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Discussion on Designing Prototype for Child Centered User Interface for Virtual Reality Tourism

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1. Introduction

There are various research related to the importance of Virtual Reality (VR) in education that focuses mainly on adult groups [1]. However, in this research we recognized the effectiveness of visualizations in learning for children using VR, we study a child-centered user interface that utilizes VR technologies. As a concrete topic, we developed a virtual tourism application which navigate and explore the tourist destinations of Muroran, Japan. Our study has 2 steps, the first is to develop a base application aimed at users of all ages. Next is to improve its interface for children's use.

In this paper, to improve the effectiveness of our design of the base application, we conducted preliminary evaluations involving university-level students based on the evaluation approaches employed by Carnevale et al. [2]. The invaluable feedback obtained from this initial testing phase serves as a foundation for further refinement and optimization of the user interface. By incorporating the insights gained from these evaluations, we strive to ensure that the interface is not only technologically robust but also aligns seamlessly with the unique needs and preferences focusing children. This iterative development process underscores our commitment to enhancing the child-friendly features of the interface, that is both engaging and educational.

2. Overall Methodology

2.1. Base Application Design

We captured comprehensive 360° images across nine distinct tourist locations in Muroran, Japan, showcasing the beauty of each site in all four seasons- summer (June-August), winter (December-February), spring (March-May), and autumn (September-November) during the year 2023 (Fig 1). Subsequently, using Figma, we crafted a user interface prototype with a focus on child-centric design. This designed prototype was then brought to life using Unity Hub. The immersive experience was culminated by presenting the prototype through the Oculus Meta Quest 2, allowing users to explore Muroran beauty in a unique and engaging manner.

2.2. User Testing

We engaged both graduate and undergraduate students from Muroran Institute of Technology for user testing. The developed prototype underwent testing with 13 of these students using the Oculus, and the evaluation was conducted through a questionnaire survey (Fig 1).

2.3. Evaluation of the prototype

We evaluated the collected responses provided by the participants through different statistical testing at 95% confidence level. A Student t-test was conducted to assess the correlation between participant satisfaction and the virtual presentation of the virtual environment. Additionally, a chi-square test ($\chi 2$) was employed to appraise the virtual presentation quality among participants.

2.4. Child-Centric Interface Upgrade

We analyzed the respondents feedback on the suggestion to improve the user interface for child-friendliness. Their input will be integrated into future enhancements, focusing on making the interface more accommodating for children.

3. Results

Approximately 23% of the participants were female, with the remaining majority (77%) being male. The responses were nearly

evenly split between international students (around 50%) and national students (50%). Only one participant was not able to navigate to the virtual environment easily while remaining participants were able to navigate ($\chi 2$ = 0.0, p -value = 1). The visual presentation of the virtual environment received positive feedback (t-test = 4.38, $p<0.05$), with 7.7% of the participants expressing disagreement. Additionally, more than 7.7% neither agreed nor disagreed, while a substantial majority of 69.2% agreed, and 15.4% strongly agreed (Fig.2). Similarly, 23.1% of the participants respondent the virtual environment was neither good nor bad while 46.2% of the participants were satisfied with the virtual quality of the virtual environment followed by 30.8% of the participants who were very satisfied with the virtual quality of the virtual environment (t-test = 5.11, $p<0.05$) (Fig.2).

Concerning the enhancements required to elevate the virtual tourist experience in Oculus, a substantial number of respondents (50%) recommended incorporating an exit button. While 20% of participants proposed arranging images more effectively, addressing instances where images were misplaced, 10% of the respondents each advocated for the use of higher resolution images, increased inclusion of images and videos, and the stabilization of the UI position.

To create a child-centric interface, 40% of the respondents recommended incorporating lively characters with colorization. Additionally, 32% suggested presenting information about nine different locations in Oculus using the national language (Japanese), centering specifically to children. Furthermore, 12% and 16% of the participants proposed integrating audio descriptions for locations and implementing a time-limit feature, respectively, as part of enhancing the virtual environment for child-friendly experience.

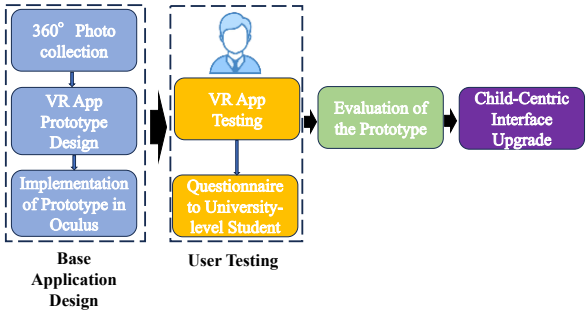

Fig 1. Overview of the methodology employed

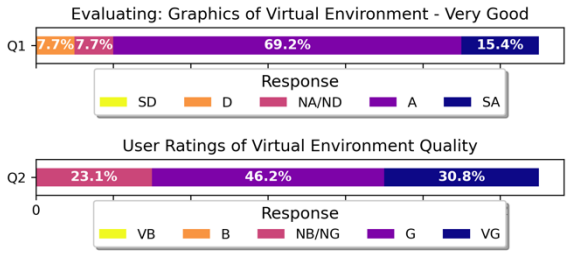

Fig 2. Likert scale with percentage of the response. Q1. Evaluating graphics of virtual environment-very good where SD = Strong disagree, D = Disagree, NA/ND = Neither agree nor disagree, A = Agree, SA = Strongly agree. Q2. User rating of virtual environment quality where VB = Very bad, B= Bad, NB/NG= Neither bad nor good, G= Good, VG= Very good

4. Conclusions

We gathered suggestions from university-level students regarding nine distinct popular tourist destinations in Muroran within Oculus to enhance the virtual environment's quality, with a particular focus on making it child-friendly. Our findings focus emphasized the importance of lively characters and vivid colorization (40%) for optimal enhancement. In the future we will incorporate the feedback provided by the respondents and will insert the lively characters and vivid colorization for making child friendly interface suggested by the majority of the participants.

References:

[1] Marougkas, A. et al., 2023. Virtual Reality in Education: A Review of Learning Theories, Approaches and Methodologies for the Last Decades. Electronics, 12: 2823.

[2] Carnevale, et al., 2022. Virtual reality for shoulder rehabilitation: accuracy evaluation of Oculus Quest 2. Sensors, 22: 5511.