Ph.D. Thesis Offer

Title: Enhancing Steelmaking Operations through Interactive Immersive Simulation

Introduction: The steel industry is a crucial sector in the global economy, and the efficiency of steelmaking operations significantly impacts production quality, energy consumption, and environmental factors. Effective training of operators in the steel industry is essential for optimizing these operations. This Ph.D. thesis proposal aims to integrate modeling and simulation, 3D experiences, and artificial intelligence to enhance the training of operators and improve steelmaking performance.

Research Objectives: The primary objectives of this research are as follows:

- **Development of Educational Models:** Create educational models for Arc Furnace Operations Training to define retraining programs based on required skills and performance metrics.
- **Modeling and Simulation:** Develop a simulation model using Business Process Model and Notation (BPMN) to orchestrate a 3D environment that accurately replicates operations. This model will provide a platform for training and performance assessment.
- **Integration of AI:** Incorporate artificial intelligence modules, including machine learning, to dynamically adapt training content based on data collected in real steel plants.
- **Distributed Simulation Challenges:** Heterogeneous components operate in parallel. Therefore, there is a need for distributed simulation techniques to address interoperability issues, and time management and synchronization [1]–[3].

Expected Outcomes: This research aims to provide the following outcomes:

- Improved training methods for operators in the steel industry, leading to enhanced steelmaking operations, reduced energy consumption, and better environmental performance.
- Interactive immersive training solutions that facilitate realistic operation scenarios.
- A framework for integrating artificial intelligence into training simulations for continuous improvement.

Conclusion: This Ph.D. thesis proposal focuses on enhancing steelmaking operations through innovative training methods, interactive immersive simulations, and the integration of artificial intelligence. The research aims to bridge the gap between theoretical knowledge and practical expertise, ultimately improving the performance of operators and the steel industry as a whole.

References

[1] M. U. Awais, P. Palensky, W. Mueller, E. Widl, and A. Elsheikh, "Distributed hybrid simulation using the hla and the functional mock-up interface," presented at the IECON 2013-39th Annual Conference of the IEEE Industrial Electronics Society, IEEE, 2013, pp. 7564–7569.

[2] P. Bocciarelli, A. D'Ambrogio, A. Falcone, A. Garro, and A. Giglio, "A model-driven approach to enable the simulation of complex systems on distributed architectures," *SIMULATION*, vol. 95, no. 12, pp. 1185–1211, Feb. 2019, doi: 10.1177/0037549719829828.

[3] J. Possik, A. D'Ambrogio, G. Zacharewicz, A. Amrani, and B. Vallespir, "A bpmn/hla-based methodology for collaborative distributed des," in *2019 IEEE 28th International Conference on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE)*, Capri, Italy, 2019, pp. 118–123. doi: 10.1109/WETICE.2019.00033.

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Host entity: Ecole Du Numérique (EDN), Faculté de Gestion, Economie et Sciences (FGES), Université Catholique de Lille, Lille, France

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- École du numérique (EDN) / Faculté de Gestion, Économie et Sciences (FGES)

Application deadline: October 30, 2023

Application documents: please send a detailed cv and your engineering or master's degree grades.

Applicant profile:

- The candidate should possess strong development skills, as well as a good command of the English language.
- Knowledge in virtual reality development is a plus.

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