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Survey of Industrial Automation Systems for Material Handling and Packaging

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ABSTRACT

Today, Industrial automation programming and design is based on PLCs. After forty years of PLCs introduction, they are still the most prevalent implementation platform for automation systems in many industries. In 1992, IEC 61131 standard in PLC was introduced, which reduces the number of languages available on PLC platform. However, it is difficult to develop complex distributed control system by using tool available in IEC 61131. This paper proposes to introduce new software and methodological tools yet available in industry and research to build control applications. This allows the synthesis of the controller for controlled system's behaviour and its specification.

Keywords: IEC 61131, automation, PLC.

I. INTRODUCTION

Todays, most of programming of automation systems is based on the International Electro technical Commission (IEC) 61131 standard but this standard does not meet OOP requirements while making programming of large distributed systems hence it quite difficult to program.to overcome this deficiency the standard is currently being revised. The IEC 61131 already contains simple class concept, the FB which has an internal state, used to a routine manipulating this state, and it may be instantiated several times. So extending the existing functional block with the help of object oriented features is a natural path of introducing object orientation in the IEC 61131. This is the path that the current working draft of IEC 61131 revision is following adding methods, inheritance and interface abstraction to FB

Object oriented programming has demonstrated its capability in handling complex software development problems and producing flexible and reusable software component. In industrial automation, objects are often related to physical devices built in a specific industrial domain context. Thus, in industrial automation the application of object oriented programming is expected to be more intuitive than it has been in software engineering. Industrial control systems are not basically generic computer systems, then OOP tools oriented to industrial automation should satisfy the additional requirements, direct access to I/O signals;

Multi-paradigm programming i.e., objects programming should be optional to offer a stepwise and reversible transition to OOP. Object oriented programming should be supported in all languages provided by IEC 61131 so that both textual and graphical languages can be used, the latter being very useful when programming sequences. Real time software requirements are implicit in most of industrial automation. Industrial control systems are usually equipped with real time operative systems, which guarantee the meeting real time constraints from a control engineering point of view.

On the other hand, there exists another IEC standard i.e. the IEC 61499 .This standard built on IEC 61131 and on the functional block concept, provides an implementation-independent distributed control standard. One of the main achievements in IEC 61499 standard is that introduction of the event based execution order for program organization unit. Main drawbacks of IEC 61499 standard that is very different from IEC 61131 thus requiring a steep learning curve, it supports

partially OOP and there are few commercial implementations. A huge amount of manpower and money has been spent in industry in order to establish applications using IEC 61131 and this makes difficult to adopt new standards or new paradigms.The main purpose of this paper is the paper is to introduce new software and methodological tools yet available in industry and research to build control application and allow the synthesis of the controller for controlled systems behavior and its specification

II. METHODS AND MATERIAL

A. Literature Review

In [1] the automation can be on the same machine level on a production line, or in a whole department where the workers tasks is monitoring, inspection, and maintenance. This paper presented the automation of material handling and packaging in a production line of which this process is done manually in different companies. PLC today are advancing in terms of applicability and capability. The experimental prototype uses a programmable logic controller specifically the Mitsubishi FX 2N 48MR PLC and the electro-mechanical devices. The system works during normal operation and greatly improved the automation processes with the use of the PLC ladder diagram. The wiring and installation procedure are also improved because the PLC input and output devices are assigned with specific addresses, and thus; further simplifies troubleshooting. Cost reduction mainly on the man-power or personnel cost is achieved in this paper. Hence, only one or two personnel are needed for the operation and maintenance with the automated system.

In [2] the paper presents the elaboration of a concept to develop and implement real-time capable industrial automation software that increases the dependability of production automation systems by means of soft sensors. An application example with continuous behaviour as it is a typical character treat of process automation is used to illustrate the initial requirements. Accordingly, the modelling concept is presented which supports application development and which is supplemented by an implementation approach for standard automation devices, e.g., programmable logic controllers. The paper further comprises an evaluation which adapts the concept for two use cases with discrete behaviour (typical character treat of manufacturing automation) and validates the initially imposed requirements.

In [3], a generalized approach is presented which provides a means for the evaluation of alternative container designs in the transportation of multiple package types of random size and weight between multiple locations. It is assumed that each of the package types are small in comparison to the size of a semi-trailer and resources (such as fork lib, pallets) are available to move moderate sized filled containers (less than 2,000 pounds). The generalized approach is motivated by a case study. The case study demonstrates the effectiveness of the approach. In the case study, there is quantitative justification of the dimensional design of an alternative container design. Furthermore, statistical evidence is provided to support the evolutionary direction of dimensional specifications of semi-trailers purchased in the future.

In [4] Lithography for Advanced Packaging is considered a market with a high potential for growth as it includes many different players along the supply chain. In addition, due to the remaining challenges to solve in the lithography processes for Advanced Packaging, there are huge business opportunities in this area which are driving photolithography equipment demand to meet the requirements in terms of performances and cost. The opportunity to meet the packaging area's lithography needs has driven the entrance of Front-End and Back-End equipment suppliers. This creates a battleground between vendors who crave market share in the Mid-Process space.

In [5] an object oriented approach, the programming language SFC together with a proper way to organize the inputs and outputs of FBs and

supervisory control are proposed to implement industrial automation control systems to meet the new challenges of this field. FBs are assumed to be objects with methods and proper- ties. Methods together with a SFC help to make event-based the execution order of FBs. Moreover, FBs are seen as service providers, according to a service-oriented paradigm. Further- more, it has been shown that supervisory control can be adopted to solve the coordination, in the context of industrial control, of the concurrent behaviour of the several FBs which constitute a typical automation software application. Indeed, the desired behaviour of such an application results to be expressed in terms of desired sequences of events. PNs have been chosen since efficient methodologies are available to apply supervisory control using this formal model and it has been shown that they can be easily implemented on commercial PLCs.

B. Methodology

This is a step by step process which corresponds to both input and output peripherals that are needed in programming the ladder diagram. In automation includes the placement of box, filling of materials in box, transferring, checking, and sealing of the final product. The overall design is implemented with the help an experimental prototype.

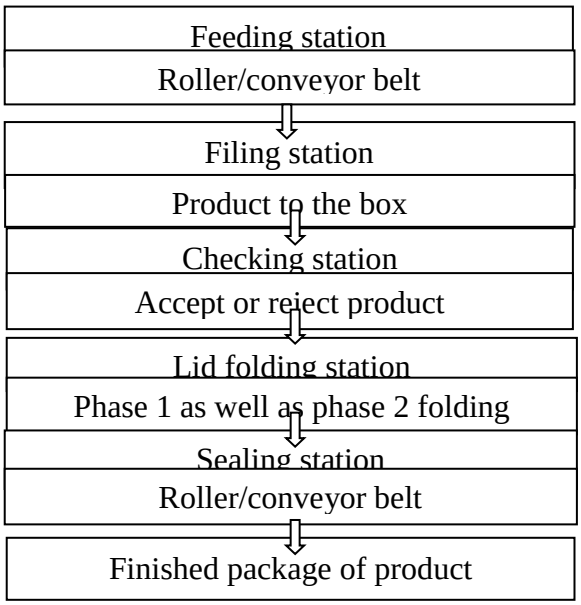

Fig. 1.1 illustrates the process of material handling as well as packaging system which shall be automated by using new processor

Below is the discussion of whole operation which is perform during automation

1. When the start button is pressed then, box shall be push inside the hopper by cylinder 1.
2. Box sensor 1 is provided as to sense the presence of box inside the hopper. When a box is detected, hopper motor start runs, thus; dropping marbles to the box this box is stationary.
3. The correct number of marbles being drop to the box is counted by counting sensor which provide monitor.
4. A load sensor activates as to determine if the loaded box is overload or exact load after the desired numbers of marble balls is dropped. Good items are pushed to the next phase by cylinder 2, while the inside load box and the overload box is pushed away from the line by cylinder 3, then which is to be checked manually.
5. Having a good item box triggers the conveyor 2, to start its operation. The approaching box is monitored by sensor 2 box.
6. When a box is sensed by sensor 2 box then, it shall activate cylinder 4 and folding the lid of the first section of side of box.
7. The second section and lid is folded, when the box moved on the specialized lid folding the obstacle or the box makes progress on the conveyor.
8. Having a partially closed box on a continuous running conveyor, it passes to the sealing station which finishes the packaging process of box. At this station, a cutter and a packaging tape is positioned on a flip type window as to allow the incoming box to pass beneath it.
9. When the flip type window is moved from upward to downward position the tape cutter sensor shall be triggered, this shall turned the tape cutter to move downward via cylinder 5, and cut the tape.

10. Having finished the required task then the system shall point out another process is to be commenced as invoke by the operator.
11. The finished item shall be collected out at the end of the line by person which on duty.

III. CONCLUSION

Today, software requirements in industrial automation include capability to implement applications involving largely distributed devices, reuse of software components, formal verification that specifications are fulfilled. In this paper, an OOP language approach, that by using this language provides proper way to organize the inputs and outputs of FBs and to meet the new challenges of this field, supervisory control are provides by this proposed to implement industrial automation control systems.

IV. REFERENCES

[1]. Joanna Marie M. Baroro, Melchizedek I. Alipio, Michael Lawrence T. Huang, Teodoro M. Ricamara, Angelo A. Beltran Jr., "Automation of Packaging and Material Handling Using Programmable Logic Controller", International Journal of Scientific Engineering and Technology, Volume No. 3, Issue No. 6, pp.: 767 – 770. (ISSN: 2277 – 1581), 1 June 2014.

[2]. Daniel Schütz, Andreas Wannagat, Christoph Legat, and Birgit Vogel-Heuser, Senior Member, IEEE, "Development of PLC-Based Software for Increasing the Dependability of Production Automation Systems", IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS, VOL. 9, NO. 4, NOVEMBER 2013.

[3]. John R. English, University of Arkansas, Fayetteville, "Material-Handling of Random Packages: Design for Reliability", 1993 PROCEEDINGS Annual RELIABILITY AND MAINTAINABILITY Symposium, IEEE.

[4]. Amandine PIZZAGALLI, "Lithography technology and trends for Advanced Packaging", Yole Développement, 75 Cours Emile Zola, 69100, Villeurbanne - Lyon, France, IEEE 2016.

[5]. Ana Luisa Ramos, José Vasconcelos Ferreira and Fabio Bernardes, Improving the Productivity of a Packaging Line Using Lean Manufacturing Tools and Simulation", Proceedings of the 2015 International Conference on Industrial Engineering and Operations Management Dubai, United Arab Emirates (UAE), March 3 – 5, 2015.

[6]. Francesco Basile, Senior Member, IEEE, Pasquale Chiacchio, Senior Member, IEEE, and Diego Gerbasio, "On the Implementation of Industrial Automation Systems Based on PLC", IEEE TRANSACTIONS ON AUTOMATION SCIENCE AND ENGINEERING, 2013.

[7]. M. Cong, J. Zhang, and W. Qian, "Fault diagnosis system for automated assembly line," in Proc. IEEE ICIPS, 1997, pp. 1478–1482.

[8]. A. Wannagat and B. Vogel-Heuser, "Increasing flexibility and avail- ability of manufacturing systems—Dynamic reconfiguration of automation software at runtime on sensor faults," in Proc. 9th IFAC IMS, 2008, pp. 381–386.

[9]. B. Vogel-Heuser, Handbook of Automation.NewYork: Springer-Verilog, 2009, Ch. Automation in wood and paper industry.

[10]. W. Lepuschitz, A. Zoitl, M. Vallée, and M. Merdan, "Toward self- reconfiguration of manufacturing systems using automation agents," IEEE Trans. Syst.Man Cybern. C, Appl. Rev., vol. 41, no. 1, pp. 52–69, Jan. 2011.

[11]. M. Cong, J. Zhang, and W. Qian, "Fault diagnosis system for automated assembly line," in Proc. IEEE ICIPS, 1997, pp. 1478–1482.

[12]. W. Lepuschitz, A. Zoitl, M. Vallée, and M. Merdan, "Toward self- reconfiguration of manufacturing systems using automation agents," IEEE Trans. Syst.Man Cybern. C, Appl. Rev., vol. 41, no. 1, pp. 52–69, Jan. 2011.

[13]. P. Vrba, P. Tichy, V. Marik, K. H. Hall, R. J. Staron, F. P. Maturana, and P. Kadera, "Rockwell automation's holonic and multiagent control systems compendium," IEEE Trans. Syst. Man Cybern. C, Appl. Rev., vol. 41, no. 1, pp. 14–30, Jan. 2011.

[14]. A. Lüder, A. Klostermeyer, J. Peschke, A. Bratoukhine, and T. Sauter, "Distributed automation: Pabadis versus HMS," IEEE Trans. Ind. Inf., vol. 1, no. 1, pp. 31–38, Feb. 2005.