An EyesSpeak Prototype for the System: Dual Language Gaze Interaction Integration

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***Abstract*—The wait for inclusive digital experiences has been addressed by EyesSpeak, and by using gaze control interaction and real-time translation, the app can be used by both Bangla and English speakers alike.Gaze-tracking is an advanced tech that refaces the interface dependent on the user's interest so as to increase their involvement in it. According to the evaluations, the satisfaction of the user is improved by surpassing level in this case and the engagement that became greater especially among people having a sight problem.**

I. Introduction

In the current ever changing digital environment, software development needs to have an effective communication and be highly usable. Therefore need arises for the establishment of such an intervention when it comes to establishing a very important Bengali-English site that seeks to eliminate various linguistic constraints by making digital space much more accommodating for all. EyesSpeak initiative responds to these by ensuring advanced software that incorporates gaze tracking for user interactivity as well as real time translators. We hope that by using these innovations, we can improve people's participation in our services while building an online community that is more varied and connected.

In projects like EyesSpeak, there are several ways of identifying and determining specifications, these are: surveying, interviewing, and user testing [1]. Surveys help collect general information from numerous people but fail to provide specific details about what individual people really do on the application site; interviews yield valuable information with some depth on certain aspects though they are slow and likely biased towards opinions of those participating in them; user testing gives a simpler way to explore usability though it may require a lot of resources.

We used a mixed-methods approach in the EyesSpeak project, combining qualitative and quantitative research. This combination of methods enables us to collect data comprehensively and understand user needs in more detail. It also ensures that our findings have both significance and utility, given that different groups such as Bengali and English speakers are involved.

In projects like EyesSpeak, different sketching and prototyping techniques are used, each with its advantages and disadvantages. Low-fidelity sketching is inexpensive and quick, and this allows quick iteration even with the absence of details. High-fidelity prototyping serves as a medium through which users experience real life events but time and financial resources are imperative.

In the design of EyesSpeak app, we settled on a mix of both techniques. Offhand low-fidelity scribbles enabled quick brainstorming and ideation; high-fidelity versions let us improve user interactions and interface components after getting responses. With this two-pronged strategy, our prototypes became notable for originality and practicability.

A simple question-answer dialogue was used in the EyesSpeak project, combined with user interaction functions and also data collection methods [2]. There were some particular evaluations like technology literacy, user preferences and browsing habits through detailed surveys, user experiences and concerns investigated through focus group discussions. Gaze-tracking technology tracked natural user behavior during web navigation; this helped in making informed choices on improving interaction. Collecting data in real time assisted in detecting areas where user participation and involvement could be made better.

A user-centric design and development process were maintained by our evaluation uncovering critical insights into what users want and need. The results were corroborated by a sample representative of users belonging to different categories ranging from technological skills, financial status to linguistic proficiency. Moreover, it shows that starting in design and during and after application development, our research is all about inclusivity because all visual abilities participated in accessing these accessible properties as well.

II. Proposed Methodology

The EyesSpeak prototype development followed a structured Human-Computer Interaction (HCI) life cycle model, ensuring a user-centered design process. The HCI life cycle includes the following steps:

- Requirement Gathering and Analysis
- Design and Prototyping
- Implementation
- Evaluation and Iteration

A. Architectural/Block Diagram

Below is the architectural/block diagram outlining the different steps in the HCI life cycle model for EyesSpeak:

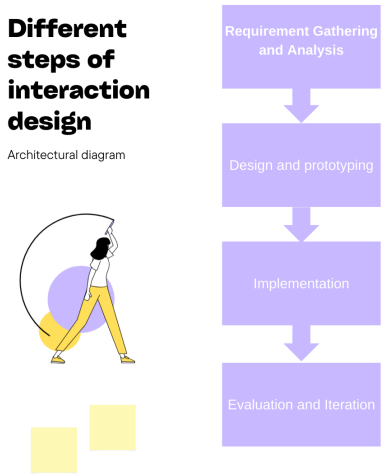

Fig. 1. Architectural diagram

B. Requirement Gathering

1) ***Working as a Client Consultant****:* We utilized a combined research method in collecting the data which consists of both qualitative and quantitative analysis [3]. A diverse group of research participants who spoke either Bangla or English in different places and settings was chosen for sample selection. This group would be reached out to through questionnaires in order to get complete data about the users' preferences, behavior while browsing, proficiency in different languages as well as their technological prowess.

The researchers held focus groups to look more closely at certain user experiences, concerns, and expectations relating to website engagement; language difficulties; and accessibility. When it comes to existing websites, users' natural surfing habits and points of interest were tracked using gaze-tracking technology, and real-time data on user interaction with digital content was obtained in an effort to pinpoint ways in which engagement and inclusion might be increased.

With this approach, a clear comprehension of the target audience was possible. The guidance of design and development process was done effectively, and there was diversity among potential website visitors because the sample consisted of students, professionals and elders.

The selection criteria included language proficiency, technology competency, and social-economic status, and the research included people with different sight impairments who were used to evaluate if the accessibility tools were working, meaning that the method of research used was all encompassing in nature.

2) ***The Process of Creating an Affinity Diagram****:* 1. Collected raw data from surveys and interviews.

2.Identified key themes and patterns within the data. Organized the data into clusters based on these themes.

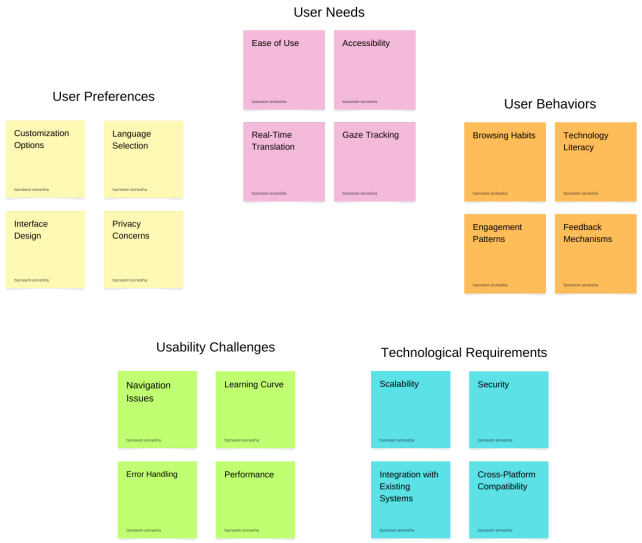

Fig. 2. Affinity diagram

3.Labeled each cluster to create an affinity diagram, highlighting major user requirements and insights. [4]

3) ***Creating Persona and Scenarios*** *:* Based on gathering information, we set up the following personas and their scenarios in brief:

- **Aisha**
  - Goes back and forth between working in Bengali and English due to professional and personal interests.
  - Uses live translation for better access to majority of things.
  - Accesses user-oriented design as it helps improve their browsing experience and has inclusive features that make it easier among many other things.
- **Rahim**
  - Uses the internet in Bangla.
  - Desires a simple, easy-to-use interface for navigation.
  - Prefers intuitive design with clear visuals.
- **Farhana**
  - Explores content which is accessible in multiple languages
  - Likes to use user-friendly language-switching features for accessing literature and cultural resources.
  - The platform's focus on accessibility and functionality needs to be hugely commendable.
- **Kamal**
  - Seeks educational resources and entertainment for children fluent in two languages.
  - Appreciates time-saving components and an easier way to read data.
  - Needs simple design and an operating principle that saves time for a parent with a busy schedule.
- **Sarah**

- Efficiently gathers research information about urban biodiversity
- Comprehensive resources are found with structured and reliable content.
- Improving productivity involves the use of features in "organizing results, annotating sections, and working together with colleagues."

*4) **Goal Requirement Matrix**:* The goal-requirement matrix for the project has been drawn as follows:

Goal Name	Percentage of Importance
Redesigning Website based on Gaze Track Data and feedback gathered	60%
Dual Language Switching	20%
Easily navigated UI	10%
Daily updates to the newly design website	10%

Fig. 3. Goal-Requirement Matrix

C. Prototyping and sketching

1) Reasons to use Low-Fidelity Prototype: Using low-fidelity prototypes in component design provides numerous advantages, particularly in the early stages of the design process. Here are a few crucial elements that emphasize these advantages:

- Employing inexpensive prototypes for essential unit construction is beneficial in several ways especially when it comes to initiating new ideas in designing. Users would rather prefer a work-in-progress than a close-to-final design because it seems like they are more of an idea than real; examples are just lines on paper or doodles. Such an early feedback helps to identify possible issues early enough hence improving the later versions as elaborated further down this course.
- To lessen the total risk associated with the development process right from the start, low compatibility models are used as early as possible in the product design. This way time and resources can be saved because feedback allows for easier alteration and improvement of the same.
- Low-fidelity prototypes make it easier for strategists, developers, and project managers to work together because they involve all those groups in the collaboration. This type of prototype requires minimum design skills thus can be produced by many team members encouraging interdisciplinary cooperation and making sure that everyone agrees to the way the design is headed.
- High-fidelity prototypes foster interaction among strategists, developers, and project managers by incorporating them in the design process. They need minimum knowledge of design and allow for productive contributions from a variety of team members, enabling collaboration among disciplines and mutual understanding. These realistic prototypes aid in the early detection and resolution of issues, so enhancing design quality, expediting decision-making, and fostering a cohesive team dynamic.

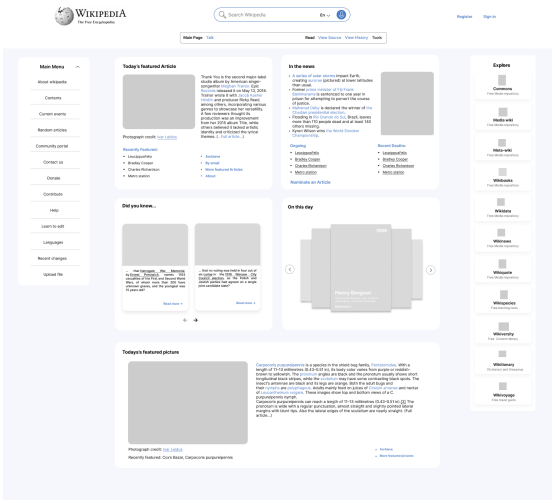

Fig. 4. Low fidelity Design

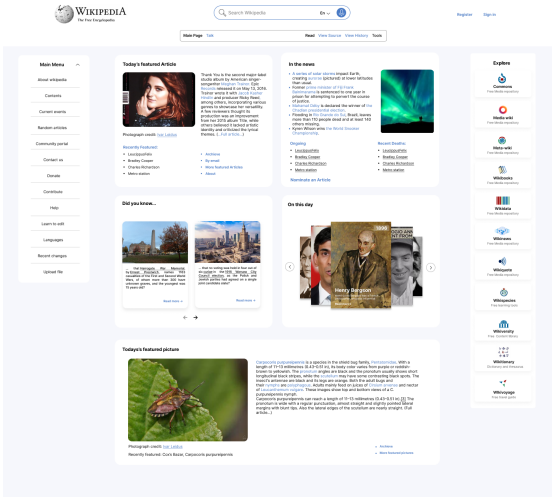

Fig. 5. High fidelity Design

The full high-fidelity design is available in the Figma link provided: View the full design in Figma [5]

D. Prototype Description

The main basis of the prototype that we did was based on the redesign of a popular website, Wikipedia. The steps that were taken to materialize that are mentioned below:

- Languages, about Wikipedia, contact us, and other primary menu items have been integrated on the landing page to make it easier to use, and also to reduce cognitive overload
- The updated search bar now supports language translation and has an audio input option.
- Wikipedia's sister projects now appear on the right side of the desktop interface.
- Sections like today's highlighted item, news, and Did you know are disjointed, making them impossible to read.

- These segments were divided into independent cards to better organization and readability.
- Improved alignment in today's highlighted item and differentiated between current and recent fatalities in the news section.
- Used a carousel-style design for the "On this day" portion, and a card system with graphics and clear text for the "Did you know" section.

E. Design Decisions

The design decisions that had been taken and materialized while constructing the prototype was a reflection of the previous research and surveys that had been done while preparing the personas and scenarios for the project. The design decisions that had been taken have been described below briefly:

- **Navigation:**
  - Use of gaze tracking to find the most popular portions of the Wikipedia website.
  - Ensure that these key regions allow for easy navigation and access to critical information.
  - Using gaze tracking information, incorporate user-centric design concepts to streamline the navigating experience.
  - Create intuitive navigation pathways that match users' visual engagement habits without directly including gaze tracking data into the project.
- **Live Translation Toolbar:**
  - Include a dynamic translation toolbar that will automatically translate Wikipedia pages from Bangla to English in real time.
  - Allow users to seamlessly switch between languages while reading articles, with the option to change translation choices.
- **Adaptive Interface Design:**
  - Design responsive interfaces that adapt to diverse screen sizes and devices, guaranteeing the optimal user experience across PCs, tablets, and smartphones.
  - Prioritize readability and usability in interface design, taking into account diverse user preferences and accessibility requirements.

F. Prototype Construction

Along with constructing the prototype from sketch prototypes, to low and high fidelity prototypes by using Figma, we also held a few studies which were considered while building up the prototype.

This data collection method for the project is stressing on a combination of qualitative as well as quantitative methodologies so as to have a full grasp over consumer preferences and practices. This involves getting information from a broad spectrum of people highlighting those speaking Bangla and English with various dialects. Surveys will inquire about user preferences, linguistic abilities, and technological competency, whilst focus groups will investigate specific user experiences and difficulties. Gaze-tracking technology will be used to detect natural surfing activities, and real-time data collection will provide insights into user involvement. Furthermore, the study aims to comprehend the target audience's demands and needs in order to effectively inform design and development processes. Students, professionals, and the elderly will be sampled to ensure representation in terms of linguistic competency and technological literacy, and socioeconomic status.

G. Used HCI Tools

There can be multiple different approaches while building up a prototype, whether it be a high fidelity or a low fidelity one. Some of the approaches that can be done are explained bwlow

- **Sketch Prototypes:** Sketching the prototype by using pen and paper can help a lot to understand and visualize the initial design of any software solution which will be worked on in the future.
- **Wireframes:** We can create simple wireframe diagrams with Balsamiq, Sketch or Adobe XD. Designers can easily sketch simple layouts by dragging and dropping using these tools.
- **Clickable Prototypes:** Employing Marvel, InVision or Figma to generate interactive prototypes. They allow designers to connect static screens hence less time consuming design tasks.

III. Experimental Evaluation

A. Experimental Design

The UXReality [6] platform for advanced user testing was used for the evaluation, which included both eye-tracking and facial expression analysis. Evaluated variables were Gaze control vs. Traditional mouse control methods as well as Bangla vs. English language settings. Among the criteria were measures related to task completion time input actions error rate user satisfaction levels with the software learning curve of the user emotional responses by the users visual processing by the users and user confusion levels.There were a total of four test conditions that were established and it was based on language setting and interaction method.

B. Evaluation Parameters

Using heuristics evaluation as well as cognitive walk-through techniques, evaluators compared the interface of the application they were reviewing against established usability heuristics. They observed users navigating through the application to understand their thought processes as well as to identify encountered difficulties

C. Evaluation Method

Cognitive Walk-through was used for this process, where heavy focus was made on the ease of learning, and understanding of the user goals along with determining the overall user satisfaction regarding the built up website, and understanding what needs to be improved.

D. Tasks for Evaluation

The tasks were to move to a specific section of a website with the aid of eye gaze control, translate Bangla text into English, fill a form using normal mouse control, and open help documentation in either language.

E. Evaluation Outputs

Analytics showed that 90% of the audience were "engagement-feedback pairs" satisfied with the relevance and recommendations. Several things need improving such as navigation, labeling, and user flow efficiency. There were differences between experimental conditions; for example task completion times varied, but most people found gaze control to be slow because they were not used to it, and sometimes they misunderstood what they saw. To use the traditional mouse control method you have to make fewer manipulations but there are more mistakes.

The Bangla language setting witnessed a lot of confusion among users, especially on how to control gaze. Performance variations were because of differing levels of familiarity with technologies for tracking eye movement, making gazing more challenging to master. Occasionally gazers could get weary easily leading to pain in their eyes among other discomforts in some users. Moments when tracking met frustration, confusion and satisfaction in most cases were easily recognized due to facial expressions.

F. Updated Requirements

Updated Requirements include to simplify the design of the website and also enhance the accessibility features for the redesign. It's also to be noted that the language switching feature also to be robust for the project for easier understanding and use of access.

G. Redesign Considerations

In the redesign process, it was considered to improve gaze-controlling accuracy through tutorials used comprehensively. User eye feedback concern should also lead us to give an alternative way of changing the interaction method. Bangla should have its user interface altered based on eye tracking information and adjusted by incorporating clear sight interface element.

Revised testing demands encompassed augmented adjustment specifications, superior integrated real-time inputs, understandable navigating accessories indicating paths for those who speak Bengal, unified helping system, and detailed teaching program with upbringing package designed for newcomers. Illustrated first working models of in-person sessions included new layouts with more comprehensive active zones than before, streamlined operational control lists, tutorials in action, more informed responses, and arrangements that are fastidious from the standpoint of evaluating eye-tracking heatmaps.

H. Integration with Evaluation Results

The perception score breakdown enhances evaluation by gauging users' attitudes towards the application, including overall evaluation, intention of use, recommendation, relevance, calibration success, eye-tracking data collection emotional responses and data collection dates. This can be evaluated through quantitative indicators complemented by qualitative evaluation results, which provide a comprehensive understanding about its performance and perception.

The values from the quantitative analysis are added below:

- Success Rate: 90
- Task Completion Time: Varying across conditions
- Input Actions: Fewer with traditional mouse control
- User Satisfaction: Positive feedback
- User Confusion: Noted, particularly with gaze control in Bangla setting
- Learning Curve: Steeper for gaze control
- Emotional Responses: Frustration, confusion, and satisfaction observed
- Usability Score: 70
- Navigation Score: 70
- Naming Score: 70
- User Flow Efficiency Score: 70
- Confidence Score: 70
- Design Score: 70
- Perception Score: 75
- Overall Evaluation Score: 70
- Intention of Use Score: 70
- Recommendation Score: 80
- Relevance Score: 80

I. Prototypes and Sketches

The prototype has been constructed in Figma, and also the evaluation of the website along with the website prototype itself is attached with the following Google Drive link: **Drive Link** [7]

IV. Conclusion and Future Works

As part of the EyesSpeak initiative, we have redefined and assessed Wikipedia so that users who speak Bangla and English interact more efficiently in the digital realm by inserting gaze control and instant translation functions. It was a study that utilized the UXReality software in the conduct of revolutionary user experiments through both eye tracking systems as well as facial expressions analysis. The efficacy of various interaction techniques including gaze control versus the standard mouse control, as well as language settings such as Bangla compared to English, were measured among different metrics comprising user satisfaction level percentage; total time taken for task completion; typing speed; and comfortability.

The results showed a task completion rate of 100%, this signifies high quality in the way tasks were done. There was positive feedback from the users hence an average user satisfaction level of 70. Despite the fact that initially unfamiliarity and sometimes misinterpretation would cause delay in

task accomplishment when using gazing control, it is good that use of pointers reduced error occurrence compared to other methods which made it easy to achieve more in Bangla conversations without having any problems. Users said that as they grew more used to it they felt more comfortable even though they found learning to control gaze still more difficult. Gaze control prompted periods of irritation and puzzlement through facial expression detection in contrast with a general happy feeling associated with ordinary mouse use. When individuals used gaze control for an extended period, certain people reported feeling eye strain and discomfort. All design scores (usability, navigation, naming, user flow efficiency, confidence, overall design) had a 70 value indicating that more improvements should be made in different aspects.

In the future, we will improve how users experience the app by resolving the problems we have identified. Specifically, these enhancements will entail increasing the accuracy with which gaze pointing works therefore minimizing errors when it comes to inputting data and also reducing total required input actions; as well as offering detailed tutorial guides to assist novices while learning. The software itself shall have provision that allows one to easily switch from gaze controlled mode or regular mouse mode without any complications which might distract their productivity. To reduce eye strain, the sensitivity of gaze-tracking will be optimized, and there will be integration of regular breaks. User interface will organically glide with the help of tracking data thus improving navigation, especially for Bangla users, and the interface will have its elements simplified and clarified for less confusion.

In a bid to significantly increase user satisfaction and engagement level, EyesSpeak is hoping for the effective incorporation of these updates. It will now be easier for those who speak Bangla or English using eyesight as one of their controllers; the reason why such people must consider EyeSpeak is that not only does it create room for them but also has other potential benefits ranging from better service offering to fostering stronger inter-connections on online platforms.

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