MRO part tracking system with RFID technology

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ENGINSOFT · UNIVERSITÀ DEL SALENTO · Avio Aero A GE Aviation Business

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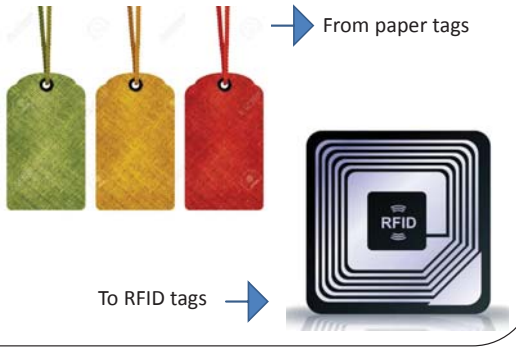
Introduction

The research presented in this poster was carried out under the activity 5.2 of **SPIA** project – Strutture Portanti Innovative Aeronautiche , or, in English, Aeronautical Innovative Bearing Structures- (funded by the Italian government grant : Pon 2007-2013 "Ricerca e competitività" PON03PE_000067_3).
This activity pursued an **improvement of manufacturing data distribution** and the analysis of related issues. Focus on the improvement of the process of collecting product data across the whole life cycle and then properly re-distribute them, in order to speed up new product development and improve product quality.
The project has been developed in collaboration with Avio Aero Brindisi Plant where MRO activities are performed on aircraft engines. When an engine enters the plant for overhaul undergoes disassembly and then a complex repair process. Each single MRO task takes place in a specific area of the plant. Each part of the engine is now tracked with paper tag. The main issue of this environment is the massive presence of metallic components which may interfere with electromagnetic fields of real time positioning technologies.



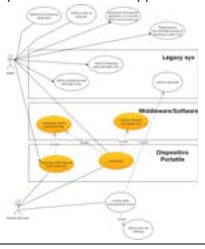
Objectives

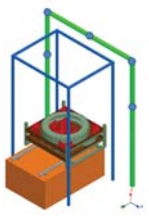
The project aims at supplying complete, accurate, prompt information when needed to all the workstations along the factory in order to reduce assembly mistakes and scraps, shortening the time spent in producing documents associated to work-cycles, highlighting misalignments between the correct process and the work instructions actually implemented by the shop-floor. The technology to be applied has to work well with metallic parts, sometimes overlapping when arranged on pallets.

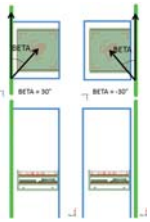
- Real time monitoring of the manufacturing process
- Data gathering on items positioning and on manufacturing process status,
- Concurrent update of information stored in company's IT systems ,
- Real time data collection to ensure the quality of the final product,
- **Choose the right technology to work with metals and possible overlaps**

Materials and Methods

1. Context Mapping and Analysis
   Factory assessment , detailed analysis of manufacturing processes, interviews with key actors involved
2. Issues and Problem recognition
   Process assessment and recognition of bottlenecks, wasted time. **Correct definition of issues arisen by the metallic environment.**
3. Requirements elicitation
   Requirement formalization of a part tracking solution.
4. Literature Review
   Review of scientific publications, technology journals and specialized websites on localization technologies
5. Benchmark of Positioning Technologies
   QFD analysis and cost -benefit consideration, with particular attention to the ability of working with metals.
6. Selection of the most suitable positioning technologies
   Taking in consideration the results of the previous phase, the UHF RFID technology has been chosen.
7. FEM numerical analysis of a system with features required by the pilot
   CAD solid modelling of the system *gate]and electromagnetic FEM numerical analysis with ANSYS HFSS
8. Technology test
   On-site reliability test of UHF RFID technology under simulated normal operating conditions
9. Assessment of changes to the MRO process due to introduction of the RFID technology into the plant
10. Software development
    Development of a mobile app and an associated web interface on GE Predix environment

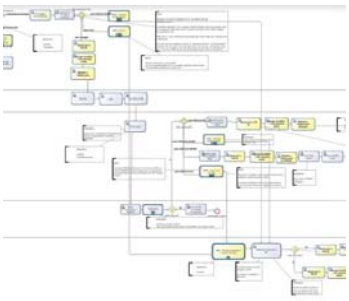






Results

BPMN detailed mapping of factory processes and sub-processes



Avio MRO process for civil engines.

Technology benchmarking

Business Req.	Weight	RFID	UWB	Beacon	RuBee
#1.High efficiency reading in metallic environment (with GATE configuration)	3	4	5	1	5
#2.Locating System	2	3	4	2	4
#3.Single tag reading	3	5	4	5	5
#4.Unique Middleware	3	5	5	3	3
#5.Shock resistance	1	5	5	5	5
#6.Memory	1	4	5	4	4
#7. Low Cost	3	4	2	4	2
#8.High Maturity	2	5	2	3	4
Tot. (Req*Weoght)		79	70	58	70

Electromagnetic simulation

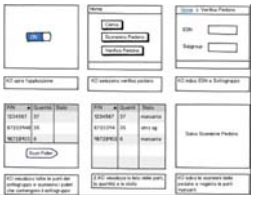
All elements of the system have been modeled in ANSYS HFSS. Avio Aero supplied CAD models of pallets, gates and items to be tracked together with materials characteristics .

On-site test

Reliability of the system (defined as number of items accurately detected by the RFID system with gate configuration expressed in %) varied between 92 and > 98%.
Results depended on different power settings and on different positions of the items and of the tags on the items

Agile Software development

From use case to code



Storyboard produced during the agile development