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Realization of Multipath Routing with Secret Sharing Scheme in MIMO Ad Hoc Network Through AODV Conjugated STBC for Disaster Management

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Abstract— Efficient Disaster control and management become realistic only due to the boons of Information Technology. The emergence of Mobile Area Network (MANET) has the potential to monitor the physical and environmental conditions through its sensors or nodes. The information gathered on such conditions are to be protected in an efficient way. In the present work, Space Time Coding (STBC) conjugated AODV protocol is proposed to avoid data loss due to high mobility induced network failure. This approach uses multipath routing to amplify the diversity gain and coding gain after the utilization of three-dimensional diversity of MIMO systems. In order to overcome the challenging channel conditions, we analyze the MIMO-Ad Hoc network activity by combining the AODV (Ad hoc On-Demand Distance Vector) impregnated Secret Sharing Scheme (SSS) with STBC. With varying SNR values, this system's primary goal is to increase network coverage and throughput while conserving energy. Herein, performance analysis of AODV-STBC-SSS Scheme's in MIMO based communication framework is thoroughly discussed. The bit error rate (BER), packet delivery ratio (PDR) and routing stability are evaluated and it is recorded that BER becomes $\sim 10^{-3}$, PDR turns out to be 0.8 implying all data packets were received with minimum loss as supported by BER. The data transmission portfolio was achieved by integrating MIMO, AODV, and STBC with different modulation techniques such as BPSK, QPSK, 16-QAM and 64-QAM.

Keywords— AODV Secret sharing scheme (SSS), MIMO Ad Hoc, STBC, Outage capacity, Disaster control

I. INTRODUCTION

Over the last decade, due to advancement in Internet of Things (IoT) technology, the wireless and cellular communication experience exponential growth as per CISCO's 2023 annual report. The wireless sensor network (WSN) becomes inevitable for controlling the network's performance. WSN has different function-abilities towards disaster management like 1. Monitor physical and environmental conditions, 2. Assist in identification and prediction of hazards, and finally 3. Afford real-time information at the time of and at the end of disasters. The data collected during the monitoring of environmental conditions,

should be preserved carefully for taking necessary actions. In this context, MIMO Ad-hoc network becomes a potential solution. MIMO Ad-hoc communication systems become an integral part of WSN as it employs manifold antennas at both link terminal. These antennas act as trans-receiver elements while they utilize the 3-dimensional (spatial) domain resulting remarkable high data rate and spectral efficiencies. The bottleneck of this type of architecture is the constrained bandwidth and transmitted power [1,2]. The popularity of MIMO Ad Hoc network is gradually upsurged due to the ever increased usage of wireless gadgets connected to mobile networks [3]. Disaster management trusts this emerged architecture in case of failure of manual network structure. [4,5]. It is quite challenging to administer the node transmission coordination for secure communication. In this paper, enhanced security is proposed with the help of multipath routing married with secret sharing system. The Maximum Likelihood (ML) receiver maximizes diversity and minimizes bit error ratio (BER) to provide optimal system performance. In presence of white Gaussian noise (WGN), the detection process is finest and the bit error rate becomes minimum. The present work illuminated orthogonal Alamouti coding for optimum detection process offered by MIMO Ad Hoc STBC coded architecture. In this Alamouti model, the rows and columns of the $\rho \times N_t$ number of signals are orthogonal. [6] Jiang et. al. projected an improved edition of AODV protocol for MANETs by initiating a MMLSS (multi-metric link selection scheme) that lowers average end-to-end delay (E2E Delay) and with an association of energy consumption. This results prolong overall network lifetime. [7] Although direct integration of MIMO Adhoc network in disaster management is not yet found in proliferation, still MIMO based UAV offers signified contribution in disaster management utilizing spatial multiplexing and diversity gain. [8] Another research finding illuminates essence of MANET in mobility aware network (specially in disaster management case) by incorporating co-operative relay network architecture. [9] The uniqueness of the present work is the illustration of flat fading environmental effect on information bit rate and spectral efficiency of the STBC coded signal. In the context of present work, node conciliation

STBC is enumerated for a variety of modulation techniques where QPSK is proved to be the most safe modulation strategy for STBC encoded data transmission. The uplifting in signal constellation outperforms bit error rate increment for the same SNR

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