



An IIoT-based architecture for decision support in the aeronautic industry

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Agenda



Introduction



Decision Support System for Manufacturing &
Fasten Open IIoT Architecture



EMBRAER Case Study



Potential Results



Conclusions

AGENDA

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Introduction

1. Introduction

Digital Transformation: Challenges and Drivers

General

MARKET DYNAMICS	INNOVATION	NEW BUSINESS MODELS
RESOURCE AND ENERGY EFFICIENCY	SUPPORT FOR DECISION- MAKING	HUMAN FACTORS

Aerospace

- Customer relationship
- New products and services
- Value chain ecosystem
- Efficiency: production rate, costs and quality
- Digitalization of business processes
- Workforce

1. Introduction

Digital Transformation: Challenges and Drivers

General

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INTRODUCTION

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1. Introduction

Digital Transformation: Challenges and Drivers

Efficiency through the increase of production rate, reduction in costs and improvement on quality.

RESOURCE AND ENERGY EFFICIENCY	RESOURCE UTILIZATION	LEAD TIME & CYCLE TIME	PROCESS RELIABILITY	PROCESS FLEXIBILITY	ADVANCED AUTOMATION & ICT
SUPPORT FOR DECISION-MAKING	SENSING & SYSTEMS INTEGRATION	DATA MANAGEMENT	DATA ANALYTICS	REAL-TIME MONITORING	ADDED VALUE & EFFICIENT COMMUNICATION

INTRODUCTION

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1. Introduction

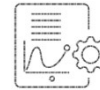
IIoT Platform and Decision Support Systems

IoT Platform



- Network of interconnected objects
- Vertical & Horizontal integration
- Data gathering
- Interaction and communication

Decision Support System



- Communication-driven: Cooperation
- Data-driven: Access, Visualization and Manipulation
- Document-driven: Data formats
- Knowledge-driven: Problem Solving
- Model-driven: **AI, Simulation or Optimization**
- Hybrid System

1. Introduction

This work addresses one of the manufacturing digital transformation trends:

- **Decision Support System for Manufacturing based on the IIoT Platform**
 - ✓ Real-time monitoring capabilities
 - ✓ Hybrid approach of Data-Driven, Knowledge-Driven and Model-Driven

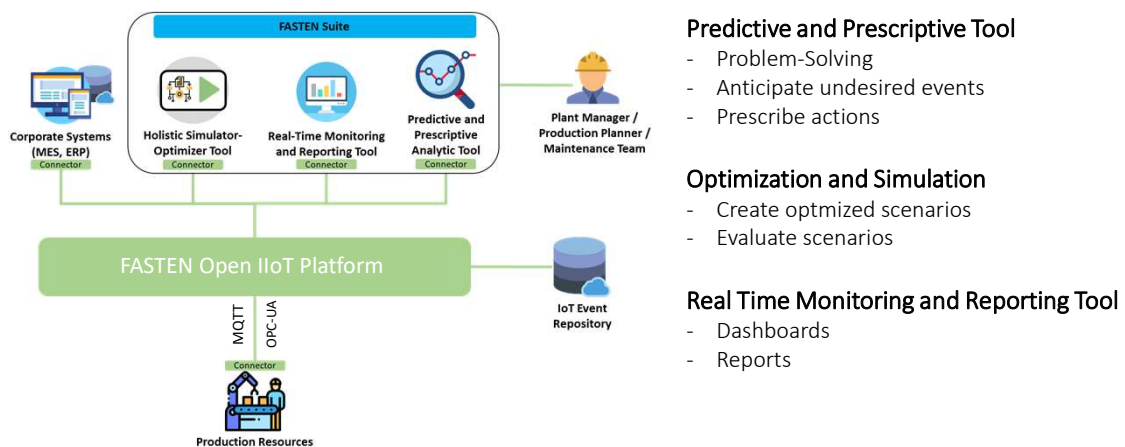
Decision Support System for Manufacturing based on the IIoT Platform

DSS

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2. IIoT-based architecture for decision support

Decision Support System - Fasten Suite



DSS

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Application Case

APPLICATION CASE

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3. Application Case Context



Embraer Aerospace - Évora, Portugal
Metallic Centre Wing Assembly Line (WAL)



- Necessity to evaluate different scenarios
 - Disruptions (lack of resource, new products)
 - Line balancing and resources allocation

APPLICATION CASE

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3. Application Case Context

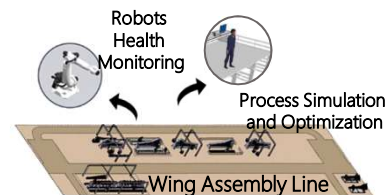
Objective: To enhance decision making on shop-floor and help managers to deal with unexpected events and evaluate different production scenarios

Required abilities:

- Predictive Maintenance
- Optimize scheduling
- Optimize line balancing and resource allocation
- Performance simulation (KPIs)

Focusing the improvement of :

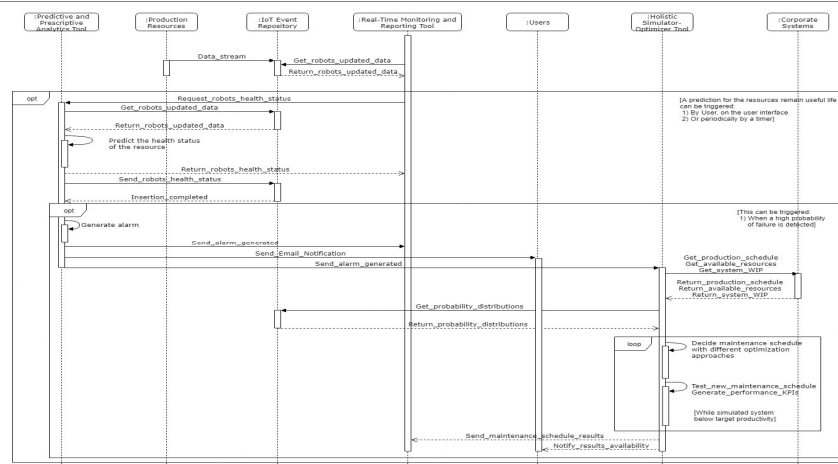
- Line Efficiency
- Resource utilisation



APPLICATION CASE

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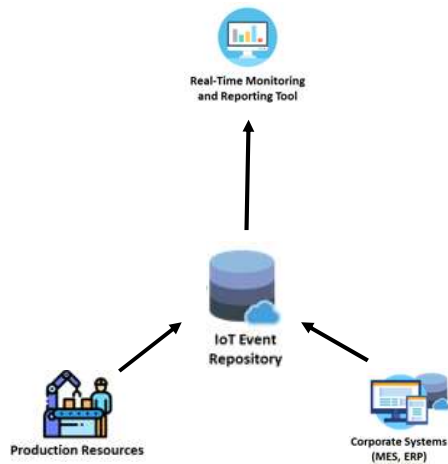
3. Application Case Use Case Description



APPLICATION CASE

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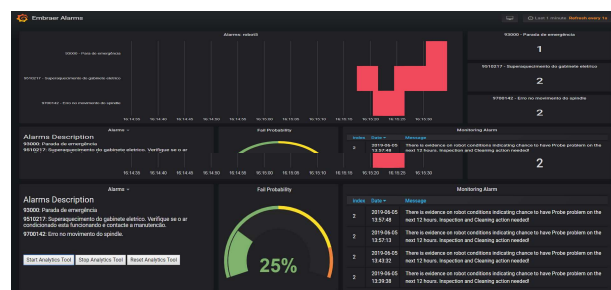
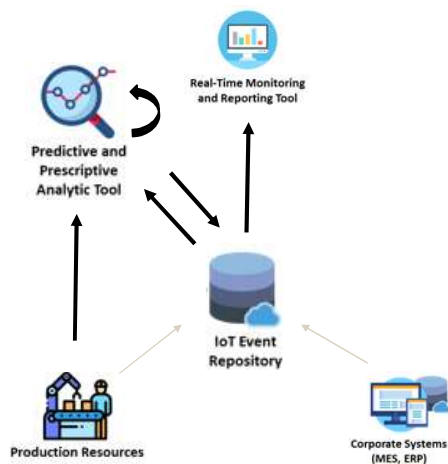
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APPLICATION CASE

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3. Application Case Use Case Description

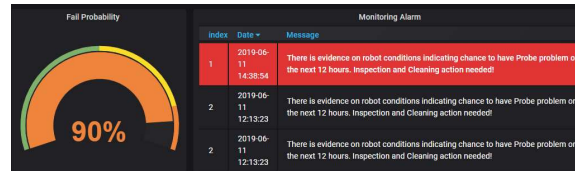
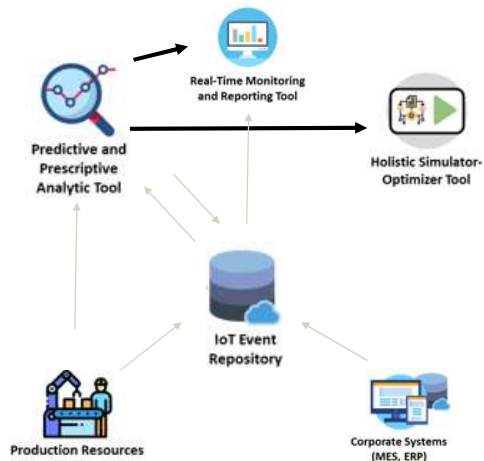


Real-Time Monitoring And Reporting Tool Dashboards
and Predictive and Prescriptive Analytic Tool

APPLICATION CASE

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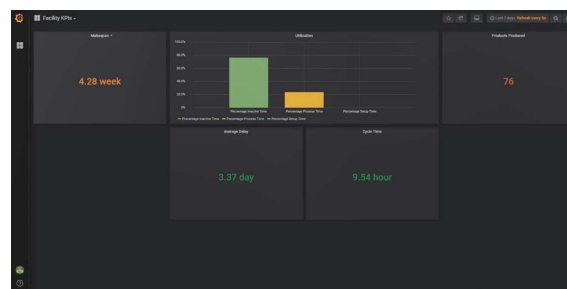
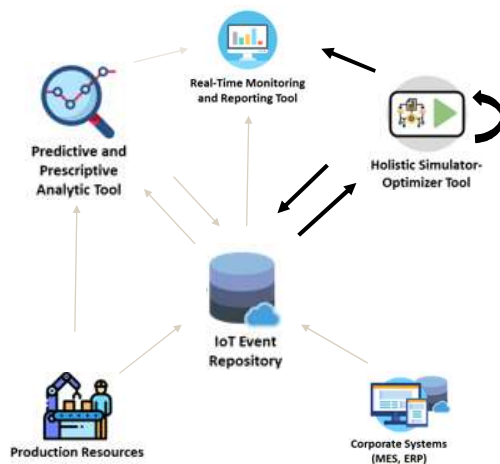
3. Application Case Use Case Description



Alarm detected

APPLICATION CASE 19

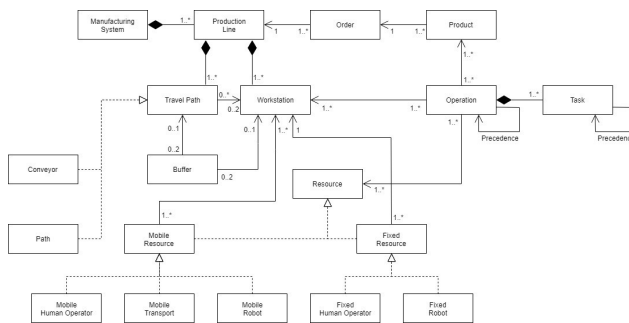
3. Application Case Use Case Description



Holistic Simulator-Optimizer Tool Report

APPLICATION CASE 20

3. Application Case Data Model



- ✓ Manufacturing systems
- ✓ Production lines
- ✓ Workstations, buffers, and transport paths
- ✓ Operations, and Tasks
- ✓ Resource (Fixed or Mobile)
- ✓ Production Plan
- ✓ Products
- ✓ Sequence and precedencies of operations
- ✓ Probability distributions of the production times
- ✓ Work-in-progress in the system
- ✓ Resources state are used to run.
- ✓ Equipment logs (Process, State and Maintenance)

APPLICATION CASE 21

3. Application Case Potential Results

- Enhancing and simplifying the production and maintenance managers decisions
- Availability of useful information, such as:
 - Optimized layout configurations and resource allocation;
 - Predictions of remaining useful life for critical equipment;
 - Expected KPI's for the factory.
- Agile behaviour
- Preventive & Corrective to Predictive Maintenance (Reducing maintenance costs)
- Optimized resource allocation (Fixed assets and Human resources)
- The solution suggests a potential improvement of 6% on WAL System efficiency



Online Dashboards

APPLICATION CASE 22

Conclusions

4. Conclusions

- The framework includes the concepts of decision support system and IIoT Platform.
- The framework can be generalized for different applications in operations context.
 - Predictability
 - Optimization
 - Simulation
- The case study demonstrates the feasibility of the proposed framework.
 - Predictive Maintenance
 - Line Balance
 - Performance Simulation
- Besides the organizational and decision support improvement, the tool presented a potential improvement of 6% of general efficiency on assembly line.

Thank you