RSSI BASED CLUSTERING ALGORITHM FOR WIRELESS SENSOR NETWORKS

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Abstract: Technological developments on wireless communication systems and sensors productivity-enhancing wireless sensor networks have led the development of new algorithms. Wireless sensor devices (nodes) were developed along with the use of these two cases, and data collected has been achieved forwarded to a central location. Studies in the literature were shown that, WSN (wireless sensor networks) systems are focused on the detection the position of the nodes in the network and worked for energy efficiency. One of the major activities in the wireless sensor network is to create their own organizing clusters with selected cluster head, each cluster can send the data. Cluster head selection is based on a random number that is above the threshold value is calculated by the addition of the number, etc. parameters of nodes in the network or having highest energy value. In this study, the cluster head selection is performed by calculating a distance between nodes in the cluster. Distance information is obtained from RSSI (Received Signal Strength Indicator). Each node in the network, all nodes can communicate with them on the record and finds the average RSSI level. The highest average per cluster node is selected and published in this case to the other node. The cluster head node will include its own cluster the node that is lower than the average RSSI. Cluster head selection and clustering process continues with iterations until all nodes clustering in the network. Experimental studies conducted with simulation program developed C # .net environment and network efficiency are investigated. In the results, the cluster is first created which settled in the center of the network, and the center population was determined to be more than others. In this case, a threshold value must be determined for correcting the data next to the average RSSI. So, accordingly the necessity of re-aggregation network is detected.

Keywords: RSSI, clustering, Wireless Sensor Network

Introduction

Wireless Sensor Networks (WSN) that on sensor, battery, processor and communication unit which is to collect data from the environment they have created networks of small nodes. Wireless Sensor Networks aim of Madiran delivered to the collection point of data collected from the environment. The studies in the literature on this topic can be collected in the localization and energy efficiency, data routing. One of the important work areas in WSN is to select a cluster head (CH) in self-organized clusters create their own clusters and each cluster can send the data. Clustering algorithms basic principle, the energy of the nodes in the network to select a CH in order to use the highest efficiency and the data are included in the set is based on its submission to him. If the selected cluster head transmits data from the central node.

Cluster head (CH) selection on the calculated energy to generate a random number with the participation threshold of parameters such as the number of nodes in the CH node or that the network is based on a high. But choosing themselves a CH node of a clustering algorithm clusters close to each other based on the distance from the node would lead to less energy will be more accurate than logically. When analyzed studies on the subject, which appears to be related to the selection algorithm Leach per cluster. LEACH algorithm was developed in 2002 by Heinzelman and CH selection was built. In another study that was made by Heinzelman in the same year, due to the not to be homogeneous distance between CH and nodes in cluster, the CH of the energy efficiency of the nodes has been mentioned is low (Heinzelman, 2002). There are studies about the measurement of the battery capacity with distance information and the distance estimation between nodes and determine the position of movable objects in confined spaces with RSSI. (Arias, 2004, Saxena, 2008, Chung, 2009, Wessels, 2010, Blumrosen, 2010, Faheem, 2010, Blumrosen, 2013, Chakrabortya, 2013, Zheng, 2011, Heurtefeux and Velois, 2012).

In a study conducted in 2015 by Kannan, RSSI value between the central station and node is taken and the average RSSI value has been calculated for the selection of CH. Energy levels and the average RSSI value of the node to

obtain a threshold value are added together. If the average RSSI per cluster node is above this threshold value is selected. Clustering is carried out by the center (Kannan,2015).

An alternative method is presented for the selection of clusters head in the network with RSSI data in a study conducted by Fazackerley. Simulation studies related to work was performed and was compared with Leach algorithm. Nodes was calculated the average RSSI data from the node in around and gets the P_{fact} value. If P_{fact} value is above the predetermined value $RSSI_{thres}$ then this node is the CH node (Fazackerley, 2009).

As a result of analysis of the literature, RSS data between nodes in a wireless sensor network; routing the data transmitted to the central station, finding location of the nodes in the network and is used for the purpose of election of the head of the network cluster to cluster. In this study, a clustering algorithm is proposed for CH selection and clustering with RSSI values of the network. The proposed algorithm consists of two main parts. The first part, the selection of CH node will be the creation of clusters and the other. CH selection was provided with development of Kannan (2015) algorithm.

Materials and Methods
### Cluster Head Selection
CH selection algorithm implemented at once spread to areas of the network has been developed in accordance with self-organizational approach. For CH selection, each node communicates with other nodes for obtaining average value of $RSSI_{avrg}$. Value $RSSI_{avrg}$ is obtained by the equations given in Equation 1.

$$RSSI_{avrg} = \begin{cases} \sum_{k=1}^{n} \dfrac{RSSI_k}{n} & n > 0 \\ \infty & n = 0 \end{cases} \qquad \text{(1) Kannan(2015)}$$

Here; n the number of nodes being communicated, the $RSSI_k$ value represents the RSSI value of $k.th$ nodes. Nodes that calculate average $RSSI_{avrg}$ transmits their average to network. All nodes repeat the same process and records the average $RSSI_{avrg(i)}$ values from the other nodes. This is an average; it is likely to be the most effective parameters of the CH node. If $Node\ RSSI_{avrg} < RSSI_{avrg(i)}$, $i.th.$ node becomes the CH node.

Clustering Algorithm
In this phase, the selected CH defines its own set. CH, compares the value of $CH_{RSSI_{avrg}}$ with $RSSI_i$ values between other nodes that are stored in the memory. If $RSSI_i < CH_{RSSI_{avrg}}$, $i.th.$ node would be included in the cluster nodes. This process continues until all nodes clustering in the network. Clustering algorithm flow chart is given in Figure 1.
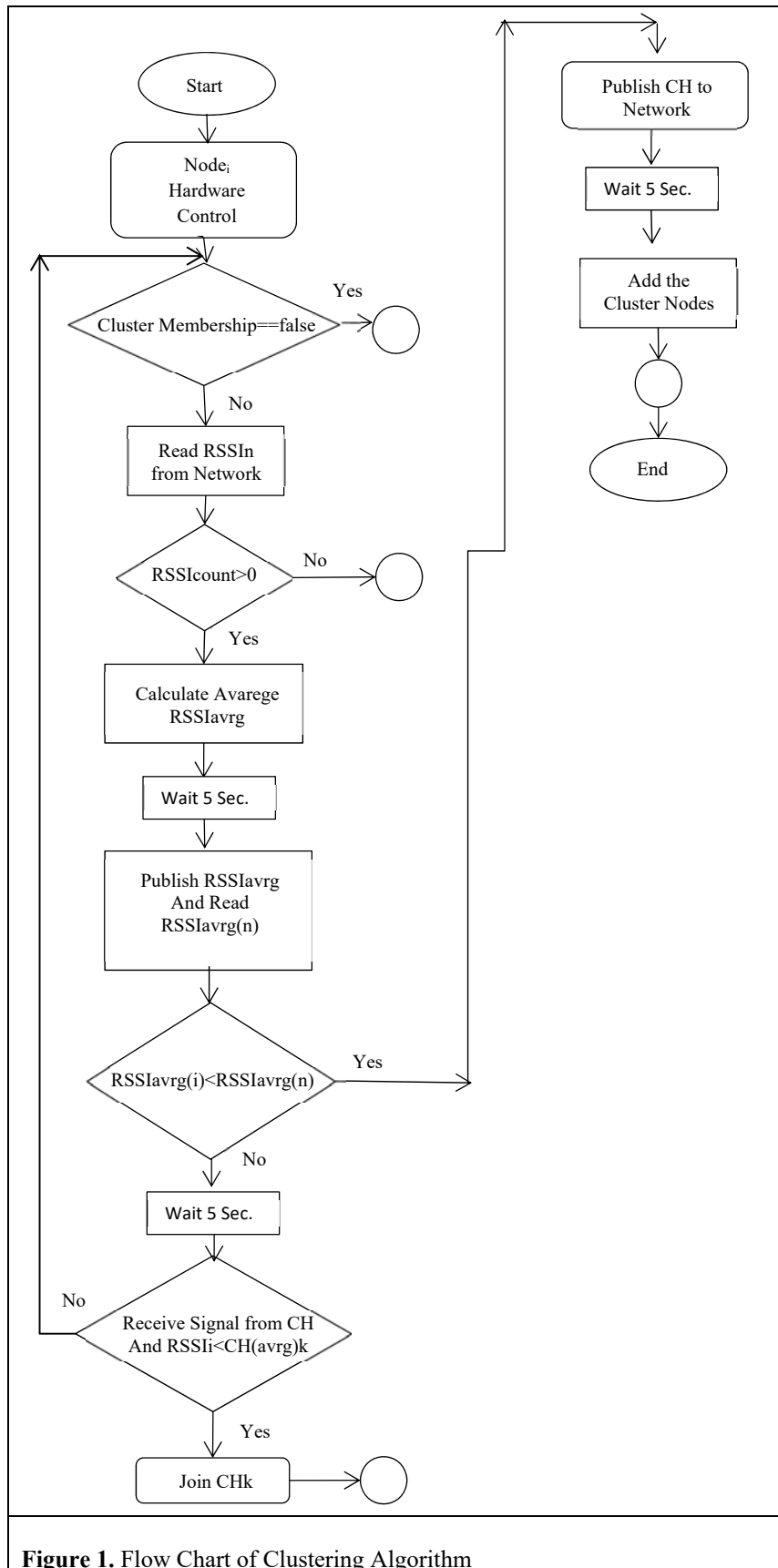
Figure 1. Flow Chart of Clustering Algorithm

Results and Discussion

Experimental studies in order to see quick results of the algorithm are made by developed simulation program. Nodes are derived by adding the memory unit, the microcontroller and transmitter / receiver units. The register units are planned in the memory unit containing the identification information, the distances between other nodes and CH ID information. Randomly distributed nodes simultaneously employ algorithm specified in the Material and Methods section. Experimental studies were performed on four different networks consisting 10, 20, 50 and 100 nodes. Each node was assumed to be able to communicate there between.   Distance between nodes is treated as RSSI data. CH selection and clustering capacity of 4 different networks consisting of 10, 20, 50 and 100 nodes is shown in respectively Figure 2, Figure 3, Figure 4 and Figure 5. Selected CHs in the network are indicated with a circle formed. Also cluster heads and with the number of nodes that are subject to them, and as Table 1, Table 2, are given in Table 3 and Table 4.
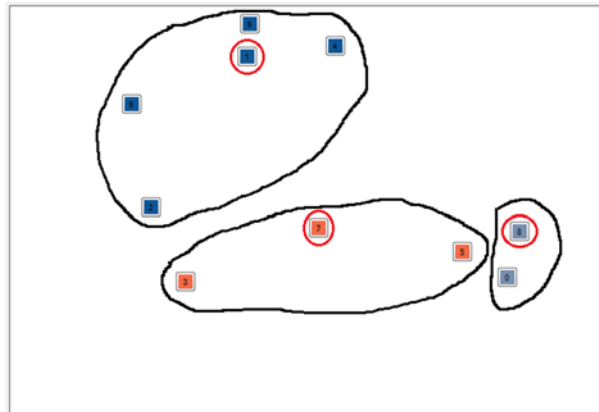
Figure 2. Network Map and Clustering with 10 Nodes

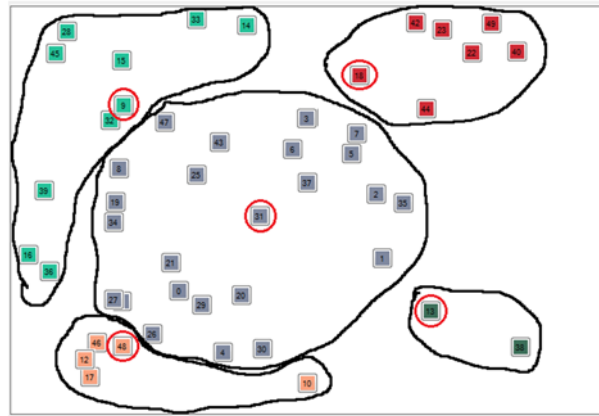**Table 1**: Cluster Table with 10 Nodes

| CH ID	CH Color	Cluster Members
7	7	3
1	1	5
8	8	2
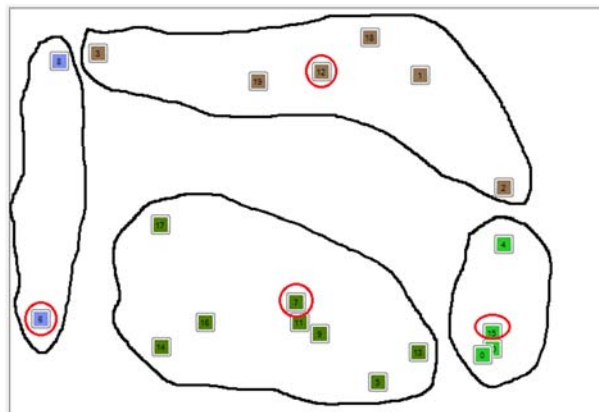
Figure 3. Network Map and Clustering with 20 Nodes

Table 2: Cluster Table with 20 Nodes

CH ID	CH Color	Cluster Members
7	7	8
12	12	6
15	15	4
6	6	2

Figure 3. Network Map and Clustering with 50 Nodes

Table 3: Cluster Table with 50 Nodes

CH ID	CH Color	Cluster Members
31		25
9		10
18		8
48		5
13		2
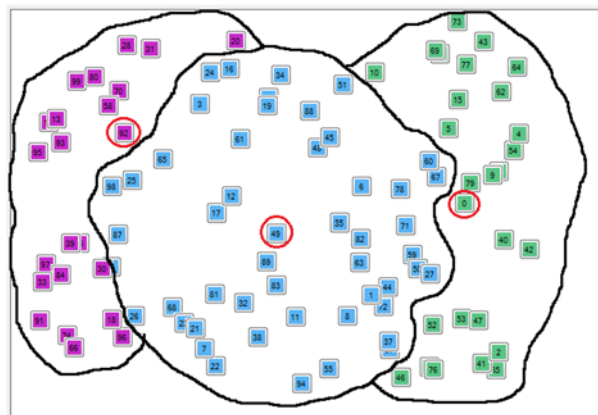
Figure 4. Network Map and Clustering with 100 Nodes

Table 4: Cluster Table with 100 Nodes

CH ID	CH Color	Cluster Members
49		50
0		27
92		23

The simulation results of clustering and network characteristics are examined, it is seen that in a number of different iterations of the network cluster. Looking at the corresponding table showing the distribution of the network node of the cluster was observed within the first iteration of the population is higher than others. This will increase the data density of traffic throughout the cluster and the CH job. It will also cause decreased efficiency of the network and will negatively affect the energy efficiency of nodes. Also, in previous iterations of the nodes included in a cluster, in subsequent iterations have been observed at a distance closer to the other CH is selected.

Conclusion

In this study, an algorithm has been developed to selection of CH with RSSI values and clustering of the network. Algorithm results have been observed that in a successful by not leaving outside any node cluster in the network. However when node count increases in the network, the node populations of the first cluster were found to be too high of the others. In addition, the number of clusters to be created cannot be interfered with. In addition, the number of clusters to be created cannot be interfered with.   For optimizing the number of nodes in the cluster to remove and eliminate these drawbacks, which must be on the set $Node \quad RSSI_{avrg} < RSSI_{avrg(i)}$ it has been identified the need to update the rules. In future studies, the desired number of clusters to be created, a threshold value is calculated using the number of nodes in the cluster so the network parameters to be included in the rules is planned to examine the clustering efficiency.

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