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Research Article

Website Personalization: Strategy for User Experience Design & Development

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Abstract: Personalization of websites is well accepted by the industry to reduce the cognitive load of the online users and disseminate Information on the website. With proliferated usage and information on websites in recent years, effective design of Personalized Websites is a challenge for the business which requires an increase in investment for applying personalization features to generate dynamic websites to cater to individual user needs. It is important to choose personalization features wisely to get a higher return on investment to cater to users' dynamic needs. Personalized Web Information System Design requires close attention to personalization aspects to be used in the design and development considering cognitive and affective factors affecting website usage. This research reviews website design strategies, their development methodologies with the comparative study of traditional and personalized website development. The research presents the in-depth literature review of different personalization aspects used in website design, proposes a personalized website design model for adaptive website development.

***Keywords*—**Personalization, Personalized Web Information System Design, Object-Oriented Hypermedia Modeling, Personalization

I. INTRODUCTION:

In the recent era of web evolution, the website is considered as a mandatory medium for information dissemination, entertainment, and communication to reach out to the large community of users in various domains like business, e-commerce, education, social media, banking, etc. While the websites have been proliferated with the information delivering the same information to the users elevates one-size-fits for all issues which deficit to satisfy the user's individual need. Effective Website Design has become a prominent issue to manage the problem of information overload which limits users' information processing, cognitive skill, and decision-making capabilities. In information and communication technologies (ICT) Web Personalization has been adopted as a significant strategy to overcome the problem of information overload and one size fits all issue. Personalization is used to satisfy individual users' needs, to be competitive in the market, and efficient information management. Effective personalization design is critical in improving the performance (perceived usefulness, ease of use, enjoyment, satisfaction, and control) and its impact on users' intention to revisit the personalized website. In the field of Information System Design and Human-Computer Interaction (HCI), researchers, as well as web designers, have thus been paying increasingly close attention to personalization issues in the design and development of personalized
websites; satisfy the needs of the user by serving the user with more relevant information. However, personalized web development and software development significantly varies in several key areas like the dynamic nature of website design and development to cater to customers' needs, their information system structuring, and design [20] Information architecture, presentation, and navigation functionality are dynamic and more complex in personalized web development compared to conventional software development. These significant differences targeted study is the focus of this research paper by addressing the distinctiveness of personalization issues in the website design and development process. In the next section, we will review and analyze how personalization aspects are designed, its implementation and development process of Website, and review the different definitions of personalization in website personalization with a prominent vast body of interdisciplinary nature.

II. WEBSITE DESIGN:

Web site design & Development has increased the need for special attention to using it as an effective marketing tool for attracting large numbers of users and retaining existing customers. Effective website design strategies and implementation has been researched over the last two decades with the era of the internet. Website design creates a tidy experience for users which results from a whole set of decisions—some small, some large—about how the website looks, how it behaves, and what it allows you to do. These decisions build upon each other, informing and influencing all aspects of the user experience [13]. The study of website development by [13], proposed a theory that defines five layers between an abstract level and a concrete plan. The five layers of user experience of websites are the surface plane (visual design), skeleton plane, structure plane, scope plane, and strategy plane. The surface plane is a series of Web pages, made up of images and text. The skeleton plane

concerns the placement or layout of the buttons, tabs, photos, and a block of text. The structure plane defines the navigation plan i.e. how the user gets to the page in question and where they could go next. The structure defines how the various features and functions of the site fit together. The scope plane encompasses features and functions (included or not), which fit together to define the structure. The scope is fundamentally determined, however, by the strategy of the site. This strategy plane incorporates not only what the people running the site want to get out of it but what the users want to get out of the site as well [13]. Another tripartite subdivision proposed by [13] distinguishes interface design, navigation design, and information design. User interface design regards the visible elements of interface; navigation design refers to the way information is presented using, in both ways, information design, which establishes effective communication with the user.

Among all these features, information architecture and navigation are unique to web development, whilst hypermedia has more complex presentations than conventional software. Personalized/Adaptive website presents different information architecture, interface design, and navigation based on the type of user categorized in user modeling and business rules. Adaptive hypermedia systems can be defined as "all hypertext and hypermedia systems which reflect some features of the user in the user model and apply this model to adapt various aspects of the system to the user" [6]. In the next section, we will review how personalization aspects are used in the website design process, and how different disciplines investigate the topic of personalization.

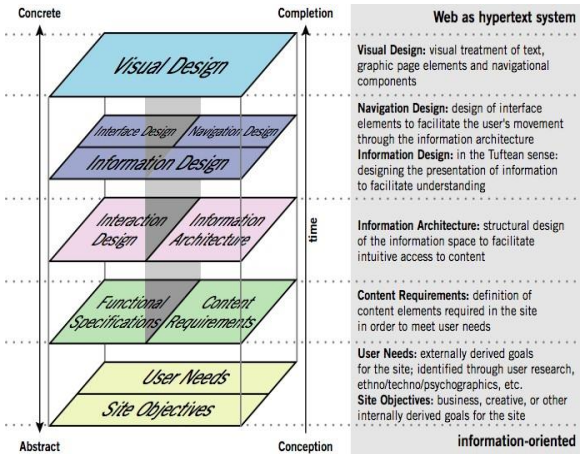

Figure 1: User Experience Design (Garrett 2003).

III. PERSONALIZED WEBSITE REVIEW:

Personalization is the process of presenting a tailor-made website in the form of information, website layout, and structure, which is generated either implicitly using data analytics or explicitly by asking the user in the form of a feedback form or demographic details [9]. Personalization is presented as three dimensions of implementation: (a) the aspect of an information system that is manipulated to provide personalization (what is personalized),(b) the target of personalization (to whom to personalize), and (c) who does the personalization (explicit vs. implicit i.e., the user or the system) [12].

For the first dimension, what is personalized, we can distinguish four aspects of Information System (IS) design that can be personalized: the information itself (content), how the information is presented (user interface), what link structure of the website is presented (navigation) and what users can do with the system (functionality)[36]. What to personalize is the fundamental of website IS design which can be dynamically presented in a personalized system to make the system more personally relevant to the users' implicit need. This dimension focuses on the particular parts like website information, presentation, and layout/navigation of the system that deliver personalization to the user. [37] define web personalization as the adjustment and modification of all aspects of a website that are displayed to a user to match the user's needs and wants. In addition to the user interface and content, the hypermedia links that are presented to the user are included in the definition. Author of [37] Concentrate on various dimensions of content: (1) different sources of content; (2) the arrangement of content on the screen; (3) the delivery mechanisms (system or user-initiated) and the delivery vehicles (web browser, mobile phone, pager, etc.). Web personalization may be implemented in the form of personalized content presentation and/or content delivery (inserting or removing thematic units/sections/paragraphs, optional explanations or detailed information, personalized recommendations /offers/ prices/ products/ services), personalized structure (sorting, hiding, unhiding, adding, removing or highlighting links) e.g. yahoo.com, personalized website layout presentation and media format (from images to text, from text to audio).

The second dimension, the target of personalization, can be either an individual or a group of individuals with common characteristics like demographics, behavior, etc. Insofar as an individual user identifies with this category one to one, he or she is likely to perceive that the system is personalized for them. Individuated or one-to-one personalized system design to adapt and cater to the implicit or explicit needs of a single user. It is targeted to a specific individual, and its goal is to deliver goods, services, or information unique to each individual as individual. Furthermore, research [12] has indicated that people react differently when they are focused on their unique identity as an individual (individuated) as opposed to how they act if they focus on their identity as members of a social group (categorized). When people focus on category membership, their motivation revolves around values and concerns of the social group; they are more influenced by group norms than by individual considerations; they tend to make judgments based on perceived group standards, and they may be stereotype members of our groups, groups they view as opposed or different from their own [12].

In the view of the third dimension, [5] further examined the user- initiated customization (explicit) and system-driven personalization (implicit), and concluded that customization is less threatening to the privacy and security of consumers. Author in [29] identifies Customization as user-initiated personalization and Personalization as system initiated.

Table 1: Personalization Dimension Paradigm

Information	Presentation	Navigation	References
Content	Interface	Structure	(Desai D. 2018, Desai D. 2016, Kwon et al.2012)
Content	Interface (e.g. theme, background color, look & feel and visual appeal)	Navigation Structure	(Wang 2009)
Content, i.e. credibility, correctness, relevance, sufficiency.	Design, i.e. the visual appeal of the website; interactivity, i.e. the extent to which the site is personalized to the user.	Navigation, i.e. structural consistency of the website	(De Wulf et al 2006)
Content e.g. Self-relevance	Form	System Functionality	(Fan and Poole 2006)

As Table 1 illustrates, this classification also fits in with other classifications of personalization in other disciplines. In this research, we would like to investigate different personalization design aspects and how these design aspects play a role in decision-making and behavioral change in users.

IV. Personalized Website Development:

Recently Adaptive and Personalized Websites have gained the attention of researchers and business owners. Personalization has been used as an effective marketing strategy that overcomes the problem of information overload and increases users' cognitive decision-making skills. Websites can be broadly categorized into four types: Adaptive/Personalized Web hypermedia Application, web hypermedia application, web software applications, and web applications [5,6,20]. Web hypermedia application is a non-conventional application characterized by the authoring of information using nodes, links, and delivery over the web. Author in [18] defines a hypermedia system "as an interactive system that allows users to navigate a network of linked hypermedia objects. In the case of the WWW, these hypermedia objects are Web pages." Hypermedia objects consist of information chunks, which can be different media types such as text, images, audio clips, video clips, etc.[18].

The web software application is a conventional software application that relies on the Web or uses the Web's infrastructure for execution. Many e-commerce and social networking web applications fall into this category. Typically these employ development technologies (e.g. DCOM, ActiveX), database systems, and development solutions (e.g. J2EE). A web application is an application delivered over the Web that combines characteristics of both Web hypermedia and Web software applications. Adaptive/ Personalized Web Application, which is the object of this study. Web Applications which comprises personalization features implemented in the development process based on user modeling and other algorithms based on the business need. An adaptive hypermedia system tries to anticipate the actions of individual users based on their prior Internet behavior and will help them to navigate in many ways by hiding links, limiting the hyperspace, or by showing appropriate link annotations [6]. Essentially, the idea of adaptive hypermedia is based on monitoring what the user is doing and, when necessary, asking questions. In other words, the system tries to learn how the user will behave. The goal of adaptive hypermedia is to increase the functionality of hypermedia by making it personalized [6]. This requires the system firstly to collect comprehensive information about the user, and secondly to adapt the content, information structure, and/or presentation according to this user information, and thirdly to provide the user with the results of this adaptation. Systems that perform these steps automatically are called adaptive.

Personalized or Adaptive Web Application development, Web development, and conventional software development differ with regards to their application characteristics, primary technologies, development process drivers, application availability, customers (stakeholders), update rate (maintenance cycles), their architecture and network, their academic foundations, legal, social, and ethical issues, and information structuring and design [20]. Some of these comparisons were tabulated as follows:

Comparative Study of Application Development Strategies

Table 2: Personalized Web Application, Web Application, and conventional software Web Application

	Personalized Web Application	Web Application (Mendes & Mosley 2006)	Conventional Software Application (Mendes & Mosley 2006)
Disciplines involved	Adaptive Hypermedia System Design, User Modeling, Personalization Algorithms, Cognitive & Decision Science(HCI), Software engineering, hypermedia engineering, requirements engineering, usability engineering, information engineering, graphics design, and network management	Software engineering, hypermedia engineering, requirements engineering, usability engineering, information engineering, graphics design, and network management	Software engineering, requirements engineering, and usability engineering
Development process drivers	Ease of Use, Perceived Usefulness, customization options, personalization modeling	Reliability, usability, and security	Time to market takes priority over quality Groups
Customers	Different strata of users who are willing to share personal information and implicit & explicit needs	Wide range, known and unknown users	Groups confined within the boundaries of departments, divisions, or organizations

update rate (maintenance cycles) People	Real-time based on analytics result to serve users need, Frequently without specific releases, maintenance cycles of hours or days based on user modeling, navigational behavior	frequently without specific releases, maintenance cycles of days or even hours Web	Specific release, maintenance cycles ranging from a week to years
People involved in the development Information	Web Designers, Data Analytics experts, Web Mining Business Intelligence experts, Domain Experts, Graphic Designers, writers, artists, Database Designers, Project Managers, Data Scientist, network security experts, usability experts,	Web designers, Programmers, graphic designers, librarians, database designers, project managers, network security experts, usability experts, artists, writers	IT professionals with knowledge of programming, database design, and project management
Information structuring and design	Personalized Content, Structure, and Interface of Web page, Structured and unstructured content, use of hyperlinks to build navigational structures	Structured and unstructured content, use of hyperlinks to build navigational structures	Structured content, seldom use of hyperlinks

V. Personalization in Web Designing/Engineering:

Personalization in Web engineering is a multi-disciplinary area, influenced by several communities such as multimedia, adaptive hypertext/hypermedia, human-computer interaction, software engineering, and information engineering. Information on the Adaptive Web is disseminated using hypermedia (i.e. textual content, images, video or audio sequences, layout, and presentation) which is actively interconnected by links. Website system design is engineered and modeled by considering several usability issues, navigation, and interaction support. Website is a repository of associative and non-linear browsable objects or items that are accessed through navigational links, interrelation of objects done through website modeling. Personalized or adaptive web modeling has been studied covering different aspects of website design including data structures and modeling using entity-relationship model, data relationship methodology, object-oriented hypermedia design modeling using Web Modeling Language, hypermedia design with combining object relationship model and website design method. Web Modeling is applying Unified Modeling Language Modeling (UML) based on web objects, which is based on an object-oriented system. WebML has been studied thoroughly in recent years. Object-Oriented Hypermedia Modeling (OOHDM) uses proprietary notations with a design framework like notations with a small set of primitives for personalized attributes and methods using object-oriented hypermedia modeling concepts, different user modeling, and business rules. OOHDM adapts the user class in the conceptual model and presents the relevant information and subsequently presents an adaptive navigation class model to adjust information to the user.

WebML specifies personalization rules in its conceptual model which consist of page request; activation rule specific to different business rules and conditions along with evaluation parameters in context with previously acquired information adaptation of hypertext user interface design. WebML has also been extended with the use of different models to support adaptability. The UWE is a UML-based Web Engineering model which is defined in the form of Unified Modeling Language using an object-oriented approach and model-driven approach. It follows the principles of the Unified Software Development Process and systematic development of adaptive web applications by focusing on system-specific personalization rules. Adaptive website designs conceptual modeling with the integration of user modeling, domain modeling, and personalization modeling with information, structure, and presentation. [1] suggested recommendations for information modeling based on contextual user

modeling by inferring user's contextual states based on most recent behavior in website browsing of links and utilize sequential information in user's history of interaction to identify, predict the need, and adapting the system's recommendations to users interest concerning context. Relevant personalized information plays an important role in modeling based on the user's implicit and explicit needs. Researchers have studied recommender systems using different algorithms for relevant recommendations based on collaborative filtering [27], Hybrid Filtering, page rank-based filtering [11]. Adaptive website designs have several design pages like types of adaptation, customization vs. transformation, content-based vs. access-based adaptation, and degree of automation [25]. The navigation structure of the personalized website is dynamic as per users' needs which should be easy to search and locate needed information with minimum cognitive efforts, ease of navigation, and joyfulness. The success of any website can be measured with various criteria like the number of clicks for URL, frequency of use and time spent on the e-commerce website number of items purchased, ratings, and recommendations by the user. [19] studied computational parameters for measuring the success of personalized websites with trust, ease of disclosing information by the user, and ease of use. Ease of use, enjoyment, and efficiency of navigation are the key factors for website success. Website navigation structure and semantics are defined with Static Hypermedia Design and Object-Oriented Hypermedia Design Method (OOHDM).

Personalization is a toolbox of technologies and application features used in the design of a user-orientated experience. Personalization features classification ranges from displaying user's name with greetings(Facebook, Yahoo! etc) on a web page to restructuring website complex navigation structure of catalogs and customization with different features with the personalized user interface by offering a theme, catalog, fonts, page layout and look & feel preferences based on deep models of users' need and behavior. The personalization technologies range from accessing user information from databases, cookies, and generating dynamic webpage as per users' implicit and explicit need by pattern matching and machine learning algorithms, rule-based inference, and web data mining techniques [18]. Web data mining techniques use web content/ information, website structure, web server logs generated with web data usage, and user profile data. [11,31]. The web personalization process comprises major five modules like user profiling, website log analysis and web usage mining, information or knowledge acquisition, information management, and website publishing. Web Usage Mining is the process of applying mining techniques on website logs data which consist of three phases after cleaning website logs in the data pre-processing stage which is also known as the data preparation stage, pattern discovery, and pattern analysis phases. The pattern analysis is used for deriving rules of personalization and user modeling. [22], classified the website data into four different categories: content data, structure data, usage data, and user profile.

VI. Personalized Website Model:

UML-based Web Engineering focuses on personalization features based on user model and an adaptation model design. It also focuses on adaptive navigation features depending on user explicit preferences, user modeling which is based on prior knowledge of the user's implicit preferences and browsing history. User Model is represented as a class diagram stating interactions of different classes of user model including user's attributes and their functionalities concerning adaptive or personalized web application. User models should be designed by keeping in mind users' dynamic needs and preferences which are time and context- specific. A personalized website is designed based on basic three models like domain model, user model, personalization model. The domain model is the structure of domain data based on business rules. The user model is the structure derived from analyzing users' demographic profiles and navigation behaviors using websites. The personalization model consists of three sub-models: information model, navigation model, and presentation model. The personalization model is designed based on business-related personalized policies, presenting personalized websites with content based on user model, user interface, and navigation structure. The information model is a structure of generating dynamic content based on the user model. The navigation model defines the structure and behavior of the navigation based on domain data, also the presentation model is the layout of the website user interface with hypermedia navigation structure and look and feel. Information captured about the user and knowledge base with business rules is the foundation for personalization actions which is described in the personalization model. Web-based application development is characterized usually as an integrated set of activities producing three products of a Web application: application domain models, navigation models, and presentation models [2,3].

The application domain model comprises abstract concepts, which are provided as information in a Web-based system. Navigation models usually describe possible navigation paths and navigation support through information space determined by the application domain model. The presentation model for a Web application describes visual characteristics of information presented by a Web application, such as the layout configuration of information items presented and their appearance [2].

VII. Conclusion & Future Direction:

The effective website structure design is one of the prominent issues across many application domains on the World Wide Web in design engineering. The adaptive website improves and transforms site organization and

presentation based on the user's website access pattern and user profiling. Personalized websites adapt website information, navigation structure, and presentation by applying mining techniques and analyzing Web Server logs, and generate rules for adaptation. Websites generate recommendations for adaptive content based on different techniques like rule-based filtering, collaborative filtering, and hybrid filtering. For example, Amazon.in adapts websites with collaborative filtering techniques and recommends users with different items searched and purchased with similar interest. Website recommendations are also generated based on users' demographic profiles like income, gender, age, etc., and how closely product features to match with users' implicit or explicit preferences, degree of matching for the order of presenting the product, and rule-based filtering techniques.

Our research aims to develop a website experiential design working model for effective website personalized website development using the WebML model and hybrid filtering techniques in the future.

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