

ABSTRACT

The development of Unmanned Ground Vehicle (UGV) technology presents significant opportunities for operational deployment in hazardous areas or regions with limited human access. However, UGV communication systems often face signal challenges due to physical obstructions and complex geographical conditions, such as hilly terrain, dense vegetation, or limited infrastructure. This issue becomes critical, especially when real-time transmission of video and sensor data is required to support rapid decision-making.

To address this problem, an internet-based UGV communication system was developed, equipped with a backup manual control system using an auxiliary radio and a microstrip array antenna. The main system is operated by an Nvidia JETSON, which manages online data transmission. When the internet connection is disrupted, the operator can manually switch UGV control to the radio channel using a controller, although this comes with limitations such as the absence of real-time video transmission.

The test results show that the system is capable of maintaining stable data transmission and vehicle control over the internet network, and can continue to operate manually when the connection is lost. Based on the antenna parameter measurements, the system achieved a VSWR of 1.43, a return loss of -14.72 dB, and a gain of 10.251 dBi. With these specifications, the vehicle can operate under Line of Sight (LOS) conditions up to a distance of 346 meters using a single antenna mounted on the left side of the vehicle. The operational range increases to 464 meters with a two-antenna configuration on both sides of the UGV. Under Non-Line of Sight (non-LOS) conditions, the system achieves a maximum range of 213.73 meters with a single antenna, and 241.86 meters with the dual-antenna setup. Therefore, this communication system is considered suitable for use in Unmanned Ground Vehicles (UGVs) that require communication flexibility and resilience in various environmental conditions.

Keyword : auxiliary radio, LOS, non-LOS, Communication system, Real-time video, Unmanned Ground Vehicle (UGV)