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OPPORTUNISTIC ROUTING WITH CONGESTI0N DIVERSITY IN WIRELESS AD HOC NETWORKS

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Abstract

Energy savings optimization becomes one of the major concerns in the wireless sensor network (WSN) routing protocol design, due to the fact that most sensor nodes are equipped with the limited non rechargeable battery power. In this paper, we focus on minimizing energy consumption and maximizing network lifetime for data relay in one-dimensional (1-D) queue network. Following the principle of opportunistic routing theory, multihop relay decision to optimize the network energy efficiency is made based on the differences among sensor nodes, in terms of both their distance to sink and the residual energy of each other. Specifically, an Energy Saving via Opportunistic Routing (ENS_OR) algorithm is designed to ensure minimum power cost during data relay and protect the nodes with relatively low residual energy. Extensive simulations and real testbed results show that the proposed solution ENS_OR can significantly improve the network performance on energy saving and wireless connectivity in comparison with other existing WSN routing schemes.

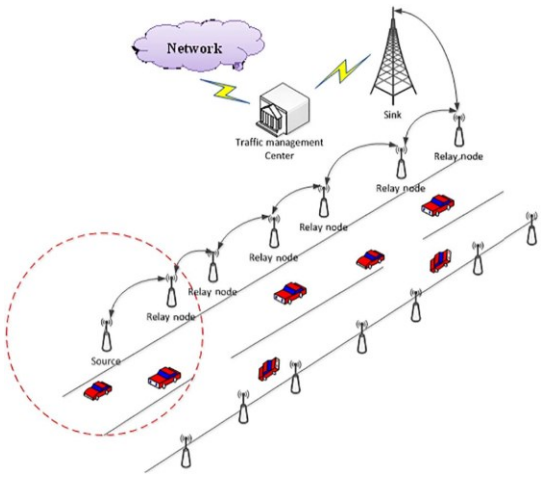
Index Terms—Energy efficiency, one-dimensional (1-D) queue network, opportunistic routing, relay node, wireless sensor network (WSN).

INTRODUCTION

WIRELESS sensor network (WSN) offers a wide range of applications in areas such as traffic monitoring, medical care, inhospitable terrain, robotic exploration, and agriculture surveillance. The advent of efficient wireless communications and advancement in electronics has enabled the development of low-power, low-cost, and multifunctional wireless sensor nodes that are characterized by miniaturization and integration.

In WSNs, thousands of physically embedded sensor nodes are distributed in possibly harsh terrain and in most applications, it is impossible to replenish energy via replacing batteries. In order to cooperatively monitor physical or environmental conditions, the main task of sensor nodes is to collect and transmit data. It is well known that transmitting data consumes much more energy than collecting data. To improve the energy efficiency for transmitting data, most of the existing energy-efficient routing protocols attempt to find the

minimum energy path between a source and a sink to achieve optimal energy consumption. However, the task of designing an energy-efficient routing protocol, in case of sensor networks, is multifold, since it involves not only finding the minimum energy path from a single sensor node to destination, but also balancing the distribution of residual energy of the whole network. Furthermore, the unreliable wireless links and network partition may cause packet loss and multiple retransmissions in a preselected good path. Retransmitting packet over the preselected good path inevitably induces significant energy cost. Therefore, it is necessary to make an appropriate tradeoff between minimum energy consumption and maximum network lifetime.



Smart traffic information acquisition system

RELATED WORK

In recent years, there are several studies on routing-related parameters, like connectivity-related parameters and density of the distributed nodes, in 1-D queue networks. Previous works and studied the connectivity probability of two certain nodes versus the entire network. Other work in investigated on uniformly and independently distribution under the assumption that the transmission range is fixed among sensor nodes.

Software Environment

Java Technology

Java technology is both a programming language and a platform.

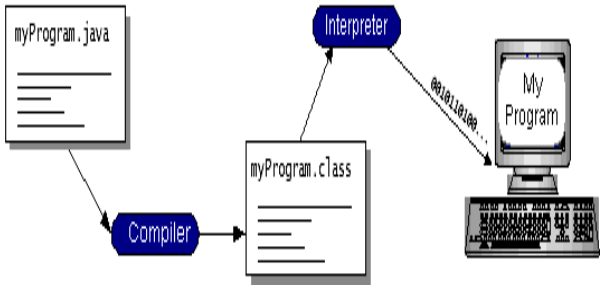
THE JAVA PROGRAMMING LANGUAGE

THE JAVA PROGRAMMING LANGUAGE IS A HIGH-LEVEL LANGUAGE THAT CAN BE CHARACTERIZED BY ALL OF THE FOLLOWING BUZZWORDS:

- Simple
- Architecture neutral
- Object oriented
- Portable
- Distributed
- High performance
- Interpreted
- Multithreaded
- Robust
- Dynamic
- Secure

With most programming languages, you either compile or interpret a program so that you can run it on your computer. The Java programming language is unusual in that a program is both compiled and interpreted. With the compiler, first you translate a program into an intermediate language called *Java byte codes* —the platform-independent codes interpreted by the interpreter on the Java platform. The interpreter parses and runs each Java byte code instruction on the computer. Compilation

happens just once; interpretation occurs each time the program is executed. The following figure illustrates how this works.



IMPLEMENTATION

- **Service provider:**

In this module, the service provider will browse the data file and then send to the particular receivers. Service provider will send their data file to router and router will connect to Intermediate Relay Nodes, via relay nodes the data will transfer to end user and if any attacker will change the battery power of the particular relay node, then service provider will reassign the it for corresponding relay node.

- **Relay Router**

The Relay Router manages a multiple Relay Nodes (R1, R2, R3, and R4) to provide data storage service. In each and every relay node, the battery power will check. If the power is more enough to transfer the data from one node to another, then it will transfer or else the data will transfer via another nodes and the time delay will be calculated based on the routing delay.

- **Relay Node**

A **relay network** is a broad class of network topology commonly used in wireless networks, where the source and destination are interconnected by means of some nodes. In such a network the source and destination cannot communicate to each other directly because the distance between the source and destination is greater than the transmission range of both of them, hence the need for intermediate node(s) to *relay*.

A relay network is a type of network used to send information between two devices, for e.g. server and computer, that are too far away to send the information to each other directly. Thus the network must send or "relay" the information to different devices, referred to as nodes that pass on the information to its destination. A well-known example of a relay network is the Internet. A user can view a web page from a server halfway around the world by sending and receiving the information through a series of connected nodes.

- **Receiver (End User)**

In this module, the receiver can receive the data file from the service provider via router. The receivers receive the file by without changing the File Contents. Users may receive particular data files within the network only.

SYSTEM STUDY

FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates.

During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

Three key considerations involved in the feasibility analysis are

- ECONOMICAL FEASIBILITY
- TECHNICAL FEASIBILITY
- SOCIAL FEASIBILITY

SYSTEM TESTING

TESTING METHODOLOGIES

The following are the Testing Methodologies:

- **Unit Testing.**
- **Integration Testing.**
- **User Acceptance Testing.**
- **Output Testing.**
- **Validation Testing.**

SYSTEM DESIGN AND DEVELOPMENT

INPUT DESIGN

Input Design plays a vital role in the life cycle of software development, it requires very careful attention of developers. The input design is to feed data to the application as accurate as possible. So inputs are supposed to be designed effectively so that the errors occurring while feeding are minimized. According to Software Engineering Concepts, the input forms or screens are designed to provide to have a validation control over the input limit, range and other related validations.

Validations are required for each data entered. Whenever a user enters an erroneous data, error message is displayed and the user can move on to the subsequent pages after completing all the entries in the current page.

OUTPUT DESIGN

The Output from the computer is required to mainly create an efficient method of communication within the company primarily among the project leader and his team members, in other words, the administrator and the clients. The output of VPN is the system which allows the project leader to manage his clients in terms of creating new clients and assigning new projects to them, maintaining a record of the project validity and providing folder level access to each client on the user side depending on the projects allotted to him. After completion of a project, a new project may be assigned to the client. User authentication procedures are maintained at the initial stages itself. A new user may be created by the administrator himself or a user can himself register as a new user but the task of assigning projects and validating a new user rests with the administrator only.

CONCLUSION

WSN has been widely used for monitoring and control applications in our daily life due to its promising features, such as low cost, low power, easy implementation, and easy maintenance. However, most of sensor nodes are equipped with the limited nonrechargeable battery power. Energy savings

optimization, therefore, becomes one of major concerns in the WSN routing protocol design.

In this paper, we focus on minimizing energy consumption and maximizing network lifetime of 1-D queue network where sensors' locations are predetermined and unchangeable. For this matter, we borrow the knowledge from opportunistic routing theory to optimize the network energy efficiency by considering the differences among sensor nodes in terms of both their distance to sink and residual energy of each other. We implement opportunistic routing theory to virtually realize the relay node when actual relay nodes are predetermined which cannot be moved to the place according to the optimal transmission distance. This will prolong the lifetime of the network. Hence, our objective is to design an energy-efficient opportunistic routing strategy that ensures minimum power is cost and protects the nodes with relatively low residual energy. Numerous simulation results and real testbed results show that the proposed solution ENS_OR makes significant improvements in energy saving and network partition as compared with other existing routing algorithms.

In the future, the proposed routing algorithm will be extended to sleep mode and therefore a longer network lifetime can be achieved. Apart from that, an analytical investigation of the new energy model include sleep mode will be performed.

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