

MULTIMODAL REMOTE TOWER IN VIRTUAL REALITY ENVIRONMENT

PROJECT COORDINATOR: **Deep Blue**

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MOTO

THE EMBODIED
REMOTE TOWER

#automation
#HumanPerformance
#RemoteTower
#Multimodal Solutions

CONSORTIUM



Human Performance advances in Air Traffic Management (ATM) have been traditionally mainly focused on one sense sight. There is still an unexplored potential to improve Air Traffic Controllers performance in Remote Tower Operations (RTO) by implementing multimodal sensorial support.

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AIM

To understand the impact of different sensory inputs on Air Traffic Controller's performance in RTO.

METHOD

Fifteen ATCOs participated in the first validation experiment. The validation study was performed in a virtual reality environment using the HTC Vive Head Mounted Display platform. The participants were asked to manage different realistic Tower Air Traffic Control operational scenarios. These scenarios were rendered in different complexity levels (easy vs hard) and in four sensory modalities conditions (i) visual; ii) visual and auditory; iii) visual and haptic; iv) visual, auditory and haptic).

To investigate **human performance, sense of presence/immersion, situation awareness** and **cognitive workload** a combination of subjective and objective measures were used:

- Neurophysiological signals (Electroencephalogram, Electrocardiogram, Galvanic skin response and Electrooculogram);
- Subjective questionnaires;
- Subject Matter Expert judgement.



MULTIMODAL SUPPORT FOR REMOTE TOWER OPERATIONS

- ATCOs performance could be enhanced by integrating the visual channel with one sensory modality at a time (either audio or haptic).
- ATCOs experienced significantly lower workload in the combined Visual and Audio condition compared to the others. This condition should be preferred in RTO platform setups.
- The full combination of Video, Audio and Haptic condition induced a degradation in performance, possibly due to distracting stimuli contribution that is higher than their informative contents.

SENSE OF PRESENCE INDEX

- ATCO experience higher sense of being present and immersed in the virtual tower environment when they are engaged in a highly demanding scenarios and when the virtual environment is enriched also with the auditory input.

NEXT STEPS

Multimodal design requirements implemented in the augmented solutions.



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