Compare the performance of CSMA & ALOHA protocols in 802.11p on the basis of mean density of progress in Rayleigh fading environment using MATLAB

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Abstract- IEEE 802.11p is an advanced version of 802.11 to add wireless access in vehicular environments (WAVE). This includes data exchange between high-speed vehicles and between the vehicles and the roadside infrastructure. In this paper we have compared simulation results for different MAC protocols in 802.11p (Vehicular Ad hoc networks) to design a 802.11p with optimal network throughput. We have analyzed the performance of different MAC protocols in IEEE 802.11p on the basis of mean density of progress by simulating with different values of path loss exponent β, mean of Raleigh channel μ, distance R, probability p and noise W and we will see the performance of Aloha and CSMA protocols. By comparing Aloha and CSMA protocols in a VANET under different channel conditions. The results show how network performance deteriorates with changes in the conditions and to design their networks and optimize their performance by tuning the transmission probability p in Aloha-based schemes and the CS Threshold in CSMA based schemes to maximize the network throughput.

Keywords – IEEE 802.11p, MAC protocol, MAC layer, Rayleigh fading, mean density of progress.

I. INTRODUCTION

IEEE 802.11p is an advanced version of 802.11 to add wireless access in vehicular environments (WAVE). It defines enhancements to 802.11 required to support Intelligent Transportation Systems (ITS) applications. This includes data exchange between high-speed vehicles and between the vehicles and the roadside infrastructure in the licensed ITS band of 5.9 GHz (5.85-5.925 GHz).IEEE 1609 is a higher layer standard on which IEEE 802.11p is based. 802.11p is used as the groundwork for Dedicated Short Range Communications (DSRC). Dedicated short-range communications are one-way or two-way short to medium-range wireless communication channels specifically designed for automotive use and a corresponding set of protocols and standards.

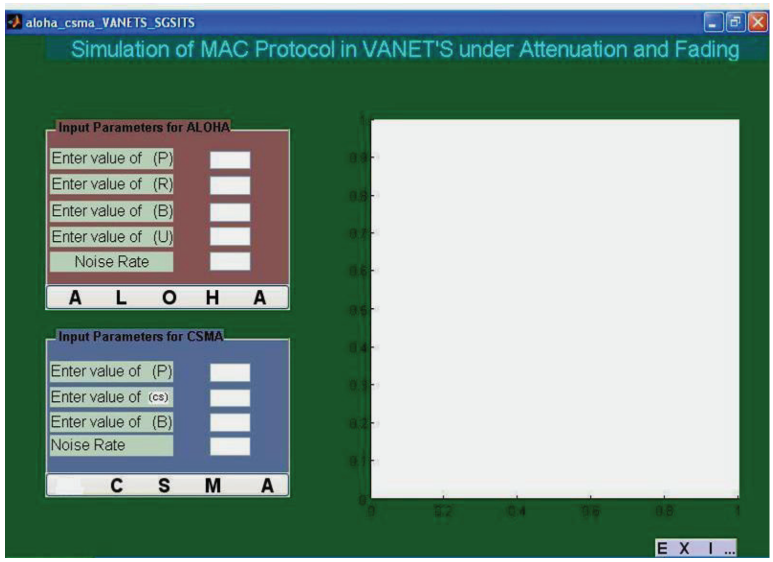
II. PROPOSED ALGORITHM

A. Simulation Procedure –

MATLAB 7.8.0 is used for all simulation procedure in this project. The simulator used for simulations models the behavior of Aloha and CSMA protocols. The Aloha simulations were done by changing the value of R and p. The CSMA simulations were done by changing the values of R and CS Threshold.

The value of W in our simulations is W=0mW for no noise condition, $W=10^{-10}$ mW for low noise conditions and $W=10^{-6}$ mW for high noise conditions. We have used $\beta = 3$ to represent low lossy conditions e.g., open roads with no vegetation or buildings, $\beta = 4$ for relatively higher lossy environments e.g., urban areas and $\beta = 6$ for even higher lossy environments e.g., highways during rush hour. We also use the value of $\mu = 1$, $\mu = 5$ and $\mu = 10$ to see the effect of increased fading on VANET performance. In our simulations the capture threshold T is taken as 10. The simulation is performed with different values of path loss exponent β, mean of Raleigh channel μ, distance R, probability p, and noise W and we will see the performance of Aloha and CSMA protocols. We will compare the Aloha and CSMA protocols in a VANET under different attenuation and fading conditions and we will provide which one is better and why? This work will be done through simulation and we will be comparing both scheme using simulation results. This design will be beneficial for the VANET designers. The model used for simulation is given below.

B. Simulation Model –



Simulation Model for MAC protocols in VANET under different Attenuation and Fading conditions

III. EXPERIMENT AND RESULT

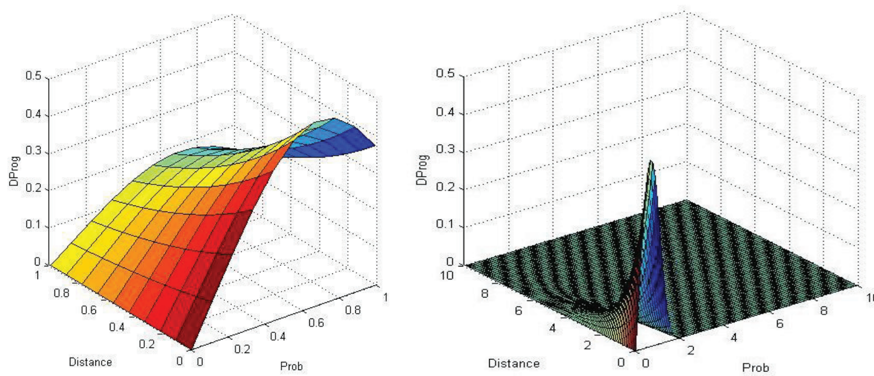
SIMULATION RESULTS:
This part describes the results obtained after simulation. The result is calculated in three parts. In first part the Mean Density of Progress (dprog) is calculated using simulation for Aloha and CSMA for different values of **β** (path loss exponent) and we will see the effect of variable attenuation. In second part, the Mean Density of progress is calculated for different values of μ (mean of Rayleigh fading) and we will see the effect of variable fading. In third part, we will compare the Aloha and CSMA technique using simulation results and we will provide which one is better and why? This section shows the results arrive from the simulation tool MATLAB 7.8.0.

Effects of change in fading Environment
In this section we will discuss the effects of fading on the performance of MAC protocols, specifically Aloha and CSMA. We studied our VANET for μ=1, 5 and 10. If μ increases, the value of the random fading F(x;y) should decrease, resulting in a decrease in the signal and interference but with no effect on the noise. In effect as μ increases, dprog decreases. It should be noted that when the noise is negligible, increasing μ will not affect dprog very much.

Comparison between CSMA and Aloha
It is seen that under low noise conditions, CSMA's dprog is nearly double that of Aloha, which seems to imply that CSMA would be more preferable for use in VANETs. However, it shows that the advantage that CSMA had, disappears when we have a noisy channel. This can be easily explained since with high levels of noise, CSMA cannot distinguish between an actual transmission and noise. In that case the CSMA protocol does not offer any performance superiority over the simple pure Aloha scheme.

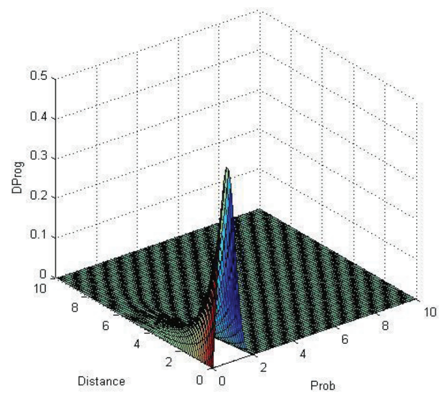
Table 1 shows the results of mean density of progress for different values of μ in Aloha and CSMA protocols are given below:

	Noise/ W (mw)	Mean Density of progress		
		μ=1	**μ=5**	**μ=10**
ALOHA	**0**	**0.4**	**0.3**	**0.25**
	10^{-6}	**0.35**	**0.3**	**0.2**
CSMA	**0**	**0.5**	**0.45**	**0.45**
	10^{-6}	**0.45**	**0.44**	**0.4**

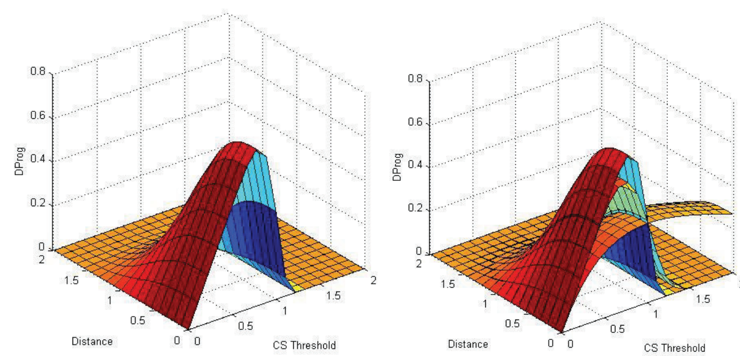


Dprog for μ=1 Dprog for μ=10

Mean Density of progress for different values of μ in Aloha and W=0mW

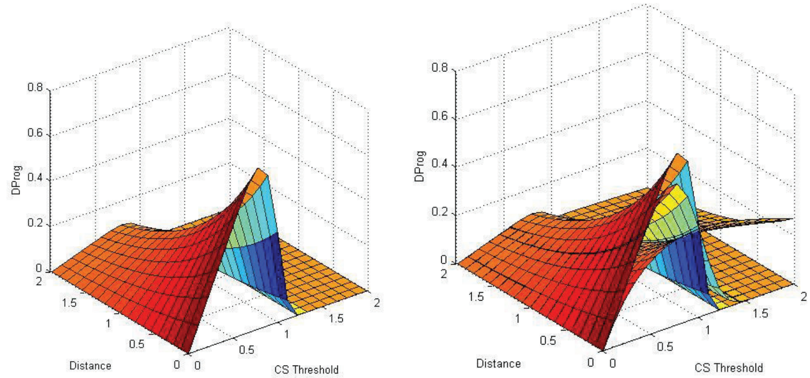


Dprog for μ=10, Mean Density of progress for different values of μ in Aloha and W=10-6mW



Dprog for μ=1 Dprog for μ=10

Mean Density of progress for different values of μ in CSMA with and W=0mW



Dprog for μ=1 Dprog for μ=10

Mean Density of progress for different values of μ in CSMA and W=10-6mW

IV.CONCLUSION

VANETs are an important type of MANETs because they can help to increase road safety. In this paper we have presented simulation results for Aloha and CSMA MAC protocols for VANETs. We compare the mean density of progress, which is defined as the expected total progress of all the transmissions per unit length of the network, for both protocols with different attenuation and fading conditions. VANET designers can use these results to design their networks and optimize their performance by tuning the transmission probability p in Aloha-based schemes and the CS Threshold in CSMA based schemes to provide the maximum density of progress and hence maximize the network-throughput.

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