

Chapter 15

Cognitive Agent for the Quality Management in Flexographic Printing on Packages


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ABSTRACT

The aim of the chapter is to develop an approach for improving quality management in flexographic printing on packages using cognitive agent. A hybrid agents' architecture based on the learning intelligent distribution agent architecture (LIDA) and hierarchical temporal memory has been developed. Such approach has not been developed before; therefore, it is the main contribution of this chapter. The first part of the chapter presents the introduction to the research problem and background. Next, research methodology and the LIDA cognitive agents have been described. The main part of chapter presents the cognitive agent's architecture and functionality related to quality management in flexographic printing. The last part presents discussion, future works, and major conclusions.

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INTRODUCTION

In flexographic printing on packages, a quality management is related mainly to correct depiction of color. Presently, this process is realized manually by a person, and/or semi-automatically by measuring optical density with a spectrophotometer. Considering the first method, it is directly related to experience and knowledge. Color quality control is carried out at the end of the process, when we receive the final product. The printer (employee) checks if the color is within the tolerance of the standard. If he is not sure, a second method is available to check the range of the visible spectrum using a spectrophotometer. If the color does not match the client's expectations, there is a deduction stage, which of the elements of the process affected the print quality. This manner of quality management is, therefore, very time-consuming and costs-consuming. The person assessing the print must carry out an in-depth analysis of several factors affecting the correctness of the color, such as: parameters of order (printing profile), characteristics of printing units, properties of ink, properties of duct tape, type of anilox, type of printing matrix. If a mistake is made, it may happen that a large part of the production batch will not meet the color quality standards and will constitute waste. The costs of implementing the production order will increase. Therefore, the full automation is required for improving the quality management. We propose to use the cognitive agent for resolving this problem.

The aim of the chapter is to develop an approach for improving quality management in flexographic printing on packages using cognitive agent. A hybrid agents' architecture based on The Learning Intelligent Distribution Agent Architecture (LIDA) and Hierarchical Temporal Memory has been developed. Such approach has not been developed before, therefore it is the main contribution of this chapter. The Design Science Research Process (DSRP) methodology has been used. The implementation of following modules of LIDA will be developed: Sensory memory, Perceptual memory, Episodic memory, Declarative memory, Workspace, Global Workspace, Consciousness module, Action selection module, Procedural memory, sensory-motor memory.

It is also worth noting that cognitive agents have lots of properties related to the theory of autopoietic and isself-sustaining processes, which constitute the main subject of the book. Both concepts autopoiesis and cognition, although deeply related, are not immediately identical: a system can be autopoietic without being cognitive, and cognitive without being autopoietic (Bourgine, P., & Stewart, J.) . Although hybridizing autopoiesis and cognition may lead to the incorporation of new possibilities (autopoiesis is a self-generated system that is created and recreated only with the use of its elements. Cognitive agents, on the other hand, are capable of operating effectively in unforeseen and uncertain situations. It means that the automation tool can use the information it has in a way similar to human reasoning.)

The remaining part of this chapter is organized as follows: the related works are presented in the next section. Next, the Design Science Research Process as a research methodology has been discussed shortly. Sequentially, the mentioned cognitive agent has been developed and its architecture and main functionality have been described. At the end of the chapter, discussion and future research directions have been identified. The last part of this chapter presents major conclusions.

BACKGROUND

The literature on the subject presents many approaches for the quality management in flexographics printing. The paper (Scaccabarozzi, et al. 2020) presents a measurement method, based on the eddy

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