

REQUIREMENTS FOR EFFICIENT VIRTUAL MENTORSHIP

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Speech Recognition

The impact of Speech Recognition in the agency of the ECA allows to understand the instructions or questions given by the trainee in order to process them.

By combining Speech Recognition with the ITS, it allows to identify the lack of knowledge from the trainee on a specific topic, making it easier to teach directly the missing knowledge.

Speech Recognition can also enhance the emotional and social aspect with the trainee by using Emotional Speech Recognition which increase the social presence of the ECA toward the trainee.

Intelligent Tutoring System

The Intelligent Tutoring System (ITS) can be seen as the brain of the ECA. Based on the data received as input, the ITS decides the next action the ECA has to perform.

An ITS is composed of different modules, allowing it to teach knowledge or adapt its teaching strategy in regard of the trainee's performances.

By using machine learning, the ITS can also learn to recognize emotions and adapt its reactions accordingly.

Eye Gaze

Eye-gaze can be used to point out points of interest to the trainee (Gaze-cueing effect).

Eye gazing has proven an efficient technique to engage and maintain attention with the trainee [2].

Non-Verbal Behaviors

Postures, gestures, facial expressions, eye gaze and lip synchronization contribute directly to the non-verbal behavior, enhancing the agency of the ECA by allowing it to exhibit realistic demonstrations to the trainee.

The pedagogical aspect is increased with non-verbal behavior like co-speech gestures which emphasise the message when talking.

Moreover, non-verbal behavior and especially body gesture enhance the inclusion feeling toward the trainee [4].

Verbal Behavior

The ECA can talk using pre-recorded human voices or using Text-To-Speech (TTS) to give instructions, teach and converse with the trainee.

TTS combined with the dialogue management module of the ITS can generate motivational talkative content toward the trainee, and even add an emotional dimension to the conversation (Emotional TTS [3]).

Pointing

Pointing toward an object or a position (Deictic gesture) is a fundamental feature for a virtual companion especially in a technical training context.

Moving

The ECA can move inside the factory by using pathfinding algorithms to navigate toward equipments and machinery, which is core to the agency of the ECA.

This also allows the ECA to guide the trainee in the factory or around the digital twin as well as taking/showing the correct positions during interactions.

A genuine sense of proximity can also be felt by the human learner if the ECA manages correctly the personal space between themselves.

Learning factories are a new way to instruct learners to use machinery using digital twins and virtual technologies like Virtual Reality or Augmented Reality.

Immersive Learning [1] is a framework combining experiential learning and/in immersive environments. Like mentorship that once used to be the privileged way of training newcomers, resorting to virtual mentorship is expected to yield faster knowledge acquisition and better engagement from learners.

A virtual companion is firstly a conversational agent (ECA), endowed with pedagogical skills, and ultimately able to work at an emotional level to generate social presence.

[1] Panzoli, D. (2021). L'interaction pédagogique dans les jeux d'apprentissage immersifs (Doctoral dissertation, Université Toulouse III-Paul Sabatier).

[2] A. Hartholt, E. Fast, A. Reilly, W. Whitcup, M. Liewer, and S. Mozgai, "Multi- platform expansion of the virtual human toolkit: ubiquitous conversational agents," International Journal of Semantic Computing, vol. 14, no. 03, pp. 315– 332, 2020.

[3] R. Liu, B. Sisman, and H. Li, "Reinforcement learning for emotional text- to-speech synthesis with improved emotion discriminability," arXiv preprint arXiv:2104.01408, 2021.

[4] Sajjadi, L. Hoffmann, P. Cimiano, and S. Kopp, "On the effect of a personality- driven eca on perceived social presence and game experience in vr," in 2018 10th International Conference on Virtual Worlds and Games for Serious Applications (VS-Games). IEEE, pp. 1–8, 2018.

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