Fuzzy-Logic-Based Clustering Approach for heterogeneous WSNs in large scale

Oubadi Sihem, Derdouri Lakhdhar
UNIVERSITY OF L'ARBI BEN M'HIDI, OUM EL BOUAGHI

ABSTRACT
The design of energy efficiency WSNs is a challenging research since battery is consider as power source to the sensor nodes. We presents a Dynamic Cluster Head Election Using Fuzzy Logic for heterogeneous WSNs in large scale in order to reduce energy consumption and the lifetime of the networks can be prolonged.

1. INTRODUCTION

A Wireless Sensor Networks (WSNs) consists of a large number of tiny and low power sensor nodes, which are randomly or manually deployed across an unattended target area. WSNs have potential applications in environment monitoring, disaster warning systems, health care, defense reconnaissance, and surveillance systems [1].
WSNs are characterized by many resource constraints such as energy, processing power, storage and transmission range. Out of these factors, energy of deployed sensors has been the major resource constraint.

2. Related Works

LEACH (Low-Energy Adaptive Clustering Hierarchy) is a well-known cluster-based routing protocol in WSNs. In LEACH, each node becomes a CH based on probabilities. However, its main drawback is that a node with very low energy may be selected as a CH and thus it may quickly die. Moreover, the CH transmits their data directly to the BS via single hop communication which also lead to quick death of the CH in large scale WSNs [1].
GA_CH (Genetic Algorithm Based Clustering Approach for WSNs to Optimize Routing Techniques) a GA based clustering algorithm which evaluates the fitness function by considering the two major parameters distance and energy has been proposed. Simulation result proofs that the proposed protocol performs better than LEACH protocol and enhances the network lifetime [2].
CHEF the authors propose a fuzzy logic approach to elect a CH which is based on three descriptors: energy, concentration and centrality. Simulation shows that depending upon network configuration; a substantial increase in network lifetime can be accomplished compared to probabilistically selecting the nodes as CHs using only local information. However, the major drawback of this approach is that the election of a CH is done in a centralized way.[3]

3. Figures

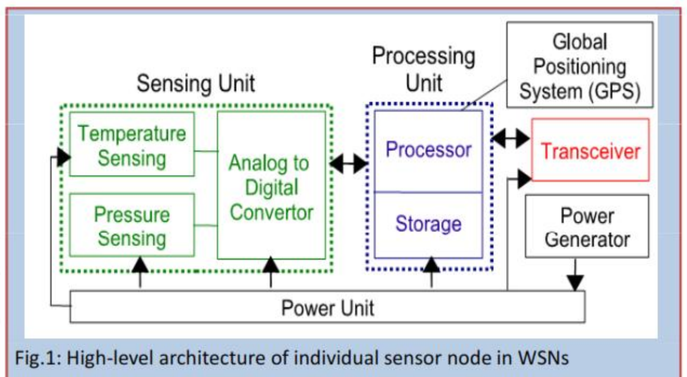

Fig.1: High-level architecture of individual sensor node in WSNs

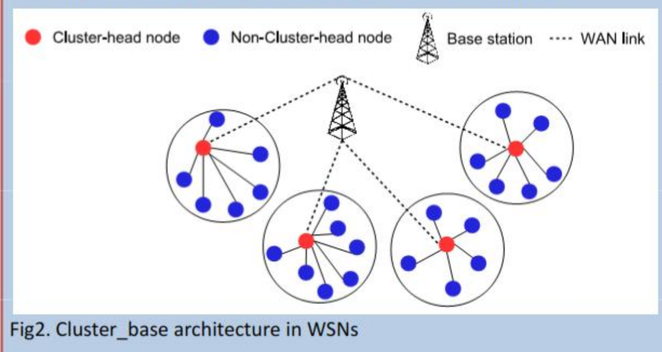

Fig2. Cluster_base architecture in WSNs

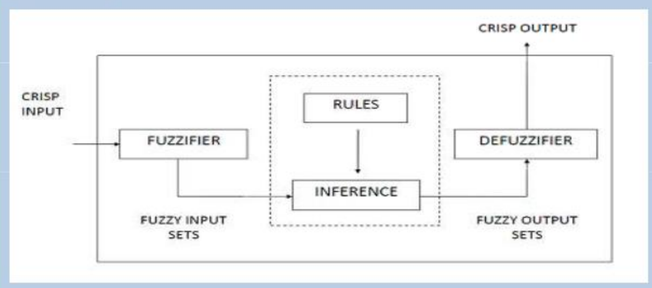

Fig.3: Fuzzy-Logic-Controller-component

4. Algorithm

procedure INITIALIZATION PHASE
AN = Advanced Node: CH = Cluster Head
i : ID of sensor node in current round
j : ID of neighbors node in current round
NbrNeighbors = number of neighbors
Seuil : amount of energy
T = RTT (Round Trip Time)
Each ANi broadcast RequestMessage (ID)
Wait for T time to receive ResponseMessage
if ReponseMessage(Nodej) = True then
Calculate Distance(ANi, Nodej)
Add identifier to table of neighbors
if (tableneighbors) = null then ANi <- Chi
NbrNeighbors <- table neighbors.size
procedure SETUP PHASE
Each Ani calculates chancei using Fuzzy Logic Inference Engine
Broadcast ValMsg(IDi, chancei) Wait (T)
if (ReceiveV alMsg(IDj; chancej)) = false then)
ANi <- Chi
Else if (allchancej) < chancei then
ANi <- Chi
else Send JoinMsg(IDi) to the closet CH
procedure STEADY PHASE
for all MC send TDMA Each MC senses data, send Packet (MCj, Chi, Data) in TDMA slot
for all CH collects, aggregates Data and compresses it CH transmits data to the BS

4. Description

Our proposed clustering algorithm is divided into three phases similar to some protocols; initialization, setup phase and steady phase. he model of FL control consists of a fuzzifier, fuzzy rules, fuzzy inference engine, and a defuzzifier as shown in fig3. We have used the most commonly used fuzzy inference technique called Mamdani's method. Fuzzification of the input variables : energy, distance and node density, by taking the crisp inputs from each of them and determining the degree to which these inputs belong to each of the appropriate fuzzy sets.

5. CONCLUSIONS

WSNs have attracted significant attention over the past few years, and can be employed in a wide spectrum of applications in both civilian and military scenarios. We have presented our proposed approach for heterogeneous WSNs in large scale. As perspective, we intend to evaluate the performance of our algorithm in OMNet++ simulation environment while comparing the results with existing protocols LEACH and CHEF.

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Contact Information

Oubadi Sihem

Address
Tel: +1 066 - 666666
Fax: +1 066 - 777777
Email: sissima.91@gmail.com