

Experiment #4

Extended Reality Lab [Nokia]

Overview and Objectives

The **Nokia Extended Reality Lab** tested a solution for immersive remote driving of an Autonomous Ground Vehicle (AGV) at the UMA testbed. The AGV is equipped with 3 ELP KL170R 1920x1080 Full HD cameras and a Jetson Xavier NX Developer Kit. The solution is complemented by a gaming steering wheel and pedals, Meta Quest 2 Virtual Reality glasses with 128 GB of storage, and a high-performance PC. The PC includes:

- **Unity 2021 LTS:** Necessary to run the application on the Meta Quest.
- **Software for running the remote-control application:** Enables control of the AGV from a distance.
- **Software for receiving streaming from the onboard cameras:** Facilitates real-time video feed from the AGV cameras.

Experiment Execution and Results

The purpose of the testing was to check the performance of the immersive remote driving solution over a 5G private network. The initial connectivity testing verified the basic connectivity and communication between all the components of the solution over the 5G network. The AGV was connected to the 5G network using a 5G modem. The remote control worked, but we could not receive the video in the external PC to perform the remote driving. This feature assigns directly to the Jetson the IP address assigned by the network to the UE. This avoids the need of port redirections, but limits the integration of additional services in the AGV. During the testing, the traffic generated by the 5GC was monitored and visualized, as illustrated in Figure 1.





Figure 1: Traffic generated by the 5GC

Overall evaluation

The evaluation of the AGV in a 5G private network has enabled to test aspects, such as network connectivity, network performance and the overall system efficiency. The most important outcomes of the testing have been the evaluation of the consistency of the network connections of the AGV. Also, the bandwidth generated by the AGVs for the remote teleoperation has been characterized.

For more information, do not hesitate to visit the website <https://www.5gepicentre.eu/> and/or contact the 5G-EPICENTRE team.

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