International Journal of Emerging Engineering Research and Technology
Volume 3, Issue 5, May 2015, PP 33-37
ISSN 2349-4395 (Print) & ISSN 2349-4409 (Online)

Secure Handoff Management in Wireless Sensor Networks

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ABSTRACT

Handoff in Wireless Sensor Network as the process where a mobile node changes the destination addresses of its data packets from one access point to another. Mobility Management is an essential problem for wireless communication especially in wireless sensor network. The RSSI approach (Received Signal Strength) is an arbitrary units; is an indication of the power level being received by the antenna. The RSSI is high, then its produce the stronger signal. However, when Handoff is performed by RSSI, produce the high rate of packet loss. To tackle this problem a generic approach Fuzzy Logic Mobility Controller (FLMC) is used to reduce the bandwidth and it is placed in each source sensor node. It is proposed to aid mobile sensor nodes to decide whether they have to perform the handoff to a new position or not. The FLMC has shown significant benefits compared to other conventional solutions in terms of packet delivery ratio, energy consumption, throughput and bandwidth. To further reduce the power consumption the nodes are formed as clusters. In this technique the node with minimum weight value is chosen as cluster head. By using fuzzy logic, if any cluster member decides to leave from a cluster means then its mobility will be predicted. This technique uses RSSI and node's velocity and calculates the residence time of the Cluster member. Authentication is performed when the handoff process is initiated.

Keywords: Wireless Sensor Networks, Mobility, Handoff, Fuzzy Logic, FLMC, RSSI.

INTRODUCTION

Wireless sensor networks are the networks that use radio frequency channels as their physical medium for communication. It provides a bridge between the real physical and virtual worlds. A wireless sensor network is a collection of nodes organized in a network. Each node consists of one or more microcontrollers, CPUs or DSP chips, a memory and a RF transceiver, a power source such as batteries and accommodates various sensors and actuators. Nodes that transmit and receive over the air, need to be physically connected to any network, such networks offer data connectivity along with user mobility. The mobile user moves over the network, orientation messages are sent from the sensor to the sink forwarded by intermediate nodes. Data may be sent via different intermediate nodes based on the location of the mobile user. In order to continuously receive information from the mobile workers a mobility management technique must be implemented so as to enable the handoff between different access points. A handover process starts by a mobile node (MN) when it receives weak RSSI from a BS/AP. After getting weak signals from the current BS/AP, an MN starts searching for available networks. The handover time is mainly dependent on the scanning delay of the available networks. Fuzzy Logic (FL) techniques are used to predict the mobility of the movable nodes. FLMC is designed to enable any wireless sensor MN to decide intelligently whether the handoff procedure has to be triggered. If the RSSI of the communication link between the MN and the current parent is below a predefined threshold H then the MN will trigger a handoff. This option was named RSSI Threshold handoff. The RSSI information is available at the frame header of every packet that is transmitted.

RELATED WORKS

In order to efficiently monitor or control a mobile person moving in a WSN area, the mobile entity must be able to handoff between different supporting nodes or networks while performing its

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movement. Mobility management [1] deals with location of the subscriber for data delivery, maintenance of the Subscriber's connection during change of location from one base station to another. The two main functionalities of mobility management includes: A) Location management and B) Handoff management. Mobility management enables communication network to locate roaming terminals in order to deliver data packets and maintain connections with terminals moving into new areas.

Location Management

Location management [2] tracks the mobile node during the communication between two devices. It includes two important tasks, namely, (i) Location update, and (ii) Call delivery. In location update (also called as location registration), the mobile device periodically informs the system to update relevant location databases with its up to date location information. In call delivery, the system determines the current location of the mobile terminal.

Handoff Management

The handoff management is the process in which the mobile device keeps its connection active when it moves from one access point to another. There are three stages in a handoff process. First, the initiation of handoff is triggered by either the mobile device, or a network agent, or the changing network conditions. The second stage is for a new connection generation, where the network must find new resources for the handoff connection. Finally, data-flow control needs to maintain the delivery of the data from the old connection path to the new connection path.

In [9], consider a fuzzy system for making routing decisions. Here Fuzzy Logic has been used for routing and management of a network. The system is based on the fuzzy inference system. The major components of the system consist of the knowledge base, decision making, fuzzification and defuzzification.

In [4], consider a MIH standard for provide handover management in heterogeneous networks. The MIH standard uses different events messages to control the process of handover management. These events messages are used by an MN for communication with a BS/AP and also by AP/BS for communication with an MN, new AP/BS, and MIIS server. MIIS server is used for supporting various information services that can provide available networks within a geographical area.

In [10], the handoff decision strategy is given by fuzzy MADM (Multiple Attribute Decision Making).The fuzzy logic concept is used because of the imprecise information of the network criteria. The selection of network with respect to the basic criteria is based on Ranking of those criteria. This ranking in deciding the suitable network is determined by using either Multiple Objective Decision Making (MODM) or Multiple Attribute Decision Making (MADM). Usually MADM method has two main phases: (1) the rating of each network, by aggregation of the degree of satisfaction for all criteria, per decision network; and (2) the ranking of the network with respect to the global aggregated degree of satisfaction.

PROPOSED SYSTEM

If the RSSI of the communication link between the MN and the current parent is below a predefined threshold H then the MN will trigger a handoff. This option was named RSSI Threshold handoff. The RSSI information is available at the frame header of every packet that is transmitted. The Fuzzy Logic (FL) techniques are used to predict the mobility of the movable nodes. The reasons for selecting Fuzzy Logic are:

- It has the ability to control nonlinear systems based on observable phenomena.
- It provides the opportunity to easily modify the experts-defined rules and tune the membership functions so that to achieve the desired performance. In other words, fuzzy logic can be flexible.
- It can be built based on the experience of people who already understand the system.

Framework of WSN

WSN has mainly been focused on protocols and algorithms for applications, in which large, random, and static deployment is the norm and in which node mobility and network performance assurances are not considered critical. Most sensor applications need the deployment to be infrastructure-less, without any human intervention. It is the responsibility of the sensor network to be adaptable to any physical changes like the addition of extra nodes Mobility support in this work has been mainly motivated by the need to monitor the status of mobile workers. Sensors attached to mobile workers, their condition can be monitored and alarms can be signaled when an emergency occurs.

Fuzzy Logic Mobility Controller

The Fuzzy Logic-based Mobility Controller (FLMC) is designed to enable any wireless sensor MN to decide intelligently whether the handoff procedure has to be triggered. Aim is to ensure that the controller will have the proper information available to be able to make good decisions, and will have proper control inputs to be able to steer the controlled system in the directions needed, so that it achieves a high-performance operation. A simple fuzzy inference engine (FIE) is designed to operate locally at each sensor MN, and control the handoff decision procedure, using linguistic rules that describe the behavior of the environment in differing widely operating conditions. The FIE implements a nonlinear decision probability to trigger the decision whether a sensor mobile node has to handoff to a new position or not.

Cellular Topology Results

To form the cellular topology, initially 50 nodes are created. From those nodes select one node as mobile user. Base stations are created in the cellular topology. By using the base station only handoff is performed without call dropping. This topology is used to compare the RSSI and FLMC through the performance metrics such as throughput, handoff delay, bandwidth, packet delivery ratio, packet received, delay, end to end latency, call connection.

EXPERIMENTAL RESULTS

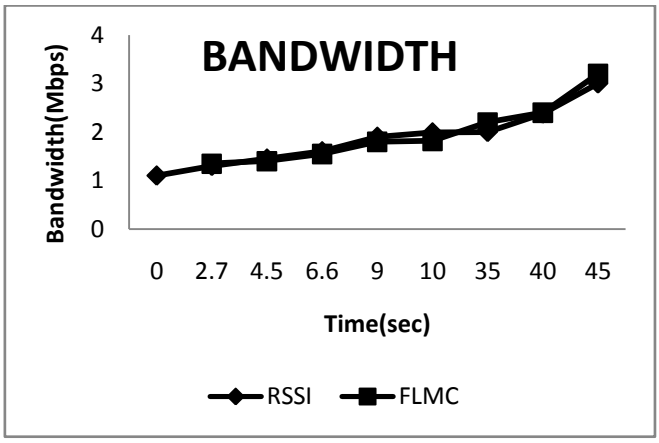

Fig1. *Bandwidth comparison of RSSI and FLMC*

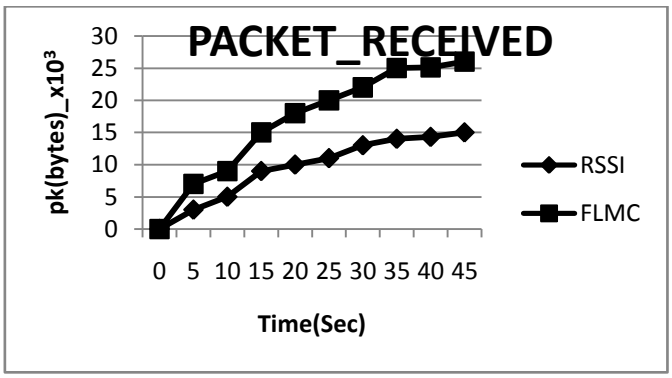

Fig2. *Packet Received comparison of RSSI and FLMC*

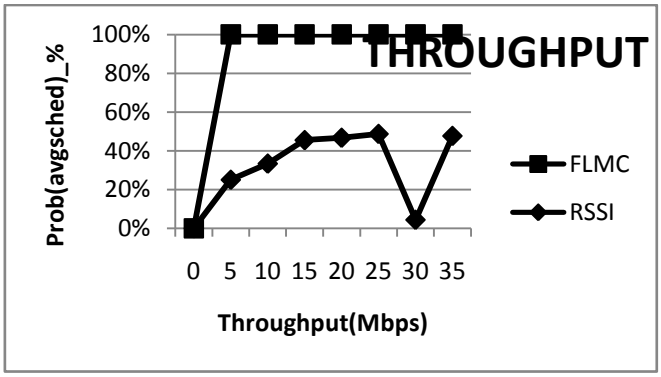

Fig3. *Throughput comparison of RSSI and FLMC*

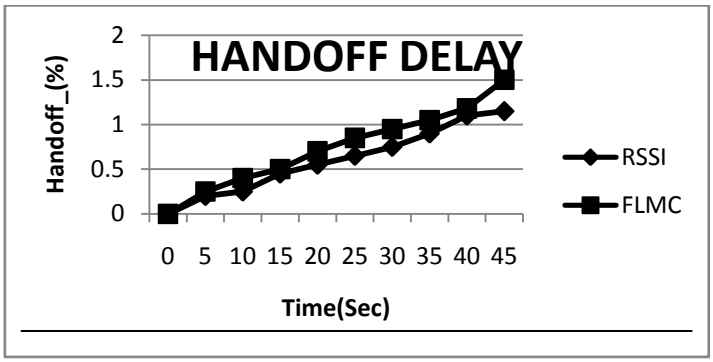

Fig4.*Handoff Delay comparison of RSSI and FLMC*

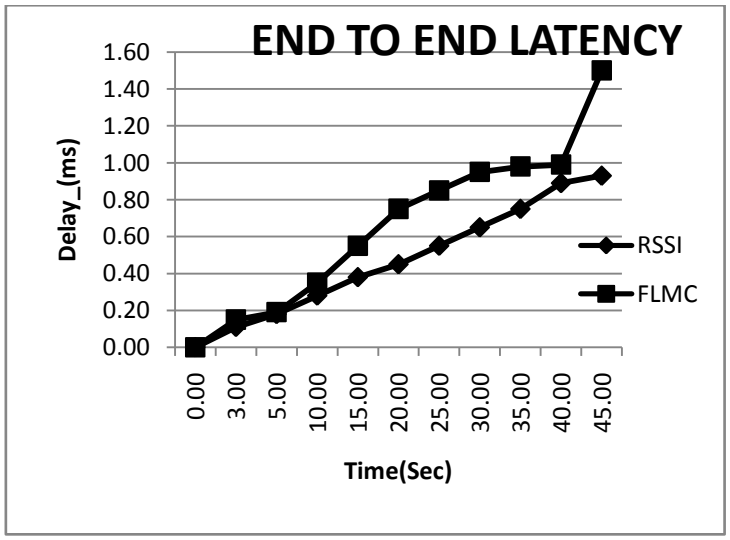

Fig5. *End to End Latency comparison of RSSI and FLMC*

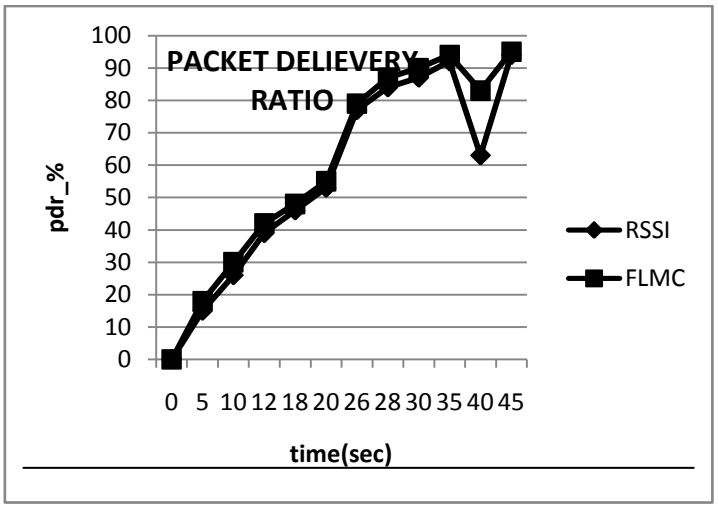

Fig6.*Packet Delivery Ratio comparison of RSSI and FLMC*

CONCLUSION

The simulation results indicate a better overall performance of the proposed scheme in terms of Bandwidth, Packet Received, Throughput, Handoff Delay, End to End latency, Packet delivery Ratio and increased connection time with the selected network that is preferred by the end-user. The Fuzzy Logic is used to predict the mobility of movable nodes and reduce the number of handoffs. Other schemes implemented and simulated in terms of intelligent and efficient handoff decisions.

FUTURE WORK

In future, an adaptive way of Clustering formation is used to reduce the power consumption and use security algorithms to ensure the authentication for the handoff process.

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