www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 2 Issue 6 June, 2013 Page No. 1794-1798

ADAPTIVE PROTOCOL FOR INDUSTRIAL AND CONTROL APPLICATION USING WIRELESS SENSOR

1k.Anandhavali, 2s.Mangaiyarkarasi, 3k.Kavinila, 4t.Vennila
1Asst.professor, Dept.of.Computer science, Meenakshi Chandrasekaran College of Arts & Science Pattukkottai-614 626. Thanjavur..
2,3Research Scholar, Dept.of.Computer Science, Tamil University, Thanjavur-613010.
4Computer Science & Engineering, Kings College of Engineering, Punalkulam, Thanjavur.
Email ID:vithish88@gmail.com

Abstract— ***An energy-efficient, reliable and timely data transmission is essential for wireless sensor networks (WSNs) employed in scenarios where plant information must be available for control applications. To reach a maximum efficiency, cross layer interaction is a major design paradigm to exploit the complex interaction among the layers of the protocol stack. This is challenging because latency, reliability, and energy are at odds, and resource constrained nodes support only simple algorithms. In this project, the novel protocol Breath is proposed for control applications. Breath is designed for WSNs where nodes attached to plants must transmit information via multi-hop routing to a sink. Breath ensures a desired packet delivery and delay probabilities while minimizing the energy consumption of the network. The protocol is based on randomized routing, medium access control, and duty-cycling jointly optimized for energy efficiency. The design approach relies on a constrained optimization problem, whereby the objective function is the energy consumption and the constraints are the packet reliability and delay. The challenging part is the modeling of the interactions among the layers by simple expressions of adequate accuracy, which are then used for the optimization by in-network processing. The optimal working point of the protocol is achieved by a simple algorithm, which adapts to traffic variations and channel conditions with negligible overhead. The protocol has been implemented and experimentally evaluated on a test-bed with off-the-shelf wireless sensor nodes, and it has been compared with a standard IEEE 802.15.4 solution. Analytical and experimental results show that Breath is tunable and meets reliability and delay requirements. Breath exhibits a good distribution of the working load, thus ensuring a long lifetime of the network. Therefore, Breath is a good candidate for efficient, reliable, and timely data gathering for control applications.***

Keywords: **Sensor, Cycle, Topology.**

I. INTRODUCTION

Wireless sensor networks (WSNs) are networks of tiny sensing devices for wireless communication, monitoring, control, and actuation. Given the potential benefits offered by these networks, e.g., simple deployment, low installation cost, lack of cabling, and high mobility, they are specially appealing for control and industrial applications. The variety of application domains and theoretical challenges for WSNs has attracted research efforts for more than a decade**.** Although WSNs provide a great advantage for process, manufacturing and industry, they are not yet efficiently deployed. This is because the software for these applications is usually written by process and software engineers that are expert in process control technology, but know little of the network and sensing infrastructure that has to be deployed to support control applications. On the other side, the communication infrastructure is designed by communication engineers that know little about process control technology. Moreover, the adoption of wireless technology further complicates the design of these networks. Being able to satisfy high requirements on communication performance over unreliable communication channels is a difficult task. Reliability: Sensor information must be sent to the sink of the network with a given probability of success, because missing these data could prevent the correct execution of control actions or decisions concerning the phenomena sensed. However, maximizing the reliability may increase substantially the network energy consumption. Hence, the network designers need to consider the tradeoff between reliability and energy consumption. Delay: Sensor information must reach the sink within some deadline. A probabilistic delay requirement must be considered instead of using average packet delay since the delay jitter can be too difficult to compensate for, especially if the delay variability is large. Retransmission of old data to maximize the reliability may increase the delay and is generally not useful for control applications. Energy efficiency: The lack of battery replacement, which is essential for affordable WSN deployment, requires energy-efficient operations. Since high reliability and low delay may demand a significant energy consumption of the network, thus reducing the WSN lifetime, the reliability and delay must be flexible design parameters that need to be adequate for the requirements. Note that controllers can usually tolerate a certain degree of packet losses and delay. Hence, the maximization of the reliability and minimization of the delay are not the optimal design strategies for the control applications we are concerned within this paper. Adaptation: The network operation should adapt to application requirement changes, varying wireless channel and network topology. For instance, the set of application requirements may change dynamically and the communication protocol must adapt its design parameters according to the specific requests of the control actions. To support changing requirements, it is essential to have an analytical model describing the relation between the protocol parameters and performance indicators (reliability, delay, and energy consumption). Scalability: Since the processing resources are limited, the protocol procedures must be computationally light. These operations should be performed within the network, to avoid the burden of too much communication with a central coordinator. This is particularly important for large networks. The protocol should also be able to adapt to size variation of the network, as, for example, caused by moving obstacles, or addition of new nodes. In this paper, we offer a complete design approach that embraces all the factors mentioned above. We propose the Breath protocol, a self-adapting efficient solution for reliable and timely data transmission. Since the protocol adapts to the network variations by enlarging or shrinking next-hop distance, sleep time of the nodes, and transmit radio power, we think that it behaves like a breathing organism.

II. IMPLEMENTATION OF SENSOR NETWORK

1. Sensor Network

In these module we allocate the more sensors in different places, that used to collect the temperature details of the particular place, here we are using the temperature sensor to observes the temperature of the place. these sensors are collect the temperature of the several places these details are send to the cluster head.

2. Send sensor value:

Sensors receives the temperature details after that details are send to the cluster header, in these process done by the sensor ID and cluster head system name. after that enter the values of the sensor, then these details are forward to the particular cluster header.

3. Receive sensor value:

Here the cluster head system receive the various sensor's temperature values from the various sensors using sensor ID and cluster header name, then cluster the given values.

4. Cluster Head:

The cluster head used to collect the data from the sensor nodes, it collect the temperature details from the various sensors. Then the values are stored in the cluster header and arrange the values for the frequent access. Finally the values are send to the controller.

5. Controller:

Controller gets the values from the cluster head, that values are get from the various sensor nodes. Then the controller display higher temperature values with the particular place. Controller analyze the given various temperature and find the higher temperature in which node. Then display the higher temperature in which place.

i) TESTING

1.1 Testing Objectives

Testing is the process of executing a program with the intention of finding an error. A good test is the one that has a high probability of finding an as-yet undiscovered error successful test is that which uncovers an as-yet undiscovered error. A successful test is that in which no errors are found. The objective is to design tests that systematically uncover different classes of errors and do so with a minimum amount of time and effort.

1.2. Unit Testing

Unit testing involves only those characteristics that are vital to the performance of the unit under test. This encourages developers to modify the source code without immediate concerns about how such changes might affect the functioning of other units or the program as a whole. Once all of the units in a program have been found to be working in the most efficient and error-free manner possible, larger components of the program can be evaluated by means of integration testing.

1.3. Black Box Testing

Black box testing explains the users not able to view the entire process of the context based Image Retrival.Through keywords search the image. It does not allow the user to view inside.

1.4. Functional Testing

Functional test cases involves exercising the code with normal with values for which the expected results are known as well as boundary values and special values such as logically related inputs.

In this project this test can be performed using the Keywords for the image. For example the users modify the key word for the image.

1.5. White Box Testing

In immigration consultancy portal, white-box testing refers to a methodology of the users can view the entire process of the admin.The user get the internal knowledge of the image retrival.

1.6. Acceptance Testing

Acceptance testing involves planning and execution of functional tests. Performance tests, and the stress tests to verify that the implemented system its requirements. Acceptance tests are typically performed by the quality assurance and/or customer organizations.

This testing generally involves running a suite of tests on the completed system. Each individual test, known as a case, exercises a particular operating condition of the user's environment or feature of the system, and will result in a pass or fail.In this we can able to develop the plan of user or the customer.

1.7. Integration Testing

The purpose of integration testing is to verify functional, performance, and reliability requirements placed on major design items.

This may be carried out in 2 ways. They are,

1.8. Bottom up Integration:

Bottom-up integration consists of unit testing by subsystem testing. followed by testing of the entire system.

Instead of testing from the first module this project uses the bottom-up strategy for testing. First all the individual forms are tested and then the module and with the entire project the testing was carried out (Example: Registration Form, Keyword modification form).

1.9. Top-Down Integration:

Top-down integration starts with the main routine and one or two immediately subroutines in the system structure.

This project has been tested starting from the dealers Register form, Login form. The user can view the image and modify the keyword. Using that the user can generate the new keyword and search the image.

1.10. Validation Testing

Tests to determine whether an implemented system fulfills its requirements. The checking of data for correctness or for compliance with applicable standards, rules, and conventions. The process of applying specialized security test and evaluation procedures, tools, and equipment needed to establish acceptance for joint usage of an AIS by one or more departments or agencies and their contractors.

ii) SYSTEM

2.1. System Testing

System testing is performed on the entire system in the context of a Functional Requirement Specification (FRS) and/or a System Requirement Specification (SRS). System testing is an investigatory testing phase, where the focus is to have almost a destructive attitude and tests not only the design, but also the behavior and even the believed expectations of the customer. It is also intended to test up to and beyond the bounds defined in the software/hardware requirements specification.

2.2 Security Testing

Security testing is a process to determine that an information system protects data and maintains functionality as intended. USER ID and PASSWORD to the dealers. The dealers should follow the security rules and restrictions.

2.3 Performances Testing

Performance Testing covers a broad range of functional evaluations where a material, product, system, or person is not specified by detailed material or component specifications: rather, emphasis is on the final measurable performance characteristics. Testing can be a qualitative or quantitative procedure.

III. PROPOSED IMPROVEMENTS

In this proposed system the control algorithm designers impose a set of requirements on reliability, packet delay and energy consumption that the communication infrastructure must satisfy. Breath protocol, a self-adapting efficient solution for reliable and timely data transmission. Since the protocol adapts to the network variations by enlarging or shrinking next-hop distance, sleep time of the nodes, and transmit radio power, we think that it behaves like a breathing organism. The receiver sends out beacon messages at regular intervals and a sender must wait until it receives one and respond by sending the message in the rendezvous action to minimize channel usage.

In this existing system the sensor information must reach the sink within some deadline. A probabilistic delay requirement must be considered instead of using average packet delay since the delay jitter can be too difficult to compensate for, especially if the delay variability is large. Retransmission of old data to maximize the reliability may increase the delay and is generally not useful for control applications. Both protocols are similar since it activates only a fraction of the nodes in a certain area at any given time. A major weakness of GAF is precisely the requirement that the routing feature be guaranteed, which results in inefficiency in terms of latency and energy consumption.

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VI. CONCLUSIONS AND FUTURE DIRECTIONS

We designed and implemented Breath, a protocol that is based on a system-level approach to guarantee explicitly reliability and delay requirements in wireless sensor networks for control and actuation applications. The protocol considers duty-cycle, routing, MAC, and physical layers all together to maximize the network lifetime by taking into account the tradeoff between energy consumption and application requirements for control applications. We provided a complete test-bed implementation of the protocol, building a wireless sensor network with Tiny OS and Tmote sensors. An experimental campaign was conducted to test the validity of Breath in an indoor environment with both AWGN and Rayleigh fading channels. Experimental results showed that the protocol achieves the reliability and delay requirements, while minimizing the energy consumption. We are currently investigating the extension of the design methodology to consider mesh networks such as coexisting ad-hoc and wireless sensor networks.

5. AUTHOR DETAILS

[1] **K.Anandhavali** M.Sc, M.Phil., M,Ted.,

Asst.professor, Dept.of.Computer science,

Meenakshi Chandrasekaran College of Arts &

Science Pattukkottai-614 626. Thanjavur.

[2]S. Mangaiyarkarasi

Research Scholar, Dept.of.Computer Science, Tamil

University, Thanjavur-613010.

[3]K. Kavinila

Research Scholar, Dept.of.Computer Science, Tamil

University, Thanjavur-613010.

[4]T. Vennila

Computer Science & Engineering, Kings College of

Engineering, Punalkulam, Thanjavur.

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