Design and Implantation Information Material Requirements Planning System (IS-MRP)

Asst. Prof. Dr. Soroor k. Hussain
Engineering College-Baghdad University
Rabab khayon shibram
Engineering College-Baghdad University
Mechanical Engineering Department

Abstract:-

The main problem that the most industrial plants suffer from is the difficulty of material planning to create the suitable environment for implementing their production plan. The perfect solution for this problem is represented by adopting the material requirement planning (MRP) system which is a computerized system, helps so much in determining the time and quantity of orders by planning and releasing the purchase and work orders. In this study it has been designed an information material requirements planning system called (IS-MRP) system, using visual basic language and Microsoft ACCESS program to build the system's database. It consists of two modules which are forecasting module and MRP module. This system has been tested in an actual industrial environment at (EIC) company, and provided with output report that included the values of: (calculated gross requirements, calculated net requirements, calculated POH inventory, calculated planned order receipts and calculated planned order releases) for each item of the finished product in each time period.

Key words: MRP, Computerized System, Forecasting Model, information material requirements planning system (IS-MRP).

Soroor k. Hussain
Rabab khayon shibram
Association of Arab Universities Journal of Engineering Sciences
NO. 2   Volume. 24   Year. 2017

1. Introduction -

Manufacturing organizations are required to deal with complexity because of numerous products, processes, parts, and uncertainties. The typical manufacturing company may have thousands of products and parts to manage, constantly shifting priorities and unpredictable demand. It is possible to manage this situation through use of a computerized planning and control system called Materials Requirements Planning (MRP) [1]. MRP is an information system that uses concept of backward scheduling to improve the production efficiency and service supplied to the customer [2]. It is a set of techniques that employs bill of material (BOM) data, inventory data, and the master production schedule (MPS) to calculate requirements for materials [3]. So the main

Objective of MRP system is: "Getting the right materials to the right place at the right time" [6] Through answering the questions "what, when and how many items are required?" [7].

MRP technique can be applied in industry as well as in service sectors in order to improve customer service, Minimize inventory investment, and Maximize production operating efficiency [8].

2. Structure and Logic of MRP System

As shown in **fig. 1** [40] the structure of MRP system consists of three component sources of data to feed it as essential inputs, which are [41]:

- Master production schedule (MPS).
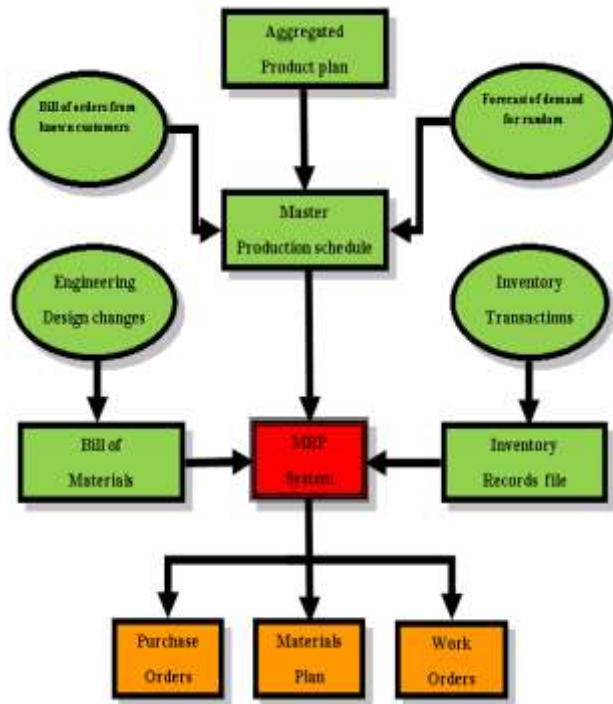- Bill of materials (BOM).
- Inventory records.

Soroor k. Hussain
Rabab khayon shibram
Association of Arab Universities Journal of Engineering Sciences
NO. 2   Volume. 24   Year. 2017

Fig 1. Structure of MRP system [40].

Logically the system operates on the data contained in these three input files (MPS, BOM and inventory records). Where the end items list that needed by time buckets (or time periods) is specified by the MPS. The description of the materials and part required to make each item is detailed in the BOM file while the number of units of each item and material currently on order and on hand are contained in the inventory file [41].

Hence MRP computations are carried out in the following steps [37]:

- Explosion: the end product into their components
- Netting: the gross requirement to net requirements.
- Offsetting: based on the lead times required for each item
- Consolidation: the requirement of particular item for all the end products in which it's used.

3. The Planning Format & Basic Mathematical Formulation of MRP System

The planning format for a typical MRP is shown in **Figure (2)** below [44]:

Soroor k. Hussain
Rabab khayon shibram
Association of Arab Universities Journal of Engineering Sciences
NO. 2   Volume. 24   Year. 2017

Fig 2. Typical MRP Planning Format [44].

Where the rows have the following mathematical meanings: - [5]

- Gross requirements G (t), calculated using the formula:

  G (t) component = R (t) parent X q. ………………………….. (1)

  Where:

  (t): Period number.

  (q): Quantity of the component required to produce the parent item.

- Projected on hand inventory H(t), calculated using the formula:

  H (t) = S (t) + P (t) + H (t-1) - G (t) ……………………. (2)

Where:

S (t): schedule receipts.

P (t): planned order receipts.

- Net requirements N (t), calculated using the formula:

  N (t) = G (t) + S.S – S (t) – H (t-1) ………………… ….. (3)

  Where:

  S.S: safety stock.

- Planned order releases R(t), calculated using the formula:

  R (t-L-SL) = P (t) ………... (4)

  Where:

  L: lead time

  SL: safety lead time

4. The Designed (IS-MRP) System

Based on the logic and formulas of MRP system that presented above "an information material requirements planning system" called (IS-MRP) system has been designed using the visual basic language and Microsoft ACCESS program to build the system's database. This system can perform two functions, each function

interface with other function, because it consist of two subsystems or modules that are designed to determine the quantity and delivery dates of the product, and to find the forecasted demand of finished product. Connection between the two subsystems is achieved by information flow, so the System Program assists the user in running the computer efficiently with minimum need for human intervention. **Figure (3)** shows the architecture of (IS-MRP) system.
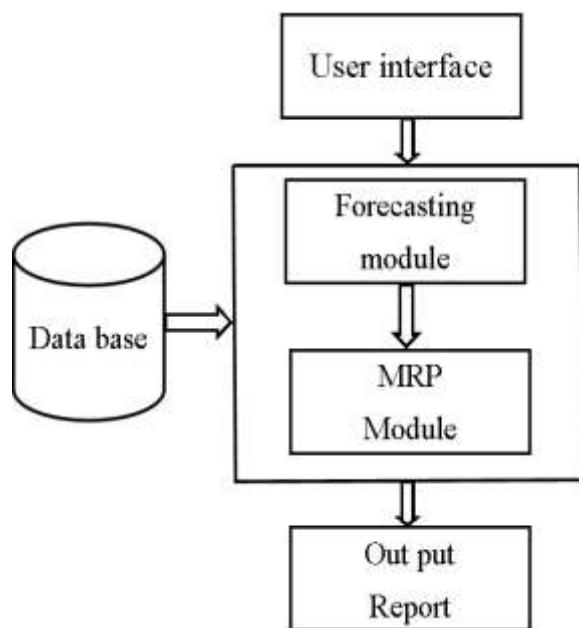
Fig 3. The architecture of (IS-MRP) system [researcher].

4.1 User Interface

It is used in (IS-MRP) system to enter the inputs of needed data and display the outputs of processed data in a visual way which is created using Visual Basic's program.

4.2 Database

it has been building a database for the IS-MRP system using the ACCESS program in order to control over replication and consistency of data, and to give the system the ability of multiple and simultaneous access to data. This database consists of the following files: Bill of material database file, Inventory database file and demand database file that have been collected from EIC Company in order to feed the system with all required data for implantation.

4.3 Forecasting Module

It is the basic input to the MRP module in processing sequence which is based upon transforming the time period demand quantities into time

period gross requirements using the simple linear regression method of forecasting. The forecasting module first calculates the demand for each time period (time bucket) over planning horizon, then the calculated demand will represent how many quantities and when are to be produced as a gross requirements of the finished product.

4.4 MRP Module

After completing the forecasting step, MRP module performs the conversion of the finished product requirements into time phased part requirements. It starts with importing the gross requirements from the forecasting module and uses information from the inventory and BOM files to explode the master production schedules (MPS) and produces the time phased production requirements for each component required to assemble the finished product. The result is a time phased production plan that indicates

when the material should be ordered, in what quantities and when work orders should be released. Generally this is executed through the following steps:

1. Determination of gross requirements.
2. Determination of net requirements.
3. Determination of lot sizing.
4. Determination of offsetting.

4.5 Output Report

This unit generates the output reports of calculated values that clarified from the prior modules in the system. The output report includes calculated gross requirements, calculated net requirements, calculated Projected on hand inventory, calculated planned order receipts and calculated planned order releases for each item in each period.

5. Implementation of (IS-MRP) System

In general the system is fed with the required data for implementation, either through the database that have been built and saved in the (ACCESS) program, or by the direct entering of data by the user. The first screen in (IS-MRP) system is the welcome screen, as shown in **fig. 4**. By clicking on enter icon, the second screen appears which is (IS-MRP)

Fig 4. Welcome screen

screen as shown in **fig. 5** It's the main commands screen or home screen, contains five icons as follows:

- Bill of materials icon: leads to a new screen called (bill of materials).

- Materials Inventory icon: leads to a new screen called (Materials inventory).

- Gross requirements icon: leads to a new screen called (Gross requirements).

- Data base icon: leads to a new screen called (Data base).

- Output report icon: leads to a new screen called (output report).

Finally (EXIT) icon when it is clicked the program ends.

Fig 5. IS-MRP screen

Bill of material screen has two options for creating the BOM, one option is (design BOM) that involves the direct entering of data by user, while another option which is (import BOM) enables to get required information from the database as shown in **figure (6)**.

Fig 6. Bill of material screen for (import BOM option).

Data base screen consists of three sheets of data base which are BOM database sheet as shown in **fig. 7** Inventory database as shown in **fig. 8**, and Demand database as shown in **fig. 9**.

Soroor k. Hussain
Rabab khayon shibram
Association of Arab Universities Journal of Engineering Sciences
NO. 2   Volume. 24   Year. 2017

Fig 7. database screen for BOM database sheet.

Fig 8. database screen for inventory database sheet.

**Fig 9. database screen for demand database sheet.**

Materials Inventory screen contains two options which are (input inventory) to enter data directly to the screen by the user, and (import inventory) to get information from the database as shown in **fig. 10**
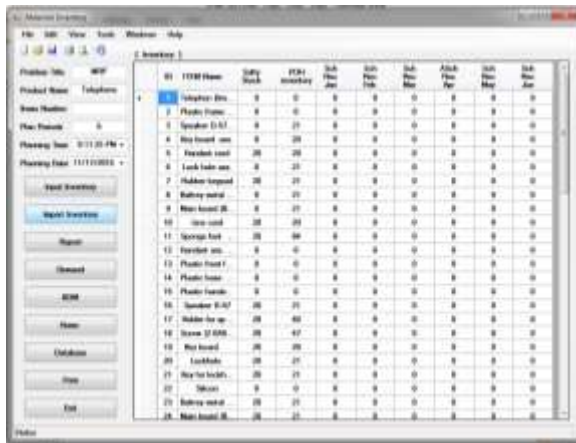
Fig 10. material Inventory screen for import inventory

Gross requirements screen in which is performed the forecasting of product demand for future periods by entering the demand quantity for last periods. There are two options for this purpose, which are (input demand) to enter demand directly by the user. and (import demand) to get demand data

from the database as shown *in* **fig. 11**.
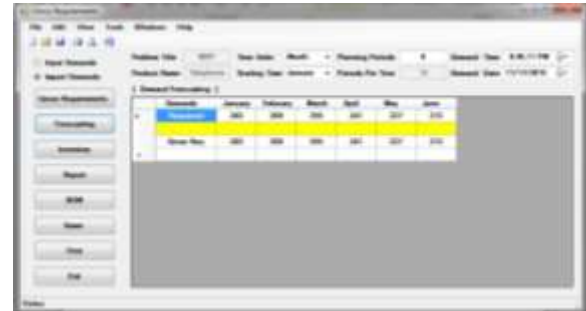
Fig 11. Gross requirements screen for import forecasted demand

Output report screen provides the user with detailed report for all product's items as shown in **fig. 12** which represents the output report of EIC company data. Also it extracts summarized reports of only manufactured items, only imported items, only purchased items as shown in **fig. 13** or only low level coding items as shown in **fig. 14**. Print icon is used to print the output report.

Fig 12. output report screen of EIC company data (all items).

Fig 13. output report screen of EIC company data (only purchased items).

Fig 14. output report screen of EIC company data (only low level coding items).

6. Conclusion

1- The system has the ability to extract the planning process for production of particular product in a specific form with accurate and detailed orders even before the production or purchasing of any raw material.

2- The system has the ability to calculate projected on hand inventory, and to determine the most appropriate timing for releasing and receiving the orders of purchase, work and production.

3- The System provided with separated reports about imported, purchased and manufactured items that enabled the company for:

- Releasing import orders to import the imported materials from abroad supplier.

- Releasing purchase orders to buy the purchased materials from local market.

- Releasing work orders in the given dates to the relevant factory to produce the specified quantities of each manufactured materials.

4- The system provides with BOM, inventory and demand database that can be updated at any time.

5- The system allows using four types of planning periods which are (hour, day, week, month, and custom period).

6- The system allows using four types of lot size techniques which are (LFL, EOQ, FOQ, and POQ).

7- The system designed to work on structure of product with infinite number of levels and components.

7. References

1. Carol A. ptak, CFPIM, CIRM and chad J. smith. " Orlickey's material requirement planning ", McGraw-Hill Education; 3 edition (June 1, 2011), ISBN-13: 978-0071755634.

2. Davis, M.M., Aquilano, N.J., and Chase, R.B., "Fundamentals of Operations Management" McGraw- Hill /Irwin, 2003..

3. Dinesh E. D., Arun A. P. and Pranav R., "material requirements planning for automobile service plant", International Journal of Innovative Research in Science, Engineering and Technology, Volume 3, Special Issue 3, pp. 1171-1175, (March 2014).

4. Hassoon S. T., "A Contribution in Materials Requirement Planning Techniques", AL-MANSOUR JOURNAL, ISSN: 18196489, Issue 10, pp. 64-84, (2007).

https://books.google.iq/books?id=spSE_UggpPUC&hl=ar&source=gbs_navlinks_s

5. J. Oleskow, P. Pawlewski and M. Fertsch " Limitations And Performance of MRPII/ERP Systems –Significant Contribution of Ai Techniques", 19th International Conference on Production Research, (2005).

6. Leif Enarsson," Future Logistics Challenges ", Copenhagen Business School Press DK, 2006, ISBN 8763001705, 9788763001700.

7. Mahmoud A. M., "studying the adoption and implantation of MRP-type system to support manufacturing in Iraqi industries environments ". Ph.D. thesis, AL-rasheed collage of engineering and science, (2006).

8. R. B. KHANN , " production and operation management " , PHI Learning Pvt. Ltd., 2007, ISBN

8120332032, 9788120332034. Available on:

9. Schroeder, R.G," operation management: contemporary concepts & cases"., 3rd edition, Mc Graw-Hill / Irwin . inc 2007

10. Vassilis M., "material requirements planning MRP", Report produced for the EC funded project (INNOREGIO:

dissemination of innovation and knowledge management techniques), January (2000).

11. Vonderembse, M.A., and White, G.P., "Operations Management: Concepts, Methods, and Strategies", john Wiley and sons, 2006.

12. DMADV", International Journal of Innovative Science and Modern

تصميم و تنفيذ نظام معلومات لتخطيط الاحتياج من المواد (IS-MRP)

أ. د. سرور خضر حسين

رباب خيون شبرم

جامعة بغداد/ كلية الهندسة /قسم الميكانيك

الخلاصة:

المشكلة الاساسية التي تعاني منها اغلب الشركات الصناعية هي الصعوبات في موازنة الطلب على المواد لتنفيذ خططها الانتاجية في بيئة مناسبة و سليمة. ان الحل الامثل لهذه المشكلة يتمثل باعتماد نظام تخطيط احتياج المواد و الذي يساعد بصورة كبيرة على تحديد المواد و كمياتها و فترة احتياجها الزمنية كما يقوم بتخطيط و اطلاق اوامر العمل و الشراء. بناء على الحقائق المتقدمة قام الباحث في هذه الدراسة بتصميم نظام معلومات لتخطيط الاحتياج من المواد. حيث سمي النظام المبني ب (نظام المعلومات لتخطيط احتياج المواد) و قد تم تصميمه باستخدام لغة فجوال بيسك و برنامج مايكروسوفت اكسس لبناء قاعدة البيانات الخاصة بالنظام. و هو يتكون من موديلين او نموذجين هما : نموذج التنبؤ و نموذج تخطيط الاحتياج. و قد تم اختبار النظام و تنفيذه في بيئة عمل واقعية في شركة الصناعات الالكترونية. و تم استحصال تقرير المخرجات المطلوبة لكل فقرة من فقرات المنتج النهائي قيد الدراسة ولكل فترة زمنية حيث تضمن التقرير قيم :(اجمالي المتطلبات المحسوبة , صافي المتطلبات المحسوبة, الخزين المدور المحسوبة , الطلبيات المستلمة المحسوبة, الطلبيات المخططة المحسوبة).