

The User Requirements for Building Maintenance Management Systems in Malaysian Public Universities

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ABSTRACT

Representing almost 50% of the total turnover of construction activities, building maintenance investment is huge all over the world. In facilities management activities, building maintenance is also regarded as a common function. This paper emphasises the current user requirements for building maintenance management in Malaysian public universities. Starting with semi-structured interviews, information gathered focuses on different aspects of building maintenance practice to identify the main user requirement issues. The areas of study are to justify the objectives of maintenance departments and examine the processes of maintenance reporting and verification and other associated tasks. In this study the applications and contributions of Information Technology (IT) facilities in maintenance practices are reviewed. Finally, the development of user requirements by using the interface design concept is explored. It is envisioned that, in the future, good building maintenance practices will become the norm in Malaysia so that users will extract maximum benefits from their buildings and facilities.

Keywords: Building maintenance, user requirements, information technology, interface design concept.

1. INTRODUCTION

This paper builds on a previous research paper entitled *A Pilot Study of User Requirements of Building Maintenance Systems in Malaysian Higher Education Institutions* [1]. The findings from this research will be an interface design concept derived by analysing user requirements. Building maintenance codes of practice play a major role in facilities management activities as they help organizations develop agreed services for buildings which support and improve the effectiveness of their primary activities, this was ratified by the British Standards Institution (BSI) building maintenance code of practice and the European Committee for Standardisation (CEN)[2]. The main contributing factors for the development of facilities management activities in Malaysia are due to an increasing awareness of the importance of a proper building maintenance and management system [3]. In managing Malaysian government-owned property, five management issues were identified, the areas that need to be improved are: having a proper property unit/department within a ministry, the availability of expertise, the adoption of proper strategies, having the proper management procedures and the implementation of IT usage [4]. In Malaysian public universities the previous studies found that the maintenance management systems mainly carry out corrective and cyclical maintenance work, they are also not IT-based. Besides that, the key performance indicators are not clear; the new needs-driven maintenance also has to replace the current budget-driven maintenance. In addition, the inadequately qualified personnel and understaffing issues have to be solved [5]. The tremendous growth of mobile devices in recent years has also influenced this paper, where the way in which people and organisations communicate has been transformed. It has also had some impact on the construction industry where the way in which information is exchanged and viewed has been revolutionised [6] [7]. This preliminary analysis involved four selected universities representing 20% of Malaysian public universities. The objective of this study

is to determine the user-requirements for effective building maintenance practices in Malaysian public universities. These user-requirements must be clearly identified and will be manipulated to form the main criteria for developing an interface design concept for a mobile application. The four Malaysian public universities each have different criteria in terms of size, age and categories (Research University, Comprehensive University and Focused University). The results collected from this study will identify the user-requirements and the most suitable technology to be adopted. These user-requirements are very important in understanding the needs and concepts to be proposed in future research. The following sections discuss the methodology adopted in the pilot study, the maintenance practices in universities and user-requirements in building maintenance management processes followed by a cross-analysis and the development of the interface design concept. Finally, conclusions are drawn.

2. METHODOLOGY

In each of the four Malaysia public universities, semi-structured interviews were conducted with the officer directly involved in maintenance management practices within the maintenance department. As a previous study recommended only 10% as the final study size, four out of the twenty Malaysian public universities was an ideal number [8][9]. A major advantage of conducting semi-structured interviews is that respondents could provide reliable and comparable qualitative data [10] which can be analysed in different ways. The informants were also allowed to express their own points of view [11] [12]. It was pre-agreed that the name of the university would not be revealed and that information would also be confidential. Thus, the universities are coded as University I, II, III or IV.

3. THE BUILDING MAINTENANCE MANAGEMENT PROCESS: THE USER REQUIREMENTS

The standard procedures are being applied in those four universities and cross-analysis is used to compare the implementations. Indeed, it is possible to determine the user-requirements in the building maintenance management process, which meets the main objective of this study. In order to make the analysis visible, the user-requirements for the building maintenance management process have been divided into five different stages: medium of request, requestor information, defect or failure information, information to maintenance staff and the post-maintenance process. Users in each stage might be different as the requestor might be a layman while the maintenance staff may have a good technical background. The maintenance management flow chart implemented by the universities is shown in Figure 1 and the information related to these five stages was then collected and analysed as shown in Table 1.

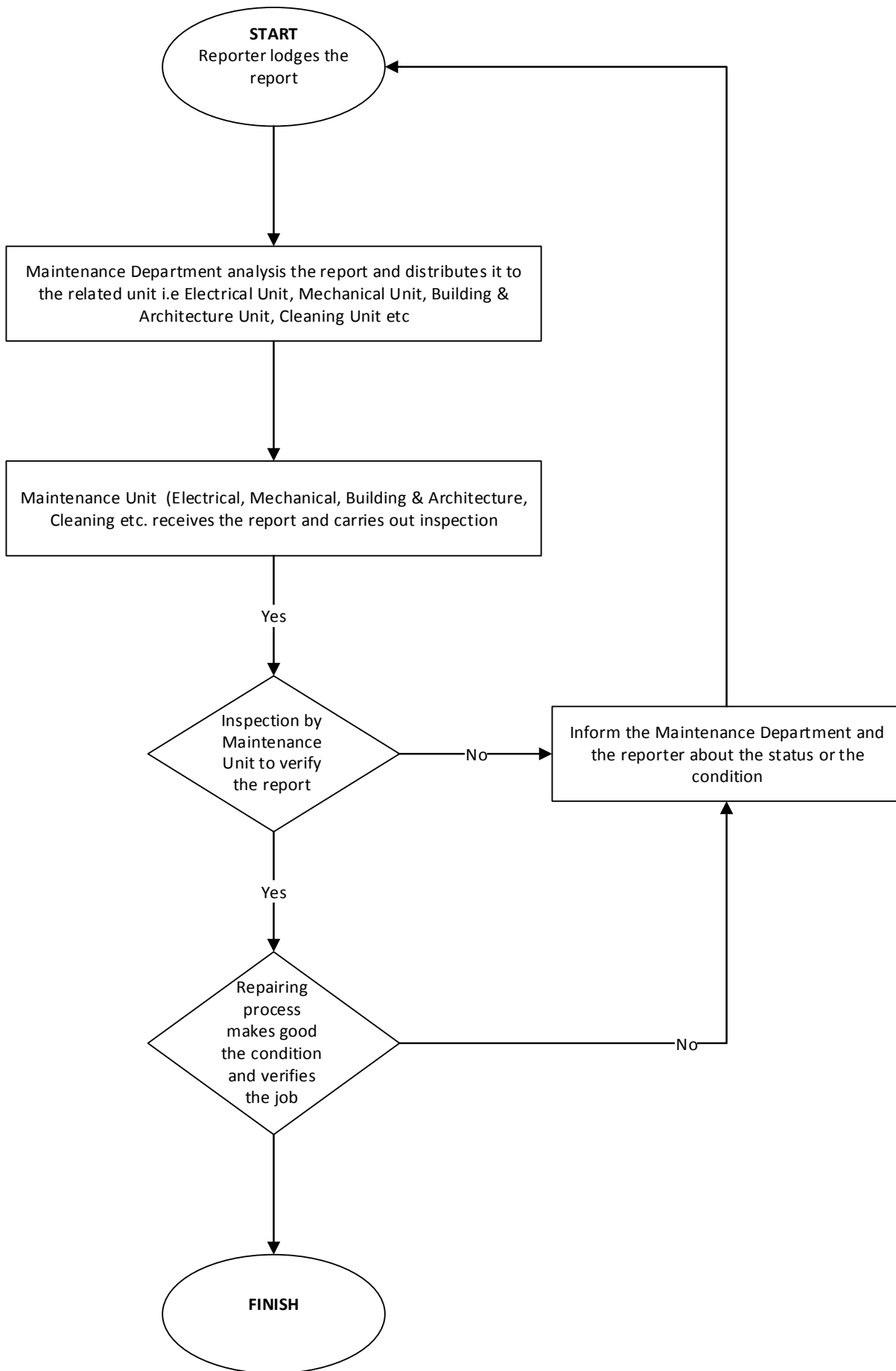


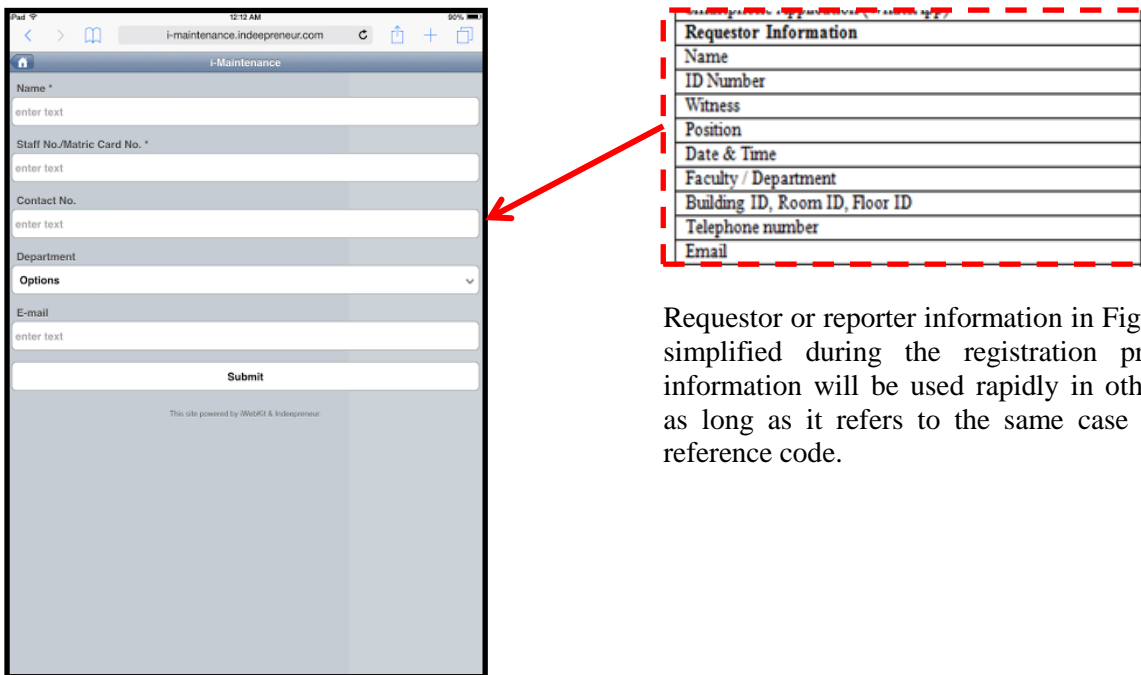
Figure 1: Building Maintenance Management Flow Chart

Item Description	University I	University II	University III	University IV
Medium of Request				
Fax / Email / Letter / Request Form				x
Website / Online	x	x	x	
Walk in	x	x	x	x
Telephone	x	x	x	x
Smartphone Application (WhatsApp)			x	
Requestor Information				
Name	x	x	x	x
ID Number		x	x	
Witness	x			
Position			x	
Date & Time	x			x
Faculty / Department	x	x	x	x
Building ID, Room ID, Floor ID			x	
Telephone number	x	x	x	x
E-mail		x	x	
Defect or Failure Information				
State / Campus / Space		x		
Name of Building (List Provided Yes/No)	Yes	No	Yes	No
Block (List Provided Yes/No)	Yes	No	Yes	No
Level (List Provided Yes/No)	Yes	No	Yes	No
Location (Description)	x			x
No. of Room (List Provided Yes/No)	No	No	Yes	No
Category of Defect or Failure (List Provided Yes/No)	Yes	Yes	Yes	No
Type of Defect or Failure (List Provided Yes/No)	Yes	Yes	Yes	Yes
Description	x	x	x	x
Information to Maintenance Staff				
Status of Job	x	x	x	
Verification		x	x	x
Date Start	x	x	x	x
Time Start	x	x	x	x
Date & Time Finish	x		x	
Total Hours	x		x	
Reference Number / Service ID	x	x	x	x
Work Request ID / Work Order ID			x	
Name of Staff	x	x	x	x
Staff Contact Number / Job Position		x		
Scope of Work	x	x		x
Name of Contractor	x	x	x	x
Work Description	x	x	x	x
Cause of Defect or Failure	x			
Name, Quantity and Price of Spare Parts	x			
Total Cost	x			
Post Maintenance Process				
Client Feedback	x	x	x	x
Survey Form		x	x	
Job Statistics / Job Status / Job Category	x	x	x	x

Table 1: Cross Analysis of User Requirements in the Building Maintenance Management Process [1]

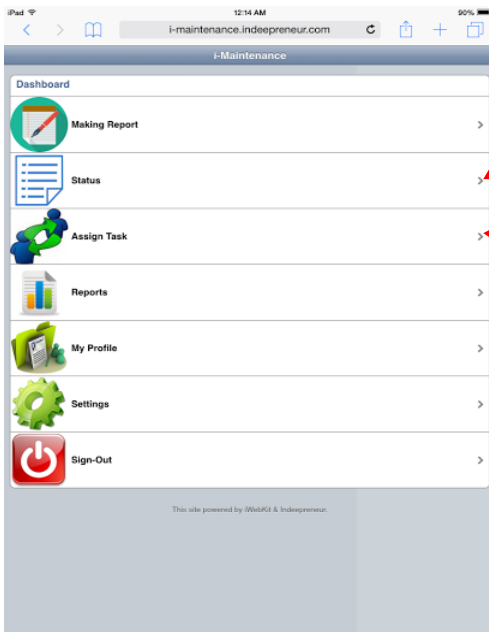
4. DEVELOPMENT OF USER REQUIREMENTS BY USING THE INTERFACE DESIGN CONCEPT.

System analysis and user-requirements-gathering in the system development life cycle will directly affect the ultimate success of an information system project. The contributions can be described as follows [13]: 1) Confirm the current role of the organisation and the tasks of each organisational unit. 2) Make an accurate job specification of current processes. 3) Familiarise with the latest IT development. 4) Acquire appropriate information related to flow of data. 5) Identify the requirements of the problem domain and its limitations. 6) Have a good knowledge of the user requirements and 7) Perform the main system design and ensure verification by the clients. Providing a set of business process models is the most important task during this stage, including AS-IS models, which are established according to system analysis, and a preliminary TO-BE design, which is based on user-requirements-gathering. Figures 2, 3, 4 and 5 below show the interface design concept derived from the user requirements list.



Requestor or reporter information in Figure 2 will be simplified during the registration process. This information will be used rapidly in other interfaces as long as it refers to the same case or the same reference code.

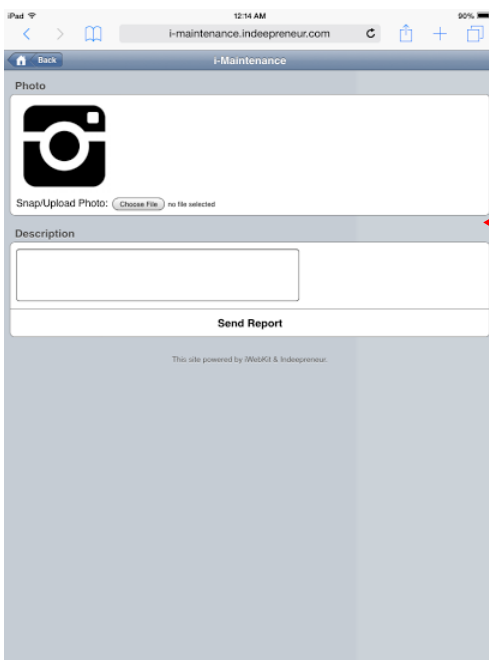
Figure 2: Requestor or reporter information.



Description	
Information to Maintenance Staff	
Status of Job	
Verification	
Date Start	
Time Start	
Date & Time Finish	
Total Hours	
Reference Number / Service ID	
Work Request ID / Work Order ID	
Name of Staff	
Staff Contact Number / Job Position	
Scope of Work	
Name of Contractor	
Work Description	
Cause of Defects or Failure	
Name, Quantity and Price of Spare Parts	
Total Cost	
Post Maintenance Process	
Client Feedback	
Survey Form	
Job Statistics/ Job Status/ Job Category	

Figure 3: Contents of the report.

The main contents of the report will be simplified and divided into three sections: status, assign task and reports. The content is derived from three different sources: the maintenance department, the maintenance unit and the reporter.



Description	
Requestor Information	
Name	
ID Number	
Witness	
Position	
Date & Time	
Faculty / Department	
Building ID, Room ID, Floor ID	
Telephone number	
Email	
Defect or Failure Information	
State / Campus / Space	
Name of Building (List Provided Yes/No)	
Block (List Provided Yes/No)	
Level (List Provided Yes/No)	
Location (Description)	
No. of Room (List Provided Yes/No)	
Category of Defects or Failure (List Provided Yes/No)	
Type of Defects or Failure (List Provided Yes/No)	
Description	

Figure 4: Interface features for the reporter while reporting the failure.

All information about the reporter and details about defects/failures - including photo or video evidence - would be simplified in one page. The photo will be the main reference for different entities like the maintenance department, the maintenance unit and the technicians.



Report No	4042
Reporter	Muhamad
HP Number	019 4567890
Location	Block P – Soil Lab
Coordinate	3°8'00"N 101°42'00"E
Time / Date	9.00 am - 08/10/2014
Category	Electric
Description	Down light not functioning

Medium of Request
Fax / Email / Letter / Request Form
Website / Online
Walk in
Telephone
Smartphone Application (WhatsApp)
Requestor Information
Name
ID Number
Witness
Position
Date & Time
Faculty / Department
Building ID, Room ID, Floor ID
Telephone number
Email
Defect or Failure Information
State / Campus / Space
Name of Building (List Provided Yes/No)
Block (List Provided Yes/No)
Level (List Provided Yes/No)
Location (Description)
No. of Room (List Provided Yes/No)
Category of Defects or Failure (List Provided Yes/No)
Type of Defects or Failure (List Provided Yes/No)
Description



Figure 5: Detail information received from the reporter.

This detail information derives from the combination of requestor or reporter information in Figure 2 and the Interface feature for the reporter while reporting the failure in Figure 4. This information will be the main reference for different entities like the maintenance department, the maintenance unit, the technician and maintenance manager.

5. CONCLUSIONS

The implementations of the building maintenance process in Malaysian public universities, although having different practices, share common criteria of good practice. All participating universities share some important criteria while implementing building maintenance management processes as shown in the cross-analysis. The core business remains the same even though there is some gap between the universities during the implementation. It can be concluded that the great effort required to develop such systems may lead to a high-end and sophisticated, well-maintained, building environment. Finally, the user-requirements from this pilot study will be a stepping stone in developing an efficient method of managing the building maintenance with customisable elements that suit each organisation and bring benefits to the stakeholders. Development of user requirement by using the interface design concept is very important as it would be a meeting point for the user need. Furthermore, the interface design concept would simplify much information into one page whilst at the same time being shared by the different entities. As this application could be applied using computers and smartphones, it is envisioned that, in the future, the building maintenance practice will implement the ‘on-the-go’ concept.

6. ACKNOWLEDGEMENT

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