Ijesm
Consulting, help, relaxation
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES AND MANAGEMENT
Vol. 1(1) Sept-Dec (2011)

AN INTELLIGENT DATA MINING SYSTEM FOR DECISION MAKING BASED ON ERP

Arif Khan *, Gopal Prajapati [1], Manish Gautam[2]

**,1,2 Department of Computer Science & Engineering, Central India Institute of Technology, Indore, M.P. – India*
**Corresponding Author*
E Mail: khan123arif@gmail.com

Abstract

As Enterprise Resource Planning (ERP) implementation has become more popular and suitable for every business organization, it has become a essential factor for the success of a business. This paper shows the best integration of ERP with Customer Relationship Management (CRM). Data Mining is overwhelming the integration in this model by giving support for applying best algorithm to make the successful result. This model has three major parts, outer view-CRM, inner view-ERP and knowledge discovery view. The CRM collect the customer's queries, EPR analyze and integrate the data and the knowledge discovery gave predictions and advises for the betterment of an organization. For the practical implementation of presented model, we use MADAR data and implemented Apriori Algorithm on it. Then the new rules and patterns suggested for the organization which helps the organization for solving the problem of customers in future correspondence.

Keywords: ERP systems, Data Mining, Apriori Algorithm, CRM.

1. INTODUCTION

DATA MINING

Data Mining is a powerful & emerging new technology today with great potential to help companies focus on the most important in their data warehouses. Data Mining is also known as Knowledge Discovery in Databases. The basic goal of Data Mining is discovering hidden value of the data warehouses. Literally, Data Mining can be defined as "the non-trivial extraction of implicit, previously unknown, & potentially useful information from data." It uses machine learning, statistical & visualization techniques to discovery & present knowledge in a form which I easily comprehensible to humans.

Modern Data Mining systems self-learn from the previous history of the investigated system, formulating & testing hypothesis about the rules, which the system obeys.

Data Mining tools predict future trends & behaviors, allowing businesses to make proactive, knowledge-driven decisions. Data Mining tools can answer business questions that traditionally were too consuming to resolve. They scour databases for hidden patterns, finding predictive information that experts may miss because it lies outside their expectations.

Data Mining techniques are the result of a long process of research & product development. Data Mining's evolution began when business data was

first stored on computers, continued with improvements in data access, & more recently, generated technologies that allow users to navigate thro' their data in real-time.

The most commonly used techniques in Data Mining are: -

• Artificial neural networks

• Decision trees

• Genetic algorithms

• Nearest neighbor method

• Rule induction

Data Mining is ready for application in the business community because it is supported by 3 techniques that are now sufficiently mature:

• Massive data collection

• Powerful multiprocessor computer

2. ERP System

The core of the ERP system circulates within the company as well as the management information and control needs of the entire production process including reducing inventory, labor, and operation costs, improving business processes to enhance operation efficiency and improving customer response. However, Markus and Robey (1988) pointed out that although industry specific ERP has already focused on industry characteristics and includes the optimal business operation management model, the promotion of ERP is still significantly related to interaction with the organization. Beyond that CRM often describes a strategic or philosophic approach for managing customers. Hence CRM could be seen from a process oriented, technological, capability-oriented, philosophical, and/or strategic perspective [2]. CRM has different meanings, It is a business strategy to select and manage customer to optimize long-term value, CRM also is a strategy that increases the importance of relationship marketing and integrates with other organization strategies.

Despite the efforts of CRM on efficiency and affectivity of management decisions, statistics reflect that unreasonable decisions are made by CRM systems; IT experts said errors were caused by incorrect or not enough data. According to Forrester Research, 57% of business firms cannot justify CRM investments because they cannot measure customer profitability. The necessary broad level of security is determined by the CRM security objectives which an organization needs to meet. A CRM security strategy outlines in general terms how an organization will achieve its CRM security objectives. In order to increase the use of ERP systems it is recommended to begin with the financial section, the applications invoicing, cost control, accounting and financial then it should be added many functions from Financial, Relation Management Production, Distribution, e- Business and Analyses. The order of the customer is routing automatically to the next department when one department finishes their work of the customer order and each department have access to the single database that holds the customer's new order.

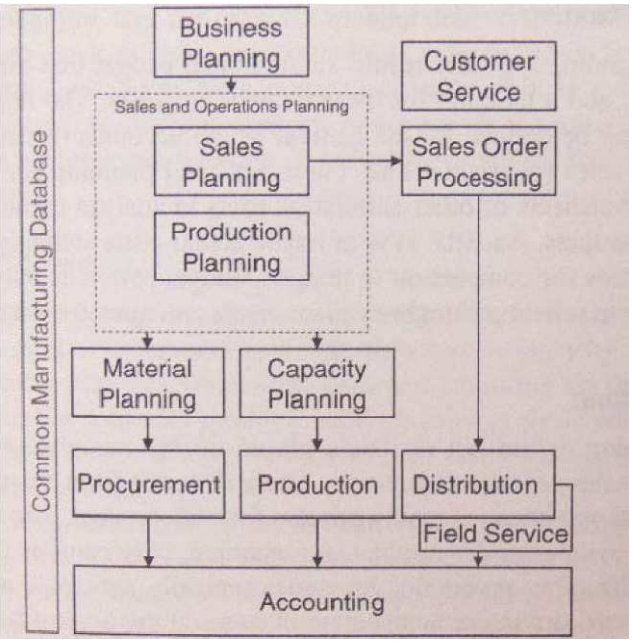


Fig. - Architecture of an ERP System

3. METHODOLOGY

The ERP-CRM model shown in the Fig , clearly described the ERP model to solve the business problems. Whenever customer request engender directly forward to the concern department for the assessment and positive response. After statistical analysis and evaluation of the request the answer back to the corresponding customer and this feedback will be saved in the database for the future requirements. This scenario is most common in each and every organization for creating more sophisticated and steadfast environment we presented this whole scenario in our model in three different views. In effect after, there is a construction of an easy to use and implement surroundings for the upper management and their employees for put their stress and expertise within the company's limitation and taking their company on top and behaving with their customer on priority.

The three views are as follows:

i. Outer View

ii. Inner View

iii. Knowledge Discovery View

Description of Three Views

A. Outer View

Whenever a customer contact with the company the customer support officer receive customer's request. In the company's prospectus this department has much importance because of correspondence directly with the customer. In our model we presented customer relationship management as an outer view. CRM is responsible for receiving requests and replying to the customer directly. These requests includes queries, complaints, suggestions and orders then forward these requests to the inner view enterprise resource planning (ERP) through the query generator. After taking action on the perspective request the answer will forward through the CRM –The Outer View. And result will also be save in the database for knowledge discovery view.

B. Inner View

The important part of the model is inner view or ERP view. In this view each department have equal access to a single database that holds the customer's data or complaints. In ERP view the customer queries rotating and evaluating by the concern department. For example a customer want to purchase any product will apply for a product through the customer support department (outer view) and the request will be forward to the sales department (inner view) and sales department will check the payment status in the database and will forward the same request to the operations department (inner view) for the delivery of the product and the record will be stored in the database to generate new rules and patterns (knowledge discovery view) from the experienced data.

C. Knowledge Discovery View

This view is concern with the central database having all kind of data saved from outer and inner views. This data can be customer's history, manufacturing status and sales. In this environment we can use several kinds of data mining techniques for discovering the knowledge. The best implementation is presented in this paper by using Apriori Algorithm.

Description of Three Layers

A. CRM Layer

Whenever a customer contact with the company the customer support officer receive customer's request. In the company's prospectus this department has much importance because of correspondence directly with the customer. In our model we presented customer relationship management as an outer view. CRM is responsible for receiving requests and replying to the customer directly. These requests includes queries, complaints, suggestions and orders then forward these requests to the inner view enterprise resource planning (ERP) through the query generator. After taking action on the perspective request the answer will forward through the CRM Layer. And result will also be saving in the database for knowledge discovery view.

B. ERP Layer

The important part of the model is ERP Layer. In this view each department have equal access to a single database that holds the customer's data or complaints. In this layer the customer queries rotating and evaluating by the concern department. For example a customer contact with customer support department (CRM layer) after initial review and statistics this query will throw to the ERP Layer. The ERP's

department is responsible to find the solution and give proper reply to the customer and forward feedback back to customer through CRM layer as well as in the central database for future assistance.

C. Knowledge Discovery Layer

Knowledge discovery can be defined as the extraction of contained, hidden and useful information from the large database. As per the definition, in the presented model this

layer is also concern with the central database having all kind of data posted from any department of ERP and CRM layers. The data has several attributes and characteristics according to the queried customer. As the specialty of this layer we used Clustering and Apriori algorithms for advantageous and high-quality results.

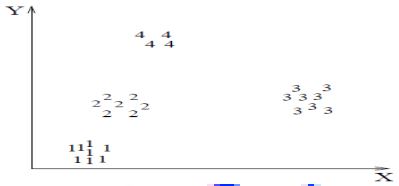
Data Clustering

Data clustering is a method in which we make cluster of objects that are somehow similar in characteristics. The dependent. Clustering is often confused with classification,

but there is some difference between the two. In classification the objects are assigned to pre defined classes, whereas in clustering the classes are also to be defined. The goal of data clustering, also known as cluster analysis, is to discover the natural grouping(s) of a set of patterns, points, or objects.

B.1. Clustering Implementation

Clustering implementation on the data is a process in which we try to make some groups of objects together having similar characteristics according to the pre-defined criteria. The criteria to merge similar objects in one group are depending on the implementation. In this case study we collected data shown in Fig. 2. In which we have four (04) kinds of attributes includes; customer's query, queried department, forwarded to concerned department and action of the department. We clustered the data on the basis of actions of the customer's query. Moreover, action's column has again four (04) types of action have taken against the particular query. The similarity criterion which we set here in this case is dependent on the action. We described these actions as numbers 1,2,3,4 for gathering them in separated groups shown in Fig.3**.** As the result we got four different clusters, in which each cluster is fulfilling the selection criteria.



Data Cluster

CASE STUDY

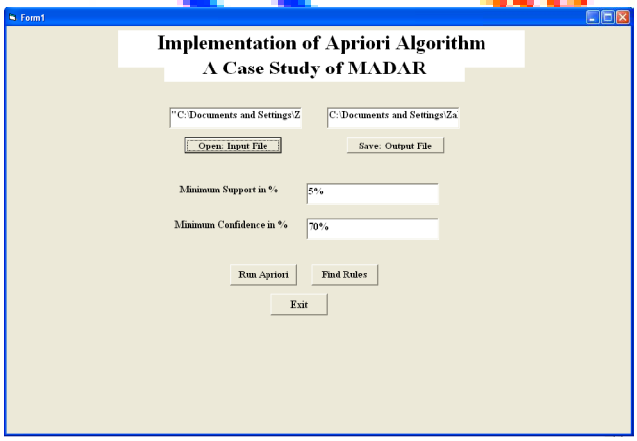
The efficient implementation of presented ERP-CRM model using data mining techniques is applied on MADAR data. For this we used Association mining- Apriori Algorithm for finding new rules and patterns from the experienced data. The description of all phases on our case study are as follows:

A. Apriori Algorithm

Apriori is a classic algorithm for learning association rules. Apriori is designed to operate on databases containing transactions (for example, collections of items bought by customers, or details of a website frequentation) [7,11]. As is common in association rule mining, given a set of itemsets (for instance, sets of retail transactions, each listing individual items purchased), the algorithm attempts to find subsets which are common to at least a minimum number C of the itemsets. Apriori uses a "bottom up" approach, where frequent subsets are extended one item at a time (a step known as candidate

generation), and groups of candidates are tested against the data. The algorithm terminates when no further successful extensions are found [7, 11, 15]. One way to construct a simpler model computed from data, easier to understand and with more predictive power is to create a set of simplified rules [5]. Apriori Algorithm is suitable to compute the rules and patterns and predict for any organization to improve the customer satisfaction. We implement Apriori algorithm on MADAR data and generated some rules and patterns for MADAR. The descriptions of these rules are in the following steps. *A.1. Apriori Pseudo Code Apriori large 1-itemsets that appear in more than transactions } while Generate*(*Lk* − 1)

B. *Programming Tool Used* For the implementation of Apriori Algorithm to get new rules on the MADAR data we used VB technology. Input and output data files can be in any format e.g databases, Notepad, Excel worksheets, etc. But in this case we used Notepad and Excel worksheet as input and output files.
B.1. *VB Interface*
The VB interface is shown in Fig.



4. DATA GATHERING / SURVEY

We gathered the data by survey. For this we make a survey for MADAR and collect the two months data through a questionnaire from each and every department. The data is then organized in a small database.

Data Transformation In the Fig.5. we transferred the useful data from the database into the excel format for describing the data more sufficiently and for applying some rules and formulae on surveyed data. Furthermore we columned the data in customer query, queried department, corresponding department and action by the department

Data Enhancement
In the Fig.6. we enhanced the data by categorizing the data according to the appropriate action of the department. In which we categorized all three actions of the department in three (03) categories. Further we add one more column to assign binary value (0 or 1) according to the action from the MADAR correspondent. This extra column is the key for the implementation of apriori algorithm which is shown in the next steps.

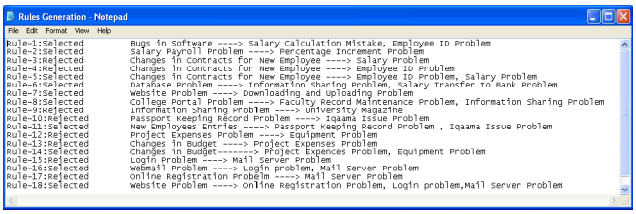
Selected Data for Apriori Implementation
In the Fig . Shows the selection of concerned data after some enhanced features we used as an input file. We select notepad format as an input file for the Apriori program developed by using VB Technology. The selected data for input file includes the Customer Query and Binary Value of action on the query did by department. Moreover we put 5% minimum support as an input also for the generation of frequent item sets from the input file.
C.4.

Output Data

The Fig.8. Shown the output file with 5% minimum support. We applied apriori algorithm for the generation of frequent itemsets. These Itemset generation is based on the customer query, corresponding binary value and minimum support(5%). In consequence we find out that how much queries has been dealt on time, and how much queries were delayed in the last two month. In the next step we generated and suggested some rules from the frequent itemset generations (output file) to the MADAR organization for handling with the customer in more efficient way and for the betterment of the organization in future. This was a sample implementation of apriori algorithm on the CRM-ERP based model. We can find different kind of frequent itemsets generation in the same manner by increasing or decreasing the minimum support.

Rules Generation

Fig.9. Shown the selected and rejected rules table. After rules generation we found several rules which proposed and suggested to the MADAR that there are some basic problem and queries are coming from the several department within the last two months records. The rules is showing the other big problems which are actually because of some basic problems. After the implantation of these rules we can decrease number of queries and several kind of queries will automatically be resolved. i.e. website domain problem , online course registration, login problem, mail server problem. For example if the query raised from the website controller then after sometimes the query will also be generated from other online related department, i.e. online course registration. We conclude that the basic query was website domain problem if the MADAR will overcome this problem immediately than other queries can be stop



5. FUTURE WORK

The model will be enhancing with more information and more data mining technique will be applying and new rules will be generated in future for the enhancement of an organization. New ERP tools will be used to modify the existing work and make ease for the customers to access the organization's facilities without any hesitation.

6. CONCLUSION

In today's technologies the customer has a lot of difficulties to access the organization's facilities. The customer have problem in contacting the organization. The model presented in this paper will solve these problems all the customers complaints will be recording in the central database and will be process according to the customer need. The customer can easily contact the organization and can purchase the organization products very easily. The CRM (outer view) will collect the information about the products and the queries will be forwarded to the inner view (ERP) to act upon these queries. The knowledge discovery view generates new rules and patterns for the betterment of an organization for future correspondence to improve the growth of the customers for an organization.

7. REFERENCES

[1].Sonja Grabner-Kraeuter, Gernot Moedritscher, Martin Waigunyc, Werner Mussnigb, ―Performance Monitoring of CRM Initiatives‖, in Proceedings: IEEE conference on System Sciences, 2007.

[2]. Philippe Dugerdil, Gil Gaillard, ―Model-Driven ERP Implementation‖ In Proceedings: ICEIS, 8th International Conference on Enterprise Information Systems, May, 2006, Paphos, Cyprus.

[3] Han-joon, Kim TaeHee, Lee Sang-goo, Lee Jonghun Chun, "Automated Data Warehousing for Rule-based CRM Systems", 14th Australasian Database Conference (ADC-2003), Adelaide, Australia, 2003.

[4]. Jae-won Park, Nam-Yong Lee, ―A Conceptual Model of ERP for Small and Medium-Size Companies Based on UML‖, IJCSNS International Journal of Computer Science and Network Security, VOL.6 No.5A, May 2006.

[5]. Mar__a C. FERN_ANDEZ_, Ernestina MENASALVAS_, Óscar MARB_AN_, Jos_e M. PE~NA__, Socorro MILL_AN, ―MINIMAL DECISION RULES BASED ON THE APRIORI ALGORITHM y‖, Int. J. Appl. Math. Comput. Sc.i, Vol.11, No.3, 691704, 2001.

[6]. Wen-Hsiung Wu, Chin-Fu Ho, Hsin-Pin Fu, Tien-Hsiang Chang, ―SMES IMPLEMENTING AN INDUSTRY SPECIFIC ERP MODEL USING A CASE STUDY APPROACH‖, Journal of the Chinese Institute of Industrial Engineers, Vol. 23, No. 5, 2006, pp. 423-434.

[7].Apriori Algorithm, http://en.wikipedia.Org /wiki/Apriori algorithm #Algorithm,
Accessed Date: 12th April, 2009.

[8]. Virgil Chichernea, Romanian, ―THE USE OF THE ERP-CRM-CIM SYSTEMS WITHIN THE MASTER'S DEGREE PROGRAMMES‖ In Proceedings: Annales Universitatis Apulensis Series Oeconomica, Nr. 9 / 2007, Volume 2.

[9]. Chang-Shing lee, Yi-Chuan Wang, Wei-Ming liu, Yi-Chen lin, ― Crm Ontology Based On CMMI Project Planning For Business applications‖, in Proceedings: IEEE conference on machine learning and cybernetics, Hong Kong, August, 2007.