International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Intelligent Approach for Optimizing Resources in Supply Chain System using RFID

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Abstract: ***Artificial intelligence started as a field whose goal was to replicate human level intelligence in a machine. Recent work has intended to concentrate on commercializable aspects of "intelligent assistants" for human workers. Artificial Intelligence is now becoming an integral part of manufacturing arena where unsuspicious situations arise at times not expected. At such cases, expert decisions are required. This paper is one such idea for optimizing resources in a supply chain A system and method for optimizing resources in a supply chain and production line using RFID and artificial intelligence which can be adapted to any supply chain or product line, including warehouses, and which is able to optimize a plurality of tools/machinery or processing stations, a plurality of products and even personnel in real time by analyzing real time information about the entities and historic information stored in databases about optimum decisions taken in the past by the system.***

Keywords: Artificial intelligence, supply chain, Evolutionary computation, optimization, RFID

1. Introduction and Motivation

A supply chain is a system of organizations, people, technology, activities, information and resources involved in moving a product or service from supplier to customer. Supply chain activities transform natural resources, raw materials and components into a finished product that is delivered to the end customer. In sophisticated supply chain systems, used products may re-enter the supply chain at any point where residual value is recyclable. In order to address all those needs, two important objectives must be fulfilled: the tracking of the item throughout all the chain, and ultimately, the intelligence of the system within the warehouse. Concerning item tracking, RFID is the state-of-the-art technology, offering comprehensive and automatic product identification, and tracking throughout the supply chain

A. Supply chain management

"Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies. Supply Chain Management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, and finance and information technology."

B. Optimization System

The primary objective of supply chain management is to fulfill customer demands through the most efficient use of resources, including distribution capacity, inventory and labor. In theory, a supply chain seeks to match demand with supply and do so with the minimal inventory. Various aspects of optimizing the supply chain include liaising with suppliers to eliminate bottlenecks; sourcing strategically to strike a balance between lowest material cost and transportation, implementing JIT (Just In Time) techniques to optimize manufacturing flow; maintaining the right mix and location of factories and warehouses to serve customer markets, and using location/allocation, vehicle routing analysis, dynamic programming and, of course, traditional logistics optimization to maximize the efficiency of the distribution side.

C. Radio Frequency Identification.

Radio Frequency Identification" (RFID) and the related Electronic Product Code (EPC) standards provide accurate details, to enable an automatic collection of supply chain data for optimization purposes. The applications of Radio Frequency Identification (RFID) and Electronic Product Codes (EPC) in supply chain management have vast potential in enlightening effectiveness and efficiencies in solving supply chain problems. EPC is the concept of storing product identification on chips no larger than a grain of sand, then placing these chips on tags, which in turn are placed on objects so they can be uniquely identified. RFID technology can track inventory more accurately in real time resulting in reduced processing time and labor.

2. Review of Literature

There have been various research activities carried out that address the business potential of sharing data across the supply chain – both regarding data in general [11] and RFID based data particularly[12]. The supply chain (SC) is "a bidirectional flow of information, products and money between the initial suppliers and final customers through different organizations", and supply chain management (SCM) encompasses the planning, organizing, implementing and controlling of this flow [13] In this, the author explores three key dimensions of supply chain incorporation, namely:

information integration, which is the sharing of data's called demand information, which includes inventory status, capacity plans, production schedules, promotion plans, demand forecasts, shipment schedules and knowledge between supply chain stakeholders; the second one is coordination, which involves the reorganization of decision rights includes replenishment decisions, work, and resources to the best; the third gives organizational relationship linkages, which include the definition and the maintaining of tight communication channels.

From the analysis, he represents a reliable research methodology for sensing, validating and refining disruptive innovations such as RFID technology in multiple and evolving real-life contexts with the aim of validating, in empirical environments within specific contexts such as retail industry, warehousing and, emerging applications, new services or products [15].

3. Arena of Exploration

This is related to systems and methods for optimizing resources in a production supply chain and more particularly, to a system and method for optimizing resources such as material and human resources at any place of a supply chain, monitoring used and available spaces, monitoring the productivity of human resources using automatic identification to control supply and production processes and make optimizing recommendations in real time using Evolutionary Computing and Expert Systems.

Not having all this information on time could result in a wrong decision to solve a problem or not making a decision at all. On the contrary, by having these information in Real Time could mean making a decision before a problem. This is possible by processing data generated at the line of production on every movement. Of course, if every entity is tracked in real time, that means a huge amount of data generated on every second. Hence, this research involves the following entities,

1. Information Technology Systems – for processing;
2. Evolutionary Computing – for making decisions;
3. Expert Systems – for learning from decisions and making comparisons.

There have been developed systems and methods for optimizing supply chains and production lines but none of them are able to offer optimizing solution in Real Time based on real time information.

4. Evolutionary Computing

Evolutionary computation is a subfield of artificial intelligence (more particularly computational intelligence) that involves combinatorial optimization problems. Evolutionary computation uses iterative progress, such as growth or development in a population. This population is then selected in a guided random search using parallel processing to achieve the desired end. Such processes are often inspired by biological mechanisms of evolution.

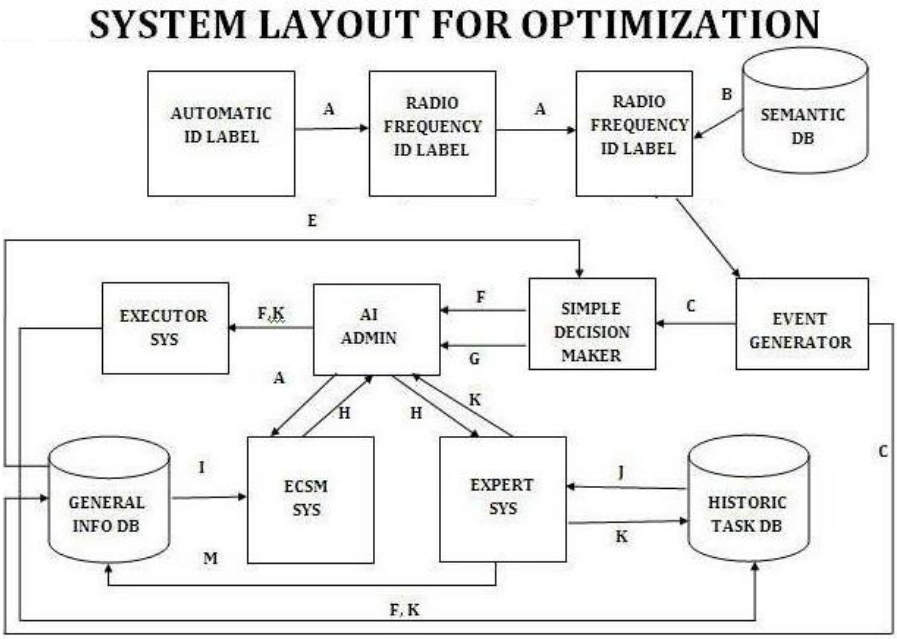
5. Expert Systems

In view of the above, we have developed a system and method for optimizing resources in a supply chain and production line using RFID and artificial intelligence which can be adapted to any supply chain or product line, including warehouses, and which is able to optimize a plurality of tools/machinery or processing stations, a plurality of products or even personnel in real time by analyzing real time information about said entities and historic information stored in databases about optimum decisions taken in the past by the system.

6. Intelligent Approach

The method of intelligent approach for optimizing the resources in the system comprises of,

1) Obtaining identification information and attributes, from a plurality of entities using RFID and further obtaining transactions history for said plurality of entities from one or more databases.
2) 2. Processing said identification information and attributes using simple decision maker system further detecting any new transactions for said entities in order to generate one or more tasks or recommendations for optimizing the production process and further:
3) Send said task or task to an artificial intelligence administrator as generated tasks;
4) If no task can be generated with the obtained information then send said information as a non-generated task to an artificial intelligence administrator;
5) Processing generated tasks, information relate3d to a non – generated task to an artificial intelligence administrator in order to,
6) Send generated tasks and approved tasks to an executor/communication system for execution or communication of the task;
7) Send information related to non-generated tasks to an Evolutionary Computing Solution Maker System;
8) processing the information related to non-generated tasks and parameters values related to the historic performance of generated tasks from a database using an ECSM system running a Genetic Algorithm or other Evolutionary Computing Paradigm in order to generate a non-validated task;
9) Send the non-validated task generated by the ECSM system using an expert system for approving or rejecting the tasks by:



a. Approving the task if a very similar task already exist in historic databases, and the evaluation of the results for said similar tasks are acceptable based on predetermined parameters;
b. Approving the task if there is not similar task in historic databases and begins to record results for said task in a database;
c. Rejecting the task if a very similar task already exist in historic databases, and the evaluation of the results for said similar task are not acceptable based on historic predetermined parameters for an entity and adjust the parameters for the ECMS system for affecting the generation of the next task;

10) Sending the approved tasks to the AI administrator.
11) The system and method of the present invention provide a plurality of tasks or recommendations in real time thanks to the continuous monitoring of all the entities of the production line and supply chain using real time identification technologies, evolutionary computation and expert systems as well.
12) Since the provided tasks and recommendations are evaluated considering the positive and negative results obtained by past tasks, it is assured that the task or recommendation provided will yield positive results when it is applied to the supply chain and or production line.

7. Conclusion

This research when implemented can lead to efficient production in a supply chain. Since the methodology involves AI and RFID techniques, this method is bound to be accurate. This change implies not only an increase in the efficiency in the execution of the identification and validation activities but also a reduction of human errors. Additionally the produced information in the RFID processing allows automatic control and update over product inventory. Moreover, since RFID support identification of instance of products, a greater control exists in the system.

- Anticipates operational problems working in preventive mode by analyzing trends in Real Time
- Optimize the usages of resources: cost, time, priorities, etc.
- Makes intelligent decisions considering ALL players and their real time situation in few seconds.
- Learns form intelligent decisions taken for making more intelligent assessment every day.

From the work it must be understood that the system and method for optimizing resources in a production line with supply chain using RFID and AI, of the present invention, is not limited. With the intelligent system provided by this origination, we can make modifications to the system and the method for optimizing resources in a production line and supply chain using RFID and AI there by chances of reduction by the Human Error.

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