

Preliminary Design of Flexible Packaging Forming System with Material Waste Reduction

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Abstract

Automation in the industrial sector is an essential ingredient for an advanced and productive system. Every manufacturing firm should automate its operations when a certain level of production and demand is reached. The section of packaging is one of the most important sections of every manufacturing unit. There are separate units of packaging providing services related to packing for any production unit. The packaging system's automation is not new and started in the 1960s, but improvements are still in process for optimum material wastage and free of labour intervention. This thesis is based on a case study analysis of an automated packaging-forming system to resolve issues related to the induction of an automated packaging system in Omani industries. The system is in operation with a production unit in a company situated in Oman, particularly in Muscat, named Omani Packaging Company (SAOG). The process of the company and automation unit is analysed for critical problems. The company's process of box manufacturing was investigated, and suggestions were made for possible improvements. A proposed preliminary design was suggested to optimise the production and to reduce the waste of raw materials. This thesis also discusses supplier-material selection as the output preparation in the manufacturing sector of cardboard boxes. The first step in addressing these problems is dealing with cutting, which indicates the issue of splitting a large cardboard sheet (raw material) into smaller sheets that will form the boxes. In such cases, the specification of the amount of the raw material and the proper size of the correct suppliers is important to the professional production process. A paradigm representing the essence of the issue is proposed based on a nesting algorithm. These cardboard boxes must comply with a strict standard compliant with their customer's specifications concerning their material type and dimension. The proposed method for nesting with the preliminary proposed design was compared with that of the case study in material wastage. The result demonstrated the effectiveness of the proposed method over the traditional company's method. Using the proposed algorithm on the waste reduction formulation led to a significant improvement in terms of material waste reduction. The percentage amount of waste reduction was more than 32% compared to the company's traditional method.