


Chapter 5

Robotics E–Learning Supported by Collaborative and Distributed Intelligent Environments

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ABSTRACT

Robotics e-learning environment that facilitates tailored learning for individual students studying robotics is developed. The developed collaborative and distributed intelligent environment (CoDIE) enables multi-users to access simultaneously remote and integrated mixed reality facilities through the web. The developed system constitutes a robotic center to help in transferring theoretical knowledge enhanced by simulation and practical experience. It enables realistic interaction by immersing users in a shared 3D CoDIE. The system enables users to do programming, simulations, experiments, manipulating data and objects, diagnostics and analyses, control and monitor actions. Also, users can receive feedback from the system or instructors. The developed system has been implemented and tested using two real manipulators and virtual robots supporting real-time tracking and simulation. Three modes of operations have been implemented, individual robot training mode through virtual robot models, multi-user mode working together, and individual or group-based training by instructor.

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INTRODUCTION

There is no agreed universal definition of artificial intelligence (AI). However, in a general sense, it is the synergy of multiple technologies that together can create systems that can perform tasks (by applying algorithms and models to find patterns in large amounts of data) usually require human expertise. With the convergence of disruptive technologies (Robotics, nanotechnologies, genetics, 3D printing, etc.), the emergence of every new technologies are accelerating the growth and the capabilities of AI to address new opportunities and challenges (D2L 2018; Luckin et al, 2017). However, the new technologies disrupting the job market will always demand new skills. Hence, new evolution is taking place impacted by AI to lead the development transforming education, teaching and learning into a new era with aim to meet the need by enriching education techniques and methods. The use of AI in education and learning provides classrooms, teachers, schools and universities with innovative ways to understand how to support students' learning process and assess their learning and skills as well as allowing better ways to enhance course content, individualized tutoring and facilitate tailored and adaptive learning experience. The principles of AI in higher education underlie a range of innovative systems that may include for example: analytics, robots, virtual experiences, advising, grading and intelligent tutoring (Wolf, 2009). AI will significantly influence what we teach and learn, as well as how better it can be done. Furthermore, the usage of machine learning, deep learning, and neural networks in AI systems beside the increased computational power represents effective AI-driven tools that facilitate and expand the opportunities to support and improve the education and learning process. New generation of students are living the new era of education as they are growing up with the latest and smart technologies integrated through Internet and other networks.

Since the beginning of E-learning in 1997 it was associated with interactive learner-centered distance learning with aim to enhance knowledge and performance and it is expanded with the evolution of the information and communication technologies that support the growth of the Internet based technologies which evolved to support wide range of web-based applications using resources of various digital technologies (Mori, 1997; Rosenberg, 2001; Rossett, 2001; Cross, 2004; Khan, 2005). Robotics integrated with AI supporting automation along with service robots are influencing current and future industry, economies and society (Wolf, 2009).

This chapter aims to establish effective synergy between robotics, education with AI techniques by synergizing it with the integration of information and communication technologies with the necessary expertise beyond space and time constraints. Information, equipment, devices and expertise along with other resources are scattered across our planet and these resources may not be available where they are needed at the necessary time. The quality of communication technology and

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