An Enterprise Resource Management Model for Business Intelligence, Data Mining and Predictive Analytics

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***Abstract*—Enterprise Resource Management System (ERMS) is used in the management of enterprise for the computerization of enterprise processes such as management of customer data, employee data, client data, financial data, sales reports, attendance reports, inventory details, equity details and payroll details. An ERMS can handle different user roles such as manager, CEO, employees, customers and has abstraction features for its users. It is the core software used by all enterprises as it provides an interface for the overall management of the enterprise. The proposed ERMS model is easy to use, easily configurable as well as economical in terms of time and cost. Moreover, it can adapt easily to any browser or device through its inbuilt bootstrap framework. Migration of data from the existing enterprise system is also feasible. Business Intelligence can be obtained by performing data mining and predictive analytics with the massive data obtained in the central cloud storage area of the proposed ERMS model. Implementation of the proposed ERMS model can be extremely beneficial for the enterprise as it can gain valuable insights regarding the running of its business, customers and competitors.**

Keywords—ERMS; Enterprise Resource Management; Business Intelligence; Data Mining; Predictive Analytics; Bootstrap;

I. INTRODUCTION

ERMS means Enterprise Resources Management System, a system that can manage all the resources of an enterprise, manage the information from different teams of a company and helps in proper gathering of complete information about the current state of the system [1]. ERMS can be used for business management as it can manage more than one resource such as employees, clients and vendors. It has a unified system for management of products, bills, workforce, stocks, inventories and the business can predict the risks and challenges using ERMS modules. Most ventures which are successful has an ERMS software running in the background. Assets, liabilities, equity can be calculated with accounting standards using ERMS in automated state.

Without an ERMS framework, a business person will have a hard time making business decisions which may not have a real impact on his business because the data is not centralized and often leads to loss in business operations. Always an ERMS [2] has been highly beneficial due to the following reasons:

- Reconciliation among various practical territories to guarantee appropriate correspondence, profitability and effectiveness.
- Customer feedbacks valuation to keep a track of the likeness of a product. This helps the enterprise to know which product the users like.
- Product sales and commission information can be known from the ERMS.
- Keeps synchronized between stock in hand and sale of stock.
- ERMS can adapt to any processor easily, so the enterprise need to only use the existing devices for implementing ERMS.
- Provides extra protection as authorization is also included in ERMS so that only right users access those modules.
- Data security and data integrity can be ensured so that no employee modifies the data and cause loss to the business.
- Gives work force easy control of invoicing and installment handling and in this manner boosting their profitability in operations.
- Reduce paper records through digitization of business data.
- Greater precision with charts that tracks down loss of business and helps to recover the losses immediately.
- Improves Universal operations by providing global expense structures, invoicing plans, various monetary forms, global balance sheets.

An ERMS has modules for financial administration, human asset administration, production, supplier and buyer administration, stock and material administration, CRM and Venture Administration [3].

1. Finance administration- Using ERMS, organizations can manage the accounts receivable and accounts payable of the organization with significant advantages such as accuracy and accountability over redundant bookkeeping procedures, for example company budget plan creation, distribution and administration; income monitoring; creditor liabilities and receivable and revenue reporting are part of finance administration.

2. Human Asset Administration- ERMS arrangement offers a wide range of sub-frameworks under the Human Resource (HR) module. The subsystems are Staff Administration, Association Administration, Finance Administration, Time Administration and Self-improvement. ERMS framework

incorporates human capital administration that computerizes and improves the whole HR lifecycle. Human Asset management modules are available for managing contract of employees, employee training and their improvement, employee attendance, employee salary and other benefits as well as modules for their administration by the managers. They likewise empower HR staff by helping every employee achieve their maximum capacity.

3. Production- The assembling segment of an ERMS framework incorporates instruments that improve the whole end-to-end procedure of planning and building an item. It shows production plan, resources available for production and management of production with optimize production methodology that follows quality standards. With ERMS and its assembling capacities, organizations are engaged to make the most ideal item in the most productive and practical way.

4. Supplier and Buyer Administration- An ERMS framework suite incorporates elements to enhance stock administration, request administration, acquiring and obtainment, product logistics, inventory network management, product returns management to help organizations viably facilitate and control their supply chain network. With ERMS framework, organizations can better deal with all production network operations, including the sourcing, obtaining, the booking and administration of the warehouse in supplying the products to the buyers on time.

5. Stock and Material Administration Module- Stock Control Module contains the following modules such as stock entries with the quantity, name, price of the product. When this information is fed into the ERMS framework, stock is calculated for each product, the stock management team can have a better assurance of the stock in hand and get alerted if a product goes out of stock, the company can acquire the stock as per the need of the customers.

6. CRM- Customer relationship management (CRM) module guarantee legitimate administration of lead, client, opportunities and by and large better tracking of client and further development in business.

7. Venture Administration- For production, supply and invoicing, organizations need to effectively start, plan and execute the daily routine tasks for the satisfaction of the customers. ERMS framework and its modules provide administrative tools [4] to effectively manage and control production, supply, customers, employees, stock and equity. ERMS promises easy administration and effective control.

The paper proposes an ERMS model that has human resource management modules, customer relationship management modules, feedback modules, project modules, client modules, inventory modules, production and supply modules, finance and accounting modules, payroll modules, employee modules and user modules. Modules store data in a centralized cloud storage which helps to gain business intelligence by analyzing raw data as well as perform predictive analytics and data mining.

II. LITERATURE REVIEW

An existing system has different modules like manufacturing management system, accounting system, financial system, sales system and human resource system are depicted in Figure 1 [5]. Most of the present systems [6] have very few modules such as the billing system, the product information system and the customer membership system. Many tasks are not digitalized in existing systems and are recorded in register books manually by the manager. Often the collected data are affected by human errors and cause wrong stock details of products which can affect the business and the customers. Customer Resource Management (CRM) system helps to manage the customers and their preferences. Feedback system collects the feedback of clients. Customers are very important for the success of business. These modules are absent in the existing systems.

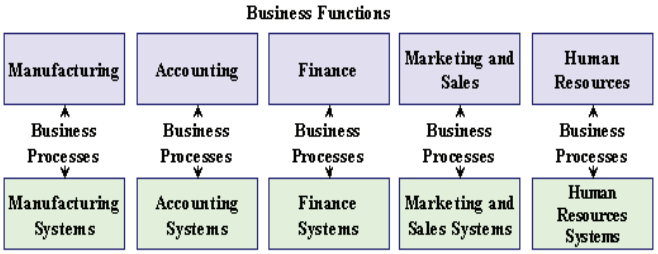

Figure 1. An existing Enterprise Resource Management System

Every shop has a billing system to manage the orders of customers as well as other independent systems to manage the stock, the employees, the customers. An accounting system is used for managing the assets and liabilities of the business; a payroll system is used to keep track of employee working hours and salary. Existing ERMS models have no relationship with other modules and perform tasks independently. So often team members have to communicate the information to members of other teams which cause huge delay when solving customer issues. Lack of feedback system and the CRM system can cost huge loss to the company. Moreover, the topmost executives of the company would not able to know the current state of the company, to know the current state he has to ask the employees from each department to prepare reports and further combine the data in reports manually to assess the enterprise resource. As every minute is extremely valuable in an enterprise, there is a need of highly efficient, self-sufficient, and fully automated ERMS.

III. PROPOSED SYSTEM

The proposed system has the following modules- human resource management modules, customer relationship management modules, feedback modules, project modules, client modules, inventory modules, production and supply modules, finance and accounting modules, payroll modules, employee modules and user modules [7,8]. It is in connected and integrated state so that data can be accessed easily between departments as in Figure 2. The Proposed ERMS model is highly economical, agile, easy to use, easily configurable and supports fast migration of data from existing enterprise systems

and is supported on all old as well as new browsers and devices [9-11]. The system has been developed over agile software process which is the standard software development process used by multi-national corporates for developing highly adaptive and productive software in the IT industry. Due to effective passing of data between the ERMS modules the proposed system does the tasks in the best possible manner, as a result managing of the enterprise of the enterprise will be easier, efficient and is far better than the existing system.

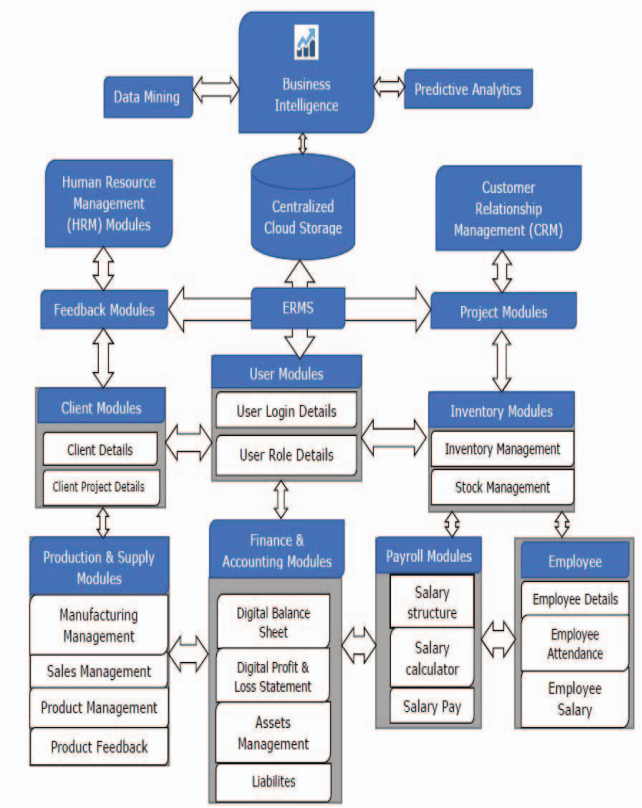

Figure 2. The Proposed Enterprise Resource Management Model

The proposed model has human resource management modules, customer relationship management modules, feedback modules, project modules, client modules, inventory modules, production and supply modules, finance and accounting modules, payroll modules, employee modules and user modules. All data is stored in a centralized cloud storage for easy access by any module. Data from the cloud can be used for data mining which analyzes the raw data of the enterprise and summarizes into extremely useful information which can be used to cut cost, increase sales, increase revenue and increase profits. Correlations between variables like price, product, sales can gather business intelligence which can help in future growth of the business [12-14]. Business Intelligence helps in identifying opportunities for innovation, optimal usage of resources, succeed in competition and so on [15]. Predictive Analytics can be used to understand the future outcomes and trends. Enterprises opportunities and risks can also be evaluated [16]. It also helps to understand the customer better. It also provides a probabilistic model to predict the chance of occurring an event like to know the probability a product will be purchased by a consumer, the probability the business will gain profit in the second quarter, the probability of customer satisfaction [17].

ERMS has specialized modules for employees, clients, accounting, products, payrolls and inventory. The dashboard of the ERMS, where it shows the statistical data of the enterprise in graphical form is shown in Figure 3.a. It shows new orders, total revenue, total cost, total profit as well as a graph that shows number of sales in each month. Each of the modules has submodules for inserting, updating, deleting data records with live data search and data sort feature. These modules are described as below.

A. EMPLOYEES MODULES

Employee Modules manages the main resource of every enterprise, the employees. Employee module has *Employee Details*, *Employee Attendance* and *Employee Salary* submodules where each employee is identified by a unique Employee ID. All the basic details of employees, which contain basic information, including the feature to edit employee details as well as remove them and a search option to find specific details is shown in Figure 3.b. All personal details of the employee are managed using Employee Details submodule while Employees time-in and time-out of the office is managed using the Attendance submodule and salary of employees are managed using Salary submodule. The attendance details of employee modules are shown in Figure 3.c.

B. CLIENT MODULES

Client Modules manages client data. It has mainly *Client Details* and *Project Details* submodules. Client details submodule is for storing clients personal details while Project details submodule is for managing the project requirements put forward by the clients. The details of clients are displayed in the client details page, with an edit button to edit their details as well as search button to find client details as shown in Fig 3.d.

C. ACCOUNTING MODULES

Accounting Modules manages financial accounts. This is extremely important for the growth of the company. Accounting module has mainly the following sub modules – *Digital Balance Sheet*, *Digital Profit and Loss Statement*, *Assets Management System*, *Liabilities Management System*. Balance Sheet submodule has a digital balance sheet with automated calculation of the company's assets and liabilities. Profit & Loss Statement submodule has a digital equity statement with net profit or net loss calculated. Assets, liabilities, total assets, total liabilities can be seen in the equity modules page as shown in Figure 3.e. The Assets Management System has the company's current assets such as investments, property holdings, cash in bank recorded digitally. The Liabilities Management System has the company's current liabilities such as loans, borrowings, bill payments recorded digitally.

D. PRODUCTION MODULES

Production Modules manages the production information of products or services with submodules such as *Manufacturing Management System*, *Sales Management System*, *Product Management System* and *Product Feedback System*. Sales Management System manages the orders placed by the customers with features to calculate net amount using product base price and quantity. All orders by customers can be viewed through the order details listing as shown in Figure 3.f. Product Management System helps to keep track of product stock and automatically informs the administrator through email if the product goes out of stock. Product Feedback System tracks the feedbacks about the product quality and likeness given by customers.

E. FEEDBACK MODULES

Feedback Modules manages feedbacks of employees given by clients on completion of projects assigned to them. A company can evaluate customer satisfaction and employee performance using feedback module. Negative feedbacks raised by the clients can be resolved by the management team.

F. PAYROLL MODULES

Payroll Modules manage the salary structure and salary withdrawal details of employees. It has mainly the following submodules - *Salary Structure*, *Salary Calculator* and *Salary Pay Slip*. Salary structure submodule has detailed salary structure, including basic pay, gross pay, net pay, allowances such as insurance, provident fund and professional tax. Salary Calculator submodule helps the management to calculate the cost-to-company (CTC) and total tax. Detailed salary detail of employees can be viewed through payroll modules page as shown in Figure 3.g.

G. INVENTORY MODULES

Inventory Modules are used to manage the inventory in possession of the company. It has following submodules - *Inventory Management System*, *Stock Management System*. The inventory Management system keep detailed information of goods and materials which are possessed by the company for conducting production. The stock Management system keeps track of products sold by the enterprise as part of its daily operation.

H. USERS MODULES

User Modules manages the different types of users and their authentication details. It has following submodules - *User Role Details* and *User Login Details*. User Role submodule distinguishes a user either as an administrator, a manager, an employee or as a client. User Login submodule contains the authentication details of the users. Personal Data including Login details are stored in a highly encrypted form. All the users who have access to the ERMS can be viewed through the user's module page as seen in Figure 3.h.

Figure 3.a. Dynamic Dashboard with Analytics

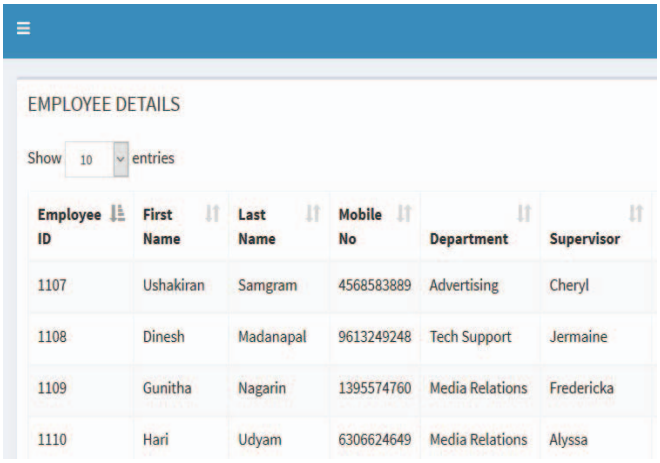

Figure 3.b. Employee Details Module

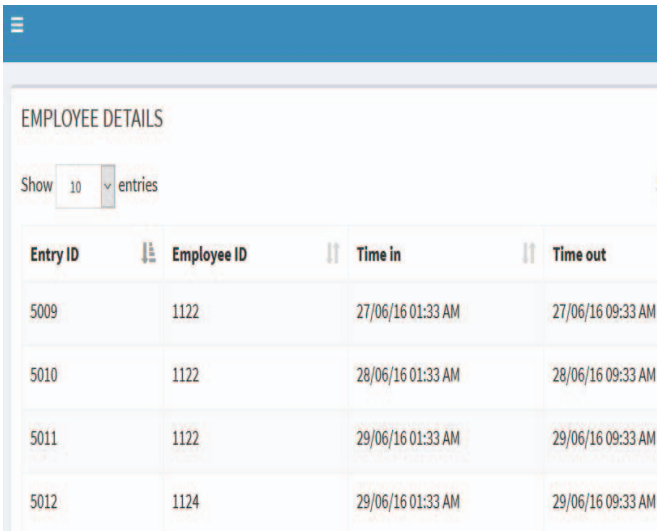

Figure 3.c. Employee Attendance Module

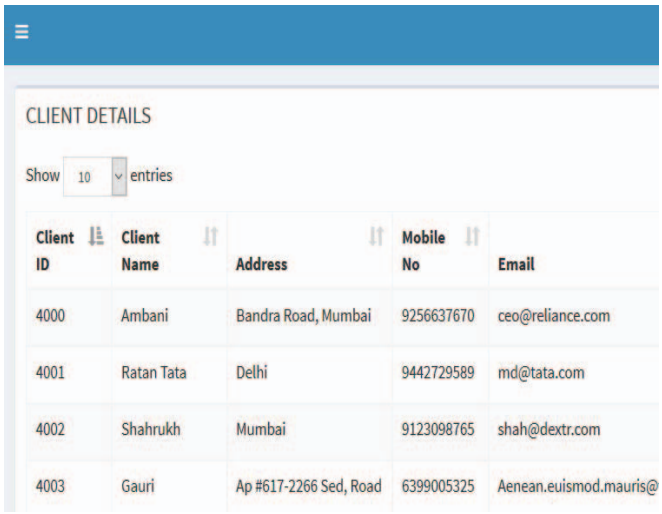

Figure 3.d. Client Details Module

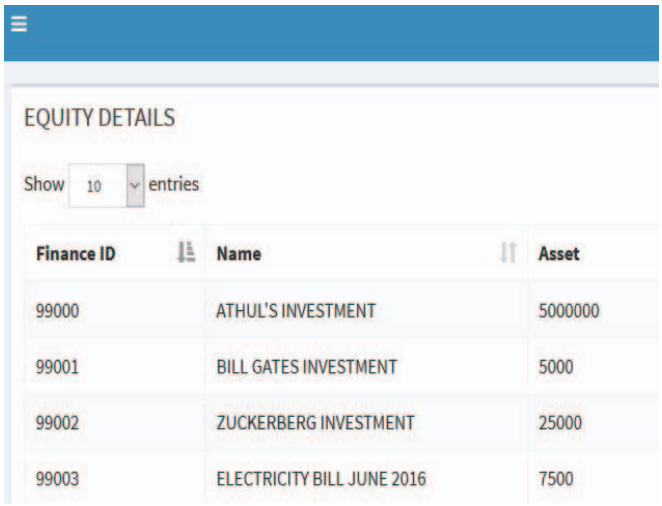

Figure 3.e. Digital Equity Module

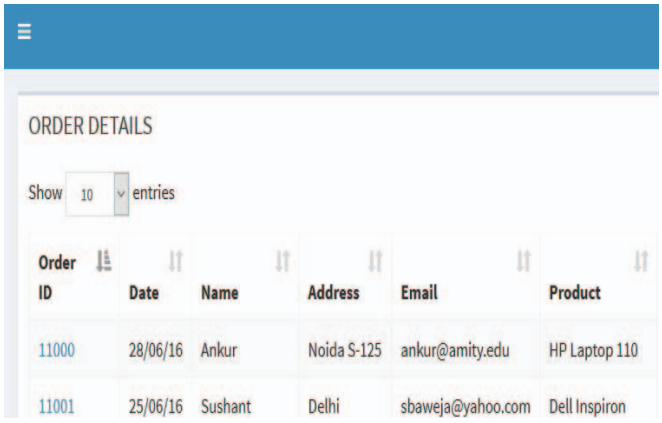

Figure 3.f. Product Orders Listing Module

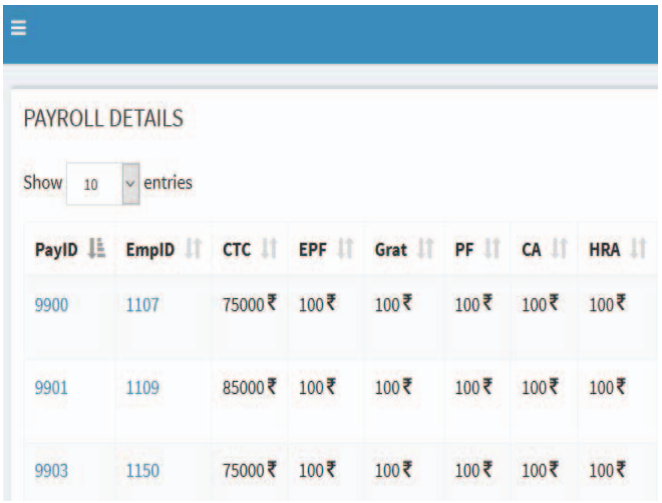

Figure 3.g. Payroll details Module

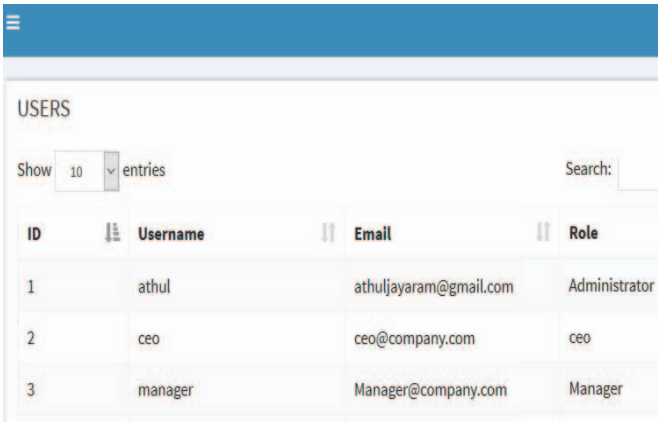

Figure 3.h. Different user types of ERMS

IV. IMPLEMENTATION AND RESULT

Advanced Java and Bootstrap are used for implementing the proposed ERMS model. Bootstrap is imported to the project and it is extended in the Java environment. The data storage framework is also configured. The JSP pages are designed to handle forms using Advanced Java servlets. An automated data handling algorithm is designed for handling data within the ERMS framework. Similarly, modules were designed for Employees, Attendance, Payroll, Accounting, Inventory, Orders, Projects, Feedbacks and users. For attendance marking a calendar API has been consumed to build the feature of time-in and time-out, which marks the attendance of the employees in the enterprise.

An ERMS is expensive and takes too much time. Customers should be given prime importance, so employees must be counseled and be included in all phases of the execution procedure [18,19]. Giving appropriate instruction and training are the right ways to prepare them. Directors can actualize their ERMS frameworks in a few ways, which incorporate the entire coordination and the single-module methodology [20].

For Payroll Modules an algorithm is proposed to calculate salary. In Accounting Module, a digital balance sheet is developed, which performs the same operation as the traditional balance sheet. Algorithms to calculate net liability, net assets, equity from raw data is also developed. The users module shows the different types of users that can access the system. Different modules are integrated to form the ERMS framework. The ERMS framework is compiled and deployed on the local server successfully.

Proposed ERMS works on all browsers and devices. ERMS possess information from different fields and required information can be passed to other departments through the same system, a fine example is order purchase information passed to the product delivery team as well as the Customer Engagement Team. ERMS is the most important application to any enterprise to coordinate different business operations and enhance profitability. An ERMS is used for a specific end goal to expand production, lessen costs and optimize business for profits.

V. CONCLUSION AND FUTURE SCOPE

An Enterprise Resource Management System (ERMS) has been designed with modules for employees, attendance, finance, HR and production. The proposed ERMS model can be used by any enterprise for developing their own ERMS that works efficiently in all browsers and devices. ERMS plays a key role in every enterprise and can be used to manage its entities and modules easily.

Today employees and clients, get notification as SMS from ERMS, in near future ERMS can send updates through WhatsApp and other mobile apps we consume, which can bring down the cost to the company even further. Facebook already has business bots which can answer customer's product queries automatically without human interaction. This will decrease the need of workforce in companies and more jobs will be done by machines itself. Companies spend billions of dollars for developing an ERMS. The developed ERMS system is cost effective and can be scaled at economical costs. If we can develop an ERMS which can customize itself based on user needs, then that ERMS can be easily consumed and installed by the company itself. In future we can see enterprises integrating virtual reality and the Internet of Things in their ERMS frameworks.

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