

PROCESS OF THE RFID TECHNOLOGY IMPLEMENTATION INTO THE PRODUCTION

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Abstract: The article deals with RFID technology and its implementation under real conditions. The paper familiarizes reader with RFID technology, functionality of RFID technology and its basic elements. It offers a complete picture about RFID technology. The main focus of this paper is on guideline for smooth and cost effective process of implementation this new technology into the production processes taking into account real conditions. There are defined steps to follow to meet the requirements and obtain all proposed benefits after implementation of RFID technology. This paper helps to avoid complications during process implementation of RFID technology.

1 Introduction

Data collection is important task to be performed to keep traceability especially in automotive industry. In case of recalls need to be immediately found the root cause and identify amount of possible affected parts to protect final customers. Production data are also essential part for evaluating and managing the systems and processes in general. It is a key element to know status of production and on this bases make a decisions.

There are many methods and technologies for data collection. Considering pressure on cost reduction in nowadays it is highly recommended to automate the process of data collection as much as possible. Suitable is also eliminate influence or work force on data collection and data flow. One of the most modern and effective technologies for data collection and evaluation is RFID technology.

2 RFID technology

RFID is wireless technology which is focused on automatic identification of objects and data collecting. Acronym RFID refers to Radio Frequency Identification. RFID technology was used for the first time during second world war for military applications. Scientists began work on a wider use of RFID at the end of the 20th century.

Figure 1 describes concept of RFID technology which consists from Electronic Product Code (EPC) placed in microchip. Microchip together with antenna is a part of RFID tag which is fixed on objects of interest. RFID tag must be placed in electromagnetic field of reader. RFID technology allows easily identify or count many objects simultaneously.

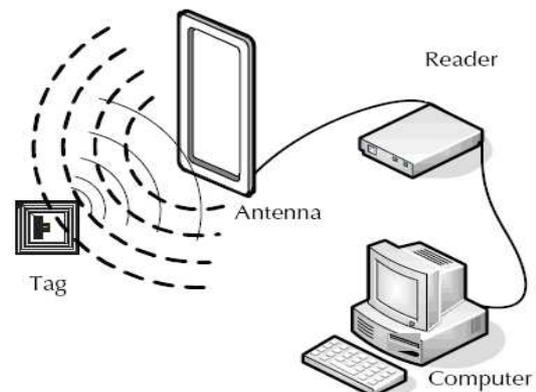


Figure 1 The basic components of RFID technology

RFID tags – based on criteria such as memory type, frequency, power supply type and design it is possible to identify more types of RFID tags. In terms of memory we distinguish read only tags which contain coded data and read/ write tags which is possible to overwrite. Table 1 shows frequency used for RFID tags with its characteristics and the most common usage. Ultra high frequency is the most suitable frequency for RFID technology applied in production field. It has range 1 – 6 meters and it enables to achieve high speed of reading. According power supply type tags are active, passive and semi passive. Active tags includes own energy source. They are able to collect, evaluate and sending the data. Passive tag provides energy radio field which is made by antenna of reader. Passive tag can only react. It means that they can only sending data saved in microchip. Semi passive tags has own source of energy but they do not use it for communication with reader. Tags can have different size and shape according the needs.

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Table 1 Frequency used for RFID tags

Frequency	Characteristic	Application
Low frequency 125 – 134 kHz	<ul style="list-style-type: none"> • Range < 50 cm • Low data volume at low speed • Expensive • Readable through liquids 	<ul style="list-style-type: none"> • Attendance systems • Chips for animals
High frequency 13,56 MHz	<ul style="list-style-type: none"> • Range < 1 m • Readable through liquids • Anticorrosive system 	<ul style="list-style-type: none"> • Smarts cards • Traceability of containers
Ultra high frequency 860 – 868 Europe 902 – 928 USA 950 – 956 Japan	<ul style="list-style-type: none"> • Range 1 – 6 m • High reading speed • Frequency zone for EPC generation 2 	<ul style="list-style-type: none"> • Traceability of containers • Manipulation with luggage at airports

Reader – It is a device to communicate with tags. The part of reader is antenna that receives and transmits electromagnetic waves. The most important are directional, polarization characteristics, location, shape and size of antennas. Reader performs encoding, decoding and store data from and to RFID tag.

Server – it is a computer unit that presents data from reader [7].

RFID systems by collecting and displaying data on the terminals provide a clear picture about entire production process in real time. It allows identifying productions issues and supporting operational improvement.

Importance of RFID takes a new dimension when information obtained by RFID is applied into operational application such as MES, ERP and etc.

Implementation of such technology brings many economic benefits such as [8]:

- Easier stocktaking,
- Minimizing labelling costs,
- Simplification in data management and exchange
- Improvement of inventory evidence.

To achieve listed benefits, it is necessary to complete the implementation process of RFID technology.

3 Steps to follow for successful implementation of RFID in production

Companies tend to face many issues to solve while RFID is well implemented and set. Based on practical experiences it is possible to formulate logical steps which give as a guideline how to smoothly implement this new technology on the shop floor (Figure 2).

Decision to make – At the very beginning stage is crucial to evaluate the need of RFID in company. Expectations from set up this technology must be very clear defined. Implementation of RFID technology is cost intensive

investment but on the other hand it brings many benefits and also return of investment. Suitable method that helps to decide about implementation of RFID is to do business case. Business case should clearly define all advantages and benefits of implementation on one side and necessary cost for implementation on the another side. It is also important to mention in business case service cost to keep RFID technology working and in good condition. Comparison of results in terms of cost for implementation and savings after implementation give a clear picture that helps easily to decide [10].

Build the team – Implementation of RFID like new technology into the organization standards has to be defined as a project. Every project need to have specialist involved to meet all expectations and time scheduling. The team members need to be extremely focus on RFID project implementation. They have responsibilities for planning, designing and implementing of a project. The right team composition is a key factor for smooth project implementation. Members of team need to be engage and enthusiastic about project implementation and also have all necessary knowledges.

Concept of RFID within the processes – From range of whole production processes is necessary to identify key processes where RFID technology will be implemented. It is extremely important to know this key processes into the details. For consideration is also to find out how implementation of RFID will influence performing of this operations. In concept should be also define a level to tag. Tag can be hold on all objects produced or on pallet and boxes where objects are gathered. Tag level influences amount of data that have to be managed and project cost.

It is recommended to draw a scheme shows how is process working with RFID implemented. In another words to do a concept of future state where processes are improved by application of RFID technology.

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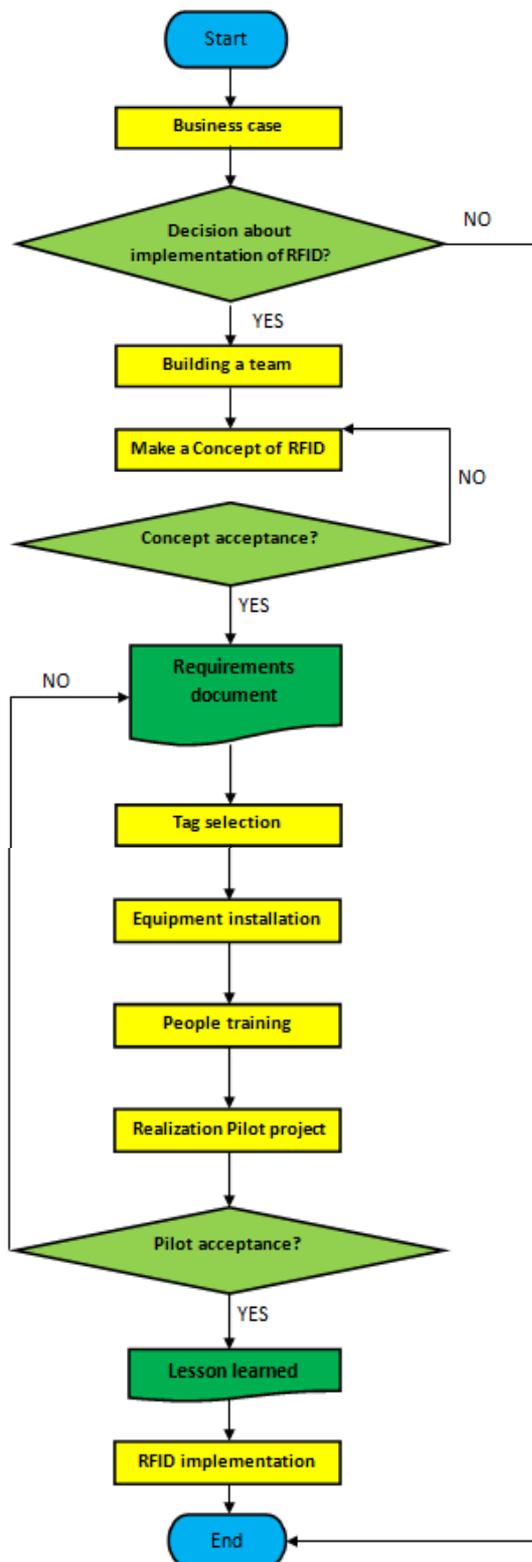


Figure 2 Flowchart of RFID process implementation

For scheme is sufficient to use existing layout of particular area where read points of tags will be

implemented. Concept has to be shared with all stakeholders such as [10]:

- Business management,
- IT department,
- Maintenance,
- Logistics,
- Production,
- Inventory management,
- End users.

All of this parties need to agree about the concept and in this way support the implementation. This is also accurate stage to do changes based on stakeholders feedback that allows to minimize cost in comparison with doing changes after project implementation.

Requirements document – Finished and approved concept presents all requirements and resources desired to implement RFID technology into the production. Requirements document should collect all of this identified tasks. It should be kind of check list where is identified what need to be done and when. Inseparable part of requirement document is also defined responsible team members for performing the tasks. Main attention in requirement documents should be focus on software solution and hardware devices, type of RFID tags, networks, environmental factors, security concerns and reliability of a system. Usually additional softwares are not desirable for companies. RFID technology could also run under already existing software solution implemented in companies after certain modification.

This documents must be signed by all interested parties. Requirements documents represents a plan with time scheduling involved for effective process of a project realization and it avoids future misunderstandings.

The Tag selection – Today are plenty of tags format on market with wide range of prices depends on their usage. As was mentioned in previous chapter we distinguish few different configurations and functional abilities of tags. Choose proper tag depends on many factors in production. The most important factors to consider are [6]:

- Material of interested object (plastic, metal, fabric, wood and etc.),
- Part of object where tag is going to take a place,
- Temperatures which tag will be expose,
- Supposed distance between tagged object and reader,
- Durability requirements.

Another important factor to consider in selecting the proper tag type is requirement on human readable data. In this case is sufficient to use tags printed with human readable text. Such solution represents back up in case when tag is not readable or data on label is damage. The choice of tag also affects possibilities of tag location and orientation. Tag can not interfere with manipulation or to cause safety issue in production. To help hold tag on the

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object of interest in desired position there are many accessories such as holder and cases available on market place. In case of temperature as a factor of environment is important to consider duration of tag exposure to temperature.

As a result after consideration of all mentioned factors should be identification of one or more tags relevant for real conditions at production. In case of more suitable tags identified need to be done comparison of selected tags under real conditions. The tags should be hold on object in the required position and orientation and run through the production. After testing tag will be expose to the reader to check if is still readable and in good condition. This testing should be done repeatedly to check the durability of tag affected by environmental factors.

Equipment instalation – All devices identified in concept or requirement document will be in this stage install according layout specification. High requirements are imposed on IT and maintenance specialists and their cooperation. During instalation is appropriate to minimize connection points and length of cables as much as possible because it causes losses and instability of a system. Correct instalation influences the whole project success during its lifetime.

People trainig – Depending on the purpose of data collection by RFID technology there is still some people who work with collected data. For those people it is important to provide a training to use software and hardware devices to get desired outcomes.

Pilot project - Before final implementation it is highly recommended to do trial run of a system to prove its functionality. It is last opportunity to do system changes without additional costs. Pilot project shows all shortcomings that need to be eliminated. It is testing software and also hardware devices, connections and data collection. In terms of readers and antennas pilot project proves their correct location defined in concept or give an opportunity to improve their ability to read tags by changing a location. During project pilot run is possible to see every competing signals in area which can affect the quality of collected data and do modification for better future state. Real conditions have to be simulate as much as possible during the trial. Suitable is also simulate different scenarios that could appear in production to see how system react. On pilot project should participate all parties to provide a feedback for improving of a process. At this stage is clear if expectation defined on the very beginning could be meet [6].

Lesson learned – Lesson learned is common method to end up any project. It is a tool that gather knowledges and experiences from project implementation. This document helps to be aware of similar mistakes and supports to do right decisions for future projects.

4 Conclusions

RFID technology presents future in automatic object identification. It allows having real data at real time especially in nowadays when data driven is the key element for effective productions and logistics processes. However, RFID is not suitable for every application. Decision about RFID implementation needs to be done based on depth analyses. To obtain all benefits from implementing this technology and fast return of investment is essential smooth process of implementation.

RFID technology provides background for future development. The aim is work with data collected by RFID and increases production excellence.

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