

A Requirement Model For Managing Inventory of Raw Materials

Nor Laily Hashim¹, Nor Zahirah Mohd Ghouse² and Noraini Ismail³

¹School of Computing, Universiti Utara Malaysia, Malaysia, laily@uum.edu.my

²School of Computing, Universiti Utara Malaysia, Malaysia, annur_cempaka@yahoo.com

³School of Computing, Universiti Utara Malaysia, Malaysia, mail.noraini@gmail.com

ABSTRACT

This study presents an initial study on managing knowledge related to consumption of raw food inventory used in an organization that deals with preparing food and beverage services. A requirement model capturing the functionalities of this system is proposed, where its prototype has been evaluated using TAM. The finding from this evaluation shows that this prototype is easy to use and provide useful function to its target users.

Keywords: Inventory system, raw food, and management of information system.

I INTRODUCTION

In an organization that manages food and beverages products or services, for an example, in preparing for a food product, ingredients and recipes used to produce it should be supported by availability of raw ingredients in the store. However, there are several problems that arise in inventory system where such information relating to recipes are difficult to access and shared, since there is no medium to store the information on-line.

Besides, the price for each item involved in each recipe used in food production and the number of raw material orders that are required cannot be calculated and forecasted automatically. The ability to provide warning that the inventory is almost out of stock is important in ensuring the production of products run efficiently.

Therefore, by having to automate the above operations, the management personnel is able to efficiently monitor and make better decision on when and deciding the accurate quantity of new stocks by referring to the reports on the rate of consumption and supply of the raw ingredients. In this paper, a requirement model of an online system inventory of raw materials is proposed to solve the problems mentioned earlier.

The organization of this paper is as follows. Chapter 2 presents the background of study. Chapter 3 shows research method applied. Chapter 4 presents the model of requirement of this system. Chapter 5 presents the evaluation result. Chapter 6

presents the research contribution, and lastly, conclusion and future work are presented.

II BACKGROUND

The inventory system is one of the important systems in the industries and in certain organizations. American Production and Inventory Control Society (APICS) defines inventory as item in storage or resources that are in phase transformations that have economic value that will be used for continuous operation in the manufacturing process of a product before distribute to customers (Dictionary, 2008).

A good inventory system is able to apply the latest methods of inventory control and systematic using the following inventory control (Mabert, 2007).

- a. Materials Requirements Planning (MRP)
- b. Materials List (Bill of Material)
- c. Average Forecasting Method Summary

In general, inventory consists of several parts; raw materials, component parts of items that have yet to be completed in a process of production, work in process (inventory that is waiting to be processed or being processed) and finished product the is final item in the production process. The descriptions of goods inventories system are discussed below.

A. Material Requirements Management (MRP)

MRP is a system of computerized inventory control and planning that are used to control the scheduling of the uncertainty of demand and demand in the manufacturing industry. It was first introduced in 1960 by Joseph Orlicky, George Plossl, Oliver Wright and the American Production and Inventory Control System (Dictionary (2008), Mabert (2007)).

MRP technique was applied using Bill of Materials (BOM) and Master Production Scheduling (MPS) to manage and plan the material requirements. The main purpose of the use of MRP is to plan activities for the purchase of raw materials and components, manufacturing activities (sub-assembly) and finished product delivery schedules. The following are the objectives of the MRP :

- i. Ensure that materials are always available when needed.
- ii. Ensure that inventories remain at a minimum.
- iii. Responding to customer requests or changes.

MRP also serves to detect any changes in the component (part) in the production process in the whole system. In addition, their use can also warned the MRP planning on out of stock (stock out) or nearly expired items (missed due dates). Among the major benefits of the use of MRP is as follows:

- i. Achieve a minimum level of inventory.
- ii. Achieve a minimum cost of production.
- iii. Demonstrate the delivery time can be predicted with certainty.
- iv. Have a flexible feature of any changes.

B. Materials List (Bill of Material)

The list of materials, better known as the Bill of Material (BOM) is a list of various semi-finished materials and components needed in a manufacturing process or installation of products (Mabert, 2007). In addition, the BOM also displays the phases of the installation sequence to produce the product. Some of the information contained in the BOM is as follows:

- i) Name of component
- ii) The quantity of component
- iii) A brief description of each component
- iv) Component level

With the BOM, all the requirements needed in the production of a product can be clearly seen and easy to create a finished or semi-finished products.

C. Forecasting Purchase Short-Average Method

There are several methods of forecasting can be used in making the prediction. This forecasting method is used to predict the purchase or specific data for the months to come (Mabert, 2007). Forecasting models can be classified into four types: qualitative, time series analysis, cause-effect relationship, and simulation. In qualitative methods, there are methods of market research, opinion panels and the Delphi method.

While for time series analysis, the methods are Condensed Average and Moving Average Weighted Moving Average.

Simple average is the average of all requests in all past tense. Past tense refers to the last few months of sales data.

Condensed Average(CA, *simple average*)

$$= \frac{\text{total demand for all time}}{\text{the number of times}}$$

$$= \frac{D1 + D2 + \dots + Dn}{N}$$

Example: Get a sales forecast at 4th-Month

Thus, the average forecast of sales in the month of data

$$= \frac{1 + 2 + \text{month-to-3rd months}}{3}$$

A. Comparison of existing inventory systems

There are four case studies presented below which are related to inventory systems. They are Manufacturing Inventory System (Azmi, 2004), Inventory Control Application in the Industry Sector (Peng, 2003), Inventory Control and Management System for Raw Materials (Yen, 2007) and UPHA Web Applications in Inventory Management (Leng, 2004).

Table 1: Summary of Comparison from of Inventory System

Features	Case Study 1	Case Study 2	Case Study 3	Case Study 4
System specification	Visual basic 6.0 and Microsoft Access	Visual Basic and Microsoft Access 97	Dream weaver, PHP and MySQL	Microsoft visual Interdev 6.0, ASP 3.0, Microsoft Access and Internet Explorer
Access Method	LAN	LAN	Web-based application	Web-based application
System Interface	Good	Good	Good	Good
Ability to generate schedule	Unable	Able	Unable	Able
"session" phase	Don't have	Have	Don't have	Have
User level	Understandable	Understandable	Understandable	Understandable
Message Display	Good	Good	Good	Good

The comparison shown Table 1 provides assistance to the researchers in improving the quality of performance in terms of interfaces, programming languages and databases that will be implemented in this system.

III RESEARCH METHODOLOGY

The sequences of the five steps which are awareness of problem, suggestion, development,

evaluation and conclusion are applied in this study. This step is a general methodology for carrying out the proposed inventory system which is adopted from methodology of Design Research by Kuechler & Vaishnavi (2008).

In this study, the requirements of system are gathered from a College that offers courses that manages food and beverages preparation. The requirement model of managing the raw material inventory is produced using Rational Unified Process approach, where the notations used are using UML diagrams, which is performed Suggestion phase. During the development phase, the researcher has transformed this requirement model into a web-based prototype using PHP and MySQL database. The output for this development phase is a web-based system prototype for an Inventory System for Hotel and Catering (IVHC).

In this phase, the design from the previous phase was translated into the program code. This study provides the users (Administrator and lecturer at Hotel and Catering Department) functionalities to manage courses, modules, BOM of related recipes based on the module respectively, manage orders from raw material suppliers, manage the information of raw material suppliers, and several additional functions which are beneficial to the users.

The IVHC prototype was developed using Photoshop, Photo Scape, Image Editor, Macromedia Dreamweaver 8 and Macromedia Dreamweaver MX2004 also will be used as a platform to PHP and MySQL Web Development afford.

The prototyping process is used to develop the system prototype approach [9]. By allowing the user to interact with the prototype, they can get a better idea of their information requirements. The application will be approved by the users can be used as a template to create the final system (Claudon & Laudon, 2000).

VI. PROPOSED REQUIREMENT MODEL

The requirement model aims to delimit the system and define functionalities that the system should offer. For this study, two models are required to develop this prototype; these two models are use case model and user interface model. Table 2 below shows the functional requirements of the system. Due to space limitation, detail specification of these requirements is not shown.

Table 2: Functional requirements

No.	Requirement Description
LOGIN	
1	Admin can login into the system by enter correct user name and password
2	Admin can cancel the login and back to homepage
3	Admin can back to login form
4	Admin can check the username and password
MANAGE BILL OF MATERIAL IN RECIPE	
5	Admin can add the bill of material in recipe
6	Admin can delete the bill of material in recipe
7	Admin can edit the bill of material in recipe
8	Admin can generate the bill of material in recipe
9	Admin can generate the total cost of recipe, base on desire number of generate (pax)
MANAGE RAW MATERIAL IN INVENTORY	
10	Admin can add the raw material in inventory
11	Admin can delete the raw material in inventory
12	Admin can edit the raw material in inventory
13	Admin can view the details of the raw material in inventory
14	Admin can view graph of the specific raw material in inventory
15	Admin can cancel the detail of raw material in inventory
MANAGE RAW MATERIAL ORDER	
16	Admin can add the raw material order
17	Admin can delete the raw material order
18	Admin can edit the raw material order
19	Admin can view the details of raw material order
20	Admin can cancel the detail of raw material order
CALCULATE AND VIEW PURCHASE FORECASTING	
21	Admin and lecturer (Staff) can calculate the view the purchase forecasting
VIEW REPORTS	
22	Admin and lecturer(staff) can view raw material in inventory report
23	Admin and lecturer(staff) can view raw material order report

This section also presented screen shots of two of the main functions of the system which are manage bill of materials (BOM) per recipes (refer Figure 1) and also calculate purchase forecasting (refer Figure 2). Based on Figure 2, forecasting methods are applied in this system is the method of Simple Average as mentioned in the Background section.

V. EVALUATION RESULT

The reason for performing technology acceptance evaluation is to determine the level of usefulness, and ease of use of the system. This is conducted through the use of questionnaires given to the administrator and lecturers. Each respondent has been thought to use the prototype of SISHK. The questionnaires are set up based on Technology Acceptance Test (TAM).

The questionnaires consist of five parts, which are part A for general information, and Perceived Ease of Use (PEOU) and Perceived Usefulness (PU). Additionally, every question Likert Scales where number 1 is strongly disagree to number 5 is strongly agree. The results are shown in Table 3.

Table 3: Aspects in Evaluation Based on Questionnaires Result

Based on the result shown in Table 3, it is found that SISHK prototype is providing ease to use and useful features that could help the target group such as administrator and lecturers an easier way to

Item:	Description	Mean value
PERCEIVED EASE OF USE (PEOU)		
B1	I found system is easy to use	4.33
B2	I would find it easy to get this system to do what I want to do	4.48
B3	Learning to use the system would be easy for me	3.95
B4	I would find this system flexible to interact with	4.00
B5	My interaction with this system was clear and understandable	4.10
B6	It would be easy for me to find information via this system	4.05
B7	It would be easy for me to become skillful by using this system	4.33
PERCEIVED USEFULNESS (PU)		
C1	Using this system in my job would enable me to accomplish task (manage the raw material inventory process) more quickly.	4.20
C2	Using this system would enhance my effectiveness in evaluation	3.86
C3	Using this system would make it easier to do my job	4.33
C4	Using this system would improve and enhance my tasks performance	3.81
C5	Using this system would stimulate and increase my productivity	3.95
C6	I found this system useful	4.00

manage existing raw materials management system on-line at the Department of Hotel and Catering. Besides, the price for each item involved in each recipe during the classes and the number of orders that are required to follow ("*pax*") can be calculated automatically.

VII. RESEARCH CONTRIBUTION

Among the research contributions of the system:

- i) Body of knowledge – With the proposed requirement model of web based raw food inventory system, it is hope that other organizations who have similar operations can adopt this model in creating similar system.
- ii) Practical- This prototype could assist the manager of the raw food inventory to improve his/her decision making by providing more useful knowledge in terms of bill material in the recipes, availability of raw material in the inventory, when to order the raw material and their quantities and able to forecast the next purchasing order.

VIII. CONCLUSION AND FUTURE WORK

According to previous sections, the objective of this study is to design and develop a requirement model and also a working prototype of SISHK and evaluate its technology acceptance towards the prototype of SISHK. This system was developed for managing inventory and raw material data involved in this Hotel and Catering department and any similar organizations.

The interactive web based Information System for Hotel and Catering course developed is able to record, add, view, modify and delete information. In addition, it can also able to generate information Bill of Material (BOM), show a list of ingredients for a recipe in detail, and calculate the total price of the desired recipe. Besides, it also has the ability to calculate the total price for orders of raw materials in the "master sheet" as well as calculation of forecasting purchases.

For the future work, the first suggestion given by end users is to enhance the system's functionalities, meaning that end users want the developer to expand the functionalities of SISHK, where other areas of co-operative management should be included to develop a complete system. However, deeper research needs to be done in order to fulfill requirements on developing a complete management system.

The user IDs and passwords are not encrypted and this will expose the stored data to fraud or embezzlement activities. Therefore, for security improvements, encryption of user ID and password are needed to protect the confidential data from being hacked by unauthorized users.

Search engine is one of the additional criteria that can be included in this system. The search engine can be specific to trace user's password, in case if they forget. Besides, the system can also send the generated automatic password via user's email, if they forget their password too in future. Without this mechanism, users will have to contact the database administrator to get their password. Consequently, this will be more time consuming and will affect the system's performance.

REFERENCES

- Azmi, W, M (2004). "Manufacturing Inventory System", Unpublished Master Dissertation, Universiti Kebangsaan Malaysia.
- Britanica (2005). "Encyclopedia Britannica". Retrieved Dec. 11, 2010, from www.britannica.com.
- Claudon, K. & Laudon, J. P. (2000). "Management Information System: Organization and technology in the Networked Enterprise," Englewood Cliffs: Prentice Hall.
- Dictionary, A. (2008). American Production and Inventory Control Society. Retrieved Dec. 11, 2010, from <http://www.apics.org>.
- Kuechler, B. & Vaishnavi, K. (2008). "On theory development in design science research: anatomy of a research project," *European Journal of Information Systems*, vol. 17, pp. 489-504.

- Leng, C. Y. (2004). "Web Application Project Management Inventory," Unpublished Master Dissertation, Universiti Kebangsaan Malaysia.
- Mabert, V. A. (2007). "The early road to material requirements planning," *Journal of Operations Management*, vol. 2, pp. 346-356.
- Peng, K. S (2003). "Inventory Control applications in the Industrial Sector," Unpublished Master Dissertation, Universiti Kebangsaan Malaysia.
- Yen, T. C. (2007). "Inventory Control System and Raw Material Management Case Studies UPHA," Bachelor Thesis, Universiti Kebangsaan Malaysia.

<<: Rekod Senarai bagi Resepi >>

Bil	Modul	Nama Resepi	Papar 'BOM' Resepi	Fungsi	Fungsi	Fungsi	Fungsi
1	DHK 310	sambal petai mala	[Senarai Bahan (BOM) bagi Resepi]	[Kemaskini]	[Padam]	[Senarai Bahan (BOM) bagi Resepi]	[Lihat Pesanan]

Function list bill of material (BOM) per recipe

<<: Senarai bahan ('BOM') bagi resepi berikut >>

* Maklumat secara terperinci untuk senarai bahan bagi resepi berikut:

Nama Modul : DHK 310
 Nama Resepi : sambal petai mala
 Nota : ww

Sila masukkan data yang betul dan wajar bagi resepi dalam modul berikut. Terima kasih.

Nama Bahan : _____
 Kuantiti : - Pilih -
 Harga : _____
 Harga Kasar : _____ Harga Ringkas (Senarai Selok Harga)
 Nota : _____

[Simpan]

<<: Senarai bahan ('BOM') bagi resepi berikut >>

* Maklumat secara terperinci untuk senarai bahan bagi resepi berikut:

No	Bahan	Kuantiti	Harga	Harga Kasar	Nota	Fungsi
1	oli pinglis	227 Gram	RM 2.47	3.00	ww	[1] [Kemaskini] [Padam]
2	petai	100 Gram	RM 2.33	2.80	ww	[1] [Kemaskini] [Padam]
3	test1	120 miligram	0.50	1.00	ww	[1] [Kemaskini] [Padam]

Jumlah harga kos bagi resepi berikut (per individu) : RM 5.3

Figure 1: Interface of Function List Bill of Materials (BOM) per Recipes

<<: Pengiraan Peramalan bagi Kaedah Purata Ringkas >>

Arahan :Masukkan hasil pembelian pada n bulan yang lepas bagi mendapatkan nilai anggaran peramalan pembelian pada bulan akan datang.

Bilangan mengikut bulan yang dikehendaki :

bulan A :
 bulan B :
 bulan C :
 bulan D :
 bulan E :
 bulan F :

Maka, anggaran jualan bulan akan datang :

1. Insert the desired coefficient value, n
2. Insert the past 3th month purchase value
3. Forecasting Purchase Short-Average Method will calculate automatically by click in the system.

All Rights Reserved.2011©
 Faculty of Information Technology
 CAS, UUM
 MSc IT
 Nurzaharah Mohd Ghause (808836)

Figure 2: Interface of Forecasting Short-Average Method Calculation.