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PERFORMANCE ANALYSIS OF FIRE ALARM SYSTEM BASED ON WIRELESS SENSOR NETWORKS USING NS-2**B. RAJESH****STUDENT**

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ABSTRACT

Fire disaster is one of the most dangerous professions in which people are employed. Automatic fire alarm system provides real-time surveillance, monitoring and automatic alarm. It sends early alarm when the fire occurs and helps to reduce the fire damage. In this paper, the use of wireless sensor networks may be one way of reducing the risk faced by the fire disasters and assist in the process of rapid extinguishment of the fire. The NS2 simulation environment is a flexible tool for network engineers to investigate how various protocols perform with different configuration and topologies and the ns-2 framework to include support for sensor networks. This paper presents the simulation results in order to choose the best routing protocol to give the highest performance when implement the routing protocols in the target mobile node application. The simulations comparing two ad hoc routing protocols named DSDV and AODV.

KEYWORDS

wireless sensor networks, fire alarm system.

INTRODUCTION

In recent years, wireless sensor networks (WSNs) are widely deployed in environmental monitoring, structural health monitoring and industrial monitoring. It provides low cost solutions for such applications. It consists of small size, low-power, and low-cost devices that integrated with limited computation, sensing, and radio communication capabilities. So WSN is very suitable for communication between detectors in fire alarm system. Automatic fire alarm system is widely deployed in more hazardous places. Large numbers of small fire detectors should report their information to the control center of a building or a block.

Recent technological improvements have made the deployment of small, inexpensive, low-power, distributed devices, which are capable of local processing and wireless communication, a reality. Such nodes are called as sensor nodes. Each sensor node is capable of only a limited amount of processing. But when coordinated with the information from a large number of other nodes, they have the ability to measure a given physical environment in great detail. Thus, a sensor network can be described as a collection of sensor nodes which co-ordinate to perform some specific action. Unlike traditional networks, sensor networks depend on dense deployment and co-ordination to carry out their tasks.

The primary purpose of this project is to establish a foundation in ns-2 for simulating sensor networks. This foundation consists of building sensor nodes that are tapped into an 802.11 channel for communicating with surveillance center. This work is a small contribution that should benefit sensor network research where simulation is appropriate. It is an effort to aid the analysis of various sensor network configurations under the demands of specific sensor applications.

The paper begins with an overview of the Related Work, followed by section 3 describes our extensions to ns-2 and guidelines for using them in simulations. Section 4 discusses system design and implementation. Results of the simulation are discussed in section 5. Followed by conclusions in Section 6.

RELATED WORK

Wireless sensor networks are dense wireless networks of small, low-cost sensors, which collect and disseminate environmental data [1]. Therefore wireless sensor networks can be an alternative in these cases since WSNs are deployed without the need for any pre-existing infrastructure and with little maintenance [2]. Faouzi Derbel researched the reliability of wireless communication for fire detection systems in commercial and residential areas, and analyzed parameters that can influence the radio transmission within buildings [3]. NS-2 for simulating sensor networks [3] consists of building sensor nodes that are tapped in to an 802.11 channel for communicating with surveillance center. Performance evolution of routing protocols using NS2 simulations [4].

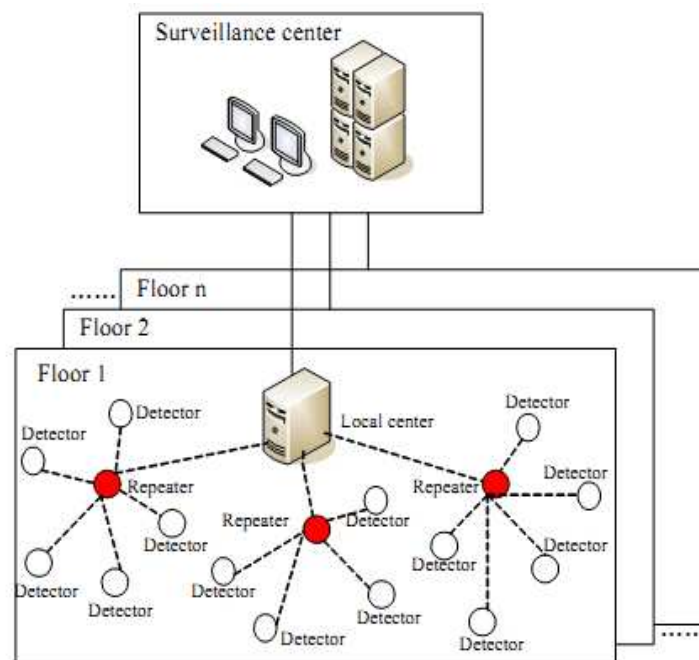
WSN FOR FIRE ALARM SYSTEM**NETWORK ARCHITECTURE**

Nowadays, securing one's property and business against fire is becoming more and more important. Monitoring commercial and residential areas all-round is an effective method to reduce personal and property losses due to fire disasters. Automatic fire alarm system is widely deployed in those sites recent years. Large numbers of small fire detectors should report their information to the control center of a building or a block. But the cost of wiring is very high in traditional wired fire alarm systems.

As we know, large numbers of monitoring points are required in high-rise buildings. Due to transmission distance limitations of low-power radio, repeaters are required to relay monitoring information from detectors to surveillance center. If all the monitoring information is transmitted to the surveillance center directly, the network load becomes very heavy. In order to reduce the communication overload and improve the stability of network, a hierarchical structure is designed for our system. The network architecture is shown in Figure.1 large numbers of detectors [2], some repeaters and a local center constitute the wireless sensor network, which responsible for fire detection of one floor. The detector is the simplest monitor, which must connect to repeater to report its monitoring

information. The repeater not only monitoring its area, but also provide network access for detectors. The surveillance information of one floor is aggregated by local center, and local centers of every floor report the monitoring information of the floor to the surveillance center through cable connection.

FIGURE 1: NETWORK ARCHITECTURE



SYSTEM DESIGN AND IMPLEMENTATION

NETWORK SIMULATOR 2 (NS-2)

NS2 is one of the most popular open source network simulators. The original NS is a discrete event simulator targeted at networking research. In this section, we will give a brief introduction to the NS2 system [3].

For network simulation, more specifically, it means that the computer assisted simulation technologies are being applied in the simulation of networking algorithms or systems by using software engineering [4]. The application field is narrower than general simulation and it is natural that more specific requirements will be placed on network simulations [1]. For example, the network simulations may put more emphasis on the performance or validity of a distributed protocol or algorithm rather than the visual or real-time visibility features of the simulations.

FIGURE 2: CLUSTER ARCHITECTURE



CLUSTER ARCHITECTURE

The network system taking 4 clusters, each cluster consists of 9 nodes and these clusters contain a cluster head. All the nodes in the cluster have to report the observations to the cluster head if in case the cluster head is dead it can take other node as head, in the cluster choose the packet sending at nearest path, so cluster head in turn will report to the local server (Figure 2). the node 36 is local server and node 37 is surveillance center through with out cable connection.

AD HOC ROUTING PROTOCOLS

An ad-hoc network is a collection of wireless mobile nodes dynamically forming a temporary network without the use of any existing network infrastructure or centralized administration. A number of routing protocols like Ad Hoc On- Demand Distance Vector Routing (AODV) and Destination- Sequenced Distance-Vector (DSDV) have been implemented.

DESTINATION SEQUENCED DISTANCE VECTOR (DSDV) PROTOCOL

The destination sequenced distance vector routing protocol is a proactive routing protocol which is a modification of conventional Bellman-Ford routing algorithm. This protocol adds a new attribute, sequence number, to each route table entry at each node [9]. Routing table is maintained at each node and with this table; node transmits the packets to other nodes in the network. This protocol was motivated for the use of data exchange along changing and arbitrary paths of interconnection which may not be close to any base station.

AD-HOC ON-DEMAND DISTANCE VECTOR (AODV) PROTOCOL

AODV is a very simple, efficient, and effective routing protocol for Mobile Ad-hoc Networks which do not have fixed topology. This algorithm was motivated by the limited bandwidth that is available in the media that are used for wireless communications [7]. It borrows most of the advantageous concepts from DSR and DSDV algorithms [8] the on demand route discovery and route maintenance from DSR and hop-by-hop routing, usage of node sequence numbers from

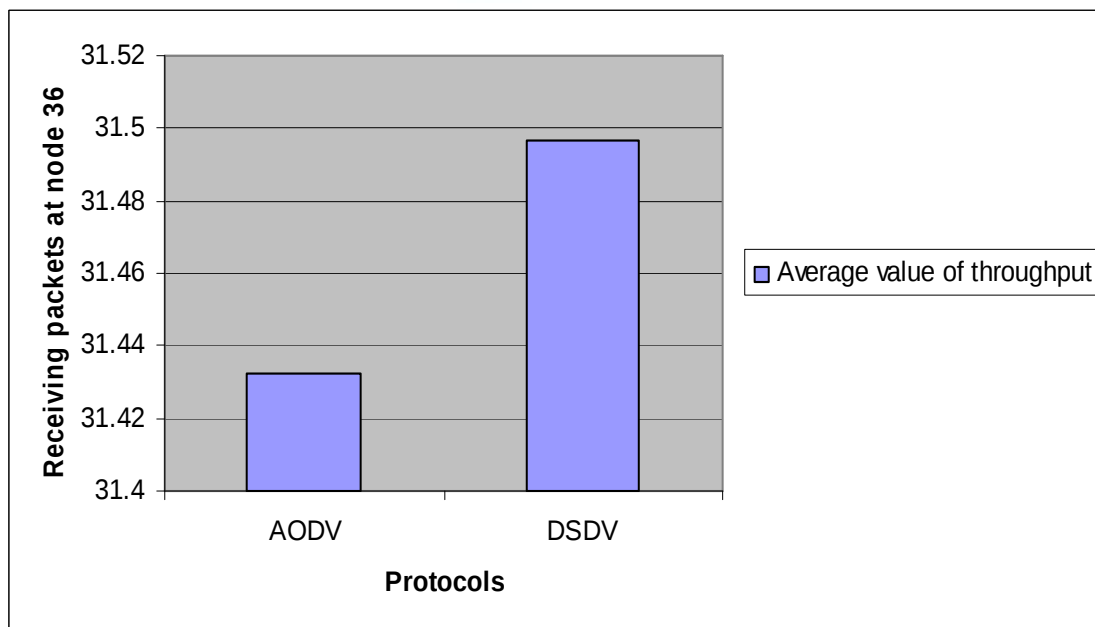
DSDV make the algorithm cope up with topology and routing information. Obtaining the routes purely on-demand makes AODV a very useful and desired algorithm for MANET's.

PERFORMANCE ANALYSIS OF DSDV AND AODV

AVERAGE VALUE OF THROUGHPUT

Figure 3, Throughput is a measure of how fast we can send the data through the network. Comparison of AODV and DSDV using average value of throughput. The explanation of given graph means first we have to take the AODV throughput of receiving packets to 36 node (local center) and same as DSDV throughput of receiving packets to node 36. then we can take average value of throughput choosen. The AODV protocol has less data send to node 36 compare to DSDV so DSDV is the better protocol in the throughput. This graph implementation first we have to take the every cluster send the packets to the local center node 36, so that that time the local center how many packets are receive at the random time to check this type of simulation and to draw the throughput graph of comparison with both AODV and DSDV.

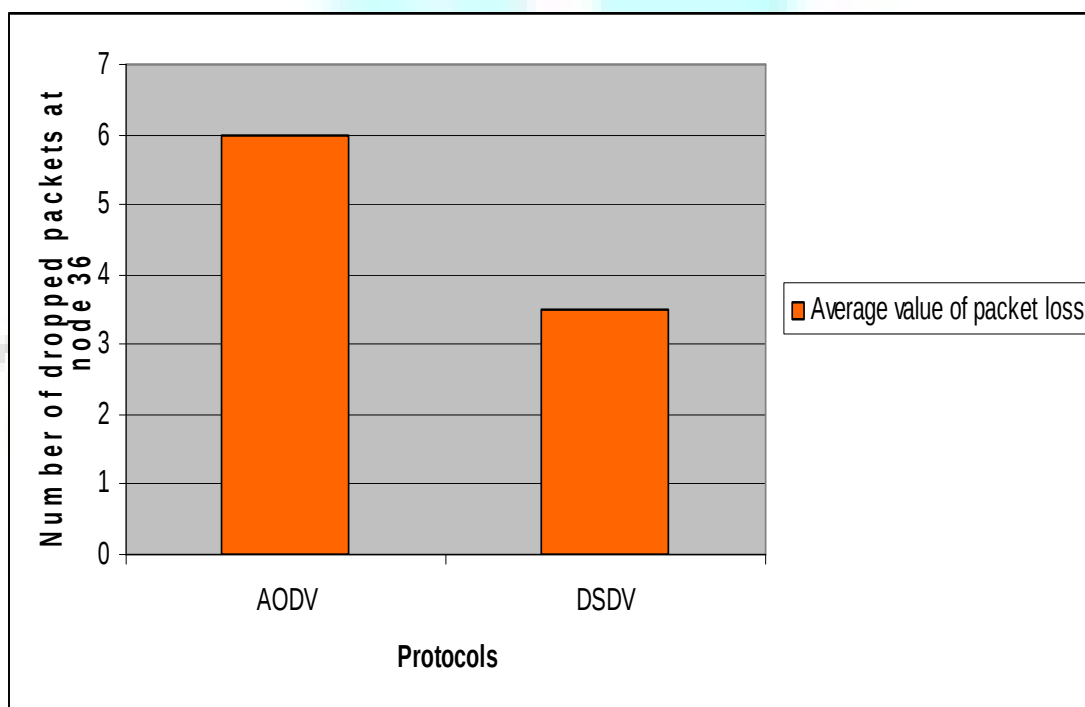
FIGURE 3: THROUGHPUT OF RECEIVING PACKETS AT LOCAL CENTER (NODE 36)



AVERAGE PACKET LOSS

Figure 4; show not much packet loss on DSDV side. This is because when a link fails, a routing error is passed back to a transmitting node and the process repeats. Meanwhile for AODV, this routing protocol shows it is as good as DSDV if packet loss be as indicator [7]. This can be prove by the characteristics of AODV which information on new Routes, broken Links, metric change is immediately propagated to neighbors. This graph implementation first we have to take the every cluster send the packets to the local center node 36, so that that time the local center how many packets are receive at the random time to check and how many packets are dropped at that time and to draw the packet loss graph of comparison with both AODV and DSDV.

FIGURE 4: NUMBER OF DROPPED PACKETS AT THE NODE 36



RESULTS

Throughput and packet loss in the network by using AODV and DSDV are shown in the figures 6,7,8,9 respectively. The average packets generated, sent, received and dropped values are given in the table 1.

FIGURE 5: THROUGHPUT IN AODV

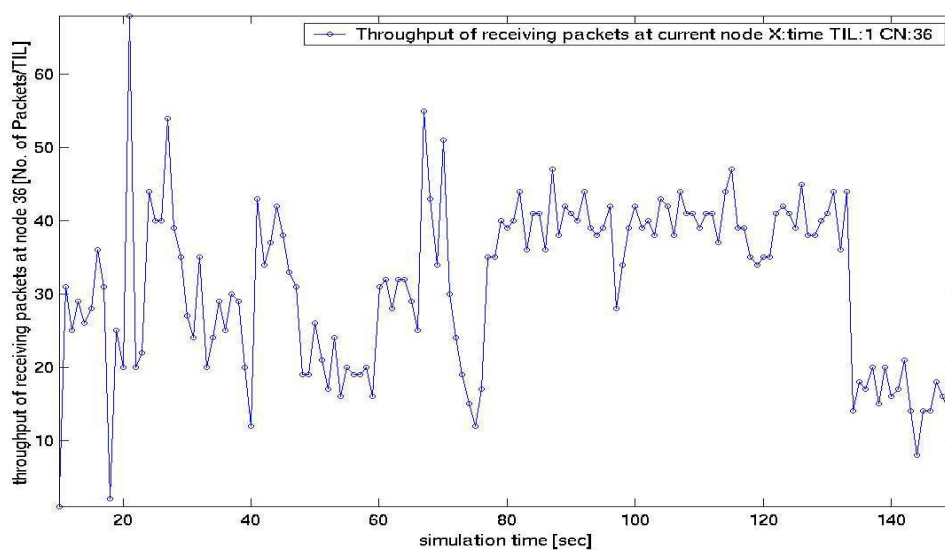


FIGURE 6: THROUGHPUT IN DSDV

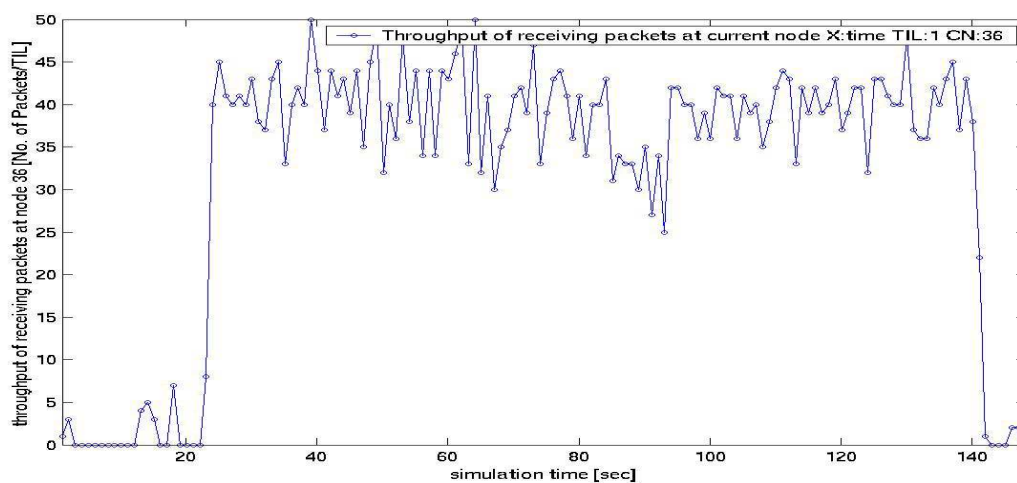


FIGURE 7: PACKET LOSS IN AODV

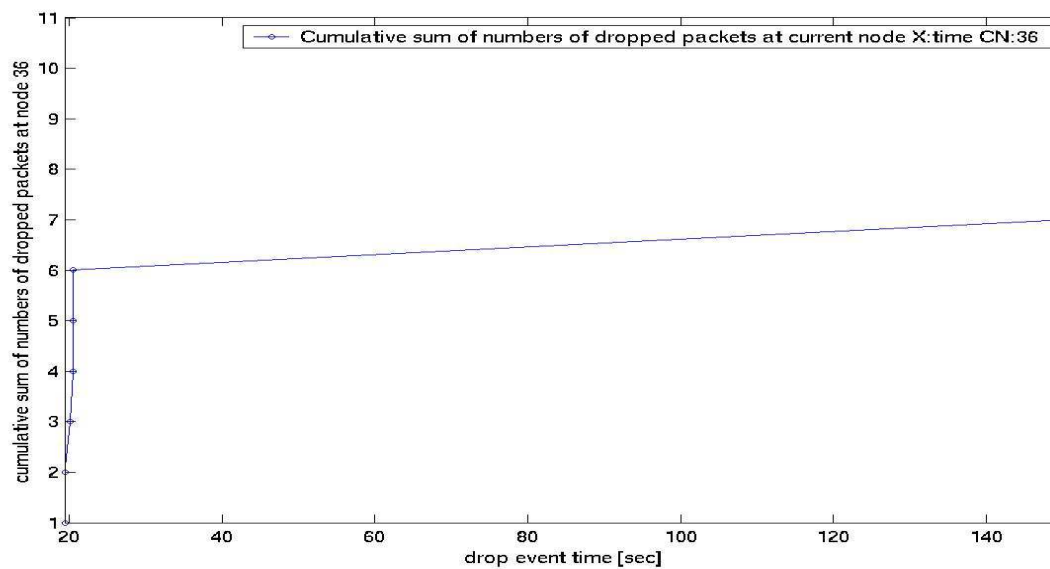


FIGURE 8: PACKET LOSS IN DSDV

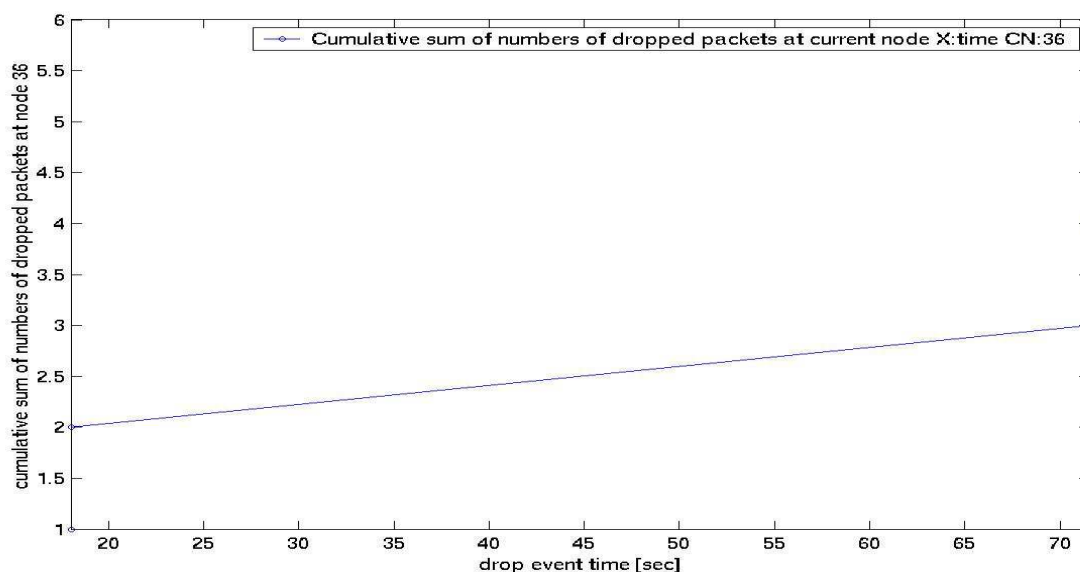


TABLE 1: PERFORMANCE ANALYSIS OF CLUSTER ARCHITECTURE

	Routing protocols	Average value of generated packets	Average value of sent packets	Average value of received packets	Average value of dropped packets
Cluster architecture	AODV	6179.5	5269.5	5035	6
	DSDV	5102.5	5060	4308.5	3.5

CONCLUSION AND FUTURE WORK

An automatic fire alarm system based on wireless sensor networks in NS-2 is designed and developed with emphasis on the network architecture and communication protocol. Prototype system tests show that the system provides early extinguishing of a fire disaster so that damages will be reduced effectively. Detector in this system due to localization mechanism is considered. This paper does the comparison of two routing protocols DSDV, AODV. The significant observation is, simulation results agree with expected results based on theoretical analysis. As expected, reactive routing protocol DSDV performance is the best considering its ability to maintain connection by periodic exchange of information, which is required for TCP, based traffic. In future implementing the clustered based routing protocol LEACH can be simulated.

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