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Joint Clustering and Routing Algorithm for Performance Improvement of Moving Nodes in Wireless Sensor Networks

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ABSTRACT: These days Wireless Sensor Networks (WSN) have been used in various Internet of Things (IoT) applications viz., healthcare monitoring, disaster management, smart buildings, smart farming etc. it is one of the substitutes for solving distinct problems of IoT in various areas. This paper proposed a joint clustering and routing algorithm. We develop a simulation area for node movement and communication. A Joint clustering and routing (JCR) protocol proposed for reliable and efficient data collection in large-scale wireless sensor network. Theoretical analysis and simulation results will prove the connectivity and efficiency of the network topology generated by JCR.

KEYWORDS: Wireless sensor network, joint cluster, routing, throughput, energy, node life time.

I. INTRODUCTION

WSN is an association of compact micro sensors with wireless communication capabilities. Like many advance technologies, WSN owe its root in heavy industrial applications as well as military applications. The first wireless network that is in line with the latest WSN is the Sound Surveillance System (SOSUS) developed on submerged acoustic sensors. Sensors in SOSUS were distributed in the Pacific Ocean Atlantic oceans. Stimulated by the developments pertaining to Internet in 1960s and 1970s to develop the hardware for today's Internet, Defense Advanced Research Projects Agency (DARPA) initiated the Network (DSN) program in 1980[21]. The motive was to explore the design challenges related to WSN. With the birth of DSN and its penetration into education through Carnegie Mellon University and the Massachusetts Institute of Technology, WSN technology could find its base in household, education and civilian scientific research. Very soon, public and private communities started deploying sensors to monitor air quality, detect forest fire, forecast weather, prevent natural disaster etc. The sensors however at that time were bulky, expensive and made use of proprietary protocols. The use of such WSNs thus weighed down the industry which used it. This disproportionate relation of high cost with low volume of sensors declined their pervasive use. Realizing the potential of the network, industry and academia joined hands to solve the engineering challenges associated with sensors and lead to the production of modern sensors: low cost miniature size sensors, having simplified development and maintenance tasks.

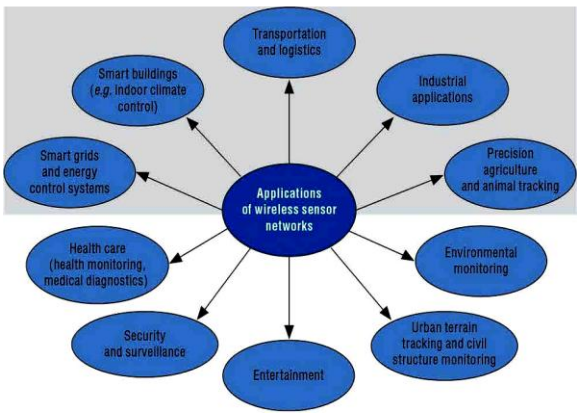

Figure 1: Wireless Sensor Networks Applications

The most much of the time utilized remote sensor systems applications in the field of Transport frameworks, for example, screening of traffic, dynamic directing administration, and checking of parking garages, and so forth., utilize these systems. Fast crisis reaction, mechanical procedure observing, robotized fabricating atmosphere control, biological system and natural surroundings checking, common auxiliary wellbeing observing, and so on, utilize these systems.

II. Related work

S. Lata et al., [1] to prolong the function of wireless sensor networks (WSNs), the lifetime of the system has to be increased. WSNs lifetime can be calculated by using a few generic parameters, such as the time until the death of the first node and other parameters according to the application. Literature indicates that choosing the most appropriate cluster head by clustering is one of the most successful ways to improve the lifespan of the WSN. The drawback of clustering protocols is based on the probabilistic model. Sometimes they select two cluster heads for two different clusters which are very close to each other and results in head situated at the edge of the cluster in some cases. This type of cluster head selection leads to a reduction in energy efficiency. Therefore, we have proposed the LEACH-Fuzzy Clustering (LEACH-FC) protocol and implemented a fuzzy logic-based cluster head selection and cluster formation to maximize the lifetime of the network. For selections of cluster head and formation of the cluster, we have used a centralized approach instead of distributed ones. We have also employed fuzzy logic in the selection of vice cluster head, which is also a centralized approach. The proposed algorithm has been found to be effective in balancing the energy load at each node thereby enhancing the reliability of WSN. It outperforms other proposed algorithms for improving network lifetime and energy consumption.

M. A. Hossen et al., [2] Intellectual radio (CR) is a versatile radio innovation that can consequently identify accessible directs in a remote range and change transmission boundaries to improve radio working conduct. Because of the dynamic idea of range accessibility and remote channel condition, it is difficult to keep up solid system availability. Bunch based CR impromptu systems mastermind CR hubs into gatherings to successfully keep up reliable independent systems. Bunching in CRAHN underpins helpful assignments, for example, range detecting and channel administrations and accomplishes organize versatility and strength. In this paper, we proposed a Q-learning based bunch development approach in CRAHN, in which Q-esteem is utilized to assess every hub's channel quality. To frame a dispersed group arrange, channel quality, lingering vitality and neighbour hub/organize conditions are thought of. By trading every hub's status data as far as channels and neighbours, every hub knows neighbouring geography and which hub is the best contender for group head (CH). Circulated CH choice, the ideal normal dynamic information channel choice, and passage hub choice techniques are introduced in this paper. The proposed component can expand the system lifetime, improve the reach ability between part hubs as well as with other group systems, it can likewise offer steady and solid support utilizing the chose information channel and maintain a strategic distance from conceivable obstruction between neighbouring specially appointed bunches.

X. He et al., [3] In remote sensor systems (WSNs), collecting information with versatile sinks is a compelling method to understand the "vitality opening issue". Be that as it may, a large portion of existing algorithms of versatile sinks overlook the heap equalization of meeting hubs, which will fundamentally abbreviate the system lifetime. Also, most versatile sinks are typically required to visit areas of sensor hubs without exploiting their correspondence ranges. Consequently, this paper proposes a vitality effective direction arranging calculation (EETP) in view of multi-target molecule swarm enhancement (MOPSO) to abbreviate the direction length of the portable sink and equalization the heap of meeting hubs. EETP intends to diminish the postponement in information conveyance and drag out the system lifetime. To abbreviate the direction length of the portable sink, we plan an instrument to choose potential visiting focuses inside correspondence covering scopes of sensor hubs, as opposed to areas of sensor hubs. Moreover, as per direction attributes of the portable sink, we plan a viable direction encoding strategy that can create a direction containing an unfixed number of visiting focuses. The recreation results show that the proposed EETP is better than existing WRP, CB and the MOPSO-based calculation, as far as postponement in information conveyance, arrange lifetime and vitality utilization.

W. He et al., [4] A proficient and vitality sparing calculation, K-means and FAH (KAF), has been proposed to take care of the issues of hub vitality limitations, short system cycle and low throughput in current remote sensor systems. System bunching is acquired by improving K-implies clustering. In view of FAHP (Fluffy Logical Order Procedure) strategy, the bunch head choice is upgraded thinking about the variables of hub vitality, good ways from base station and vitality effectiveness of hubs. In light of the components of transmission separation, vitality and bounce number, multi-jump directing is built to viably lessen the vitality utilization of hubs in information transmission. The recreation results show that contrasted and different conventions, KAF calculation has evident points of interest in lessening hub vitality utilization, drawing out system life cycle and expanding system throughput. Also, under various directing convention, the exhibitions of the calculation are checked. By changing the size of the up-and-comer hub set determination territory, the dependability of information transmission of the significant distance hub is expanded, and the vitality utilization heap of the close separation hub is diminished. Simultaneously, the utilization of sharp transmission procedures builds the dependability of information transmission. The recreation results show that the proposed convention can successfully lessen the vitality utilization of hubs and drag out the system life cycle.

W. Osamy et al., [5] Remote sensor systems (WSNs) have charmed considerable consideration from both mechanical and scholastic examination since most recent couple of years. The central point behind the examination endeavors in the field of WSNs is their tremendous scope of utilizations, for example, reconnaissance frameworks, military tasks, medicinal services, condition occasion checking, and human security. Be that as it may, sensor hubs are low potential and vitality requirement gadgets; in this manner, vitality productive steering convention is the preeminent concern. In this paper, another Group Tree directing plan for social event information (CTRS-DG) is suggested that made out of two layers: steering and conglomeration and remaking. In accumulation and recreation layer, a dynamic and self-arranging entropy based grouping calculation for bunch head (CH) determination and bunch development is proposed. Information is amassed and packed at CHs dependent on compressive detecting strategy. In directing layer, another proposed calculation to frame the steering tree as spine of the system is proposed. The steering tree is utilized to advance the packed information by CHs to the base station (BS). At long last, as a period of accumulation and recreation layer, a viable CS remaking calculation called Honey bee based sign reproduction (BEBR) is proposed to improve the recuperation procedure at the BS. BEBR uses the upsides of the eager calculation and Honey bees calculation to locate the ideal arrangement of reproduction process. Reproduction results uncover that the proposed plot beats existing benchmark calculations regarding strength period, organize lifetime, and normal standardized mean squared blunder for compressive detecting information recreation.

III. PROPOSED METHODOLOGY AND SYSTEM MODEL

Let consider simulation area 500 meter X 500 Meter. The following flow chart represents the work flow-

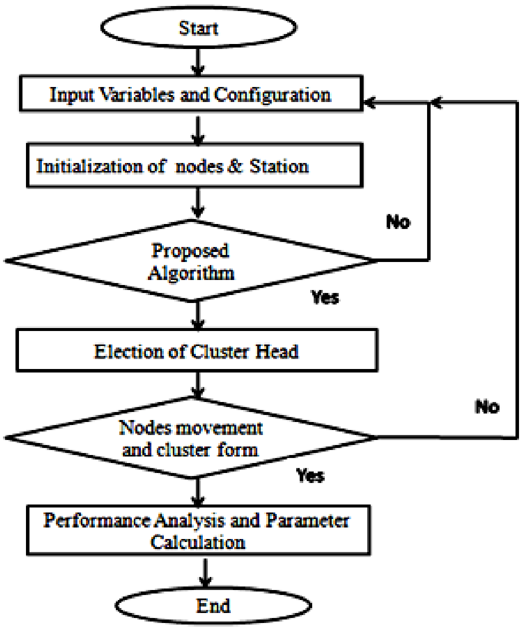

Figure 2: Flow chart

Energy Efficient Hierarchical Clustering-

Energy Efficient Hierarchical Clustering (EEHC) is a randomized, appropriated clustering calculation that genius aches the system lifetime. In this part sensor hubs are sorted out into bunches with a hierarchy of group heads. the CHs gathers the data from the hubs inside their bunches and send the collected information to the BS through the hierarchy. This calculation depends on two phase clustering: single-level and staggered clustering. At the single-level clustering stage, every sensor hub turns into a CH based on a pre-characterized likelihood p and declares itself as the volunteer CH to its neighbors inside hops separation. Any hub which gets this declaration becomes individual from the nearest bunch. In the event that a hub doesn't hear any declaration inside a preset time stretch t, at that point it will end up being a constrained CH. This time span t is determined based on the

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length for a parcel to arrive at a hub that is k-jumps away. The energy expended for sending the data to the sink relies upon the boundaries p and k.

At the subsequent stage, same procedure is applied from base up to staggered clustering. Expect there are h levels in a clustering hierarchy, among which level-1 being the lowest one and level-h being the most noteworthy one. At that point level-1 aggregates the information from its group individuals and sends it to level-2 CHs, etc. At long last the level-h CHs send the collected information to the base station. The expense of transmitting the data to the base station is the force devoured by sensor hubs to send information to level-1, at that point energy utilized by level-1 CHs to the base station by means of h – bounce CHs at various hierarchical levels.

Modified low energy adaptive clustering hierarchy

That drives us to begin considering building the systems. To additionally improve energy efficiently, two methodologies presented in the papers are summed up in the following:

Drain is a group based remote sensor organizing convention. Filter adjusts the clustering idea to disperse the energy among the sensor hubs in the system. Filter improves the energy-proficiency of remote sensor organizing past the typical clustering engineering. Thus, we can broaden the existence time of our system, and this is the significant issue that is considered in the remote sensor organizing field.

In Drain convention, remote sensor organizing hubs separate themselves to be numerous nearby groups. In every neighborhood bunch, there is one hub that goes about as the base station (or we can call it "group head"). Consequently, every hub in that neighborhood bunch will send the information to the group head in every nearby group. The significant method that causes Filter to be unique in relation to the typical group engineering (the channel the hubs battery rapidly) is that Drain utilizes the randomize strategy to choose the bunch head contingent upon the energy left of the hub.

IV. SIMULATION RESULT

The simulation is performed using MATLAB software, it contain various library function and commands to make the simulation scenario-

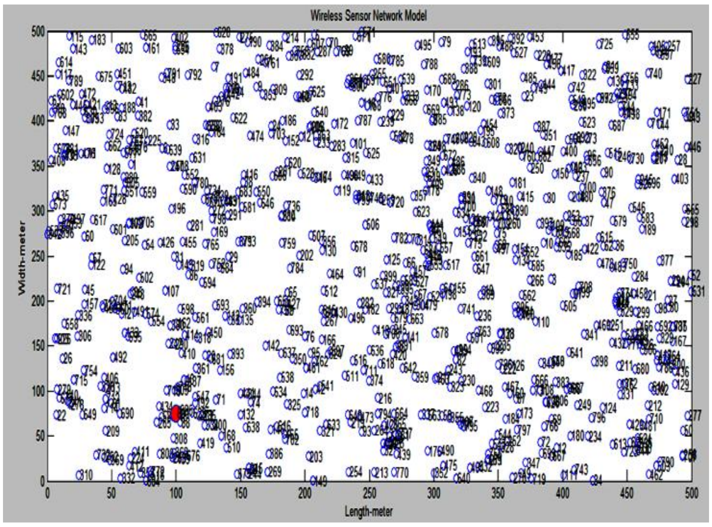

Figure 3: Simulation area 500m X 500m

Figure 3 show the simulation scenario where length and width of wireless sensors network area is 500m X 500m. Total nodes taken are 100 to 1000. In this step all variables, mobile agent and configuration are initialize the simulation.

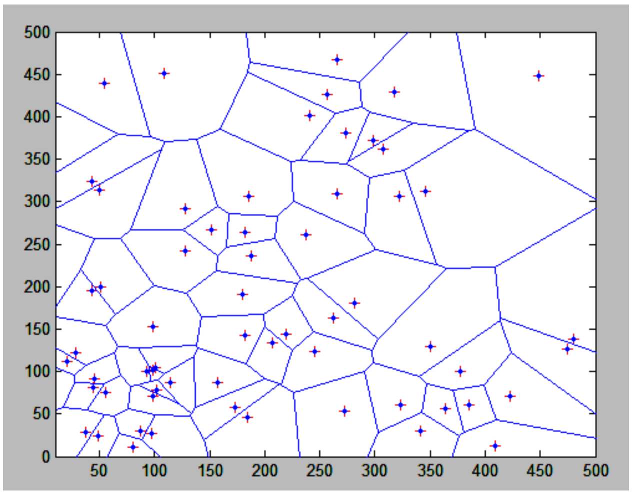

Figure 4: Clusters form

This figure 4 presents cluster formation. Here applied proposed algorithm i.e joint cluster approach. The combination of Energy Efficient Hierarchical Clustering and Modified low energy adaptive clustering hierarchy are using for joint clustering.

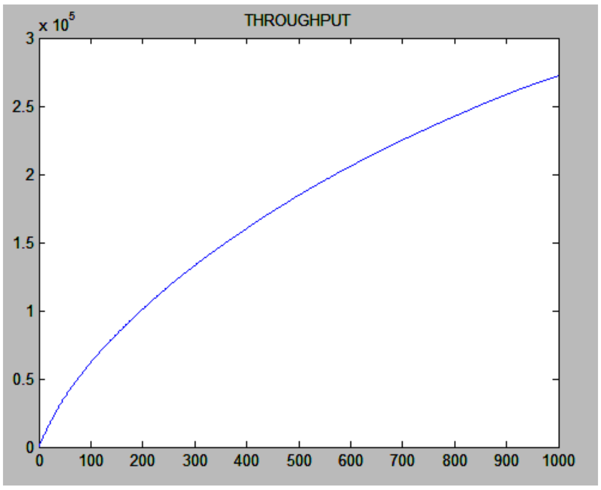

Figure 5: Data transmission rate or throughput

This figure 5 presents the data transmission rate or throughput rate. It is clear that the throughput is 275Kbps.

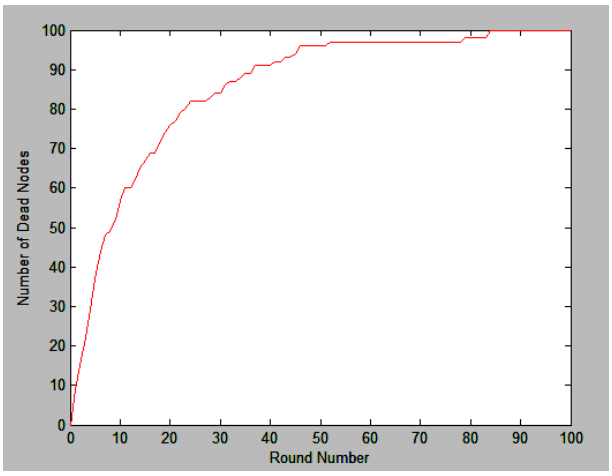

Figure 6: Dead nodes

This figure 6 shows that the total dead nodes count. During simulation nodes loss energy and it become dead during execution time. Therefore aprox 100 nodes dead.

Table 1: Comparison of proposed work result with previous work

Sr No.	Parameters	Previous Work	Proposed Work
1	Simulation area	500m X500m	500m X500m
2	Total nodes	200 to 800	200 to 800
3	Methodology	Novel Approach	Joint Cluster
4	Network transfer rate (Throughput)	250 Kbps	275 Kbps
5	Data size	200 byte	400 byte
6	Node Energy consumed	5 nJ	1 nJ

V. CONCLUSION

In this paper, we have proposed a JCR system for node performance improvement. This paper proposed joint clustering protocol approach. It consider total simulation area 500X500 meter and nodes area taken 200, 800 during nodes simulation. Proposed method based on joint cluster while previous approach based on novel method. Network transfer rate or throughput is achieved by proposed method is 275Kbps while previous it is achieved 250Kbps. Simulation time is also reduced upto 835 Sec. The overall energy consumption is 380J while previous it is 1000J. Therefore it can be say that the proposed methodology approach gives significant better performance in wireless sensor network than previous approach. The future advancement of the work can be more advancement can be done in the proposed method so that network lifetime by using different more approaches.

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