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Integrated Production Management System (IPMS)

Reshma.A.More[1], Krishna Gudi[2], Venkataravana Nayak[3]

[1] Department of Computer Science and Engineering, GSSIT, Bangalore, Karnataka, India

[2] Department of Computer Science and Engineering, GSSIT, Bangalore, Karnataka, India

[3] Department of Computer Science and Engineering, GSSIT, Bangalore, Karnataka, India

Abstract

In extended automobile industry, real-time manufacturing information tracking plays an important role and aims to provide the right information to the right person at the right time in the right format to achieve optimal production management among the involved enterprises. This paper proposes a RFID-enabled real-time manufacturing information tracking infrastructure to address the real-time manufacturing data capturing through the process of Barcode printing and barcode scanning of the vehicle serial number. Following the proposed infrastructure, the traditional manufacturing resources such as employees, machines and materials are equipped with RFID devices to build the real-time data capturing environment. Then, a series of manufacturing information processing methods such as manufacturing cost, progress, WIP (Work-in-progress) inventory etc. are established to track the real-time manufacturing information of extended enterprises.
KeyWords: BIW, Trim Chassis Fitment, MES, MIS, OEE.

1. Introduction

Integrated Production Management Systems (IPMS) is the prime innovative project of the Automobile industry in the field of technology. IPMS handle the complete life cycle starting from procurement till delivery. A web based solution which takes full advantage of the "Cloud" which is the future of information technology. Developed with the help of “Open Source” technology and when combined with cloud, it’s highly cost effective. IPMS can be easily integrated with existing IT systems with ease.

- Inventory Management
- Production Plan
- MIS
- Order Tracking
- Costing

IPMS (Integrated Production Management System) are computerized systems used in manufacturing. IPMS can provide the right information at the right time and show the manufacturing decision maker “how the current conditions on the plant floor can be optimized to improve production output”. IPMS work in real time to enable the control of multiple elements of the production process.

IPMS might operate across multiple function areas for example: management of product definitions across the product-life-cycle, resource scheduling, order execution and dispatch, production analysis for Overall Equipment Effectiveness (OEE), and materials track and trace.

Vehicle and aggregate tracking and genealogy are an important requirement of any auto industry. Vehicle is tracked from the time it is created throughout its life when it is with customer and when it comes for warranty etc. Similarly, major aggregate and part fitments also need the same level of tracking and verification. This tracking will be difficult through standard SAP as back flushing is not real time and it happens in the form of bulk booking. This needs to be achieved through serialization, barcode generation for internal assemblies, scanning and capturing the details at different points of production. This involves setting up of wireless access points, configuring hand held terminal scanners and customizations in system to capture the required details.

2. Project Overview

As we know that a vehicle consists of minimum 2000 different and important parts. The process of tracking can be made easier by keeping the record of each and every part. Also the information about the user or the shop floor employee who is incharge of it. In this

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process initially the production booking method is based on:

i. Printing the Barcode.
ii. Scanning the Barcode.

This same process is carried out in four shops of the plant.

- Frame Shop.
- BIW Shop.
- TA Shop.
- TCF Shop

➢ The frame is the main part of the chassis on which remaining parts of chassis are mounted. The frame should be extremely rigid and strong so that it can withstand shocks, twists, stresses and vibrations to which it is subjected while vehicle is moving on road. It is also called underbody. The frame is supported on the wheels and tyre assemblies.

In this stage of manufacturing the serial number for each of the frame is created using the Barcode printer. The Barcode sticker is stick on the History card of each frame. History card is paper on a note pad, where the detail of the individual is attached. The History card pad is carried along with the each frame, as shown in fig.1.

➢ Body in white or BIW refers to the stage in automotive design or automobile manufacturing in which a vehicle body's sheet metal components have been welded together, but before moving parts (doors, hoods and deck lids), the motor, chassis sub-assemblies, or trim (glass, seats, upholstery, electronics, etc.) have been added and before painting.

Here in this shop also same procedure is carried out as in frame shop. For each of the body of vehicle, a Barcode sticker is printed and placed on to the history card of the body.

➢ In the automotive field, a transaxle is a major mechanical component that combines the functionality of the transmission, the differential, and associated components of the driven axle into one integrated assembly. Transaxles are near universal in all automobile configurations that have the engine placed at the same end of the car as the driven wheels: the front-engine, front-wheel drive layout, rear-engine, rear-wheel drive layout and rear mid-engine, rear-wheel drive layout arrangements.

In this shop two barcode stickers are printed for each engine (transaxle). One barcode sticker is stick on the history card and another on the engine itself, as shown in fig.1.

➢ In the last TCF shop that is Trim Chassis Final Assembly shop, all the above parts are assembled together.
Here the special aggregate scanning procedure goes on. In this aggregate procedure all the barcode from frame, BIW, TA shop are merged and a new different vehicle number or chassis number is given. The same number is printed twice and one is sticked on the History card and another on the vehicle.

The shops are fully automated ensuring that there is no minimal chance for error in the manufacturing processes. After the vehicle is completely assembled, it goes through several checks like wheel alignment, sideslip test, brake test, shower test, and a short test run before it is ready for dispatch. All systems such as materials management, maintenance and other activities are computerized, enabling smooth operations and minimum inventory needs.

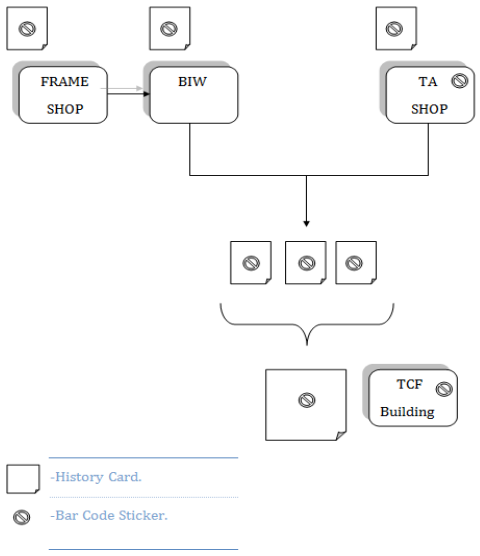

Fig.1 IPMS implementation on Shops

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3. Module Description

A vehicle identification number, commonly abbreviated to VIN, is a unique code including a serial number, used by the automotive industry to identify individual motor vehicles defined in ISO 3833.Chassis is a French term which is now denotes the whole vehicle except body in case of heavy vehicles. “Chassis consists of engine, power train, brakes, steering system and wheels mounted on a frame”.

Initially with the use of barcode printer the series of Equipment number and its material number are generated. The generated series are printed on the stickers. The serial numbers are created based on planning and sequencing.

I. Module: Chas. Create.

In this chassis creation section, it consists of the chassis details that has been manufactured in the production plant. This program is used to create equipment for category type ‘C’(Chassis) using RF screens. User will scan the Barcode of the equipment & material using Radio Frequency Device.

a. Chassis Serial No

This field will be entered by the user at the shop floor. It is the 17 alphanumeric character field. The format for chassis serial number is: E.g. MATXXXXXXEXDXXXXX.

MA or else ME code is the Indian code for the vehicles. The serial number for the vehicles that are to be exported start from MAT. From 4^{th} place to 9^{th} place it consists of 6 digit number which represents the different models or vehicles. The 10^{th} place is for the Year code, in the above e.g. E represents the Year 2014. The 11^{th} place is for the Production line code number. The 12^{th} place is for the month code, D represents the April month. X represents digits.

b. Material No

It is the 12 place alphanumeric character field. The ABFR in the below example is for the Ace zip white model. It is different for different colors of model. E.g. XXXXXXXXABFR

AHOR-Neon Rush, ABFR-Arctic white, AIHR-Icy blue, ABNR-Ruby red

II. Module: Chas. Class

In this chassis class module two types of scanning are carried out.

a. Aggregate Scanning

In this phase the chassis number, Engine serial number and Transaxle number all are scanned for each and every vehicle. As the name specify aggregate which means merging.

b. RFID Scanning

The merged numbers from the aggregate phase is given a new Chassis number and a RFID serial number.

III. Module: Production Booking

This phase is also called as confirmation phase. Where again the Chassis serial number is scanned. Back flushing process is carried out in this phase. Back flushing is automatic accounting of material consumed for production, at the time of confirmation. e.g. When a 4 wheeler automobile is rolled out from assy line, 4 wheels &Tyres are deemed to be consumed and issued to production order automatically by way of backflushing by the system. Er number is also given in this phase if vehicle is for export.

IV. White Tag & White Tag Clear

The vehicle with certain defect is tagged as White Tag. The main advantage of IPMS is in this phase. If any defects found in the vehicle, those are registered here with its specific chassis number. Along with chassis number its shortages are also noted down as shown in fig.2. Once the defect are cleared then again their chassis number are noted down in the White tag clear table.

All module consists of options Save, Clear, Back , Update, Delete.

Save: Chassis serial no & material number are saved in to the SAP system through scanner.

Clear: This option can be used to clear the entries from the dialogue box, with condition before the update process.

Back: Back button take us to the Chassis menu screen.

Update: Scanned chassis serial no & material number are stored in client 600 server.

Delete: Particular selected chassis number can be removed using this option. The conditions for this will be explained later.

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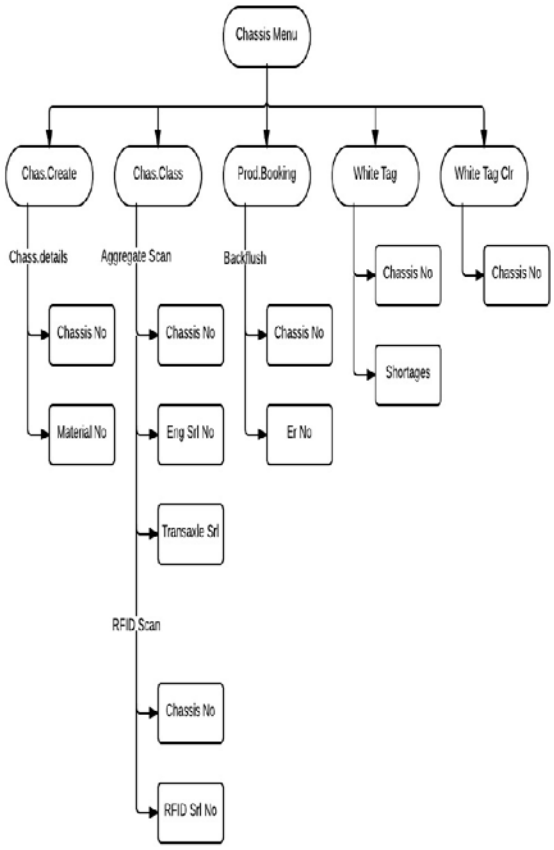

Fig.1 Proposed IPMS Architecture

4. SAP

SAP(System, Application and Products in data processing) software plays an important role in this process. The main advantage of using SAP as company ERP system is that SAP has a very high level of integration among its individual applications, which guarantee consistency of data throught the systems and the company itself.

SAP R/3 is one of the main products of SAP, where R stands for Real-time and the number 3 relates to three tier application architecture. Most of the business in today's world runs on SAP R/3 system. About 80% of the companies implement this software. SAP based the architecture of R/3 on a three-tier client/server structure:

1. Presentation Layer (GUI)
2. Application Layer
3. Database Layer

5. SAP NetWeaver

SAP NetWeaver, SAP GUI for Windows 730 Final Release / Version 7300.1.0.1074 Copy right @ SAP AG. SAP NetWeaver is the technology platform on which all applications run, from SAP Business Suite, SAP ERP, and SAP Customer Relationship Management through custom developments. As middleware, SAP NetWeaver ensures that the SAP software runs smoothly and enables developers to build their own applications.

6. SAP ABAP

Using this programming language IPMS project is carried out. Advanced Business Application programming language (ABAP). It is the fourth generation language. It is Not Case sensitive. It is an Event driven programming language. ABAP (*Allgemeiner Berichts-Aufbereitungs-Prozessor*, German for "general report creation processor") is a high-level programming language created by the German software company SAP. It is currently positioned, alongside the more recently introduced Java, as the language for programming the SAP Application Server, part of its NetWeaver platform for building business applications. The syntax of ABAP is somewhat similar to COBOL.

7. Advantages

- Planning and sequencing of production can be performed like
  - Creating monthly plan.
  - Converting monthly requirement plan to daily plan.
- Integrated Production Management System helps create flawless manufacturing processes and provide real-time feedback of requirement changes, and provide information at a single source. Reduced waste, re-work and scrap, including quicker setup times.
- More accurate capture of cost-information (e.g. labor, scrap, downtime, and tooling).
- Increased uptime.
- Incorporate Paperless Workflow Activities.

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- Reduced inventory, through the eradication of just-in-case inventory.
- Comply With Regulatory Traceability Requirements.
- Can handle complex genealogy.
- Daily planning - directly in SAP.
- Real time aggregate / VC booking.
- VIN number directly in SAP.
- On line status monitoring of aggregates and vehicles.
- Rationalization processes across locations.
- Use of Mobile data acquisition devices for faster & accurate data capture & improved productivity.
- Centralized system for Cost effective IT solutions.

8. Conclusion

Integrated **P**roduction **M**anagement **S**ystem is the Customization to SAP booking System. It is used for Real time Production booking by Use of Mobile data acquisition devices for faster & accurate data capture & improved productivity. This helps in automating production booking through barcode generation at the aggregate or Vehicle initiating point and scanning at the production booking point. The development of IPMS is to overcome the disadvantages of SAP booking like Mistakes during booking by manual entry. System errors: If no stock in system the process won't get hampered. This system runs in a different SAP client (600) and data from this is interfaced with main SAP client (500) at regular intervals. This is used for Genealogy

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Reshma.A.More BE,[M.Tech] in Computer Science and Engineering , GSSIT

Krishna Gudi BE, M.Tech , Asst Professor, Dept of CSE, GSSIT

Venkataravana Nayak K BE, M.Tech , Asst Professor & HOD, Dept of CSE, GSSIT