

DEVELOPMENT OF SECURE E-COMMERCE SYSTEM SUPPORTED WITH ECRM SERVICES

**Abdalfatah Ali Abuaysha^{1*}, Said Naser Said Kamil¹, Mahmud Sad Shertil¹,
Salah A. Jowan² and Salah Alhadi Gbeg²**

¹*Department of Computer Science, Faculty of Science, Elmergib University, Email:*

²*Computer Department, Faculty of Science, Alasmara Islamic University*

** corresponding author: abdalfatah0334@gmail.com*

ABSTRACT

The online transactions have increased significantly throughout the use of web stores and applications. Consequently, this give rise to several security issues that can affect customers' information and their use of online payments. This paper introduces a study for a secure E-commerce system supported with Electronic Customer Relationship Management (ECRM) services for an online store. The development of the system has taken into consideration the importance of security and ECRM in today's E-commerce application. The developed system will significantly help to meet the requirements of the customers through providing a wide range of facilities, such as, accessibility, product catalogue, usability, feedback and automated notifications.

Keywords: security, secure E-commerce system, online transactions, ECRM.

1. INTRODUCTION

Security remain, a great concern in today online activities, there are still some that are reluctant in conducting online transaction, as a result of security challenges associated with e-commerce and online transaction (Saxena et al., 2019). Furthermore, the importance of data security and information on the e-commerce is considerably challenged as reported by (Wang et al., 2019) and (Ahmed and Rana, 2019). E-commerce activities are getting more competitive nowadays, with businesses competing against each other for huge market share locally and globally. One major way of achieving highest advantage over rival organisation is to improve their

business operations and service delivery via the use of security enhanced information system available from implementing e-commerce applications and excellent Customer Relationship Management (CRM) services (Kim et al., 2003).

To achieve success in this ever dynamic and competitive marketing place, organizations should strive to develop strong reliable and secure e-commerce system and maintain effective customer relationships services by implementing CRM system with call centre application embedded in the system. A CRM system is defined as “An approach to building and sustaining long-term business with customers, this approach can be in stages which includes select, acquire, retain and extend”. Today, organizations are also implementing web-based CRM system known as Electronic-CRM (ECRM) system (Fingar et al., 2000). ECRM system offered a wide varieties of benefits among which are customization of marketing message; product personalization; responsive feedback, cost-effective targeting; increase depth, breadth (wide coverage) and nature of relationship; lower cost; achieving a learning relationship using different tools throughout the customers life cycle (Shoniregun et al., 2004). Customers online behave differently when compare to physical environment, as such; a modern e-commerce website not only secured, but also ought to be able to identify customers’ needs (Ajay kumar et al, 2010). Moreover, promptly respond to it by providing an effective relationship that can draw and retain more customers both online from system feedback and offline through comments from word of mouth (friends and customers). Electronic CRM likes email alerts, SMS alerts; birthday greeting, feedback/comment, live chat etc, will

go a long way in achieving successful implementation of e-commerce system (Clark and Das, 2008).

This paper aims to study on E-commerce activities and Customer Relationship Management (CRM) and implement a secure E-commerce website supported with ECRM services that will enable companies to effectively manage, understand and serve the customers better, while also given the customers a new experience and conveniences.

The outline of this paper has been divided as follow. The literature review is given in the next section, and then the analysis and design are introduced. In Sect. 4, we present the implementation of the system. In Sect. 5, we discuss the system testing and we end the paper with Sect. 6 with the conclusion and our future work.

2. LITERATURE REVIEW

2.1 E-commerce

E-commerce is often confused with e-business but Efraim et al (2010) in their book “Electronic Commerce 2010, A Managerial Perspective” clarified this as below:

“E-commerce is a process of buying, selling or exchanging products, services or information via computer. It covers a range of human endeavour and may have different meaning depending on how and where it is being used, from business process, services, learning, collaborative to virtual community”.

On the other hand, E-business offers a broader view of e-commerce that include not just the buying and selling of goods and services, but also servicing customers, collaborating with business partners and conducting electronic transactions within an organization (Chaffey, 2009). According to Efraim et al (2010), E-commerce framework offers five key supports (people, public policy, marketing and advertisement, support services and business partnerships).

2.2 E-Commerce Security

The use of internet as a means of buying and selling through e-commerce comes with huge amount of security issues ranging from online payment, spamming, phishing, to identity compromise during the purchase of goods and services online. These challenges sometimes drive customers away while also having negative impact on the business survival online in terms of trust and integrity. In order to assure consumers online that their transactions are secure, and all their credit card information is safe, e-commerce site needs to use strong security measures such as firewall and secure socket layer (SSL) to protect user from hackers (SSL Shopper, 2013). Whereas, SSL using cryptography and authentications for sustaining the security of data communication (Ahmed and Rana, 2019).

2.3 Security Components of E-commerce

E-commerce security deal with two issues: protecting the integrity of business network and its internal systems; and with accomplishing transaction security between the customer and the business. E-commerce security comes in the form of user-end security (uncompromised password,

customer's device – PC, mobile device) (Gunter, 2013) as well as business end security (firewall, SSL, strong and encrypted password) (Randy and Joseph, 2002).

2.4 Comparison of Existing System

In other to identify weakness and strength of some of the existing and similar ecommerce system, the following e-commerce stores were review. They are Little SASA and BT eStore.

2.4.1 First E-commerce Store (Little SASA)

Little SASA is an online boutique store specialising in sales of kids wear and materials as well as adult ladies stuff. In terms of usability, several features are offered by Little SASA store that can give customers excellent experience while shopping online.

However, in terms of ECRM, the eStore lack good features like feedback/comment, product rating, reward system etc. Additionally, the eStore lack of several security features, for instance, the site does not accept the online payment directly.

2.4.2 Second E-commerce Store (BT Solutions)

BT Solutions eStore is a company of business that sales computer hardware, software, and accessories. A number of features are presented by BT Solutions, for example, product categorization and details; search tool, contact us, payment and delivery information.

On the other hand, in terms of ECRM, features like Contact us (for feedback) and newsletter, order history, wish list etc will go a long way in

retaining more customer. Also, the security features are however low compare to what is expected of a modern day eStore and considering the fact that online attackers are busy defining new way of attacking unsuspected users.

3. ANALYSIS AND DESIGN

3.1 Development of Functional Modules for the System

The proposed system is expected to have three functional modules, namely customer module, staff/admin module and ECRM modules. This is to ensure strong implementation and integration purposes.

3.1.1 Customer Module

This system module will have a web presentation interface for customers to have access and interact with the company's E-Commerce products and services. Features here will include customer registration, online ordering, product search.

3.1.2 ECRM Module

This system module will provide ECRM features aimed at making customers shopping experience better and improved. Most of the activities/functionalities here will be automated with less intervention from either the company staff or the customer themselves. Features here will include live chat, birthday alert, feedback/comment and product notifications.

3.1.3 Staff/Admin Module

This module will provide all the required resources for the company to manage product inventory, process customer orders, accuracy of the online information and other activities to help making the e-commerce a worthy investment.

3.2 Interface Specification for Functional Modules

The interface specification for the functional modules is going to be a web-based interface that will allow interaction and accessibility across the client/customer's web browser, with navigation links to the products and services available.

3.3 UML Diagrams

UML diagram is designed to let developers and customers view a software system from a different perspective and in varying degrees of abstraction. The UML uses mostly graphical notations to express the design of software projects. Using UML diagrams, we can represent system description with use case, class diagram, sequence diagrams.

3.3.1 Use Case Diagrams and Description

A Use Case Model is used to describe the proposed functionalities of a new system. It defines set of interactions between external user (actor) and the system necessary to deliver the service that satisfies the goal. This interaction is a single unit of meaningful task, to be built in the proposed system, which can include another Use Case's functionality or extend another Use Case with its own behaviour.

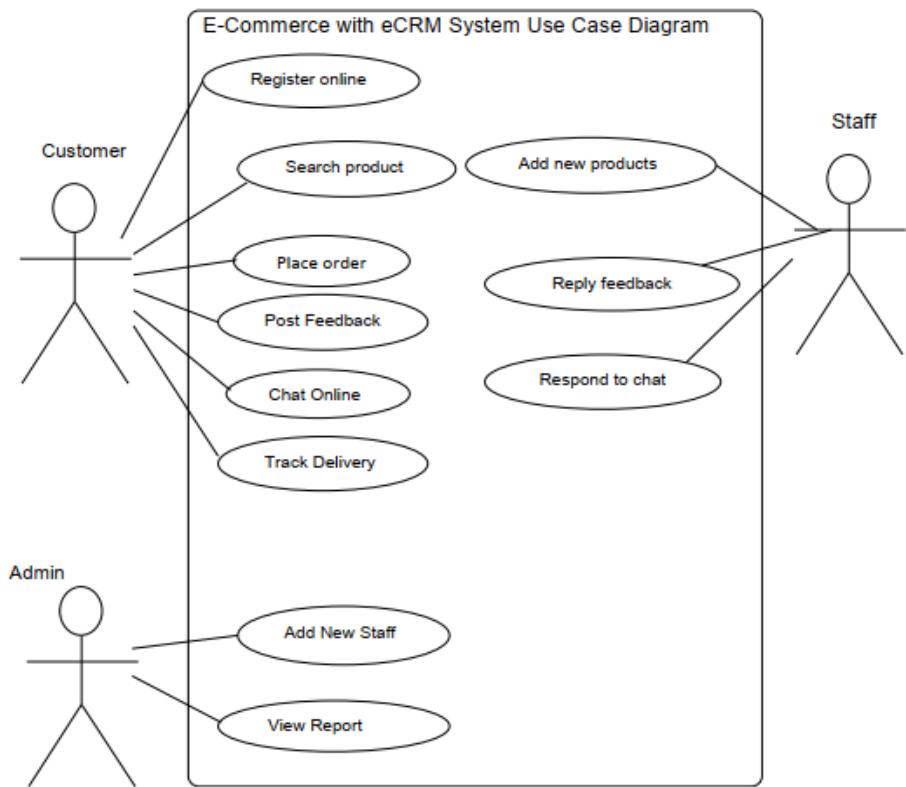


Figure 1: E-Commerce with ECRM System (Use Case Diagram).

3.3.2 Class Diagram

Class diagram is used to present the overall object interaction within the system boundary. The Class diagrams are widely used to describe the types of objects in a system and their relationships, attribute and methods.

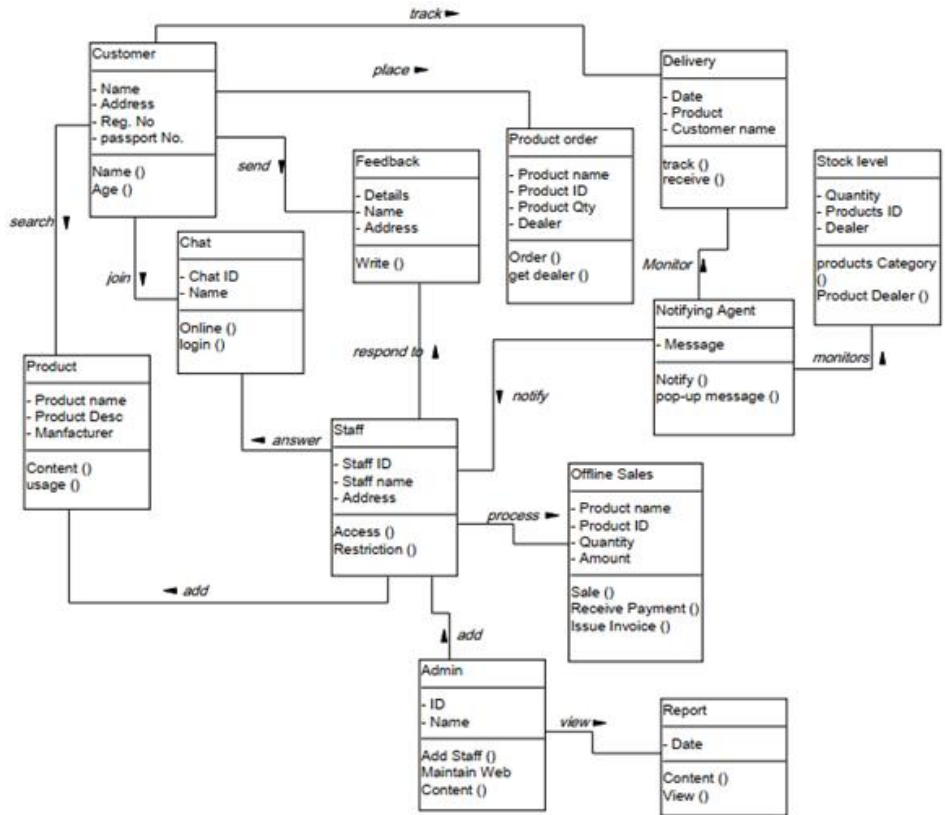


Figure 2: The Class Diagram

3.3.3 Sequence Diagram

Sequence diagrams demonstrate the behaviour of objects in a use case by describing the objects and the messages they pass. Sequence diagrams are read from left to right and descending.

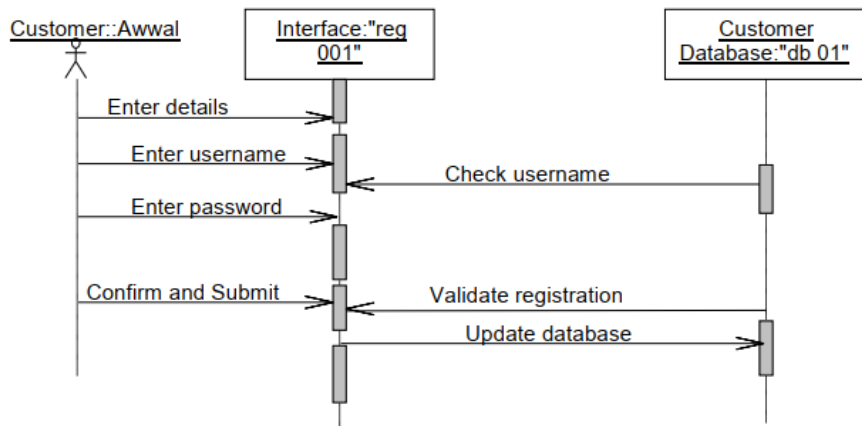


Figure 3: Register as a customer.

4. IMPLEMENTATION

This section focuses on implementation processes, activities and technologies detail for the full implementation of the system. This implementation process includes the client platform (presentation layer), the business tier (sales transaction) and data tier (server side) and how all the tiers effectively interact and send request to each other. This system implementation is a web-based application that allows customers/consumers to access range of products available online, place order for it, and tracks their shipment till such product gets to them; interested customers can also register on the e-commerce site.

The system implementation required a programming language (Visual Basic.Net), a web server (IIS 7) because it's been developed on .Net framework. Other technologies are Active Server Page.Net (ASP.Net)

which is a server-side scripting, JavaScript – a client-side scripting, Ajax tools and Microsoft SQL Server (that provide database design and implementation).

4.1 Architectural Design of the System

The architectural design of the system falls into three, namely, the presentation layer, the business logic and the data tier layer. All these are developed with a combination of more than one tool as presented in the subsequent section below.

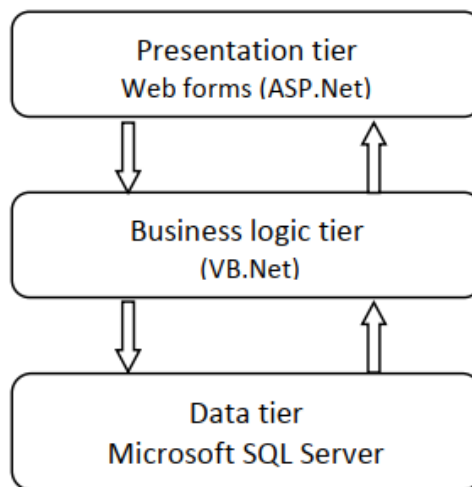


Figure 4: The 3-tier architecture of the ECRM system.

4.1.1 Presentation Layer ASP.Net

The presentation layer for this system is design with Microsoft's Active Server Page.Net (ASP.Net) as it offered opportunities to create dynamic web pages using its drag and drop features. ASP.Net also supports code written in compiled languages such as Visual Basic, C#, and J#, and it

features server controls that can separate the code from the content, allowing easy editing of the web interactive page. All ASP.Net files in this system ended with the .aspx extension. ASP.NET provides better reusable components compare to typical HTML controls with its tag-like syntax for declaring the various controls used on a web page. With the help of this tool, customers will be able to conveniently interact with the ECRM system.

4.1.2 Business Logic Tier (VB.Net)

The business logic layer provides platform for interactions, transaction activities, product management, inventory management, sales management and other business-related activities. This tier involved active programming and is developed using VB.Net and ASP.Net, several classes were declared here to achieve the targeted business solution for ECRM. The codes from this tier served as the major backbone for the business logic.

4.1.3 Data Tier (Database Design with Microsoft SQL Server)

Microsoft SQL Server (MSSQL) database will used to design the database that will hold customer's information, product inventory information, transaction details and other related information required of an E-Commerce website. The data tier consists of the database implementation for the system, and various database tables that provides a backend support for user's request and retrieval.

5. SYSTEM TESTING

This section covers the testing applied on the developed system to ensure that the system can run perfectly without any errors. The aims are to identify

the likely errors and correct same before final deployment of the system. There are two predominant testing methodologies: black-box and white-box testing.

5.1 Test Plan – Black Box Testing

Black-box test design treats the system as a "black-box", so it doesn't explicitly use knowledge of the internal structure. Black-box test design is usually focus on testing based on the functional requirements. Testing that falls into this category includes behavioural, functional, alpha testing, beta testing, system testing.

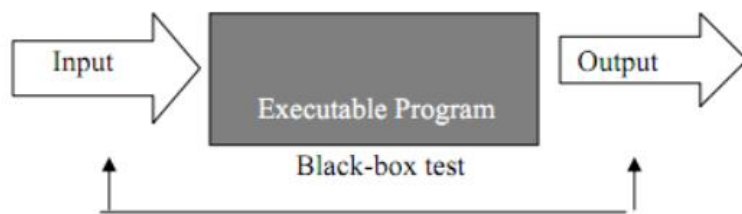


Figure 5: The Black Box Testing.

A black-box test considers only the input and output of the software without regard to the internal code of the program. Black-box testing attempts to find errors in the external behaviour of the code in the following categories: incorrect or missing functionality; interface errors; behaviour or performance errors etc. Through this testing, we can determine if the functions appear to work according to specifications.

5.1.1 Functional Testing

Functional testing is a form of black-box testing, and it covers the whole system to identify any missing functions or errors associated with such functions. A sample test plan is presented below.

TABLE 1: TEST CASE OF NEW CUSTOMER REGISTRATION.

Test Case ID	F002	
Procedures	1. Click on the “Register” link to start the registration process 2. Fill in the required details and click on the “Submit” button to proceed	
Input data	1. First Name: Fatah 2. Last Name: Ali 3. Username: Fatahali 4. Email: wwwa_nw@yahoo.com 5. Confirm password: same as above 6. Date of birth: 05/10/1987 7. Phone: 0927222339	
Expected result	1. Registration successful and user is re-directed to user’s home page with his username appearing on top.	
Test result	Pass: √	Fail:

5.2 Security Testing

This is also, a black box testing of the system security features to ensure customer information and transactions are safe.

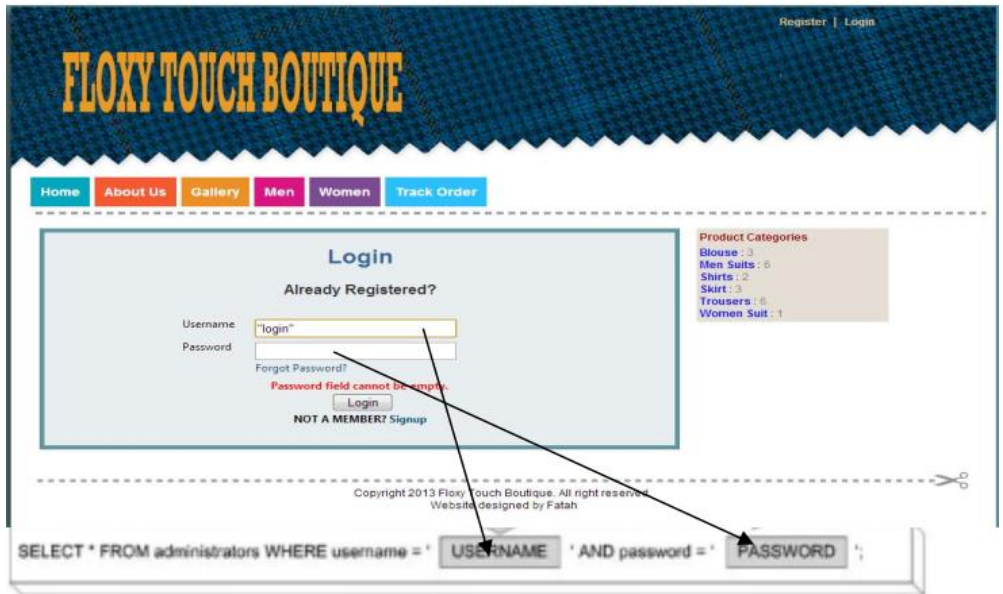
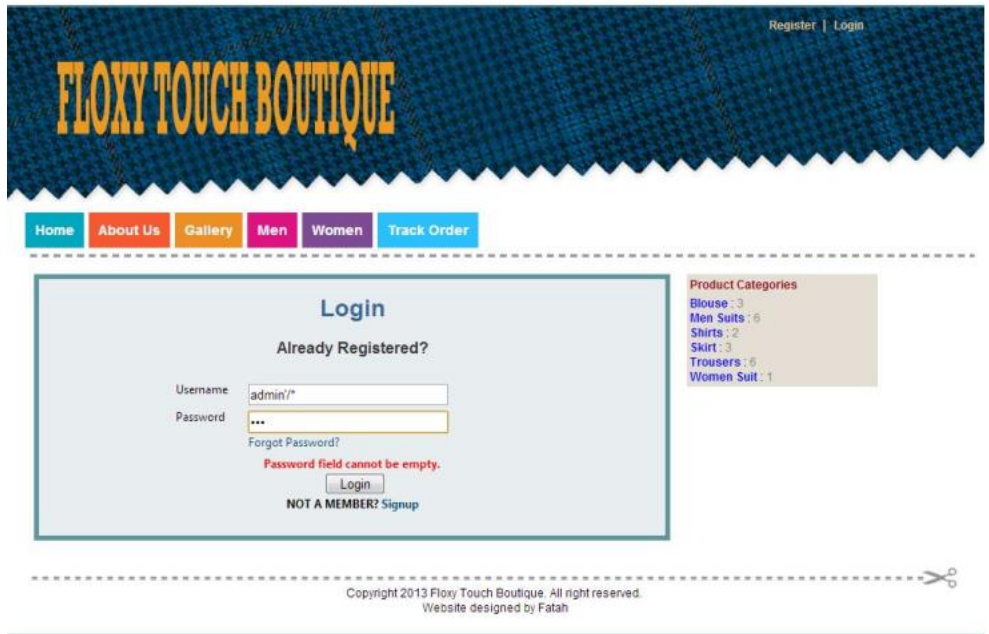


Figure 6: SQL Statement Creation.

5.2.1 Using Multiline Comments

In this attack, we use the Username field to select the user we want and start the comment with the “ /* ” sequence. In the Password field we finish the comment “ */ “ and we add the single-quote sequence to end the statement syntactically correct with no effect on the result.



The screenshot displays the Floxy Touch Boutique website. At the top, there is a navigation bar with links: Home, About Us, Gallery, Men, Women, and Track Order. Below this is a login section titled 'Login' with the subtext 'Already Registered?'. The login form includes fields for Username (containing 'admin/*') and Password (containing '***'). There is a 'Forgot Password?' link and a 'Login' button. A red error message states 'Password field cannot be empty.' Below the login form is a link for 'NOT A MEMBER? Signup'. To the right of the login form is a 'Product Categories' section listing: Blouse : 3, Men Suits : 6, Shirts : 2, Skirt : 3, Trousers : 6, and Women Suit : 1. The footer contains copyright information: 'Copyright 2013 Floxy Touch Boutique. All right reserved. Website designed by Fatah'.

Figure 7: shows the part of the SQL Multiline Comments that can be manipulated.

5.2.2 Cross Site Scripting Assertion

This assertion is available only for the Cross Site Scripting Scan and automatically added as well, it checks the response for the same injection strings that were sent with the parameter (read more) and also allows you to specify a script that populates a list of URLs to check separately for the send XSS tokens (Imperva, 2013).

The script alternative is useful if you for example are posting data into a system via a REST or SOAP interface where the immediate response is never viewed in a browser, but a separate page might make the posted data

available to end users – this page should then be checked for an eventual XSS vulnerability.

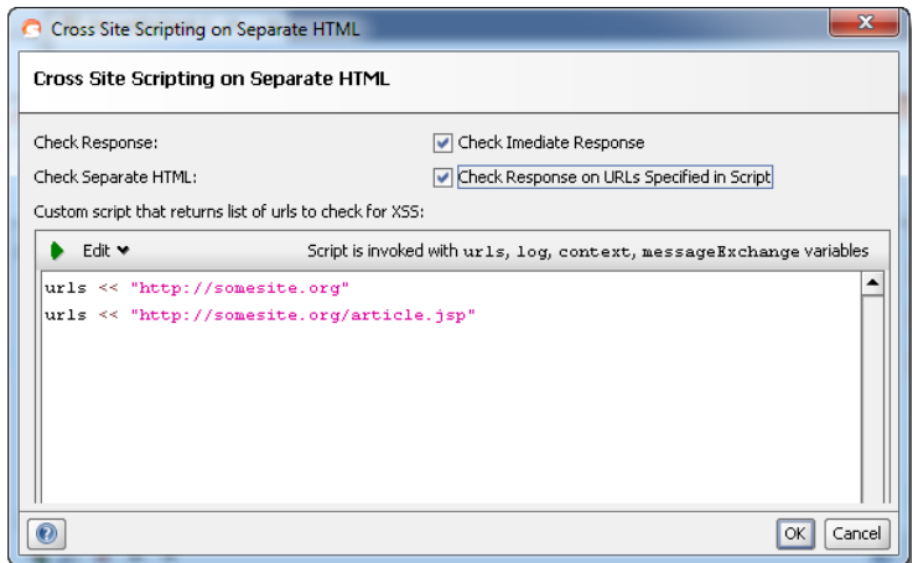


Figure 8: Cross Site Scripting Assertion.

The deployment of the Online System consists of both a window based and web-based interface, hence expected can be access by the staff through its windows and web interface while customer can access it only through a web browser. As a result of this, the system is tested for browser compatibility on the following browsers (Firefox, Chrome and Internet Explorer) and it has been found that it works perfectly as expected.

6. CONCLUSION

This paper has presented a secure E-Commerce system supported with ECRM services for an online store. Several advantages can be gained by the adoption of the developed system, for instance the ease of access and high

level of security. As known, technologies changes rapidly, coupled with increasing and dynamic human requirement which required matching technologies to satisfy those needs. Therefore, continuous changes and updates will be necessary for the developed system.

As a future work several improvements are suggested. Firstly, real time web surveillance. This will allow the company to monitor customer's reactions to the online products in a real time deliver using bar chart or pie chart. This will be showing dynamically and in real time as customers are either searching, making purchase or just viewing the product. Also, mobile application can be developed so that customers can access the application on their iPad, iPhone and other mobile devices. This will ensure deep penetration to wide range of customers and ease of services. Furthermore, a tool may be integrated into the website to translate the display language into other major languages. A tool that can support multi-currency on the e-commerce site can be integrated so as cater for the need of customers that may preferred their order to be paid for in another currency.

REFERENCES

- [1] S. Saxena, S. Vyas, B. S. Kumar, and S. Gupta. (2019). "Survey on Online Electronic Paymentss Security." In *2019 Amity International Conference on Artificial Intelligence (AICAI)* (pp. 756-751). IEEE.
- [2] W. Zhaoqing, Y. Zhao, and G. Zhong (2019). "Public-Key applications in E-commerce." In *Journal of Physics: Conference Series* (Vol. 1213, No. 4, p. 042083). IOP Publishing.
- [3] A. Tooba and R. Tauseef. (2019). "Secure Architecture for E-commerce Websites." *Sir Syed University Research Journal of Engineering and Technology*, 9(1).
- [4] A. kumar, A. Tejaswi, L. P. Koyi, G. N. Rao, S. S. Illapu. (2010). "CRM System Using PA-AKD Approach of D3M." Available from, *International Journal of Computer Science and*

- Information Technology*. Volume 2, Number 2, April 2010. Available online at: <http://airccse.org/journal/jcsit/0202csit9.pdf>
- [5] D. Chaffey (2009). "E-Business and E-Commerce Management, Strategy, Implementation and Practice." 4th Edition, *Pearson Education Limited*.
 - [6] E. Turban, D King, J. Lee, T. P. Liang, D. Turban (2010). *Electronic Commerce 2010, A Managerial Perspective*, Pearson Education Incorporation.
 - [7] P. Fingar, H. Kumar and T. Sharma, (2000). "Enterprise E-commerce: The Software Component Breakthrough for Business-to-Business Commerce." *MeghanKiffer Press*, Tampa.
 - [8] G. Ollmann (2013). "Web Based Session Management: Best practices in managing HTTP-based client sessions." Available at: <http://www.technicalinfo.net/papers/WebBasedSessionManagement.html>
 - [9] Imperva (2013). "The Cross Site Scripting." Available online at: http://www.imperva.com/resources/glossary/cross_site_scripting.html
 - [10] K. Jonghyeok, S. Euiho, and H. Hyunseok. (2003). "A model for evaluating the effectiveness of CRM using the balanced score card." *Journal of Interactive Marketing*, Volume 17/Number 2/spring 2003, Pg. 5-19. Available online at: http://www.livros.online.pt/ideias/pdf/IOP_EvaluatingCRM_scorecard.pdf
 - [11] S. Shoper (2013). "The Purpose of Using SSL Certificates." available online at: <http://www.sslshopper.com/why-ssl-the-purpose-of-using-ssl-certificates.html>
 - [12] C. Paul and D. Neel. (2008). "Exploring the Use of ECRM Element and Effective Website Design Tools." *Journal of Technology Research*, Available online at: <http://www.aabri.com/manuscripts/08125.pdf>
 - [13] C. Randy, Marchany and J. G. Tront (2002). "E-Commerce Security Issues." *Proceedings of the 35th Hawaii International Conference on System Sciences – 2002*. Accessible online at: http://www.hicss.hawaii.edu/hicss_35/hicsspapers/pdffdocuments/inisc01.pdf
 - [14] Shoniregun, C. A., A. Omoegun, D. Brown-West and O. Logvynovskiy. (2004). "Can ECRM and trust improve EC customer base?" *Proceedings of the IEEE International Conference on E-Commerce Technology*, IEEE Computer Society.