IN PARTNERSHIP WITH PLYMOUTH UNIVERSITY

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Module Code: **PUSL 3122**	Module Name: **Computer Graphics, and Visualisation**
Coursework Title:	
Deadline Date: **23th May 2023**	Member of staff responsible for coursework: **Dr. Alaa Alkhafaji**
Programme: **BSc. (Hons) Computer Science, University of Plymouth** **BSc. (Hons) Software Engineering, University of Plymouth**	

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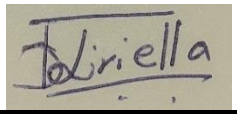
Group work: please list all names of all participants formally associated with this work and state whether the work was undertaken alone or as part of a team. Please note you may be required to identify individual responsibility for component parts.

Mahindu Bandaranayake – *10749841*
DT Kiriella *– 10748147*
MYM Yusry *– 10749082*
SMA Dharmasena *– 10749195*
EAYI Edirisinghe *– 10749143*
PHN Kavindya *- 10748162*

We confirm that we have read and understood the Plymouth University regulations relating to Assessment Offences and that we are aware of the possible penalties for any breach of these regulations. We confirm that this is the independent work of the group.

Signed on behalf of the group: 

Individual assignment: ***I confirm that I have read and understood the Plymouth University regulations relating to Assessment Offences and that I am aware of the possible penalties for any breach of these regulations. I confirm that this is my own independent work.***

Signed :

Use of translation software: failure to declare that translation software or a similar writing aid has been used will be treated as an assessment offence.

I *have used/not used translation software.

If used, please state name of software……

Overall mark _____% Assessors Initials _____ Date__23/05/2023_____

PUSL3122 HCI, Computer Graphics, and Visualization Coursework 2023

Participants (Group 27)

[1]Mahindu Bandaranayake, [2]DT Kiriella, [3]MYM Yusry, [4]SMA Dharmasena, [5]EAYI Edirisinghe, [6]PHN Kavindya

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Lecturer

[1]Dr. Alaa Alkhafaji

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Table of Content

Introduction

Due to the spectacular improvements in the technological world, the performance of computer applications tends to evolve at a greater pace, defying ground-breaking achievements in any of the fields which IT is involved with. Computer Application possess interfaces, where users can interact with, to obtain relevant information and accomplish automatic tasks (Ex: Banking Applications can produced wireless money transfers, deposits etc). User interfaces depend on two relatively new fields: Human-Computer Interaction (HCI) and Computer Graphics (CG) (Rodriguez and Hascoët, no date).

Concepts behind Computer Graphics are referred to as the creation, manipulation and rendering of images, animations and visual representation using computer software and hardware. Also, the author states that sub fields such as 2D and 3D graphics, computer vision, virtual and augmented reality are present in the domain (Bouknight, 1970).

Human Computer Interactions (HCI) consists with various design principles and heuristics to be followed in order to attract the user and absorb the essence of the application. Concept of Affordance, Low physical effort, user satisfaction, learnability and flexibility in use are the main techniques that are considered when developing an application (Duenser and Billinghurst, 2007).

Based on another article, applications relating to children with special needs, are developed using the above-mentioned techniques to support and encourage the learning process (Baykal, Van Mechelen and Eriksson, 2020).

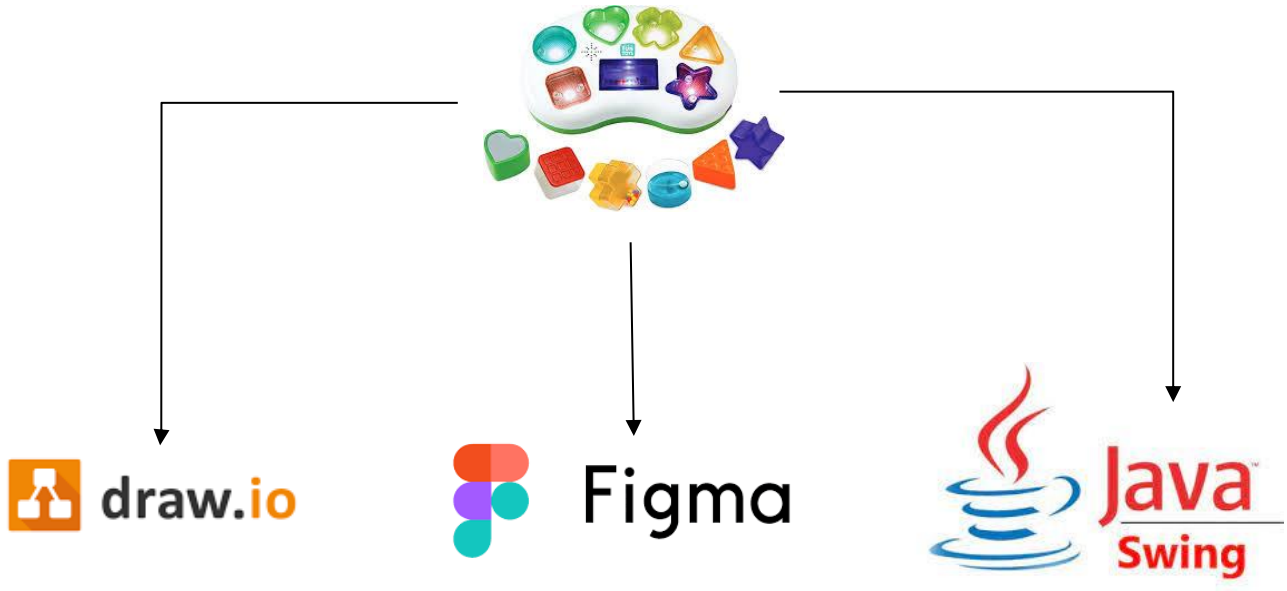
The Scenario in which the **Designing**, **Prototyping** and **Development** are taken place is stated below

Target Audience – *Kids between the age of 3 to 7*

Functions – *Basic Calculations, Shape Identifications, Shape Creation*

- **Designing Process** – Draw.io
- **Prototyping Stage** – Figma
- **Development** – Java Swing in VSCode

Development source code : https://github.com/Plymouth-University/main-coursework-dom-s-family



Background

Scenario

The project will be containing a scope to design and prototype an educational application for children focusing on pattern recognition. In order to depict a real contrast to the idea, the user interfaces will be developed using the 'Java programming language' and to test the usability nature of the application. Several stages will be followed in order before reaching the development destination.

- *Requirement Gathering :*

Identification of Functional and Non-Functional requirements will be conducted during this stage.

- *Designing*

The ideas will be put in to paper using the technique of wireframing, creating a low fidelity diagram, indicating the possible outline of the application.

- *Prototyping*

The actual structures with colors and required function will be depicted using Figma designing software.

- *Development*

The prototype will be converted to a working output using the swing library in Java programming language.

Functions

1. ***The application will be containing options to learn basic calculations***
   - Addition
   - Subtraction
   - Multiplication
   - Division
2. ***Literacy (English Language)***
   - Letters
   - Words
   - Meanings
3. ***Shapes and Patterns***
   - Different Shapes with different dimensions
   - Different Colors for each shape
4. ***Colors***
   - RGB colors
   - Variety of Color Parameters
5. ***Demo Page***
6. ***Categories***
   - Mode of Study
   - Age
   - Language
7. ***Activity Page***

Facts Gathering

A different procedure needs to be carried when it comes down to developing application for kids. The biological aspect of kids grasping techniques needs to be identified before development process is conducted. Psychological understanding is factor to be considered when dealing with minor age personas. Therefore, different strategies are required to be used in order to identify the key methods to implement in a simpler manner benefitting the relevant party, while sharpening existing knowledge.

Research Papers and Existing Systems

According to a published article, it states that color can increase the effectiveness in learning activities, where certain experiment entities were carried out by conducting an examination with reasonable number of children (Mazlum and Mazlum, 2019).

Another aspect of collecting data was done through analyzing similar type existing systems in the web. Various learning platforms are available in the modern day, focusing on different age categories and different subject matters.

https://www.education.com/games/?gclid=EAIaIQobChMI3LPNzdvd_gIVzHUrCh1NYABCEAAYASAAEgKWjfD_BwE

Based on the research conducted the following sections will be present in the designing stage.

Educational System For Primary Kids

Interfaces (Design and Prototyping)

- Login
- Signup
- Preferences/Customization page
- Categories
- Demo/Instructions Page
- Lessons (Shapes)
- Intro to 3D and 2D
- Creation Page
- View Page
- Edit Page
- Activity Page

Login Page

- Name
- Password

Signup Page

- Phone Number
- Password
- Name
- E-mail

Preferences Page

- Selection of Age
- Selection of Language
- Selection of Mode (Optional)

Categories

- Learning outcomes – Maths, English, Shapes and Colors
- Functions Available

Demonstration/Instruction Page

- How to Use each function (Labels and Notations)

Lessons (Shapes, English, Colors)

- Shape Types (Display Diagram - 2D, 3D)
- Naming convention
- Coloring Names

Intro to 3D and 2D

- Dimension change (Big ,Small – Width and Height)

Creation Page

- Enter Shape Name
- Enter Color
- Save

View

- 3D and 2D

Edit

- Change Dimensions
- Change Color
- Change Shape
- Save Changes

Activity Page

- Summary
- Feedback Page

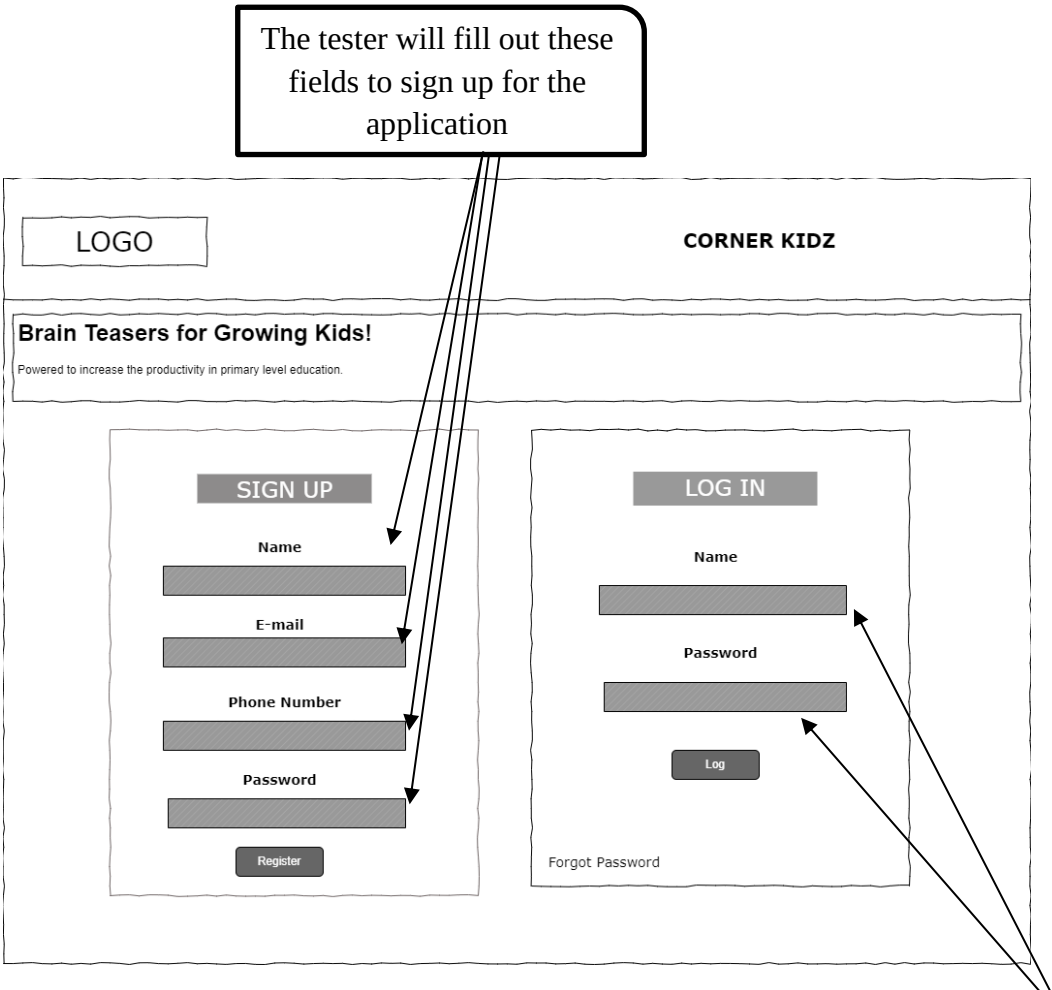
Storyboard

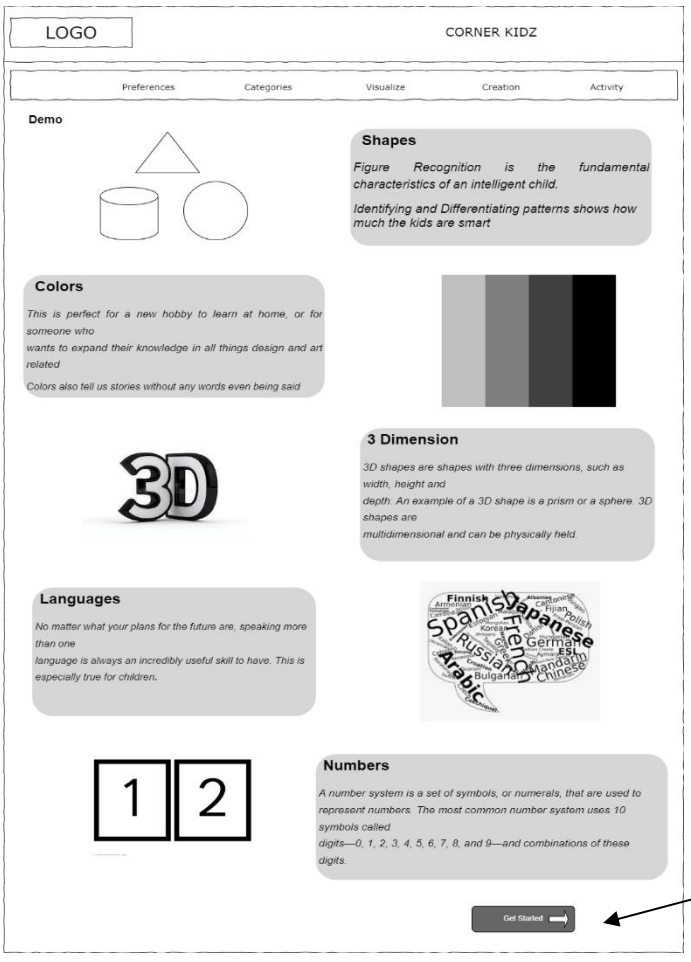
The below mentioned scenario is a conversation between a mother and a daughter, where the daughter is trying to figure out what could the shape of the name in her mind could possibly be. Therefore, the mom answers her questions precisely.

The conclusion which can be drawn is to automate the above scenario, where certain more extra assistance can be given through a web application

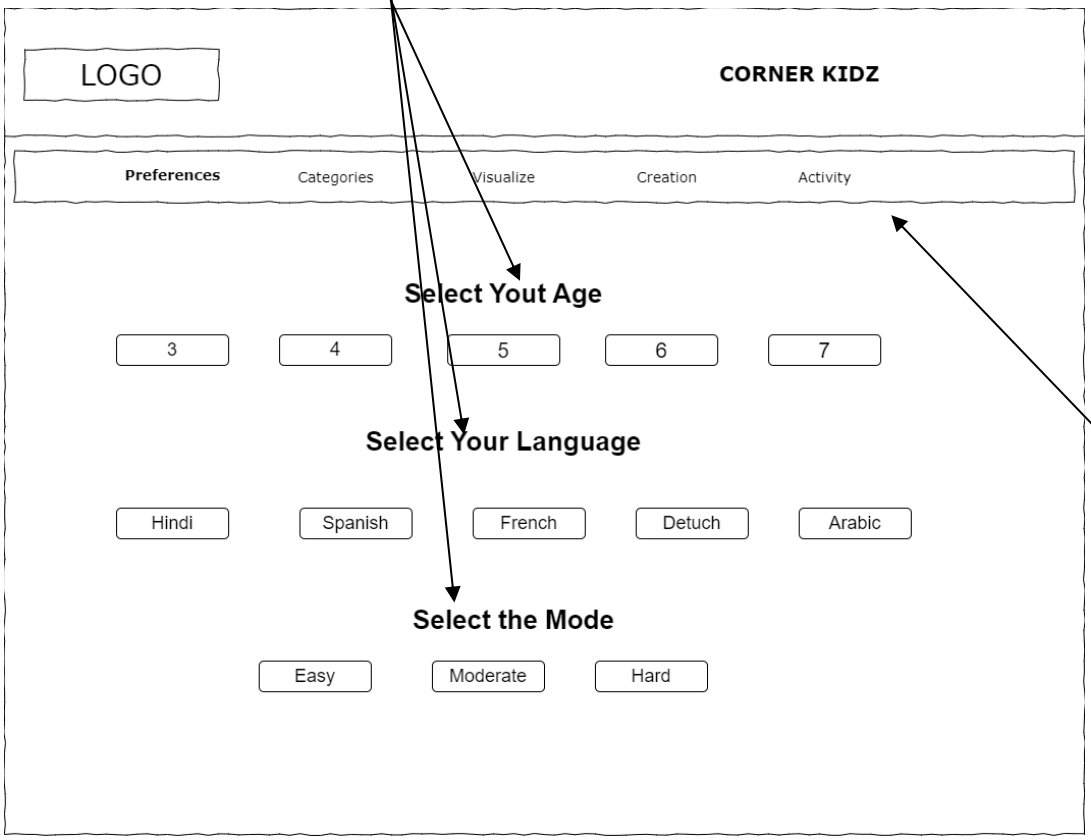
Low-Fidelity

Usability Testing



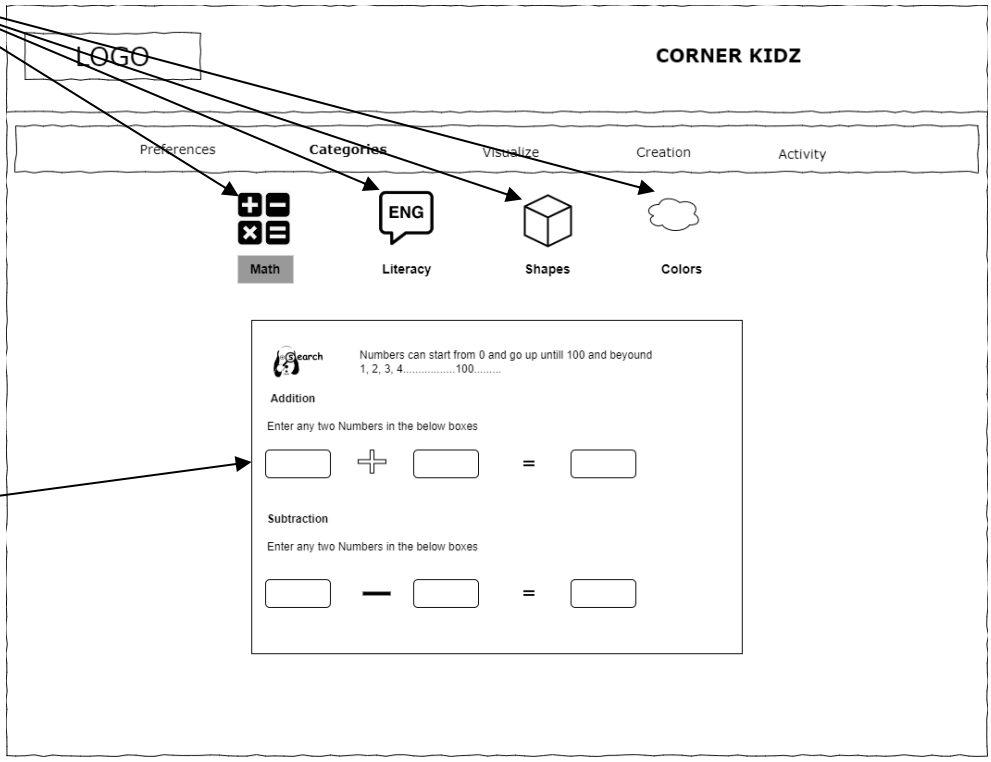


After the tester clicks the button, the Preference Page will be appeared. This is a mandatory page which the tester must select the correct values to each to proceed forward



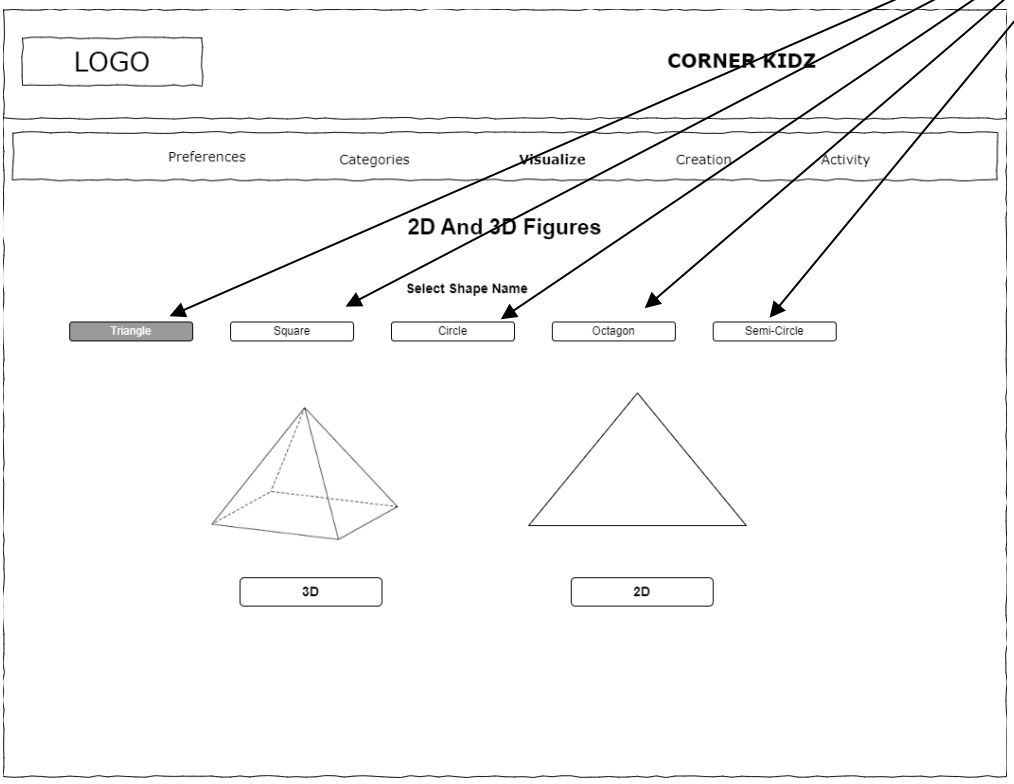
The tester can decide and navigate to any other tab using the panel here

If tester decides to click the ‘Categories’ button, the tester will be presented with options to explore activities relating to these.



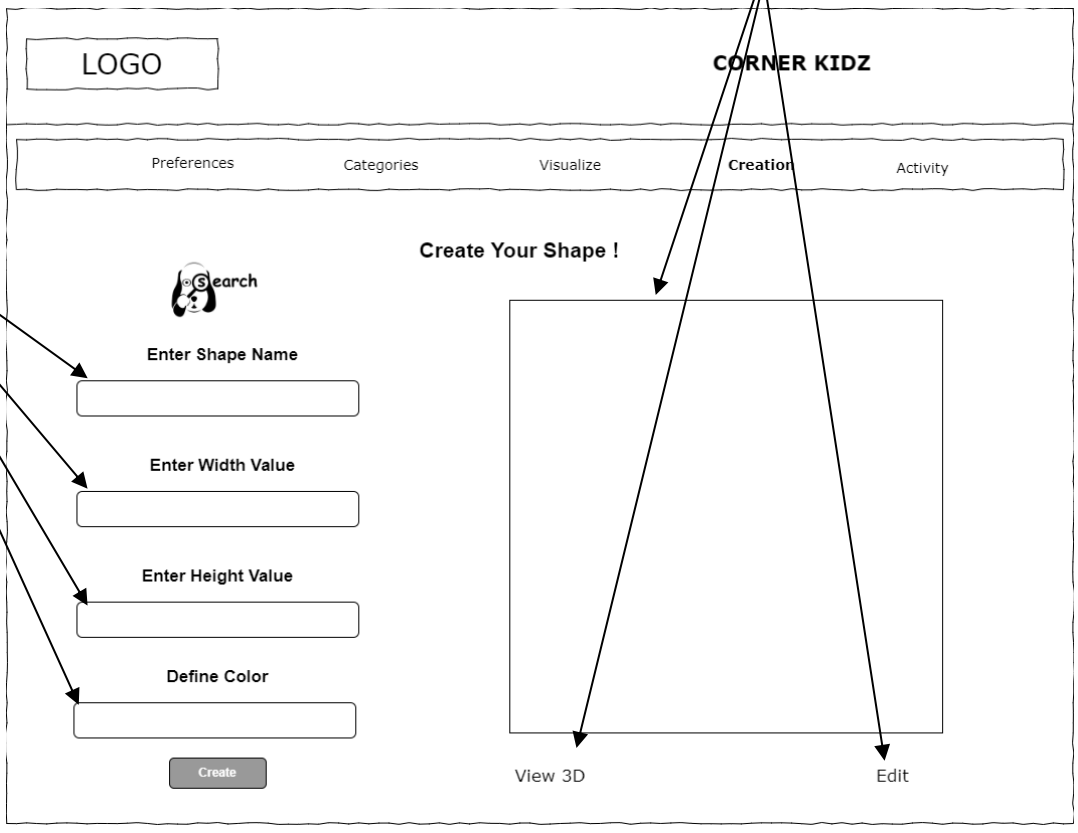
The tester can learn and perform task based on the criteria given while swiping

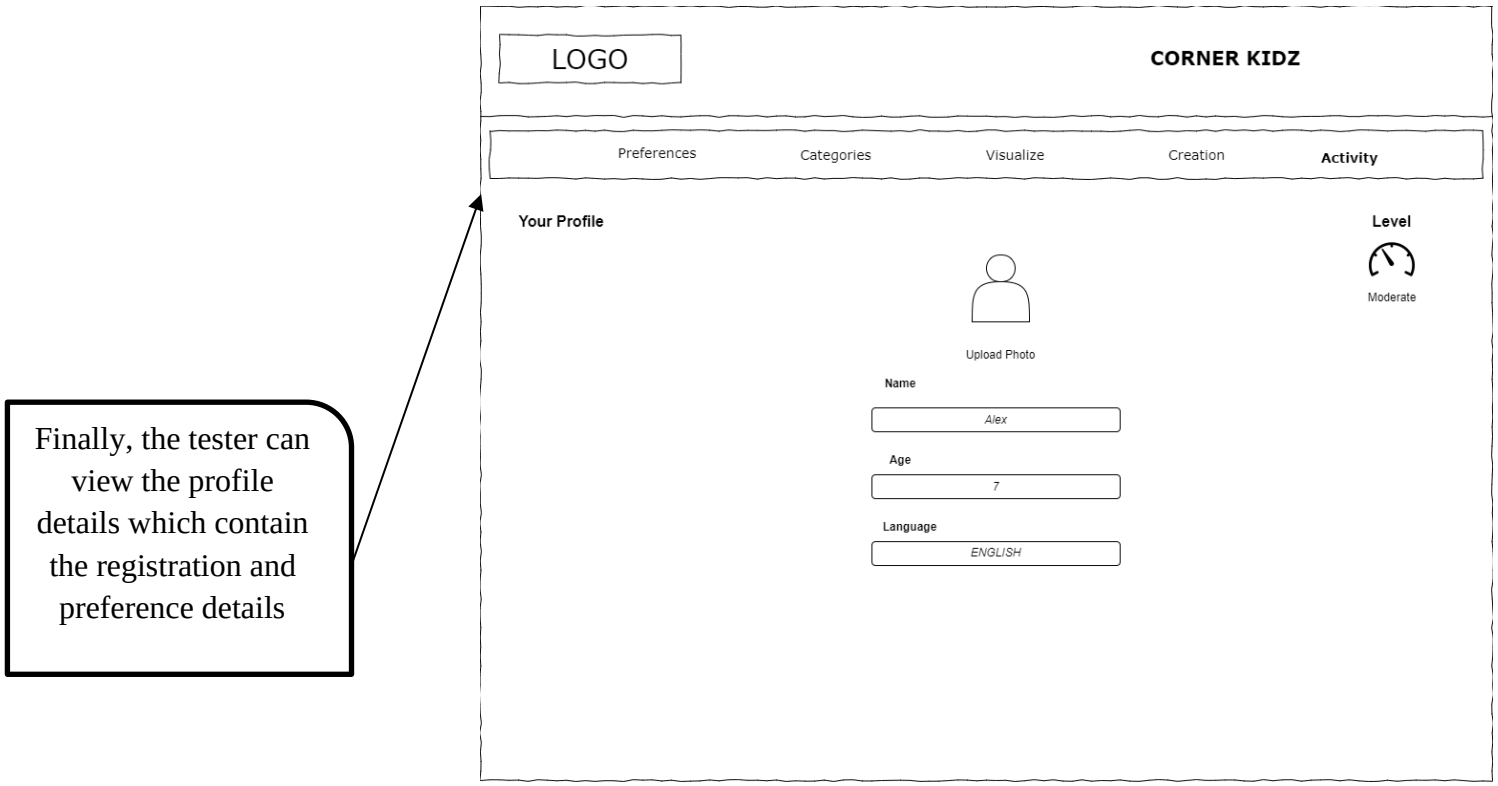
The tester can learn the different types of shapes and view them in 2 different formats by navigating to visualize tab



The tester can view the created shape in 3D and change the sizes using the edit option

The tester can create their own shapes with custom dimensions by filling out these fields with certain values





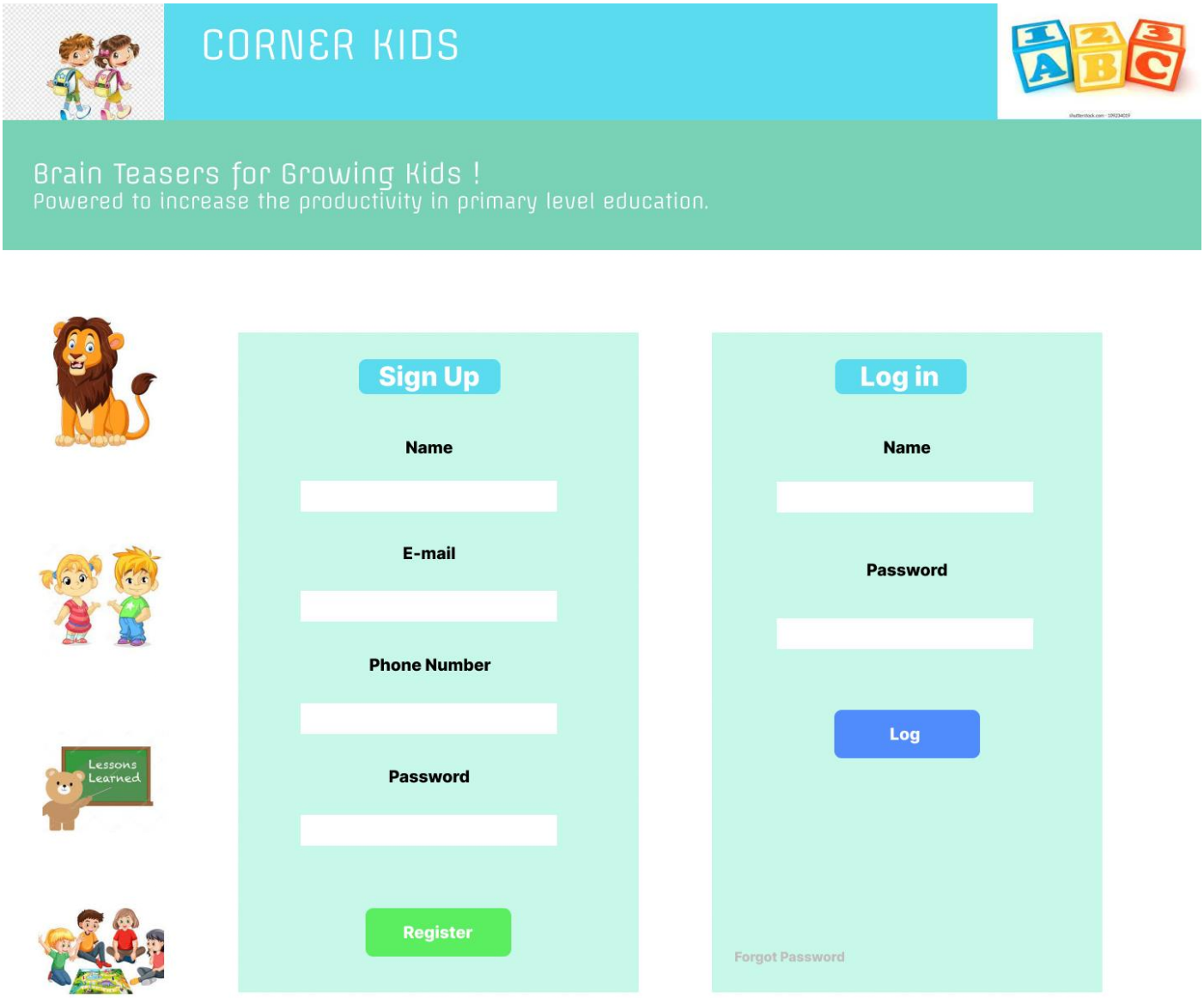
Discussions (Tester Reviews)

- More options to adjust the shapes (Add colors, combine different shapes together)
- More categories can be add (Ex: Logics, Science Related teaching Items)
- More shapes by specifying necessary dimensions are required

Testers : EAYI Edirisinghe and PHN Kavindya

High Fidelity

Signup and Login



Demo Page

CORNER KIDS

Demo

DISCOVER OUR CONTENT

SHAPES

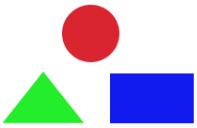
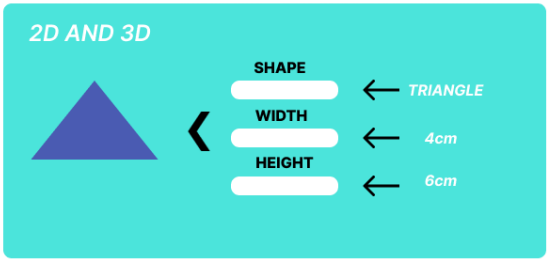
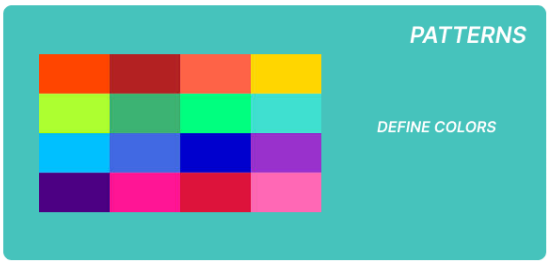


Figure Recognition is the fundamental characteristics of an intelligent child.
Identifying and Differentiating patterns shows how much the kids are smart



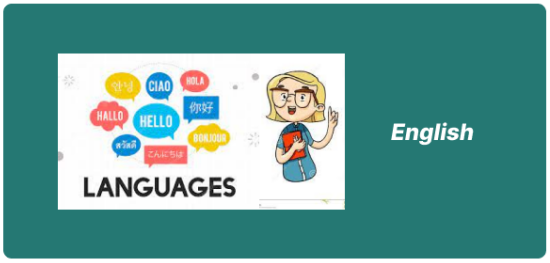


COLORS

This is perfect for a new hobby to learn at home, or for someone whowants to expand their knowledge in all things design and art related
Colors also tell us stories without any words even being said

3 Dimension

3D shapes are shapes with three dimensions, such as width,
height anddepth.
An example of a 3D shape is a prism or a sphere. 3D shapes are

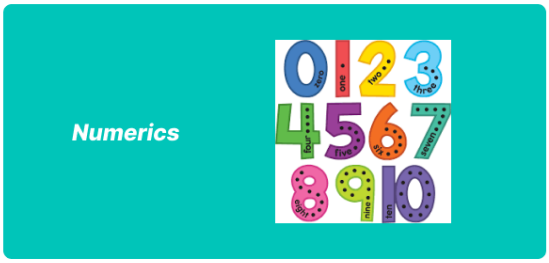


Languages

No matter what your plans for the future are, speaking more than one language is always an incredibly useful skill to have. This is especially true for children.

Numbers

A number system is a set of symbols, or numerals, that are used to represent numbers.
The most common number system uses 10 symbols called digits—0, 1, 2, 3, 4, 5, 6, 7, 8, and 9—and combinations of these digits.



Next ⟶

Preference Page

CORNER KIDS

Preferences Categories Visualize Creation Activity

Select Your Age

3 4 5 6 7

Select Your Language

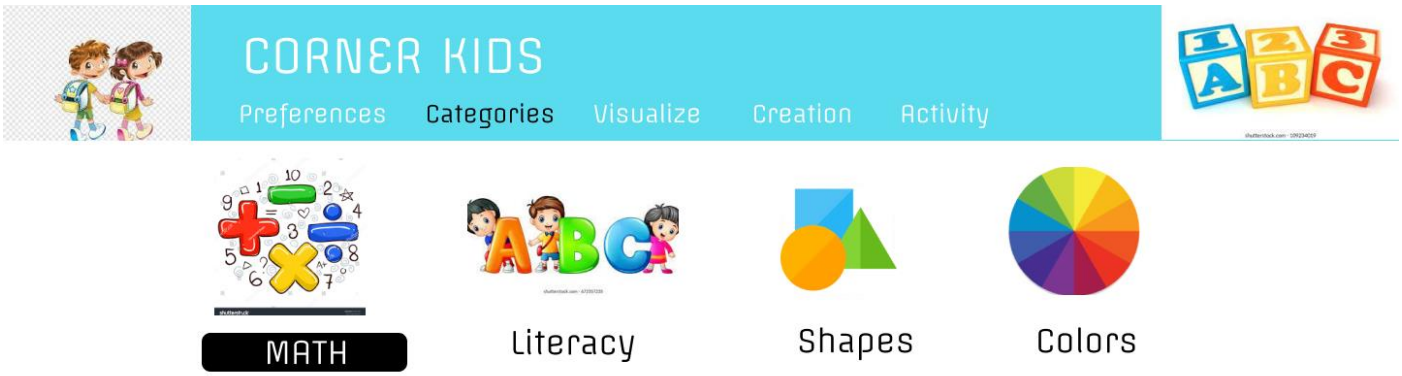
Hindi Spanish French Detuch Arabic

Select the Mode

Easy Moderate Hard

Get Started

Categories Page

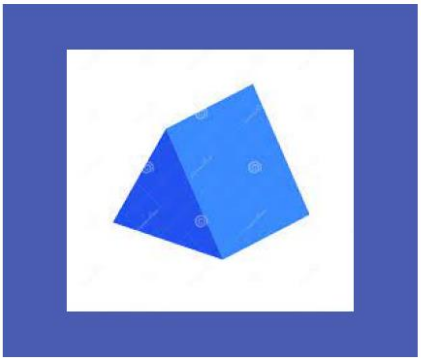


Translate to Spanish

Visualize Page

2D AND 3D FIGURES

Triangle | Square | Octagon | Semi-Circle



3D

2D

Translate to Spanish

Creation Page

CREATE YOUR SHAPE !

Enter Shape Name

Enter Width Value

Enter Height Value

Define Colors

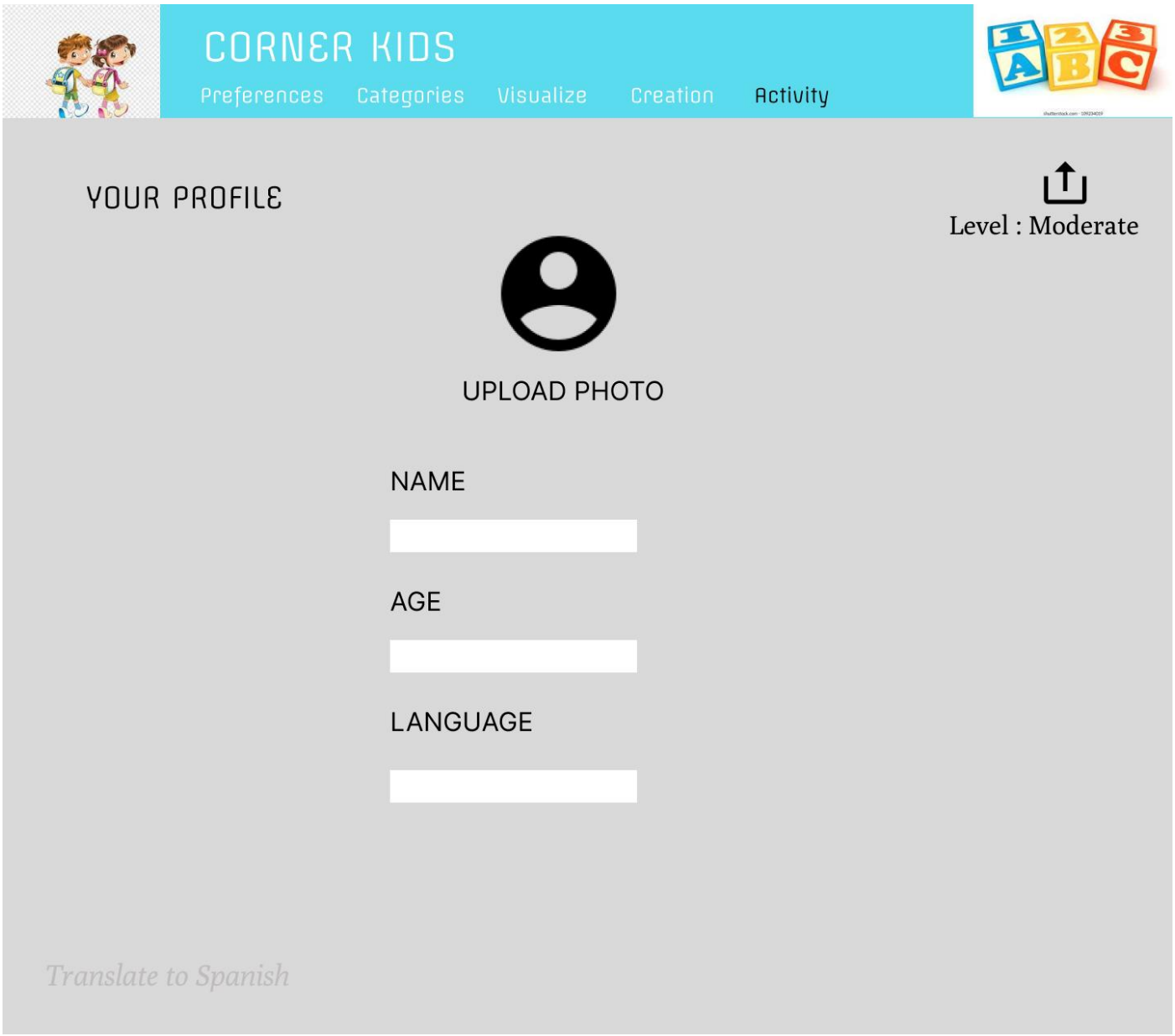
Create

View 3D

Edit

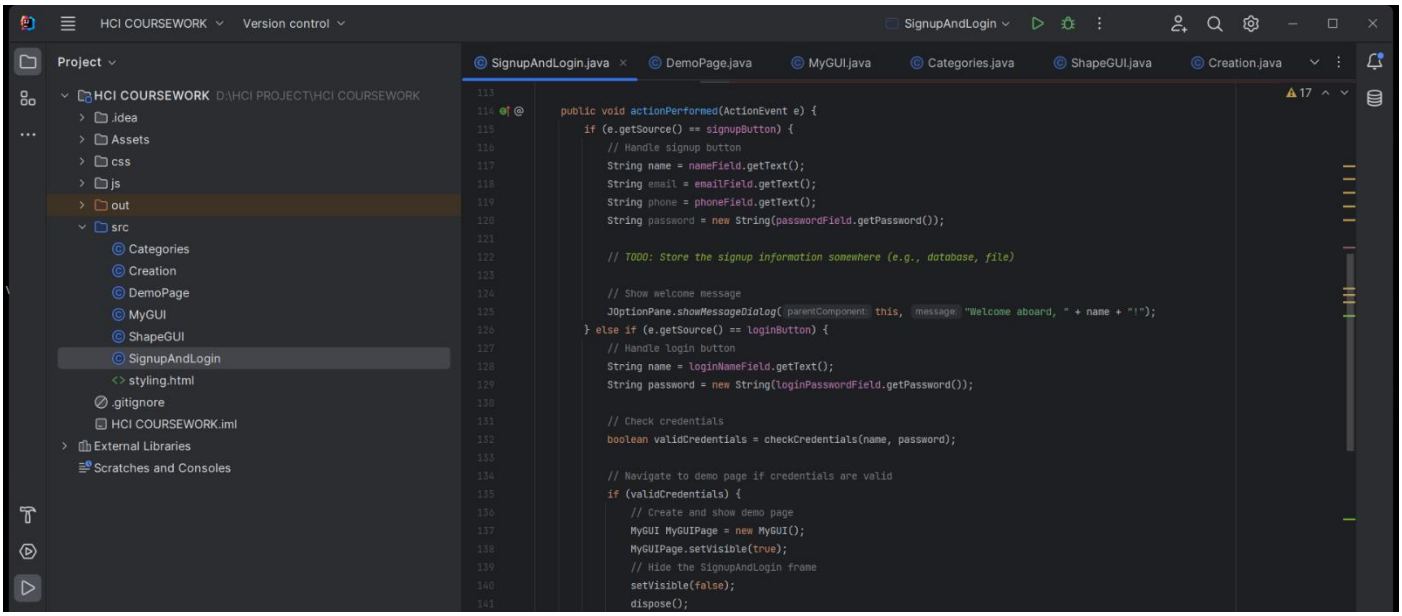
Translate to Spanish

Activity Page

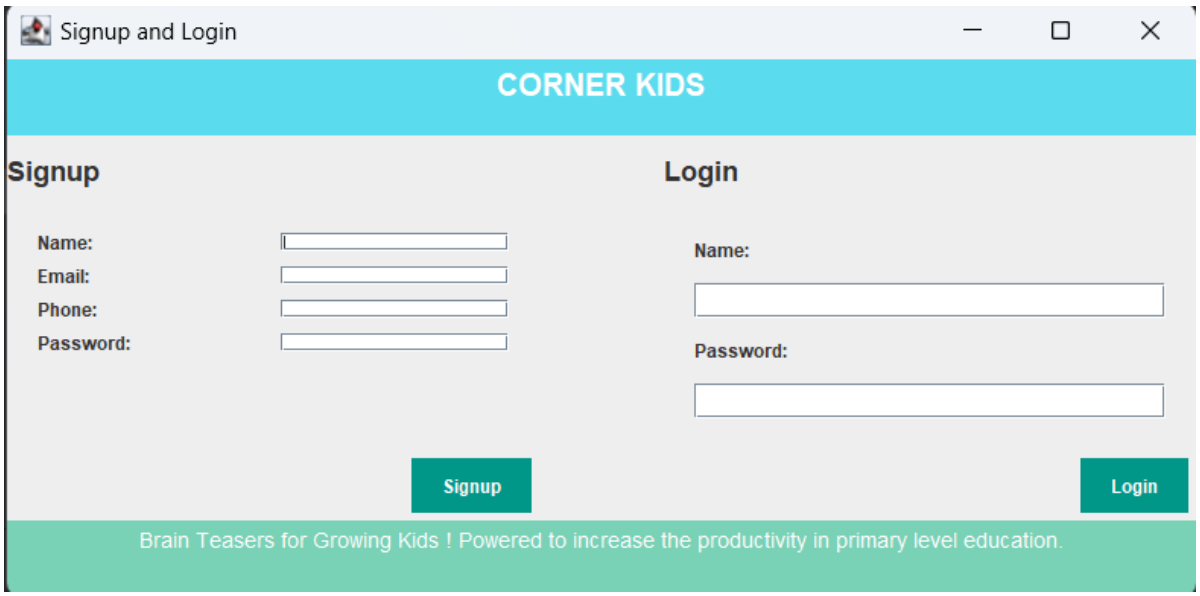


Implementation

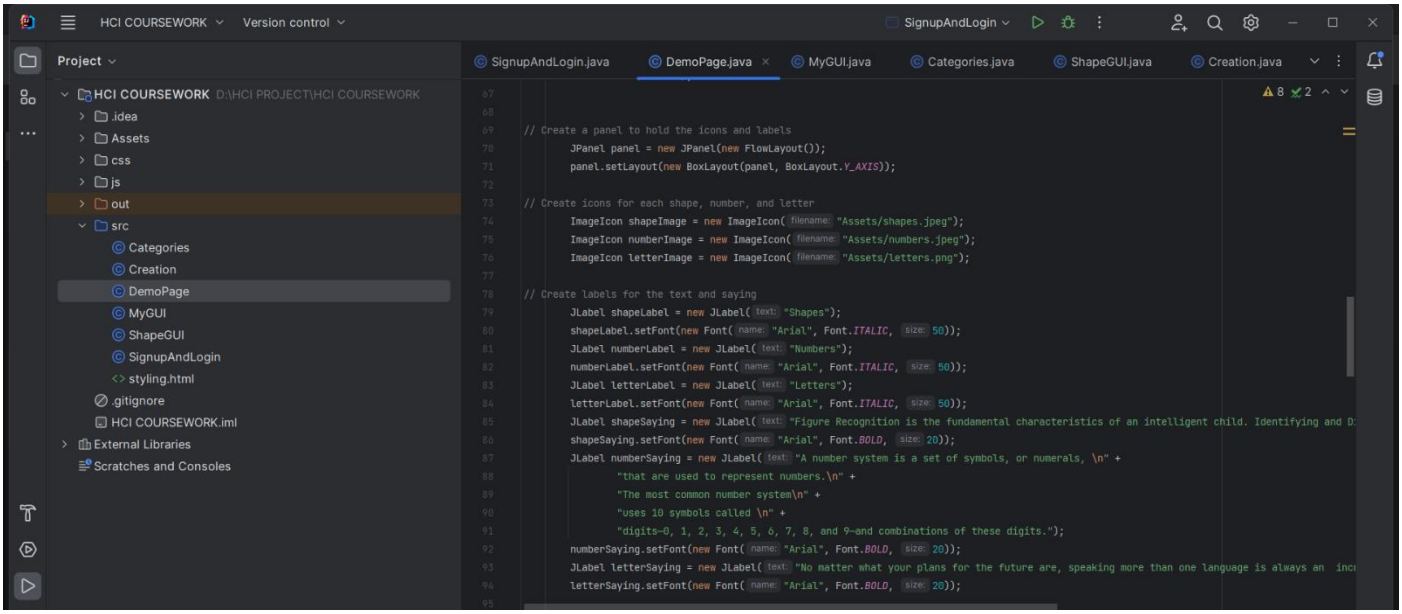
Logic behind Signup and Login Page



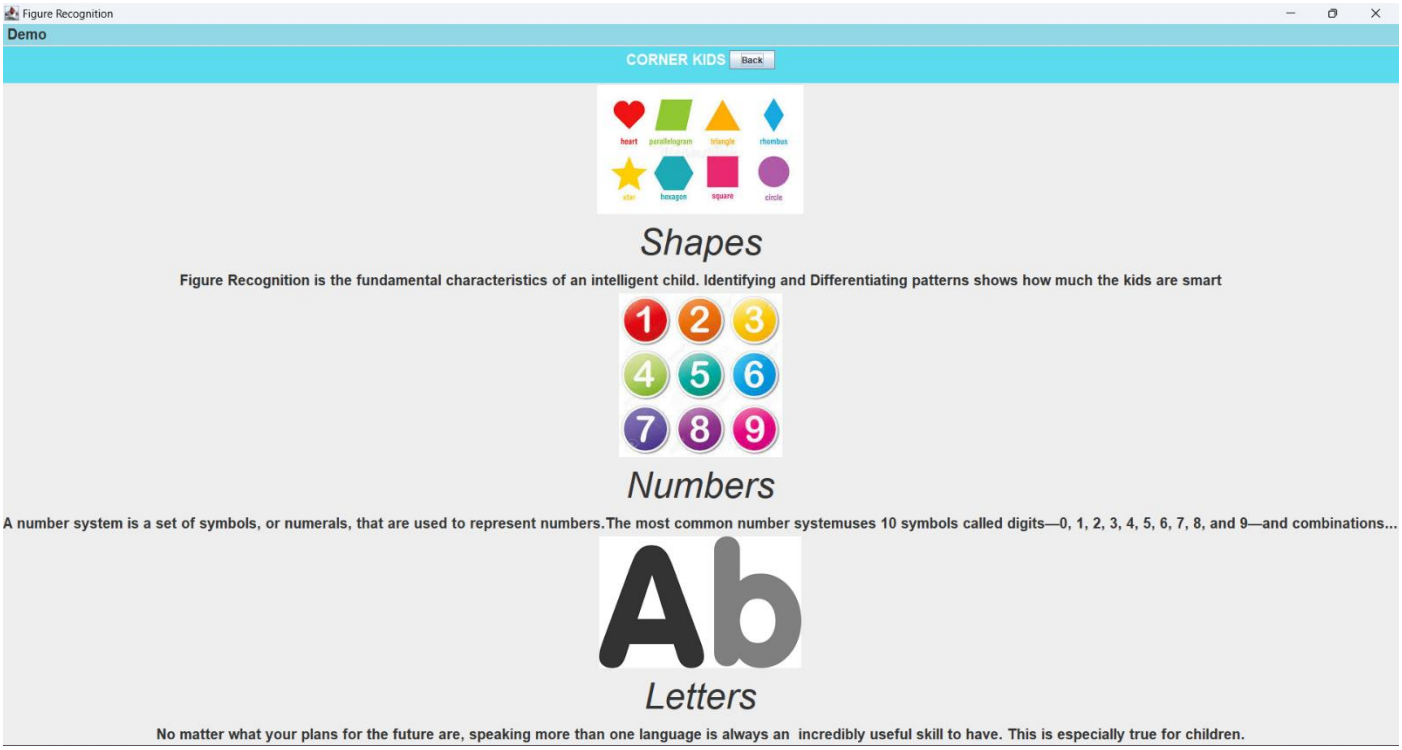
Buttons, Text Fields will carry out functions such as validating a user before entry



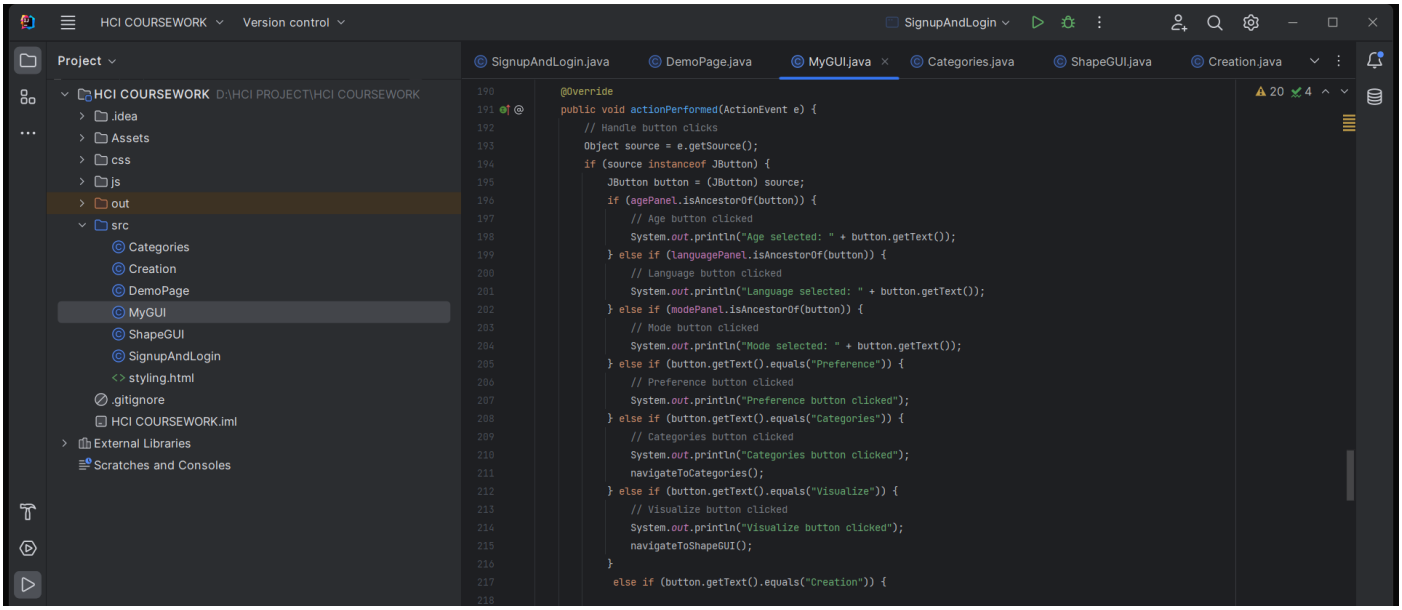
Logic behind Demo Page



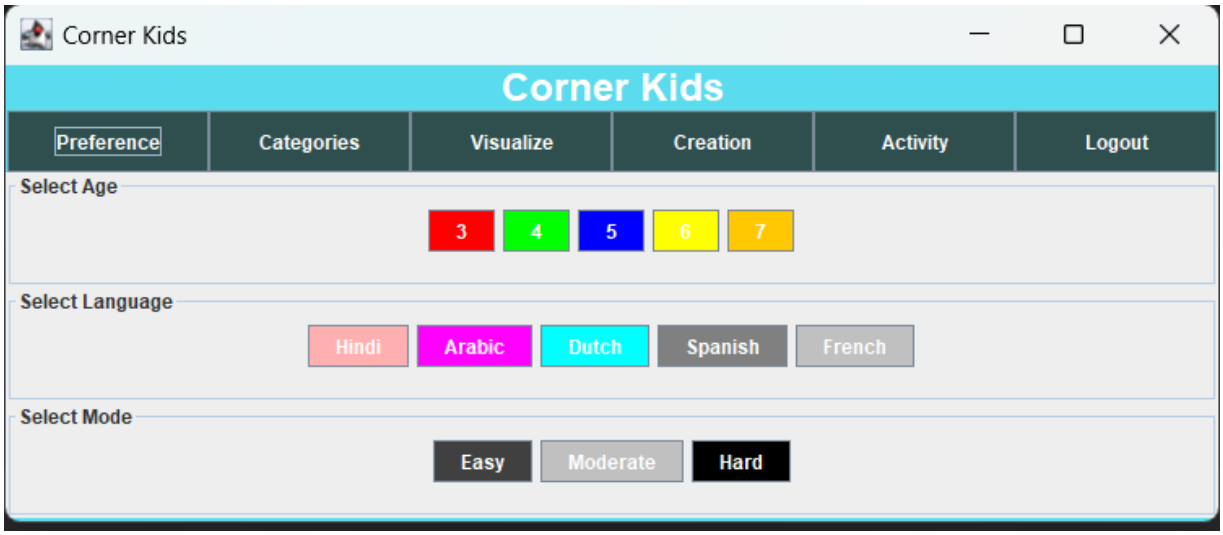
Images, text labels will be depicted using this page



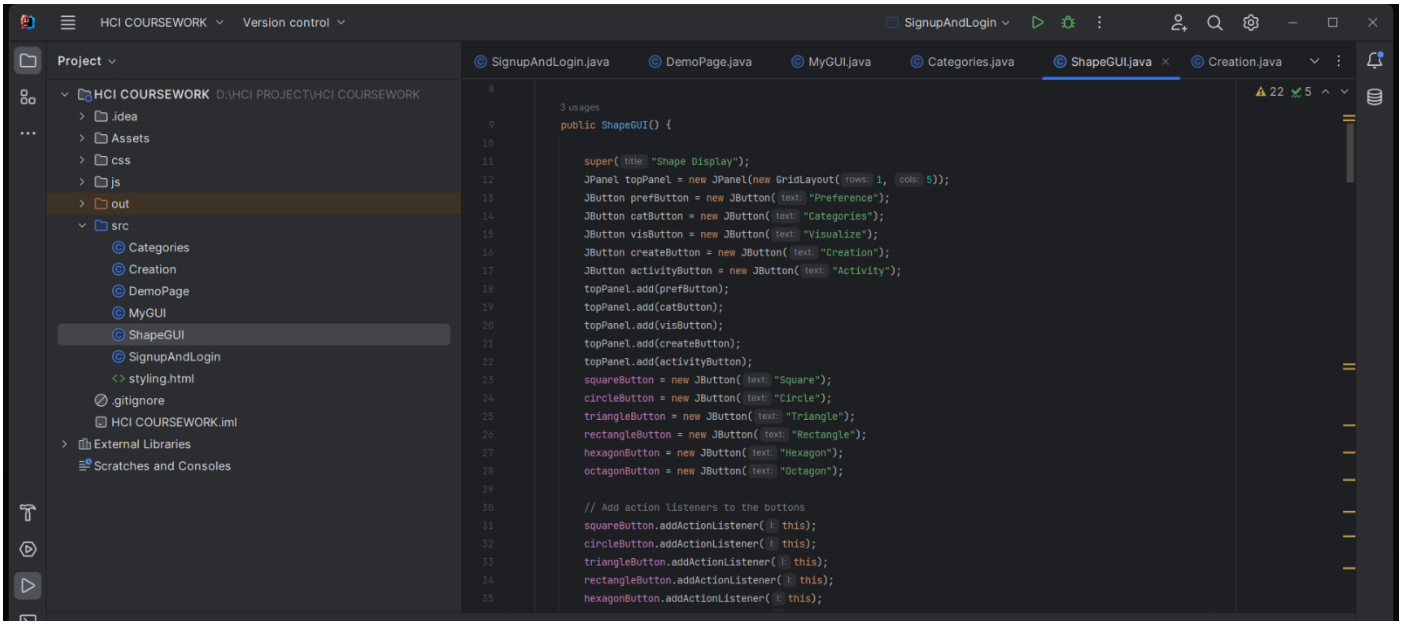
Logic behind Preference Page



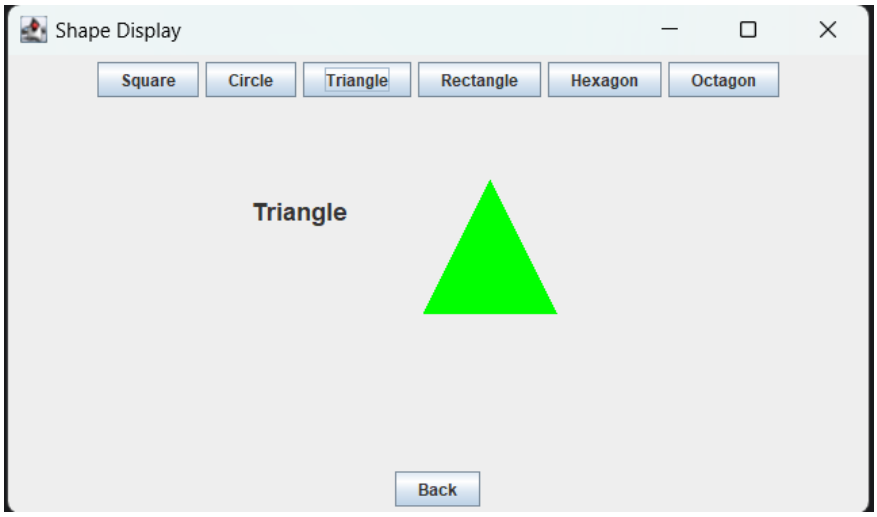
Navigation, user selection buttons



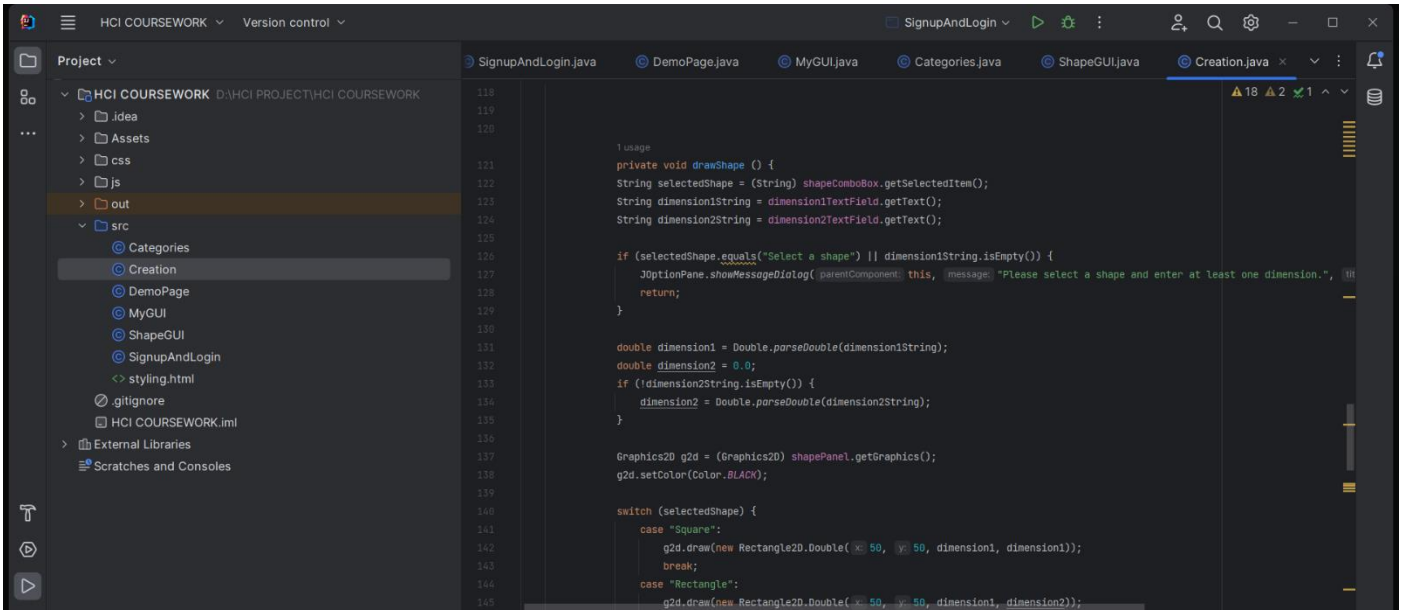
Logic behind Visualize Page



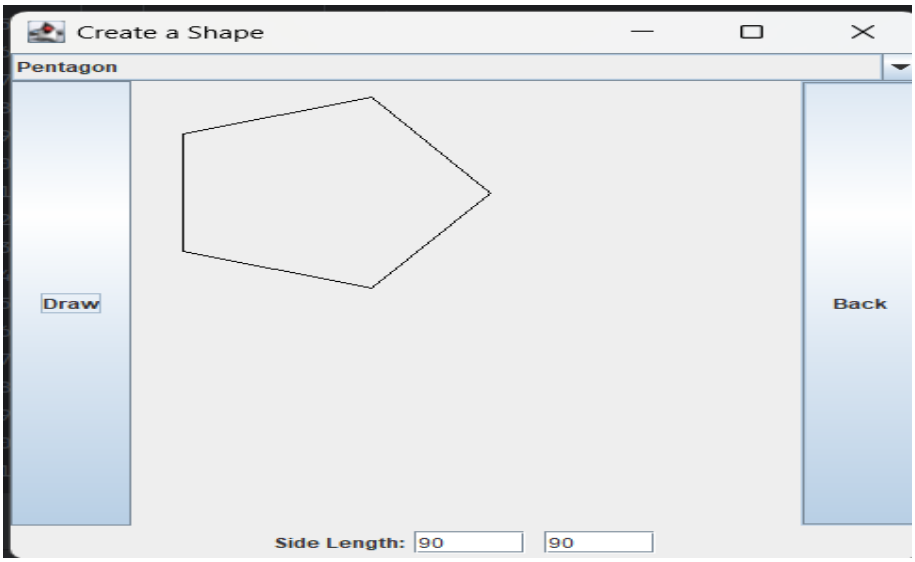
Shapes with different colors will be created in 2D



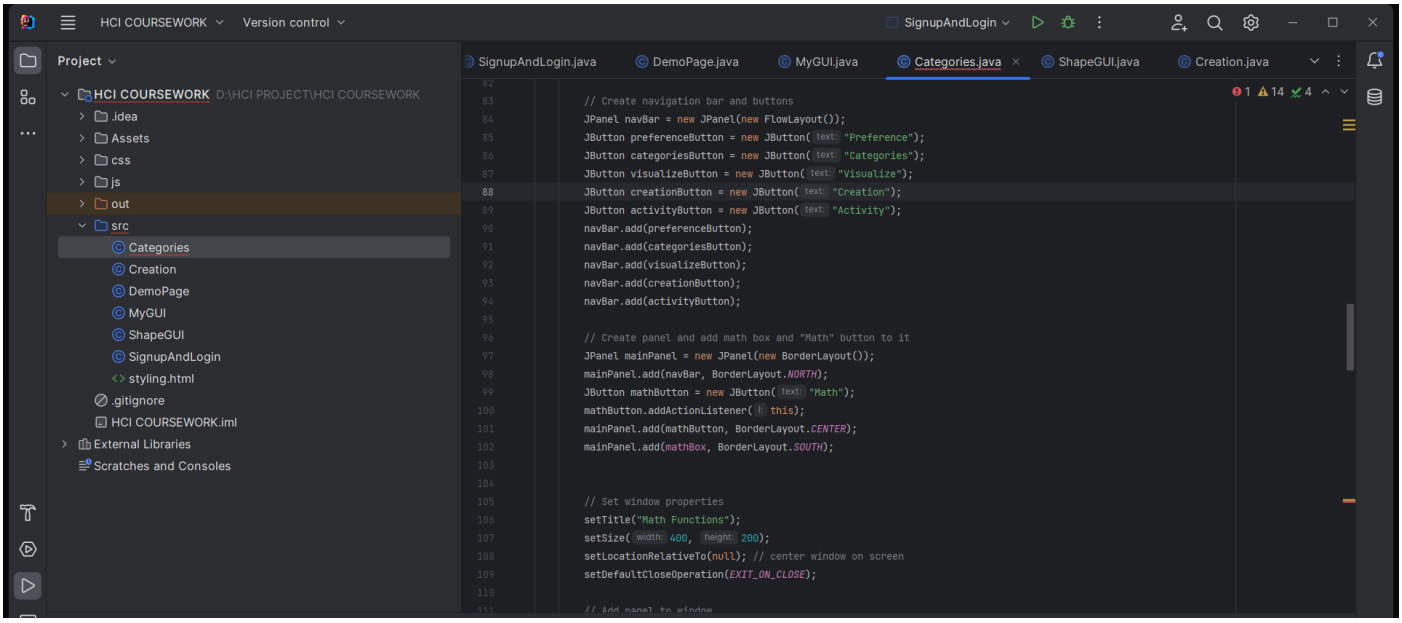
Logic behind Creation Page



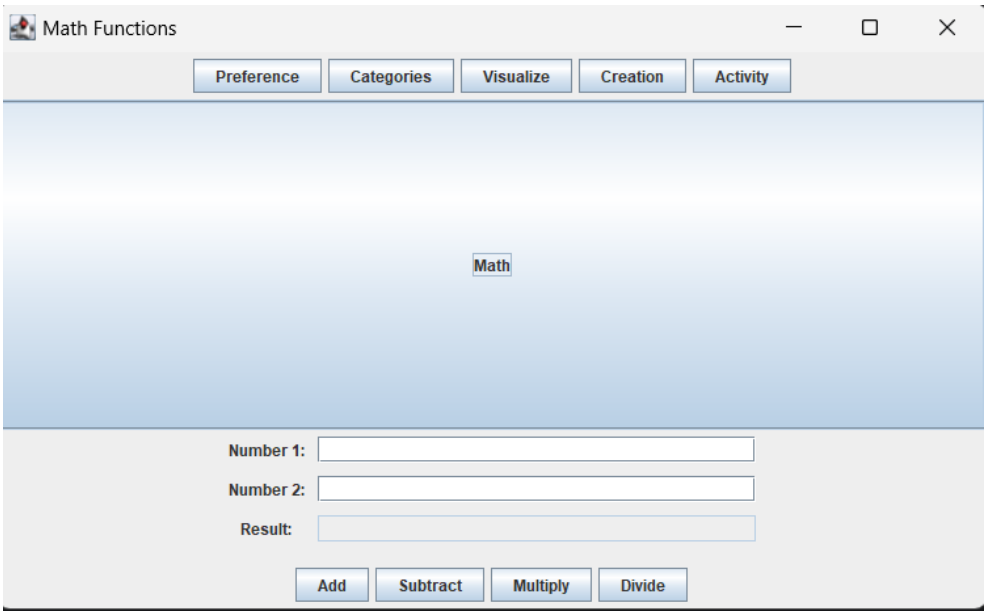
Shapes will be formed with the custom dimensions inserted by the user



Logic behind Categories Page



Mathematical functions will be carried out (Add, Sub, Multiply and Division)



Evaluation

Participant 1 – User Studies

Mahindu Bandaranayake

- Initially private fields containing buttons and labels with text fields were defined.
- Functions were created to retain the user entered dimensions for different shapes.
- Improvements are needed, implementation and integration of colors to shapes were quite hard to be constructed.

Participant 2 – User Studies

DT Kiriella

- Certain major shapes with different colors are integrated together
- The shapes are defined using the key concept of Graphics2D
- Another vast number of other shapes can be implemented using these methods

Participant 3 – User Studies

MYM Yusry

- Integration between page navigation was conducted
- User data collection was established

Participant 4 – User Studies

SMA Dharmasena

- Implementation of Signup
- Implementation of Login
- Validating users

Participant 5 – User Studies

EAYI Edirisinghe

- Mathematical operations are conducted using if statements and math box
- Furthermore, features can be implemented in order to make the interfaces more attractive such as implementing tips and tricks to learn languages etc.

Participant 6 – User Studies

PHN Kavindya

- Demonstration page will depict the overall functions and idea in the application
- Animation regarding the functions were bit hard to be implemented

Summary

- The idea of the scenario is illustrated using various techniques (Explanation and Storyboard)
- The designing is carried out in form a wireframe manner without proper colors and highlighting of important feature
- The actual lookalike illustration is depicted through prototyping using figma software
- The development process is conducted using Java programming language (Swing library)

Workload Matrix

Name	Plymouth ID	Contribution
Mahindu Bandaranayake	10749841	Development, Prototyping, Report
DT Kiriella	10748147	Report, Wireframing, Development
MYM Yusry	10749082	Development, Wireframing
SMA Dharmasena	10749195	Development, Wireframing
EAYI Edirisinghe	10749143	Usability Testing, Development
PHN Kavindya	10748162	Usability Testing, Development

Video Link

References

Baykal, G.E., Van Mechelen, M. and Eriksson, E. (2020) 'Collaborative Technologies for Children with Special Needs: A Systematic Literature Review', in *Conference on Human Factors in Computing Systems - Proceedings*. Association for Computing Machinery. Available at: https://doi.org/10.1145/3313831.3376291.

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Mazlum, Ö. and Mazlum, F.S. (2019) 'A study on conceptual associations of colors in preschool children', *Pegem Egitim ve Ogretim Dergisi*, 9(3), pp. 729–764. Available at: https://doi.org/10.14527/pegegog.2019.024.

Rodriguez, N. and Hascoët, M. (no date) *Curricula of HCI and Computer Graphics: From theory to practice*. Available at: https://www.researchgate.net/publication/255571346.