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Performance Evaluation of ad hoc Wireless Local Area Network in Telemedicine Applications

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Abstract

The presented paper evaluates and compares the performance of routing protocols in Wireless Ad Hoc network and also discusses the application of ad hoc mode of wireless local area network (WLAN) in emergency health services for a hospital. The vital data of patients within a hospital are monitored and communicated to doctors within the hospital. The proposed scenario helps in managing any emergency situation to a great extent and reduces the delays which may be crucial for such emergency situations. In the proposed study, the doctors and patients are assumed to be mobile so as to mimic the real situation. However, the movement of patient and doctors are confined to a limited range.

Keywords: WLAN, Telemedicine, Ad Hoc network, Performance Evaluation

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1. Introduction

The past decade has witnessed mammoth developments in the field of communication and network technology. Health services are one such area, which can have a high impact of these advancements. The evolution of mobile telemedicine has made possible to transfer vital sign of a patient across any geographical areas in a flash, thus minimizing even the slightest lapse of critical time and saving the patient's life in many cases. However, despite being a normal practice for hospitals in US and other developed nations, these telemedicine technologies still do not find much application in developing nations due to multiple reasons such as cost, lack of infrastructure, etc. Therefore, to promote telemedicine in these nations, more studies and research are needed to establish the suitability of such applications in the context of current communication and network technologies.

There are wide ranges of communication technologies that have been employed in telemedicine. Wireless Local Area Network (WLAN) based on the IEEE.802.11 family of standards is the first and the oldest technology to be used in medical applications [1]. WLAN still remains a popular option because of its ease of use and economic viability. Further, it supports mobility of users (up to a few meters) and provides a reasonable amount of bandwidth. Hence, WLAN seems to be the best suited network that can be used in areas which do not have extended network infrastructures.

In addition, the non-infrastructure oriented WLAN or Ad Hoc WLAN is best suitable for temporary connections and short duration transmission and can play a vital role in case of emergency applications. As WLAN chosen as the network for analysis, this paper aims to analyze performance of routing protocols, namely Ad hoc On-Demand Distance Vector (AODV) and Destination-Sequenced Distance-Routing (DSDV) and their application in remote healthcare services. Based on the result the study will be extended to other protocols.

Section II explains the basic information of wireless routing protocols, which are being used. In the Section III, the designed scenario and simulation for the proposed paper has been discussed. The section IV lists out the parameters on which the two protocols are evaluated. The network design in the simulation environment is discussed in Section V followed by the simulation results and discussions in Section VI. Finally, the conclusions are discussed in Section VII.

2. Wireless Routing Protocols for Health Services

WLAN networks fall under two major categories, infrastructure-oriented and Ad Hoc Networks [2], which are non-infrastructure oriented [3]. In infrastructure oriented networks the nodes are connected to an access point which act as a central point of communication. Whereas, in Ad Hoc networks, the mobile nodes form a decentralized network, which work without any access point [4].

However, the Infrastructure based networks are more efficient than Ad Hoc networks. In general, they do not account for much when additional nodes (or patients in this case) are to be added immediately as required in case of an emergency. Hence, in this paper, we have focused on using the Ad Hoc network for implementing patient monitoring systems as in many situations, the establishment of the infrastructure based network is not possible due to the nature of the problem and time limitations. Routing protocols in Ad Hoc networks [3, 5] are classified into three categories: Table Driven, On Demand [6] and Hybrid [7].

In Table-Driven routing protocols [8], the routing tables are present at each node which is updated periodically and the routing that occurs is done on the basis of data from these tables. In On-Demand Routing Protocol routes are decided on demand by flooding the network with route request packets (RRPs). The combination of reactive and proactive protocols known as the hybrid protocol is presented in [7, 9]. The routing protocols discussed in this paper are AODV and DSDV, which are an example of On-Demand and Table-Driven routing protocol, respectively [10].