Enhanced Multipath Routing With CSMA/CN Mechanism for Reliable Service Discovery in WSN

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Abstract: - Wireless mobile sensor network is a grown field in network communication, WSN devices are light weighted which quipped with processor, memory and communicate one to another through radio waves. Due to limited capacity of devices and network bandwidth the problem of congestion and collision occurs, while multiple senders want to communicate in same time. In the previous research authors are proposed mac and network based methodology to resolve the congestion and collision problem, but in recent utilization of WSN devices need some efficient technique to improve the network performance with collision and congestion free network. In this paper proposed a collaborative network and mac layer approach to provide efficient network communication and congestion notification status (CSMA/Cn). That CSMA/Cn method immediately notify to sender while congestion arises in established route, so that the sender sends the data through alternative path that handled by network layer protocol name is ad hoc on demand multipath distance vector routing. All those work simulated through network simulator-2 and compare the result of AOMDV-CSMA/Ca with AOMDV-CSMA/Cn in the network parameters as throughput, normal routing, data sends, receives and delay and found that proposed AOMDV-CSMA/Cn perform well in all aspect of defined network criteria.

Keywords— **Congestion, Collision, AOMDV, CSMA/Ca, CSMA/Cn, WSN.**

I. INTRODUCTION

Wireless mobile sensor networks are group of wireless nodes which communicate directly or indirectly over the same wireless channel. The mobile device or nodes are processed with wireless transceiver. They do not require to any additional infrastructure, such as base station or wired access point, etc. Therefore, every node does not only play the role of an end system, but also acts as a router, which sends packets to preferred nodes. They must communicate with everyone, but setting up a infrastructure or cabling in the area which is unfeasible or much expensive. The most pivotal challenge in Wireless sensor networks are routing and trait of wireless communication. In infrastructure's networks a node can communicate with each and every node in the same cell. In WSN a node may communicate only with nodes in its area. This node may communicate with each other nodes, but a routing algorithm is essential. Unlike wired communication, wireless networks had transmission barrier with data broadcasting such as, possibility of asymmetric connections and higher interferences.

In this paper describe about the WSN MAC and routing layer strategies about the collision as well as congestion resolution, paper is divided into many subsections section I is introduction about WSN, section II related work, section III proposed work, section IV proposed algorithm, section V proposed architecture, section VI simulation result and section VII describe the conclusion and future scope of the research.

II. RELATED WORK

WSN is recent trends of communication technology for the limited range but problem occurs while multiple sender compete for the resources such as channel, devices etc, in this section describe existing work those design the MAC layer and routing layer strategies for solving these type of problem.

Yinling Fu, et al, [1] author by plan a mechanism like hybrid channel access with carrier sense multiple access collision avoidance and SOTDMA to increase the efficiency of the network performance of MANET, In this title, if we talk about the network throughput rate, a hybrid channel access approach is proposed and execute, which can combine the merits of CSMA\CA and SOTDMA to preserve high and stable network throughput rate automatically or manually. In this paper the channel synchronization method is used to increase the efficiency the hybrid network performance with NMEA data and Pulse per Second is proposed in this title synchronization of clock is a major factor to affect the throughput of SOTDMA.

Qi Wang, Katia Jaffr `et al [2] author differentiate the time division multiple access with CSMA collision avoidance for wireless multi hop communication to analyse the impact of delay, This title author differentiate the after math in analytical ways to differentiate the impact of TDMA and CSMA/CA in terms of delay, time variation etc. In the worst case delay the method of probabilistic approach and analytical framework captures the flexibility of the wireless medium is used . Analytical delay bounds are gained from delay distributions, which are distinguished depended upon the simulation according to author results.

Yuichi Igarashi, et al [3] author plan the priority based dynamic multichannel transmission approach for industrial wireless communication. In this title, a priority-based dynamic multichannel transmission scheme is placed for WSNs. In the recommended method, a root node controls the broadcast timing of high-priority packets, whereas other nodes autonomously decide which channel to use and when to broadcast packets to a neighbor. According to author Simulation results show that real time control is probable where a reflex delay from transmission of a request to reception of a reply at a root node is contained by 1,140 ms at per-link communication success probability with a retry of higher than 93%.

Viktor Richert, et al [4] has been implementing an improved wireless sensor network MAC protocol for critical situation. In this title an enhance variant of carrier sense multiple access is used which implements weak signal detection (WSD). This method allows us to divide collisions from weak signals and takes suitable decisions to decrease energy consumption. The CSMA/WSD protocols is given as a multidimensional language and put into effect in OMNeT++ by exploitation the

MiXiM framework structure. Implementation tests are practised to prove the validity of the implemented protocol in distinct scenarios. If we talk about the perspective of author distinct simulation scenarios show that this protocol provides a higher throughput, a smaller mean bakeoff time, and less average delay in critical environments.

T. Mickus, et al, [5] the author here projected the improved media access control protocol for the wireless sensor network, In this title, they talk about the circumstance is a class of wireless sensor networks for emergency environmental monitoring. The attractive possessions are simplicity, self-organization, ability to adapt to scenario change and a lack of scenario-specific parameter tunings. Emergence Medium Access Control (E-MAC) is a scheme that individually reacts to environmental stimuli inspired by biological social populations. It exhibits the desired emergent properties using a terribly easy protocol. When distinguished to a well recognized sensible counterpart, the IEEE 802.11 CSMA/CA standard, it displays better throughput, end-to-end delay and fairness.

B. K. et al [6] the adaptive backoff scheme beneath wireless sensor communication is been used by the authors. In this title they talk about, an adaptive backoff scheme in WSN whose backoff range is attuned depending on the contention level, and present its Markov model for mathematical analysis. The proposed scheme is analysed and its competence is validated by ns-2 simulation in admiration to network throughput and energy consumption. Its presentation is also compared with the standard and previous works, showing that it outperforms them for a whole range of arrival rate.

Yishan Su, Xiaomei et al [7] has been putting into practice the cross layer medium access control sensing mechanism**.** In this title they discuss a, compressed sensing (CS) theory which is consumed in a medium-access control (MAC) method for wireless sensor networks (WSNs). They discuss a new, cross layer compressed sensing medium-access control (CL/CS-MAC) method, which when combine with the physical and data link layer, where the wireless transmission in physical layer is well thought-out as a compress process of requested packets in a data link layer according to compressed sensing (CS) theory. They first bring in using compressive complex requests to recognise the exact active sensor nodes, which makes the scheme more capable. Moreover, as a result of the reconstruction method is dead in an exceedingly advanced field of a physical layer, where no bit and frame synchronizations are needed, the asynchronous and random requests scheme can be put into practice without synchronization consignment. We set up a testbed depended software-defined radio (SDR) to execute the proposed CL CS-MAC method almost and to show the validation. For large-scale WSNs, the simulation consequences show that the proposed CL CS-MAC technique offers higher throughput and robustness than the carriers sense multiple accesses (CSMA) and compressed sensing medium-access control (CS-MAC) schemes.

Imen Bouazzi, et al [8] enhance queue backoff algorithm for wireless sensor communication is been used. In this title, they converse a study of the backoff exponent (BE) management in the Carrier Sense Multiple Access with the conduction and Collision turning away (CSMA/CA) methodology underneath the Medium Access management (MAC). While BE parameter highlight the amount of your time that a node ought to wait before access to the channel. In this context, we propose a scheme that dynamically adjusts the IEEE802.15.4 parameters according to the queue length of each sensor node in order to increase the efficiency of the network life time. The performance metrics studied are energy consumption, average delay throughput and packet loss probability

Nileshkumar et al [9] The author have proposed enhanced clear channel assessment for slotted CSMA/ CA in IEEE 802.15.4. This title also decreases the number of backoffs as well as channel access problems. Proposed method also decreases the number of impacts. In order to realize these goals, proposed method takes two, three or four consecutive CCAs to make decision based on current channel status. An analytical Markov process Model is developed for the derivation of an assortment of chances related to plan methodology then it's been analyzed with the assistance of illustrations.

Md. Forkan Uddin, et al [10] The author have proposed carrier sensing depended medium access control protocol for wireless communication to exploiting successive interference cancellation. In this title, they suggest a carrier sensing-based medium access control (MAC) protocol for wireless local area networks (WLANs) for exploiting successive interference cancellation (SIC). We then develop an analytical model to calculate the total throughput of a WLAN under the proposed MAC protocol in the presence of path loss, Rayleigh fading, and log-normal shadowing and authenticate the model via simulation. By means of the investigative model and simulation results, we distinguish the presentation of a carrier sense multiple access (CSMA) MAC protocol and the proposed MAC protocol in consuming all the opportunities from SIC. We find that the proposed MAC protocol effectively consumes the opportunities of SIC and significantly improves throughput when distinguished with the CSMA MAC protocol. We also consider the effect of some of the parameters of network and wireless channel on the performance of SIC.

Qi Wang, et al [11] The author have differentiated the TDMA with CSMA/CA for wireless multi hop communications which works under soft real time networking. This title they discuss an analytical comparison of the time behaviour of two distinctive representative TDMA and CSMA/CA protocols in conditions of worst-case end-to-end delay. This worst-case delay is expressed in a probabilistic manner and is caused due to our analytical framework captures the versatility of the wireless medium. Analytical delay bounds are obtained from delay distributions, according to author which are compared to fine-grained simulation results.

H Indrapriyadarsini, et al [12] The author have proposed a cross layer depended secure multipath neighbor routing protocol in Mobile ad hoc network. In this article they discuss a, cross layer is organize to increase the efficiency of lifetime and quality of service (QoS). By deploying secret distribution technique have offered message integrity and authentication. According to author by using the experimental aftermath of CLSMRSCA achieves more path reliability rate, lifetime, end to end delay and less overhead than the existing scheme CLMNRP.

Prasanta Kumar, et al [13] The author have proposed an energy efficient multipath routing protocol for MANET. In this title they suggest an Energy Aware On-demand Multipath Distance Vector Routing (EAOMDV) is established in order to select the path for the transmission of packets. EAOMDV is a multipath routing protocol which selects paths between source-destination pair depended on a route cost function. The cost function is calculated by considering residual battery power of a node and its present traffic. We brief the performance of EAOMDV by comparing it with an existing protocol AOMDV.

Chi-Kin Chau, et al [14] The author have analysed the effective static and adaptive carrier sensing for dense wireless CSMA Networks. In this title this paper believes a realistic signal-to-interference-and-noise ratio model. We give a total study for two efficient wireless CSMA protocols: Cumulative-

interference-Power Carrier Sensing and Incremental-interference-Power Carrier Sensing, in two aspects:

(1) Static approach that sets a universal carrier sensing threshold to guarantee interference-safe transmissions regardless of network topology, and

(2) Adaptive technique that fiddles with the carrier sensing thresholds dynamically based on the feedback of nearby transmissions. We also give simulation revise to calculate the starvation ratio, fairness, and good put of our approaches.

At last this feature helps in categorising power carrier sensing.

Souvik Sen, et al [15] The author have proposed CSMA/CN: carrier senses multiple access with collision notification. In this title effort to approximate CSMA/CD in wireless networks with a novel scheme called CSMA/CN (collision notification). Under CSMA/CN, the handset uses PHY layer information to sense a clash and immediately notifies the transmitter. The collision notifications have a unique signature, sent on the same channel as the data. The spreader employs a listener antenna and carries out signature correlation to discern this notification. Once differentiated, the transmitter immediately aborts the transmission.

III. PROPOSED APPROACH

Wireless sensor network has limited capable due to light weighted device form the network and bandwidth for the communication is minimum. But in recent advancement of WSN network, that is very useful for the communication purpose, where the static cabling is not possible or small area group communication needed. Due to their utilization, WSN network is now on demand for the future prospective of communication and demands the high capability devices as well as bandwidth, but WSN limitation cannot increase their bandwidth that arise the problem of congestion and collision. In the proposed methodology minimize the network congestion while the network higher utilized, through network layer based methodology (AOMDV) and data link layer media access mechanism (CSMA/Cn), both are jointly improve the network performance. In the wireless sensor network hidden terminal problem increase the probability of congestion because multiple sensor device cannot directly communicate from one to another they use some communicator nodes or intermediate node. While the multiple sender simultaneously detect same intermediate node but all the sender not know about intermediate node as same and start the transmission to same intermediate node that arise the problem of collision. The collision problem avoids through mac layer CSMA/Ca but increase the delay, so here multipath and CSMA/Cn helps to resolve the problem of collision. Intermediate node sharing by multiple source nodes also come up the problem of congestion due to limited bandwidth share by multiple nodes, that problem also resolve through proposed methodology.

A. Physical and Mac layer Based Collision Notification:

Wireless sensor network uses the media access technique as carrier sense multiple access (CSMA) technique but its divided into various strategies such as CSMA/Ca, CSMA/Cn and many more. In the proposed approach carrier sense multiple access with collision notification are apply for the media sensing. In this mechanism while the multiple sensor nodes simultaneously sends the data through radio waves, meanwhile some intermediate nodes are shared by multiple senders and sends data without synchronized manner and arises the problem of collision as well as congestion than CSMA/Cn, receiver or intermediate node uses the physical layer information to detect a collision and immediate notifies the respective transmitters. After getting the collision notification message by transmitter, it stop data sending by existing path and they use alternative route option to transmit remaining data through of fresh alternative route provided by AOMDV routing. Collision notification consists of a unique signature, sent on the same channel as the data sent. The transmitter uses listener antenna and verify the signature to distinguish this notification. Once verified the signature, the transmitter immediately abort the transmission and call the network layer for new route decision such routing strategies is AOMDV.

B. Network Layer based Congestion Resolution:

In the network layer, routing protocol use ad hoc on demand multipath distance vector (AOMDV) routing that is suitable for mobile ad hoc and wireless sensor network (WSN). The basic functionality of AOMDV is three best possible route selections from source to end receiver, so that data are transmitted through multiple paths in simultaneous way. Multipath routing useful for the congestion avoidance and load balance. In the proposed enhanced multipath routing solve the problem of collision and congestion, because it's taken the feedback from Mac layer and execute the appropriate action. In the fresh route search, source node spread the route packet through broadcast technique and gets three best shortest path, after that out of three, two path allotted for communication one for data sending and one for acknowledgement receiving, remain one path for the backup for future use (time to time update the route table).

While the sender ready to start the data transmission from selected shortest path and collision detected in between communication link, than CSMA/Cn detect the collision using physical layer information and immediately respond to source node using collision notification method. Source node calls the AOMDV routing and immediately get alternative route (backup route) for next data communication, that work minimize the waiting time, delay and extra route overhead. The proposed enhanced AOMDV and CSMA/Cn resolve the problem of congestion and collision. That also increases the network efficiency through multipath route utilization and fairly network load balancing.

IV. PROPOSED ALGORITHM

In this section describe how the actual system works to achieve reliable service for the wireless sensor network. Algorithm describes how the network layer and Mac layer jointly solve the issue of collision and congestion while the multiple sensors compete for the channel and resource utilization. Here collision notification technique detect the collision through physical layer sensing mechanism and immediately sent notification to source node to abort the transmission and free from collision status. Proposed algorithm describe as following steps.

Algorithm: Enhanced multipath with CSMA/Cn for reliable service of WSN

Input: W: sensor device
S: source device
R: receiver device
M: intermediate device
l_{jk}: link between j to k device
b_{jk}: bandwidth between j to k device
device status←free/busy
mac: CSMA/Cn
np: network protocol AOMDV
r_r: radio range (550 m^2)

Output: data send, receive, throughput, nrl, delay

Procedure:

Route Established module

S execute AOMDV routing search the R
np(AOMDV, S, R)
While R! = current id & M == true & r_r == 550 **do**
Store route table l_{jk} information

Forward np packet to search R
End do
If R == current id **than**
Count number of path
Select 3 shortest paths
Sent 3 selected path notification to S node
S sent data by 1st best shortest path
R sent acknowledgment to S by 2nd shortest path
Path 3 is reserve for future use
Else
R not found
Re-execute np for next step time
End if
Congestion/Collision Notification module
W use the CSMA/Cn
If M data receives by multiple sender **than**
M sense physical layer and retrieve information
If receiving time S_1 == receiving time S_n **than**
Data S_1 collide with data S_n
Notification generate (S_1, S_n)
Sent notification to S_1 and S_n devices
S_1 and S_n verify the respective signature
If signature match than
Abort transmission
Call np for reserve path 3 utilization
New path granted
Sent data to R by alternative route
Else
Search rest of S_{n-1} for signature correlation
End if
End if
Check b_{jk} for congestion detection
If b_{jk} == fully utilize & M == busy & memory == full **than**
Network is congested
Select low priority S
Sent congestion notification to low priority S
Verify signature by S
Abort transmission
Call np for reserve path 3 utilization
New path granted
Sent data to R by alternative route
Else
b_{jk} available and M free
Smooth data transmission conducted
End if
End if

V. PROPOSED ARCHITECTURE

In this section describe the working architecture of proposed system, which resolves the collision and gives the alternative route while found collision. Architecture divide into various section and describe their functionality such module is mac and physical layer, network, sender and analysis module through of those module achieve the reliable service discovery for the wireless sensor communication.

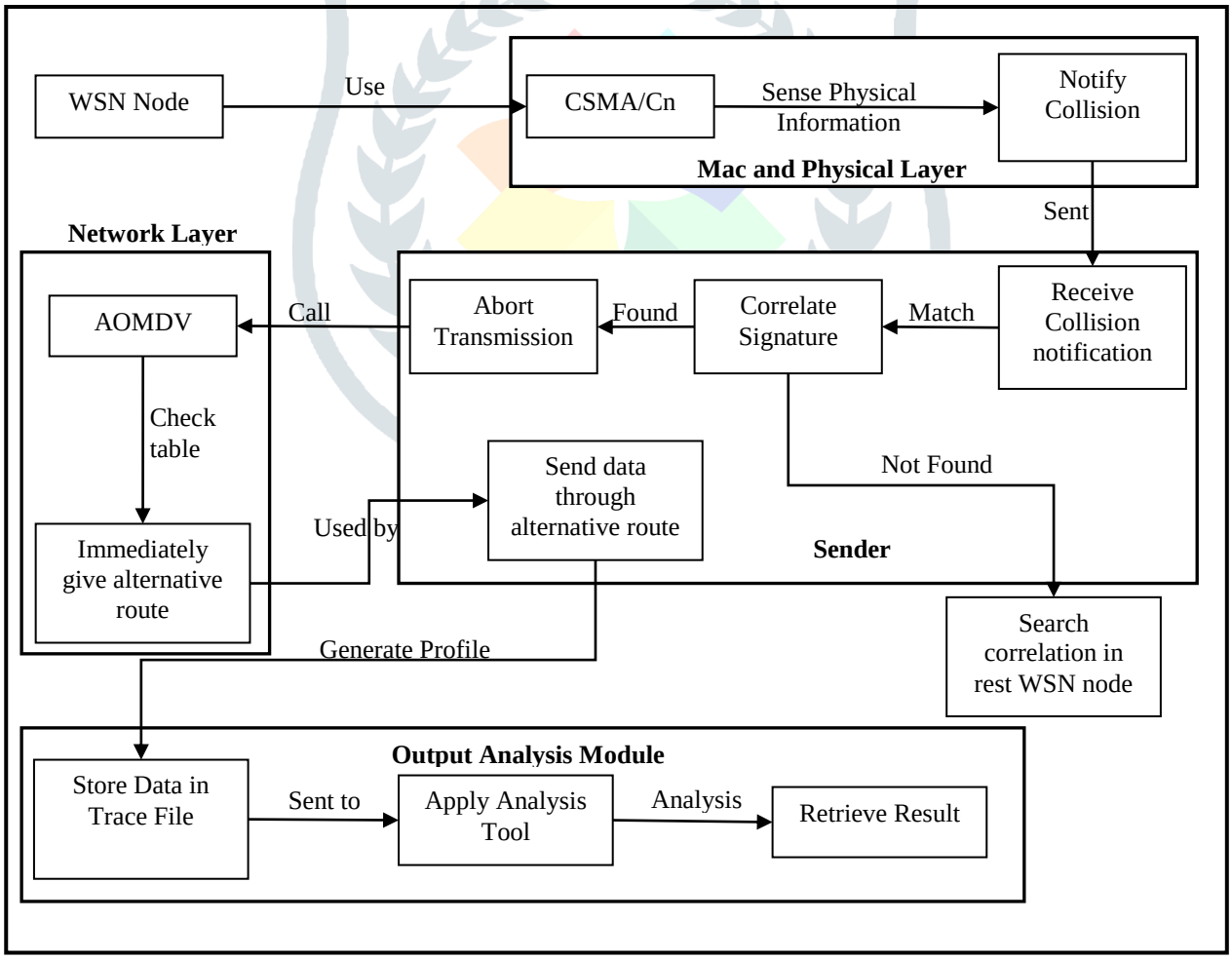

Figure 1: Proposed Architecture

VI. SIMULATION RESULTS

The analysis is allotted mistreatment Network Simulator-2 version 2.31 (NS2- 2.31) [**add-reference**]. The performance of CSMA/Ca and CSMA/Cn is evaluated with AOMDV multipath protocol. The amount of nodes is taken into account as sensor nodes. The total numbers of sensors are considered 50 for simulation and simulation duration is taken 100 seconds in WSN. The simulator version is employed for simulation is NS-2.31. The final parameters of Network parameters are listed in Table 1.

Table 1 Simulation Parameters

Parameters	Value
Network Type	WSN
Nodes/Devices	50
Physical Medium	Wireless
Simulation Time	100 seconds
MAC Layer	CSMA/Ca, CSMA/Cn
Routing Protocol	AOMDV
Traffic Type	CBR, FTP
Number of Connection	10
Propagation radio model	Two ray ground
Rate	10 acket/s

A. *Performance Analysis of Data Sending and Receiving*

The nodes in wireless sensor network are sensing the neighbour to sending data packets and send the request of connection establishment to nearby nodes and the nodes are forward the request of sender to destination. The sender is starts the sending of data in network and receiver successfully receive data if the possibility of congestion is not occur in network. In this graph the performance of sending as well as receiving of data is measured in AOMDV/Ca and proposed AOMDV/Cn. The performance of proposed Collision notification is better as compare to Collision avoidance in network.

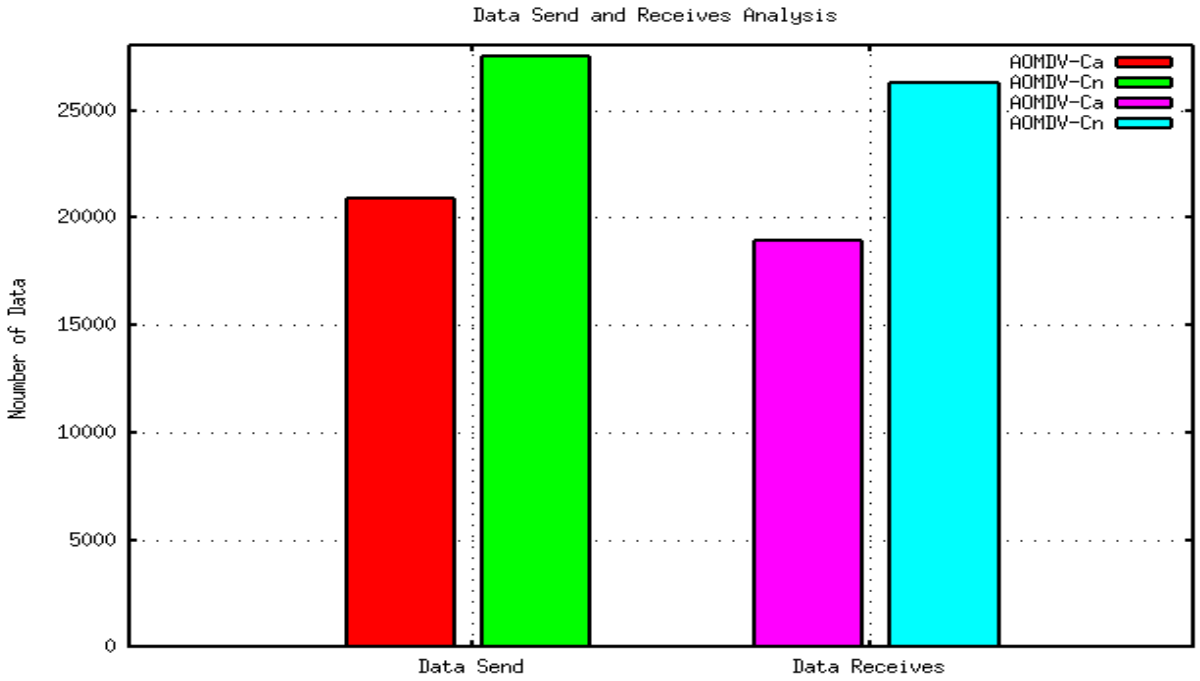

Figure 2: Data Sending and Receiving Analysis

B. *Percentage of Data Receive Analysis*

The collision notification is better than the collision avoidance because after notification the alternative path is used for sending data and the congestion possibility is reduced in network. The sensor nodes having limited processing and bandwidth because of that heavy load is not possible to handle by nodes in network. In this graph the PDR performance of AOMDV/Ca and AOMDV/Cn is evaluated and the performance of AOMDV/Cn is provides the better receiving percentage. The collision avoidance is also handle the congestion in network but it controls by minimizing the data rate in network by that data receiving is affected. The performance of proposed scheme is provides better receiving of packets that improves routing performance.

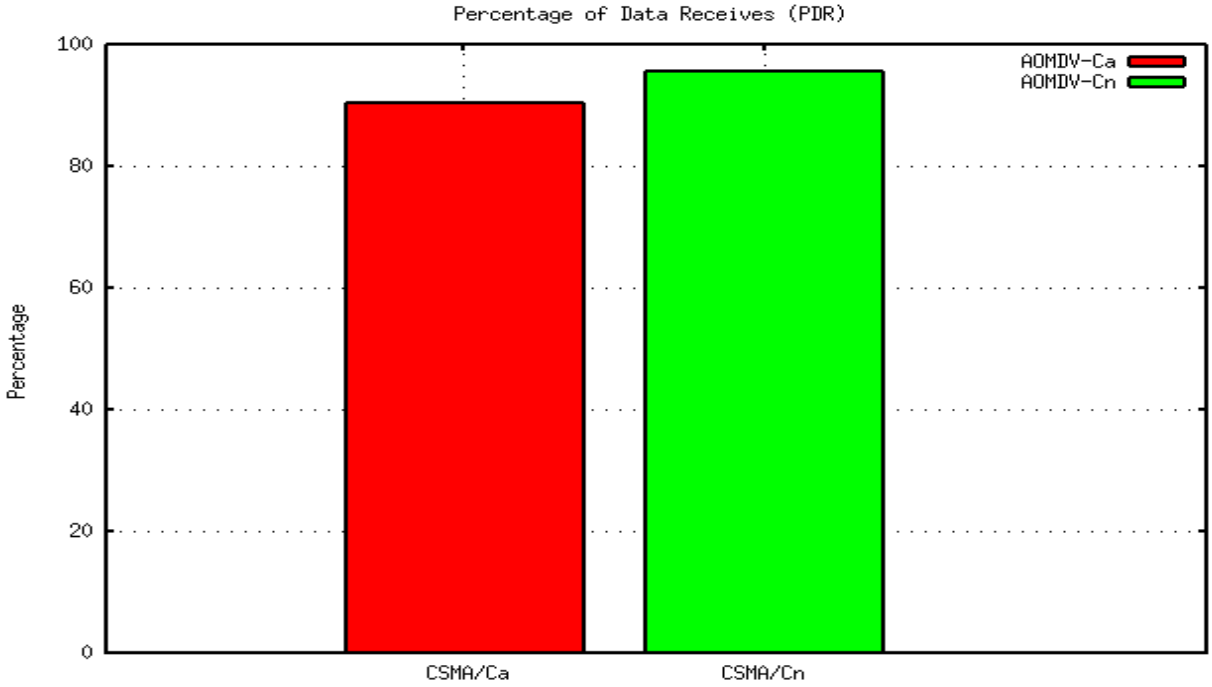

Figure 3: PDR Performance Analysis

C. *Normal Routing Load Analysis*

Routing overhead in network is increase due to the unnecessary link breakage and slows down the traffic rate of data packets in network. The AOMDV/Ca is actually control the data traffic to reduce congestion and because of that the packets receiving affected and the possibility of link expiration is enhanced, that is the cause of overhead enhancement. In this graph the overhead performance of proposed AOMDV/Cn is reduces the overhead by utilizes the AOMDV protocol technique efficiently. The only alternative path is used after notification and diverts the load on next path by same rate, which is the reason of overhead minimization in network. The more overhead in network is reduces the data packets receiving and also consumes the limited bandwidth in sensor network.

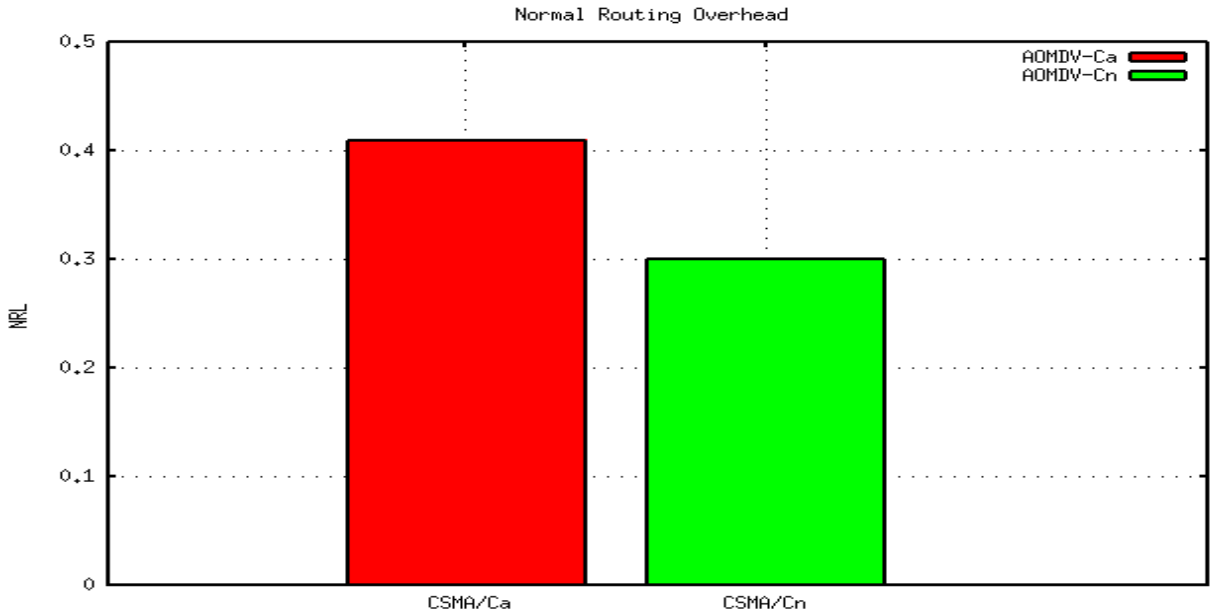

Figure 4: Overhead Performance Analysis

D. *Average End to End Delay Analysis*

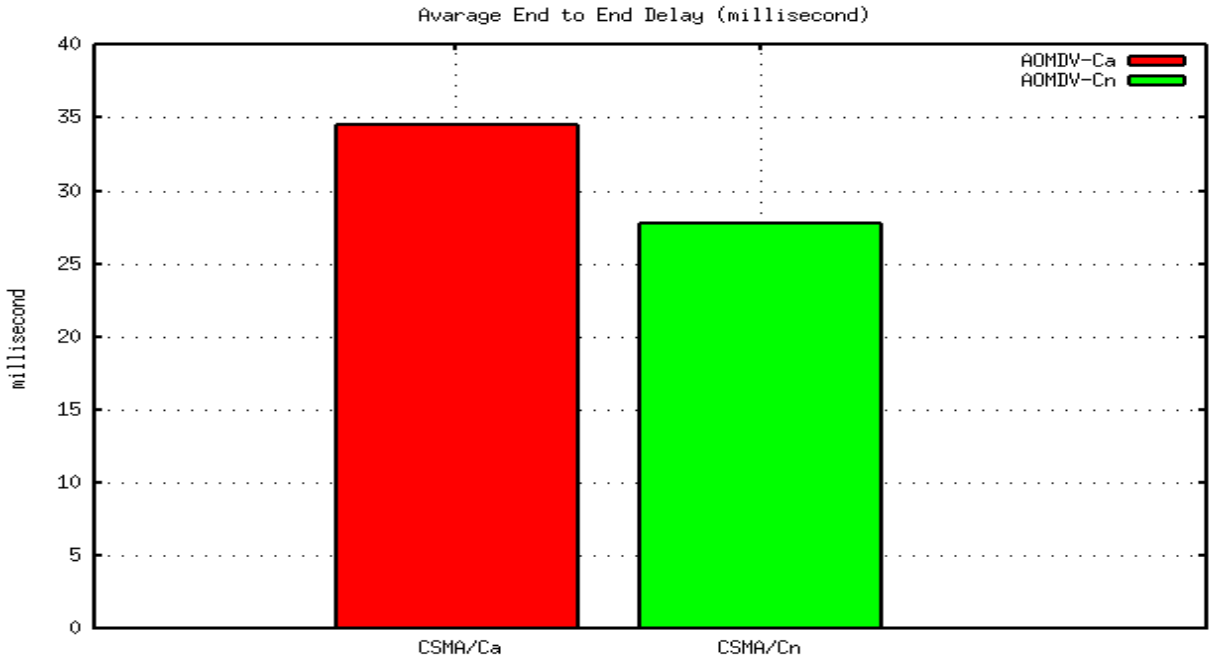

Figure 5: End to End Delay Analysis

The end to end delay in network is increase due to more flooding of routing packets because the link is break due to congestion. The congestion in network is enhancing by not controlling the data rate or not presence of alternative path in network. The performance of proposed AOMDV/Cn is provides the less delay because collision notification performance in terms of delay showing the better performance in WSN. The congestion is also handled by AOMDV/Ca but it minimizes the rate first then choose the alternative path, that means AOMDV/Ca is not utilizes AOMDV instantly to reduces delay as well as packets receiving. The delay of AOMDV/Cn is reduces because of that bandwidth in network is utilized and the performance of data receiving is improves.

E. *Throughput Analysis*

The multipath routing is improves the performance of network by providing the option of alternative path in network. The throughput performance of AOMDV/Ca and AOMDV/Cn is evaluated and the AOMDV/Cn performance is better in term of Kbps receiving at destination. The better receiving of data packets are also provides the better throughput performance. The congestion in network is efficiently controlled by proposed scheme that shows the minimization in congestion and because of that a bit receiving at destination is also enhanced. The performance of proposed. The better throughput performance is also showing the reduction is delay and routing overhead and proposed AOMDV/Cn is fully utilizes the AOMDV performance in WSN.

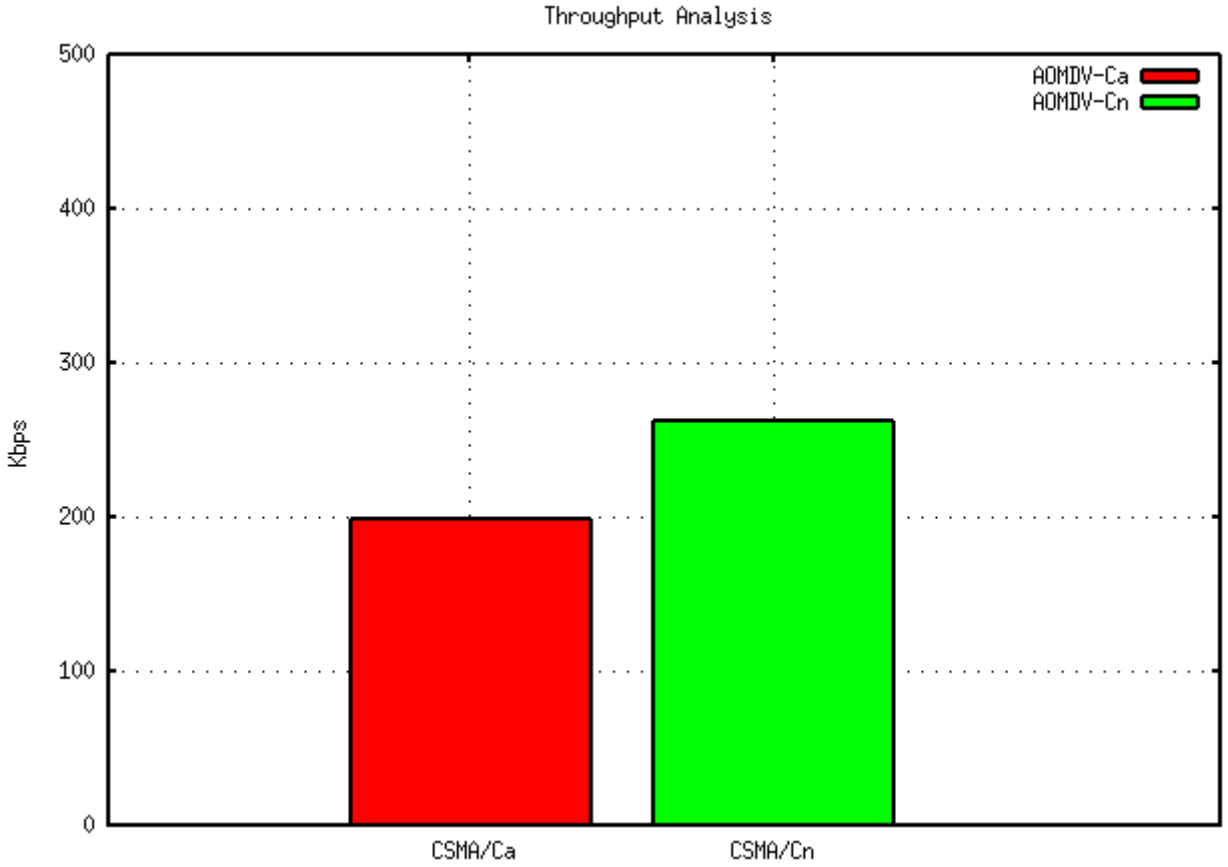

Figure 6: Throughput Performance Analyses

VII. CONCLUSIONS FUTURE WORK

The nodes in Wireless Sensor Network (WSN) is sending and receiving data in limited area. The Multipath routing can balance the load better than the single path routing in WSN, thus reducing the congestion by dividing the traffic in multiple paths. The performance of the network can be improved by using a load balancing mechanism. Such a technique transfers work from heavy loaded nodes to lightly loaded nodes. AOMDV routing allows the establishment of multiple paths between a pair of source and destination node. It is characteristically proposed in order to maximize the reliability of data transmission or to provide load balancing and has received more and more attentions. In this research we proposed the Collision notification (Cn) scheme to improve the performance of AOMDV routing and compare the performance with Congestion avoidance scheme (Ca). The link failures in the primary path, through which data transmission is actually taking place, cause the source to switch to an alternate path in place of beginning another route discovery. The existing AOMDV/Cn is improves the routing that reduces the end to end delay and overhead in network. The AOMDV/Ca is also control the congestion but it avoids it by control the rate of data. The data rate controlling is good to control congestion but it also occur the possibility of delay and packet loss. The alternative path is not efficiently utilized in AOMDV/Ca technique. The proposed scheme is control the congestion by using alternative path after notification in network. The proposed AOMDV/Cn is improves the data packets receiving that is also improves the PDR and throughput of WSN.

The sensor nodes having only one antenna for sending, receiving and sensing, the technique of multiple antennas are improving the node capability in WSN. The MIMO (Multiple Input and Multiple Output) is improves the performance by sending and receiving signals through multiple antenna in network. The MIMO is improves the performance of AOMDV-Ca and handle congestion more efficiently in network.

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