Factory Infrastructure Monitoring and Supervision

Extended Abstract

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ABSTRACT

In this demonstration, we illustrate our Industry 4.0 ready, integrated factory infrastructure monitoring and supervision solution built upon on our tools and products used in ICT systems performance monitoring and management. The central component of this solution is our Fault Manager. It gathers the alerts from the monitoring tools of the different factory subsystems (Production, ICT, Base Infrastructure) and based on correlations and rules, and purpose driven data storage and handling, it derives the root cause of failures. This integrated approach results in decreased fault localization time, hence less production downtime and revenue loss. We demonstrate our solution on a plotting board, which illustrates the simplified operation of a bottling plant. We generate failures in the different plant subsystems, show their impact on the other subsystems if any, and show how failure recovery can be facilitated and speed up thanks to our integrated factory infrastructure monitoring and supervision solution.

1 INTRODUCTION

Modern, Industry 4.0 ready factory infrastructures are pretty complex. The factory subsystems, such as (i) production lines/machines, including PLCs, RFID and BARCODE readers, HMI panels, PCs, and their control system (SCADA, MES, ERP); (ii) factory ICT (information and communications system of the factory); and (iii) the factory base infrastructure (facility including power supply, water, heating) constitute a complex production ecosystem (Fig. 1). It is paramount for every factory to assure the quality and continuity of production, which can be measured by the waste product ratio and the production downtime.

In this complex ecosystem, it can easily happen that a failure in a unit blocks the whole production process, and thus the normal operation of the factory. In this situation, likely dozens of alerts will be generated by the independent monitoring systems of the factory subsystems and the operations and maintenance (O&M) team can spend significant time and effort to localize the real source of the problem. However, if we handle this monitoring and supervision task in an integrated manner, a central fault manager implementing failure root cause analysis can easily point out the problem source reducing drastically the fault localization time and eventually the production downtime.

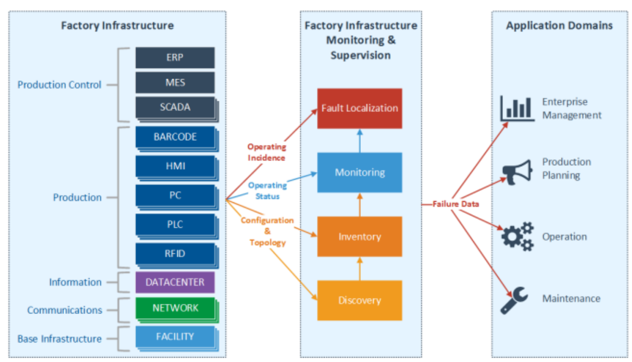

Figure 1: Failure detection and impact in a factory.

Our solution is an integrated framework, which consists of our OSS (Operations Support Systems) tools and products, and our IoT platform implementing the required tasks (Fig. 1). Hence, our IP Explorer (IPE), Network Inventory (NETinv), Performance Visor (PVSR) and Fault Manager (FM) [1] accomplish the Discovery, Inventory, Monitoring and Fault Localization tasks, respectively. Moreover, our SensorHUB IoT platform [2] provides application domain support.

2 DEMONSTRATION

2.1 Scenario

The demonstrated scenario is a simplified bottling plant, where we monitor the operation of some elements of the Communications, Production and Power Supply subsystems (Fig. 2). When a failure occurs, the Fault Manager, gathering the alerts from PVSR and/or the other monitoring tools of the factory subsystems, runs failure root cause analysis based on predefined correlations and rules, and purpose driven data storage (using graph databases) and handling, which results in pointing out the problem source.

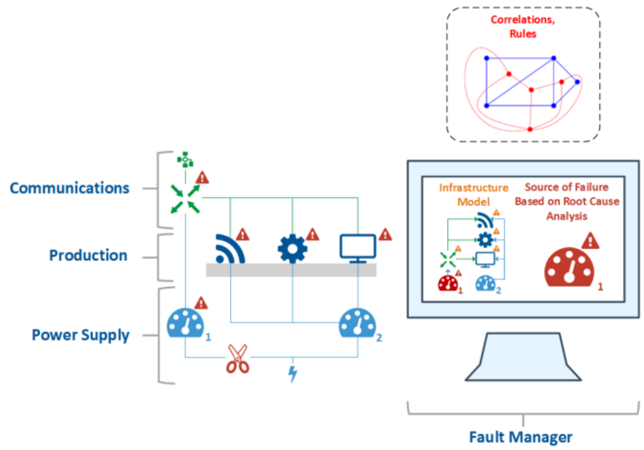

Figure 2: Demonstrated scenario.

2.2 Setup

The demonstrated scenario has been implemented on a plotting board. The bottling plant consists of: Cart, Belt & Tank, Communication Centre, Monitoring & Supervision Centre, Warehouse, and Intervention Console (Fig. 3). These components are communicating with each other via a local WiFi network.

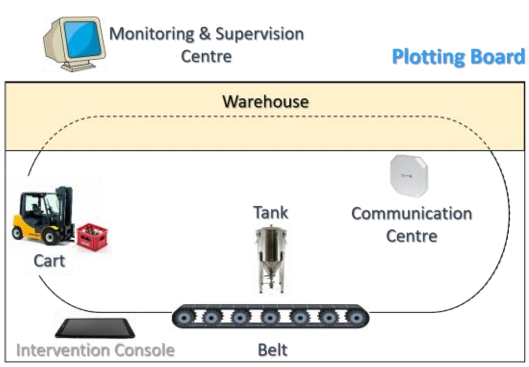

Figure 3: Plotting board with the illustrated bottling plant.

2.3 Operation

The self-driving Cart moves a bottle case along a track illustrating the main operation phases of a bottle plant, such as (i) empty case movement; (ii) bottle filling up on the Belt; (iii) full case movement; (iv) case swap in the Warehouse. The operational status of the main elements of the different subsystems are monitored in real-time and visualized on the Fault Management Console (Fig. 4).

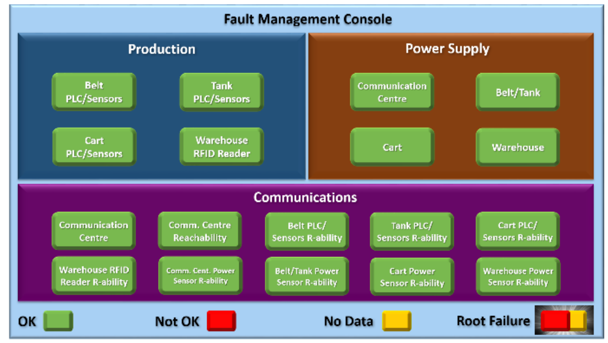

Figure 4: Fault management console.

Beyond the normal operation, we have implemented several fault scenarios with regard to all the three subsystems resulting in simple and compound impacts. These scenarios are grouped into two types such as requiring or not manual intervention. Hence, the visitors can intervene interactively in the demonstration via the Intervention Console. The caused failures are visualized on the plotting board, since their impact and the source of the failure are showed on the Fault Management Console (Fig. 5). After failure recovery the system returns back to the normal operation.

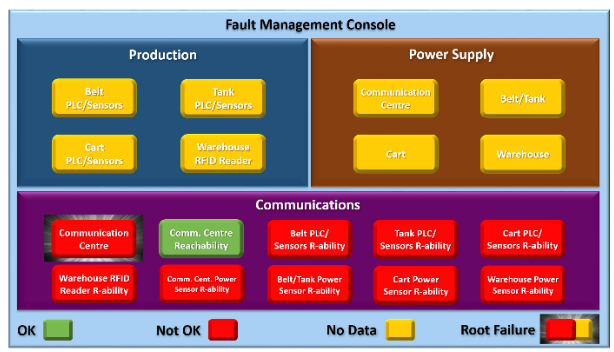

Figure 5: Root failure on the fault management console.

2.4 Requirements

Our demonstration requires only power supply (220V, 50Hz) and enough space (150cm x 240cm) to set up the plotting board.

ACKNOWLEDGMENTS

The design and development of this demonstration have been carried out in the frame of project no. 2017-1.3.1-VKE-2017-00042, which has been implemented with the support provided from the National Research, Development and Innovation Fund of Hungary, financed under the 2017-1.3. funding scheme.

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