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An efficient clustering algorithm for max-link selection on CRN

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Abstract:
Lifetime enhancement has always been a crucial issue as most of the cognitive radio network (CRNs) operates in unattended environment where human access and monitoring are practically infeasible. Clustering is one of the most powerful techniques that can arrange the system operation in associated manner to attend the network scalability, minimize energy consumption and achieve prolonged network lifetime. To conquer this issue, current researchers have triggered the proposition of many numerous clustering algorithms. However, most of the proposed algorithms overburden the cluster head (CH) during cluster formation. To overcome this problem, many researchers have come up with the idea of fuzzy logic (FL), which is applied in CRN for decision making. These algorithms focus on the efficiency of CH, which could be adoptive, flexible, and intelligent enough to distribute the load among the sensor nodes that can enhance the network lifetime. But unfortunately, most of the algorithms use type-1 FL (T1FL) model. In this work, we propose a clustering algorithm on the basis of interval type-2 FL model, expecting to handle uncertain level decision better than T1FL model.

Keywords: Cognitive radio networks, node creation, security, cluster mechanism, fuzzy logic.

I. Introduction

The huge applications of CRNs bring many challenges even if these tiny sensor nodes are battery controlled and deployed randomly or deterministically in hazardous places where traditional infrastructure based network is practically infeasible. There are many typical issues like limited energy resources, limited computing capacity, open environment and wireless connectivity makes the sensor network failure most of the time.

Once sensor nodes are deployed, nodes with finite battery power should sustain for months or years at a stretch without any intervention. An important design issue in CRNs is to reduce the energy consumption by the use of energy conserving hardware, operating system and communication protocols. Extending network lifetime and sensor functionality is crucial for the successful utilization of cognitive radio network (CRNs) in applications where replacing or charging energy storage units (i.e. batteries) is impractical or not cost effective. Considering the importance of large data gathering projects, lifetime expansion of CRNs is extremely important. Although different techniques were proposed to extend the lifetime of sensor networks, the most prominent approach is to balance the CRN communication in the network in order to deplete energy at a similar time or rate.

In such approach, routing decisions play an important role in selecting candidate paths in order to balance energy in the network. Recent advances in battery-powered wireless sensors have enlarged their applications, including environmental monitoring, machine failure detection, surveillance, and internet-of-things applications. Low-cost and small-sized wireless sensors have gained particular interest in efficient monitoring that involves thousands of wireless sensors in the measurement and report within a target area. Wireless sensors are typically scattered in a wide region without a sophisticated coordination. Since recharging the battery is almost impossible, cognitive radio network (CRNs) are subject to energy management for maximizing their lifetime.

II. Literature Survey

The paper [1] proposes the Sensor webs consisting of nodes with limited battery power and wireless communications are deployed to collect useful information from the field. Gathering sensed information in an energy efficient manner is critical to operate the sensor network for a long period of time. In W. Heinzelman et al. (Proc. Hawaii Conf. on System Sci., 2000), a data collection problem is defined where, in a round of communication, each sensor node has a packet to be sent to the distant base station. If each node transmits its sensed data directly to the base station then it will deplete its power quickly. The LEACH protocol presented by W. Heinzelman et al. is an elegant solution where clusters are formed to fuse data before transmitting to the base station. By randomizing the cluster heads chosen to transmit to the base station, LEACH achieves a factor of 8 improvement compared to direct transmissions, as measured in terms of when nodes die.

In this paper, we propose PEGASIS (power-efficient gathering in sensor information systems), a near optimal chain-based protocol that is an improvement over LEACH. In PEGASIS, each node communicates only with a close neighbor and takes turns transmitting to the base station, thus reducing the amount of energy spent per round. Simulation results show that PEGASIS performs better than LEACH by about 100 to 300% when 1%, 20%, 50%, and 100% of nodes die for different network sizes and topologies, The paper [2] designing the cognitive radio network, the energy is the most important consideration because the duration of the sensor node is bounded by the battery of it. To overcome this demerit many research have been done. The clustering is the one of the representative approaches. In the clustering, the cluster heads gather data from nodes aggregate it and send the information to the base station. In this way, the sensor nodes can reduce communication overheads that may be generated if each sensor node reports sensed data to the base station independently. LEACH is one of the most famous clustering mechanisms. It elects a cluster head based on probability model.

This approach may reduce the network lifetime because LEACH does not consider the distribution of sensor nodes and the energy remains of each node. However, using the location and the energy information in the clustering can generate big overheads.

III. Problem Statement

Wireless sensor network are deployed in remote area with the goal of collecting the data about that environment. Sensing, Routing and security are the process which is followed by CRN to collect the data from environment. Each process consumes reasonable energy to complete the task. More energy consumption in any of this work will affect life time of the entire Network. So reducing energy consumption is the ultimate goal in wireless sensor network.

IV. Methodology

Many applications that utilize cognitive radio network (CRNs) require essentially secure communication. However, CRNs suffer from some inherent weaknesses because of restricted communication and hardware capabilities. Key management is the crucial important building block for all security goals in CRNs. If node A has in his Route Cache a route to the destination E, this route is immediately used. If not, the Route Discovery protocol is started: Node A (initiator) sends a Route Request packet by flooding the network, If node B has recently seen another Route Request from the same target or if the address of node B is already listed in the Route Record, Then node B discards the request! , If node B is the target of the Route Discovery, it returns a Route Reply to the initiator. The Route Reply contains a list of the “best” path from the initiator to the target. When the initiator receives this Route Reply, it caches this route in its Route Cache for use in sending subsequent packets to this destination. Otherwise node B isn’t the target and it forwards the Route Request to his neighbors (except to the initiator).

V. Frame Work and Implementation

In this module, 'N' number of sensor nodes are created and randomly deployed in network area. Each sensor nodes equipped with initial energy as 100 joules to perform it functionalities such as data sensing, routing. In this module, 'n' cluster groups are identified with the help of deployed location of the nodes. For each cluster boundary values will be fixed in random manner. Nodes which are placed within the boundary of the cluster will be grouped as single cluster. In each cluster head node will be elected by using this head selection module. In this module each nodes performance characters such as remaining energy, distance with base station and concentration factors are calculated then type-1 fuzzy rules are applied on the nodes parameters to identify member function results such as less, average and high. Later these member function details will be input to type-2 fuzzy rules to decide the confidence factor which is the main possibility factor of the node to act as head node. At the end of fuzzification, head nodes are identified in each cluster. Additionally at the end level cluster (cluster which is near to BS) a standby cluster head will be elected to avoid huge work load issue at end level cluster head node

VI. Outcomes

1) *Throughput:* It is the number of information units a system can route within a particular amount of time; it is the rate at which messages are delivered through nodes in CRN.

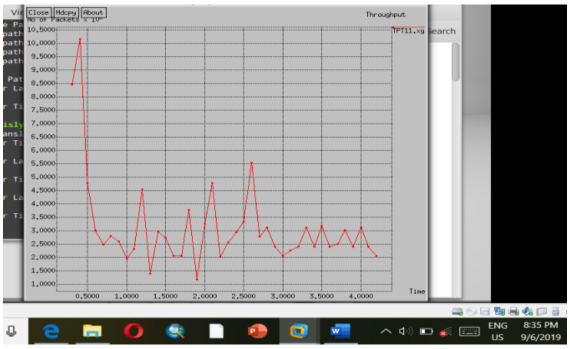

Figure.1 Throughput

2) *Packet delivery ratio*: It indicates the difference between how many packets are sent and packets that delivered. High the PDR more the efficiency of the network.

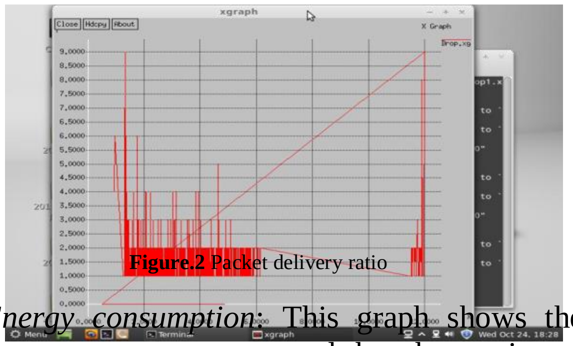

Figure.2 Packet delivery ratio

3) *Energy consumption:* This graph shows the average energy consumed by the projected model. To accomplish wide life time consumption of the resources, this scheme offers a subsequently tread in source allocation and energy efficient routing which will recover the routine of the network in terms of energy

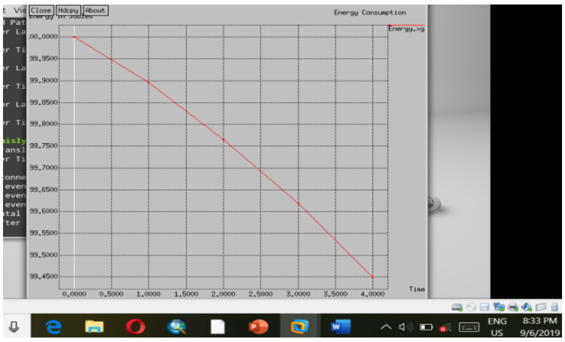

Figure.3 Energy consumption

4) *Packet Drop Ratio:* It indicates the difference between how many packets are sent and packets that dropped. The less the PDR more the efficiency of the network.

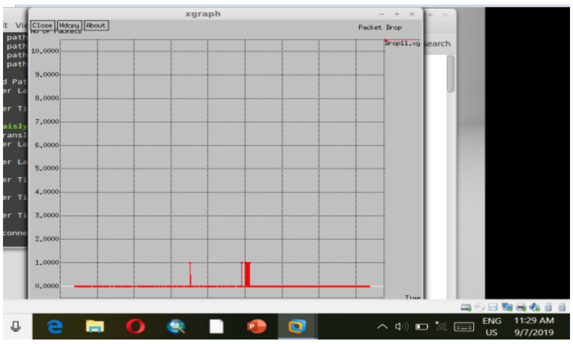

Figure.4 Packet Drop Ratio

VII. Conclusion

We have evaluated the presentation of clustering based algorithm underlay the CRN using the max link selection routing protocol, precise and asymptotic expressions for efficient path and diminish the utilization of energy for maximum linkage choice for end-end connection, the guesstimated phrase was attained maximum number of conveying hops to reduce the probability of outage also, accurate SER expressions. To accomplish extensive life time consumption of the resources, this scheme offers a next tread in source allocation and energy efficient routing which will recover the routine of the network in terms of energy.

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