MASS CUSTOMIZATION THROUGH INTERNET

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Abstract

This paper describes the concept of Mass Customization through Internet. It has great potential in delivering customized products and services to a broader community through the universal access provided by the Global Information Infrastructure (GII) such as Singapore ONE. With the Internet, it is possible for users on GII to take a proactive role in defining their needs and customizing their products or services provided by enterprises' database servers and transmit their requests for procurement.

Keywords: Internet Customization Design, Axiomatic Design Approach, Spiral Branding Effect,

1. Introduction

Mass Customization is the mass production of individually customized goods and services [1]. It aims to meet individual customer needs with near mass production efficiency. Meeting customers requirements requires full understanding of the customers' values and preferences. In addition, customers need to understand what the company can offer, their possible options and the consequences of their choices, perhaps as cost and schedule implications .

The rapid adoption of the Internet as a commercial medium has caused firms to experiment with innovative ways of marketing to consumers in computer-mediated environments. These developments on the Internet are expanding beyond the utilization of the Internet as a communication medium to an important view of the Internet as a new market such as E-Commerce [2].

2. Internet as the Customizing Medium

The traditional one-to-many mass media model [3] for mass media is shown below in Figure 1. In this passive model, enterprises (denoted by E), provide content through a

medium to a mass market of consumers (denoted by C). Examples of traditional mass media are TV, Radio and Print.
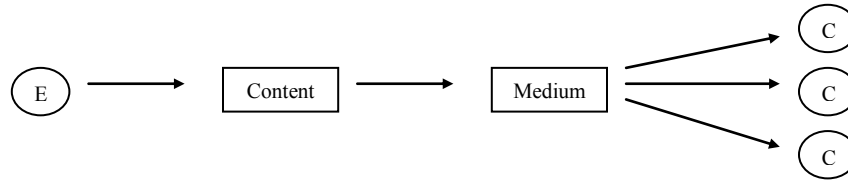

Figure 1. Traditional Mass Media Model of One-to-Many Marketing Communications

With Internet, the customization of Web allows consumers to have a personal and rich relationship with the enterprises that is unachievable in traditional mass media. Figure 2 shows a proactive customized one-to-one marketing communications of the new mass media model.
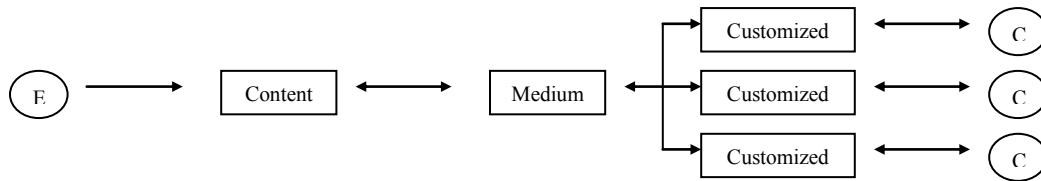

Figure 2. New Mass Media Model of One-to-One Marketing Communications using Web

3. Internet Customization Design (ICust)

With the belief that Mass Customization can best be approached from design, the authors propose the concept of Internet Customization Design (ICust) for Mass Customization through Internet.

ICust aims to create an Internet environment wherein customers can take a proactive role in defining their needs and negotiating to meet their explicit and implicit requirements. It differs from traditional approach by bringing the voice of customers into design and manufacturing, linking customers choices with the capabilities of the company using Internet. The goal is to harness available Web tools to create a relationship with both the customers requirements and functional requirements for effective simulation of the customized product.

The first step is to link the four aspects of product design under ICust Chart. Refer to Chart 1 below.
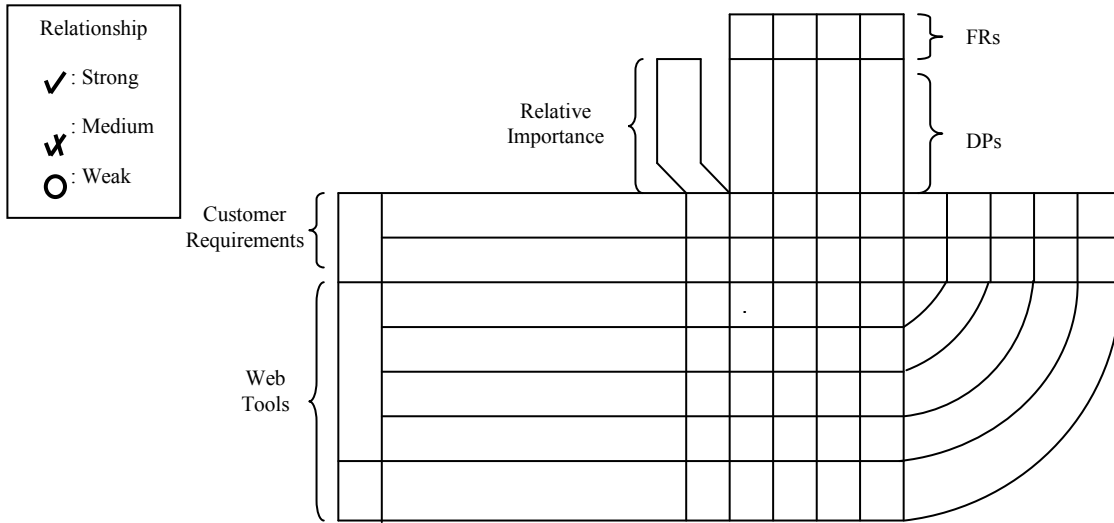
Chart 1. ICust Chart

Aspect I: Product design
Using axiomatic design approach [4], the functional requirements (FRs) of the functional domain and design parameters (DPs) of the physical domain of the product are mapped out. Refer to Figure 3.
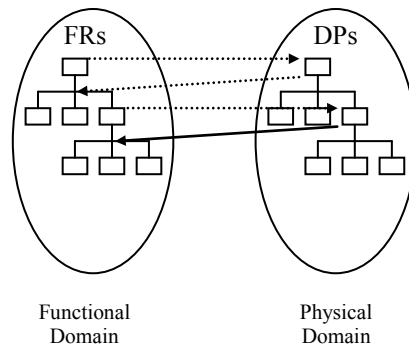

Figure 3.Mapping of FRs and DPs

An example of a pager is used in this paper. Refer to Charts 2 and 3 for the actual mapping of FRs and DPs.

Functional Requirements (FRs)

1st Level	2nd Level	3rd level	4th level
Receiver	Receive Signal	...	...
	Decode Signal	...	...
	Display Signal	...	...
	Select Modes	Scroll thru' the modes	...

		Select the mode	...
		Read signal	...
	See in the Dark	Even distribution of illumination for LCD panel	... ...
	Notify User	Notify User Silently	...
		Notify User by Sound	... ...
	Power Supply	As small as possible	...
	Protection from Dust	Display signal and buttons	
		To insert and remove parts easily	

Chart 2. Functional Requirements Chart

Design Parameters (DPs)

1st Level	2nd Level	3rd level	4th level
Pager	Receiver Board	...	...
	Decoder Board	...	...
	LCD Panel	...	...
	Buttons	Scroll button	...
		Select button	...
		Read button	... ...
	Lamp	Lightwedge	...
	Alarm	Vibrator	...
		Transducer	... ...
	Battery	'AAA' Battery	...
	Housing	Front Housing	
		Back Housing	

Chart 3. Design Parameters Chart

Aspect II: Customers
- Capability presentation
  Customers are informed of the capabilities of the company, including the spectrum of product offerings and product attributes.
- Customers requirements
  Customers state their desired attributes for their requirements.
- Relative Importance
  Customers are then asked to prioritize the desired attributes for their requirements. (1-10 where 10 is most important)

Aspect III: Linking customer voice to product design
Develop a relationship matrix between customers requirements and functional requirements (FRs) [5].

Aspect IV: Web tools
Categorized Web tools based on human five senses: see, smell, hear, taste and touch. The bandwidth of the Web is limited, thus there is a trade off between the richness of the Web content and the reach to the mass. Therefore, we develop a relationship matrix between Web tools to customers requirements and functional requirements (FRs) in order

to display the correct simulations on the customizable attributes that are important to customers.
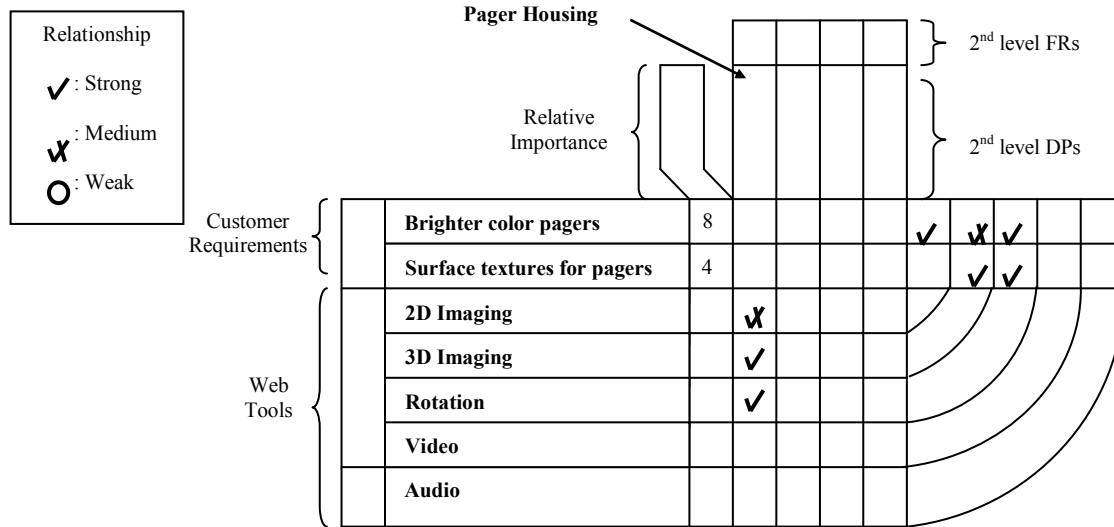

Chart 4. An example using ICust Chart

Based on the customer requirements in Chart 4., we can deduce there is a strong relationship between the stated customer requirements and pager housing. From the chart, customization of the pager housing is crucial in the Web. In this case, rotation, 2D and 3D imaging of the customized pager housing will be necessary for virtual simulations to the customers.

The next step is to bring the customizable product up into Internet. The next section will discuss the ongoing work of implementing the customization in the Internet.

4. Framework for ICust

Realizing ICust using Internet requires a 3-tier architecture, comprising the client interface which is a web browser, the web server and the database. All data exchange and storage between the client and the database have to go through the web server, handled securely by Java Servlets. The schematics for this system are illustrated in Figure 4.
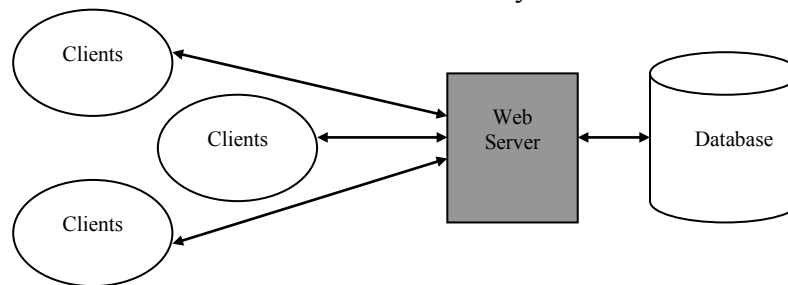

Figure 4. ICust system

Based on the schematics of Figure 4, the framework of ICust is designed and illustrated in Figure 5.
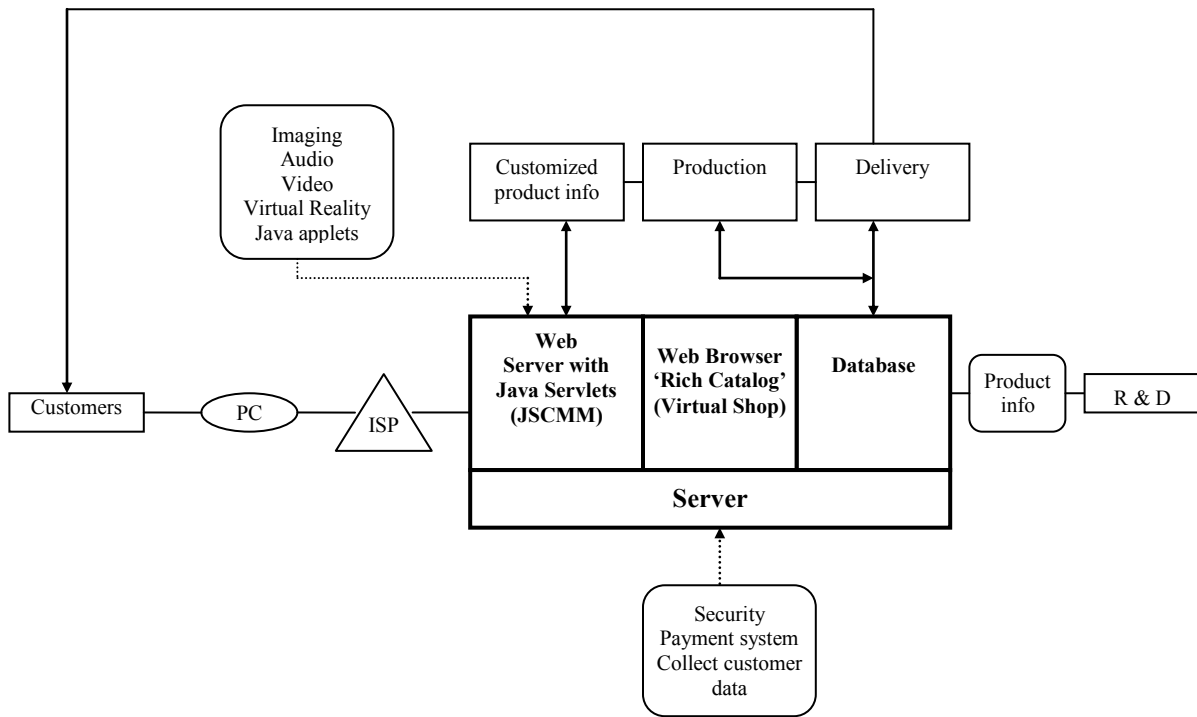

Figure 5. Framework of ICust

The client interface, appropriately termed as the Virtual Shop, allows the end-users to customize their products. Currently, there are two modes of customization being taken into consideration in this system: Assembly-to-Order (Product Variety) and Make-to-Order (Product Customization). The first mode allows the choosing procedure from the listed options that the company can offer from stock. The cost of customization can be said to be low for this case. On the other hand, the Make-to-Order mode enables customers to have precise control over what they want – the design, the specifications and the desired functions.

The Virtual Shop would be linked up with the Java Supply Chain Management Module (JSCMM) at all times so that the customers can check the accompanied price and delivery time, and also authenticate the viability of the customized products with the internal users (Suppliers, Manufacturers, Designers and so on) of the Supply Chain.

The JSCMM aims to link the data from the various business processes so that global access to such information is possible by each and every Supply Chain process. As such, efficiency is guaranteed since through this Module, corrections, updates and checking can be performed on-line.

The ultimate aim is to web-enable the Virtual Shop and the related modular components. The rationales for using the Internet browser as the loading engine are:

- Every terminal is already equipped with a basic browser.
- The browser allows the client interface to be very thin as all the proprietary software resides on the server side.
- Maintenance and upgrading of systems can be done easily on the server side with the changes made to the Java applets and Servlets. Thus, every time the clients visit the ICust website, he/she will always be making use of the most updated version of the system.

The Apache Web Server has been employed in this project while ObjectStore PSE Pro version 3 for Java has been used as the dedicated storage database since it is object-oriented.

4.1 VRML-to-Java3D Converter

In regards to the visual data format employed in the Virtual Shop, the authors have managed to modify an existing VRML-to-Java3D converter written in Java (Figure 6) with permission from the original inventor so that this allows the porting of model files in Virtual Reality Modeling Language (VRML) format to Java3D format. The integrity of the file is ensured since the converter is only parsing the VRML file. Thus, this caters for the numerous existing CAD/CAE/CAM packages where exporting in VRML format is always one of the possible options.
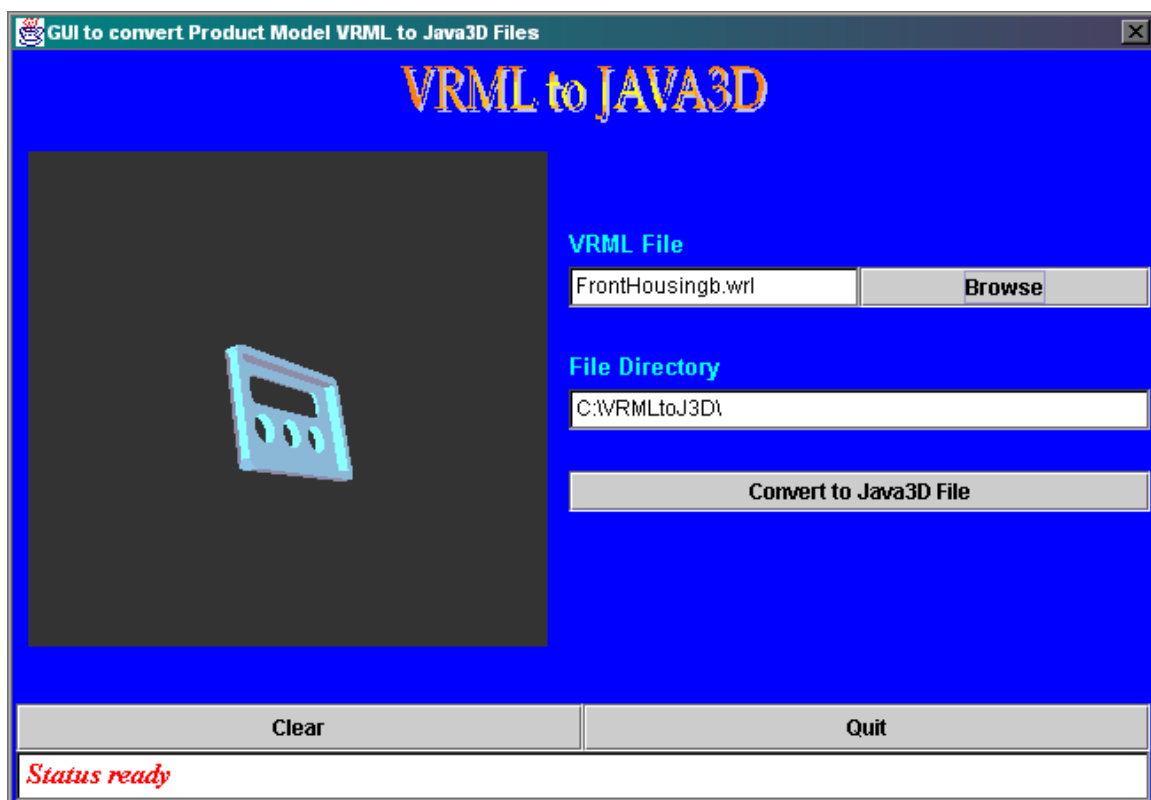

Figure 6. Interface for the VRML-to-Java3D Converter

4.2 Virtual Shop

The Virtual Shop forms the focal point for the customization process when the client first accesses the Login/Registration ICust website. Registration has to be done at this stage. Registered clients can immediately visit the Virtual Shop in customizing the desired products. In the Virtual Shop, two modes of customization are possible.

The client will firstly customise the characteristic of the product components and assemble them in the parent interface window. Should the "Product Variety" mode be selected which is the default, choices of the aesthetics and functions can be made from the given list for each individual component. As shown in Figure 7, the external color of the outer front casing of the pager can be chosen from the varieties provided. At this phase, the colour selection for both the front housing, back housing and the buttons can be performed independently of one another. Furthermore, the pager sound can be selected from the list offered in the main interface.
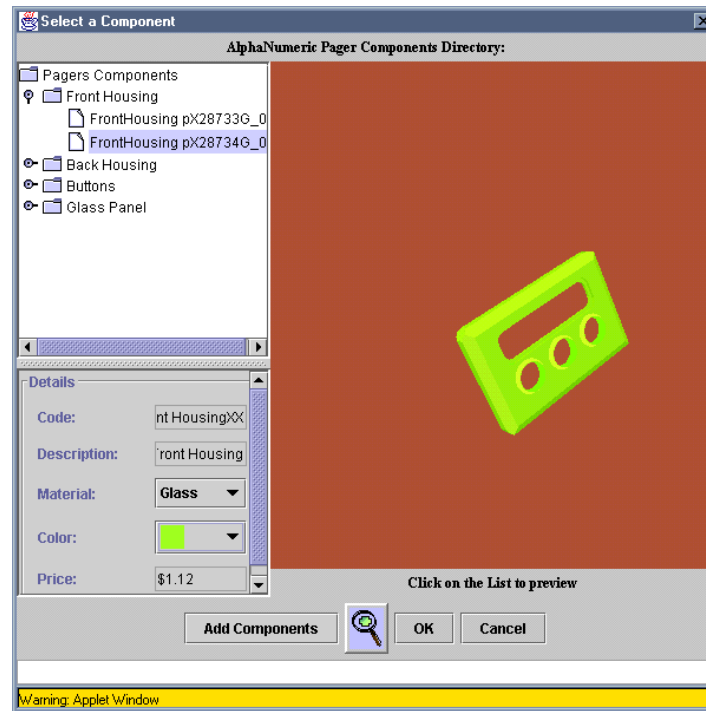

Figure 7. Colors Variety for the External Pager Casing

For the Make-to-Order mode, the colour combination of entire housing will be set such that the front-housing colour and the back-housing colour will be synchronized. Thus, the external color of the outer casing of the pager can be customized using the combination of the three primary colors (Red, Green and Blue) as shown in Figure 8. Pager sound can also be customised with the client uploading the sound data to the enterprise through the Virtual Shop.
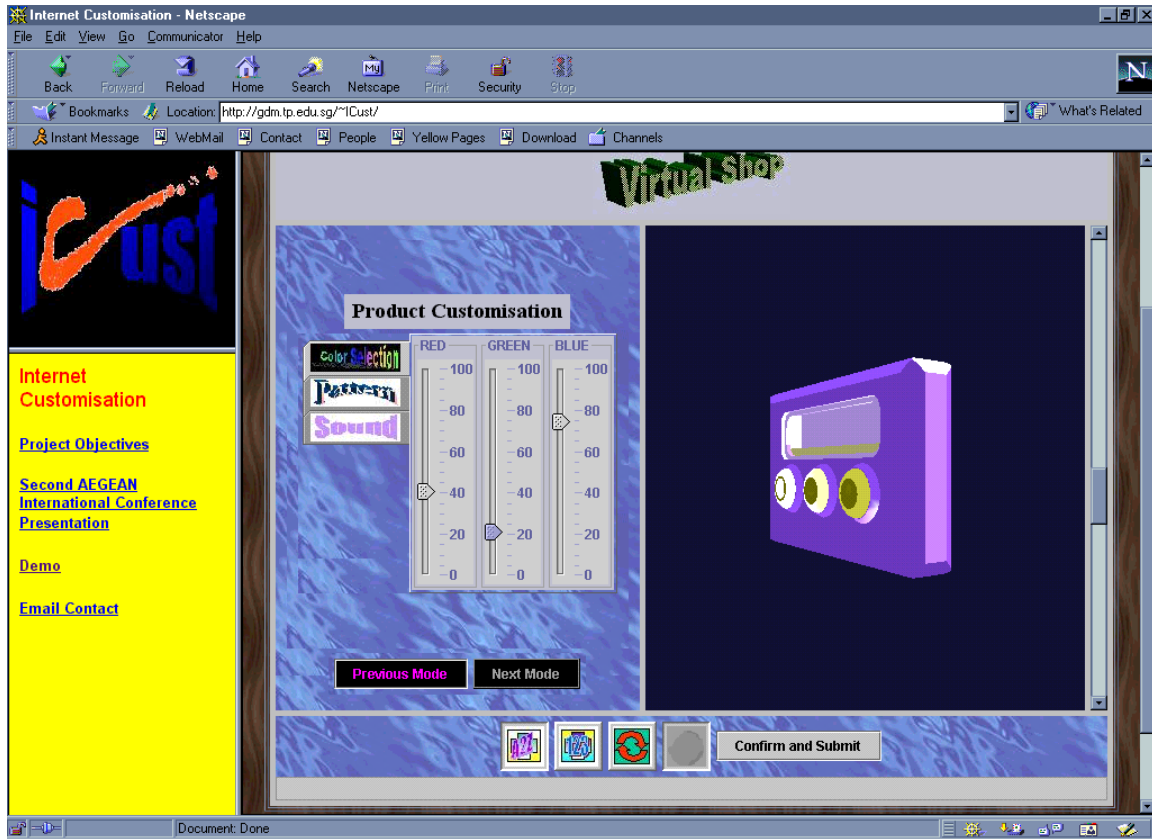
Figure 8. Customized color by combining primary colors

5. The Spiral Branding Effect

The final step of ICust is to attempt to create new and retain existing customers. Emailing allows enterprise to keep in touch with customers and the Web allows enterprises to create a personal and rich relationship with consumers. These new capabilities provide the necessary ingredients for integrating Web into the traditional mass media to create a new marketing strategy shown in Figure 10 - a three-stage branding spiral. The word "spiral" describes the accelerating benefits of a positive feedback loop.

The first phase is to use traditional mass media like TV, Radio or Print to get mass market of consumers interested in the products or services being offered and then to persuade them to check them out on the Web. In the second phase, enterprise use the Web to get consumers involved by allowing them to customize Web content, products and/or services offered. In this phase, a continuous relationship-building is created: to give consumers information and capabilities of enterprise, products and/or services being offered and to receive information from consumers about their needs with respect to such offerings for customization. Each consumer's preferences, personal data such as email address and products or services purchased will be noted and recorded in the enterprise's

consumer databank. In the third stage, enterprise can use email to remind and incent them to return to TV ads and Web again. Email closes the loop and starts people around the spiral again. Thus, the relationship between consumers and enterprises will be continuous and further enhance the advantages of using Internet for customization and procurement.
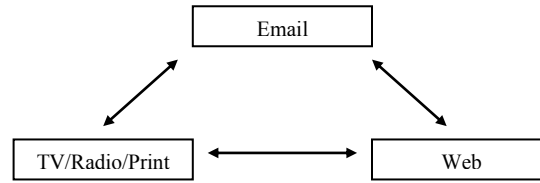

Figure 10. Spiral Branding

6. Future Work

The Virtual Shop is currently working for one product. In the pipeline will be the addition of another product. Furthermore, the linking and storage of the customers' selection to the database will be accomplished in the near future.

The JSCMM structure will allow object-oriented management of the enterprise data so that global access by both the end-users and internal users is maintained. This module will be accomplished by using Java Servlets API and Java Swing.

7. Conclusion

The Internet has taken the world by storm since it opens up new opportunities. This is especially so in the case of the manufacturing and business arenas. We have witnessed the phenomenon of the increase in productivity such as the web-enabling of the CAD/CAE/CAM packages and even remote manufacturing through technical modules (For example, Control Technology's model 2717 web-server module which is a web-enabled controller to allow machines to reside as 'nodes' on an intranet, or the Internet [6]). Indeed, the Internet has, in some sense, removed the necessity of one to be physically at one place in order to perform certain functions.

In view of the global access provided by the Information Infrastructure, the trend of doing businesses on the web or E-commence has been growing at an unbelievable rate. In this project, the ICust system first determines what Web tools to use in the Web for virtual simulations of customizable product or services. It then web-enable the process of purchasing individually customized products. The Java Supply Chain Management Module (JSCMM) allows the various business process holders (whether it is the end-users or the internal users) to communicate the viability of the customization. Spiral branding effect will create long lasting and deep relationship with the customer.

It is hoped that through this system, clients or customers will find it worthwhile and easier to attain customizable products on the Web. Thus, it will be more beneficial and

fruitful to visit the ICust Virtual Shop than to pay an actual physical visit to the retailer outlets where full customization may not be available.

8. References

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