WORKING PROTOTYPE OF WARRANTY MANAGEMENT SYSTEM (WMS) FOR COMPUTER SALES AND SERVICES SHOPS IN UNIVERSITI UTARA MALAYSIA (UUM).

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FOR THE MASTER OF SCIENCE IN INFORMATION TECHNOLOGY UNIVERSITY UTARA MALAYSIA

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ABSTRACT

Currently, there are rapid developments and improvements of technologies that we can see with our own eyes that change the way of people works and thinking. One of the fastest technology improvement and development can be categorized into computer technology including the hardware and software system. Therefore, the need of warranty for customer satisfaction and protection is increasing everyday. Serious action and concern need to be taken into account to ensure the effectiveness and value of the computer technology. Warranty Management System (WMS) belongs to a class of a system intended to assist customer to claim computer peripherals or products warranty in a more easiest and comfortable way. This research describes the working prototype of Warranty Management System (WMS) for the computer sales and services shops in University Utara Malaysia (UUM). The Warranty Management System (WMS) is a web based application system. The process of warranty record is available online and the record will be stored in secure database. Customer does not have to bring the receipt or warranty card to claim for computer peripherals or products warranty. More, customer can also check their computer products or peripherals through the system. The Warranty Management System (WMS) will keep all the customer records with unique ID assign for each customer. Only authorized person or staff can access to the system. These new methods must attain unprecedented levels of security, speed, privacy, decentralization, and internationalization.

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LIST OF ABBREAVIATION

ATM Automated Teller Machine

HTTP Hypertext Transport Protocol

UUM Universiti Utara Malaysia

WMS Warranty Management System

WWW World Wide Web

UCD User Centered Design

IT Information Technology

MySQL My Structured Query Language

ID Identification

OEM Original Electronic Manufacturer

HP Hewlett Packard

HTML Hypertext Markup Language

.

CHAPTER 1

INTRODUCTION

1.1Background

Warranties have been studied by researchers from many different disciplines and deal with a diverse range of issues. These include historical, legal, legislative, economic, behavioral, consumerist, engineering, statistical modeling and analysis, operations research, accounting, marketing, management and societal (Murth, Solem & Roren, 2003). Most products are sold with some form of warranty. The type of warranty offered depends on the product type. Warranties serve a somewhat different purpose for customer and seller. From the customer's point of view, the main role of a warranty is to protect them and the second role is informational (Jegan, 2008).

These roles of the warranty assure the buyer that a faulty item will either be repaired or replaced at no cost or at reduced cost. Many buyers infer that a product with a relatively long warranty period is a more reliable and long-lasting product than one with a shorter warranty period. In the side of seller, warranty also provide for protection and promotion. When the products are provided with warranty by the manufacturer or supplier, then the percentage of customer to buy the product is much higher than the product without any warranty cover. Leading companies realize that warranty data is an integral component of the voice of the customer. Not only is it strategic to the bottom line, it also affect customer satisfaction and brand reputation.

Brand reputation for safety and reliability takes years to create but much longer to recover even if consumer confident is undermined by only one issue (Pritchard, 2008). Creative deployment of information system technologies can lead to new ways to differentiate products and services through customer service, while simultaneously strengthening

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References

- Accenture (2005). Maximizing the Business Impact of Warranty Management: Current State and Best Practices. White paper. Accenture 2005.
- Appliances. (2000). *Computer Support Plus*. Retrieved November 25, 2008, From GE Warranty Management Inc Database.
- Ash L.(2003). The Web Testing Companion: The Insider's Guide to Efficient and Effective Tests. First edition. Canada. John Wiley & Sons, Inc.
- Byrne, P. M. (2004). Logistics Management . *Making Warranty Management Manageable*. Retrieved November 25, 2008, From www.logisticsmgmt.com/article/ca445767.html
- Cokins, G., Pirrello, C. & Hardt, L. (2007). Discover How Analytics Makes The Difference Between Managing And Improving Performance. *Improve Performance Through Strategic Insight And Predictive Performance Management*. Retrieved November 25, 2008, From SAS Database.
- Christian Bauer, Armo Schari (1999). Acquisition and Symbolic Visualization Of Aggregated Customer Information For Analyzing Web Information System.

 Proceedings of the 32nd Hawaii International Conference on System Sciences 1999.
- Cunningham C., Song Y., Chen P.P.(2004) Data Warehouse Design to Support Customer Relationship Management Analyses. *Communication of the ACM. Dolap'04*, *November 12–13*, 2004,pg.14-22
- Compaq.com (2004) Customer Advisory: PH981130_CW01 LCD Panel Defect

 Specifications Warranty Replacement Criteria. Retrieved on 23 July 2008 at

 http://wwss1pro.compaq.com/support/reference_library...&prodid=117&source=PH

 981130_CW01.xml&dt=3&doci

- De, S. & Kumar. S. (2007). Warranty Week. *Warranty Management*. Retrieved November 24, 2008, From www.warrantyweek.com/archive/ww20071114.html
- Derrick, R. D. (2004). Rethinking Warranty Management To Achieve High Performance And Differentiation. *Outlook Point Of View*. Retrieved November 25, 2008, From Accenture Database.
- Dell. Warranty Terms and Condition. Retrieved on 23 July 2008 at http://www1.euro.dell.com/content/topics/topic.aspx/emea/topics/footer/terms?c=eu& l=en&s=gen&%7Elt=popup
- Dell Online Policy. Retrieved on 23 July 2008 at http://www.dell.com/content/topics/global.aspx/policy/en/policy?c=us&l=en&s=gen &%7Esection=010
- Fast Design. (2008). *Warranty Management Software*. Retrieved November 25, 2008, From Fast Design Technology Database.
- Gecker, R. (2006). *Business Success Case Study:* Sears Stakes Claim To Service Success With Web-Based Warranty Management System. Retrieved November 25, 2008, From Aberdeengroup Database.
- Gecker, R. (2007). IBM Targets Sales Growth And Customer Satisfaction With "Intel"-Ligent Warranty Management System. *Journal Of Business Success Case Study*.

 Retrieved November 25, 2008, From Aberdeen *group Database*.
- Ganapathy S., Ranganathan C, and Sankaranarayanan B (2004) Visualization Strategies and Tools For Enhancing Customer Relationship Management. *Communication of the ACM 2004. November 2004/Vol. 47*, No. 11..pg 3-5
- Gerald P, Learmonth and Blake Ives (1987). Information System Technology Can Improve Customer Service. *Database Winter 1987*.
- Groot, A. D. (2007). How To Turn Warranty Liability Into Profitability?: Save Costs, Improve Quality And Earn Money From Suppliers. Retrieved November 25, 2008, From Yellow & Red Database.

- Harrison. (2007). Dealership Management System. Warranty Information Management: An Electronic System For Effectively Managing Warranty Claims. Retrieved November 25, 2008, From PFW Systems Corporation Database.
- Implied Warranty. In *Wikipedia*, *The Free Encyclopedia*. Retrieved November 05, 2008, From http://en.wikipedia.org/wiki/implied warranty
- Jegan. (2008). Warranty Management Services: Raising The Bar On Customer Satisfaction And Asset Velocity. Retrieved November 25, 2008, From Computer Sciences Corporation Database.
- Jazayeri M. (2007)Some Trends in Web Application Development. Future of Software Engineering(FOSE'07) *IEEE computer society*.
- Kaner C., Falk J., Nguyen H.Q. (1993). *Testing Computer Software*. Second Edition. New York: John Wiley & Sons, inc.
- Kim H.W. and Pan S.L (2006) (Towards a Process Model of Information System Implementation: The Case of Customer Relationship Management (CRM) *The DATA BASE for Advances in Information Systems Winter 2006* (Vol. 37, No. 1) pg 59-73
- Kozyrkov, V. (2008). *Warranty Week: Warranty Management*. Retrieved November 24, 2008, From http://www.warrantyweek.com/archive/ww20081016.html
- Long, M. (2008). *Forging The Warranty Chain*. Retrieved November 24, 2008, From Aberdeengroup Database.
- Long, M. & Dutta, D. (2008). *Get Smart: Business Intelligence For Service Organizations*. Retrieved November 24, 2008, From Aberdeengroup Database.
- Mandana, S. & Mohammad, M. (2008). Warranty Management—A Neglected Source Of Competitive Advantage. Retrieved November 25, 2008, From PRTM Database.

- Marks, T. (1999). University Of Missouri Extension. Consumer Economic Update:Warranty Card. Kansas City Starr 1-10-99 (Pf-17). Retrieved November 05, 2008,From http://extension.missouri.edu/ceupdate/scripts/1999/02/warranty.htm
- Messih A. and Enss s.t. (2005) Planning And Control For A Warranty Service Facility

 Proceedings of the 2005 Winter Simulation Conference M. E. Kuhl, N. M. Steiger, F.

 B. Armstrong, and J. A. Joines, eds.pg 2102-2106
- Micom International Limited. Standard Terms and Condition. Retrieved on 23 July 2008 at file://localhost/D:/web%20development/warranty%20process/main.asp.htm#micom
- Microsoft. (2006). *Repair And Warranty Management* For Microsoft Dynamics. Retrieved November 25, 2008, From Scalable Data Systems Database.
- Microsoft. (2008). Warranty Management For Microsoft Dynamics. Retrieved November 25, 2008, From Red Maple Database.
- Murthy, D.N.P., Solem, O. & Roren, T. (2002). Product Warranty Logistics: Issues And Challenges. *European Journal Of Operational Research*, *156*(110–126). Retrieved November 25, 2008, From Science Direct Database.
- Nguyen H.Q (2003). Testing Application on the Web: Testing Planning for Internet-Based Systems. First Edition. Canada. John Wiley & Sons, Inc.
- Nguyen H.Q, Johnson B., Hackett M. (2003). *Testing Applications On The Web: Test Planning on Mobile and Internet Based Systems*. Second Edition. Canada. John Wiley & Sons, Inc.
- Pritchard, R. (2008). *Warranty Management New Rules To Apply?*. Retrieved November 25, 2008, From Infosys Technologies, Ltd Database.
- Redington. (2006). *SAP Warranty Management Solution Brief*. Retrieved November 25, 2008, From Detering Consulting Database.

- SAS. (2007). How Can We Identify Product Quality Problems And Minimize Their Effect On Our Customers And Financial Liability?. Retrieved November 25, 2008, From Sas Institute Inc. Database.
- SAS. (2008). SAS¹ Warranty Analysis. Retrieved October 28, 2008, From www.sas.com/solutions/warranty/
- SAS. (2008). Warranty Analysis: The Leading Solution For Emerging Issue Detection And Root-Cause Analysis. Retrieved November 25, 2008, From SAS Institute Inc. Database.
- Servicebench. (2008). Preventing Warranty Fraud: Understanding And Preventing

 Warranty Fraud To Enhance Your Bottom Line. Retrieved November 24, 2008, From
 White Paper Database.
- Siemens PLM Software. (2007). The Way To Higher Product Quality And Better Warranty

 Management: Digital Manufacturing For Product And Process Traceability.

 Retrieved November 25, 2008, From Siemens Database.
- Sprague, B. M. (2005). *An End-To-End Strategy for Improved Warranty Management Capabilities*. Retrieved November 25, 2008, From Accenture Database.
- Spraker, G. (2006). Warranty Financial Management. *Part 1: Defining Warranty Expense Management*. Retrieved October 28, 2008, From www.warrantyweek.com/archive/ww20060912.html
- Spinuzzi C. (2002) Documentation, Participatory Citizenship, and the Web: The Potential of Open Systems. *Communication of the ACM. SIGDOC'02*, October 20-23, 2002, pg 194-199
- Sureka A., De.s., and Varma K. (2008) A Generic Software Architecture of a Text Processing System for Analyzing Product Warranty Claims Data. *Communication of the ACM 2008*.

- TCS. (2008). *Warranty Management: Hitech*. Retrieved November 25, 2008, From Tata Consultancy Services Database.
- Unzicker, D. & Harrity, C. (2006). Warranty Week. Service After Sales: Getting The Biggest Bang For Your Buck In After-Sales Solutions Through Benchmarking.

 Retrieved November 26, 2008, From www.warrantyweek.com/archive/ww20061205.html
- Usha Chandra, Jinyu Shi, Namas Chandra (1999). Design And Implimenting Of IBIDS-An Internet Based Integrated Design System. *Communication Of The ACM 1999*.
- Vigoroso, M. (2006). Winning With Integrated Warranty Management: Managing The Pulse Of Product Quality And Performance. Retrieved November 24, 2008, From Aberdeengroup Database.
- Warranty. In *Wikipedia*, *The Free Encyclopedia*. Retrieved November 05, 2008, From http://en.wikipedia.org/wiki/warranty
- Warranty Week. (2008). *Computer Warranty Providers*. Retrieved November 24, 2008, From www.warrantyweek.com/archive/ww20080627.html
- Warranty Week. (2007). *Computer & Peripheral Warranties*. Retrieved November 24, 2008, From http://www.warrantyweek.com/archive/ww20070918.html
- Warranty Management. (2008). Claim Handling Costs. Retrieved November 25, 2008,
 From
 http://www.warrantymanagement.nl/linkclick.aspx?link=73&tabid=53&mid=404
- Warranty Week. (2007). *Dell's Warranty Accounting*. Retrieved November 24, 2008, From http://www.warrantyweek.com/archive/ww20071107.html
- Warranty Management. (2008). *Selling More Using Warranty Claims*. Retrieved November 25, 2008, From http://www.warrantymanagement.nl/linkclick.aspx?link=71&tabid=53&mid=404
- Warranty Management. (2008). *Service Levels*. Retrieved November 25, 2008, From http://www.warrantymanagement.nl/whitepapers/servicelevels/tabid/70/default.aspx

- Warranty Week. (2008). *Sigmaquest: Warranty Software*. Retrieved November 24, 2008, From www.warrantyweek.com/archive/ww20081106.html
- Warranty Week. (2008). *Telecom Equipment Warranties*. Retrieved November 24, 2008, From http://www.warrantyweek.com/archive/ww20081009.html
- Warranty Week. (2008). *Top Declines In Warranty Accruals: Warranty Cost Cutting*. Retrieved November 24, 2008, From http://www.warrantyweek.com/archive/ww20081120.html
- Warranty Week. (2008). *Top 100 Warranty Providers*. Retrieved November 24, 2008, From http://www.warrantyweek.com/archive/ww20080905.html
- Warranty Management. (2008). *Trends In Warranty Management*. Retrieved November 25, 2008, From http://www.warrantymanagement.nl/linkclick.aspx?link=67&tabid=53&mid=404
- Warranty Week. (2008). *Verizon's Extended Warranties*. Retrieved November 24, 2008, From http://www.warrantyweek.com/archive/ww20081023.html

Warranty Week. (2008). *Warranty Research Report*. Retrieved November 24, 2008, From http://www.warrantyweek.com/archive/ww20080730.html