A Reference Model for Smart Tailor Applications Development

Haslina Mohd[#1], Rohaya Dahari[#2], Zahurin Mat Aji[#3], Nor Iadah Yusop[#4], Zaharin Marzuki[#5]

[#1-5]*School of Computing , Universiti Utara Malaysia*
06010 UUM, Sintok, Kedah, Malaysia.
[1]haslina@uum.edu.my.edu
roha@uum.edu.my
zahurin@uum.edu.my
noriadah@uum.edu.my
zaharin@uum.edu.my

[#1-5]*Institute of Advanced Smart Digital Opportunities (IASDO)*
School Of Computing
Universiti Utara Malaysia
06000, Sintok, Kedah, Malaysia

Abstract— **Practitioners in the Malaysian fashion and garment industry, particularly, tailors and fashion designers are facing various challenges in satisfying the supply and demands of their garment products because of them are still providing their products and services through traditional ways. In order to sustain their businesses and remain competitive, they need to transform their current practice in fulfilling customers' demands. In tackling this issue, this paper presents a reference model of Smart Tailor application for the garment industry practitioners. This is proposed to help reduce the time and increase the efficiency in the fulfilment of the clothing supply and demand. The study adopted the Inception and Elaboration phases of the Rational Unified Process (RUP) in developing the reference model. Starting with the Inception phase, the goal and business requirements were identified using the business model canvas approach, whilst the list of requirements was verified. In the Elaboration phase, the list of requirements was transformed into Smart Tailor design components using the Unified Modelling Language approach. Finally, the verified requirements and design components become a Reference Model of Smart Tailor for garment industry practitioners. The reference model may contribute to garment industry practitioners such as software developers, tailors, and fashion designers as well as to researchers and decision makers in the garment industry domain.**

Keywords— *Reference Model, Smart Tailor, Software Development, Rational Unified Process*

International Journal of Supply Chain Management
IJSCM, ISSN: 2050-7399 (Online), 2051-3771 (Print)
Copyright © ExcelingTech Pub, UK (http://excelingtech.co.uk/)

1. Introduction

Fashion or garment industry supplies clothing to meet various sophisticated consumers demands. This industry is among the high value sectors that support a significant number of economies and individual incomes around the world [1][2]. Nevertheless, practitioners in this industry, especially tailors and fashion designers in Malaysia are facing various challenges in satisfying the supply and demands of their garment products because most of them are still providing their products and services through traditional ways. In order to sustain their businesses and remain competitive, they need to transform their current practice in fulfilling customers' demands. Therefore, a Smart Tailor application is proposed to automate the process in the tailoring industry that specifically focusing on the process related to tailors, designers and customers. The Smart Tailor is an application system that enables tailors and fashion designers to promote, manage and fulfil the supply and demands of their products via electronic platform. Most importantly, the system helps to reduce the production time and increase efficiency. Moreover, the use of technology helps to improve the capability of the garment industry players such as tailors, fashion designers, retailers, wholesalers and manufacturers to share data and make better business decisions [1].

Dealing with any system or software development project, one has to acknowledge the importance of emphasizing on the successful criteria of project

management because the probability of ending with failure is high. For instance, the report by Standish Group CHAOS Database [3] indicates that the out of the total Government Software Projects from the fiscal year of 2010 to 2014, 13% are successful, 58% challenges, and 29% failed. Among the causes of failure are inabilities to meet deadlines and achieve the software quality standard as well as project cancellation. Classic CHAOS metrics on successful projects are those completed on time, within budget, and met the scope. On the other hand, challenges projects are those completed over budget, late, and or have unsatisfactory target. Failed projects are projects that were either cancelled prior to completion or not used after implementation. Ahmad & Seet [4] state three classifications of software project failure causes, which are project (53%), systems (36%) and user (11%) failures. From the software developer perspective, the failures of software development are often due fraught difficulties.

Since the software development industry is still maturing [5], the construction of a reference model is important as a guideline to the software developer to ensure that they are developing an application that fulfils user requirements. In addition, the model helps in reducing the cost and increasing the efficiency of the software development. Hence, the software quality is increased and the software failure is lessened.

A reference model is an abstract framework or domain-specific ontology consisting of an interlinked set of clearly defined concepts produced by an expert or body of experts in order to encourage clear communication [6]. On the other hand, Armstrong Process Group [7] defines reference model as a group of functionalities that is classified into related elements, together with relationships among those elements. The model is also about finding common abstractions to the current systems and to provide a basis for the development of these applications [8]. In this study, a reference model is defined as a group of classes or object entities together with details descriptions, relationship and multiplicity among classes verified and validated by knowledge and domain experts to avoid miscommunication between software client and software developer. The proposed reference model may reduce the software development time and effort, which then may reduce the development cost of the software application. Therefore, by referring to the reference model, the risk of software failure caused by over budget, beyond schedule, and incomplete requirements can be reduced. This study aims to construct a requirement model of the Smart Tailor for software developer.

The Smart Tailor comprises of various components and is divided into 3-tier architecture: Presentation Layer, Business Process Layer, and Data Layer. This architecture is very important to provide a guideline to any software developers in the future. In addition, the detail descriptions of each component can be represented in a reference model of the Smart Tailor. The reference model can be used to create standards for each component in the Smart Tailor architecture. This may also assist software engineers or developers to develop the Smart Tailor applications including mobile applications for tailors, designers, and customers. In order to provide the standard, detail descriptions for each component are described in this paper. The following section discusses on the previous study related to reference model followed by the methodology, findings, and conclusion.

2. Reference Model for Software Development

With regards to system development, various forms of reference models were introduced to meet different purposes. In this paper, the reference model aim to bridge between organization and project dimensions [9] to ensure that the developed software can operate successfully across geographic and cultural [10], to enable application to run on multiple platforms [11], to bridge the gap between the data model and business process re-engineering for electronic markets [12] are described.

A reference model for global software development focuses on the strategic position in relation to the process namely the organization and project dimensions. The organization dimension emphasizes on the planning stage for global software development and mainly focuses on the management aspects of software development such as the strategic- and tactical-operational planning. The project dimension, on the other hand, focuses on the software development project administration dimension that involves the coordination of activities related to the project [9].

In addition, a reference model facilitates successful distributed development of software system for a typical multinational company. The

model is created in the form of rich descriptions of best strategies that can be used as a reference against which to compare existing distributed development practice in a company, or as a reference point for companies interested in moving into distributed development. The model discusses on the factors that enable such companies to operate successfully across geographical and cultural boundaries [10].

Calvary presents a unifying framework that structures the development process, which enables applications to run on multiple platforms. The framework focuses on the user interface that is capable of adapting to variations of the context of use while preserving usability. The framework is devised to compromise the needs of multiple computing platforms due to the proliferation of computational devices at that time [11].

Schmid and Lindemann create a reference model that attempts to bridge the gap between the data model and business process re-engineering for electronic markets. The reference model is in the form of meta-model which is necessary for the development of application-relevant models of specific electronic markets [12].

The introduction of various reference models is deemed important to facilitate the development process of the system as the advancement of technology is so rapid and the public become more demanding. Hence, to meet the demand of garment industry, this paper proposed a reference model that can be used to facilitate the development of Smart Tailor application related to the industry.

3. Methodology

The Smart Tailor application was developed following the steps stipulated in the adopted Rational Unified Process (RUP) methodology proposed by Jacobson [13]. The processes in RUP methodology are structured into set of phases consisting of Phase I (Inception), Phase II (Elaboration), Phase III (Construction), and Phase IV (Transition).

During the inception phase, the basic idea and structure of the project is determined. For this purpose, a series of focus group discussions and analyses of literature were conducted in order to define the problem, understand the business model and identify the baseline requirements of the proposed system. The stakeholders of the system and their roles were identified. In addition, current practices, online reports and company profiles were also studied. Next, the requirements of the system are gathered. Subsequently, a list of requirements for the corresponding system was developed and followed by the development of a use case diagram to represent the main functionalities of the Smart Tailor.

Following these, all the use case specifications were developed together with the corresponding activity diagrams as well as the initial sequence diagrams. This involves iterative processes of requirements elicitation, analysis and negotiations with participants, and documentations. The purpose is to rectify any misunderstanding or misconception in the requirements and thus confirm that requirements are correctly defined. To enable this, series of meetings involving the identified relevant parties are performed to review the Smart Tailor reference model.

The elaboration phase involves specifying details of the Smart Tailor Application by representing them as detailed class diagrams. In addition, the class diagram for the Smart Tailor application was also constructed to depict the relationships of entities that are existed in the system. Finally, these were represented as a Smart Tailor Reference Model as describe in Section 4.

4. Findings

The Smart Tailor platform has three main users: tailor, designer, and customer. The customer is categorized as Individual and Business Customers. Individual Customer is a customer that requests a made-to-measure service for himself or herself. On the other hand, Business Customer refers to a boutique owner or related Small-Medium-Enterprise (SME) that focuses on producing and selling of a large quantity of clothing. On top of these three main users, the platform is also accessible by the public as guests. The guests can view certain information in the Smart Tailor Platform. However, to request a service they must upgrade themselves as a registered user (Individual or Business Customer).

A reference model of Smart Tailor is presented as a class diagram as shown in Figure 1 (Refer to Appendix 1). The reference model is comprised of eight classes: Tailor, Designer, Customer (Business and Individual Customer), Job Specification, Wardrobe, Gallery, Materials, Job Progress.

The details for each class are described in Table 1 (Refer to Appendix 1). The pre-condition refers to the mandatory requirements that need to be fulfilled by the users namely Tailor, Designer, and Customer (Individual and Business Customer) in order to allow them to perform related functionalities in the Smart Tailor platform. The post-condition is the result of the functionalities performed by the users or guests of the Smart Tailor Platform. The Relationship reflects the relation between classes. In addition, the multiplicity of the relationship either one to one, one to many, or many to many among classes is also stated. Attribute refers to the main features that a class or an object entity must possess, and Method refers to the class behaviours to perform functionality related to the class

4. Conclusion

The main objective of this paper is to construct a reference model for Smart Tailor applications development. The reference model of the Smart Tailor is composed of eight classes namely Tailor, Designer, Customer (Business and Individual Customer), Job Specification, Wardrobe, Gallery, Materials, Job Progress. The class is also known as object entity that involves in the Smart Tailor platform. The details description for each class is also discusses in the paper. The reference model is important as a guideline to the Smart Tailor developers. It may reduce the development time and effort, hence reduce the development cost. In addition, the relationship among classes are also discusses, that may reduce the risk of software defect and failure because the class diagram of the Smart Tailor is clearly show the main attributes or characteristics, methods or the main functionalities for the Smart Tailor's object entities.

Acknowledgments

The authors would like to thank the Research and Innovation Management Center (RIMC), Universiti Utara Malaysia for awarding the University Grant to us. We also would like to express our appreciation to all research members for the cooperation, and commitment in completing this research.

References

[1] Nenni, M. E., Giustiniano, L., & Pirolo, L., "*Demand forecasting in the fashion industry: A review"*. International Journal of Engineering Business Management, Vol 5, pp. 37-42, 2013.

[2] De Felice, F., & Petrillo, A., "*Key success factors for organizational innovation in the fashion industry"*. International Journal of Engineering Business Management, Vol 5, pp. 27-37, 2013.

[3] The Standish Group International. *Haze*. Retrieved on Feb 12 2018 from https://www.standishgroup.com/sample_research_files/Haze4.pdf

[4] Ahmad, N. H., & Seet, P. S. "*Dissecting behaviours associated with business failure: A qualitative study of SME owners in Malaysia and Australia*". Asian Social Science, Vol 5, No. 9, 98, (2009).

[5] Prikladnicki, R., Audy, J. L. N., & Evaristo, R. "*A reference model for global software development: findings from a case study*". In Global Software Engineering, 2006. ICGSE'06. International Conference on (pp. 18-28). IEEE. (2006, October).

[6] Narasimhan S. and Chundury, Jagadish, "Enterprise Digitization Patterns: Designing, Building, and Deploying", Chennai: Notion Press, 2018. eISBN 97-1-948473-91-0.

[7] Armstrong Process Group. "Understanding Reference Models and Reference Architectures", presented at SATURN, Software Architecture Conference, Portland, Oregon, 2014.

[8] Koch, N. and Wirsing, N., "The Munich Reference Model for Adaptive Hypermedia Applications", In procceding of International Conference on Adaptive Hypermedia and Adaptive Web-based System, AH2002: Adaptive Hypermedia and Adaptive Web-Based System, pp. 213-222, 2018. Retrived on Feb 13 2018 from https://link.springer.com/chapter/10.1007/3-540-47952-X_2

[9] Prikladnicki, R., Audy, J. L. N., & Evaristo, R. "*A reference model for global software development*". In Working Conference on Virtual Enterprises (pp. 369-378). Springer, Boston, MA. (2004, August).

[10] Lings, B., Lundell, B., Agerfalk, J., & Fitzgerald, B. "*A reference model for successful Distributed Development of Software Systems*". In Global Software Engineering, 2007. ICGSE 2007. Second IEEE International Conference on (pp. 130-139). IEEE. (2007, August)

[11] Calvary, G., Coutaz, J., & Thevenin, "*DA unifying reference framework for the development of plastic user interfaces. In Engineering for human-computer interaction*", pp. 173-192. Springer, Berlin, Heidelberg, (2001).

[12] Schmid, B. F., & Lindemann, M. A. "*Elements of a reference model for electronic markets*". In System Sciences, 1998., Proceedings of the Thirty-First Hawaii International Conference. Vol. 4, pp. 193-201, IEEE. (1998, January).

[13] Jacobson, S. "*The Rational Objectory Process - A UML-based Software Engineering Process*". Rational Software Scandinavia AB. Retrieved 2014-12-17, (2002).

Appendix 1

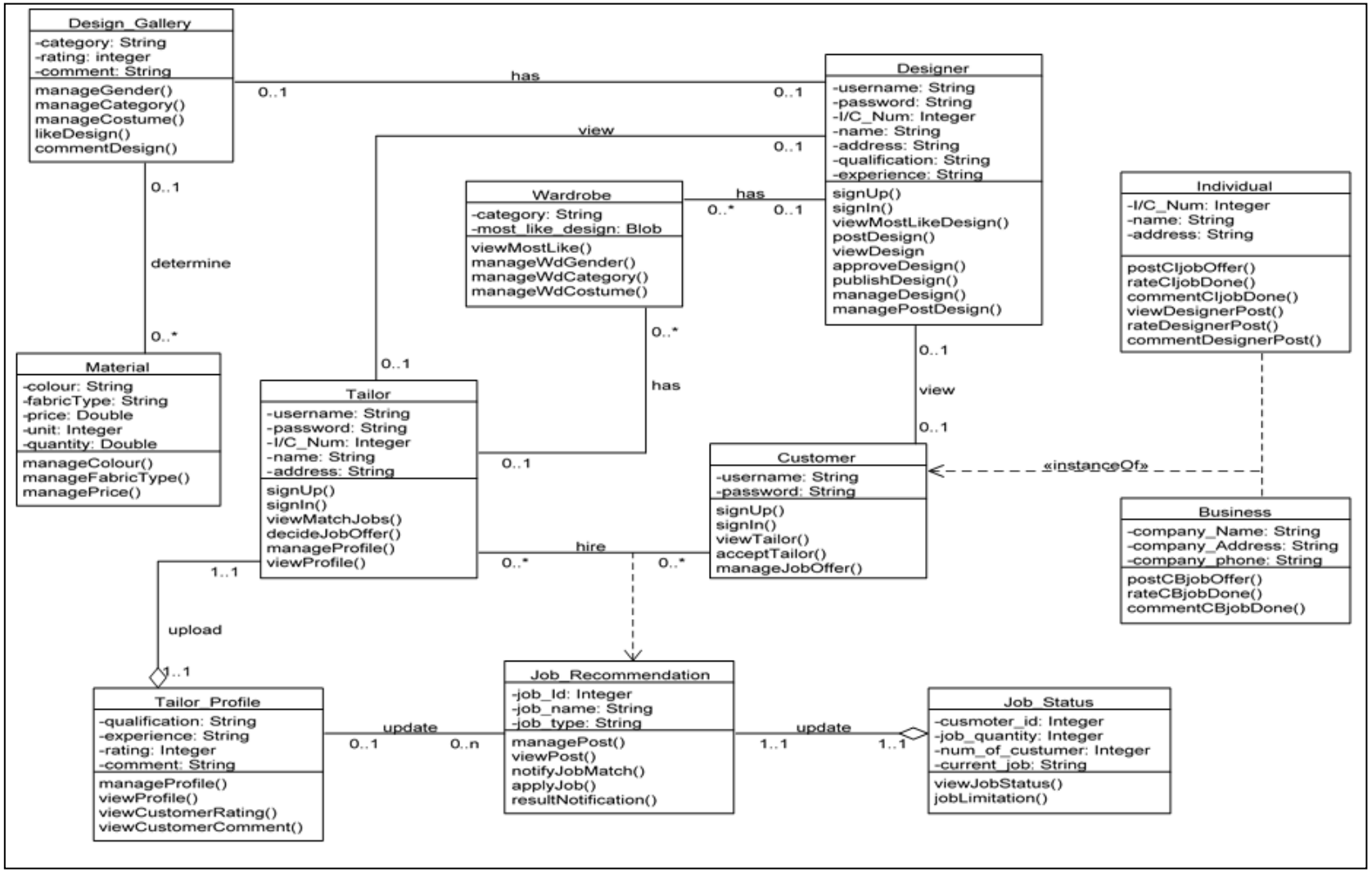

Figure 1 A Reference Model of Smart Tailor

Table 1. Smart Tailor Classes Details

No	Class	Description	Pre-condition	Relationship and Multiplicity	Attributes	Main Operation
1	Tailor	Tailor is a person who perform all the processes started from preparing the clothing pattern based on the stipulated measurement, cutting the material, and sewing the dress. The tailors can have their own wardrobe to display their ready-made clothing.	Tailor must register as one of the Smart Tailor users.	Tailor has many Customers, Tailor can have one or more Designer, Tailor has one or more Wardrobe.	tailorID, tailorName, tailorAddress, tailorQualification, tailorExperience	manageProfile, viewMatchJobs, decideJobOffer, viewProfile, viewTestimony
2	Designer	Designer is a person who designs a clothing according to customer's requirements.	Designer must register as one of the Smart Tailor users.	Designer has many Tailors, Designer has one or more Design, Designer has one or more Wardrobe	designerID, designerName, designerAddress, designerQualification designerExperience	manageResume, manageDesign, managePostDesign, viewMostLikeDesign, postDesign, viewDesign, approveDesign, publishDesign
3	Customer	Customer is an entity that request a made-to-measure to make or design his or her dress to the specific tailor or fashion designer. There are two types of Customer: Individual Customer and Business Customer. Individual Customer is a customer that requests a service for himself or herself. On the other hand, Business Customer is an owner of a business related to garment industry for mass production	Customer must register as one of the Smart Tailor users.	Customer has at least one or many Tailor, Customer has at least one or many Designer, Customer can choose at least one, and Customer can choose at least one or many clothing design.	customerID, customerType, customerName, customerAddress, customerLocation, customerContactNo	manageCustomerprofile, viewCustomerProfile
4	Job Specification	Job Specification refers to the details of the job requirements as required by the Business Customer.	Business Customer must register as one of the Smart Tailor user.	Business Customer has at least one or many job specifications depends on the job scope that is posted in the Smart Tailor platform	jobID, jobName, jobType, jobDescription.	managePost, viewPost, matchJobSpecification, postJobOffering.
5	Wardrobe	Wardrobe is a space to keep the tailor's and designer's collections. Customers can view ready-made clothing from the wardrobe. This components act as an extra service for all Smart Tailor users (customers, tailors and designers). The tailors and designers can use thisWardrobe to keep all their ready-made clothing for sales. The customers also can buy the ready-made clothing through this application. This components act as an extra service for all Smart Tailor users (customers, tailors and designers). The tailors and designers can use this Wardrobe to keep all their ready-made clothing for sales. The customers also can buy the ready-made clothing through this application.	Tailor must register as one of the Smart Tailor users. Each tailor her must create his or her Wardrobe based on types of clothings.	Tailor has at least one or many Wardrobe.	wardrobeID, wardrobeType, wardrobeDescription.	manageWardrobe, viewWardrobe, manageWDClothing selectClothing
6	Gallery	Gallery allows designers to keep all their sketches (patterns) and sample design (designer collections).	Designer must register as one of the Smart tailor users. Designer can view users' feedbacks on a specific design.	Designer has at least one or many design collections in the Gallery.	designID, designType, designDescription.	manageDesign, viewDesign.
7	Material	Material is a collection of clothing materials that a customer can choose from	Tailor, Designer, or Customer must register as one of the Smart Tailor users.	Customer can choose specific materials for his or her clothing.	materialID, materialType, materialDescription.	manageMaterial, viewMaterial.
8	Job Progress	Job Progress is a tailor progress to complete the clothing requested by the Customer.	Tailor or Customer must register as one of the Smart Tailor users. Customer must have a request for a made-to-measure clothing. The Business Customer must have a request for mass-production clothing.	Tailor has a Job Progress. Tailor and Customer can view a Job Progress	jobID, jobType, jobDescription	manageJobProgress, viewJobProgress