CS 495 – Course Project Report

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Introduction

The goal of the project was to adapt the application created in Assignment 2 to create a wireless sensor network capable of multihop routing. Each of the wireless sensor nodes was programmed to be able to monitor their environment with sensors, transmit their data, and forward data from other nodes if necessary.

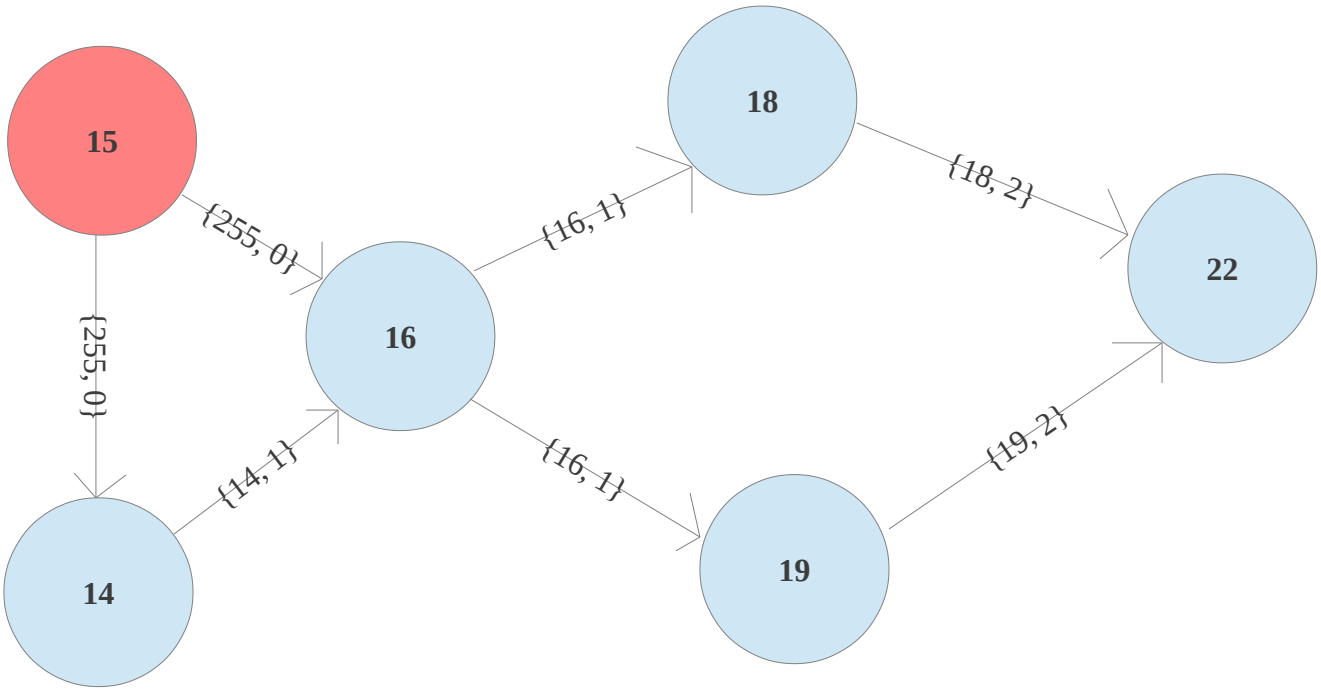
Implementation

Like in Assignment 2, the sensor nodes were programmed to use their sensors at specified intervals in order to monitor their environment. Once the sensors have completed their readings, the nodes transmit their data. Unlike Assignment 2, however, wireless sensor nodes are capable of receiving the sensor data sent by other nodes and forwarding the data if necessary. This allows for multihop communication between nodes and the base station.

In order for nodes to be able to correctly route their data to the base station, a path calculation method had to be implemented. Path calculation in this project is accomplished using a PathCalcMsg packet and by having each node store the ID of the next node in its path to the base station. The PathCalcMsg is intitially sent by the base station and propogates throughout the wireless sensor network. The base station application was modified in order to send these messages.

Each PathCalcMsg contains the ID of the node that sent it, along with the number of hops from that node to the base station. When a node receives a PathCalcMsg it checks the number of hops from the messages source node to the base station and if the number of hops is less than the current node's number of hops to the base station, the node updates its stored next node ID and adds one the the received number of hops. Once a node has received a PathCalcMsg and has determined the next node in its path, it transmits a PathCalcMsg of its own.

Network Topology



Problems

The implementation in this project is not adaptable to a network of mobile sensor nodes. If a node, Node A, is initially within range of the base station, then it will store the base station ID for its next node in its path and will have one hop to the base station. If this node later moves out of the range of the base station, but into the range of another node, Node B, then since the number of hops from Node A to Node B to the base station is two and Node A is still storing the base station as its next node with a one hop distance, Node A will not update its next node. This issue could be partially resolved by resetting the number of hops variable at certain time intervals.

Initially the application was being installed on TMote Sky nodes. However, the application was not able to receive messages. This issue did not occur with TelosB nodes. After this, when attempting to build the application, more errors occurred. Since TMote Sky nodes were initially being used, the "make tmote" command was used to build the application. However, this command eventually started creating a telosb build folder and the application was not able to be installed on the TMote Sky nodes. Again, this issue was avoided by instead using TelosB nodes.

Testing the application proved to be difficult as the appropriate ranges required were difficult to find.

Another issue occurred while all five sensor nodes were transmitting data with a noticeable increase in data loss.

Conclusion

Although thorough, larger-scale testing was not conducted, testing with three nodes showed that the nodes were to be able to establish a path to the base station even when one or more nodes were outside of the base station's range. The intermediary nodes were also able to successfully forward the sensor data transmitted by other nodes.