

A layout optimization approach for reconfigurable conveyor system using simulation technology

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ABSTRACT – Simulation software has been widely used nowadays. It is useful in the manufacturing sectors, especially in the fourth industrial revolution due to simulation software can provide ideas on how to model, simulate, analyse, and optimize the whole production systems. The purpose of this paper is to present a layout optimization approach for reconfigurable conveyor system. This paper contains user interfaces to optimize the layout of reconfigurable conveyor systems using the programming languages based on the scenario given. Tecnomatix Simulation has been used to implement the methodology.

1. INTRODUCTION

The life cycle of the product becomes shorter in today's fiercely competitive market. The important keys to competition with competitors are the customers' demand for the number and type of product changes, and rapid response [1]. To meet these requirements, reconfigurable manufacturing systems (RMS) are developed. RMS provides short-term adaptability for its functions and capabilities [2]. RMS can respond quickly and effectively to changes [3]. This is due to RMS combines the high throughput of DML and the flexibility of FMS. RMS provides the required functions and capacity. RMS is a static system which contrary to traditional DML and FMS [3]. RMS has many aspects of reconfiguration and one of the aspects is the reconfigurable conveyor system. The conveyor system is one of the material handling systems used in manufacturing industries [4], and this system able to transport products effectively [5].

Conveyor systems generally play an important role in industry and economy sectors. The trend is to continue automation of transportation, storage, production lines, and others. Besides, this focus of automation is becoming increasingly important to reduce costs. Thus, the ways to improve and optimize the conveyor system become a more interesting topic currently and also in the near future. Based on the above facts, layout optimization and simulation are two tasks that are critical to any facility planning and layout research [6]. This paper aims to provide an approach to optimize the layout of the reconfigurable conveyor system. A user interface in the dialogue form will be established based on the scenario using Tecnomatix simulation software.

2. METHODOLOGY

The step-by-step procedures for this project are

introduced using the flow chart in Figure 1.

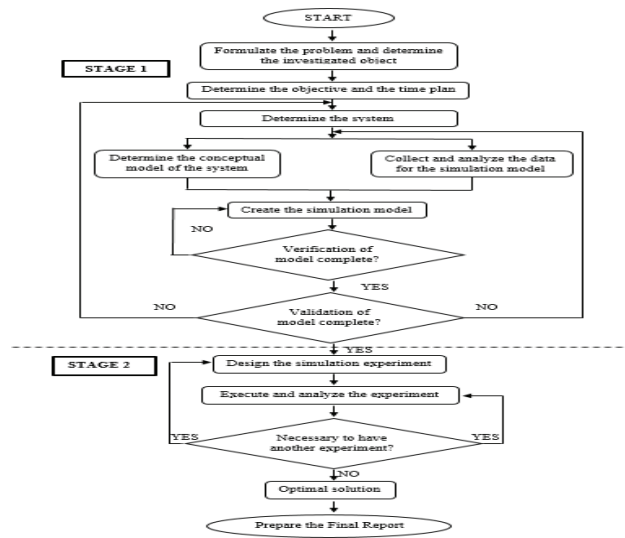


Figure 1 Step-by-step procedures

A user interface is created to help the user to draft the layout of the reconfigurable conveyor system in an optimized way. Before the creation of the user interface, the first thing that has to study is the attribute of the parameters involved in the straight line and curve conveyor system. After the study of attributes, the models for the conveyor systems need to be created before the creation of the user interfaces. The programming languages named SimTalk is used to develop the user interface. After the user interfaces had completely developed, experiments need to be run to achieve the target of the project by optimizing the layout of the conveyor systems.

3. RESULT AND DISCUSSION

Two different scenarios are created to support this study which involved two different modules which are straight conveyor modules and curve conveyor to form a complete system. The base of the conveyor system is the straight conveyor modules (Figure 2). The curve conveyor system (Figure 3) is the conveyor system that normally used in the assembly line.

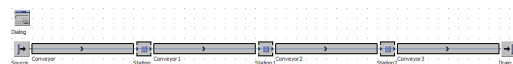


Figure 2 Straight line conveyor system

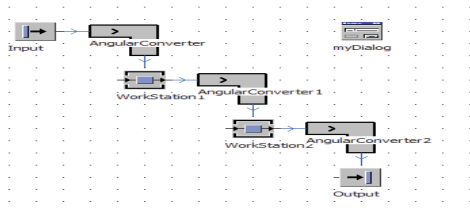


Figure 3 Curve conveyor system

The user interfaces (UI) are created based on the modules shown in the figures above. The parameters involved in both of the UI after the study of attributes are divided into two main categories which are the parameters of conveyor and parameters of transferred materials. The parameters are the same for both of the UI except for the category of the parameters of conveyors for the curve conveyor system. The curve conveyor system involved one extra parameter which is the angle of the conveyor.

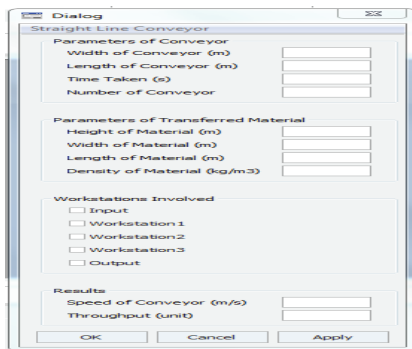


Figure 4 Simulation user interface for the straight-line layout

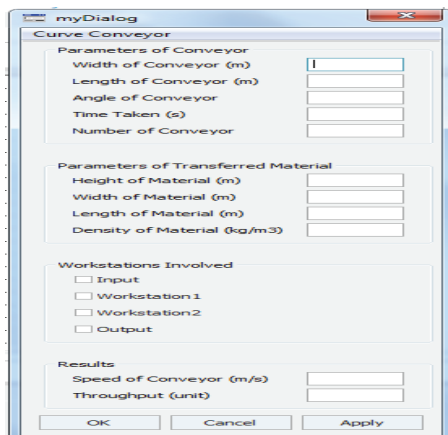


Figure 5 Simulation user interface for the curve layout

4. CONCLUSIONS

As a conclusion, the development of user interfaces able to reduce the time for the designer to design the layout in an optimized way. By using Tecnomatix simulation software to create interfaces and to optimize the layouts become possible with the assists of the programming languages.

REFERENCES

- [1] Aboufazeli, N., Reconfigurable Machine Tools Design Methodologies and Measuring Reconfigurability for Design Evaluation, pp. 62, 2011.
- [2] Youssef, A. M. A., and Elmaraghy, H. A., System Configuration Selection for Rms, pp. 1–10, 2000.
- [3] Koren, Y., Gu, X. and Guo, W., Reconfigurable manufacturing systems: Principles, design, and future trends, 2017.
- [4] Mohamad, N. R. *et al.*, The architecture of the reconfigurable conveyor system in the manufacturing system, *Journal of Advanced Manufacturing Technology*, vol. 12, no. 1, Special Issue 2, pp. 117–128, 2018.
- [5] Dematic, 2014. Conveyor systems-cost-effective conveyor systems that give years of reliable service.
- [6] Grajo, E., Strategic layout planning and simulation for lean manufacturing: A LayOPTrM tutorial. *In Proceedings of the 1996 Winter Simulation Conference*, ed. J. M. Chames, D. M. Morrice, D. T. Bnmner, and J. J. Swain, pp. 564-568, 1996.