

WORKSHOP TIME MANAGEMENT SYSTEM

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ABSTRACT

The Workshop Time Management System is a web-based application that is specially built for the third party logistics provider and workshops, with the goals to improve efficiency and shortening processing time by automating all processes and workflows involved in a central application. This project will focus more on human resources planning and efficiency such as pending job assignment, mechanic job log, task efficiency, evaluation of mechanic performance and mechanic duty shift control. By implementing the new solutions to the system, the maintenance staff will be better informed of pending jobs or faults at the workshop whereas the mechanics will be able to access the necessary information instantly to rectify the problem. A number of improvements on the existing features will also be included, such as urgent task handling, vehicle quality inspection and job activation to ensure more accurate time estimation and further improve the flexibility of the system in handling the various situations. The project will be carried out systematically with the waterfall model of Software Development Life Cycle and Structured System Analysis and Design Methodology. The business process and environment is analyzed to enable a more thorough understanding of the problems, opportunities and directives that triggered the project. Overall, this project is expected to deliver a range of mission-critical applications, including a proprietary environmental compliance database for its corporate administrative staff, and a fleet management application for its vehicle maintenance crew at the workshop.

Keywords: *workshop management, maintenance, workshop efficiency*

INTRODUCTION

As a result of recent technological advances, many firms are now relying on the information technology to automate an enormous amount of work in their day-to-day operations. In the freight and logistic industry, efficiency is everything. As part of the industry's main concern, companies always seek to improve their vehicle fault repairing and maintenance at the workshop, where time cost and error prone

processes are common. The industry need its administrative staff at the vehicle maintenance department to have a better control on the existing vehicle repairing and maintenance process, from authorization to vehicle arrival and departure from the workshop. This project will attempt to automate the entire workflow, by providing the company staff a fast and easy way to track and manage the information from a central application. When applied to the repairing process in the workshop, the efficiency is highly dependant on the way the workshop maintenance staff performs the given task. In another word, to improve efficiency of the workshop, this project is likely to include a feature that could evaluate the staff's performance. The system will also include a module that will allow the mechanic to be better informed of pending jobs and faults. In order to support the operations from the remote locations, this project will be specially designed with the web-based architecture in mind. All data will be controlled in a central web server and database server, whilst the user interface will be developed based on a web browser.

LITERATURE REVIEW

Enterprise resource planning (ERP) is a class of commercially developed software applications that integrate a vast array of activities and information to support tactical level operations and operations planning for an industrial enterprise (Algeo *et al.*, 2001). The term "ERP" refers to software that enables better execution of certain processes. In a setting of logistics, the distinguishable between transaction systems, operational planning systems and control systems related to computer mediated (extranets, intranets) or based on Internet or web technology (Visser, 2003).

As stated by Algeo *et al.* (2001), the increasingly commercial nature of the Internet and the development of communication exchange standards has had significant impact on ERP systems. The emergence of the Internet as the primary conduit for exchange of ERP-managed information among trading partners has spawned the term "Internet-based ERP". Thus in many ERP systems, web browsers have emerged as the platform for both local and remote user interfaces. Increased visibility and the transfer of real-time information bring new effectiveness to supply chain management (Aminoff, *et al.*, 2002). Simultaneously there are solutions being developed where Web-based browsers allow companies without

ERP systems (SME companies mostly) to complete transactions with other companies with ERP systems (D'Amico, 2001). In this project, a web based operational planning and control system would be an ideal solution for the intended logistic business. When dealing with the remote locations of company branches and partnering workshops, the Internet technology is considered to be the suitable solution in this case.

For the Decision Support System (DSS), there are two major categories of DSS, enterprise-wide DSS and desktop DSS. Enterprise-wide DSS are linked to large, data warehouses and serve many managers in a company. Desktop, single user DSS are small system that resides on an individual manager's PC (Power, 1998). In another words, A DSS may be an enterprise-wide DSS that supports a large group of people in networked, client server environment with a data warehouse or a desktop, single user DSS on a PC. Considering needs and requirements of the system, this project will adopt the concept of enterprise-wide DSS in a client server environment. This is because the client server DSS architecture can create bridges to move data and analyses back and forth from the client to server storage. Conceptually, the project is likely to provide the freight company and workshop the decision supports in terms of time efficiency, better resources allocation and performance evaluation.

METHODOLOGY

In the initial project selection phase, a major decision is what system development life cycle (SDLC) will be used in the project. Somerville (1990) suggests a number of general models (or development process paradigms). Three models that are commonly used are waterfall model, exploratory programming and prototyping. This project will be developed based on the Waterfall Model of the software life cycle, which is also known as Linear Sequential Model. A second major decision in initial phase is what methodology will be used. According to Avison *et al.* (1991), a methodology is a collection of procedures, tools and documentation aids which will help the system developers to implement a new information system. This project will utilize the model driven route of Structured System Analysis and Design Methodology (SSADM) in the developing process. The following description provides an overview of SSADM and how it is applied in the project. The justification of why the methodology is chosen will be presented in the next section. SSADM Methodology is an integrated set of standards and guides for the analysis and

design of computer system. It was first introduced in 1981 as the standard method of analysis and design developed by

CCTA (Central Computing and Telecommunications Agency) for UK government projects. It defines in detail the activities to be carried out in Feasibility Study Phase and Systems Analysis and Design Phase. (ISTD, 2003). The selection of the linear sequential model in Software Development Life Cycle (SDLC) has several advantages to the project:

- i. It minimizes planning overhead because all the phases are planned up front.
- ii. Requirements analysis tends to be more thorough and better documented
- iii. Alternative technical solutions tends to be more thoroughly analyzed
- iv. System design tends to be more stable, adaptable and flexible because they are model-based and more thoroughly analyzed before they are built.
- v. The approach works well when fulfilling user expectations and it tends to produce a better quality product, in terms of documentation standard, acceptability to the user, maintainability and consistency of software.

The following is a list of reasons for why the SSADM methodology is chosen:

- i. The modeling process in SSADM ensures that the focus of the project is on what the business requires. Thus it helps to deliver systems that respond to changes in the business environment.
- ii. SSADM uses the most commonly available skill in a wide market place – for example, Data Flow Modeling and Logical Data Modeling. It is likely to save time on the development phase as no additional time is required to pick-up the new skills.
- iii. By defining the required quality of design documents, and stating the tests for them, SSADM promotes better quality management by reducing error rates.
- iv. The major boosts from SSADM to productivity performance can be achieved by providing well documented techniques which accurately specify business and system requirements.

ANALYSIS

To enhance the competitive advantage in today's viable 3PL market, the strategies for high-performance business are topping corporate agendas. For the freight company, the vehicle is among the most important corporate assets that will impact company's performance more than any other form of capital. For this reason, the efficiency of vehicle maintenance and repair service has played an important role in the business. The efficient vehicle repair service enabled the company to streamline the logistics and transportation services to their customer. It ensures the company vehicles to receive routine or accidental maintenance and repair services when necessary, and the vehicles are able to get instant repair support during the process of delivery client's goods to the destination. The complete process flow can be summarized as the process flow chart at Figure 1.

The following specific problems were identified through the business process investigation:

- i. Response times to the received jobs have been delayed due to inefficient manual process in job assignment.
- ii. The mechanic has begun to complain as the on-going job always being interrupted by the unexpected tasks.
- iii. The current system allows only the authorized engineer or team leader access to the vehicle information. It means the mechanic needs to refer to them to get relevant information before a repair service began.
- iv. In conjunction with the new policy adopted by the workshops, the system shall be able to support with the separated testing session. However, the existing system does not provide this flexibility at this point.
- v. The job efficiency is overlooked or neglected in the current process mode. The workshop is lack of a systematic system to evaluate the mechanic performance and task efficiency

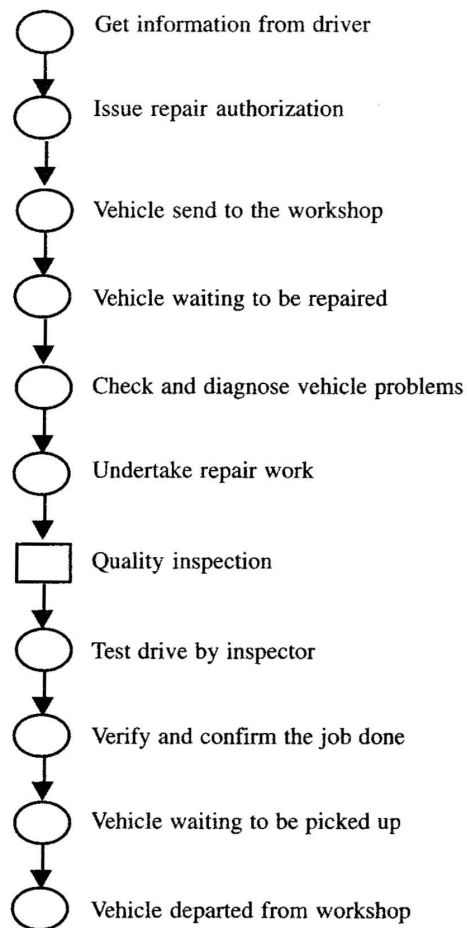


FIGURE 1
Process Flow Chart for Vehicle Repair Service

The functional requirements define the services the system is to provide for its operation. In order to satisfy the intended business needs, all the functional requirements can be further summarized in the decomposition diagram shown in Figure 2:

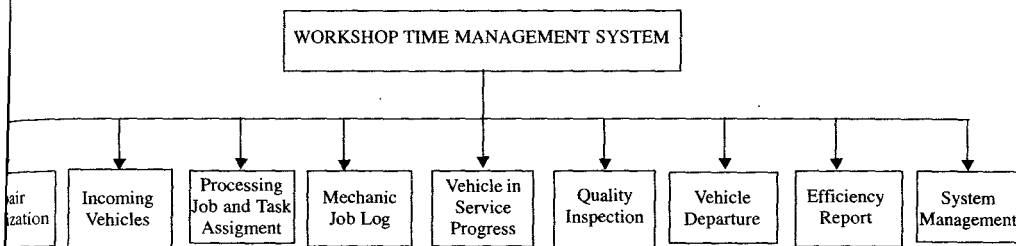


FIGURE2
Decomposition Diagram from Functional Requirements

RESULTS

The navigation of the system is controlled by a central system menu, which is known as the main menu in this context. This is followed by the sub-menus that are designed for the functions of “efficiency reports and statistics” and “system management”. Figure 3 shows the main gateway for the system upon successful logon.

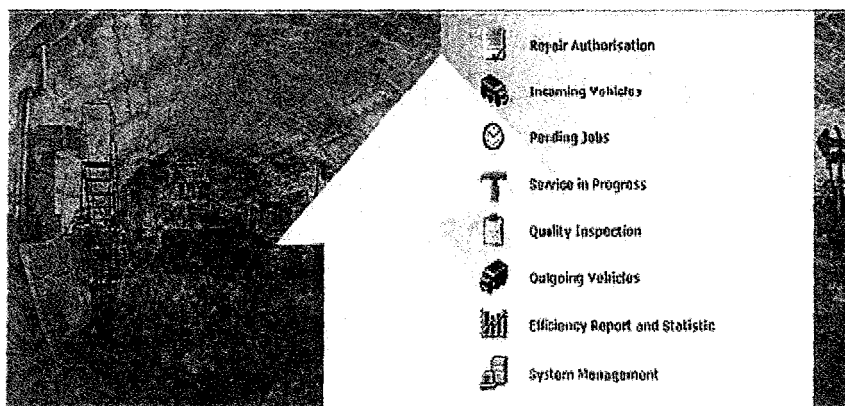


FIGURE3
User Interface for System Main Menu

Among all modules, the efficiency report and statistic is the most critical module because it caters all aspects and integration with other modules. Examples of data and result show:

- i. List of completed vehicles - Figure 4 display a list of completed vehicles.
- ii Job efficiency report - Figure 5 indicates the efficiency report that contains every detail from repair authorization till service completed.
- ii. Mechanic efficiency report – Figure 6 shows the mechanics efficiency report for every repair job done by an individual mechanics by making the comparison between the estimated completion date time with actual completion date time.

List of Completed Vehicles						
Authorization #	Vehicle No.	Estimated Completion Date	Estimated Completion Time	Actual Completion Date	Actual Completion Time	Overtime
A00034 (DEPARTED)	JNM 6677	12-08-2004	15:36	14-09-2004	08:31	754 hr 54 ms
A00023 (DEPARTED)	SCX 1369	14-09-2004	09:00	14-09-2004	22:21	13 hr 20 ms
A00041 (DEPARTED)	JNM 4678	14-09-2004	09:00	14-09-2004	22:22	13 hr 21 ms
A00044	JKL 9080	15-09-2004	14:15	15-09-2004	00:12	-14 hr 03 ms
A00043	JMN 8889	15-09-2004	09:00	17-09-2004	00:00	38 hr 50 ms
A00046 (DEPARTED)	JMN 6088	25-09-2004	02:48	18-09-2004	06:10	-164 hr 33 ms

5 Records Found

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FIGURE4
List of Completed Vehicles

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Job Service Report

Vehicle Number: JKM 6577 Truck Loaded: Yes
 Driver Code: 7895 Workshop: Johor Bahru
 Driver Name: ferry Date: 01-07-2004

Service Type: ☒ Engine Service ☐ Accident ☒ Inspection ☐ Repair

Date Arrived: 03-07-2004	Time Arrived: 12:24	
Date Complete: 14-09-2004	Time Complete: 08:31	
Driver Complaint: [1] a3 [2] a1 [3] a2		
Services Performed: --		
Spare Parts Used: Body Panels, lights etc Shock Absorbers Front Shock Absorbers Rear		
Mechanic Remarks: [1] [2] [3]		
Comment: m,kl'		

Date Testing: 11-08-2004	Time Testing: 12:30	
Status: Pass		
Remarks: the problems exists		

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FIGURE 5
Job Efficiency Report

Mechanic Efficiency Report

Workshop : A1
 Date : 15-09-2004 to 20-09-2004

Mechanic Name	Auth. #	Est. Comp. Date	Est. Comp. Time	Actual Comp. Date	Actual Comp. Time	Overtime (hr)
1. elizabeth lina	A00042	17-09-2004	20:59	17-09-2004	00:00	-20 hr 59 mi
Total Overtime :						-20 hr 59 mi

2. mech you	A00042	17-09-2004	20:59	17-09-2004	00:00	-20 hr 59 mi
	A00043	15-09-2004	09:03	17-09-2004	00:00	38 hr 59 mi
	A00044	15-09-2004	14:15	15-09-2004	00:12	-14 hr 03 mi
	A00046 *	25-09-2004	02:43	18-09-2004	06:10	-16+ hr 33 mi
Total Overtime :						-160 hr 36 mi

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FIGURE 6
Mechanic Efficiency Report

DISCUSSION

Among the strengths that have been observed are the system capabilities that allow multiple accesses from the remote locations. Having built with the web-based architecture background, the system has been purposely designed to support the users operations from various locations. This is likely to streamline the operations among the freight company and its partnering workshops without geographical limitations. As a web-based system, the clients will access to the application through the standard web browser. Thus the workshop time management system is tends to be platform independent, whereby it does not constrained by the limitation to a certain platform. While the software will be installed in the web server, it can also save trouble as no additional installations are required on the client side. The system maintenance will also become much easier, as the system can be controlled centrally in the web server. Furthermore, the GUI-based style of interaction has made system simpler and easier to learn, understand and use, especially for the user who have only the user with modest computer literary. The weakness of the system includes the risk of virus threat over the network.

As the application will be shared across the network such as Internet, both the server and clients are likely to be exposed to the virus that spreads over the network. Plus, the performance of the application will be largely dependant on the availability of the server and the traffic over the network. In another words, the application will be more vulnerable to the external environment compare to other stand alone applications. This also means additional work must be done or extra software must be installed in order to protect and secure the application from the external factors.

Following the observations of strengths and weaknesses towards the resulting system, a few areas of improvements have been determined. The security and reliability of the system are the most important areas to be further improved. Although the system have made with necessary precautions to prevent system from being accessed by the unauthorized users, however, this is never sufficient to assure the system is fully protected from external threats. Therefore, more effort must be put in the security issue, either by installing a firewall to protect the server or using any state of art software to make sure the system is secured. Whereas the reliability is refer to how well the system is working when operating

in the real environment. Regardless of how well designed, constructed, and tested the system, errors or bugs will inevitably occur. Therefore the proper system maintenance and support must be done to avoid degradation of system performance. The system must be able to complete tasks as quickly as possible without sacrificing quality and reliability of the system. In future work, the application may be further upgraded to support access from the portable hand-held devices such as mobile phone or hand-held PC. In conjunction with the future trends in mobile technology, the application must also be able to adapt this technology as a mean to survive in today highly competitive environment. Besides providing the decision support to the user, the application can be further enhanced to the knowledge-based system, which not only support the decision making, but be able to make the decision by its own. In other words, the application will have the potential to transform towards an intelligent system.

CONCLUSION

In conclusion, the Workshop Time Management System is a fully computerized web-based system designed to allow the vehicle tracking, process control, human resources planning and efficiency assessment for the intended freight company and its partnering workshops. The system is expected to help the company to solve the problems that is currently faced by the organization. At the same time, the system is designed user friendly to user to increase the learn ability and shortening the training required prior to the release of the resulting system. Towards the end, the resulting system has successfully fulfilled the objectives that have been stated at the earlier of this report. In order to make sure the development of the project is tally with the stated objectives, the project has been reviewed repeatedly and modified in order to provide a better and more efficient solution for each problem identified. Nevertheless, the Workshop Time Management System has some limitations and still reserves a great room for improvements. These limitations and improvements can be solved in the future works.

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