Enhancing the Usability of ITG Virtual Tour Website Through UI/UX Design Using the Five Planes Method

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(Received: 20 Mar 2025, revised: 17 Apr 2025, accepted: 21 Apr 2025)

Abstract

The virtual tour website in higher education significantly enhances campus information accessibility; yet, the poor usability of the ITG Virtual Tour website leads to a subpar user experience. This research offers a redesign of the UI/UX utilizing the Five Planes technique, which prioritizes clarity in information and navigation. A System Usability Scale (SUS) was employed to evaluate the site's usability prior to and after the redesign, adhering to the five stages of The Five Planes: Strategy, Scope, Structure, Skeleton, and Surface. The test findings indicated that the initial SUS score of 51.17 (classified as "poor") rose to 74.7 (classified as "good") following the installation of the revised design, demonstrating a substantial enhancement in usability and user satisfaction. This study contributes by demonstrating how the Five Planes method can be effectively applied in the academic context to improve the usability of virtual tour websites, offering a structured framework that can be adopted by other institutions seeking similar improvements.

Keywords: Navigation System, System Usability Scale, The Five Planes Method, UI/UX Design, Virtual Tour.

I. INTRODUCTION

With the rapid advancement in digital technology, virtual tour platforms have become a tool that can be used in various fields, including education, allowing information to be accessed immersively [1], [2]. With the rapid advancement in digital technology, virtual tour platforms have become a tool that can be used in various fields, including education, allowing information to be accessed immersively [3], [4].

The research conducted by [5], indicates that the Virtual Tour website offers information that enhances visitors' comprehension of the locations shown in the virtual tour. The information comprises visual signals that assist users in navigation, comprehending the description of the location, and accessing categorized sites; these visual cues facilitate effective engagement.

One of the institutions that has implemented this technology is the Institut Teknologi Garut (ITG). A higher education institution located in Garut, West Java, Indonesia. The ITG Virtual Tour website introduces the facilities and services provided by the campus to students through spherical panorama images. However, through a survey conducted by user persona using the System Usability Scale (SUS), it was found that the website has an SUS score of 51.17, categorized as "poor" with a grade of "F". The score indicates that user acceptance of the website is still not satisfactory, and users tend to become "Detractors" in the Net Promoter Score (NPS). The website has shortcomings in content consistency and information presentation, such as usage explanations, virtual tour introduction guides, and descriptions of places and icons that support user understanding in using the ITG virtual tour. UI and UX design can be one of the efforts to address this issue. UI/UX design becomes a step to improve the website in conveying clear information design and website functionality that makes it easier for users to use the website [6], [7].

The usability of a Virtual Tour website is intricately linked to UI/UX, both of which are critical in providing an informative and interactive user experience. The design of UI/UX on a website influences user ease and comprehension, commonly known as the website's usability level. UX, which evaluates the influence of a system on satisfaction, trust, and aesthetic appeal, will effect usability and the ultimate user experience, encouraging people to disseminate recommendations for the website they utilize [8], [9].

The utilization of the five planes method in UI/UX design can effectively address deficiencies in a website. The five planes method employs UI/UX design based on the user and incorporates insights gathered from stakeholders [10]. Assessing usability levels can provide a foundation for

DOI: 10.34148/teknika.v14i2.1227

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boosting usability and optimizing a website. The usability level is assessed by comparing the findings of the website's usability evaluation with the prototype generated during the design and enhancement process [11]. This study uses The Five Planes technique, a user-centered UI/UX design method, aimed at overcoming difficulties in using the ITG Virtual Tour website. This study combines SUS Score assessments conducted before and after the design phase, and redesigns the interface according to user requirements and stakeholder feedback. This is different from other studies that only focus on evaluating or developing systems from scratch.

Many previous studies, such as those conducted by Mursityo and Wijoyo (2024), assess mobile applications with the System Usability Scale (SUS) but fail to incorporate a systematic design methodology [12]. Maggenta et al. (2022) used The Five Planes in creating a new system, neglecting to examine the previous system [13]. Simultaneously, studies conducted by Yanfi and Nusantara (2023), along with Welda et al. (2020), were limited to usability testing without measurable redesign [14], [15]. Research conducted by Shikhri et al. (2021) offers a theoretical framework regarding visual cues in virtual tours [16]; however, the framework has not been fully implemented in design practice.

This research enhances these contributions by creating a layout that is sensitive to initial assessments and incorporates visual cues and validated information structures to enhance overall user understanding and experience. Considering the low usability score of the ITG Virtual Tour website and the limitations identified in previous research approaches, this study is relevant as a structured and measurable solution to improve user experience. The proposed UI/UX redesign aims not only to address interface issues but also to align with user needs comprehensively. The expected contribution of this research is to offer practical insights for higher education institutions in designing or improving virtual tour platforms, by applying the Five Planes method systematically and demonstrating usability improvement through data-driven user evaluation.

II. RESEARCH METHODS

This study adopts a combined exploratory and evaluative approach. The exploratory component aims to identify usability issues through the System Usability Scale (SUS) and user persona analysis. Meanwhile, the evaluative component measures usability improvements after applying a structured UI/UX redesign using The Five Planes method.

To carry out this approach, the research focuses on rectifying deficiencies in the ITG Virtual Tour website by enhancing usability through UI/UX design. The employed methodology is The Five Planes, accompanied by usability assessment utilizing the System Usability Scale (SUS). The research consists of seven steps: initial observation, usability testing, and the five principal stages of The Five Planes: strategy, scope, structure, skeleton, and surface, as shown in Figure 1. This approach, derived from The Elements of User Experience [17], incorporates five interconnected structural layers.

During the preliminary observation phase, a review of the scientific literature behind the research and observations related to the ITG Virtual Tour website, which serves as the focal point of this study and the foundation for the problem formulation, was undertaken.

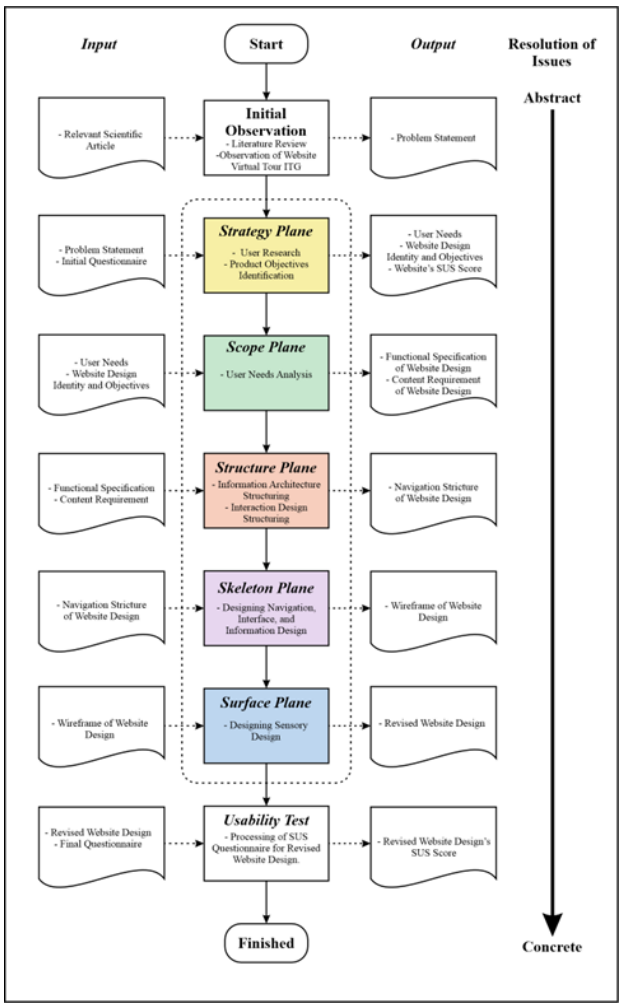

Figure 1. Research Flow UI/UX Design Using the Five Planes Method.

Initially, at the first step of the five planes approach, known as the strategy plane. This step involves defining the product objectives and user requirements for the website to be created [18]. Product objectives and user requirements can be discerned through data collection, which provides a foundation for website design comprehension. Data collecting may be enhanced by examining relevant design websites or an existing institutional site to underscore ownership identification, with direct user testing or review through the creation of personas or centralized groupings based on shared features.

Upon finalizing the strategic plan, the design will advance to the subsequent phase, known as the scope stage. At this point, the objectives and prerequisites of the website will be articulated into comprehensive descriptions of features,

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functional specifications, and content requirements to be incorporated into the website.

Following the establishment of functional criteria and content needs for the website design, the subsequent phase is the structural stage. At this step, a concept will be developed that elucidates and categorizes functional and content elements into an information architecture. Information architecture and interaction design can be elucidated through a hierarchical framework that organizes information by arranging the outcomes of these disciplines into a website diagram [19].

The subsequent phase is the skeletal plane. This phase delineates how the website's design will be formulated based on the functionality and architecture established in the structural stage. Numerous design elements impact this phase, including interface design, navigation, and information.

The uppermost and concluding layer in the five planes approach is the surface plane stage. This stage emphasizes the integration of content, functionality, and aesthetics into a cohesive design that presents a visual look consistent with the preceding four phases and is perceptible to human senses. At this juncture, the design can be developed into a high-fidelity version. High-fidelity design refers to a prototype website design that 199s aesthetic criteria, functional requirements, and is appealing to human sensory perception [20].

Subsequent to the creation of the UI/UX design. The design underwent a usability evaluation utilizing the System Usability Scale (SUS). The System Usability Scale (SUS) is a usability assessment method developed by James Brooke [21], utilizing a Likert scale comprising five response options: strongly disagree, disagree, neutral, agree, and highly agree. The SUS comprises 10 questions, consisting of 5 negative and 5 positive inquiries, detailed as follows:

1) I am thinking of using this system again
2) I feel that this system is too complicated.
3) I find it easy to use this system.
4) I need help from others or experts in using this system.
5) I feel that the features of this system are functioning as they should.
6) I feel that there are many inconsistent or incompatible things in this system.
7) I feel that others will quickly understand how to use this system.
8) I find this system confusing.
9) I feel that there are No. obstacles in using this system.
10) I need to get used to it first before using the system.

The SUS questionnaire was distributed to 17 respondents, consisting of undergraduate students who had previously completed coursework related to UI/UX Design. These participants were selected using purposive sampling, ensuring they possessed sufficient familiarity with website usability and could provide informed evaluations. This group also represents the primary user segment of the ITG Virtual Tour website, making their feedback directly relevant to the objectives of the study. The number of respondents aligns with standard SUS practices, which typically recommend a minimum of 12 to 15 participants to obtain reliable usability insights.

Each question utilizes a 5-point scale, resulting in a score range from 0 to 4. Nonetheless, a distinction exists in the computation of positive and negative question types. Positive questions numbered 1, 3, 5, 7, and 9 stipulate a deduction of 1 point. Furthermore, for the negative inquiries numbered 2, 4, 6, 8, and 10, 199 tis stipulated that the scale position shall be diminished by 5. Subsequently, once the question scores have been computed. The subsequent step involves aggregating the total scores for each question and multiplying the cumulative score by 2.5. To acquire a SUS score with a final score range of 0 to 100 [22].

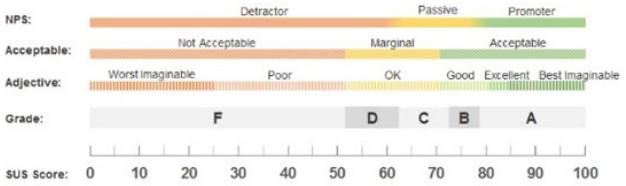

Figure 2. SUS Score Range [23]

In Figure 2, the SUS score results are presented, providing information such as letter grade levels, adjective levels, acceptance levels, and the Net Promoter Score (NPS) or user loyalty score [12]. Table 1 presents the interpretation of the SUS score on a scale of 0–100, where higher values indicate better usability. Scores are categorized from A+ to F, with adjective ratings (Best Imaginable to Worst Imaginable), as well as acceptance levels (Acceptable or Not Acceptable). NPS classifies users as Promoters, Passives, or Detractors, reflecting loyalty and recommendation tendencies. The interpretation of Table 1 can serve as a reference in assessing the effectiveness of UI/UX design in improving usability.

Table 1. SUS Score Interpretation [23]

SUS Score	Grade	Adjective	Acceptance Rate	NPS
84.1 – 100	A+	Best Imagineable	Acceptable	Promoter
80.8 – 84	A	Excellent	Acceptable	Promoter
78.9 – 80.7	A	Good	Acceptable	Promoter
77.2 – 78.8	B	Good	Acceptable	Passive
74.1 – 77.1	B	Good	Acceptable	Passive
72.6 – 74	B-	Good	Acceptable	Passive
71.1 – 72.5	C	Good	Acceptable	Passive
65 – 71	C	OK	Marginal	Passive
62.7 – 64.9	C	OK	Marginal	Passive
51.7 – 62.6	D	OK	Marginal	Detractor
25.1 – 51.6	F	Poor	Not Acceptable	Detractor
0 – 25	F	Worst Imaginable	Not Acceptable	Detractor

Each stage of The Five Planes method generated insights that directly shaped the redesign of the ITG Virtual Tour website. The Strategy and Scope phases highlighted users' needs and content gaps, the Structure phase uncovered navigation and interaction inefficiencies, the Skeleton phase addressed interface layout, and the Surface phase refined the visual aesthetics. These findings informed both design choices and the focus areas for post-design usability evaluation, thus integrating analysis seamlessly across all phases.

DOI: 10.34148/teknika.v14i2.1227

III. RESULTS AND DISCUSSION

A. Results

The beginning phase of this research entails formulating a strategic plan that encompasses user research and the establishment of product objectives by gathering questionnaire data pertaining to the Virtual Tour ITG website, which will serve as the foundation for identifying the issues addressed in this study. The SUS questionnaire was administered to five user personas, as depicted in Figure 3, which illustrates the user persona card containing information such as name, age, occupation, marital status, technical proficiency, and preferred websites. Additionally, it was distributed to ten students possessing identical characteristics and knowledge, specifically those who have completed the UI/UX Design course. A sample of 15 respondents fulfilled the requirements outlined in the SUS questionnaire [24].

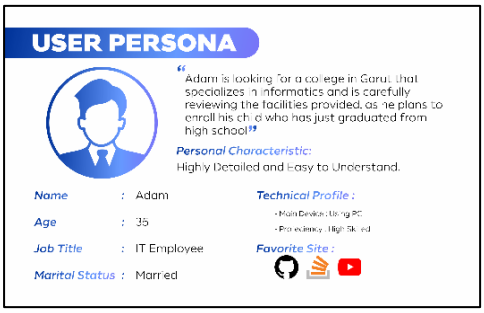

Figure 3. User Persona Card.

Figure 4 illustrates that the distribution of SUS scores for each respondent spans from a minimum of 25 to a maximum of 70. The average score was 51.17, signifying that the Virtual Tour ITG website received a F grade, indicative of subpar performance and a failure to satisfy user expectations, resulting in users likely becoming Detractors. The SUS questionnaire results indicated that the lowest scores were for question 6, "I feel there are many inconsistencies in this system," question 7, "I believe others will quickly comprehend how to use this system," and question 10, "I need to familiarize myself before using this system," with scores of 21, 22, and 23 out of 60, respectively. These questions contain elements that evaluate the coherence of material and user comprehension in navigating the website, which are somewhat challenging to grasp. The user persona administered an experiential survey on the Virtual Tour ITG website.

The challenges faced in gathering questionnaire data from respondents and surveys from user personas can be distilled into four user demands, specifically:

1) Description of the incomplete location
2) Information regarding school facilities and often frequented locations by students is difficult to obtain.
3) The design of icons, navigation menus, and color schemes remains unattractive and overly congested on a single page.
4) The utilization of the Virtual Tour website is somewhat challenging to comprehend.

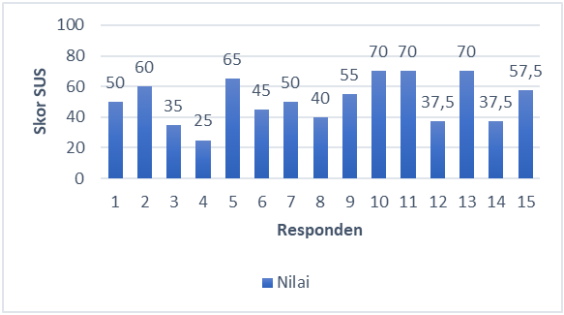

Figure 4. Website's SUS Score Per Respondent Graphic

The identification of product objectives is conducted to comprehend the website's intended function and its creation rationale. This research involves the construction of a website to rectify multiple deficiencies detected in user research. The design must prioritize brand identity, the identity of ITG stakeholders, and campus, while conforming to established requirements for virtual tours and UI/UX. Consequently, the design necessitates one of the internet references possessed by ITG.

The ITG profile website functions to provide information regarding ITG and the newest developments occurring within the ITG campus area. The website's primary color is white, with blue as the predominant accent, represented by the hex code "#066AAB". The typeface employed on this website is "Source Sans Pro."

The product objectives of this design are as follows:

1) The ITG Virtual Tour website was enhanced to showcase ITG campus facilities through a user-friendly design, perhaps improving the website's SUS score.
2) The ITG Virtual Tour website was enhanced by addressing user requirements and reinforcing ITG's brand identity.

Following the determination of product objectives and user requirements at the strategic level, the study progresses to the scope level. The analysis results of the previously acquired information are categorized into two components that underpin the system or website design: functional specifications and content requirements.

Functional requirements delineate the particulars of the functions that must be incorporated into the website based on study and consultations with diverse stakeholders. This document outlines the functional specifications for the ITG Virtual Tour website.

1) The website comprises two primary pages: the introductory information page and the virtual tour page.
2) The introductory information page is designed to provide details about the virtual tour, ITG campus highlights, and navigation to supplementary pages, specifically the creator information page and the feedback form.
3) The ITG campus hotspot will be presented on the introductory information page as a card and pop-up.
4) The virtual tour page will have a virtual tour of the ITG campus, including a navigation button, a control button symbol, place name details, and descriptions of locations or rooms.

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5) The virtual tour control icons comprise screen size modification, audio control, virtual reality headset mode adjustment, navigation button display modification, and the virtual tour image catalog.
6) The virtual tour navigation button will be displayed within the virtual tour and in a dedicated bar including a list of locations, a guide button, a map button, and a button to return to the introduction information page.
7) The virtual tour guide and floor plan are displayed via a pop-up.
8) In addition to the navigation button, the virtual tour features a place information button represented by an icon and a pop-up.
9) The choice of the 'Source Sans Pro' typeface and the blue color '#066AAB' has been tailored to align with the reference website, so reinforcing the brand identity shown in the strategy plane section.

Simultaneously, content requirements encompass the material that must be shown on a website to assist users in comprehending the website's functional specifications. The content specifications for the ITG Virtual Tour website are as follows:

1) The introductory information page features a concise virtual tour and photographs related to ITG campus amenities, along by hotspot cards that display the name and header images of the respective buildings.
2) The creator information page displays the name, headshot, and professional social media accounts of both the creator (former coder) and the designer (researcher). Additionally, details regarding the primary stakeholder accountable for the website's development, specifically LSIPD ITG, are included, with the ITG logo, the stakeholder's name, and a succinct description of the stakeholder.
3) The feedback form page displays a questionnaire that adheres to the standards of the SUS questionnaire.
4) The pop-up hotspot section displays a photosphere image of the specified location along with a concise description of the site. The locations to be showcased include the library, student lobby, UKM area on the first level, Canteen 1, Canteen 2, and Area 306.
5) The virtual tour page features a photosphere image of the ITG campus facilities, annotated with the names of locations and buildings matching to the depicted images.
6) The pop-up guide provides instructions on utilizing the virtual tour and navigating through it.
7) The pop-up displays a floor plan graphic for each building.
8) The list of photographs displays all the visuals utilized in the virtual tour.
9) In the specialized navigation bar, locations will be categorized by building into four groups: Labtek ITG, Buildings A-B, C, E, Student Area, and Building F.

At the structure plane stage, information from functional specifications and requirements is mapped or described in an information architecture and interaction design.

Figure 5 illustrates the interaction design intended to organize the diverse actions and activities users may undertake while engaging with the site. This structure is meticulously constructed to guarantee that each user action proceeds seamlessly and intuitively. A method employed to accomplish this is the creation of a user flow, a diagram that delineates the user's navigation pathway while utilizing the features offered on the website. User flow assists designers in visualizing the user's journey, identifying potential impediments, and ensuring that each interaction is seamless and gratifying. Effective interaction design enables users to comprehend site functionality, locate desired information or features, and accomplish their objectives with greater efficiency. This not only improves the user experience but also augments user retention and happiness with the website.

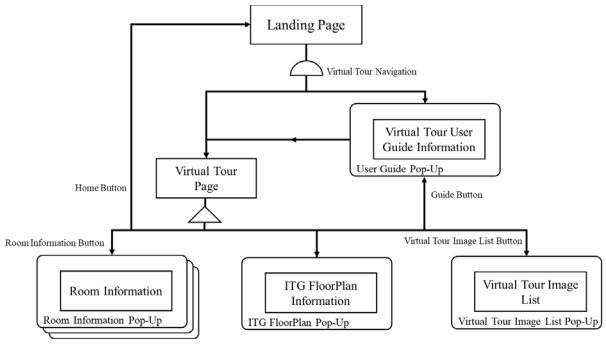

Figure 5. Interaction Design

Figure 6's information architecture facilitates the organization of the information providing process, enabling users to efficiently locate and get the content they require. This information architecture is typically depicted as a hierarchical navigation structure, wherein information is grouped according to levels of significance or classifications. Consequently, customers may swiftly comprehend how to traverse the website and locate important information with greater efficiency. An ordered structure enhances user experience, minimizes confusion, and optimizes the efficacy of information conveyed by the website.

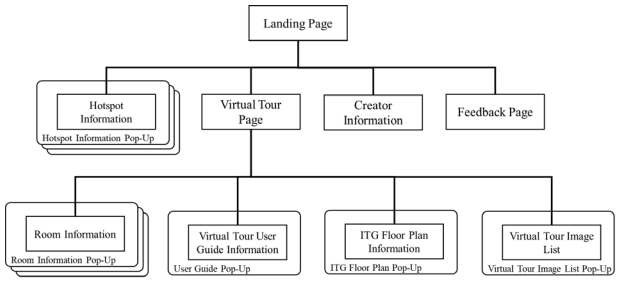

Figure 6. Hierarchical Information Architecture

After the establishment of the information architecture and interaction design. Subsequently, a preliminary visualization and modification of the interface design elements can be conducted in accordance with the skeletal phase. The interface design element manages interactive components that correspond to functions and requirements. The navigation design element manifests as a distinctive shape or container inside the interface design, facilitating the presentation of information. The information design encompasses the substance of a design to facilitate effective communication for

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users. The three aspects mutually influence one another, cannot exist alone, and may be properly represented and elucidated in a wireframe. A wireframe is a compilation of sketches or preliminary outlines depicting the structure of a website, encompassing interface design, information architecture, and navigation, presented in a low-fidelity or non-detailed format. Figure 7 illustrates an example of wireframe design.

Figure 7 illustrates a specimen of the wireframe design for the Virtual Tour website. The wireframe on the virtual tour page includes annotations that effectively elucidate the functions of the components. Developing preliminary sketches that depict the arrangement of website pages, considering interface, navigation, and informational elements. Wireframes are utilized to illustrate interactive components that correspond with user activities and requirements, create a navigation framework that enhances information dissemination, and guarantee successful communication through the provided material. Tools such as Whimsical are crucial in wireframe design, offering diverse features for collaborative diagram and sketch creation. Whimsical enables designers to effortlessly generate and modify wireframes, collaborate with the team, and obtain immediate feedback. Whimsical enables designers to delineate the comprehensive layout and navigation flow, guaranteeing the seamless integration of all critical parts prior to advancing to the more intricate design phase.

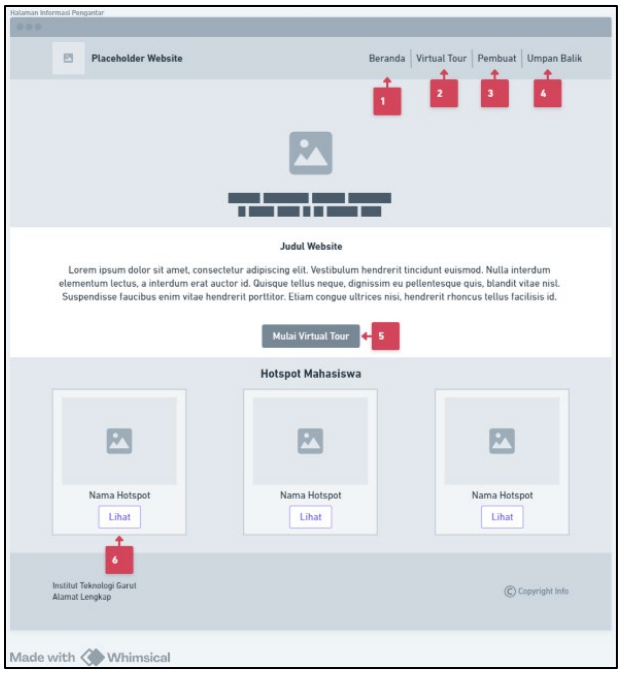

Figure 7. Wireframe Design of Introduction Page

Upon completion of the preliminary wireframe visualization, the design can go to the surface plane phase by incorporating aesthetic aspects and emphasizing sensory design based on the previously established information. The website design will be completed by developing a sensory design, which visualizes the anticipated functionality and the aesthetics appealing to the sense of sight. The sensory design generates a high-fidelity website prototype developed on the Figma platform. Figure 8 illustrates the sensory design perspective that generates the Virtual Tour ITG website prototype on the virtual tour page. The page contains elements that were designed in earlier phases. The prototype design incorporates multiple UI references from analogous websites and established applications. The sources are the Indonesia Virtual Tour website and Apple Maps. These references are integrated with the primary reference elucidated in the strategic framework.

Figure 8. Virtual Tour Page Prototype

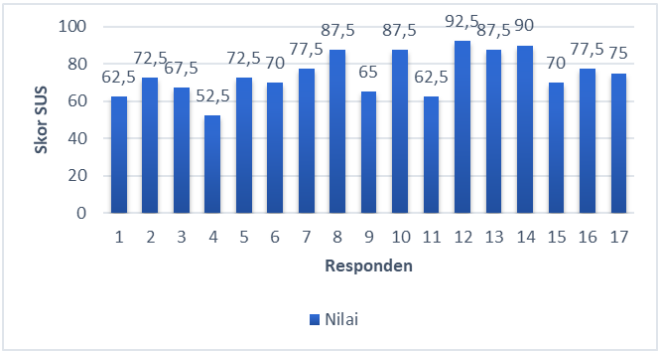

Figure 9. SUS Score Prototype Graph per Respondent

Upon the completion of the design, a usability test was performed utilizing the System Usability Scale (SUS). The SUS was employed at both the commencement and conclusion of the study to provide a comparison of the enhancement in SUS scores for both subjects, specifically the existing website and the newly created website. The SUS test on the website design was administered to 17 qualified respondents in accordance with the established norms, with the results illustrated in Figure 9.

B. Discussion

The SUS score improvement from 51.17 (grade F, poor) to 74.7 (grade B, good) demonstrates a significant enhancement in the usability of the ITG Virtual Tour website after the UI/UX redesign. This result confirms that the redesign addressed critical weaknesses identified in the initial evaluation, particularly in terms of information clarity, content consistency, and user navigation.

The increase in SUS score is not only a quantitative reflection of better usability but also suggests a positive shift in user perception. Initially, users tended to become detractors

due to confusion and difficulty navigating the system. After redesigning the interface using a structured approach, users transitioned into the passive category, indicating that while they are not yet enthusiastic promoters, their overall acceptance of the system has improved.

Several factors contributed to this improvement. The use of The Five Planes method ensured that the design process was systematic, starting from understanding user needs at the strategic level to developing the final interface in the surface layer. Each layer was informed by real user feedback and stakeholder insights. This approach supports the findings of Maggenta et al. [12], who reported that implementing The Five Planes led to measurable gains in user satisfaction and interface effectiveness.

Furthermore, the integration of visual cues—such as categorized navigation buttons, hotspot cards, usage guides, and pop-up descriptions—directly addressed earlier issues of inconsistency and lack of guidance. This aligns with the observations of Shikhri et al. [16], who emphasized the role of visual cues in improving orientation and understanding in virtual tour environments, although their work remained largely conceptual. This study builds upon that insight by demonstrating practical application and validation through usability testing.

Additional comparisons further strengthen these findings. Mursityo and Wijoyo [13] evaluated a mobile application using SUS but did not implement a structured redesign, thereby limiting the potential impact. Likewise, Welda et al. [15] assessed university website usability without proposing or measuring changes. In contrast, this research offers a complete usability improvement cycle—from initial diagnosis, through redesign, to post-evaluation—demonstrating tangible results.

Although the improved SUS score reflects substantial progress, the placement of users in the passive category suggests that further refinement is needed. Future work may explore deeper personalization, mobile optimization, or more interactive elements to enhance engagement and move users toward becoming active promoters.

IV. CONCLUSION

This research seeks to enhance the usability of the Virtual Tour ITG website via a UI/UX redesign employing The Five Planes framework. A usability evaluation was performed utilizing the System Usability Scale (SUS), revealing an initial score of 51.17 (poor) that improved to 74.7 (good) following the installation of the revised design. This enhancement demonstrates that The Five Planes technique effectively resolves the previously highlighted usability concerns, including uneven aesthetics, non-intuitive navigation, and insufficient user advice.

The Five Planes framework delineates the UI/UX design process into five principal dimensions: Strategy, Scope, Structure, Skeleton, and Surface. This study's results corroborate earlier findings that a hierarchical structure-based approach in UI/UX design can improve user satisfaction, engagement, and information accessibility.

This research enhanced the usability of the ITG Virtual Tour website; yet, obstacles persist, particularly for individuals with little technological proficiency who encounter navigation difficulties. Consequently, future research is advised to investigate other methodologies, including onboarding lectures, gamification, or heatmap analysis, to attain a more profound comprehension of user interaction patterns and improve sustained engagement.

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