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Improve the Performance of Industrial Internet of Things Technology Using Distribution Feeder Automation

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ABSTRACT: In this paper we discuss performance and reliable manufacturing industrial internet of things using distribution automation. which are easily integrable,modular design, promoting most effective components reconfigurations with minimum downtime. In this paper out approach is used resulting in modification of local controller and real industrial systems and focus on maintaining functional properties of the system. we are providing a missing link for reliable IIOT based distribution systems. the concept of distribution automation system is put forward to improve power supply reliability and power quality to the uses.

I.INTRODUCTION

The industrial automation internet of things refers to interconnected sensors,instruments.it is the process by which the collection of data is automated and analyzed.distribution automation is a littlr bit of a misnomer because it impiles a closed loop. The most prominent enabling technologies for RMS development are the (Industrial) Internet of Things (IIoT) and Cyber-Physical Systems .To ensure scalability, convertibility and customization, RMS should be modularly built on IIoT-enabled smart things – manufacturing.

Design of industrial automation/control systems commonly comes in a form of a relatively low level of abstractio In industrial practice, GRAFCET standard is frequently employed for functional specification of event-driven sequential control tasks. Control interpreted Petri nets (CIPN) are the formalism underlying GRAFCET, with the behavioral equivalence between these shown in . Following this rationale, and considering the benefits that CIPN and the parent formalism of Petri nets (PN) provide for industrial automation, we have recently proposed a method for distribution of control tasks in industrial automation based on the use of CIPN. Reconfigurable manufacturing systems supported by Industrial Internet-of-Things (IIoT) are modular and easily integrable, promoting efficient system/component reconfigurations with minimal downtime. Industrial systems are commonly based on sequential controllers described with Control Interpreted Petri Nets (CIPNs).

Existing design methodologies to distribute centralized automation/control tasks focus on maintaining functional properties of the To ensure scalability, convertibility and customization, RMS should be modularly built on IIoT-enabled smart things – manufacturing field devices (sensors, tools, machines, ...); these represent CPS that in addition to the physical devices, integrate computation and communication to support a higher level of automation/autonomy. RMS capabilities, including modularity and re-configurability, impose new requirements on the control system design. The traditional automation pyramid (where each layer of devices strictly has a lower level of automation than the layer above) is broken up, giving way to control systems with functionality distributed over different field devices that communicate with each other.

Industry 4.0 enterprise is based on ubiquitous communication between things (assets) that form the IIoT, and enable vertical, horizontal and end-to-end integration of manufacturing processes . Yet, reliable functioning of RMS with distributed control/automation tasks requires high performance connectivity of smart devices. Key performance indicators of the IIoT connectivity represent: network availability (robustness to failures), data loss and transmission errors, data latency and jitter, and data throughput . For the functions of distributed industrial control systems, reliable communication, data latency and jitter are critical.

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Design of industrial automation/control systems commonly comes in a form of a relatively low level of abstraction – i.e., as sequential discrete-event systems. In industrial practice, GRAFCET standard (IEC 60848) is frequently employed for functional specification of event-driven sequential control tasks. Control interpreted Petri nets (CIPN) are the formalism underlying GRAFCET, with the behavioral equivalence between these shown in . Following this rationale, and considering the benefits that CIPN and the parent formalism of Petri nets (PN) provide for industrial automation, we have recently proposed a method for distribution of control tasks in industrial automation based on the use of CIPNs . Specifically, starting from a CIPN representation of the global (i.e., centralized) control system, which may be extracted from a GRAFCET-compliant design tool, control system functionalities are automatically distributed to a number of local controllers (LC) executing on IIoT-enabled smart devices; local CIPNs, as well as control code in C, for all LCs are automatically obtained during this procedure. To ensure that the obtained functionality of the distributed system matches the one of the centralized system, coordination of the LCs with physical access to sensors and actuators is performed by means of communication.

II. METHODOLOGY

It was reliable IIoT-based distributed automation centralized CIPN-based controller model is transformed into local CIPNs, each of which is used to generate executable code (in C) for smart device controllers. To enable system analysis for realistic environment (e.g., communication) models, the local CIPNs are further converted into an SRNcompatible representation; the channel and plant SRN models are introduced. Such models are used to verify system reliability and performance both at design- and run-time; any detected execution scenario that violates system requirements is then used to adapt the design of local CIPNs to avoid detected failure modes. The paper's contributions are highlighted in blue.

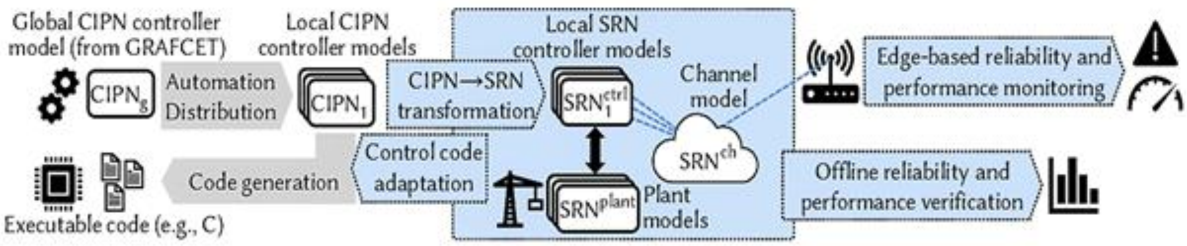

fig: methology of reliable IIOT distribution automation

communication between smart devices raises the issue of reliable information exchange which is crucial in safety and mission critical production systems. CIPNs are originally intended for modeling of centralized automation systems, and thus do not support inclusion communication channel models for control design and performance analysis. Hence, control performance of the newly obtained distributed

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Consequently, we bridge the gap between the expressiveness of the widely adopted control models and the need for verification of automatically synthesized distributed control systems. We achieve this by automatic translation of the distributed CIPN models into Stochastic Reward Nets (SRNs) — a variant of PN that supports stochastic timing features suitable for modeling of communication channels and time-varying physical executions; this enables capturing of automation-level (control-related) effects of realistic IIoT designs. SRNs were successfully used to model performance/reliability of software/hardware , communication protocols and distributed systems . We exploit composition of SRN models to verify relevant system properties, based on probability distributions obtained (and updated at runtime) from system measurements. Execution scenarios that violate the desired properties are then used to modify the distributed CIPN controllers such that potential failure modes are avoided. Finally, we do not limit the analysis to design-time only. To support dynamic IIoT environments, we develop an edge-based runtime monitoring system that checks properties of interest against system models any time the models are updated; SRN models are continuously updated using real-time process and communication channel measurements obtained by the smart devices and the monitoring system itself.
This paper is organized as follows. provides an overview of state-of-the-art distributed automation modeling and design based on CIPNs as well as its limitations in realistic IIoT-based systems. introduces SRNs, the transformation from the CIPN controller models, and network modeling. In , we present the use of such models for offline analysis and property verification, and introduce edge-based runtime verification of distributed

III. THE NEXT GENERATION OF INTERNET THINGS

The IOT is enabled by heterogenous technoluogies   used to sense,store,collect,create notifications.new systems IOT that are smart solutions with embedded intelligence,connectivity and processing capabilities for edge devices.

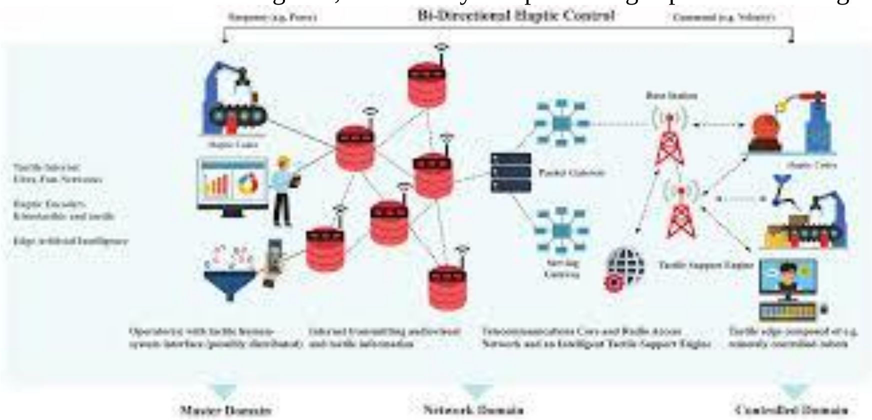

FIG: NEXT GENERATION INTERNET OF THINGS

A. ON REAL-WORLD INDUSTRIAL CASE-STUDIES:-

we show applicability of our methodology for IIoT-enabled distributed automation: 3-DOF pneumatic manipulator, and a complex pneumatic manipulator with parallel processes. The considered manipulators are not classical; they are modularly designed in terms of mechanical subsystems and their control (using a smart IoT device), to facilitate reconfiguration. Also the considered control scenarios do not follow the conventional IEC 62264 hierarchical industrial automation pyramid. While we limited our evaluation to manipulators in our physical testbed, our approach applies to other IIoT-enabled equipment.
In both case-studies, we start from distributed control models obtained using existing techniques. We transform these CIPNs into SRNs and perform analysis with the developed plant and channel models. We first show how to

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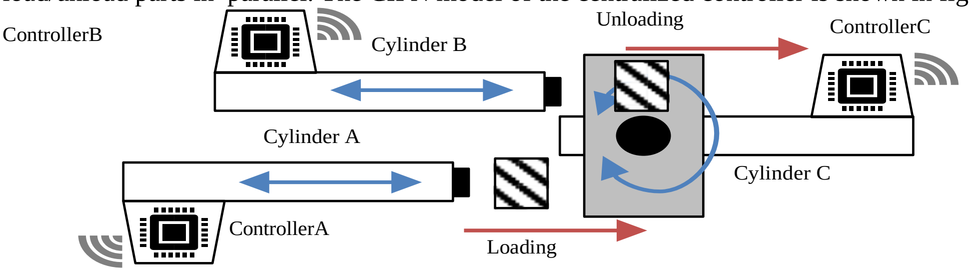
B. INDUSTRIAL MANIPULATOR WITH PARALLEL PROCESSES

The manipulator is configured in a parallel loading/unloading configuration; it consists of two (parallel) cylinders A and B, and a rotary cylinder C. The rotary cylinder rotates a base with parts, while cylinders A and B load/unload parts in parallel. The CIPN model of the centralized controller is shown in fig.



This cylinder configuration is of special interest as cylinders A and B simultaneously stroke forward to load/unload parts; thus, controllers A and B in the distributed setting must simultaneously command the forward stroke of their respective cylinders, when commanded to do so by controller C (followed by completion of the rotary movement of cylinder C). While the communication from controller C to controllers A and B can be realized using a multicast protocol, guarantees must be provided that cylinders A and B both receive the signal, and synchronously issue actuation commands.

On the other hand, while broadcast is, multicast communication is not natively supported by the power wireless communication standard employed in the previous case study. While there exist works on achieving multicast communication via IPv6 protocol , simultaneous delivery and processing ofpackets on multiple receiving nodes cannot be guaranteed. From Figure Case Study II: Industrial manipulator in a parallel loading/unloading configuration. Parts are loaded by cylinder A, and unloaded by cylinder B simultaneously, while the rotary cylinder C 'replaces' the loading/unloading positions by means of rotating the loading base.the analysis of the SRN-models obtained as described, we found again that the translation of the controller communication semantics needed to be adjusted, as the resulted distributed automation system was violating safety properties. For instance, if only one of the controllers A or B receives the packet and commences actuation, the system transitions into an erroneous state; for example, a new part is loaded against the previous one that is not yet unloaded.

We thus modified the semantics of the communication-APIs in translation from the CIPNs as part of code generation; this was done to utilize the low-power, low-bandwidth synchronization protocol devised . which is fully compatible with our LC platform implementation. When the synchronization protocol was employed, it enabled synchronous execution of actuation commands on controllers A and B, once both controllers received the signal from controller C. This may introduce additional delays, as additional handshaking between controllers A and B is added, as well as potential additional retransmissions between cylinders C and A, and C and B, which are originally nonexistent in the CIPN-based distributed automation model. Still, with (worst-case) 100 ms added to the production cycle time, sub-10 µs synchronization of cylinder A and B strokes is achieved, resulting in a verifiably safe system.

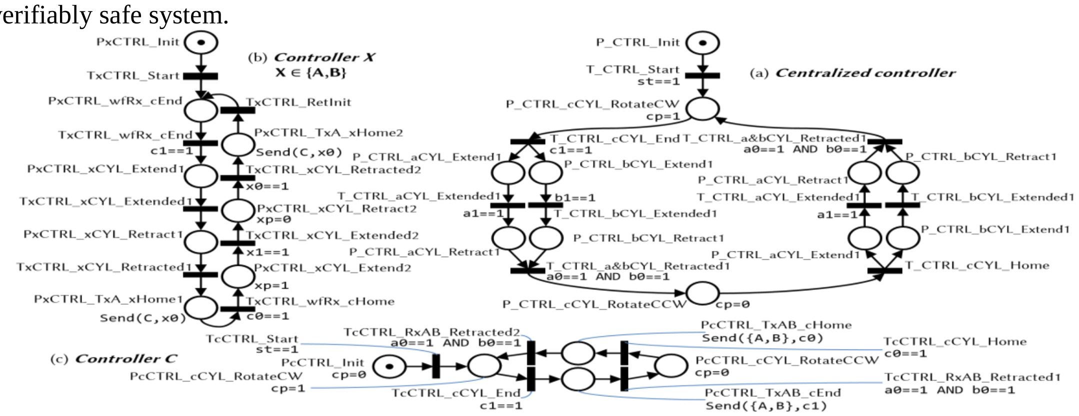


Fig: global (a), and local (b),(c) cipn controller models of the industrial manipulator

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IV.CONCULSION

In this paper we are studied the performance and reliable manufacturing industrial internet of things using distribution automation.we have represented methodology that takes of input widely used CIPN using controller models for industrial automation.our approach on world studies including industrial manipulation.we will explore inclusion of true non-determinism with the controller and allow us to capture affects on distributed automation systems. for automatic synthesis of distributed control code based on results obtained from SRN models. To support dynamic deployment environments of IIoT-based automation systems, we have proven feasibility of an edge-based monitoring system

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