New Trends in Education for Intelligent Manufacturing

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Abstract

Industry is a pillar of any economy, leveraging economic growth and prosperity. Industry 5.0 evolved from the concept of "Industrie 4.0" defined in Germany in 2011, by complementing it with resilience, human-centric and sustainability. These features are sine qua non to face a growing demand for customized products to be produced in shorter production times, requiring flexible production systems capable of efficient reconfiguration.

As storage capacity and processing power increase, data in industrial systems becomes more and more significant. Recently, a rapid proliferation of artificial intelligence, machine learning, smart production, and deep learning within the realm of industrial engineering is evident. Motivated by the promising prospects and increasing growth of Flexible Productions Systems (FPS) research within the industrial domain.

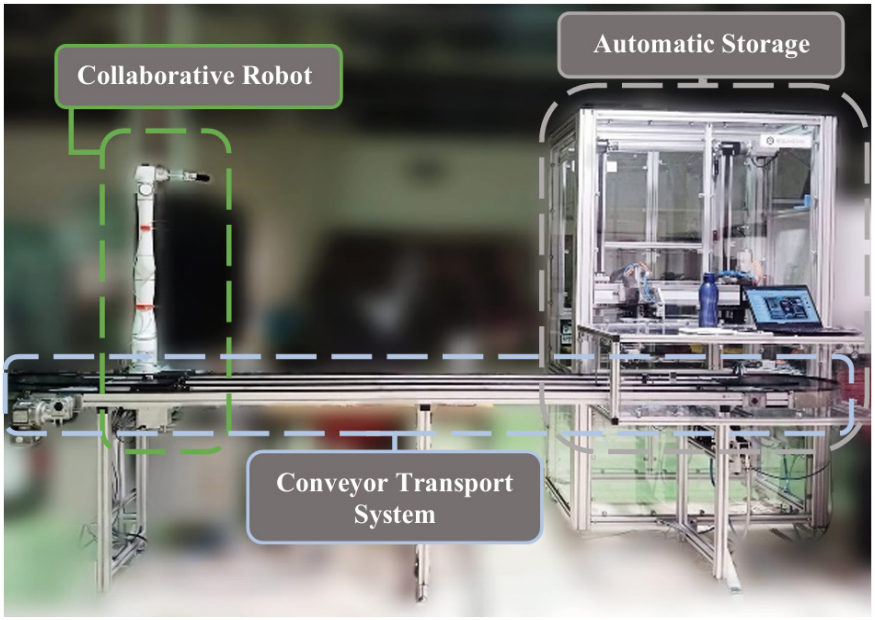

Figure 1: Intelligent Flexible Manufacturing System.

This paper explores project-oriented education in FPS at both graduate and post-graduate levels. It addresses ongoing challenges, aiming to elucidate the diverse range of solutions devised by researchers to optimize Flexible Productions Systems' methodologies. In the scope of the bachelor thesis in Mechanical Engineering, at the Center of Intelligent Systems (CIS), from the Institute of Mechanical Engineering (IDMEC), at Instituto Superior Técnico, University of Lisbon, Portugal, the configuration of an intelligent flexible manufacturing system is proposed to produce and store a product autonomously. The flexible manufacturing cell requires several machines and components organized into three main stations, see Fig. 1: i) automatic storage, ii) conveyor transport system, and iii) collaborative robot station.

The project team, consisting of eight mechanical engineering students, developed a product from ideation to final assembly, with a focus on its integration into the manufacturing cell. The automatic storage and conveyor transport system leverage Bosh Rexroth technology and are controlled by industrial servo drivers programmed in Instruction List and Sequential Function Chart. Additionally, the 6-axis collaborative robot - ELITE Robot EC66, with a payload capacity of 6 Kg (exceeding its intended purpose), was programmed in Lua employing collaborative technology.