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INSPECTION AND CONDITION ASSESSMENT FOR EDUCATIONAL BUILDINGS BASED ON IMPROVED SNAPSHOT MODEL FOR PRACTICES

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Abstract

Islamic University Institutions hostel maintenance management is essential to prolong the building life cycle and reduce the company loss. When University hostel is neglected, defects can occur which may result in extensive and unavoidable damage to the building fabric or structure. The objective of this study is to Islamic University Institutions hostel in Malaysia to find the maintenance problems used the snapshot model is to determine the major dominant fault, cause of fault, prevention and consequence analysis. The defect and the problem face will be collected and noted in a check list. This will be done by questionnaires and distributed to all service users in Islamic University Institutions hostel management student hostel. Hence, this paper is focusing on the Islamic University Institutions hostel management used snapshot model is to identify and determine the major dominant fault, cause of fault, prevention and consequence analysis which the aim is to reduce the downtime of plant items taking into account the possible impact of a failure in terms of cost. The analysis shows that the hostel building contributed to the most problematic area in Islamic University Institutions hostel based on snapshot model is a kind of hierarchical analysis where all possible failures are classified into different levels and conclude the major dominant fault, cause of fault, prevention and consequence analysis.

Keywords: Defect and Failure, Snapshot Model

1.0 Introduction

Snapshot model is a kind of hierarchical analysis where all possible failures are classified into different levels. The snapshot model is to identify and determine the major dominant fault, cause of fault, prevention and consequence analysis.

The type of data required to conduct snapshot analysis include type or area of faults/ failures, causes of the faults/failures, consequences of faults/failures (such as downtime or cost), and possible means of preventing the occurrence of the faults (Basari, 2009). Snapshot model also used to identify and define the problem and identify the daily inspection maintenance problem (Onyenanu, 2010).

By using the model, a suggestion to improve the inspection policy has been presented to engineers in order to reduce the downtime occurs during operations as well as the availability. It also presents some component replacement policy that might be improved. Further investigation has been conducted by Olanrewaju et al., (2010) to check the improvement when the suggestion on previous study being implemented. They indicate that the number of breakdowns during operations has reduced, and the proper maintenance approach has also been implemented by following to the previous study suggestions.

1.1 Snapshot Modelling Process

This section discussed the analysis and design of the data collection module and also discusses the analysis and design of the snapshot analysis module. The main process of the snapshot analysis is broken into several detail processes. The process of snapshot model (Basari, 2009) passes through three major stages which are the collection of the data, the analysis of the data, and the presentation of the results to the users (maintenance engineers)[1]. The snapshot modelling requires specific type of data and information that are used in the process of maintenance problem identification. Such types of data include:
(Meng and Minogue, 2011;Adcroft and Willis, 2008; Sims et al., 2007;Raynal and Stainer, 2012)

1. Cause of fault: This could be attributed to operator error, poor maintenance, wearing and ageing and others. Data of this type could be used to establish the nature of the source of the problem within the plant.
2. Consequences of fault: Data of this type may include the time lost or the downtime due to waiting for repair crews, waiting for or collecting spares, and repair itself, and also the cost incurred. This data could be used in identifying the factors that constitute the downtime and the cost and
3. Prevention action: It is often possible to identify the viable means or procedures for preventing or delaying the fault or failure from recurring. Such procedures could be some form of preventive maintenance or replacement, redesigning or operator training.

However, the data specified above are difficult to be found i.e. incomplete data in any organisation and also very tedious to be collected on a dynamic basis if the maintenance management information system is supposed to be used. For this reason, Basari (2009) suggested the usage of a survey form for collecting such type of data on a periodic basis [2].

The survey form will be designed with the collaborations of maintenance engineers and operational research analysts. The designed survey form then will be delivered to the maintenance engineers responsible for the repair of the hostel building component [3]. At each failure or maintenance intervention, the engineer registers the data related to the snapshot model in a survey form. After obtaining a satisfactory sample of the data, operational research analyst collects back the survey form and starts the analysis process. The results of the analysis, which is either in a graphical or tabular form, then will be reported back to the maintenance engineers. The results obtained are expected to reveal the true status of the hostel maintenance under the study [4]

1.2 Problem statement

The most critical component in hostel facilities maintenance in Higher Education Institutions (HEI's) is still a lack of accuracy and misleading. According to Lind et al., 2012, maintenance problem identification based on the snapshot model in the case of failure data is essential for maintenance engineers to analyse the maintenance problems. In the current snapshot model, there is an analysis of the major fault type where each component is listed with the number of faults. For instance, if a component that develops the highest number of faults is identified, it will disrupt the maintenance work of the hostel facilities, and this will incur cost and downtime. Thus, ranking such a component as the most critical one is misleading. Even though the ranking is established, and proper analyses are conducted, an overall ranking based on all the criteria is not considered. This could have no meaning to the users (maintenance staff) and lead to wrong decisions (Burhanuddin et al., 2015). Deeper analysis also needs to be considered to increase the accuracy of maintenance problem identification which could affect the whole building component (Swallow, 2007).

1.3 Research Objectives and Scope

The main objectives of this research are as follows:

- Identify the problem of building maintenance management in Islamic University Institutions hostel in Malaysia.
- Increase the snapshot model in identifying and ranking the most critical components in hostel facilities maintenance.
- Analyze the number of breakdowns, downtime and cost in in Islamic University Institutions hostel maintenance management a using snapshot model.

1.3.2 Scope

Islamic University Institution are one of the factors to produce good student. The Islamic University Institution are procured to create a suitable, conducive and adequate environment that supports, stimulates and encourages learning, teaching and innovations [5]. A failure in the supply of these essential services is a loss in value to the Islamic University Institution, the community, the students, staff and other stakeholders. Constructing new buildings helps to upgrade educational facilities and provide better quality education; however, it is of utmost importance to maintain the existing buildings to acceptable performance standards that are capable of facilitating the transfer of knowledge and carrying out other academic activities effectively and efficiently. This research is focusing on Islamic University Institutions hostel especially on KUIM hostel [6].

2.0 Research Design

The snapshot analysis process is the major snapshot analysis module. The main process of the snapshot analysis is decomposed into several detail processes. The new detail conceptual flow diagram is given in Figure 4.3

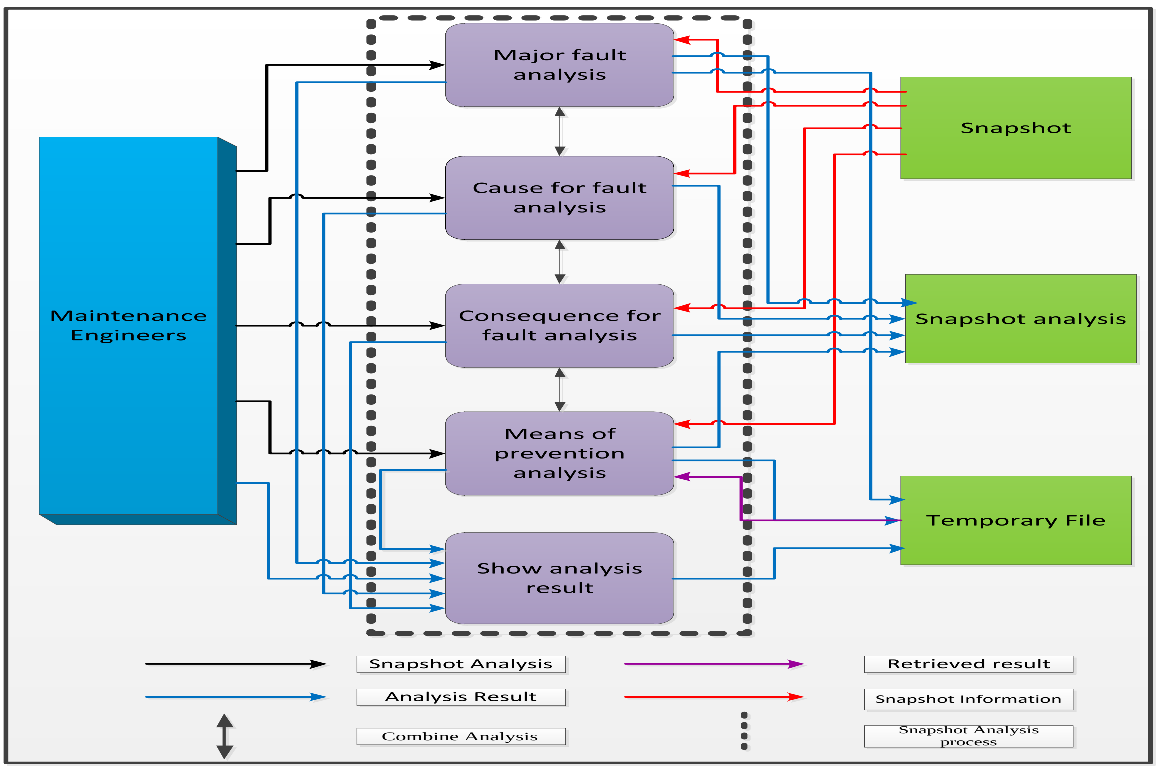


Figure 4.3 Details Conceptual Flow Diagram for Snapshot Analysis Process

As shown in Figure 4.3, it is recognised that the snapshot model is a collection of different types of analysis. The common types of snapshot analysis include:

1. Major fault analysis.
2. Cause of fault analysis,
3. Consequence of fault analysis
4. Prevention action analysis.

Extra analyses have been added that aim to augment and enhance the current snapshot model. The additional analyses include:

1. Combined Major Fault with the cost analysis.
2. Combined Major Fault with the Downtime analysis.
3. Combined Major Fault with the fault mode analysis.
4. Combined Major Fault with the fault effect analysis.
5. Combined Major Fault with the number of faults, cost and downtime.

The major fault analysis is a type of analysis that lists all the components of a HFM with their frequencies classified as fault type which are inspection, breakdown or corrective. The analysis aims to assess the severity of the faults in term of their frequencies. The analysis assumes that the component, which developed the highest frequency of fault, is the most critical and need to give more attention.

The cause of fault analysis displays the components of the HFM associated with their frequency of faults and each number of faults are divided into their cause of faults. For instance, consider a component of a HFM that developed 10 faults classified according to their cause as 3 caused by wear and tear, 5 caused by end of expired, and 2 caused by the human error, and then the component will be listed according to this classification. This kind of analysis aims to identify the most potential cause of faults. The importance of such kind of analysis stems from the fact that it can prevent solving the wrong problem. For instance, if the frequent cause of the fault is the main problem, then the training of the personnel on the operation of the HFM is likely to solve the problem than conducting preventative maintenance or increasing its interval [7].

The cost analysis aims to assess the severity of the faults in term of the cost incurred. For the cost analysis, the components of the building will be listed and associated with their corresponding cost. Similarly for the downtime analysis, the components of the HFM will be displayed along with their corresponding cost. The assessment of the analysis is perceived as the component which incurred the highest cost is the most critical part [8].

The consequence of downtime analysis aims to assess the severity of the faults in term of the incurred. In the downtime analysis, the components of the building will be listed and associated with their corresponding downtime [9]. Similarly for the downtime analysis, the components of the HFM will be displayed along with their corresponding downtime. The assessment of the analysis is perceived as the component which incurred the highest downtime is the most critical part [10].

The prevention action analysis is a kind of analysis that lists the components of the building or subsystem with their number of faults which is associated with their corresponding prevention action. The analysis aims to identify the viable means of preventing the fault from occurring [11].

The combined major Fault with the cost analysis is consisting of an analysis that lists the components of the HFM with their major fault and cost analysis. The aim of the analysis is to augment the assessment of the severity of the faults by comparing the frequency of faults with cost analysis.

The combined major fault and downtime analysis consist of an analysis that lists the components of the HFM with their major fault and downtime analysis. The aim of the analysis is to augment the assessment of the severity of the faults by comparing the frequency of faults with downtime analysis.

The combined major fault and fault mode analysis consists of an analysis that lists the components of the HFM with their frequencies classified as fault mode. The aim of the analysis is to augment the assessment of the severity of the faults by adding the fault mode factor.

Similarly, the combined major fault and fault effect analysis consists of an analysis that lists the components of the HFM with their frequencies classified as fault effect. The aim of the analysis is to augment the assessment of the severity of the faults by adding the fault effect factor [12].

The enhanced consequence analysis is also an additional analysis that aims to rank the critical components of the machine taking into consideration the frequency of faults, cost and downtime. In the case of combined major fault and cost analysis, it consists of an analysis that lists the components of the HFM with their major fault and cost analysis. The aim of the analysis is to augment the assessment of the severity of the faults by comparing the frequency of faults with cost analysis [13]. The combined of all analysis consists of an analysis that lists the components of the HFM with their Major Fault with the number of faults, cost and downtime analysis. The aim of the analysis is to augment the assessment of the severity of all possible analysis provided by the enhanced snapshot analysis. Major fault analysis is one of the main components of snapshot analysis. By this kind of analysis, the criticality of the components of the HFM can be assessed by looking at the frequency of the type of the faults occurred within the component [14]

5.2 Enhanced Snapshot Model

By using the enhanced snapshot model, nine types of analysis are developed. The four analyses are Major fault analysis, Cost analysis, Downtime Analysis and Prevention Action Analysis which is adapted from the current snapshot model. Then, an additional analysis offered five analyses, namely Combined Major Fault with the Cost Analysis, Combined Major Fault with the Downtime Analysis, Combined Major Fault with the Fault Mode Analysis, Combined Major Fault with the Fault Effect Analysis and Combined Major Fault with the Number of Faults, Cost and Downtime. In the following paragraph, detail description about each type of analysis is given [15].

Major fault analysis.

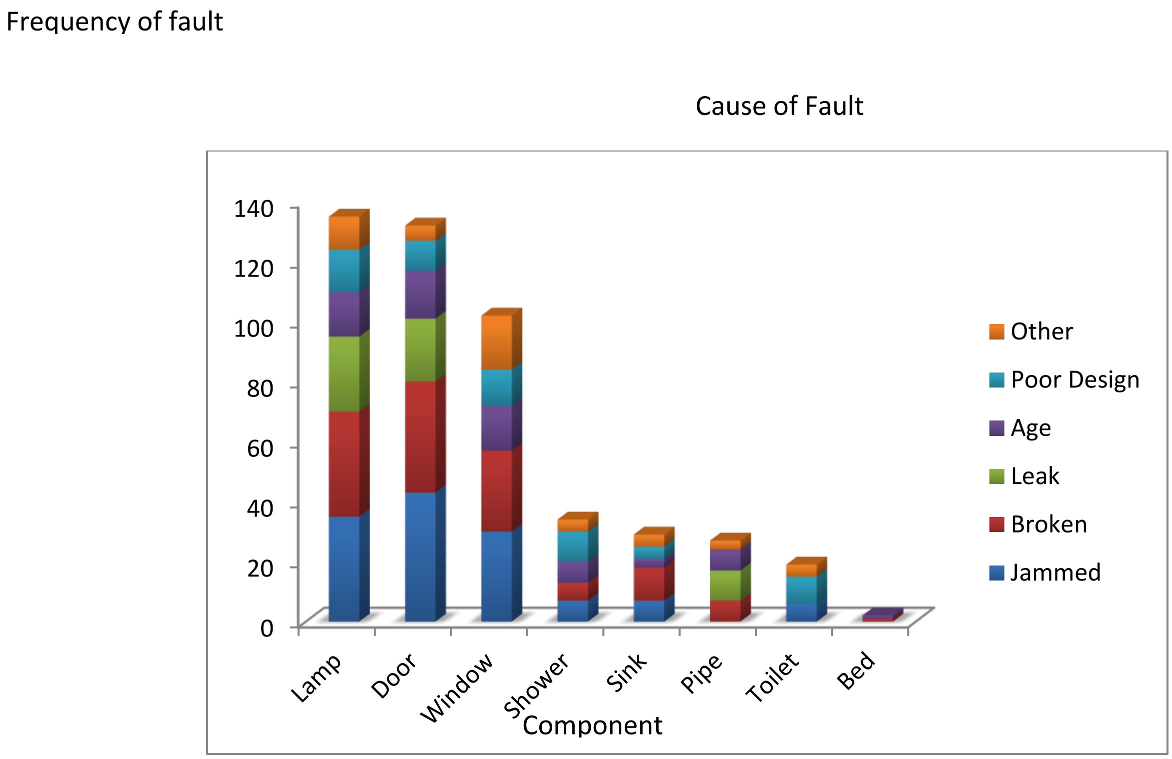
Major fault analysis is one of the main components of snapshot analysis. By this kind of analysis, the criticality of the components of the hostel facility maintenance is assessed by looking at the frequency of the type of the faults occurred within the component.

Details of the result could be seen in Table 5.1. From the result, three worst components which are counted about 77 % of the faults are Lamp, Door and window calculated about 28.1%, 27.5% and 21.3% came from other components.

Table 5.1 Total number of faults Area and Types of Faults for the period from 1 July 2012 to 30 Dec 2012 (KUIM)

		July	August	Sept	Oct	Nov	Dec	TOTAL FAULT	PERCENT
	Component	Jammed	Broken	Leak	Age	Poor Design	Other		
COMPONENT AREA OF FAULT NAME/	Lamp	35	35	25	15	14	11	135	28.1
	Door	43	37	21	16	10	5	132	27.5
	Window	30	27		15	12	18	102	21.3
	Shower	7	6		7	10	4	34	7.1
	Sink	7	11		3	4	4	29	6
	Pipe		7	10	7		3	27	5.6
	Toilet	6				9	4	19	4
	Bed		1		1			2	0.4
PERCENT		128	124	56	64	59	49	480	100 %

As shown in Figure 5.2 it shows the total number of fault area and the type of faults for the period from 1 July 2012 to 30 Dec 2012. The Door has the highest percentage among all of the other's faults, while the lowest percentage of the number of faults are bed.



4.0 Conclusion and Discussion

Building Maintenance management for KUIM consists of managing, planning and also controlling. In spite of that there are four supporting factors that need to be considered in making KUIM building maintenance management more effective and efficient when it is executed.

a) The Organization structure and general responsibilities of maintenance management.

b) The maintenance policies and standard for maintenance.

c) The maintenance management planning and scheduling.

d) The maintenance management for budgeting and cost controlling. (Yacob,2006).

Therefore, there is a deficiency in the ways in which building's maintenance procedures are being managed. Various attempts have been made to improve the performance of buildings through maintenance. While such schedule procedures offer the potential to improve the performance of maintenance management systems, the systems have, however, been reactive, hypothetical, and conditionally based. It is these substantial weaknesses in the proposed schedule procedures that have created the fundamental problems with the existing and proposed building maintenance management schedule procedure, causing their inability to improve the existing systems. Maintenance cannot be circumvented, but what is possible is that expenditure on building maintenance can be optimized through a proactive maintenance management system based on the concept of value [16].

Users measure the performance of their building in terms of various criteria that are consistent with their value systems. Maintenance management procedures must be based on the user's value systems. A significant impetus of value-based maintenance management is the progressive realization that maintenance must be viewed from engineering, scientific, technological, political, and commercial perspectives [17].

The proposed research to KUIM maintenance management focuses on field inspection and condition assessment for educational buildings. KUIM can develop an approach that uses the available maintenance data and resources to predict the condition of components and prioritize them for inspection purposes which identify and investigate the defects, symptoms, and interrelationships among top building components [18].

The first objective is to identify the most critical component for hostel facilities maintenance by using enhanced snapshot model during identification of the actual maintenance problem. It is a model that aims to facilitate maintenance staff in developing the enhanced snapshot model for maintenance problem identification, especially when data is incomplete. or missing data is commonly found in various areas in maintenance. The Hostel facilities maintenance has been designed, implemented and tested at three University Hostel buildings (KUIM, UITM, ICYM). The testing has been carried out based on the data collected for a semester at 1 July to 31 December 2012.

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