# Laboratory Information Management System
# For Faculty of Information Technology

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By

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## ABSTRACT

The World Wide Web not only essentially changes the way and improves many things, it also greatly changes how computer software is built. Which profound evolution of software development has caused many in the software industry to change their way of developing software. In this project, Laboratory Information Management System (LIMS) for Faculty of Information Technology (FIT) has designed and developed using Throwaway Prototyping methodology with web architecture. Therefore, the software complies with Internet Technology Communication standards and uses an industry standard relational database management system (RDBMS) combined with a platform-independent web browser interface for data entry and retrieval (the 3-tier technology). The resulting system guides the users in the Faculty of Information Technology laboratory workflow steps facilitating the management and tracking of all electric devices, which ensures that the right information in the right form is available to the right person at the right time. System will result in faster work, fewer errors, and smoother workflow for an organization.

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| | |
|---|---|
| LIMS | Laboratory Information Management System |
| FIT | Faculty of Information Technology |
| ELN | Electronic Lab Notebook |
| PC | Personal Computer |
| ICT | Information and Communication Technology |
| LAN | Local Area Network |
| IMS | Information Management System |
| RDB | Relational Database |
| SQL | Sequential Query Language |
| WWW | World Wide Web |
| HTTP | HyperText Terminal Protocol |
| HTML | HyperText Markup Language |
| FTP | File Transfer Protocol |
| ASP | Active Server Page |
| PHP | HyperText Preprocessor |
| TCP | Transmission Control Protocol |
| IE | Internet Explorer |
| CGI | Common Gateway Interface |
| URI | Universal Resource Identifier |
| URN | Universal Resource Name |
| URL | Universal Resource Locator |
| WYSIWYG | What You See What You Get |
| CMS | Content Management System |
| OS | Operating System |
| DBMS | Database Management System |
| UML | Unified Modeling Language |
| OOSAD | Object-Oriented System Analysis Design |
| VB | Visual Basic Programming Language |
| ID | Identification |

# CHAPTER 1

# INTRODUCTION

## 1.0 Background

Automation in the laboratory has created a demand for similar automation of information management with faster turnaround of data and increased access to information resources. Within the past decade, implementation of new, computerized information management systems designed to meet these needs has forced laboratories to confront the challenge of changing the way they do business. However, few issues can create the same level of turmoil as implementing a new LIMS (George et al., 2000).

Hinton (1995) the fundamentals of a LIMS. It establishes the criteria and goals of a LIMS as they pertain to a quality assurance laboratory. It may also be used as a reference in the design and implementation of a LIMS. The interest in LIMS is increasing; LIMS is a new field and encompasses multi-disciplines. A communication gap has existed between lab personnel and software uses. It is hoped that this project will enable these disciplines solve the some problem. Lab personnel must have the ability to describe the necessary LIMS requirements in terms that can be understood by a software developer. Likewise, the software developer needs to

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chance and training that will enable staff to be more skillful. Skills that match new opportunities will enhance productivity and promote future brains that the labs will needs specification for a production-quality system.

As a conclusion, the proposed prototype system is a viable solution to be implemented by LIMS for developing web-based application. The research has not yet explored other web-based gadget with HTTP browser, thus making it a comprehensive proposal. Experimentation and evaluation of the prototype using real connection cannot be done due to limited financial budget.

LIMS web based application has the following features that will benefit the users:

Provides direct, simple access to the focused valuable content via few keystrokes or text entry only. Information regarding LIMS is trimmed page to page navigation down to a minimum and hyperlink buttons are used to navigate back. Reduces the amount of vertical scrolling by simplifying the text to display.

Finally, LIMS as a meaningful application turns the conventional information retrieval into simplest web based approach. User can utilize this application via client/server network or internet. The development of LIMS prototype indicates the change of application development. This will lead to extensive improvement of LIMS application that positively impacts the future technology.

## 8.0 REFERENCES


Antelman & mendlzon (1998). *Design dynamic webpages*. New York : Winston.

Bodoff, S. (2007). *Introduction to Web Applications*, retrieved 9/7/2007 from http://java.sun.com/j2ee/1.3/docs/tutorial/doc/WebApp.html

Bryson, M. & de Castell, S. (1996). Learning to make a difference. *Gender, new technologies, and in/equity. Mind, Culture and Activity*, 2(1), 3-21.

Baumgartner, J. (2001), *The Complete Guide to Managing Traditional Brainstorming Events*. New Zealand: McGraw Hill.

Choo, C. W., Detlor, B. and Turnbull, D. (2000). *Web Work: Information Seeking and Knowledge Work on the World Wide Web*. Dordrecht, NL: Kluwer Academic Publishers.

Chiai Kim Heok, s. e. h. & Teo Kah Choo (2004). Database system. Singapore: Prentice Hall.

Clary B, Netscape Communications (2001). *Introduction to Web Applications, Some thoughts on Web Application Development*. Retrieved 8/7/2007 from http://devedge-temp.mozilla.org/viewsource/2001/web-applications/

Davis, F. D. (1989). *Perceived Usefulness, Perceived Ease of Use and End-User Acceptance of Information technology*. London: Prentice Hall.

Dan Bentley (1999). *Analysis of a Laboratory Information Management System (LIMS)*. Retrieved 30/7/2007 from http://www.umsl.edu/~sauter/analysis/LIMS_example.html

Degan, A. D. (2004). *Web-based Application Development for Small Business*, Technical White Paper Version 1.2. California: McGraw Hill.

Elliott, M. H. (2003). *Considerations for Management of Laboratory Data Scientific Computing & Instrumentation LIMS Guide*. UK: McGraw Hill.

Ghezzi, E. A, Robert, N., Wilson, H. B. (1991). *Fundamentals of Software Engineering*. New Zealand: Prentice-Hall.

George. (2000). *Implementing LIMS: A "How-To" Guide*. Retrieved on 10/7/2007 from http://pubs.acs.org/hotartcl

Hendry (1990). *Database design and information system*. Texas: A&M University

Hilton, M. D. (1995). *Fundamental of a LIMS*. California: Osborne McGraw Hill.

Holcomb, R & Tharp, A. (1991). *"Users, a software usability model and product evaluation", Interacting with computers*, Butterworth-Heinemann, Oxford, UK, Vol 3(2) pp. 155-166.

Hoffer, J. A., George, J. F & Valacich, J. S. (1999). *Modern Systems Analysis and Design* (2nd Edition). United Kingdom: Addison Wesley Longman.

Ibm.com. (2007). *Paper Prototype*. Retrieved 25/7/2007 from http://www.ibm.com

Jeffrey, B. (2001), *The Complete Guide to Managing Traditional Brainstorming Events*. New Zealand: McGraw Hill.

Kerner, S. M (2006). *Is PHP The Cure For The 'Broken' Web?*, internetnews.com, 13 September 2006.

Koprowski. (2002) and steinlechner (2001). *Design LIMS with microarray*. Texas: A&M University.

Kothari, C.R. (1985). *Research Methodology, Methods and Techniques*. Delhi: Wiley Eastern Limited.

Liberty, J. (1998). *Beginning Object-Oriented Analysis and Design*. Birmingham: Wrox Press Ltd.

Moreover, D. (1999). *Advantages of Web-Based Application Development*. New York: ACM Press.

Navathe, E. A. (2007). *Fundamentals of Database Systems*: Data Modeling Using the Entity-Relationship (ER) Data Model. New York: Prentice Hall.

Nielsen, J. (1994). *Scenarios in discount usability engineering*. Envisioning work and Technology. Book under preparation.

Nielsen, J. & Landauer, T. (1993). *A mathematical model of the finding of usability problems*. In ACM INTERCHI'93. Amsterdam, The Netherlands, April. 206-213.

Pacslabs.com. *Laboratory Information Management Systems*. Retrieved 10/7/2007 from http://www.pacslabs.com

Patric, L. (2004). *A Guidelines to Design a Web Page*. Canada: Wrox Press.
Ramsay, M. & Johnson, G (1989). *Evaluating usability of human computer interfaces*: a practical method, Ellis Horwood Ltd., Chichester, UK.
Robert, A. G., Risen, D. A & Rose, C. W. (1977). *ACM SIGDA*. Newsletter 7 (1). New York: ACM Press.
Robert, W. H. (2000). *Distributed Computer Network and Microsoft SQL 2000 Server*. London: Prentice Hall.
Raymond, M. J. (1995). *Management Information System A Study of Computer-based Information System* .Texas: A&M University.
Reiven. (2007). *Advantages Importance and Implementation Plug-Ins*. California: Osborne McGraw Hill.
Rubin, J. (1994). *Handbook of usability testing*: how to plan, design and conduct effective tests. Jhon Wiley & Sons.
Schmitt. (2006). *Engaging a Rich Web Experience*. Greenwich: Manning Publications Co.
Shneiderman, B. (1998). *Designing the User Interface: Strategies for Effective Human- computer Interaction* (3rd ed). MA: Addison Wesley.
Shawn, M. (2007). *Paper Prototyping*. Retrieved 25/7/2007 from http://www.alistapart.com/articles/paperprototyping
Speelman. (2002). *Database Independent Implementation and Programming Language*. New York: Prentice Hall.
Steele, T. W., Laugier, A. & Falco, F. (1999). *The impact of LIMS design and functionality on laboratory quality achievements*. Brazil: ACM Press.
Usabilitybok.org. *Methods: Rapid Prototype*. Retrieved 25/7/2007 from http://www.usabilitybok.org/methods/p312?section=how-to
Ullman, L. (2003). *PHP and MySQL for Dynamic Web Sites* (1st Edition). London: Peachpit Press.
Vu Thi Thanh Huong (2006) *Policy and Measures to Promote ICT Application and Deployment for Business Development in Rural Areas in Vietnam*. (Project Proposal).
Valacich, J. S., George, J. M. & Hoffer, J. A. (2004). *Essential of system analysis and design*, Prentice Hall, Upper Saddle River, NJ.
Wood, L. (Ed.). (1998). *User Interface Design*. Boca Raton, FL: CRC Press.

**Interview**

Amran Bin Abdullah. *System Analyst*. FIT, Universiti Utara Malaysia. September 3, 2007.