel through the network to gather data straight from the sensor nodes. SENMA is used in military applications. The tiny low-height UAVs perform the work of MAs. These vehicles gather the collected data for further observations research and joint range detection. For mobile access points, whose energy usage is not considered, SENMA enhances the energy effectiveness of every sensor nodes on the ad hoc networks. This is achieved by making sensors relieved from complicated and energy-absorbing routing methods.
Another technique is adhoc networks which use mobile sinks. Here the moving sink collects information. It approaches pre-fixed number of collecting points. Every sensor sends its data to the nearest collecting point through multiple hops. This data is then sent to sink when it visits the corresponding collecting point.

II. RELATED WORK

G. Mergen et al. [1] proposed that SENMA is an architecture, in which the many mobile access points are considered in a network of sensor nodes. Energy effectiveness perspective of SENMA is considered in this work. Data is directly sent to the mobile access points, thus the burden on the sensor nodes is reduced. This results in effective energy utilization and improvement in performance with respect to energy aspect. The disadvantages of this system are not scalable and power inefficient.

W. Liu et al. [2] proposed a model that is a general MADC (portability assisted information gathering) model to extend the system lifetime while keeping up a specific information accumulation rate for resource-restricted static sensors. This includes numerous essential parameters. For example, the quantity of portable sinks, the speed of a mobile sink, and the way that is navigated by the mobile node. By applying the proposed approach, we research the practices of WSNs with at least one mobile sinks. The discoveries uncover how WSN with portable sinks can outflank a static WSN. Also, gives knowledge on how the MADC parameters can be changed to enhance the information gathering rate and to boost the lifetime. The disadvantages are performance to be increased, data collection rate need to be increased and decreased network lifetime.

I. Maza et al. [3] performed experiment with actual UAVs. It was shown that the created design permits scope of a decent range of missions: reconnaissance, sensor deploying, fire confirmation and fire extinguishing.Key highlight of the design was the simple integration procedure of self-governing vehicles from different manufacturers and research gatherings. This quality made conceivable the utilization of different sorts of UAVs amid the AWARE Project with low advancement efforts. Disadvantages are not robust and costlier.

H.-C. Chen et al. [4] showed a simple joint deciphering plan for compressive range detecting. In particular, this plan enhances the decoding of compressive estimations from one sensor by using the decoded outcomes of another sensor. The Joint compressive range detecting in a UAV situation was used. Here the UAV works in as a characteristic gathering point for the circulated estimations. The decoding step is very much adjusted for this situation, since it effectively endures wireless transmission losses. Disadvantages are low throughput and large delay.

A. Ahmad et al. [5] conducted this work where an information transmission plan that answers the previously mentioned restrictions. The proposed plot first discovers the cluster based region on the basis of localization information data of the sensor nodes and predefined path of a mobile sink. Master node is chosen on deciding the group region in the system. It specifically transmits their information to the mobile sink upon its landing in their gathering region through limited flooding plan. Disadvantages are high energy consumption, less throughput and high transmission delay.

W. Liu et al. [6] carried out this work, where the throughput limit of WSNs is examined. Multiple mobile relays are deployed to gather information from fixed sensors; and forward the same to a fixed sink. To encourage this, another mobile-relay-assisted data collection (MRADC) model is proposed. The examination represents that, the throughput capacity is directly proportional to the relay numbers; provided relay number is lesser than the limit. Then again, if the number is more prominent than the limit, at that point the throughput limit turns steady, and the performance increase over a fixed WSN relies upon two variables: 1) the transmission range and 2) the effect of interference.

III. PROPOSED MODEL OF MOBILE COORDINATED WSN

The mobile access point traverses the trajectory path and gathers data from all the CHs in the network. The effectiveness in terms of energy is enhanced for all the sensors. The sensor nodes being not a part of routing process, and need not receive radio beacon from the MA, results in the energy effective performance of the system. In MC-WSN, the system performance is enhanced. This is achieved by reducing the number of hops to a specified number. The most favorable topology architecture for MC-WSN is shown, so as to have the mean hops among a node and its nearest MA has to be decreased to a lower value. Also to prove that the hop number can be limited to assigned count. Throughput is calculated taking single path into consideration, i.e. routing between source and MA is single path. The impact of quantity of hops on the throughput is outlined, and it is demonstrated that the throughput lessens exponentially as the quantity of hops increments. Also shown that MCWSN has much better performance in terms of energy than the conventional ESENMA

Features of MCWSN:

• The network deployment is controlled by the Mobile Access point: The Mobile access points are responsible for deploying sensors and cluster heads. Addition, relocation and replacement of nodes are managed by MA. Along with that, it can also help in recharging the MA points. The MA receives a control message from the node whose energy level is lower than normal. It then checks and based on the condition can either recharge or replace the node. Because of these multiple functions carried by MA, the MC-WSN architecture overcomes the issues related with the deployment of nodes in the network deployment. Thus resulting in the increased lifetime of the network

• Data exchange is time-critical: In MC-WSN, the delay is the data transmission is controlled by the number of hops. It is not dependent on the speed which MA moves.

• The security is enhanced: (i) MAs identify the malicious nodes and CHs and replace them. Upon receiving data from a node, MA authenticates the node. When the node clear the authentication criteria, reports for every node is monitored and compared with final decision that is got from data fusion. By observing the same over consecutive intervals, the node which is malicious is identified and discarded. (ii) By controlling the number of hops, the data transmission delay can be restricted to a limited duration. The actual delay value changes significantly, if there is any unexpected event in the network or a failure has occurred. (iii) Since MA is most powerful among all the sensor nodes in the network, it is not exposed to any compromise or destruction and also its movement and location is maintained securely.

• Increase in efficiency in terms of energy: The nodes in a WSN have limited power resources. Since the nodes communicate only with their respective CHs and they do not participate in routing function, the energy is conserved.

Measurements:

Network Measurements:

1. Node level measurements: The energy of individual sensor node is measured in a timely manner.

2. Neighborhood measurements: The distance between nodes within the cluster, distance between clusterhead and the sensornodes, and distance between cluster heads of different clusters is measured. Euclidean distance formula is used for obtaining the distance mentioned above.

$$d^2 = (x2 - x1)^2 + (y2 - y1)^2 \quad (1)$$

3. Networkwide measurements: Routing state and network topology are measured in the network. The number of hops required and the routing path is collected. The situation of a

channel over the network is measured during channel of the radio setting to attain both well combined topology and throughput of the network is high.
Based on the above measurements, the CH selection, path for MA, hops between sensor nodes and MA, energy of the nodes and energy of the CHs are determined.

Performance measurements
Comparison of existing system with the proposed MC-WSN system is done with respect to the following parameters.
1. Packet delivery ratio: It is defined as the total number of packets successfully acknowledged by the destination to the number of packets dispatched by the source. The PDR specifies the performance of network that how successfully the packets have been transferred. Larger values give better results.
2. Throughput: It is defined as the average rate of packets successfully transferred to their final destination per unit time

IV. SIMULATION SETUP

Network Simulator (NS2) is a discrete event driven simulator. Education mainly and networking research are the main goals of NS2. For designing the new protocols, and checking symmetry of different protocols, valuation of traffic NS2 is advisable. NS2 is created as a collective domain

Table 1 : Simulation Parameters

Simulation attributes	Value
Simulator	NS2
Area dimension	1102*780
Propagation Model	TwoRayGround
Number of nodes	77
Iniital energy	100 joules
Packet size	512 B
Simulation time	70ms
Routing protocol	DSDV, DSR
Channel	Wireless
Interface	MAC

V. RESULTS AND DISCUSSIONS

Simulation environment was created to create nodes, network deployment, cluster formation and cluster head selection, mobile access point and base station. Figure 1 shows the creation of sensor nodes and the network deployment. The environment has dimension of 1102*780. Number of nodes considered here is 77. The initial energy of each node was set to 100 Joules.

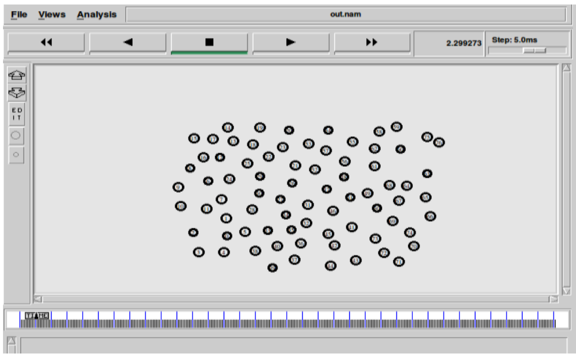

Fig 1 Creation of Sensor nodes and Network deployment

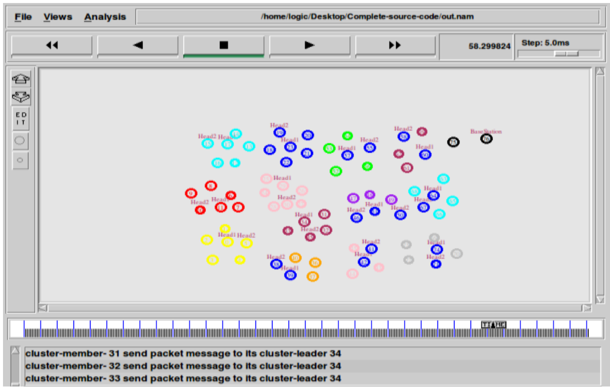

Fig 2 Cluster Head selection based on the energy and weight

Figure 2 shows the cluster head selection process. Here energy for the each cluster member in the cluster member is found out and based on the energy level, cluster head is chosen that has the highest energy, shown as Head1 in the figure.

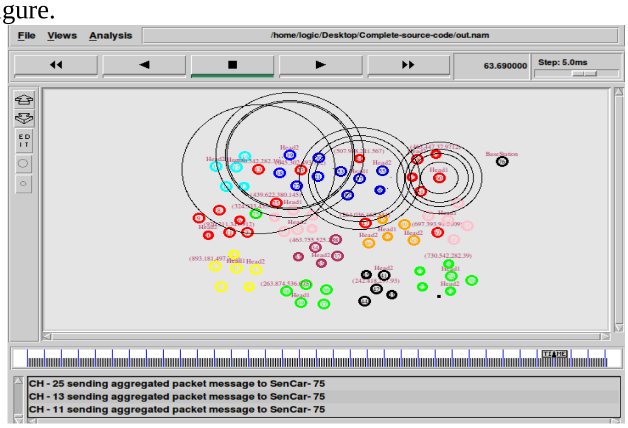

Fig 3 Mobile sink is collecting data from CH 13

The cluster head has collected packet message from its cluster members and an aggregated packet message is created. The mobile sink (here Node 75) is traveling along the trajectory. Mobile sink is collecting data from the cluster heads. The cluster head has collected packet message from its cluster members and an aggregated packet message is created. The figure shows that Cluster head 13 is sending aggregated packet message to the mobile sink.
In the following section, the simulation results are presented. Here simulations are carried out for 75 sensor nodes, one mobile sink and one base station.
1.Throughput
Throughput for MCWSN system is much higher when compared with existing system throughput.

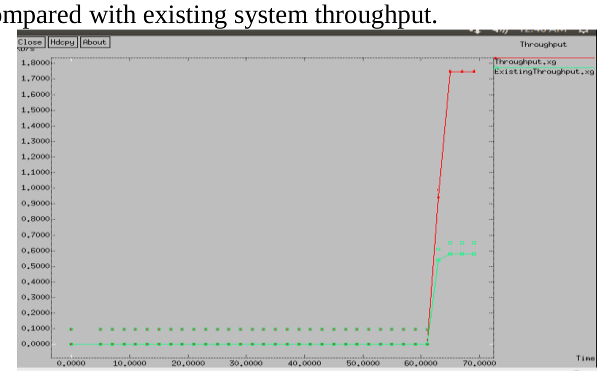

Fig 4 Throughput(Kb/s)

2. Packet Delivery Ratio
Packet Delivery Ratio is much higher in MCWSN when compared with existing system

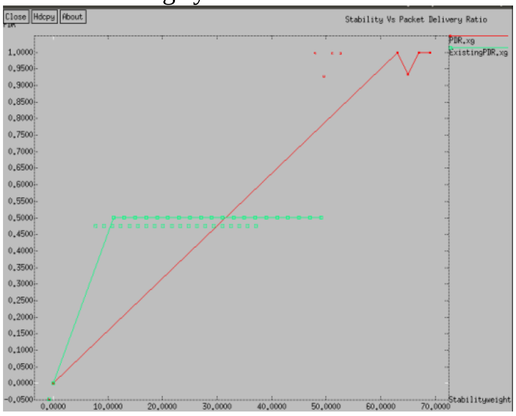

Fig 5 Packet Delivery Ratio(%)

3. Energy dissipation

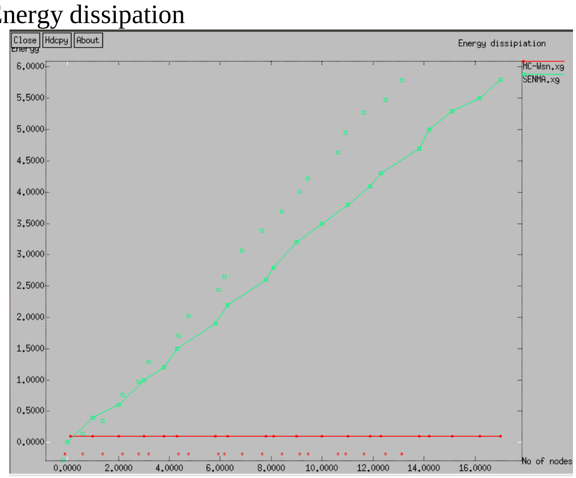

Fig 6 Energy Dissipation

Energy dissipation is comparatively lower in MCWSN than existing system SENMA, thus increasing energy efficiency.

VI. CONCLUSIONS

Mobile Access coordinated wireless sensor network system is introduced. Based on the results obtained, this architecture performs comparatively better over existing systems. Throughput is sufficiently increased as the number of hops is restricted to a mentioned number. Energy dissipation of the nodes is reduced, hence increasing energy efficiency. Delay in the data transmission is reduced as the mobile sink itself is approaching the cluster heads. The various leveled and heterogeneous structure makes the MC-WSN a very versatile, dependable, and adaptable design.

An ideal topology configuration to MC-WSN is provided with the end goal that the mean number of hops from any sensor to the MA is limited. It was demonstrated that with dynamic network arrangement and controlled number of hops, MC-WSN accomplishes substantially higher throughput and efficiency in terms of energy over the SENMA. It is also demonstrated that with controlled hop number, network can be analyzed easily. By the general structure, it is shown that MC-WSN mirrors the combination of structure-guaranteed dependability/productivity and adaptability. When any sensor node is compromised, it is detected and replaced for proper functioning of the system. Thus provides support to face security threats such as jamming and routing attacks..

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