ABSTRACT

Due to technological advancement, the Internet has become essential to contemporary civilisation. Fibre optics and other dependable network infrastructure are necessary for quick data transfer. However, wireless fibre optic technologies provide more flexibility, especially in crowded places like Margahayu Raya, which need better communication capabilities. Cables in these locations may detract from the area's visual appeal and level of service. Wireless technology is anticipated to provide high capacity, low latency internet services comparable to fibre optics.

This study is developing a wireless communication system next to the Telkom STO Cijawura in Metro Indah Mall to enhance Margahayu Raya residents' quality of life by offering more environmentally friendly internet access. This research supports the design of optical and cellular networks in Margahayu Raya by adhering to the 3GPP TS 38.133 Version 15.3.0 Release 15 standards, ITU IMT 2020, and ITU-T G.655.E. As part of the suggested solution, an optical network with a Ring topology and Free Space Opticss (FSO) is designed to provide dependable and ideal connection. Furthermore, to offer high-speed data with minimal latency, the 5G cellular network is built utilising 5G Standalone (SA) technology operating at a frequency of 2600 MHz. The network design simulations consider parameters such as Link Power Budget (LPB), Signal-to-Noise Ratio (SNR), Q – Factor , Bit Error Rate (BER), Reference Signal Received Power (SS-RSRP), Signal-to-Interference-plus-Noise Ratio (SS-SINR), and throughput.

The research results show that the Free Space Optics designed for Maragahayu Raya in sunny weather conditions, the system operates well, produces a very low Bit Error Rate and a high Signal to Noise Ratio, but during light rain, moderate rain or heavy rain the performance decreases drastically at low transmission power, resulting in the need for higher power usage and real-time monitoring of weather conditions. With SS-RSRP at -54.61 dBm and SS-SINR at 14.78 dBm, the 5G cellular network meets IMT-2020 specifications with an uplink throughput of 401.793 Mbps and a downstream throughput of 1352.121 Mbps. These findings show that the design successfully raises the network's performance. This network architecture is anticipated to provide cellular services during Margahayu Raya.

Keywords: 5G, Free Space Opticss, Margahayu Raya, Network Design