RFID在汽車零部件生產企業的應用

RFID-enabled Real-time Manufacturing Execution System (RT-MES): A Case Study in An Automotive Part Manufacturer



鐘潤陽
Ray. Y. Zhong
黃国全
George Q. Huang

目錄 Agenda



1. 公司介紹
   Introduction to the case company
2. 基於RFID的RT-MES設計及部署
   Design and configuration of RFID-enabled RT-MES
3. 車間生產過程升級
   Reengineering shop-floor operations and decisions with RT-MES
4. 案例洞析
   Evaluation and reflection

公司介紹 The case company



公司的產品結構覆蓋面廣，產品覆蓋了載重車、輕型車、乘用車、跑車、工程機械、船用發動機氣門上萬個品種。
Huaiji is an OEM (original Equipment manufacturer) specializing in manufacturing over 10,000 types of auto valves.

公司的前身為原懷集縣汽車配件廠，汽配廠成立於1971年，是國內最早從事汽車發動機氣門專業生產的企業之一。
It was founded in 1971 and currently employs more than 1,600 workers.

公司擁有年產2,500萬支氣門的生產能力，資產規模、生產能力、產銷量、銷售收入及淨利潤等國內同行業名列前茅，也是出口量最大的發動機氣門製造企業

生產特點 Production Characteristics

- 該企業採用批次混流製造模式組織生產， 批次數量從幾十到幾萬；
  Huaiji adopts **hybrid flow shop** production mode to manufacture products with a very **wide variety of batches sizes**.
- 生產週期長，平均40到60個工序
  The production cycle time is long, which has 40-60 operations on average.
- 生產排程及車間調度通過人工紙質模式進行
  Planning and scheduling is conducted in manual and paper-based ways .
- 生產數據不完整、不準確、不一致
  Data records are prone to be **inaccurate, inconsistent and lagged**.
- 缺少有效的物料監控手段
  Huaiji cannot perform **effective track and trace** to its materials and orders.

面臨的生產挑戰 Production Challenges

生產排程
Production Planning



人工排產 Manual operation
無限產能排產 Unlimited capacity planning
紙質操作 Paper-based system
訂單隨機釋放 Stochastic order arrivals

倉庫管理
Warehousing



缺乏倉儲數據管理 Inventory data management
紙質標識 Paper-based identification cards
操作不規範 Individual operational manners

車間管理
Shop-floor Management



紙質工藝卡調度 Paper-based task cards schedule
計劃與調度不合諧 Fire-fighting between planners and supervisors
在制品高 High level WIP inventory

項目啟動 Project Initiation



該企業為什麼沒有選擇ERP系統？
Huaiji did not opt for ERP (Enterprise Resource Planning) system under some reasons.

- 沒有較好的示例參照
  It is hard to benchmark a successful case in the region.
- 投資成本較高
  Investment was a bit high.
- 對企業影響太廣
  The changes might be too radical.
- 主要問題存在於車間
  The main issues come from the shop floors.

企業決定先在車間層面實行MES，解決當前面臨的問題
Huaiji decides to initiate RT-MES project to develop and implement RT-MES for shop floor management.

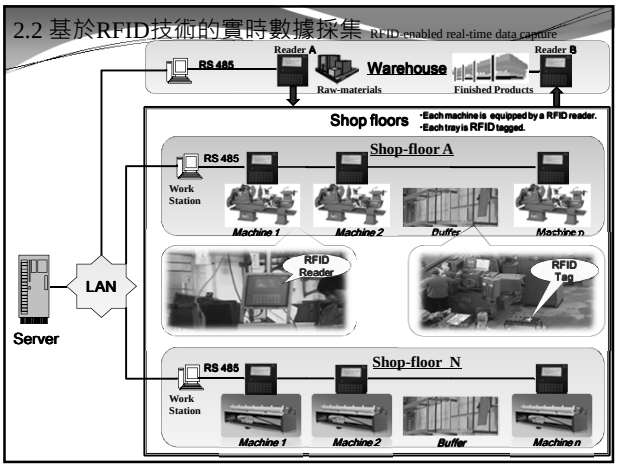
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項目目標 Project Objectives



- 研發一套MES管理系統，採用RFID技術獲取車間生產數據
  To develop and implement a suitable shop-floor MES using real-time data capturing techniques such as RFID devices ;
- 設計一套基於RFID實時數據的實時生產調試方案，提高車間生產準確性及效率
  To develop real-time decision-making solution for the sake of enhancing shop-floor production accurateness and responsiveness ;
- 設計一套WIP可視化方案，減少車間在制品庫存
  To visualize WIP traceability with the view to reduce WIP inventory level.

2.2 基於RFID技術的實時數據採集 RFID-enabled real-time data capture



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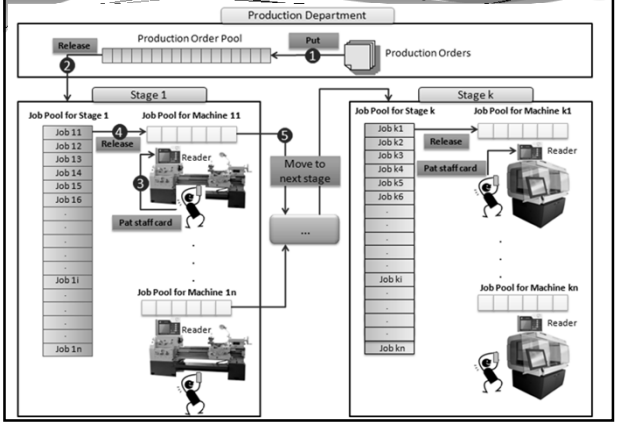
基於RFID的RT-MES設計及部署

Design and configuration of RFID-enabled RT-MES

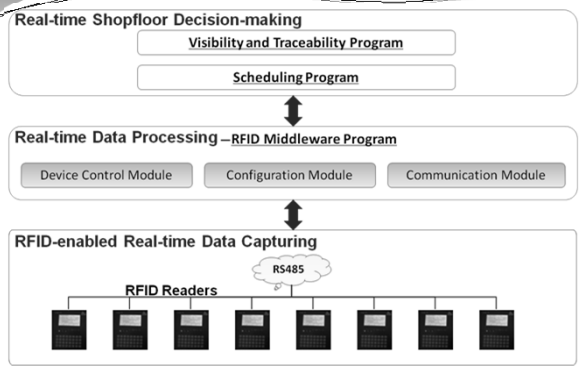


- RT-MES 概述 Overview of RT-MES
- 基於RFID技術的實時數據採集 RFID-enabled real-time data capture
- 實時生產決策 Real-time shop-floor decision-making
- 基於RFID的WIP實時監控 RFID-enabled WIP Visibility and Traceability

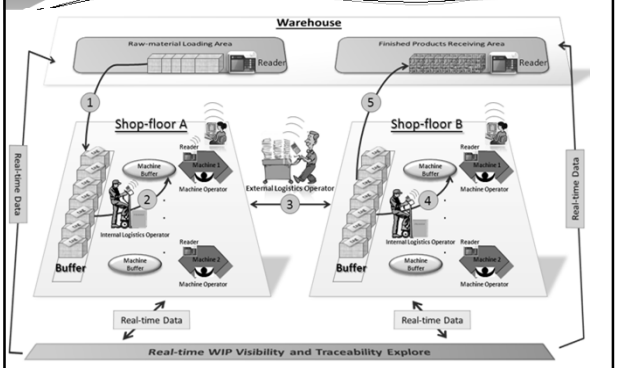
2.3 實時生產決策 RFID-enabled real-time scheduling



2.1 RT-MES概述 Overview of RT-MES



2.4 基於RFID的WIP實時監控 RFID-enabled WIP Visibility and Traceability



車間生產過程升級

Reengineering shop-floor operations and decisions with RT-MES

怎樣實現RFID技術與生產過程的融合？

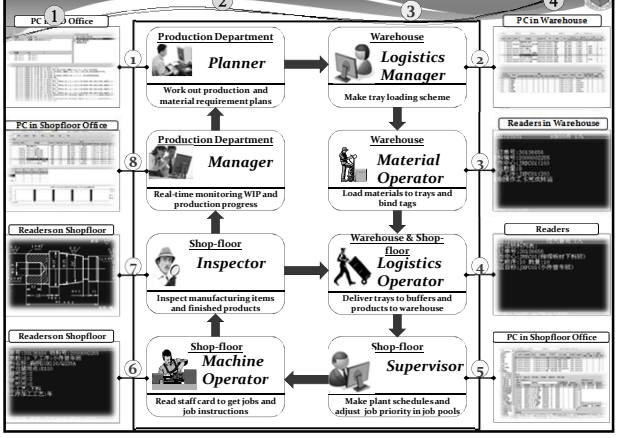
How to integrate RFID technology into the company's current production process?



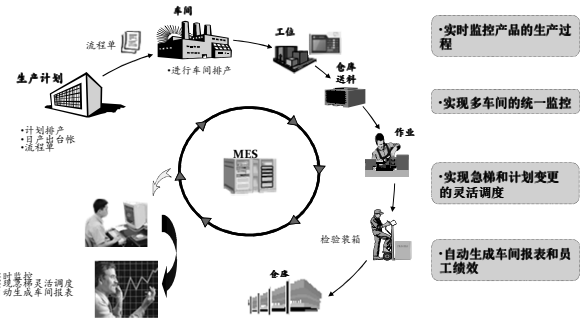
實施過程的挑戰 Implementation challenges

- 人為因素挑戰 By People
  - 對標準化的不認同
    Workers' resistance against standardization
  - RT-MES操作培訓
    Workers' training process
- 技術因素挑戰 By Technology
  - 標簽存儲有限
    Limited memory of RFID tags
  - 閱讀器反映慢
    Slow responsiveness of RFID readers





前後對比 Before and After



案例洞析 Evaluation and Reflection

- ➢實時過程的挑戰 Implementation challenges
- ➢前後對比 Before and after
- ➢成功因素 Reflection on success factors
- ➢展望 Future perspective



成功因素 Reflection on success factors

- ✓"一把手"工程 Top management support.
- ✓"由下而上"的信息化道路 Bottom-up informationization strategy.
- ✓各方通力協作 Collaborative teamwork.





- 横向展望 In horizontal dimension:
  - •ERP系統
    ERP (Enterprise Resources Planning) project
  - •手持式RFID設備輔助倉庫管理系統
    hand-held RFID devices in warehouse
- 縱向展望 In vertical dimension:
  - • 基於數據挖掘的智能生產系統
    MISP (Manufacturing Intelligence System Platform) project

