Heuristic Evaluation of Website using HCI Principles

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Abstract—In the present age of technology, there has been more emphasis given to perfecting user interface designing of applications and websites for appeasing their demands and convenience. For such a task, Human-Computer Interaction (HCI) principles are referenced to create a framework of regulations to be followed while designing. HCI is a field of study of matters regarding the interactions between a user (human) and a computer. In this paper, our system aims to take the input based on various facets of a website chosen by the user or developers for evaluation. This input will be taken through a website consisting of a questionnaire correlating to those features of the targeted website. The gathered data is then appraised by the framework built on various designing heuristics and provide an aggregated score associated with the assessment along with some relevant feedback. The results presented by this tool will be effective in pointing out various usability issues in the targeted website, and provide an overview on the design, functionality, and usefulness of the website.

Index Terms—Heuristics, user interface, framework, Usability, HCI, Website.

I. INTRODUCTION

Human Computer Interaction (HCI) is the field of study that encompasses three key components: the user, the computer, and the ways in which they interact. The importance of HCI in website development cannot be overstated, as research has shown that a significant amount of the design and programming effort goes into the interface of a website. This is crucial for making a site more convenient for the user.

HCI developed tools and techniques have substantially decreased costs and boosted productivity. Time task decreased, errors user fewer, disruption user reduced, staff support on burden less, training of elimination, and costs redesign and maintenance in changes of avoidance. Engineering usability of benefits that shown even studies have can cost project's the to amounts significant up scale.

As the use of technology continues to grow, HCI will become an increasingly important aspect of website development. Our team plans to develop a system that uses heuristic evaluation methods, such as those proposed by Jakob Nielsen's heuristics and Shneiderman's Golden Rules, to evaluate websites. The feedback from these evaluations will be used to make a website more visually appealing. We will also conduct a survey of a website by a group of students to gather insights from the perspective of typical users.

Creating a unique and memorable identity for a website is crucial for ensuring that users will remember and continue to use the site. Our system aims to bridge the communication gap between developers and users, providing feedback on aspects such as functionality, design, and performance. By using Nielsen's heuristics and Shneiderman's Golden Rules, the website will be able to provide users with a rating for each aspect, allowing them to make improvements and attract more users.

II. LITERATURE REVIEW

Paper [1] focuses on the heuristic evaluation of the Student Portal utilised by BTH University in Sweden using Nielsen's Design Principles. The BTH portal acts as a link between all the entities and personnel within the university for various educational information of students to utilize in the admission process. The authors have tested the portal based on the three components of usability: effectiveness, efficiency and satisfaction. Survey was chosen as the method of data collection for this research; as they found out that, for heuristic assessment, averaging the assessments of certain groups of assessors produced better outcomes than an individual expert.

The author of paper [2] utilized Nielsen's Heuristic principle to evaluate the UI of Uppsala University Student Portal housing a total user base of 50000. They noticed that, as the portal system was old, regardless of the usability improvements brought in, there are still many sections left to be checked out. For the evaluation process, the participants, recruited using social media based on their merits, were instructed to perform certain tasks within the student portal and then provided with a survey individually; A debriefing session was also conducted between the author and the evaluators to discuss the issues. Various tools and methods were used to analyze the data

collected from these surveys such as Excel, statistics, content analysis and SPSS. Based on the results obtained from analysis showcase many weaknesses present in the system pointed out by the evaluator and a set of guidelines have been presented by the author. They also mentioned the limitations presented by the paper, particularly in the selection process, as it was conducted mostly online through social media and offline discussions for much clearer understanding between the peers weren't possible due to covid-19 pandemic at the time. The role of interface designing has changed and widened to a great extent with the expansion of computing technology.

The main aim of paper [3] is to infer design principles, put forth a feasible method for designing an interactive system, and evaluate the changes caused to the system. The author had chosen Agile method as the approach for the designing process as opposed to the Waterfall method as Agile was comparatively much more flexible by splitting the tasks into multiple sprints, aiding in a faster completion of the project within the scheduled time-limit. Evaluation methods were broken down in two main categories: formative (done prior to the implementation) and summative (after the implementation). Heuristic approach was chosen in this study due to provision of quick and cheap feedback to designers from consumers, formulation of best practices, and system evaluation by experts. However, usage of such methods also come with a few shortcomings such as artificiality, lacking quantitativeness, and a sense of bias. While setting up the theoretical framework using Agile, 15 HCI principles are taken into consideration, some of them being accessibility, operability, simplicity, aesthetics, clarity and availability. The tools used for designing the interactive system after the completion of design principle review were HTML, CSS, JavaScript, PHP, and MySQL. After the redesigning process using the mentioned tools, the system is then put through usability evaluation, which incorporates heuristic and expert analysis. Utilization of these steps had led to improvements of the target system chosen by the authors and later validated whether the site maintains compliance throughout the design process.

In paper [4], the authors had set their motives to ensure all the users regardless of any real-life shortcomings could access useful information and functionalities of a website effectively. For this and avoiding any dissatisfaction among the users, a continuous research and tests on the heuristic evaluation of these websites was suggested. As referred to and defined in [9], usability is a "quality characteristic that evaluates the ease of use of user interfaces," encompassing factors such as learnability, efficiency, memorability, error rates, and user satisfaction. The primary heuristic method used in this study was the one developed by Nielsen [9], often referred to as the traditional heuristic. Other known heuristic approaches such as eight golden rules, Winschenk and Barker classification, etc. were also utilised. As a sample of a public administration unit website for the paper, the Public Information Bulletin (BIP) of Poland was showcased as it provides and ensures free and universal access of all the information to the public. Steps involved in proceeding with research include: selecting

BIP sites, researching the websites, identifying fundamental mistakes associated with usability of the BIP sites, categorization of those errors, evaluation and ranking the impact of each category on a scale of 1(lowest) to 5(highest), and comparing these categories with the traditional heuristics. Errors were segregated into 14 different categories involving website ergonomics, consistency, content, form, substance, navigation, accessibility, help services and miscellaneous limitations and were assigned rankings of varying severity.

The role of semiotics being used in website design evaluation is the main focus for paper [6]. Semiotics, the study of signs, forms the basis for the design of interface signs, with a focus on interpretation and creating meaning. Interface signs play a crucial role in facilitating interaction between user interfaces (UI) and end users. This study aims to examine the Semiotic Interface Sign Design and Evaluation (SIDE) Framework and its impact on interface design. The SIDE framework was developed over three years of research and data collection to guide the creation and assessment of interface signs. It comprises five semiotic layers: syntax, pragmatics, social aspects, environment, and semantics. Various factors were taken into account to assess the framework's quality. The research involved two separate studies: one with users and the other with evaluators. The findings of both studies were discussed in parallel, focusing on quality metrics, before being compared to the SIDE framework.

With the increasing volume of transactions and usage in the digital sphere, the design of an e-commerce website holds utmost importance. Paper [8] deals with the development of an evaluation system for e-Commerce websites exclusively done from the view of a first-time buyer. E-commerce websites were selected as these sites require an objective, business policies and criteria in contrast to the subjective form of evaluation or individual preferences. Important factors include the target users(suppliers, buyers,etc.), user satisfaction, the reasoning behind their satisfaction and the goal of a first-time consumer (successful transactions). The paper states that user satisfaction is derived from attractiveness and informativeness. Attractiveness is defined as the quality of a website's physical settings increasing the involvement of customers on the website, divided into three sections: customization, interactivity, and vividness; Whereas informativeness can be defined as logical settings of a website, providing constructive and clear information to its consumers, comprising of understandability, reliability, and relevance. The proposed model consisted of three key steps: finding the function on the web, conducting transactions, and producing customer satisfactions. However, this model alone cannot measure satisfaction of the consumers. Therefore, on top of this model, three points of failure (ease-of-use, ease-of-identification, usefulness and interactivity) have been set up at the end of each step to evaluate both the successful and the failed attempts. All three failure points can be applied to the first-time buyers on an e-commerce website. Since a multiple-scale scoring system was required to evaluate the satisfaction in contrast to a two-scale system, modified five-point Likert scales were used.

III. PROPOSED SYSTEM

The system will evaluate the website depending on its categories to be focused on: e-commerce, e-learning, and business. Evaluation metrics being used for this are Shneiderman's golden rules and Nielsen's Heuristics. These two metrics are guidelines proposed for helping developers to sort out any difficulties posed to the task of UI designing.
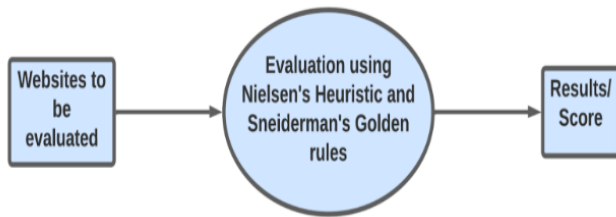

Fig. 1. Proposed model

The websites are assessed through a series of queries framed using the aforementioned metrics, splitting them into various sections. Each section would gauge different aspects of the interface design, with some correlating to the category the targeted site belongs to. The results from these segmented queries are then analysed and visualised along with some feedback related to the assessment for the user to have an easier understanding of the designing problems that needs to be mended.

IV. IMPLEMENTATION

A. Principles used for evaluation:

1) Ben Shneiderman's 8 Golden Rules:

   a) Strive for Consistency: For actions having similar purpose, the design of the attributes for accessing them should remain consistent throughout the website. Each class of actions must have an identical format to distinguish between each other.

   b) Seek universal usability: Make the website easily accessible and cater towards a wide scope of the different demographics. This can be achieved by adding various features aiding users at each level of expertise.

   c) Offer Informative Feedback: An interactive feedback should be generated as a response to a certain action by the client. The calibre of feedback correlates to the gravity of the action.

   d) Design Dialog to Yield Closure: A comment should be issued following the completion of a series of tasks by the user, as a sense of fulfillment. These dialogs act as an indicator for the users to alert them for the upcoming sequence of actions.

   e) Offer Simple Error Handling: Design the website such that user errors are restricted and minimised to the very least. If a user commits a specific error, the site should prompt a short, concise message to fix it.

   f) Permit Easy Reversal of Actions: Users should be granted access to reversing certain actions to avoid some mistake. The actions could be singular in nature or in a group, similar to a data-entry task.

   g) Support Internal Locus of Control: The system should be designed in a way that allows the user to initiate actions. Users should be given control and make the user feel that they are in charge of the system and the system responds to their actions.

   h) Reduce Short-Term Memory Load: The limitation of human information processing in short-term memory requires that displays be kept clean and simple. You have to derive the chronology of the information or you will distract the user with unnecessary information no matter where you place your site.
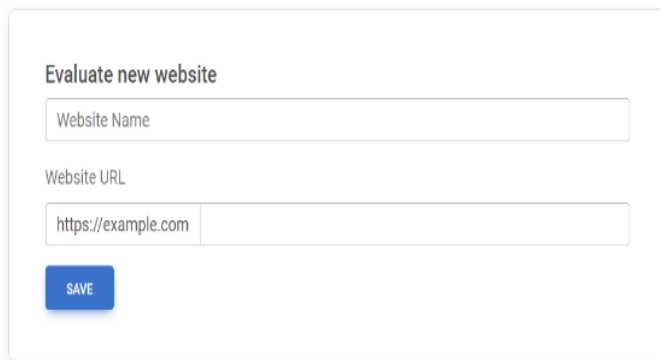
2) Jakob Nielsen's Heuristics:

   a) Visibility of system status: A website should keep the user informed about the changes made or occurring on the website through an appropriate response in a reasonable time. Whenever users interact with a system, they need to know whether the interaction was successful.

   b) Match between system and the real world: The system should speak the user's language, using words and concepts familiar to them. The information should be in a logical and natural order and also follow real-world conventions.

   c) User control and freedom: A website should always provide the user with easy access to various tools so as to perform various tasks. It provides the user with a variety of choices so the user can choose as per his/her requirement.

   d) Consistency and standards: A system should adhere to standards and should be easy to learn and use. The system should use and follow a uniform pattern throughout the system and follow domain-specific conventions.

   e) Error prevention: A website should check or eliminate all error causing factors, and offer users a confirmation option before they finalize a specific action. The higher cost errors should be solved first and later the smaller errors can be fixed as per convenience.

   f) Recognition rather than recall: The website should make it easier for the user to recognise things rather than the user having to learn all the things at once. It will be beneficial and easier if the information is easily retrievable whenever necessary.

   g) Flexibility and efficiency of use: UI should offer appropriate functionality to users with different skill sets, such that less experienced users need more detailed information. But as they learn to

use the product, they become experienced users, allowing them to use advanced processes like using keyboard shortcuts performing tasks quickly.

h) Aesthetic and minimalist design: In an interface, it is favourable to have more functionalities above aesthetics. Create interactions that contain only essential information. Avoid redundant artistic and creative visual elements that can distract users.

i) Assist users in recognizing, diagnosing, and recovering from errors: The interface should aid users in identifying and resolving issues. To achieve this, error messages should be presented in clear and straightforward language, along with suggested solutions.

j) Help and documentation: Help and documentation will assist users to understand how to perform their tasks. It is essential to provide additional help at any given time. Help and documentation should list concrete steps users can follow to complete a task without any problem.
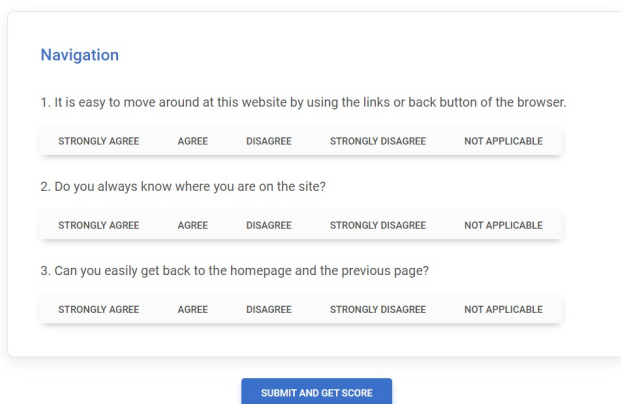
B. Working

Fig. 2. Evaluation Tool - Website details

Fig. 2 shows the interface of the evaluation tool. This is the first page, it takes in the name and URL of the website to be evaluated.
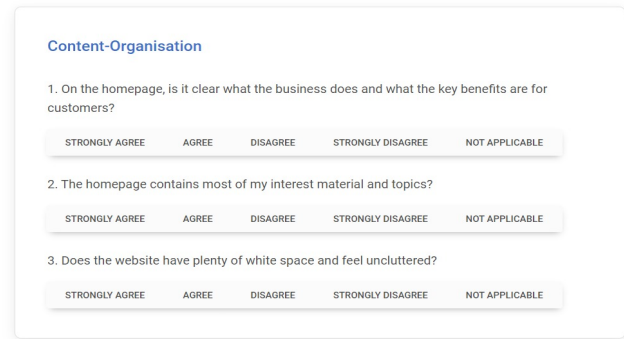
Fig. 3. Questionnaire - Navigation
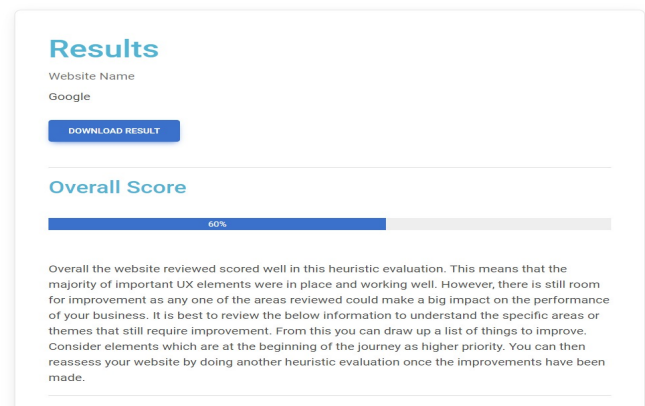
Fig. 4. Questionnaire - Content-Organization

Fig. 3 and 4 displays the questionnaire divided into multiple sections such as "Navigation" and "Content-Organisation". Users will get to choose a rating for a specific question related to the website design specified by the section and that aspect is evaluated based on it.

Fig. 5. Result - Overall score

Fig. 5 shows the overall results for the website's usability design by evaluation of the response given by the user with the help of the methods utilised.
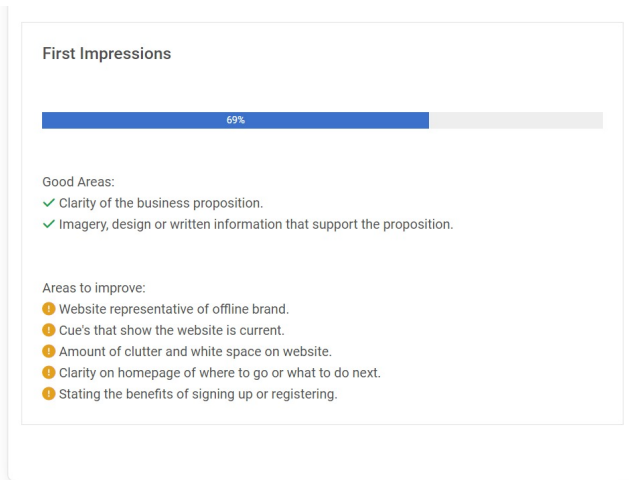
Fig. 6. Result - Feedback

In Fig. 6, feedback is given for each section in relation to the responses given by the users which improves the efficiency and usability of the website in question.

V. CONCLUSION

Heuristic evaluation is a resource-efficient, flexible inspection method. The system emphasises on the usefulness of design principles in developing an interface. When incorporating HCI design principles into the evaluation of an interactive system, it becomes possible to attain excellent usability, a well-crafted user interface, and a positive user experience. Our conclusion is that creating a valuable human-computer interaction necessitates the careful selection of both the appropriate interaction style and interface that aligns with the intended user group.

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