ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 19, April 2017

A Step of QOS in Wireless Mesh Networking Module for Environmental Monitoring

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Abstract - Wireless mesh networking(WMN) technology is used to extend the communication range over diversities. It's used to collect data from various sensors that are spread widely. This scope of this project will introduce an open source wireless mesh network (WMN) module integrated with the function of network discovery, automatic routing control and transmission scheduling. In addition, this design is open-source in order to promote the use of wireless mesh networking for environmental monitoring applications. Testing of the design and the proposed networking module is reported. The proposed wireless mesh networking module was evaluated with a hardware protocol XBee. The average package delivery ratio and standard deviation of the proposed WMN module and the XBee are 94.09%, 91.19%, 5.14% and 10.25% respectively in a 20 node experiment. The proposed system was demonstrated to have the advantages of low cost combines with high reliability and performance which can help scientists in implementing monitoring applications without complications of complex wireless networking issues.

I. INTRODUCTION

WMN in environmental monitoring is used in various applications as - health care, home monitoring, green house management, power consumption monitoring. Environmental monitoring may check for some measures like – Air quality check, pollution check and etc. Other potential application where they are being user will include collecting human data with wearable sensors, detecting pipe leakage with pressure sensors. These can be enhanced by using wireless mesh network to extend the region of monitoring

However, such products are not made available for the general public. The hardware and the source code are concealed from the view of others, because the commercial product is based on proprietary software. Without the access to source code or a detailed design of wireless network module the root cause is difficult to determine. In order to respond to this, we use a WMN module that will be easily integrated with the sensor system.

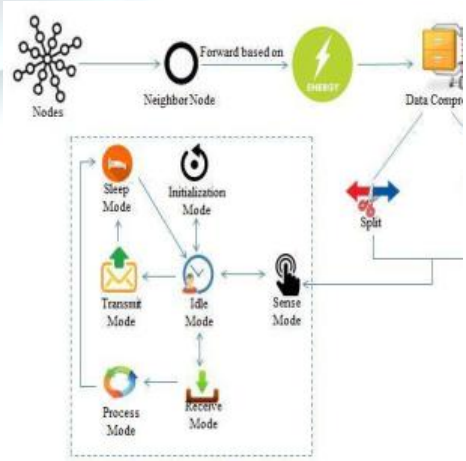
II. EXISTING SCHEMES

Source code was not made available in the earlier schemes and in the proposed we are going to take the source code and build on it. In a notion to sustain the energy and data loss to a considerable amount. The way we are going to achieve is by the use of modes.

A WMN module will include modes like – Sense/ Initialisation, Receive, Process, Transmit and Sleep mode. During an active transmission of data, we are going to make the inactive modes to sleep thereby they need not be active all time and consume energy, data and unwanted routing.

By putting them to sleep mode we are saving seconds that will help in the long run. What happens is we are saving some n seconds for a particular run of y. Suppose if we do a run of y+5, we will be saving n+10 seconds. By saving these we will be increasing the network life time of the WMN module, that can also extend its life time a little over than they actually prescribed time.

III. ARCHITECTURE



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IV. DESIGN OF WMN MODULE

(A) Architecture:

In this section we shall discuss about the WMN module completely. A WMN module will be connected to a host processor via an interface. The module will also include a host processor, Senor and a power supply. The module design is based on a 8-bit microprocessor and a simple radio frequency (RF) transceiver without special functional support. Therefore, portability can be achieved in this, and we need not change the basic design of it.

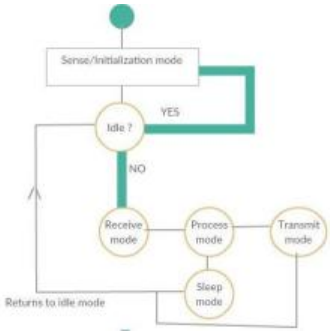
The proposed module is open-source in both hardware and software. Therefore, it cannot only be integrated to the sensor system for environmental monitoring but it can also be used to study the performance of wireless mesh networking in actual experiment and modify it depending on the requirements.

(B) Operating modes of WMN modules:

A WMN module when powered on, by a battery power source starts in the *Initialization mode* while waiting to join the network. The system switched to Idle mode after joining the network. Subsequently the WMN module switches in running mode according to the work schedule assigned from the Data sink, including the *Sense mode, Sleep mode, Process mode, Transmit mode* and *Receive mode.*

The RF transceiver only turns on in Transmit mode and Receive mode to save energy. The purpose of sense mode is to read the data from the Analog-digital convertor.

The proposed WMN module is based on Time division Multiple access (TDMA) and its sensitive to timing control.



B.1) Node Creation and Configuration:

Node creation involves the creation of the wireless nodes in the network scenario that is decided. Node configuration essentially consists of defining the different node characteristics before creating them. They may consist of - the type of addressing structure used in the simulation, defining the network components for mobile nodes, turning on or off the trace options at Agent/Router/MAC levels, selecting the type of ad-hoc routing protocol for wireless nodes or defining their energy model. Simulator node-config accommodates flexible and modular construction of different node definitions within the same base Node class. For instance, to create a mobile node capable of wireless communication, one no longer needs a specialized node creation command.

B.2) Full cooperation under complete information:

First, for the ideal case of full cooperation under complete information, the problem is formulated as a deterministic relay selection problem among all the helping MTs for the cases of split table or non-split table data at the source MT. It is further shown that in the case of split table data, the optimal rate allocation follows a simple threshold structure and can be implemented efficiently.

B.3) Partial cooperation under incomplete information:

Then, for the practical case of partial cooperation under incomplete information, the MTs belong to entities of individual interests and cannot share private information to the other MTs. Under the uncertainties on the battery levels and channel conditions of the helping MTs, we formulate the

MT's pricing and load sharing problem as an optimization problem for the two cases of split table and non-split table data of the source MT, respectively. Efficient algorithms based on dichotomous search and alternative optimization is proposed for the solutions of the problem.

B.4) Initialization Mode:

The WMN module checks whether it received any

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packages from the RF transceiver, and validates the checksum correctness. If the package is valid and it is a Beacon (from another router), it adds the source node ID into the parent buffer for later use by the Parent_Select function (which will be introduced later in this section). If the beacon queue buffers sufficient node IDs, then it executes the Parent_Select function to determine the best parent candidate; the module joins the selected parent's network and enters Idle Mode.

B.5) Idle Mode:

Idle Mode periodically checks the Boolean variables to go to different modes, which were modified by the timer ISR. The Initial Mode, Receive Mode and Transmit Mode are mutually exclusive. The Sense Mode is checked for whether it needs to sample data from the sensing component connected to the WMN module. At the end of Transmit Mode and Receive Mode, it also checks the status of the network connection (i.e., is the current parent reachable?), and will execute Initial Mode to find another, better parent if necessary.

B.6) Receive Mode and Process Mode:

Receive Mode starts by recording the current start time of the timeslot, then turns on the RF transceiver and waits for an incoming data package. This mode ends after timeout. If a package is received, it checks the checksum and forwards the data package to the corresponding path. In this mode, we synchronize the internal clock if it is a valid beacon package from its parent. In order to save energy, Process Mode checks the corresponding variable and if it is false, goes to Sleep Mode immediately. Otherwise, it processes data in the buffer until the buffer is empty. As this design is timing sensitive, the total time used by Receive Mode and Process Mode must not exceed the length of a timeslot. In this design, the timer ISR toggles Process.

B.7) Sense Mode and Transmit Mode:

In Sense Mode, the microprocessor collects data from its external sensors because the proposed WMN module can read from external sensors independently without support from a host

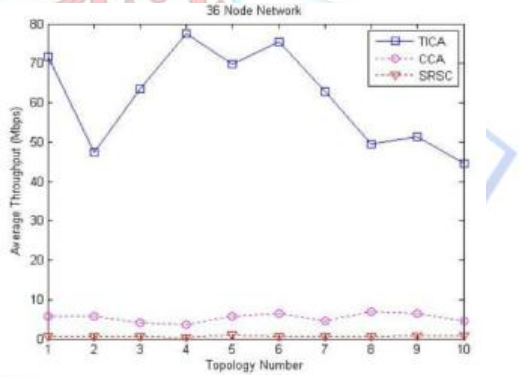
processor. On the WMN module's timeslot, it sends all the data in the buffer to the RF transceiver. After the send buffer is empty, it goes to Sleep Mode to save energy.

V. EXPECTED OUTCOME

The proposed WMN was evaluated to verify the correctness and thereby measure the environmental parameters in an apt way. And also in this paper we are trying to produce a Simulation which will help in saving the energy and data thereby increase the lifetime of the Wireless mesh module.

The sensor nodes were placed in an open space for some respective time which will help in gathering the required amount of data from the environment.

The figures are a result of simulation done on a 36 node network who output can add up to saving many necessary seconds that will help in building a network of larger network life



To subsequently increase the lifetime and to have a balance we always depend on the WMN module modes. Whose current state and movement can add up many required life seconds for the working module and thereby can help in transmitting the data in a very limited amount of time and energy

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VI. CONCLUSION

In this paper we have evaluated the actual performance of the WMN module when subjected to small changes that we have made in the modes. Operating the modes when needed will not only give a better performance ratio rather it can extend the life time of the network and indirectly it results in increasing the monitoring conditions of the environment. Earlier studies have predicted that this advancement in this theory will rather bring an efficiency upto 95% and above beating its earlier record of 94.4%.

So we can actually have this as a base and start building and making necessary changes thereby we can reach the efficiency as targeted. In the future we can further investigate the performance and power consumption by improving this design and we can also aid the scientists in implementing the monitoring applications with minimal efforts

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