

RFID Applications in Industry 4.0: A Review

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Abstract— This paper presents RFID (radio- frequency identification) application in lean manufacturing using Industrial Revolution 4.0. By focusing on value adding activities we can boost firm's performance significantly by applying lean. More effectively, Industry 4.0 is another promising trend in industry. To track the manufacturing execution by using RFID system is a significant and interesting topic for demonstration of Industry 4.0. Any manufacturing organization or workshops usually suffer from a bottleneck of capturing and collection of real time information of an on field job which is more important for improving productivity.

Keywords— RFID, Lean manufacturing, Industry 4.0

I. INTRODUCTION

1. Industry 4.0

Since the first industrial revolution, subsequent revolutions have been more effectively resulted in manufacturing industries, from water and steam powered machines to electric and digital automated production makes manufacturing more complicated, automated sustainable so people can operate machines simply, efficiently and persistently. The term Industry 4.0 stands for the fourth industrial revolution. The centralized objective of Industry 4.0 is fulfilling individual customer needs which affects areas like manufacturing commissioning, delivery, research and development and order management [17].

Three mutually interconnected factors where Industry 4.0 is used [18]:

1. Integration and digitization of any simple technical- economical relation to complex technical- economical networks.
2. Digitization of products and services offered.
3. New market model.

Industry 4.0 differs from Computer Integrated Manufacturing mainly by concern of the human role in production environment. Fig. 1 shows the four Industrial Revolutions with major inventions.

Need of Industry 4.0[18]:

1. To convert the regular machines to self-aware and self-learning machines to improve overall performance.
2. Track the status, Real time data monitoring and position of product.
3. Service life cycle management.

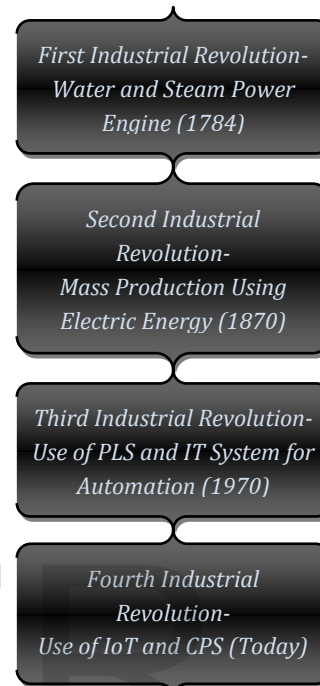


Figure 1: Four Industrial Revolutions

2. RFID

RFID stands for radio frequency identification. With many associated different areas RFID technology usage is increasing successfully. RFID study mostly having theoretical approach rather than practical approach. Radio frequency identification is used for identification of objects and assets. RFID technology has many benefits due to which it has been attracted great interest in recent years [5].

1. Non line of sight
2. Contactless
3. Simultaneous collection of data
4. High accuracy

Barcode scanner can be compared with RFID enhanced throughput distance and utilization of flexible machines for different operations. Generally, an RFID system consists of three main components: RFID tags (transponder), RFID reader (interrogator), and middleware software as shown in fig. 2 [5].

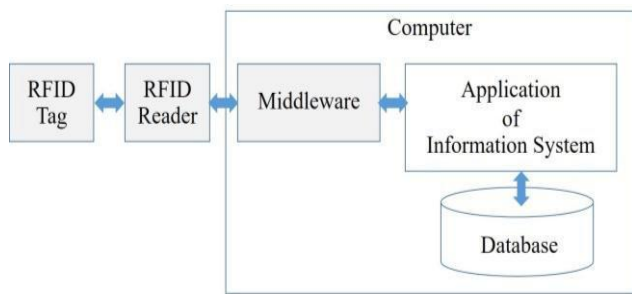


Fig.2: RFID System Components

Depending on source of electric power RFID tags are generally fall in two categories active and passive. Active tags generally have their own power source, usually an on-board battery. Passive tags get power from the signal of external reader.

Depending on the type of tags reading RFID readers come in active and passive varieties. An integrated circuit chip (microchip) and an internal antenna these are the two essential elements of RFID tag. By using RFID antenna individual RFID tags communicates with RFID reader. The RFID reader converts the radio waves reflected back from the RFID tag into digital information and passes them to the information system through middleware software[5].

In real time RFID identifies information and feeds back it to the decision making system. By applying RFID, the smart factory has more efficient execution plans and makes accurate scheduling decisions [5].

3. Lean Manufacturing

Lean manufacturing is used to reduce waste and improvement in various sectors. Lean manufacturing supports companies in their effort to improve in many areas including [12]:

1. Reduced production cost
2. Improved quality
3. Improved responsiveness by reducing lead time
4. Increased flexibility

The lean manufacturing concept evolved from TPS (Toyota Production System) by Taichii Ohno at Toyota Motor Company [20]. It is most Prominent manufacturing paradigm of recent years. More number of companies are still struggling to use lean manufacturing effectively. Some companies are succeeding at their initial phase of lean project, but more are find difficulties in their initial momentum.

II. LITERATURE REVIEW

1. *Name of Paper:* Performance analysis of the RFID-enabled Manufacturing Execution System.
Year of Publication: 2017
Findings: Study oriented results with highest percentage of success.
2. *Name of Paper:* Lean 4.0 - A conceptual conjunction of lean management and Industry 4.0.
Year of Publication: 2018

Findings: The authors conclude that LM and I4.0 supplement each other on a conceptual level.

3. *Name of Paper:* Industry 4.0 and RFID in the Automotive Sector: a Case Study on the Implementation of RFID Technology in Automaker's Supply.

Year of Publication: 2018

Findings: Implemented at tire manufacturing, In storage stage of newly manufactured tires.

4. *Name of Paper:* The link between Industry 4.0 and lean manufacturing: mapping current research and establishing a research agenda.

Year of Publication: 2018

Findings: It is easy to identify the main theoretical perspective of the article and the areas it investigates.

5. *Name of Paper:* Design and implementation of a low cost RFID track and trace system in a learning factory.

Year of Publication: 2018

Findings: To create a cost-effective RFID system for use in a learning factory.

6. *Name of Paper:* Industry 4.0 – A Glimpse.

Year of Publication: 2018

Findings: The concept of fourth industrial revolution, called Industry 4.0 which allows smart, efficient, effective, individualized and customized production at reasonable cost.

7. *Name of Paper:* Industry 4.0 implies lean manufacturing: Research activities in industry 4.0 function as enablers for lean manufacturing.

Year of Publication: 2016

Findings: It uncovers the fact that committing into Industry 4.0 makes a factory lean besides being smart.

8. *Name of Paper:* Lean 4.0 - Main difficulties during RFID implementation: an exploratory factor analysis approach.

Year of Publication: 2019

Findings: The author finds the major difficulties while implementing the RFID Technology in an Organization.

9. *Name of Paper:* Lean 4.0 - Quantitative analysis of RFID' publications from 2006 to 2016.

Year of Publication: 2019

Findings: The author studied many literatures and get the results.

ROLE OF RFID IN INDUSTRY 4.0

1. RFID applies in various sectors such as in tracking, in wireless applications.
2. RFID used as an Inventory management tool.
3. RFID used with IoT (Internet of Things) gives exact location of any object where it has been used.
4. RFID technology used with Intra network facility it Improves and reduces inventory.
5. To reduce maintenance cost associated with inventory with the help of RFID.
6. Process improvement can be done by using RFID.

7. RFID is a modern automatic identification and data capture (AIDC) technology that is slowly gaining more acceptances in the supply chain today.
8. Without human assistance RFID can identify any type object at single area once.
9. RFID is cost effective system in learning factories.

Difficulties during Implementation of RFID Technology

Despite of benefits, Implementation of RFID system is not an easy task and it faces many difficulties.

1. Barriers in the adoption of process of RFID Technology.
2. In Implementation of RFID system.
3. Lagging in the support of top management for RFID system Implementation.
4. Lack of Knowledge in employees.

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