



A GENERAL FRAMEWORK OF COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM FOR A THERMAL POWER PLANT

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ABSTRACT

This paper deals with a general framework of Computerized Maintenance Management System (CMMS) for a National Thermal Power Plant. In the present scenario, it is very difficult to maintain data and information manually and also it consumes a lot of time during retrieval. Using software for this purpose leads to efficient planning of maintenance aspects. CMMS leads to effective planning, controlling and scheduling of maintenance activities. The application software is to contain various modules such as Equipment, Work Order, Tools & Tackles, Spare Parts, Staff Details, Task Allotment and Safety Records.

Keywords: *Computerized Maintenance Management System, Information and Communication Technologies, Task Allotment, Utilities, Work Order.*

I. INTRODUCTION

Maintenance includes performing routine actions which keep the device in working order (known as scheduled maintenance) or prevent trouble from arising (preventive maintenance). Maintenance may be defined as, "All actions which have the objective of retaining or restoring an item in or to a state in which it can perform its required function". Maintenance involves keeping the workplace, its structures, equipment, machines, furniture and facilities in good repair and operating efficiently and safely.

There are two main types of maintenance work. Routine/preventative maintenance is usually planned and includes scheduled inspections repairs and replacement to make sure everything continues to work. Corrective maintenance is needed when things go wrong or break downs occur demanding reactive action to be taken to get things up and running again. Regular maintenance is essential to keep premises, equipment, machines and the work environment safe and reliable. It helps to eliminate workplace hazards. Lack of maintenance or inadequate maintenance can sometimes lead to dangerous situations, accidents, health problems and heavy downtime losses.

CMMS stands for "Computerized Maintenance Management System". A Computerized Maintenance Management System (CMMS) is a software package designed to maintain a computer database for an organization's maintenance operations and human resources functions and helps maintenance teams keep a record of all assets they are responsible for, schedule and track maintenance tasks, and keep a historical record



of work they perform. This data is intended to help the effectiveness of maintenance workers, the quality of management decisions and the verification of regulatory compliance.

Computerized Maintenance Management System (CMMS) information is intended to help maintenance workers do their jobs more effectively (for example, determining which machines require maintenance and which storerooms contain the spare parts they need) and to help management make informed decisions (for example, calculating the cost of machine breakdown repair versus preventive maintenance for each machine, possibly leading to better allocation of resources).

II. LITERATURE REVIEW

Faud et al [2012] showcased a Computerized Maintenance Management System for medical devices in Royal Medical Services. Firstly, investigation of the existing CMMS in Royal Medical Services was done, and then a list of its requirements was created. Such a system was conceptually designed and finally an object oriented model was built based on the conceptual design. The conceptual design was divided into a number of sections such as: System Access, Creating of a work order, Work orders in progress, Look-Ups, Scheduler and Reporting. The needs for the system were researched and combined to form a requirements document that outlined all needed functions of the system.

J.D Claverley et al. [2014] explained that a proper utilisation of CMMS can assure effective management of costly power plant equipment. A good CMMS can lead to increased efficiency, improved quality and better decision-making. In this scenario of information and automation, power system department has more sophisticated equipment to maintain. A proper utilization of CMMS lead to effective management of costly power plant equipments. A good CMMS can lead to increased quality, better decision-making and increased efficiency.

Ralph W. Peters [2015] introduced the CMMS Benchmarking System as the most important benchmarking tool and the improvement process that the planner or others can take to gain better use of CMMS and information technology for maintenance. This benchmarking tool is introduced as a means to help the planner/scheduler evaluate the effectiveness of their current CMMS, to define functional gaps, and to define how to enhance current use or to help upgrade functional gaps. It is also a methodology to help develop and justify a CMMS replacement strategy where many existing planners can play a critical role. It includes various evaluation criteria to help gain maximum value from an existing CMMS system.

Daye et al. [2016] explained the use of Computerized Maintenance Management System (CMMS) by almost all organizations to manage the process of maintenance. Innovations in Information and Communication Technologies (ICT) and in computers have resulted in the evolution of e-maintenance, where some of the activities of maintenance are carried out electronically. This trend will continue to expand with e-maintenance becoming more dominant.

Verma et al. [2016] developed Computerized Maintenance Management information System (CMMIS) for The Shahabad Coop. Sugar Mills Ltd. Shahabad. This CMMIS aims to lower the effective downtime, frequency of failures and overall annual maintenance cost to improve maintenance policies and machine life.

III. METHODOLOGY

The flowchart given in Fig. 1 shows the various steps involved in the development of CMMS for a National Thermal Power Plant.

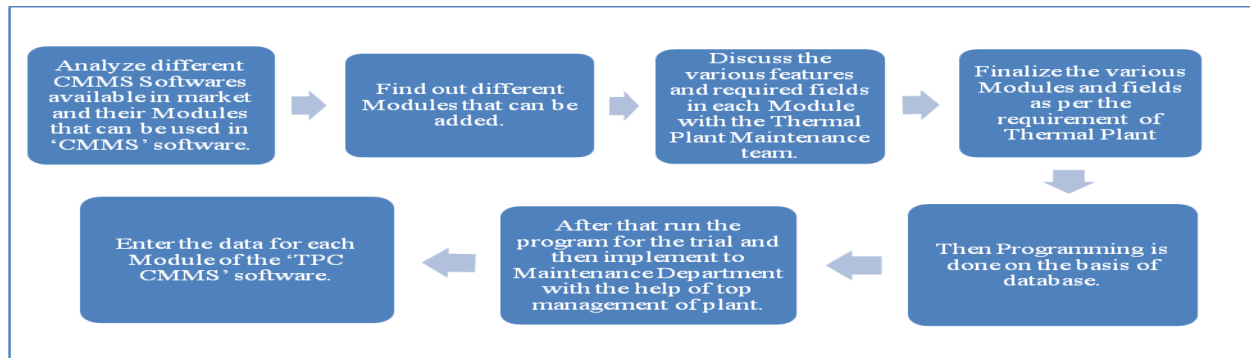


Fig. 1 Various Steps for Developing A CMMS

IV. FRAMEWORK OF COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM FOR A THERMAL POWER PLANT:

The CMMS facilitates the maintenance personnel by providing a Graphical User Interface consisting of various modules with different features by which feeding and retrieval of maintenance data and information fast and accurate.

4.1 Login Page

This feature provides a provision of a user Id along with a unique password for allowing only the required maintenance personnel to access the application software providing security to the system from unauthentic and illegitimate access.

4.2 Home Page

This provides a screen with various modules available in the application software for the user to proceed to various modules related to the task.

4.3 Operating Locations

The CMMS may include an application that allows an operator to enter and track locations where equipment operates and organize these locations into logical hierarchies or network systems. Work orders can then be written either against the location itself or against the equipment in the operating location. Using operating locations allows for the tracking of the equipment's lifecycles (history) and provides the capability to track the equipment's performance at specific sites.



4.4 Module 1: Equipment

The information about different equipment is stored in this module. The 'Equipment' tab contains general information of the equipment like manufacturer, warranty details, supplier details, cost etc. Just by selecting the respective equipment Id the information about the respective equipment can be traced.

4.5 Module 2: Resources

The CMMS may include a separate module to track labor resources. This module typically includes records for all maintenance personnel, including their craft or trade categories, such as mechanic, electrician, or plumber. Additionally, this module may include labor rates in order to capture and track true labor costs against any asset or piece of equipment. Some CMMS will allow maintenance managers to also track skill levels and qualifications for each resource to help in planning and scheduling work. Grouping labor categories into common associations can help a manager assign work to particular shop rather than an individual.

4.6 Module 4: Task Allotment

This module stores information of all those maintenance tasks performed in the thermal plant which is associated with different machines and maintenance personnel. On selecting any task Id the details related to that respective task can be achieved. The details can be of the name of task, the manpower required for accomplishing it, the equipment required along with the overall cost of that task for estimating the budget.

4.7 Module 5: Work Order

This module records all the information related to the work orders generated and their current status. The features can be the name along with the type of work, the action and the personnel assigned for the work with the dates of starting and ending of the work.

4.8 Module 6: Tools & Tackles

This module contains the features regarding all the tools and tackles used in the thermal plant for their respective maintenance activities. The features are the tool name along with its actual location in the plant, the description of the tool along with the quantity available in the inventory.

4.9 Module 8: Quick Reporting

The CMMS could provide a rapid and easy means for opening, reporting on, and closing work orders, and reporting work on small jobs after-the-fact. Labor, materials, failure codes, completion date, and downtime could all be reported

4.10 Module 9: Utilities

A utilities module that contains detailed information on utilities consumption, distribution, use, metering, allocation to users, and cost may be included. It could include modeling capability and linkage to utility control systems

**4.11module 10: Safety Records**

The information about safety related incidents occurred in the plant during the maintenance activities are stored in this module. The features can be of the name and location of the equipment on which the incident had occurred with its date and time, the description of the causes and the losses in terms of finance and infrastructure.

V. CONCLUSIONS

This paper deals with a general framework of Computerized Maintenance Management System (CMMS) for a Thermal Power Plant. It offers various advantages like reduction in total down time, overall maintenance cost, and frequency of failures of machines. An effective practice of CMMS provides a proper maintenance management with increased plant efficiency.

The CMMS assists the maintenance work by ensuring proper technical data collection, reduced maintenance cost, streamlining of work order schedule and fast access of information. By effective reporting of CMMS can provide maintenance managers and engineers with the information needed for correct decision making to control and improve the maintenance process. The use of different modules for specific maintenance field category provides the maintenance personnel a Graphical User Interface (GUI), making him more capable to ensure proper recording of data and information. The application also ensures a level of security by authentication of the maintenance personnel in authority for handling it so that there is no unauthorized access and record illegitimacy.

A proper utilization of CMMS can assure effective management of power plant equipments which are very costly. A good CMMS can lead to obtain various benefits like improved quality, better decision-making and increased efficiency.

VI. FUTURE SCOPE

The application of a CMMS can also be useful to other process industries such as Sugar, Beverages, Manufacturing, Fertilizer, Cement, Chemical, and Dairy Processing Industry where the management of a huge quantity of maintenance data and information is a tiresome task. The maintenance data can be put up on the Organization's Network so that the employee with an authority can also assess it from anywhere. Some more modules like 'Critical Issue', 'Calendar', 'History of Records, Staff Detail, 'Spare Parts' and 'Condition Monitoring' can also be developed and integrated into the CMMS software for higher effectiveness and economy of performing maintenance activities in future.

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