

ERP System for Small and Medium Sized Printing Industries

Akshay Dudani, Hitesh Hinduja, Khushboo Jethwani, Varun Golani,
Gresha Bhatia

¹(Computer Engineering, Vivekanand Education Society's Institute Of Technology/Mumbai University, India)

²(Computer Engineering, Vivekanand Education Society's Institute Of Technology/Mumbai University, India)

³(Computer Engineering, Vivekanand Education Society's Institute Of Technology/Mumbai University, India)

⁴(Computer Engineering, Vivekanand Education Society's Institute Of Technology/Mumbai University, India)

⁵(DHOD Computer Engineering, Vivekanand Education Society's Institute Of Technology/Mumbai University, India)

Abstract: The number of processes to manage in a printing industry becomes very complex to manage. On the given requirements the goal is to create an overall system that manages the tasks such as stock management, accounting, employee management, machine status management, order tracking. The development based on many components is advantageous for building the ERP system according to business needs and makes the maintenance and upgrading becomes more convenient. This paper also tells us about how the business requirements are achieved by the ERP system.

Keywords: ERP, FCFS scheduling, Printing industry, Priority scheduling, Queue.

I. Introduction

Printing industry is growing at a very fast pace from the last few years. Every year approximately 3500 new printing engineering graduates join the printing industries. Due to increase in sales as well as clients, the need for Enterprise Resource Planning (ERP) is becoming essential. The second generation systems automates work from order request to delivery of finished product, despite the earlier systems in which all the task needed to be done manually which not only increased the cost but also increased the time required to process the order. Printing enterprise is the processing enterprise with stronger industry features. The current software of the printing industry has disjoint modules will now be replaced by a completely integrated software. [1]

Developing ERP System integrates enterprise logistics, capital flow, information flow and other business information to achieve production management, inventory management, procurement management, human resources management, quality management, finance management and other aspects of functions. The software functional modules may be divided as follows as represented below:

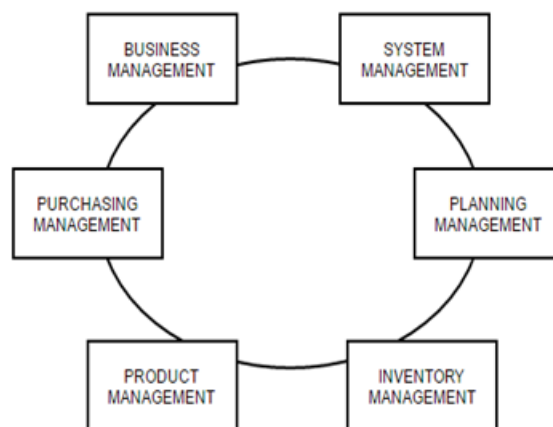


Fig 1:-Software Functions

- 1) **Business Management** - Responsibility of Business Management is for the management of customer relations, quotation, marketing activity, orders, delivery and so on.
- 2) **Planning Management** - Responsibility of Planning Management is for generating production list from customer orders, including a direct way or generating it after the decomposition and combination of orders.

- 3) **Purchasing Management** -Responsibility of Purchasing Management is for the management of request purchase,purchase,order,receiving,return,supplier information,etc.
- 4) **Production Management** - Responsibility of Production Management is for implementing the production plan on machines,materials requisition and materials return,recording of work information.
- 5) **System Management** - Responsibility of System Management is for user login and authorization management.
- 6) **Inventory Management** - Responsibility of Inventory Management is for the management of stock-out,stock-in,stock taking,monthly balance,and materials from customers.[1] [2]

II. Literature Survey

A case study about four printing ERP software were studied namely Dynamics NAV, EFI PrintSmith, which benefitted the printing companies in reducing time taken for customer orders,creation of additional invoices,reduction in commercial printing invoice cycle,quick ROI respectively.[4][6]

A. Dynamics NAV led to reduction in time taken by customer orders by 50%

Dynamics NAV is a product by Microsoft used by printing industries to automate their tasks.Since ERP systems automate every sector of printing industry,there is a need ofERP system. The advantages of the software include reduction in processing customer orders by about 50%, very minor errors about 3 in million transactions, it has ability to recover from errors and react to system changes.[4]

B. EFI Print Smith helped in creating additional \$3,000 invoices in first month after install

MPI Commercial and Digital Printing, a small business benefited from this software which included features such as reporting, invoicing and the actual e-commerce functionality. The advantages of the software include quicker generation of invoices with fewer errors, handling more work, improved efficiency, additional \$3,000 invoices in the first month after install,real time decision making by real streaming of data as it comes in the database.[4]

III. Existing System

The following are the problems faced by the small and medium sized printing industries:

A.Separated Modules

Modules such as stock management, accounts, sales, job card, purchase management, etc. are not integrated in the current system which is a problem because performing manual entry can be tedious task for a human.

B. Redundancy in data

As manual entry is performed there is no data management happening i.e. some attributes are replicated in many tables in the database leading to redundancy in data.

C. No data analytics

There is no data analytics happening in the current system which is a disadvantage because the company can't compare the profits from previous years nor can see which product is booming nor it can predict customer buying patterns.[5]

IV. Problem Statement

Every Industry operates with its modules. A printing industry has many modules of finance, Operations, SCM [3]. These modules need to be interconnected with each other to provide an equilibrium in printing industry.How can this be done?

The answer to this is through the development of an ERP system which connects discrete modules together like a web-chain and thus leading to smooth functioning in an industry with precise understanding of every requirement given by the client by each and every department of the organization.

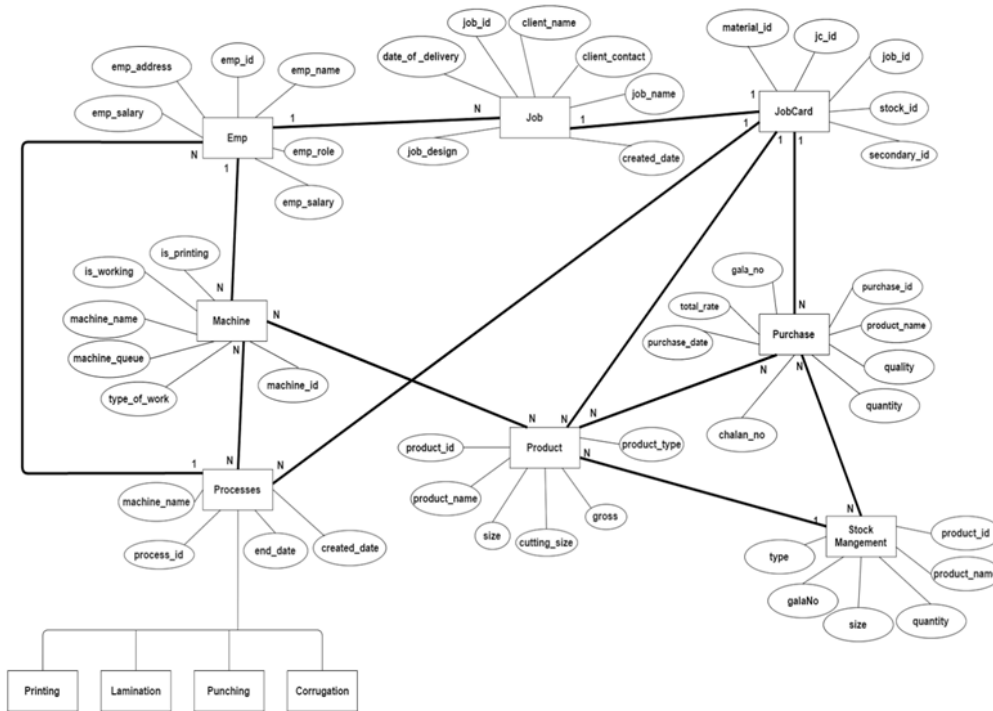


Fig.2 ER Diagram

V. Printing Process

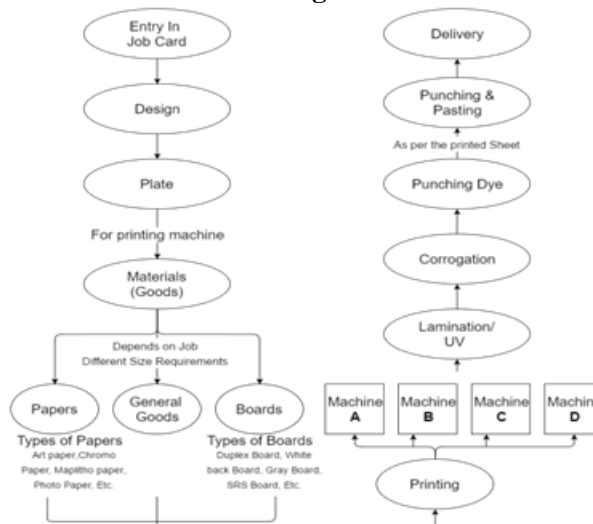


Fig. 3:- The Printing Process

The process starts with a job card which contains all details of customer requirements such as type of material, dimensions of materials, secondary processes to be performed etc. After getting the requirements, printing process is carried out according to the specifications mentioned in the job-card by the customer and the party. Lamination is one of the sub-process of the industry. Basically lamination is of 2 types are:-

- 1) Normal lamination
- 2) UV coating

Another process is punching, which gives a desired shape to the packaging material according to the requirement of the customer. Corrugation is a process in which surface is shaped into a series of parallel ridges and grooves so as to give added rigidity and strength to the material. Specified labels are pasted on the material. Finally the delivery of the product is done.

VI. Software Design

Working Environment: Desktop;
 Development Platform: Eclipse IDE;
 Language: Java;
 Database: Oracle SQL Plus.

The IDE's (eclipse) and libraries used for the project are free to use. The system can be implemented for all systems running on WINDOWS, LINUX, and UNIX etc. This system is appropriate for small as well as medium sized printing industries as they don't have enough resources to buy a software.

Software design of the ERP system is shown below:

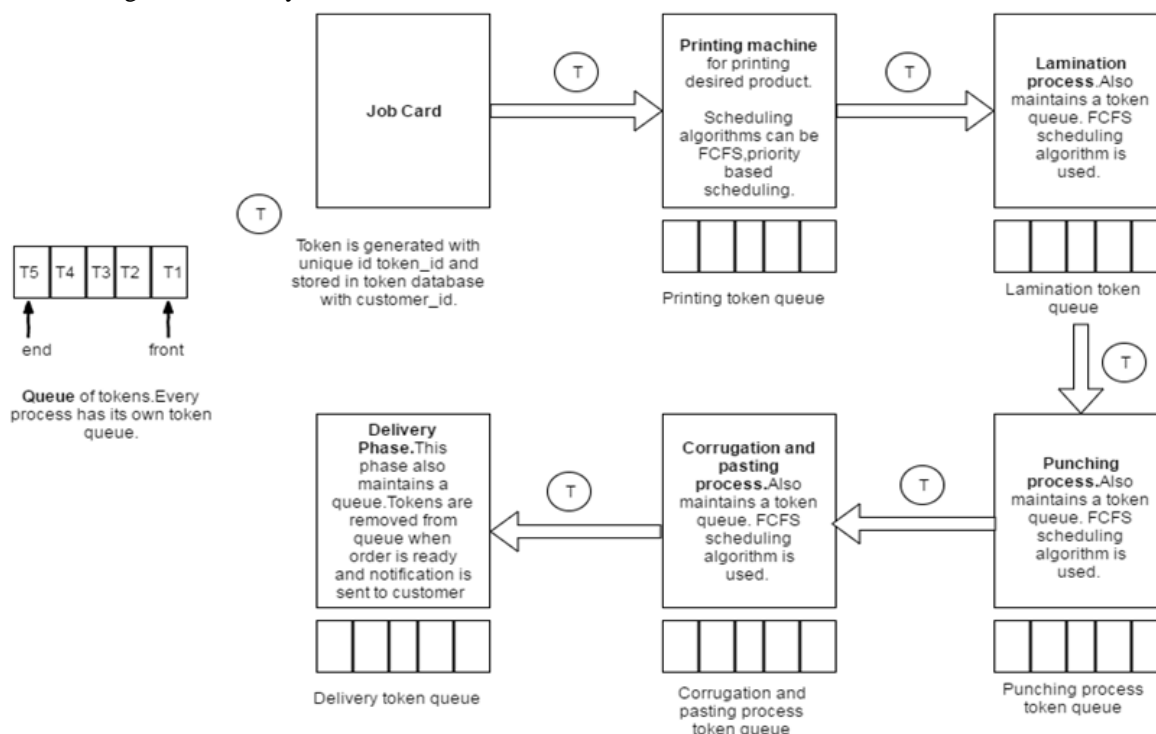


Fig. 4: - Software Design

Each phase which will be automated by this system has its own token queue except the first phase. At first the Job Card is created when customer specifies his requirements. With the creation of Job Card there is also creation of a token which has unique token_id which is stored in a database with customer_id. The token is passed to the second phase which is Printing where the token joins the printing queue where each job is processed according to First Come First Serve (FCFS) fashion, but if the customer wants the desired product early his job will be transferred to the front of the queue using priority scheduling. After finishing the printing phase, the token joins the lamination process queue in FCFS fashion.

After finishing the lamination phase the token is passed to the next phase which is punching, the token joins the punching process queue in FCFS fashion same as lamination phase. Same thing is done for corrugation and pasting phase too, the token join this phase in FCFS fashion. After corrugation and pasting phase the token is passed to the delivery queue in FCFS fashion. As the orders are dispatched from the factory the token numbers are removed from the queue and notifications are sent to the customer through email and SMS. Thus, all the processes of printing industry are automated with the help of queue as a data structure and FCFS, priority scheduling as algorithms. [1][7][8] [9][10]

VII. Algorithms For The Proposed System

Data structures used: Queue

Algorithms used: Scheduling algorithms First Come First Serve (FCFS), Priority Scheduling.

Algorithms:

Algorithm 1: - FCFS Scheduling of the printing jobs

```
Function fcfs(Queue q,inttoken_id){
    If(q is empty)
        insertIntoQueue(token_id,0)
    Else
        insertIntoQueue(token_id,q.len())
}
```

Algorithm 2: - Priority Scheduling of the printing jobs.

```
Function PS (Queue q,inttoken_id){
    If (q is empty)
        insertIntoQueue(token_id,0)
    Else
        If(there are priority jobs already)
            Put this job at the end of the priority jobs queue
        Else
            insertIntoQueue(token_id,0)
}
```

VIII. Results And Evaluation Of The Proposed System

A. Time complexity

FCFS: $O(1)$ (On one execution of the function)

Priority Scheduling: $O(m)$ (m is number of priority jobs)

B. Space complexity

FCFS: $O(n)$

Where n is number of jobs in queue

Priority Scheduling: $O(m)$

Where m is number of priority jobs in queue

IX. Conclusion

This paper elaborates on the need of an ERP system in printing sector along with its benefits and lacunas. The paper further reveals the software design for a printing industry. The components of this system can provide a well arranged structure, so that the maintenance and upgrading become more convenient. The software used for system building are java tools which are free to use and so marginal cost is required for building an ERP system. The ERP system should change from time to time as market requirements can change anytime. Thus, an ERP system can save time as well as resources. It can also lead to reduction in human power.

References

Journal Papers:

- [1]. Wenjie Yang, HaoXue Liu, Jie Shi, *The Design of Printing Enterprise Resources Planning (ERP) Software* Published in year 2010
- [2]. Taolin Ma, Xiaoming Chen, Yansong Sun, Xiurong Li, *The Research and development of IMIS for Small and Medium-sized Printing Enterprise* Published in year 2009
- [3]. Dr. Broto Rauth Bhardwaj, *Sustainable Supply Chain Management Through Enterprise Resource Planning (ERP)* Published in year 2014
- [4]. *Case study on commercial printing management software*, <http://findaccountingsoftware.com/expert-advice/case-study-round-up-commercial-printing-business-management-software/>
- [5]. Chunpeng Li^{1, 2}, Yinyin Wang^{1, 2}, *ERP Application Research in Small and Medium-sized Printing Enterprises* Published in year 2015
- [6]. *Product comparison on printing industry software ERP*, <https://www.softwaresuggest.com/printing-packaging-industry-software>
- [7]. Shan Jin Wei Ju, *ERP Load Balancing Scheme Based on Process Scheduling* Published in year 2012
- [8]. Jingxing Wei, and Y.-S. Ma, *Design of an Order Acceptance and Scheduling Module in a Unified Framework with Product and Process Features* Published in year 2012
- [9]. Roberto Lujic, Goran Simunovic, Tomislav Saric, Niko Majdandzic, *Applying Artificial Intelligence to the Scheduling Problem in the ERP System* Published in year 2005
- [10]. Péter Bikfalvi, Ferenc Erdélyi, Tibor Tóth, *Multi-Objective Performance Analysis of One-Machine Manufacturing Systems* Published in year 2012