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Enterprise Resource Planning Software for Manufacturing Industry

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Abstract: ***The world has become more efficient in management, analysis and decision making process with the developments in digital technologies like, AI, Cloud computing (SaaS, PaaS, IaaS), Big Data, Machine Learning, etc. The massive workloads of the medium and large manufacturing companies can be handled using an Information System software i.e., Enterprise Resource Planning (ERP) software. The purpose of this paper is to address the need of the ERP for the manufacturing industries and integrate the new advanced technologies to it which may lead to the evolution of industry 4.0 with better Information System which can handle and process large amount of information very efficiently and help in the decision making.***
Keywords: Enterprise Resource Planning, Information system, Cloud Computing, IoT, Industry 4.0

I. INTRODUCTION

With the implementation of advanced and upcoming technologies into the business processes, various business activities are being integrated to a single information system which leads to the proper maintenance of data and ease of management in the organization. With huge growth in the storage and computing capacity, the enterprise information system evolved with various advancements , this lead to the evolution of Enterprise Resource Planning (ERP) software in 1990s.

Enterprise Resource Planning (ERP) is a kind of software that companies use to manage daily business activities such as , procurement and accounting, project management, customer relationship management, risk management, compliance and supply chain management. It integrates every business activities of a company into a single centralized system to provide visibility, efficiency and intelligence.

Gradual change in the technology also changes the perspective of use of the ERP. Initially the internet changes the ways of using the ERP that is, accessing the information using web-browser through internet services. After the huge advancement in the world of computation power and communication capabilities lead us to the era of cloud computing which helped us to think ahead of the on-premises based ERP system and come up with the cloud based ERP system enabled with more secure and reliable properties.

Now a days, the new innovations like, artificial intelligence, big data analytics, Internet of Things(IoT), blockchain, SAAS model of cloud computing, etc., create huge impact on the insight about the ERP systems which help the organization to enhance their management of data and business activities up to the very ground level. In upcoming years the industries will undergo through the fourth industrial revolution i.e., Industry 4.0 , which will create huge gap between the new industry and the present ERP systems. This gap must be entertained with integration of the new technological innovation and create over all a new generation of information system which does not narrowed to just storing the data but analyse the huge data itself and produce reliable decision patterns for the organization.

II. HISTORY OF ERP

Fig. 1 History of ERP

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The advancement in technology always accompanied the history of ERP. It continues to boost business growth. With Sass-based cloud ERP systems, more and more companies can start using enterprise resource planning solutions in their business operations. ERP(Enterprise Resource Planning) is the evolution of Manufacturing Resource Planning(MRP II). From the business perspective , ERP has expanded from the coordination of manufacturing processes. It expanded to the integration of enterprise-wide back end processes. From a technological aspect, ERP has evolved from legacy implementation, evolved to a more flexible tiered client-server architecture[1].

A. Inventory Management & Control

Inventory Management and control is a combination of information technology and business processes, business processes of maintaining the appropriate level of stock in a warehouse.

The activities of inventory management include,

1) Identifying inventory requirements.
2) Setting targets.
3) Providing replenishment techniques and options.
4) Monitoring item usages.
5) Reconciling the inventory balances.
6) Reporting inventory status.

B. Material Requirement Planning (MRP)

Material requirement planning (MRP) utilizes software applications for scheduling production processes. MRP generates schedules for operations and raw material purchases.

Scheduling is based on,

1) Production requirements for finished goods.
2) Structure of the production system.
3) Current inventory levels.
4) Lot-sizing procedure for each operation.

C. Manufacturing Resource Planning (MRP II)

Manufacturing Resource Planning or MRP II utilizes software applications. Applications for coordinating manufacturing processes. Processes from product planning, parts purchasing, inventory control to product distribution.

D. Enterprise Resource Planning (ERP)

Enterprise resource planning or ERP uses a multi-module application software system. Software for improving the performance of the internal business processes. ERP systems often integrate business activities across functional departments.

This period in the history of ERP, big corporations implemented it. Most of the small and medium scale businesses left out of it due to the higher upfront costs.

E. Web Functionality with Internet (ERP II)

Interaction of ERP with other application suite is enabled in ERP II. An example is integrating with CRM systems.Technological advancement Accessing information using internet web-browsers and mobile devices were made possible.Technological advancement with Services Oriented Architecture (SOA) was adapted.

F. Cloud-based ERP

Business applications are delivered as software as a service (SaaS) model. Servers are deployed on the cloud and accessed with rest APIs. Android, iOS, and browser applications are developed for delivering ERP software in the SaaS model. It is helping businesses of all scales to start using ERP system since the upfront cost of cloud ERP systems are relatively less.

G. Evolution of Open Source ERP Solutions

Along with commercial vendors, open-source ERP systems are also evolved. These systems are mainly catering to the requirements of small and medium scale businesses.

Since there is less upfront cost involved while implementing these systems, businesses with less budget could also afford it. There is a surge in service providers who help in implementing and customizing open source ERP solutions.

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H. Future of ERP systems

In comparison with the history of ERP, the future of it is more dynamic due to the advancement in technology.

1) Due to the reduction of computation cost and data storage cost, collecting every minute details of business events are possible. It opens up the possibility of big data analysis and advanced reporting.
2) Based on previous data and industry benchmarks, machine learning can help in suggesting better business decisions.
3) Automation of data-driven decision making will take the front seat with the help of artificial intelligence.
4) For business transactions between multiple parties, establishing data integrity with blockchain technology.
5) In order to avoid frictions due to physical proximity, virtual reality for better interactions.
6) Jobsite management using 5G enabled smartphones.
7) Internet of things (IoT) for better data exchange between human-to-machine and machine-to-machine.

III. MODULES OF ERP IN PRESENT SCENARIO

The smooth running of a given business needs different functionality. Enterprise Resource Planning solution consists of these functionality. ERP module is a part of the whole system. Each module provides specific and related functionality. The functionality related to one area of business processes.Three types of core ERP modules are : Functional modules, Technical modules and Application suite [2]. We will discuss only the functional module.

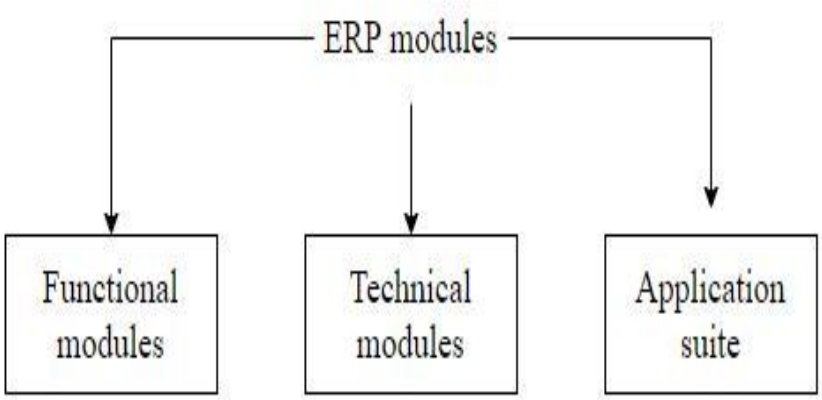

Fig. 2 ERP Modules

A. Functional modules of ERP software

1) *Finance module in ERP:It records transactions in the general ledger accounts. This module generates financial statements for external reporting purposes.*
2) *HR(Human Resources) Module:*It facilitates employee recruiting, hiring, and training. This module also includes payroll and benefits.
3) *Production Module:* It maintains production information. This module will help in doing the planning, scheduling, and recording production activities.
4) *Purchase module in ERP:* The purchase module streamlines the procurement of required raw materials. It automates the processes of, Identifying potential suppliers, Negotiating price, Awarding a purchase order to the supplier, Billing processes. The purchase module is tightly integrated with the inventory control and production planning modules. The purchasing module is often integrated with supply chain management software.
5) *Inventory Module*: Inventory is the term for merchandise or raw materials that a company has on hand. This module manages, Acquisition of raw materials from suppliers (purchasing), Handling of raw materials inventory in storage, work-in-progress goods, Shipping of finished goods to the customer.
6) *Sales module in ERP:* It records sales orders and scheduled deliveries. Maintaining and accessing customer information is the responsibility of this module. Customer information includes pricing, address and shipping instructions, billing details, and so on.

B. Technical Modules

Technical modules come under application platforms. This is like the role of the operating system for your laptop.Technical modules are tightly coupled with functional modules. They help smooth integration with different functional modules and application suite. Examples of these are security module and information system management [2].

Technical components found in ERP systems are:

1) Basis components
2) ERP Security module
3) Networking and interface
4) Management Information System
5) Application Programming module
6) Analytic module
7) APIs opened for external use

With the business landscape changing, it's imperative to keep an eye on the developments in ERP space. Keep getting updated about new ERP modules and sub-modules. We should not overlook the importance of ERP in the past, as about 80% of the big and medium businesses run with ERP solutions.

IV. NEW PERSPECTIVE OF ERP WITH INDUSTRY 4.0

The term "Industry 4.0" was initially coined by the German government which describes and encapsulates a set of technological changes in manufacturing and sets out priorities of a coherent policy framework with the purpose of maintaining the global competitiveness of German industry.Generally, Industry 4.0 refers to the means of automation and data exchange in manufacturing technologies including Cyber-Physical Systems, Internet of Things, big data and analytics, augmented reality, additive manufacturing, simulation, horizontal and vertical system integration, autonomous robots as well as cloud computing. It serves a role to help integrate and combine the intelligent machines, human actors, physical objects, manufacturing lines and processes across organizational stages to build new types of technical data, systematic and high agility value chains [3].

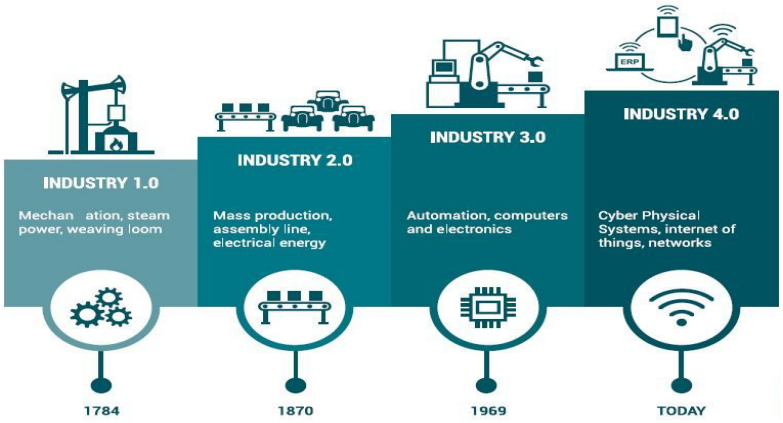

Fig. 3 Evolution of Industry 4.0

The following are the few high impact innovations with changes the industry as well as the ERP systems, Artificial intelligence and big-data-analytics, Integration with the Internet of Things (IoT), Applications over smartphones, Blockchain integration, Cloud enterprise resource planning, SAAS model.

A. Artificial intelligence and big data analytics:

Artificial intelligence (AI) with machine learning can help in making better choices for the business. AI will help businesses to optimize their all operations including,

1) Business operational processes.
2) Software systems.
3) Management structures.
4) Hardware and technology infrastructure.

Enterprise software systems gather many enterprise data from day to day business processes and generate big data. Big data analysis can predict demand and help to make future business decisions better and efficient.

B. *Internet of Things (IoT)*

Internet of Things (IoT) is a system of interconnected physical objects that are accessible through the internet. Automated, machine to machine, meaningful communication is established with it.

Following are the advantages of integrating IoT with enterprise software systems,

1) Enhanced data availability and accuracy.
2) Accurate and efficient communication.
3) Greater business intelligence.

C. *Applications over smartphones*

Mobile applications help in accessing the information on the go. They also help in collection job site information accurately.

Most popular mobile operating systems on which client applications built are,

1) Android.
2) iOS.

D. *Blockchain*

Enterprise systems are adopting blockchain technology. It helps businesses in achieving,

1) Enhanced transparency.
2) Greater security.
3) Increased traceability.
4) Improved efficiency.

It helps in achieving greater control over supply chain management.

E. *Cloud ERP*

Vendors host their software on the cloud computing system instead of customers' data centers. It helps in faster upgrading and reduced maintenance efforts.

F. *SAAS model*

Software-as-a-service models allow small and medium scale businesses to use software systems without huge initial investments. This model does not demand higher installation costs or IT people. It is pay-as-you-go based on how much you use.

V. CONCLUSION

This paper is to give a detailed description of about the Enterprise Resource Planning(ERP) and its importance. This paper also discussed about the history of the ERP system that is, the gradual evolution of the ERP system with the technological advancement.We also discussed about the modules used in the present form of ERP systems and its importance. Further, we discussed about the integration of new advanced technologies which can change the present perspective of ERP. The Fourth Industrial Revolution, i.e., Industry 4.0 is going to next industrial revolution, thus to integrate with this new industry, the new form of integrated ERP is also discussed.

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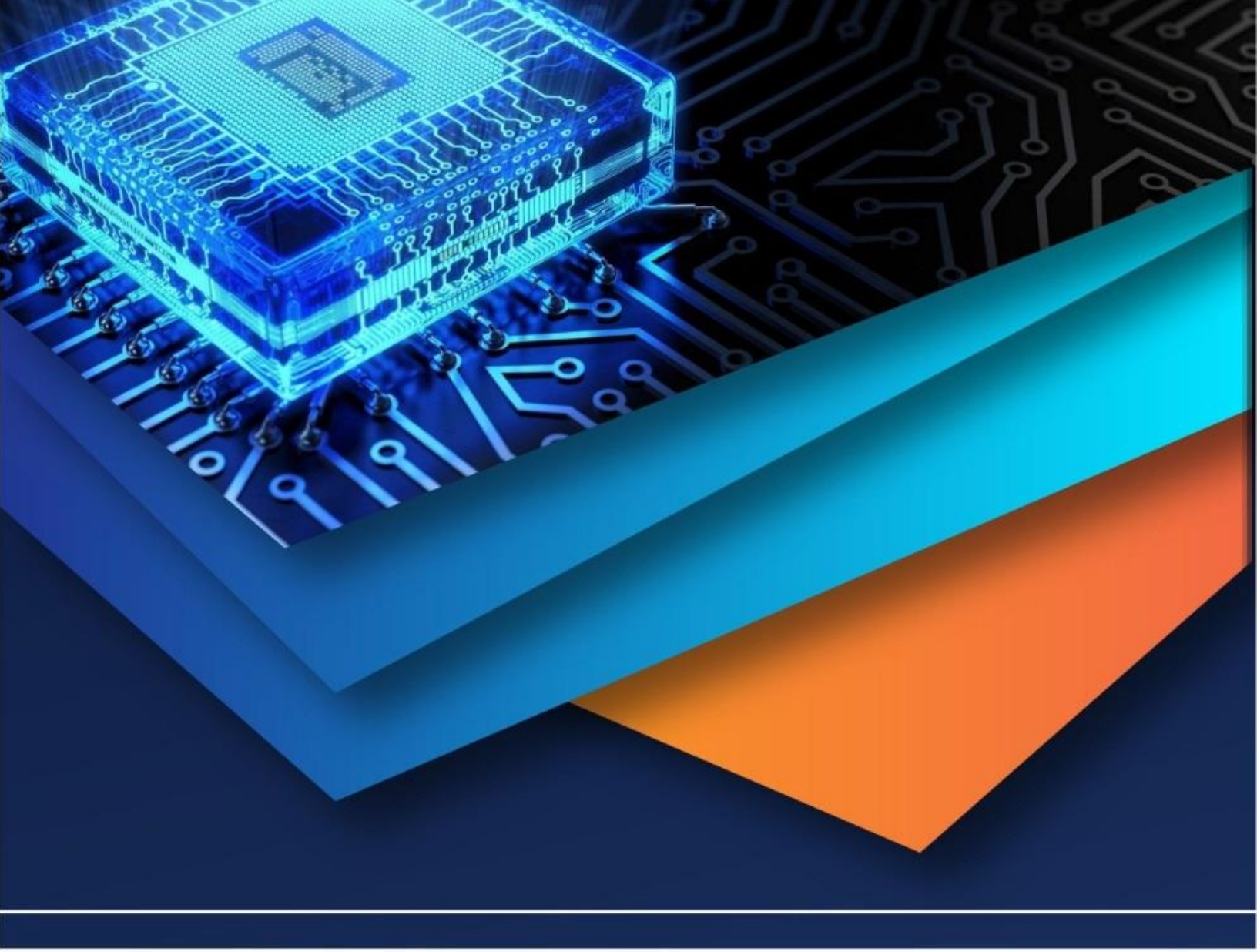

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