SECURE AND EFFICIENT COMMUNITY BASED LOAD BALANCING

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Abstract- Wireless Sensor Network is constructed with a set of data collection units. Base station, sinks and sensor devices are used in WSN. In the existing system, single clustering technique is used to balance the load. A large number of clusters are available. In this, each node selects the cluster head depending on the energy level. This results in poor load balancing when the energy of cluster head is low. In our proposed system, Dual clustering technique is used which is better than single clustering to balance the load because two cluster heads are available. So, if one cluster head energy is low it changes automatically to the another cluster head. Here, mobile sink act as an intermediate between base station and cluster head. Mobile sink gathers the data from cluster head and transmit it to the base station. This efficiently balances the load well. Simulation results shows the performance analysis in terms of load balancing, energy, delay using Network Simulator 2 (NS-2).

Keywords- Wireless Sensor Network, Dual Clustering, Mobile Sink

I. INTRODUCTION

The sensor networks are infrastructures to collect data from the environment and the data can be used to study many problems like climate change, animal migrations, and behavior changes of buildings. The sensor nodes are deployed over a geographical area to monitor physical phenomena. The wireless sensor networks (WSN) is defined as a network of devices denoted as nodes that can sense the environment and communicate the information gathered from the monitored field through wireless data networks. The wireless sensor networks consist of hundreds of thousands of tiny node, inexpensive and battery-powered wireless sensing devices which organize themselves into multi-hop radio networks. The wireless sensor networks are a self-organizing ad hoc network with potential applications in autonomous monitoring, surveillance, military, healthcare, and security.

Clustering in WSN is widely accepted that the energy consumed in one bit of data transfer can be used to perform a large number of arithmetic operations in the sensor processor. Moreover in a densely deployed sensor network the physical environment would produce very similar data in nearby sensor nodes and transmitting such data is more or less redundant. Therefore, all these facts encourage using some kind of grouping of nodes such that data from group of sensor node can be combined or compressed together in an intelligent way and transmit only compact data. This process of grouping of sensor nodes in a densely deployed large-scale sensor network is known as clustering. The intelligent way to combined and compress the data belonging to a single cluster is known as data aggregation.

The nodes are grouped into clusters. Each cluster has a cluster head which is responsible for organizing the nodes and maintaining all its information. The other nodes of the network communicate with the cluster head by packet forwarding. The routing among the nodes is established through a routing protocol. The routing protocol used here is Adhoc On Demand Multipath Distance Vector (AOMDV) routing protocol. Multiple Loop-Free and Link-Disjoint path technique is the one used in AOMDV protocol. In AOMDV only disjoint nodes are considered in all the paths, to achieve path disjointness. User can put some more powerful nodes, in terms of energy, in the network which can act as a cluster-head and other simple node work as cluster-member only. Considering the above issues, many protocols have been proposed which deals with each individual issue.

Load balancing is a core networking solution responsible for distributing incoming traffic among servers hosting the same application content. By balancing application requests across multiple servers, a load balancer prevents any application server from becoming a single point of failure, thus improving overall application availability and responsiveness. Load balancers also improve server utilization and maximize availability. Here, double clustering used to improve the load balancing, network lifetime.
II. RELATED WORK

The goal of load balancing is to distribute the load to all available resources [1]. Load balancing is directly affect the performance of network system. Therefore, load balancing mechanisms is fair. Community-partition aware replica allocation method for ASNETs can significantly improve a social network’s efficiency by taking into account social relationships and properties of its data while replicating in the community to achieve better load-balance[2]. But this paper has more copy of data item in the network, so congestion would be occurred. Load balancing content-based publish/subscribe systems that is distributed, dynamic, adaptive, transparent, and accommodates heterogeneity. The publish/subscribe (pub/sub) paradigm recently emerges as a promising solution to data dissemination owing to the decoupling characteristic. It has attracted a lot of attention from many research works. In such systems, loose-coupling is achieved by simply having producers publish information into the network without knowing the identity, location, and number of subscribers. Likewise, consumers subscribe to specific information without knowing the identity, location, and number of publishers. It lacks the ability to predict user contacts and therefore performs a form of flooding as a means of content dissemination, leading to low efficiency and very high resource usage[3]. The mobility patterns of mobile devices strongly depend on the users’ movements, which are closely related to their social relationships and behaviors. Consequently, today’s mobile networks are becoming increasingly human centric. This leads to the emergence of a new field which we call socially aware networking[4]. Community based load balancing is used to balance the load based on the clustering. To balance the load in two phases. COmmunity-based LoAd Balancing (Co-Lab) focuses on balancing all components on forwarding load in the community-based network system. Depending on factors such as broker’s processing power, message queue size and broker’s bandwidth each broker can handle certain amount of events in a time unit. We assume the maximum event messaging rate that a broker can handle is up to certain threshold. We say a broker is overloaded when the rate of event it receives, processes or forwards is higher than that certain threshold. A broker initiates load balancing process when its load reaches the threshold. The inter-community load balancing module then tries to reduce the extra load to other brokers in the system by using an offloading mechanism. Once the load among different communities is balanced then it start the intra-community load balancing mechanism. This phase employs the broker clustering mechanism unlike the inter-community load balancing module which applies offloading mechanism[5].

III. PROPOSED WORK

Dual clustering technique used to improve the energy efficiency and balance the load. It is also improve the network lifetime. Our work is motivated by the need for efficient algorithms which considers Network Formation, Clustering, Dynamic Cluster head change, Mobile sink Tour, Cluster-based priority traverse. The Dual cluster environment is implemented to increase the lifetime of the network using cluster technique. The distance based routing algorithm can be used for dual cluster implementation and AOMDV routing protocol can be used for data transaction. Fig 1 shows block diagram for dual clustering.

A. Network Formation

WSN needs data aggregation for efficient organization of network topology to balance the load and prolonged network lifetime. Sensor Nodes grouped near the MS trajectory are said to be small size clusters and which located farther away are said to be large size clusters. The data packets are sent from cluster to the cluster head CH and CH transmit the received data to the MS.

B. Clustering

Sensor nodes grouped into clusters and each cluster have a leader called Cluster Head (CH). CH nodes aggregate the data and transmit them to the base station (BS) either directly or other CH nodes. The efficient CH selection for achieving energy efficient wireless sensor network. This method proved that the network lifetime can be efficiently prolonged and minimizes energy consumption. The clustering algorithm is to choose the highest ranking
residue energy of sensor as a cluster head. Energy for each sensor node can be computed by Energy Consumption model which have transmitted power, receive power and sense power. Fig 2 shows the structure of dual clustering. Here, Eight clusters are there and each cluster has five ordinary node, two cluster head. Cluster head chosen based on the energy level. Two mobile sink used to gather the information from the cluster heads and transmit to the base station. So, dual clustering is better load balance compared to the single clustering. Each node in the cluster will be assigned a specific role. The role of nodes in a cluster includes:

- Cluster-Head: local coordinator of a cluster
- Cluster-Member: an ordinary node

### C. Dynamic Cluster head change

Dynamic clustering is an energy efficient algorithm. Energy dissipation of the network can be reduced by using clustering algorithms. The energy consumption of wireless nodes is depends upon the transmission distance, optimal routing protocols and amount of data to be transmitted. The dynamic clustering, the clusters change over the time, equalizing the energy consumption across all nodes and, thus, extending the network lifetime. In order to do this, all nodes can be promoted to the role of cluster-heads. Each node decides to become a cluster-head based on the energy level.

### D. Mobile sink Tour

The mobile sink moving trajectory is proposed that gathers data from various sensor nodes. There are two types of sinks which one can be act as mobile element and other one act as Base Station. Travelling Salesman problem (TSP) used to find a shortest path for visiting all Rendezvous points by a Mobile-Sink node. A mobile sink that preferentially visits areas of RP will prevent energy holes from forming in a WSN. In clustering purpose only all the sensor nodes send its data’s to cluster head and cluster head sends the data’s to appropriate rendezvous point and mobile sink node travel along the network and collect the data’s from rendezvous point. This process to effectively save the energy of network. The mobile sink moves towards the sensor node whose energy is high amongst all sensor nodes. Thus, it is required for those nodes having high residual energy are meant for data forwarding. However, during the movement of the mobile sink, mobile sink avoids those nodes whose energy is comparatively low.

The sink mobility along a constrained path can improve the energy efficiency in wireless sensor networks. This method makes that the network lifetime can be efficiently prolonged and minimizes energy consumption. This system minimizes the number of multi hop transmissions in the data collection by the Mobile Sink(MS).

### E. Cluster-based priority traverse

CBPT is a novel traversing technique in which mobile sink node follows the data collection path decided by the static sink, which is an efficient technique for the data collection from the clusters. The data collection using prioritized table is suitable routing for delay sensitive data collection network structure. The sink moves along a fixed track and it is predictable. The network is divided into several equal clusters. Each cluster head collects data and sends it to the mobile sink. It is selected based on the residual energy.

Indeed the sensor node will loss the energy based on the transmission range ex., if sensor communication coverage is 100m then energy loss per packet will be 2jules. And if the sensor coverage is 200m then the energy loss per packet will be 3jules. Let assume, Three sensor sending the 5 packets per seconds to leader node, the leader node will receive 15 pkts/sec (3 sens X 5pkts). The total communication duration is 5sec, so the leader will receive 75 packet in 5sec.

### IV. EVALUATION

Network Simulator tool used to evaluate the performance of our proposed load balancing scheme by comparing it with single clustering. The topology area has considered as 500 mts*500 mts with a set of nodes placed randomly. Here, each node is initially placed at a position within the defined area. The simulation settings and parameters are described in table 1. A discrete event simulator NS 2.34 is used to simulate algorithm. In simulation, 50 mobile nodes move in a 500 meter x 500 meter square region for 60
seconds simulation time. The simulated traffic is Constant Bit Rate (CBR).

Table 1. Simulation parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topology area</td>
<td>500*500 mts</td>
</tr>
<tr>
<td>Simulation time</td>
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<tr>
<td>Traffic type</td>
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<td>CBR packet size</td>
<td>512 bytes</td>
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<td>Mobility model</td>
<td>Random waypoint</td>
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<td>Interface queue</td>
<td>Drop tail queue</td>
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<td>Interface queue length</td>
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<td>Number of nodes</td>
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<td>Transmission power</td>
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<td>Receiver power</td>
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<td>Initial energy</td>
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<td>Protocol</td>
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<tr>
<td>MAC protocol</td>
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<tr>
<td>Frequency range</td>
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</tr>
<tr>
<td>Antenna</td>
<td>Omni antenna</td>
</tr>
</tbody>
</table>

Fig 3. Delay between single and dual clustering

Fig 3 shows the delay in terms of seconds between existing and proposed method. The red line indicates the single clustering technique and green line indicates the dual clustering technique. Delay and number of nodes are inversely proportional. Delay decreases as the number of nodes increases. This also shows that the delay is low for the proposed method compared to the existing one.

Fig 4. Energy efficiency between single and dual clustering

Fig 4 shows the energy in terms of Jules between existing and proposed method. The red line indicates the single clustering technique and green line indicates the dual clustering technique. Energy and number of nodes are inversely proportional. Energy decreases as the number of nodes increases. This also shows that the energy is low for the proposed method compared to the existing one.

Fig 5. Load balancing between single and dual clustering

Fig 5 shows the load balancing between existing and proposed method. The red line indicates the single clustering technique and green line indicates the dual clustering technique. Load balances more efficiently when the number of node increases. Load balancing is better than the existing method.
V. CONCLUSION

Dual clustering technique is used to design a community based load balancing where two cluster heads are available. The cluster heads are chosen based on their energy level. Based on the social relationship the nodes has been clustered. Mobile sink is added between the base station and cluster head. In this paper, two mobile sinks are used to collect the data from cluster head and they transmit the data to the base station. This increases the network lifetime and energy efficiency. So, the proposed dual clustering technique has better load balance compared to the single clustering in terms of delay and energy.

References


