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Optimized RTS/CTS Exchange Approach for Better Performance in Multi-Hope WLAN Environment

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ABSTRACT— ***The rapid growth of computer network takes the concentration of researchers in this era. When the data would like to transmit from source to destination then RTS/CTS communicate first in order to reduce the packet collision. This communication takes a long time for hand shaking. There is a need of improving the performance of RTS/CTS mechanism. In this paper focus on the problem with RTS/CTS protocol ie performance of RTS/CTS handshaking mechanism degrade if system having few number of hidden node ,to overcome this problem presented paper proposed a methodology with the hidden node and minimized transmission overhead of RTS/CTS handshaking.***

Keywords: **WLAN, CSMA/CA, RTS/CTS Handshaking, Neighbour Table Hidden Table**.

I. INTRODUCTION

In spite of having line communication the wireless network take place all over the communication system. So Mobile Ad hoc Networks (MANETs) is in higher interest of researchers. A self configured network with wireless connectivity is known as MANETs. A Stranded protocol IEEE 802.11 is has been use in Wireless Local Area Networks (WLANs). IEEE 802.11 specifies Medium Access Control (MAC) and Physical (PHY) layers for WLANs [1].

RTS / CTS is an optional four-way handshake mechanism by which DCF 802.11 adopted to reduce data frame collisions by the hidden terminal problem. The RTS and CTS short frames exchanged before the data transmission between a pair of source and destination nodes. Before transmission of a packet, an RTS will be sent, comprising the destination address and the expected data duration information. In addition to the destination address, the RTS packet is received by all other nodes in the vicinity of the source node, so that they access to the medium during the period that the source refrain is transmitted. In order to receive a RTS, the destination node responds with a CTS packet, which also confirms a broadcast packet including the data communication duration. Therefore, with the RTS / CTS mechanism is used, other nodes within the range of both the source and the target does not interfere with the intended path for packet transmission time to the next acknowledgment (ACK).

This DCF is a key function, define by IEEE 802.11. Distributed Coordination Function (DCF) is responsible for Request-to-Send (RTS) and Clear-to-Send (CTS) frame transmission between sender and receiver. It happened due to Carrier Sense Multiple Access with Collision Avoidance. The proposed work reduces the time of RTS/CTS in wireless environment.

The paper is organized as follows including the first one. Section II introduces the related works. In section III RTS/CTS protocol has discussed. Problem of RTS/CTS protocol is given in section IV. Section V shows the proposed methodology. All the Simulation and its results are shown in section VI. Finally, section VII concludes this paper.

II. RELATED WORK

Care in recent years, many electric devices equipped wireless LAN function, a high value-added service in collaboration with other devices. One of the most widely used wireless LAN standard IEEE 802.11 [10]. The IEEE802.11 employs Distributed Coordination Function (DCF) as a media access control method. DCF acts on two carrier-sense method [12]. One is the physical carrier sense with the CSMA / CA (Carrier Sense Multiple Access with Collision Avoidance) is implemented, and the other virtual carrier sense using RTS / CTS mechanism is implemented [13, 14, 15]. The virtual carrier sense is an option that is commonly used to cover the weakness of physical carrier sense in multi-hop wireless network (such as ad-hoc network, mesh network). The virtual carrier sense mechanism is through RTS / CTS handshaking [11] realized. In the RTS / CTS handshake before the data packet, control packets, called RTS (Request To Send) and CTS (Clear To Send) are exchanged between sender and receiver. These control packets contain information about how long canal will be demonstrated below. Then neighbouring terminals of the transmitter and receiver can transfer its new overheard by the control packets in case that situation, that physical carrier sense not to move to work effectively. Several studies have reported that packet collisions can be used in multi-hop network with RTS / CTS handshake. On the other side can be reduced, even though CSMA / CA is an indispensable method for wireless LAN, is RTS / CTS handshake as an optional method mentioned in IEEE802 0.11

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Standard. RTS / CTS is usually used in addition to the CSMA / CA method. Then, RTS / CTS handshake causes more control overhead transmissions. To network throughput of IEEE 802.11 network to increase, it should make a reduction of unnecessary RTS / CTS exchange. In the standard IEEE 802.11, is the use of RTS / CTS exchange only by packet length. In the standard of IEEE 802.11, RTS / CTS is used when the packet length is longer than the value of the RTS threshold, the fixed value is given by a network operator. Then RTS / CTS exchange is unnecessary if the packet length is longer than RTS Threshold in the case that hidden terminals is not intended around the terminal, the packet existed be received. Therefore, this paper is increased by reducing transmission overhead by unnecessary RTS / CTS exchange; we propose adaptive RTS / CTS control is based on the existence of hidden terminals. Our proposed method controls the use of RTS / CTS exchange adaptively based on the existence of hidden terminals around the receiving terminal.

III. RTS/CTS PROTOCOL

Collision Detection in Wireless LAN is difficult, since all the wireless stations are not able to hear each other at all the times. A station may not be in the range of all other stations. In Figure 1, nodes P, Q and R are within easy reach of access points, but are not within a range from each other. Node P has a transmission from node Q, but not by node R. If node P stops and hears no traffic, it may assume the medium without transmission errors, while node R is actually transmitted. This problem is known as the hidden terminal problem (or hidden node problem) [2, 3, 4]. In this situation, if node P starts transmitting, collision is passed. As a result, both node P and node R would have their respective packets, which leads to higher costs and lower throughput to transmit again.

To control the standard IEEE 802.11 contains [5] is an optional feature of the RTS / CTS (Request to Send / Clear to Send) function on station access to the medium when collisions occur due to hidden nodes. This option is also known as virtual carrier sensing. The correct use of RTS / CTS, you can fine-tune the operation of your wireless LAN, since it solves the hidden node problem and provides added protection against collisions [4,8]. When RTS / CTS enable for a given station, it will refrain from sending a data frame until the station completes a RTS / CTS handshake with another station, such as an Access Point. A station initiates by sending a RTS frame. The Access Point (AP) or other station receives the RTS and responds with a CTS frame. To receive the station has a CTS frame before sending the data frame. The CTS also contains a time value, to keep off other stations accessing the medium while the station initiating the RTS transmits its data alerted. Thus reducing the use of RTS / CTS collisions and improves the performance of the network if hidden nodes are present. Figure 2 and Figure 3 shows, and RTS / CTS scheme. Please note that the use of SIFS (Short Inter Frame Space), and only NAV (Network Allocation Vector) makes in order to reserve the medium.

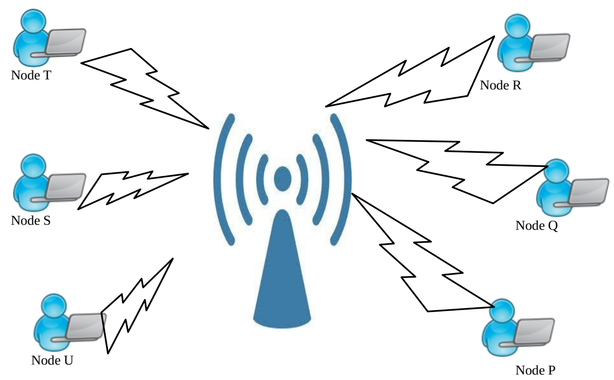

Figure 1: Hidden Node Problem

An increase in performance with RTS / CTS is the result of the introduction of overhead (ie, RTS / CTS frames) and the reduction of overhead costs (ie, fewer reps). If the network has no hidden nodes, the use of RTS / CTS will only increase the amount of overhead that can reduce throughput. In this case, the additional RTS / CTS frames cost more in overhead costs than what you gain by reducing retransmissions. Moreover, the use of RTS / CTS is useful when data frame is much longer than RTS frame [3, 4, 7, 9].

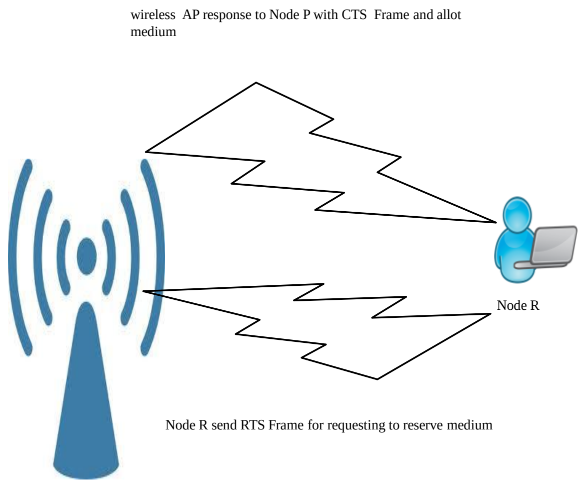

Figure 2: Medium Reservation Using RTS/CTS

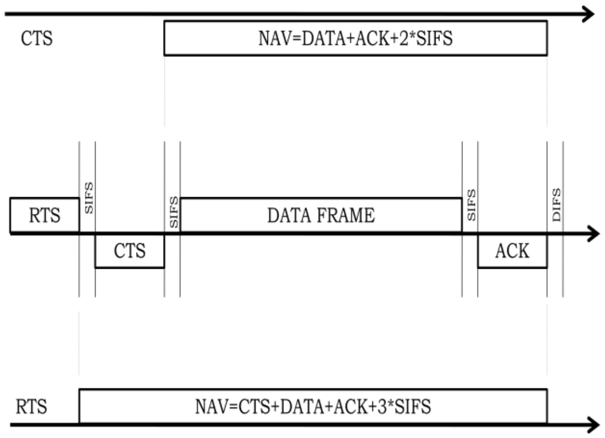

Figure 3: Time Line of RTS/CTS

When a sender wants to transmit data to another receiver, it sends a Request-to-Send packet. The receiver replies with a packet called Cleared-to-Send packet. After the transmitter node receives the CTS packet, it transmits the data packets. Encoded within the RTS/CTS packets is a duration field. The duration field is set such that the data transmission can be completed within the designated time period. If a transmitter node does not receive a CTS packet it enters into an exponential back off mode.

IV. PROBLEM IN RTS/CTS

Needless RTS / CTS exchange is increased transmission overhead. As show in the Figure 4, represented terminals A, Bi and Cj sender terminal, i^{th} neighbouring terminal, and j-th hidden terminal, respectively. Consider two situations, A transmits packet to B1 and B2. In both cases, the packet size is greater than RTS threshold, which means that RTS / CTS exchange is used for the transmissions, ie. The first case is that a packet sent to B1. In this case, although three C (hidden terminals) available to the B1, these unexpected transfers of Cs by overheard CTS will be suppressed by the B1. This is the case that RTS / CTS to work in IEEE802.11 network. On the other hand, the second, that a packet to B2. In this case RTS / CTS exchange is not for transmission, since no hidden terminal existing required to B2. In traditional IEEE802.11 standard, RTS / CTS exchange is unnecessary even in the case the packet size is greater used as RTS threshold. In the situation wasted transmission overhead of RTS / CTS exchange induced, the channel bandwidth.

V. PROPOSED METHODOLOGY

In this section we propose a new methodology optimized RTS / CTS, which would reduce the transmission overhead induced by the unnecessary RTS / CTS exchange. To reduce the transmission overhead in the new transmission, our method, the use of RTS / CTS exchange corresponding to the number of hidden terminals existing decides to the recipient of the retransmitted packet. Our method controls the use of RTS / CTS exchange, simply: If the number of hidden terminals is greater than hidden threshold, our method RTS / CTS exchange used before the new packet transmission, or transfer our method, a packet without RTS / CTS to reduce exchange-transfer overhead as show in algorithm 1 .In our method, each terminal has two types of list, are neighbour list and hidden terminal list. Each terminal computes the two lists by listening RTS and / or data packet. Once both lists have been made to each terminal is in the network know their own hidden terminal list to the number of hidden connections existing around a particular recipient.

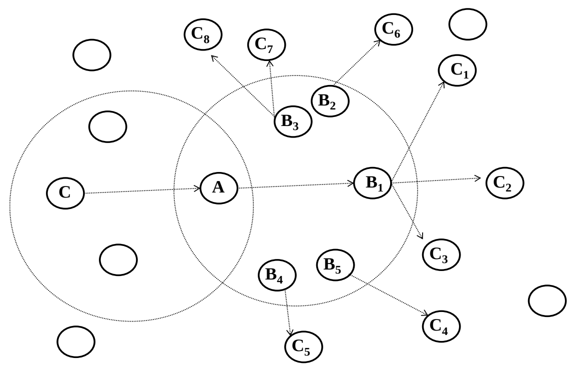

Figure 4: Network having wireless node

ALGORITH 1 (Optimized RTS/CTS)
Assumption
S_i: Source node
N_j= Neighbour node
H_k= Hidden node

Algorithm

For (i=1 ;i>=$\sum S_i$;i++)
{
For (j=1 ;j>=$\sum N_j$;j++)
{
if (HN(S_i)> $\sum H_k$)
Then
RTS/CTS used for transmission
Else
Transmission without RTS/CTS
}
}

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In Proposed methodology each terminal node Si maintain an neighbour list holds the terminal IDs of neighbouring terminals for each terminal knows as neighbour table and The hidden terminal list holds the terminals IDs of hidden Terminals for each terminal know as hidden table. Let us consider a situation S want to maintain its respective table first broadcast RTS and any terminal Nj got broadcasted packet check header of packet if source id is equal to Si and number of hop count <1 then response Si to their terminal id as neighbor node . Whereas if hop count >=1 then response Si to their terminal id as hidden node. As show in Algorithm2.

Algorithm2 (Neighbour Table, hidden table)

Assumption
S_i: Source Node
N_j= Neighbour Node
Nts_i= Neighbour Table Of Source S_i
Tid=terminal id
Hts_i= Hidden table of Source S_i

Algo( )
For (i=1 ;i>=$\sum S_i$;i++)
{
S_i Broadcast RTS To All Nodes
For (j=1 ;i>=$\sum N_j$;j++)
{
If (N_j Got RTS Request and sender Tid = $TidS_i$ and hopcount =1)
{
Response ($TIdN_j \rightarrow S_i$)
Nts_{ij}=$TidN_j$
}
Else If (N_j Got RTS Request and sender Tid = $TidS_i$ and hopcount >1)
{
Response ($TIdN_j \rightarrow S_i$)
Hts_{ij}=$TidN_j$
}
Else
Nts_{ij}=Nill
}
}

VI. Simulation and Results

The presented works has implemented in MATLAB. There are two files (one .m file and one .fig file) used to simulate the concept of this paper. The objective of simulation is to find the efficiency with proposed method and existing method as well. The given snap shots show the simulation results for both methods. The graph enclosed in this paper shows that proposed technique is better than the existing technique.

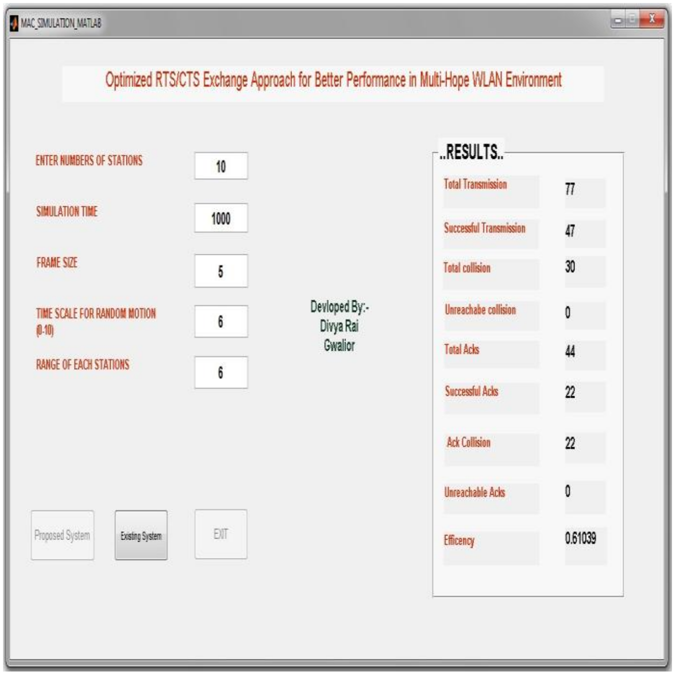

Figure 5: Outputs foe Proposed Method

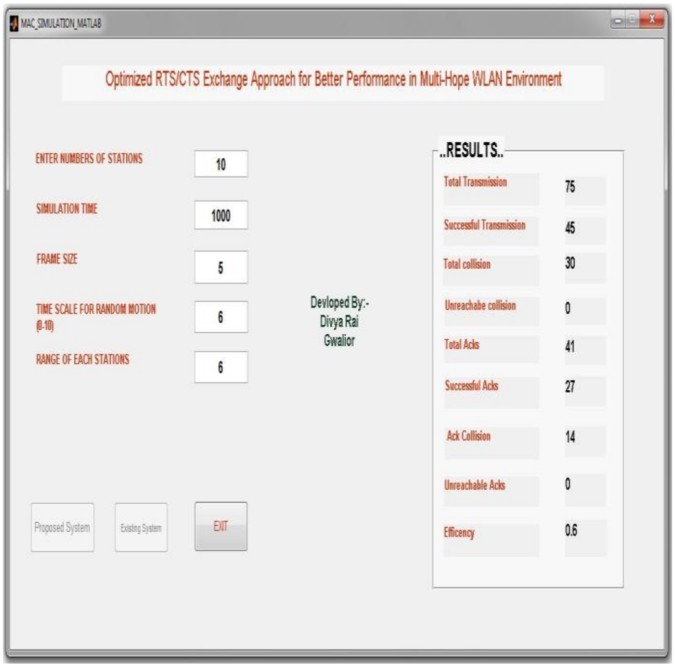

Figure 6: Outputs foe Existing Method

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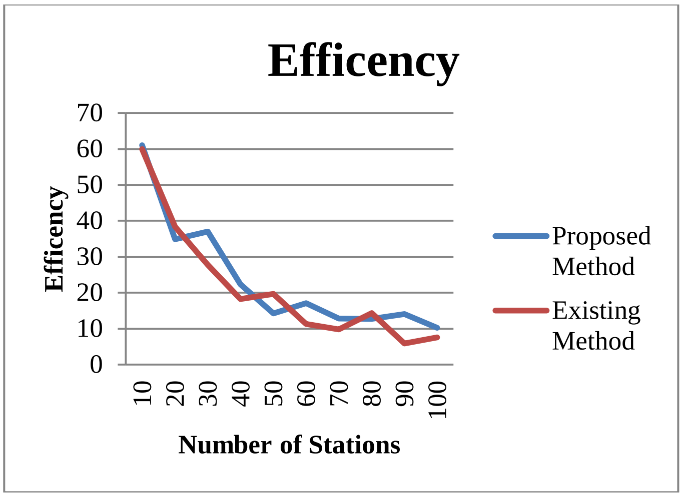

Figure 6: Comparison Graph to Show efficiency

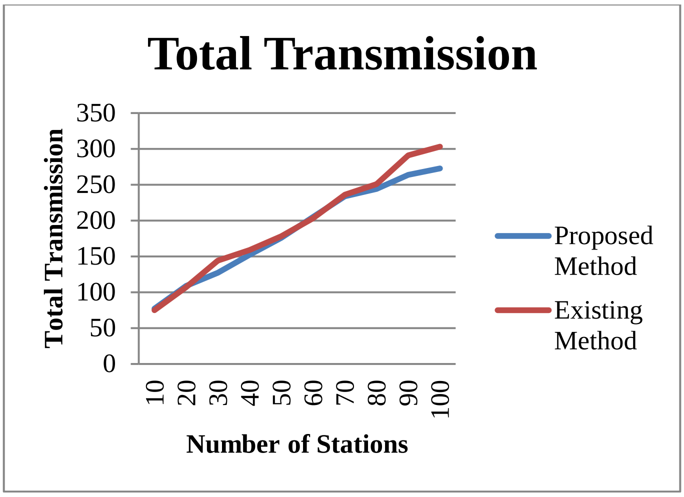

Figure 6: Comparison Graph to Show Total Transmission

The above graph shows that when number are nodes increased than efficiency will decreases because of increasing collision.

This graph shows the comparison between the proposed method and the existing method. Which shows the proposed method is better than existing method.

Input Data With Variable Stations					Total transmission		Efficiency	
No of Stations	Simulation Time	Frame Size	Time Scale	Range of Each Station	Proposed Method	Existing Method	Proposed Method (%)	Existing Method (%)
10	1000	5	6	6	77	75	61.039	60
20	1000	5	6	6	109	107	34.8624	38.3178
30	1000	5	6	6	127	144	37.0079	27.7778
40	1000	5	6	6	152	159	22.3684	18.239
50	1000	5	6	6	176	178	14.2045	19.6629
60	1000	5	6	6	205	203	17.0732	11.33
70	1000	5	6	6	234	236	12.8205	9.745
80	1000	5	6	6	244	251	12.7049	14.3426
90	1000	5	6	6	264	291	14.0152	5.841
100	1000	5	6	6	273	303	10.2564	7.59

Table 1 Comparison Table

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VII. Conclusion

Presented paper discussed how RTS-CTS basic protocol suffers of several performance drawbacks. In particular, the throughput performance is strongly dependent on the number of stations, motion, contention window size and packet size in order to reduce all drawback proposed methodology reduce transmission overhead induced by RTS/CTS exchange for improving throughput performance of IEEE802.11. The proposed method in this paper omits the needless RTS/CTS exchange by referring the number of hidden terminal that connects to the receiver destined to a newly transmission packet.

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