0.1. *Али М.* Dual-Hop RF and Underwater Visible Light Communication (UVLC)

A dual-hop RF and visible light communication (VLC) has become a significant alternative approach for underwater wireless communication towards the advanced next-generation 5G or 5G beyond (5GB) networks [1]. Nevertheless, the bottleneck exist due to distinctive turbulence channel impairments along with alignment of the transceivers. Therefore, the necessity to deploy a high reliability communication setup in boisterous channels for improving the system capacity along with the performance outcomes. The proposed system model is contained a terrestrial based source (s) which broadcasts the RF signals towards to a decode-and-forward (DF) relay (r) protocol and simultaneously received the feedback of the relay in downlink mode. However, the DF relay transmits the received signals from the source to the underwater-based autonomous underwater vehicle (AUV) (d) through an optical beam under line of sight (LOS) conditions. In this study the $s - r$ link is modelled by Nakagami-m fading distribution under BPSK modulation scheme. Nonetheless, the $r - d$ (underwater VLC) hop is designed by following Gamma-Gamma (GG) distribution fading under heterodyne detection and intensity modulation/direct detection (IM/DD) technique in consideration of pointing errors between transceivers and moderate-to-strong turbulence conditions [2]. In particular, the cumulative density function (CDF) and probability density function (PDF) are used to derive the closed-form expressions and to obtain the end-to-end (E2E) performance analysis of the proposed system model in term of Extended Bivariate Generalized G-Meijer Function (EBGMF) [3]. Additionally, the performance metrics such as bit-error-rate (BER), outage probability, the system capacity performance of the system are analytically derived and verified by the Monte-Carlo simulation approach. The E2E performance metrics are obtained based on the experimental data, which has been taken in Southern Indian Ocean (SIO) on varying vertical depth of AUV. Moreover, this study emphasize the importance effectiveness of varying physio-chemical properties of water such as temperature, pressure, salinity, dynamic viscosity, and density etc., on the real-time data monitoring of E2E performances of the proposed system model. Finally, the simulation results are obtained to depict the received E2E SNR of the proposed hybrid dual-hop UVLC system model.

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Список литературы

[1] 1. Wu, Shaoen, Honggang Wang, and Chan-Hyun Youn. "Visible light communications for 5G wireless networking systems: from fixed to mobile communications."Ieee Network 28, no. 6 (2014): 41-45.

[2] 2. M. Elamassie, S. M. Sait, and M. Uysal, "Underwater visible light communications in cascaded gamma-gamma turbulence," in 2018 IEEE Globecom Workshops (GC Wkshps). IEEE, 2018, pp. 1–6.

[3] 3. I. Wolfram Research, "BWorld Robot Control Software," https://functions.wolfram.com/, 2020, [Online; accessed 25-August- 2022].