A Cooperative Clustering Protocol with Duty Cycling for Energy Harvesting Enabled Wireless Sensor Networks

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***Abstract*- Multiple-input multiple-output (MIMO) technology is known to improve energy efficiency in energy-constrained wireless networks, such as wireless sensor networks (WSN).Although in WSNs, a node is often equipped with a single antenna, nodes can be clustered into virtual antenna arrays that can act as virtual MIMO (VMIMO) nodes. In this paper, we propose a distributed cooperative clustering protocol (CCP) that aim sat conserving energy and prolonging network lifetime by taking advantage of VMIMO communications. In contrast to previously proposed protocols, CCP fully exploits the diversity gain of the VMIMO technique by optimally selecting the cooperating nodes(CNs) within a cluster and balancing their energy consumption. We first formulate the problem of optimal CN selection at the transmit and receive clusters as a nonlinear binary program, and show the problem is NP-hard. Aiming at minimizing the imbalance in the residual energy at various nodes, we reduce the problem into two sub-problems: finding the optimal number of CNs (ONC) cluster and the CN assignment problem. To analytically address the ONC problem, we analyze the energy efficiency of two existing VMIMO methods: distributed Space Time Block Code (DSTBC)and distributed Vertical-Bell Laboratories-Layered -Space-Time(DVBLAST). The second sub-problem is addressed by assigning CNs to nodes with stronger residual energy. To make CCP scalable to large WSNs, we propose a multi-hop energy-balanced routing mechanism for clustered WSNs with a novel cost metric. Our routing method is also applicable to other clustering protocols(e.g., CMIMO, MIMO-LEACH). Extensive simulations are used to validate our analysis.**

I. INTRODUCTION

The underlying work targets energy-constrained systems such as wireless sensor networks (WSNs). In a WSN, it is often difficult or expensive to replace/recharge sensor batteries after deployment. Hence, it is critical to design the network in an energy-efficient manner. Recently, cooperative communications has attracted substantial research interest as a means of conserving energy and/or increasing network throughput by having groups of nodes cooperate in transmitting or receiving the signal. In principle, cooperative communications exploit the spatial diversity obtained from transmitting the same signal (or highly correlated ones) over multiple, spatially separated antennas.

II. LITERATURE SURVEY

2.1 Introduction

Literature Survey is the most important step in software program development manner. Before growing the tool it's miles necessary to decide the time thing, financial system n employer strength. Once these things are glad, ten subsequent steps are to determine which working device and language may be used for growing the tool and language can be used for developing the tool. Once The programmers begin constructing the tool the programmers want lot of outside guide. This aid can be acquired from senior programmers, from e-book or from web sites. Before constructing the gadget the above attention r taken under consideration for developing the proposed device.

Literature survey Is the documentation of a comprehensive assessment of the published and unpublished work from secondary resources statistics inside the regions of particular interest to the researcher. The library is a wealthy storage base for secondary facts and researchers used to spend numerous weeks and sometimes months going

through books, journals, newspapers, magazines, convention lawsuits, doctoral dissertations, grasp's theses, authorities guides and financial reports to locate statistics on their research topic. Researcher. The library is a rich storage base for secondary data and researchers used to spend several weeks and sometimes months going through books, journals, newspapers, magazines, conference proceedings, doctoral dissertations, master's theses, government publications and financial reports to find information on their research topic. With Computerized databases now quite simply to be had and accessible the literature seek is tons speedier and simpler and can be completed without getting into the portals of a library building.

2.2 Existing System

EXISTING SYSTEM:

The VBLAST technique implementing multiple antennason a sensor node can be impractical. Instead, one could useThis research was supported in part by NSF (under grants CNS-1016943, CNS-0721935, CNS-0904681, IIP-0832238), Raytheon, and the Connection One centre. Any opinions, findings, conclusions, or recommendations expressed in this paper are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. The concept of virtual MIMO (VMIMO) [3], in which several sensors are grouped to function as a virtual MIMO node. This concept led to distributed VBLAST (DVBLAST) [4] and distributed STBC (DSTBC) as virtual counterparts of conventional VBLAST and STBC MIMO schemes.

DISADVANTAGES OF EXISTING SYSTEM:

• In a WSN, it is often difficult or expensive to replace/recharge sensor batteries after deployment. Hence, it is critical to design the network in an energy-efficient manner.

2.3 PROPOSED SYSTEM:

We proposea distributed cooperative clustering protocol (CCP) that aims at conserving energy and prolonging network lifetime by taking advantage of VMIMO communications. In contrast to previously proposed protocols, CCP fully exploits the diversity gain of the VMIMO technique by optimally selecting the cooperating nodes(CNs) within a cluster and balancing their energy consumption.We first formulate the problem of optimal CN selection at thetransmit and receive clusters as a nonlinear binary program, and show the problem is NP-hard.

ADVANTAGES:

- Aiming at minimizing the imbalance in the residual energy at various nodes.
- We reduce the problem into two sub-problems: finding the optimal number of CNs (ONC) in a cluster and the CN assignment problem.

2.5 Specification

2.5.1Software Requirements

Operating system :Any Operating System after WINDOWS XP

Technology :Java

Database : Oracle 10g

IDE : NetBeans7.1.2 or Above

2.5.2 Hardware Requirements

Processor	:	1.0GHZ
RAM	:	256MB
HARD DISK	:	50GB
FRONTEND	:	Java Swings , Awt

III. SYSTEM DESIGN

3.1 Introduction

Designing is the most important phase. The Design process involves developing a conceptual view of the system, establishing system structure, identifying data string and data stores, decomposing high level functions into sub-functions, establishing relationships, interconnections among components and developing concrete data representation.

In the context of software program , design is problem fixing technique whose objective is to discover describe the manner to implement the useful necessities while respecting the constraints imposed with the aid of the non-practical necessities and adhering to standard principles of accurate great.

3.2 DFD / ER / UML diagram

DFD SYMBOLS:

In the DFD, there are four symbols

1. A square defines a source (originally) or destination of system data.
2. An arrow identifies data flow. It is the pipe line through which the information flows.

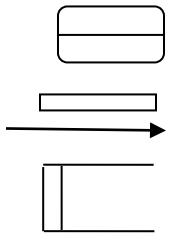
3. A circle or a bubble represents a technique that transforms profits statistics flow into outgoing data flows.
4. An open rectangle is a data store, data at rest or a temporary repository of data.

Process that transforms data flow

Process that transfer data flow

Data flow

Data Store



The development of DFD'S is done in several levels. Each process on lower level diagrams can be broken down into a more detailed DFD in the next level.

IV.TESTING

Testing is a process of executing a program with the intent of finding an error. Testing is a crucial Detail of software fine assurance and gives ultimate evaluate of specification, layout and coding. System trying out is an crucial segment. Testing represents an thrilling anomaly for the

5.1 Testing Objectives:

- Testing is a process of executing a program with the intent of finding an error.
- A good test case is one that has a high probability of finding an as yet discovered error.
- A successful test is one that uncovers an as yet undiscovered error.
- Testing Principles:
- All tests should be traceable to customer requirements.
- Tests should be planned long before testing begins.

Unit Testing:

Unit testing is done on individual modules as they are completed and become executable. It is confined only to the designer's requirements. Each module can be tested using the following

Two strategies:

Black Box Testing:

In this strategy some test cases are generated as input conditions that fully execute all functional requirements for the program. This testing has been uses to find errors in the following categories:

- Incorrect or missing functions.
- Interface errors
- Errors in data structure or external database access
- Performance errors

White Box Testing:

In this the test cases are generated on the logic of each module by drawing flow graphs of that module and logical decisions are tested on all the cases. It has been uses to generate the test cases in the following cases:

- Guarantee that all independent paths have been executed.
- Execute all logical decisions on their true and false sides.

Integrating Testing: Integration testing ensures that software and subsystems work together as a whole. It tests the interface of all the modules to make sure that the modules behave properly when integrated together.

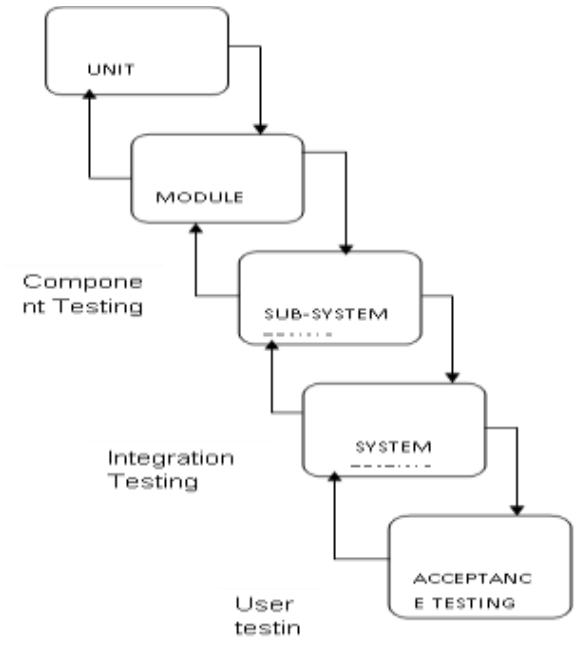
System Testing:

Involves in-house testing of the entire system before delivery to the user. Its aim is to satisfy the user the system meets all requirements of the client's specifications.

Acceptance Testing:

It is a pre-delivery test in which entire system is tested at client's site on real world data to find errors

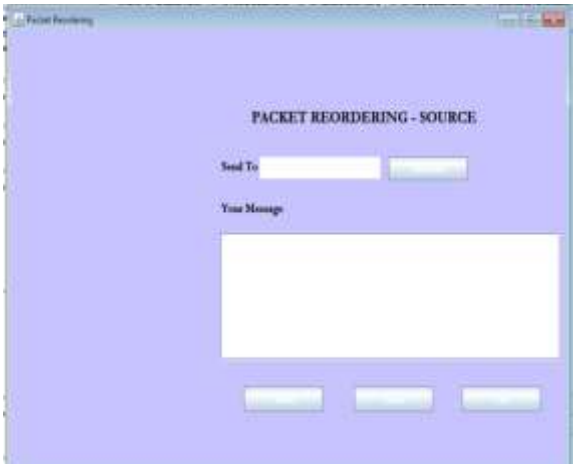
Test Case:



V. OUTPUT SCREEN

Packet Recording Destination:

Packet Recording Source:



TCP/IP packet Recording:

VI. CONCLUSION

In this work, we have developed a cooperative clustering protocol for WSNs. Our protocol takes advantage of VMIMO and enjoys the maximum diversity of DSTBC. The key engine behind CCP is the optimal CN selection algorithm. We showed that the OCS problem is NP-hard and decomposed it into two sub-problems: optimal number of CNs and CN assignment problem using energy balancing approach. The ONC algorithm serves as a framework for protocol designers in deciding the number of CNs per cluster for clustered WSNs. We also proposed the energy-balanced routing mechanism for clustered WSNs, which is applicable to existing clustering protocols. CCP prolongs the network lifetime about three times that of existing cooperative protocols (MIMO-LEACH, CMIMO).

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[6] J. Laneman and G. Wornell, "Distributed space-time-coded protocols for exploiting cooperative diversity in wireless networks," IEEE Transactions Fig. 15. CCP's lifetime versus tradeoff factor.

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