

AR / VR Based Novel User Interface for Drone Swarms Mission Control

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1. Introduction

This poster paper introduces results from project H2020 ROBORDER (Autonomous Swarm of Heterogeneous Robots for BORDER Surveillance) and specially its the novel user interface for drone swarms mission control. User interface will be based on Microsoft Mixed Reality Solution with Augmented (AR) and Virtual Reality (VR). The novel interface enabling the operator i) to monitor missions of swarm of robots; and ii) have a natural interaction metaphor with the control system, providing to the operators the ability to remotely control the vehicles. Development follows main principle of user centred design. The first proof-of-concept was developed in early phase of the project to collect feedback from various user groups. The second version, functional prototype is ready for user tests, which will be done with end-users with real drone mission.

2. The first version – proof of concept

In Figure 1 can be shown main concept of using Microsoft HoloLens mixed reality solution and virtual control table to use in drone swarms mission control in border inspection. User can plan and control drone swarms inspections areas on 3D virtual map and 'jump-in' to 3D map to see environment in real space. Also, user is able to see various sensor data from drones in augmented reality mode, which supports decision making of border control. The first proof-of-concept has been developed to collect feedback from various user groups, which supports to define the Concept of Operation of novel system.



Figure 1. Proof of concept: Microsoft HoloLens based drone mission control

3. The second version - functional prototype

The second version of the system already reached the functional prototype phase. User is able to monitor and/or control real drone via VR and/or AR user interface. User is able to see drone in 3D online 3D map and can monitor sensors values and choose camera streaming (see Figure 2 – right). Also, mission planning and execution are supported e.g. defining end-point for drone. System has been built in modular architecture, which allow to make application to AR or VR mode to various devices which are supported Microsoft Mixed Reality Toolkit (see Figure 2 – left). Also, desktop and mobile devices are supported with limited features.

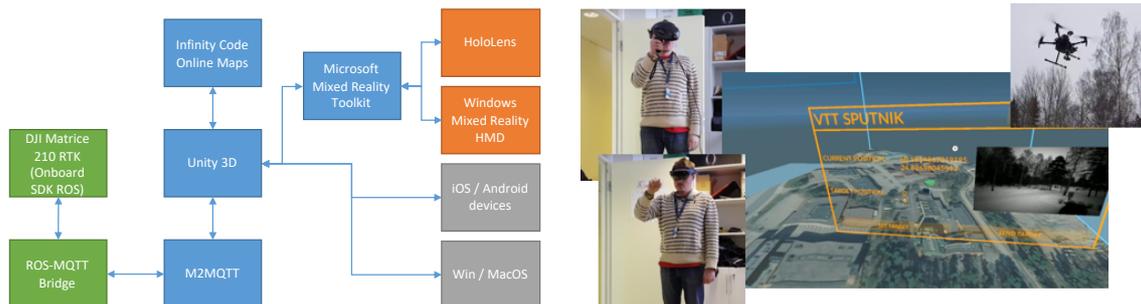


Figure 2. Left: System architecture based on Unity3D and Microsoft Mixed Reality Toolkit. Right: Second version of Novel UI for Drone Mission

4. Evaluation and next steps

The system evaluation will be done with real end-users in real conditions in autumn 2018. Following evaluation methods will be used: (1) The System Usability Scale (SUS), (2) User Interaction Satisfaction (SGUS) and (3) Simulator Signees Questionnaire (SSQ), and interviews. Based on evaluations system will be updated and enhanced.

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