CHAPTER 3

SYSTEM ARCHITECTURE

In this present research, an intelligent business decision support system has been proposed and implemented for effective apparels manufacturing, sales and selection. This proposed system consists of many components including the important components namely manufacturing feedback system, apparel selection system, business expert system and configuration management system. These modules used rules and temporal constraints to make effective decisions. The recommendations made by this system are useful not only to the customers for purchasing and also for the manufacturers to get feedback on the sales and requirements. The recommendations are provided to the manufacturer for adjusting the amount of items and the type of items to be manufactured. Supply chain management is an important area of research in the business community. In apparel industry, it consists of the parameters used by manufacturers and the sales side metrics including customer support system. A research on supply chain management has to address the configurations used in manufacturing, key parameters used in effective production of apparels, seller behaviors and the buyer’s interests in buying the apparels. If they don’t coordinate well, the balance in the system which consists of manufacturer and market will bring a larger gap. Therefore in this research work, a new business recommendation system has been proposed and implemented using artificial intelligence, data mining and business modeling approach.
The overall architecture of the proposed system is shown in Figure 3.1. The proposed system architecture consists of eleven major components namely market dataset, user interface, manufacturing feedback module, recommendation system, apparel selection system, business expert system, decision manager, rule manager, knowledge base, temporal constraint manager and configuration manager.

![Figure 3.1 System Architecture](image-url)
3.1 USER INTERFACE MODULE

The user interface module collects the necessary data from the market transaction database. Moreover, the user interface module sends the data to recommendation system for recommending suitable records. The user interface module consists of a number of menus and forms. A commercial system must have a website with good user interface (Hu Le-wei & Li Yu-sheng 2008). The main menu will provide a list of options indicating all the facilities which are provided in this system. The user can select and provide their queries through the sub menus given in the main menu. In order to perform the operations with ease, a number of forms are given. The user can register with the system using the registration form provided in this module. The user must provide some essential details including the name, address, age and some optional information such as area of interest with respect to garment selection, budget and geographical region. All these information will be useful to perform effective recommendations. The registered users are provided with a user account. They can login into their account and perform querying and other operations.

3.2 MARKET DATABASE

A market database normally consists of all the items which are sold in the market with respect to apparel sales (Cliff et al. 1998). In this work, it also stores the user information for all the manufacturers, sellers in wholesale market, sellers in retail market, sellers through e-business and all types of customers who buy items in apparel market. The market database consists of a number of tables to store customer details, sales details, supplier details and available items. It also includes the prices of different items and their suppliers. Another component of market database is the data dictionary. The data dictionary consists of all the names of the tables, the attributes available in such tables and the constraints available for each table. All data
definition and manipulation operations on the market database are performed through the user interface module.

### 3.3 RECOMMENDATION SYSTEM

The recommendation system identifies the suitable module for selecting necessary apparels with the help of the decision manager. The recommendation system proposed in this work uses rules for studying the behavior of customers and to make personalization (Schafer et al. 2007) on them. For this purpose, different questionnaires were prepared on the different garments manufactured by apparel industries and also for knowing the customer interests. The industries considered in this work focus more on 10 cities in India including Chennai, Coimbatore, Kanchipuram, Mumbai, Bangalore, Hyderabad, Visakhapatnam, New Delhi, Kolkata and Varanasi. The recommendation system interacts with the decision manager for making effective recommendations. It also interacts with manufacturing feedback module and configuration manager for understanding the parameters used in the manufacturing. Moreover, the recommendation system interacts with apparel selection system and business expert system to make suitable recommendations.

### 3.4 DECISION MANAGER

The decision manager takes decisions based on the transactions at correct times with the help of rule manager. The decision manager plays an important role in this proposed system since the overall control of the entire system is with the decision manager. Therefore, it acts as an intermediary between the apparel selection system and the business expert system in order to provide effective decisions. It interacts with the rule manager for rule selection, rule matching and rule execution. All the business rules used by the rule manager are validated and approved by the decision manager. Therefore,
the decision manager has to approve the processes of feature selection, classification, association rule mining and inference (Agrawal & Srikant 2007).

3.5 APPAREL SELECTION SYSTEM

The apparel selection system consists of two sub systems namely feature selection module and classification module. The feature selection module is responsible for selecting the important and contributing features from a set of features available on apparels. Moreover, feature selection helps to reduce the classification time. Therefore, the feature selection module uses the IAASA algorithm (Ganapathy et al. 2012) in order to select the optimal number of features. The classification module proposed in this work uses IAEM SVM classifier (Ganapathy et al. 2012) to perform effective classification of apparels. The combination of feature selection and classification enhances the performance of the system and also helps the recommendation system and decision manager to perform effective decision making.

3.6 MANUFACTURING FEEDBACK MODULE

The manufacturing feedback module gets the customer details from the recommendation system and compares them with the key parameters used for manufacturing. It also takes decisions on the number of items and the type of items to be manufactured. It interacts with the recommendation system to provide completeness property in the supply chain management (Fisher et al. 1997). Without feedback from the customers if manufacturing is carried out the items can’t be sold in the market and is very difficult to tackle the market competition. Hence, suitable feedbacks are given by the manufacturing feedback module and the manufacturing time and cost are optimized by analyzing the key manufacturing factors. It has to interact with the
configuration manager to know about the current size, color and other properties of garments as well as the modifications necessary.

3.7 BUSINESS EXPERT SYSTEM

The apparel sales expert system proposed in this work consists of two major components namely feature selection module and classification module. The feature selection module uses ICRFFSA algorithm (Ganapathy et al. 2016) for performing effective feature selection. Moreover, the classification module uses the temporal Apriori algorithm to perform classification. The result of this algorithm provides a set of rules based on support and confidence. It interacts with the recommendation system for providing rules generated from association rule mining algorithm. Moreover, this system interacts with domain expert who uses the user interface module for effective communication. The rules generated using association rules are validated by the decision manager using validation rules and temporal constraint manager. The temporal constraint manager also interacts with the business expert system for validating the temporal constraints. All the rules are stored in the knowledge base through the rule manager. The rules are used for making final decisions.

3.8 KNOWLEDGE BASE

The knowledge base consists of IF…THEN rules (Karim et al. 2012) for making effective decisions about the feature selection and classification. The rule manager is responsible for storing, manipulating and securing the rules in knowledge base. The rule manager decides on the knowledge representation technique for storing the rules. In this work, semantic networks are used as the knowledge representation technique to store the business rules.
3.9 **RULE MANAGER**

The rule manager extracts the necessary rules and gives the necessary inference to the decision manager for making effective decisions. The rule manager is responsible for performing deductive inference which is helpful to the decision manager to make effective decisions. The rule manager has algorithms for rule selection, rule matching and rule firing. It has active rules in the form of IF…THEN statements (Karim et al. 2012). The rule manager builds a discriminant network for effective rule management. The rule manager interacts with the temporal constraints manager which checks the time related constraints using instant comparison and interval comparison operations. For this purpose, this system uses Allen’s interval algebra operators for effective time management. Finally, the rule manager interacts with the business expert system to support in performing inference and to obtain rules through association rule mining.

3.10 **TEMPORAL CONSTRAINT MANAGER**

The temporal constraints manager is mainly responsible for managing temporal information and temporal constraints. The temporal constraints manager interacts with the business expert system and helps to perform temporal reasoning. Therefore, the temporal constraints manager is helpful to make effective predictions (Allen 1983). The temporal constraints manager interacts with the rule manager to analyze the temporal dependencies between database attributes. Moreover, the temporal constraints manager interacts with the decision manager and assists the decision manager for making effective decisions through temporal validations.

3.11 **CONFIGURATION MANAGER**

The configuration manager is responsible for recommending changes in the apparel design. The configuration manager interacts with the manufacturing feedback module in order to inform about the required changes
and changes made. For this purpose, a citation and co-citation analysis (Glen Hass 2003) is made on the articles written on manufacturing and sales of apparels. The configuration manager is interacting with the recommendation system to provide feedback on changes with respect to manufacturing and customer needs.

3.12 SUMMARY

In this chapter, the architectural feature of the business recommendation system proposed in this research work is explained. Using this architecture, the supply chain management of the proposed system is depicted pictorially. Moreover, interaction among various modules of the system and their contribution to the decision making process are highlighted. The architecture of the proposed system clearly illustrated the roles of all the major components and the importance of various modules of the proposed system.