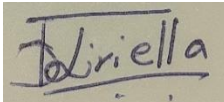


Name: **DT Kiriella**

Student Reference Number: **10748147**

Module Code: <b>PUSL 3122</b>	Module Name: <b>Computer Graphics, and Visualisation</b>
Coursework Title:	
Deadline Date: <b>23<sup>th</sup> May 2023</b>	Member of staff responsible for coursework: <b>Dr. Alaa Alkhafaji</b>
Programme: <b>BSc. (Hons) Computer Science, University of Plymouth</b> <b>BSc. (Hons) Software Engineering, University of Plymouth</b>	
Please note that University Academic Regulations are available under Rules and Regulations on the University website <a href="http://www.plymouth.ac.uk/studenthandbook">www.plymouth.ac.uk/studenthandbook</a> .	
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. <i>Mahindu Bandaranayake – 10749841</i> <i>DT Kiriella – 10748147</i> <i>MYM Yusry – 10749082</i> <i>SMA Dharmasena – 10749195</i> <i>EAYI Edirisinghe – 10749143</i> <i>PHN Kavindya - 10748162</i>  <b>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.</b>  Signed on behalf of the group: 	
Individual assignment: <b>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.</b>  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 <b>23/05/2023</b>	

# *PUSL3122 HCI, Computer Graphics, and Visualization Coursework 2023*



## *Participants (Group 27)*

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## *Lecturer*

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## Introduction

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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 Billinghamurst, 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).

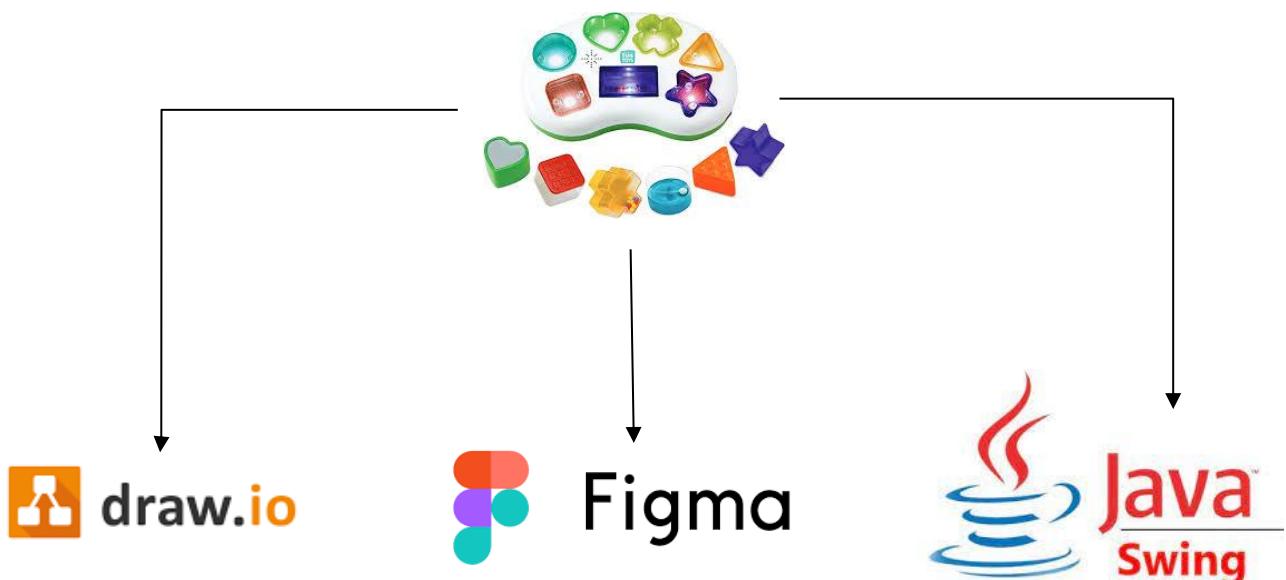
The Scenario in which the **Designing, Prototyping and Development** are taken place is stated below

**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>



### 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***

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\\_gIVzHUrCh1NYABCEAAAYASAAEgKWjfD\\_BwE](https://www.education.com/games/?gclid=EAIaIQobChMI3LPNzdvd_gIVzHUrCh1NYABCEAAAYASAAEgKWjfD_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 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

The tester will fill out these fields to sign up for the application

The wireframe shows a header with a 'LOGO' box and the text 'CORNER KIDZ'. Below the header is a banner for 'Brain Teasers for Growing Kids!' with the tagline 'Powered to increase the productivity in primary level education.' The main content area is divided into two columns. The left column contains a 'SIGN UP' button followed by four input fields labeled 'Name', 'E-mail', 'Phone Number', and 'Password', and a 'Register' button at the bottom. The right column contains a 'LOG IN' button followed by two input fields labeled 'Name' and 'Password', a 'Log' button, and a 'Forgot Password' link at the bottom. Arrows from the text box above point to the 'Name', 'E-mail', 'Phone Number', and 'Password' input fields in the sign-up form.

The tester then uses the same credentials to login

The wireframe shows a header with a 'LOGO' box and the text 'CORNER KIDZ'. Below the header is a navigation bar with tabs: 'Preferences', 'Categories', 'Visualize', 'Creation', and 'Activity'. The main content area is divided into several sections: 'Demo' with a triangle, cylinder, and circle; 'Shapes' with a text box about figure recognition; 'Colors' with a text box about learning at home and a color bar; '3 Dimension' with a text box about 3D shapes and a 3D shape; 'Languages' with a text box about the importance of language and a word cloud; and 'Numbers' with a text box about number systems and a '1 2' button. At the bottom right is a 'Get Started' button with a right arrow. Arrows from the text box above point to the 'Log' button in the login form and the 'Get Started' button.

Once the login button is clicked the tester will be directed towards the demo page automatically, where tester will be able to test each function available in the application

The tester can press the 'Get Started' button if the instructions are not necessary jump in to next tab

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

LOGO

CORNER KIDZ

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

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.

LOGO

CORNER KIDZ

Preferences Categories Visualize Creation Activity

Math Literacy Shapes Colors

Search Numbers can start from 0 and go up until 100 and beyond 1, 2, 3, 4.....100.....

Addition

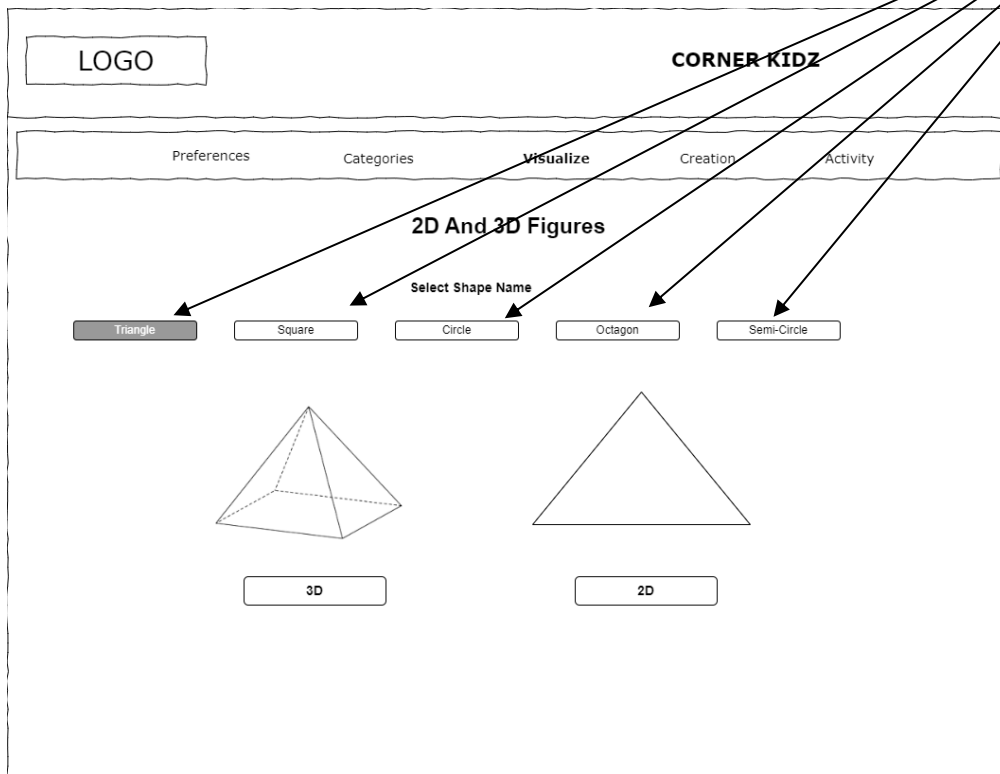
Enter any two Numbers in the below boxes

Subtraction

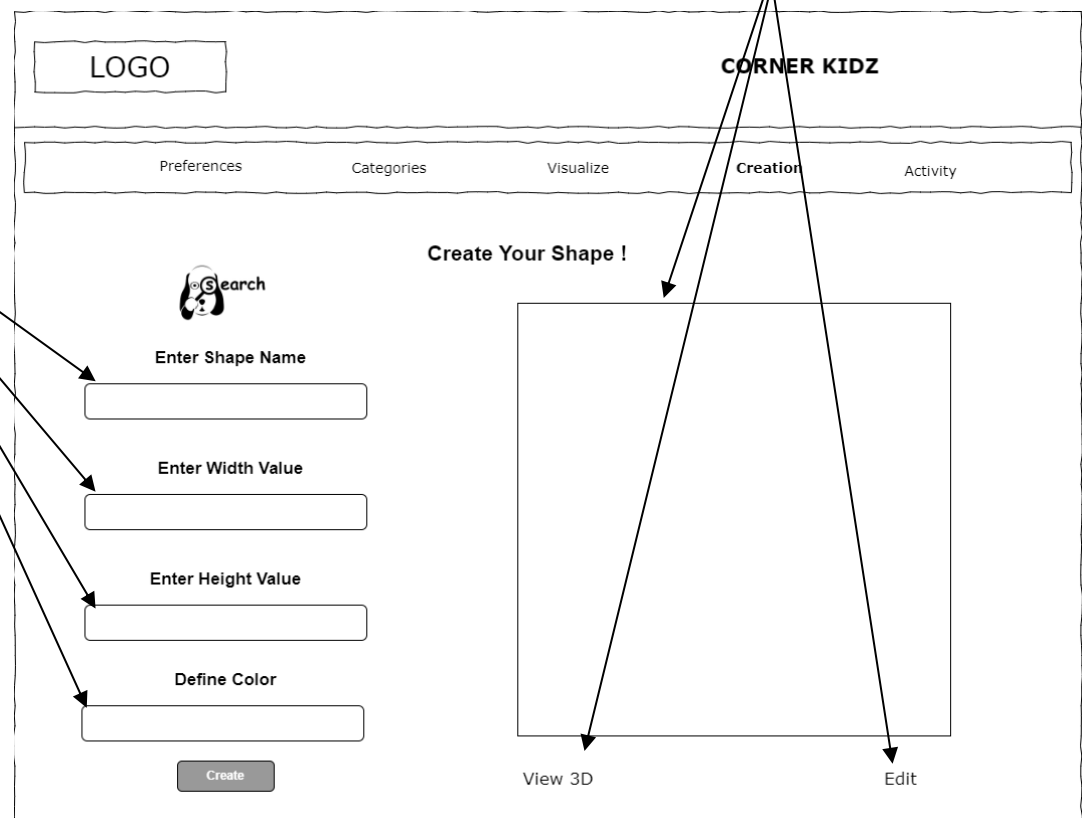
Enter any two Numbers in the below boxes

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

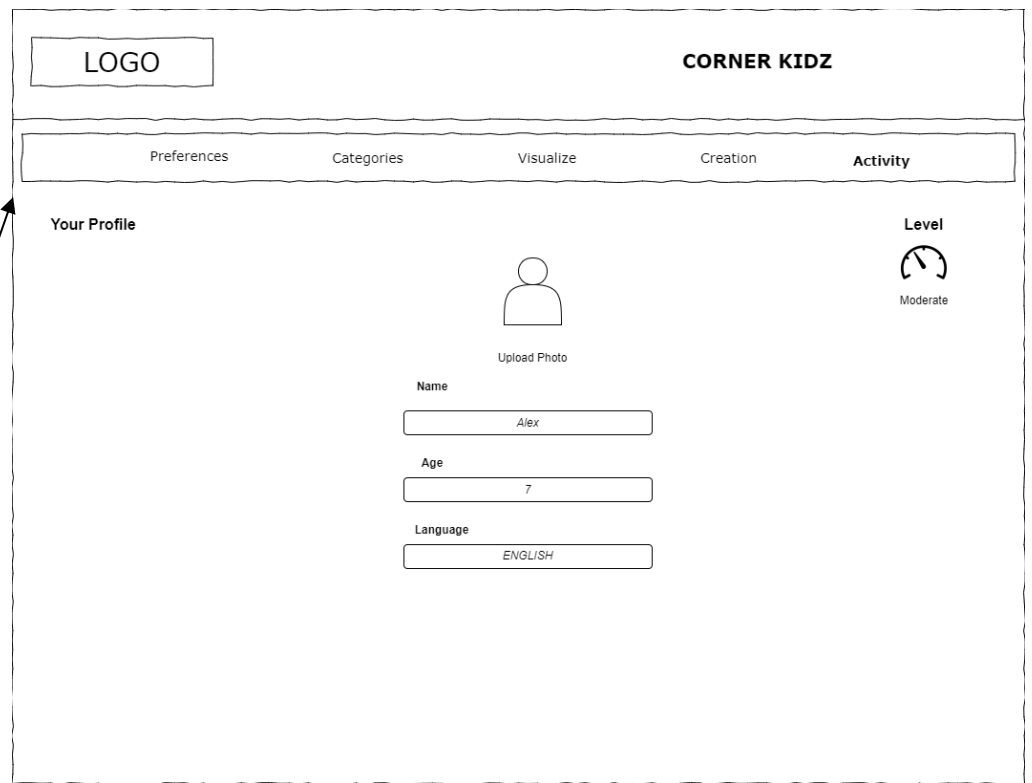


The tester can view the created shape in 3D and change the sizes using the edit option



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

Finally, the tester can view the profile details which contain the registration and preference details




The image shows a user profile page for 'CORNER KIDZ'. At the top, there is a header with a 'LOGO' placeholder on the left and the text 'CORNER KIDZ' on the right. Below the header is a navigation bar with five tabs: 'Preferences', 'Categories', 'Visualize', 'Creation', and 'Activity'. The 'Preferences' tab is currently selected. The main content area is titled 'Your Profile'. On the left side of this area, there is a large empty box for a profile picture. To the right of this box is a 'Level' indicator showing a gauge with a needle pointing to 'Moderate'. Below the profile picture box, there is a section for personal details with the following fields: 'Name' (containing 'Alex'), 'Age' (containing '7'), and 'Language' (containing 'ENGLISH'). Each field has a corresponding input box.


## 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](#)



# CORNER KIDS

Illustration.com 09024257

Brain Teasers for Growing Kids !  
Powered to increase the productivity in primary level education.



### Sign Up

**Name**

**E-mail**

**Phone Number**

**Password**

**Register**

### Log in

**Name**

**Password**

**Log**

[Forgot Password](#)



## SHAPES



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

## 2D AND 3D



### SHAPE

← TRIANGLE

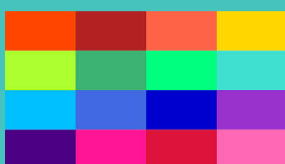
### WIDTH

← 4cm

### HEIGHT

← 6cm

## PATTERNS



DEFINE COLORS

## COLORS

This is perfect for a new hobby to learn at home, or for someone who wants 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 and depth.  
An example of a 3D shape is a prism or a sphere. 3D shapes are

## WHAT IS 3D?



## 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.

## Numerics




**Next** →



# CORNER KIDS

Preferences Categories Visualize Creation Activity

  
Illustration.com 09234027

## Select Your Age

**3**

**4**

**5**

**6**

**7**

## Select Your Language

**Hindi**

**Spanish**

**French**

**Detuch**

**Arabic**

## Select the Mode

**Easy**

**Moderate**


**Hard**



Get  
Started








# CORNER KIDS

PreferencesCategoriesVisualizeCreationActivity





MATH



Literacy




Shapes



Colors

Addition

Activity 1



Enter any two Numbers from below

⏪

+

Add

1

2

3

4

5

6

7

8

9

Translate to Spanish



## CORNER KIDS

Preferences

Categories

Visualize

Creation

Activity



Illustration.com 100234021

## 2D AND 3D FIGURES

Triangle

Square

Octagon

Semi-Circle



3D



2D

*Translate to Spanish*



## CORNER KIDS

Preferences

Categories

Visualize

Creation

Activity



cornerkids.com 09/2015/07

## CREATE YOUR SHAPE !

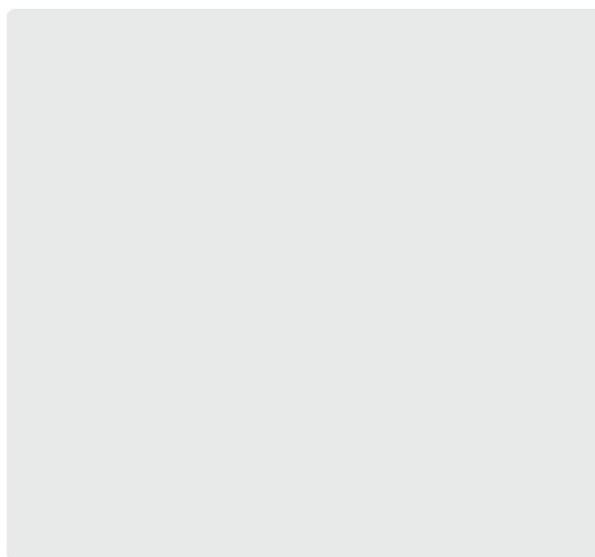
*Enter Shape Name*

*Enter Width Value*

*Enter Height Value*

*Define Colors*

Create



View 3D

Edit

*Translate to Spanish*



## CORNER KIDS

Preferences

Categories

Visualize

Creation

Activity



Illustration.com 120234021

### YOUR PROFILE



Level : Moderate



UPLOAD PHOTO

NAME

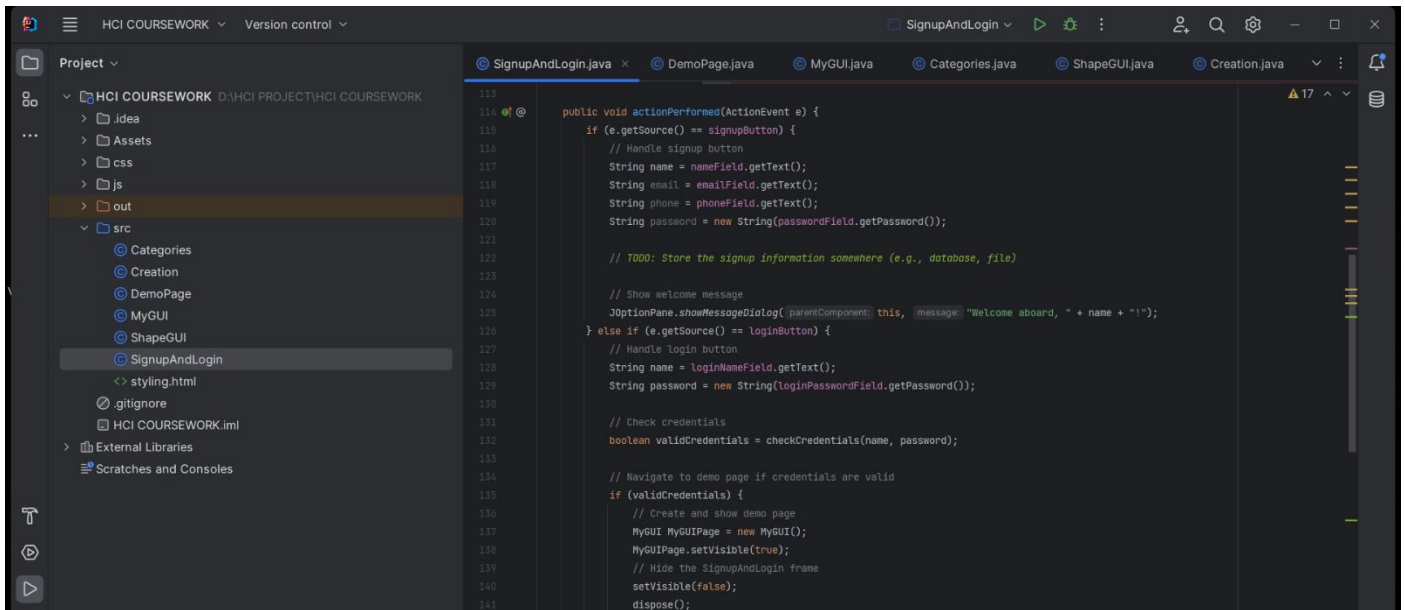
AGE

LANGUAGE

*Translate to Spanish*

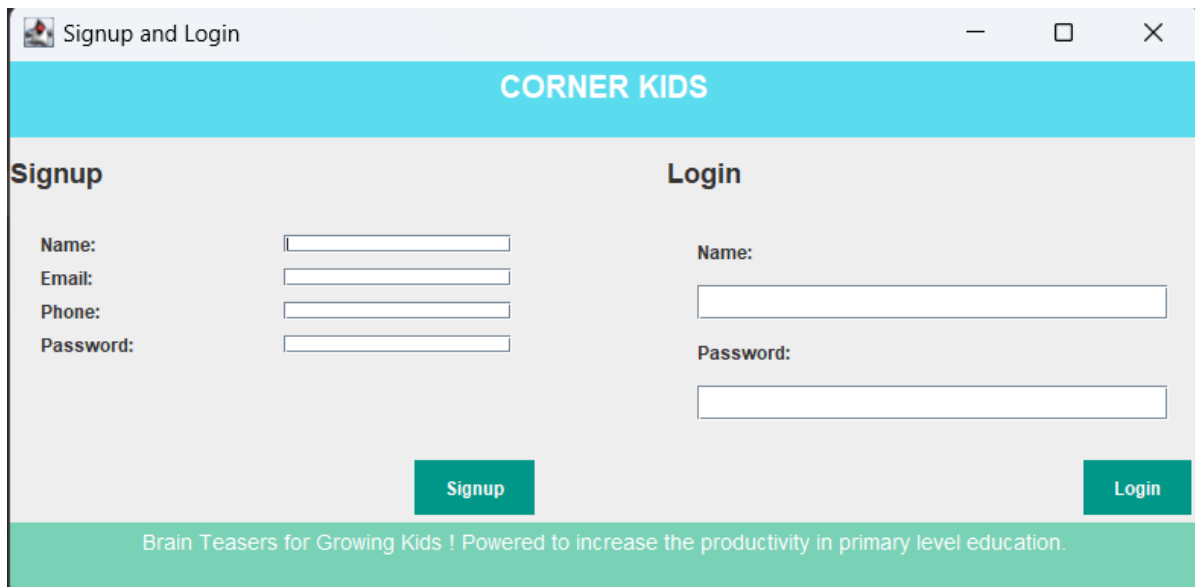
# Implementation

## Logic behind Signup and Login Page



```
113  
114 @  
115  
116 public void actionPerformed(ActionEvent e) {  
117     // Handle signup button  
118     String name = nameField.getText();  
119     String email = emailField.getText();  
120     String phone = phoneField.getText();  
121     String password = new String(passwordField.getPassword());  
122  
123     // TODO: Store the signup information somewhere (e.g., database, file)  
124  
125     // Show welcome message  
126     JOptionPane.showMessageDialog(parentComponent, this, message: "Welcome aboard, " + name + "!");  
127 } else if (e.getSource() == loginButton) {  
128     // Handle login button  
129     String name = loginNameField.getText();  
130     String password = new String(loginPasswordField.getPassword());  
131  
132     // Check credentials  
133     boolean validCredentials = checkCredentials(name, password);  
134  
135     // Navigate to demo page if credentials are valid  
136     if (validCredentials) {  
137         // Create and show demo page  
138         MyGUI MyGUIPage = new MyGUI();  
139         MyGUIPage.setVisible(true);  
140         // Hide the SignupAndLogin frame  
141         setVisible(false);  
142         dispose();  
143     }  
144 }  
145
```

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



Signup and Login

CORNER KIDS

Signup

Name:

Email:

Phone:

Password:

Signup

Login

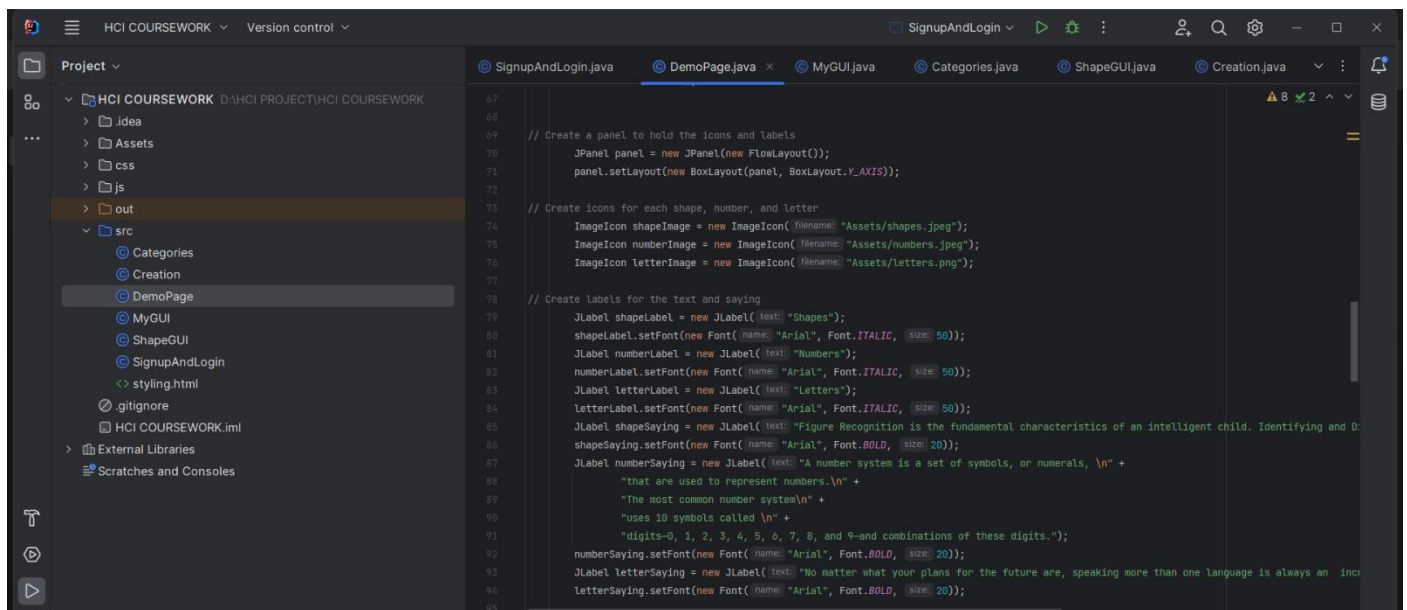
Name:

Password:

Login

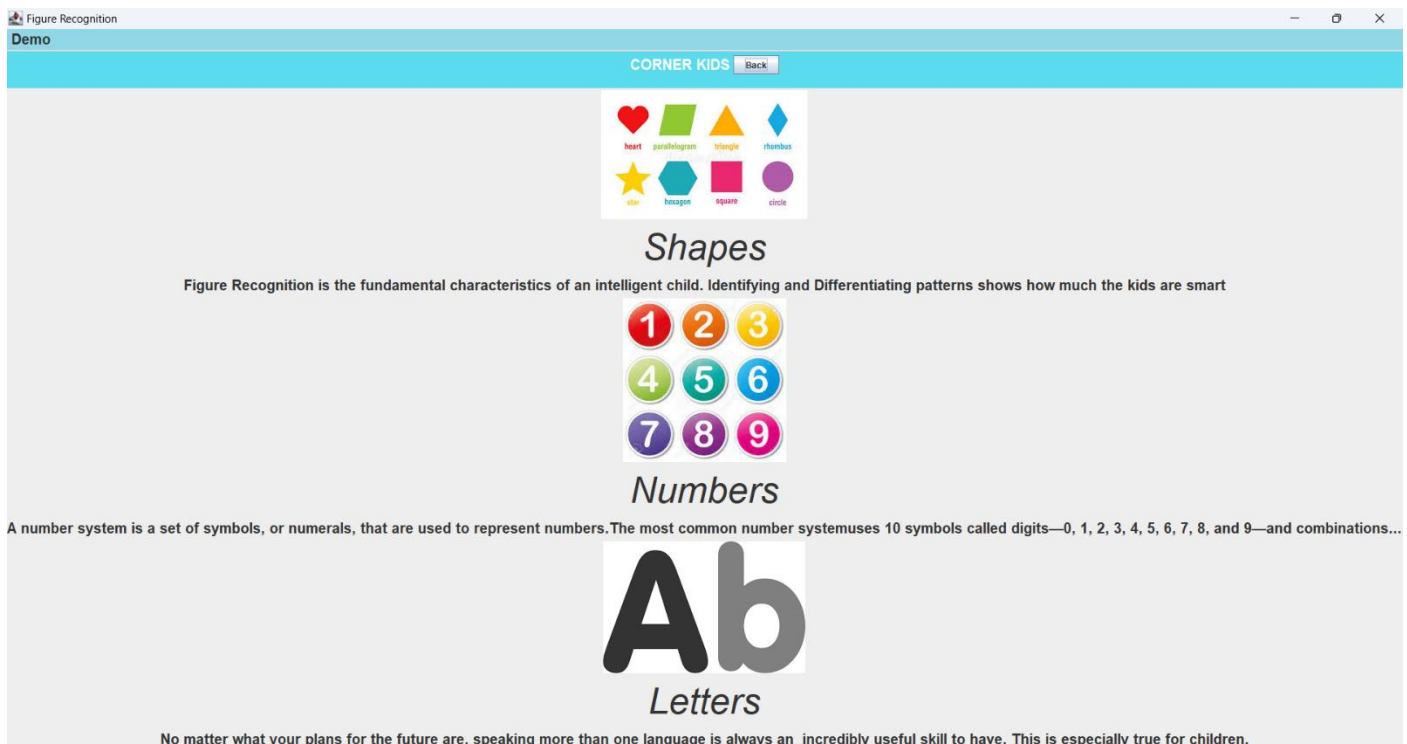
Brain Teasers for Growing Kids ! Powered to increase the productivity in primary level education.

## Logic behind Demo Page

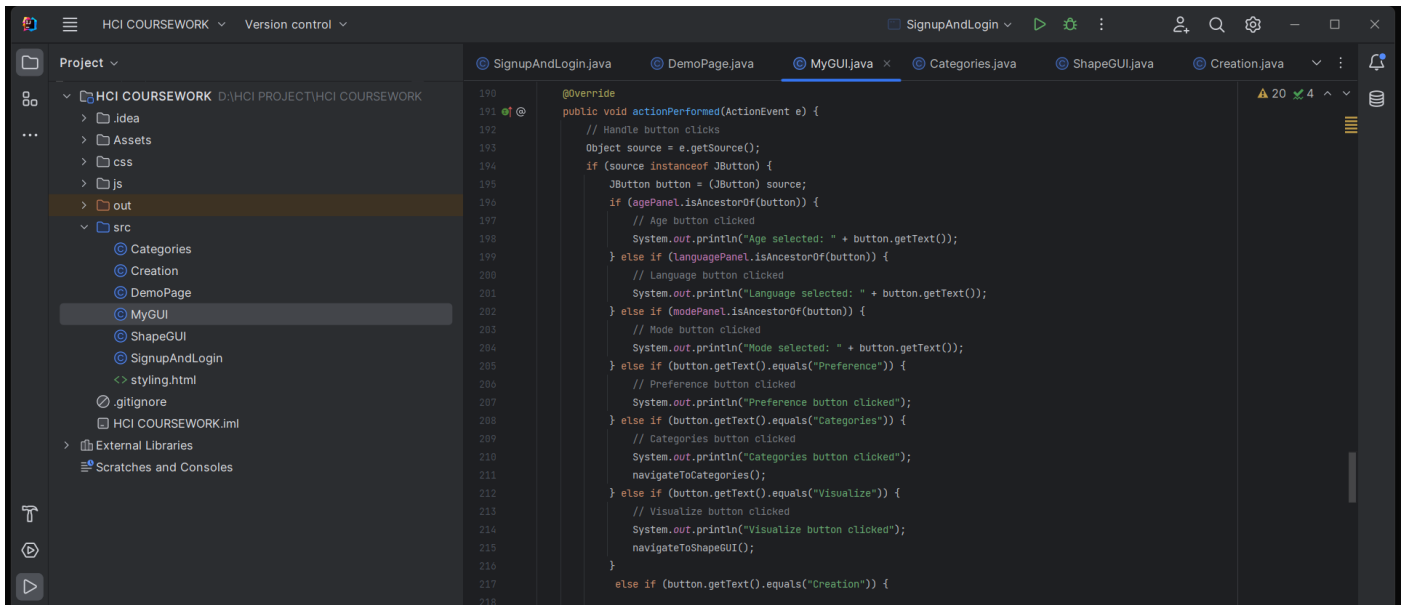


```
87
88
89 // Create a panel to hold the icons and labels
90 JPanel panel = new JPanel(new FlowLayout());
91 panel.setLayout(new BoxLayout(panel, BoxLayout.Y_AXIS));
92
93 // Create icons for each shape, number, and letter
94 ImageIcon shapeImage = new ImageIcon("Assets/shapes.jpeg");
95 ImageIcon numberImage = new ImageIcon("Assets/numbers.jpeg");
96 ImageIcon letterImage = new ImageIcon("Assets/letters.png");
97
98 // Create labels for the text and saying
99 JLabel shapeLabel = new JLabel(text: "Shapes");
100 shapeLabel.setFont(new Font(name: "Arial", Font.ITALIC, size: 50));
101 JLabel numberLabel = new JLabel(text: "Numbers");
102 numberLabel.setFont(new Font(name: "Arial", Font.ITALIC, size: 50));
103 JLabel letterLabel = new JLabel(text: "Letters");
104 letterLabel.setFont(new Font(name: "Arial", Font.ITALIC, size: 50));
105 JLabel shapeSaying = new JLabel(text: "Figure Recognition is the fundamental characteristics of an intelligent child. Identifying and D-");
106 shapeSaying.setFont(new Font(name: "Arial", Font.BOLD, size: 20));
107 JLabel numberSaying = new JLabel(text: "A number system is a set of symbols, or numerals, \n" +
108     "that are used to represent numbers.\n" +
109     "The most common number system\n" +
110     "uses 10 symbols called \n" +
111     "digits—0, 1, 2, 3, 4, 5, 6, 7, 8, and 9—and combinations of these digits.");
112 numberSaying.setFont(new Font(name: "Arial", Font.BOLD, size: 20));
113 JLabel letterSaying = new JLabel(text: "No matter what your plans for the future are, speaking more than one language is always an inc-");
114 letterSaying.setFont(new Font(name: "Arial", Font.BOLD, size: 20));
```

Images, text labels will be depicted using this page



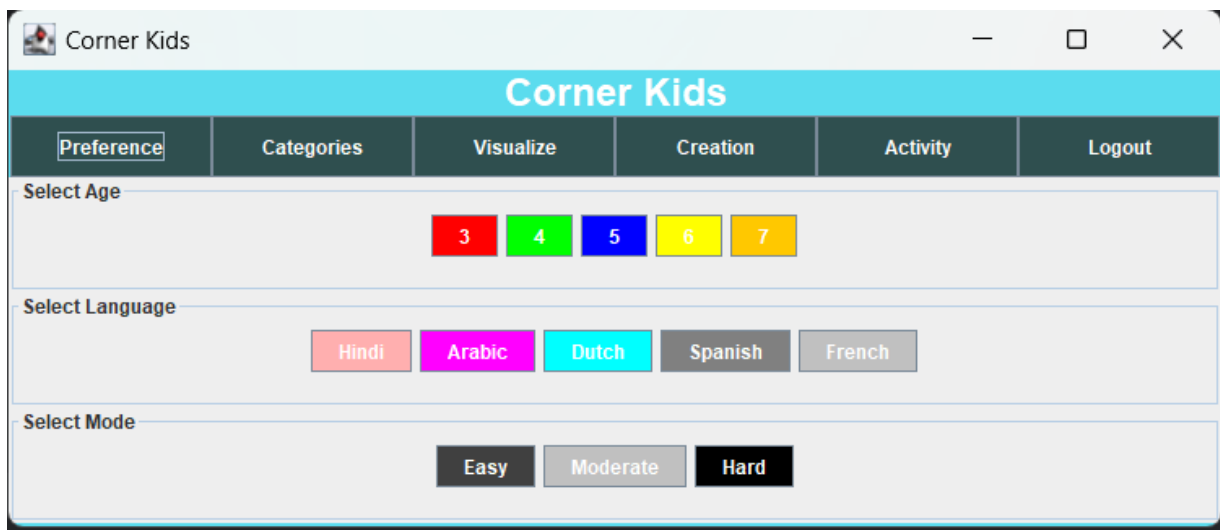
## Logic behind Preference Page



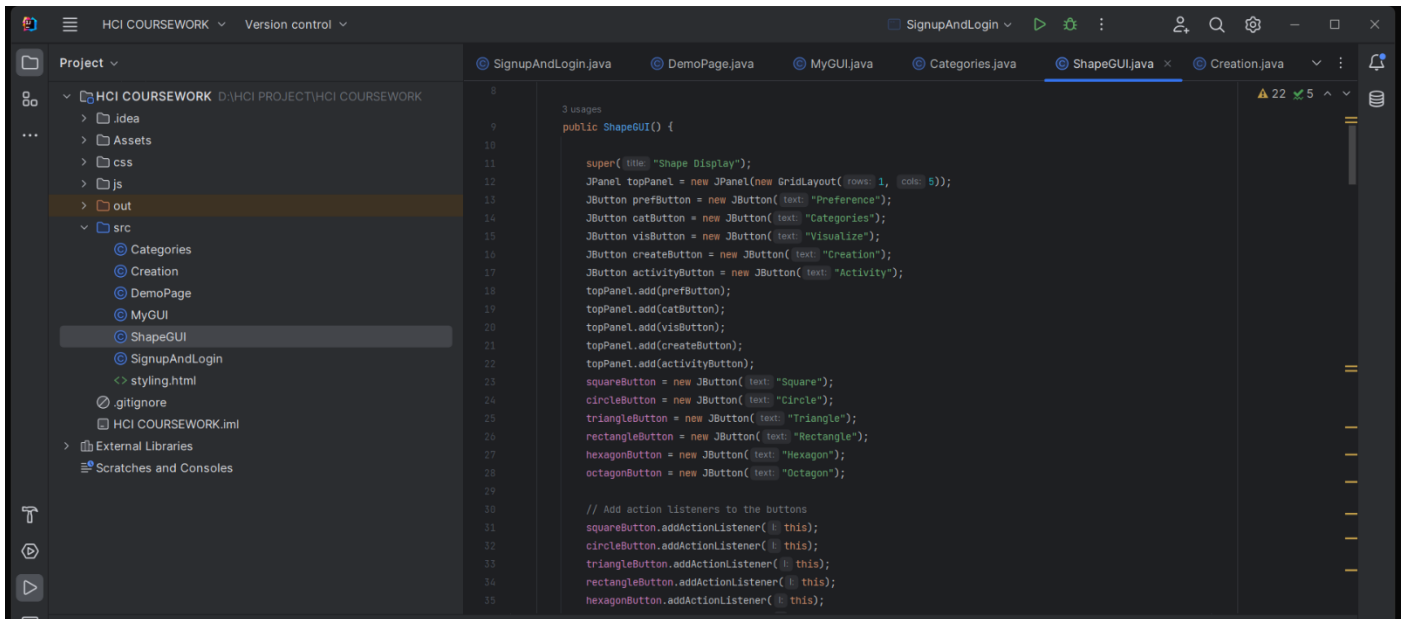
The screenshot shows an IDE with the project 'HCI COURSEWORK' open. The file 'MyGUI.java' is selected in the project explorer. The code in the main editor is as follows:

```
190 @Override
191 public void actionPerformed(ActionEvent e) {
192     // Handle button clicks
193     Object source = e.getSource();
194     if (source instanceof JButton) {
195         JButton button = (JButton) source;
196         if (agePanel.isAncestorOf(button)) {
197             // Age button clicked
198             System.out.println("Age selected: " + button.getText());
199         } else if (languagePanel.isAncestorOf(button)) {
200             // Language button clicked
201             System.out.println("Language selected: " + button.getText());
202         } else if (modePanel.isAncestorOf(button)) {
203             // Mode button clicked
204             System.out.println("Mode selected: " + button.getText());
205         } else if (button.getText().equals("Preference")) {
206             // Preference button clicked
207             System.out.println("Preference button clicked");
208         } else if (button.getText().equals("Categories")) {
209             // Categories button clicked
210             System.out.println("Categories button clicked");
211             navigateToCategories();
212         } else if (button.getText().equals("Visualize")) {
213             // Visualize button clicked
214             System.out.println("Visualize button clicked");
215             navigateToShapeGUI();
216         }
217     } else if (button.getText().equals("Creation")) {
```

## Navigation, user selection buttons

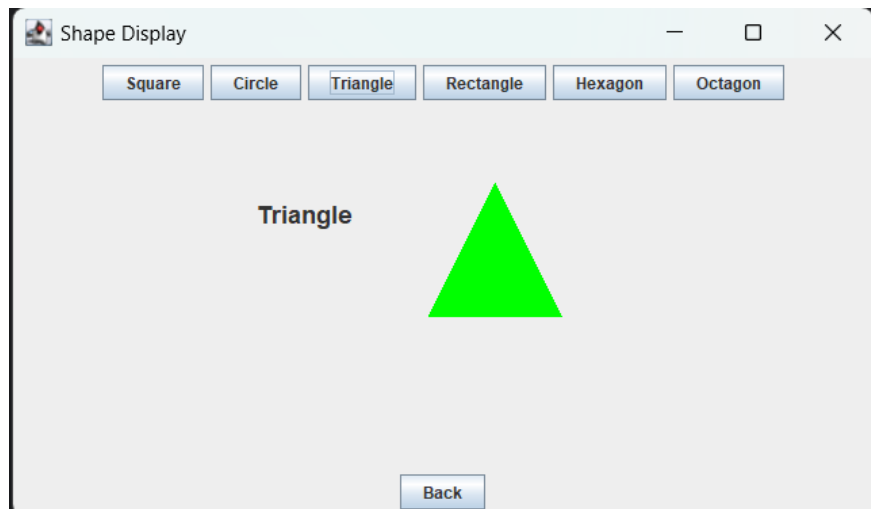


## Logic behind Visualize Page



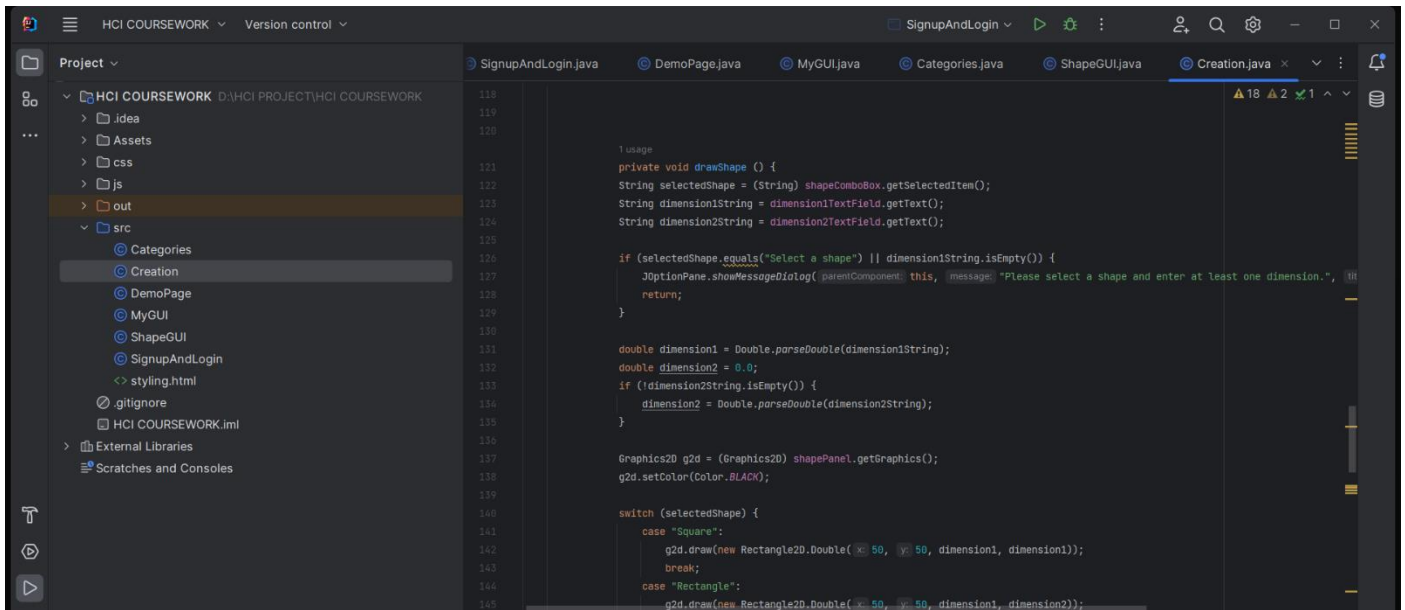
```
8
9
10
11 3 usages
12 public ShapeGUI() {
13     super(new JFrame("Shape Display"));
14     JPanel topPanel = new JPanel(new GridLayout(1, 6));
15     JButton prefButton = new JButton("Preference");
16     JButton catButton = new JButton("Categories");
17     JButton visButton = new JButton("Visualize");
18     JButton createButton = new JButton("Creation");
19     JButton activityButton = new JButton("Activity");
20     topPanel.add(prefButton);
21     topPanel.add(catButton);
22     topPanel.add(visButton);
23     topPanel.add(createButton);
24     topPanel.add(activityButton);
25     squareButton = new JButton("Square");
26     circleButton = new JButton("Circle");
27     triangleButton = new JButton("Triangle");
28     rectangleButton = new JButton("Rectangle");
29     hexagonButton = new JButton("Hexagon");
30     octagonButton = new JButton("Octagon");
31
32     // Add action listeners to the buttons
33     squareButton.addActionListener(this);
34     circleButton.addActionListener(this);
35     triangleButton.addActionListener(this);
36     rectangleButton.addActionListener(this);
37     hexagonButton.addActionListener(this);
38 }
```

Shapes with different colors will be created in 2D

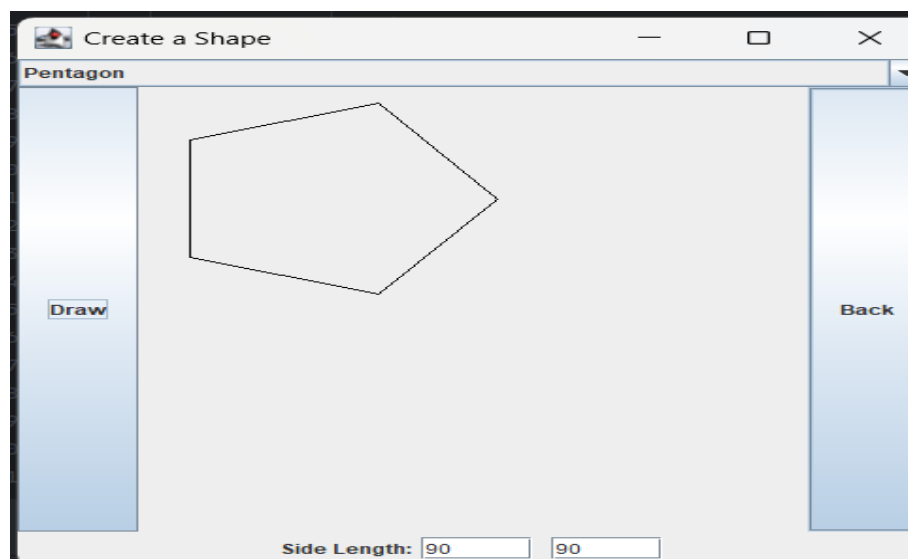




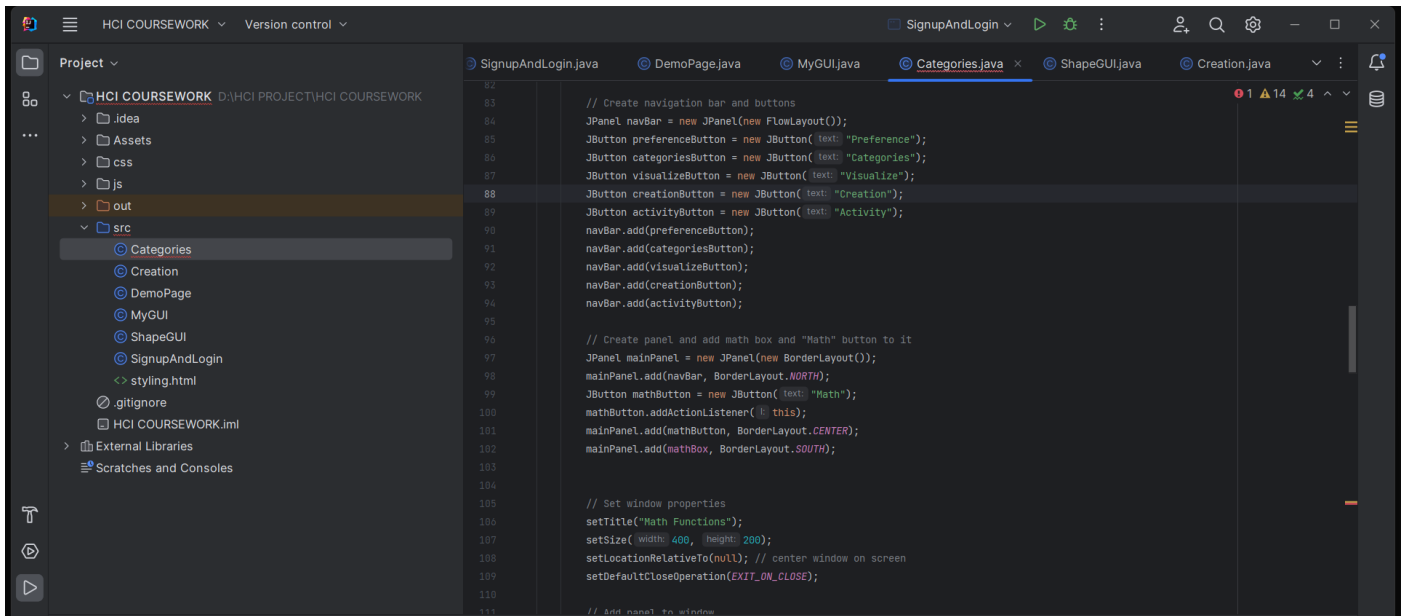
## Logic behind Creation Page



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

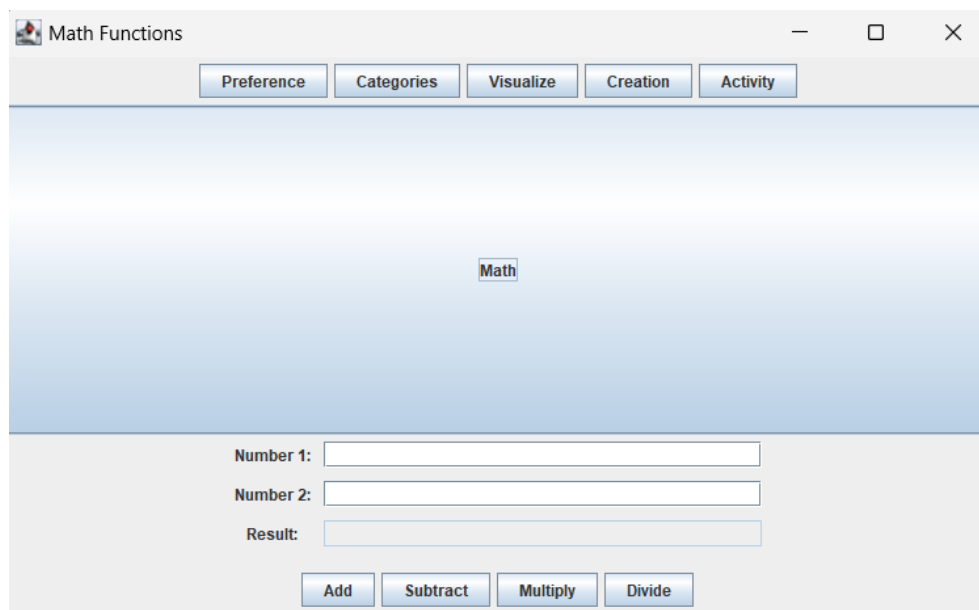


## Logic behind Categories Page



```
82
83 // Create navigation bar and buttons
84 JPanel navBar = new JPanel(new BorderLayout());
85 JButton preferenceButton = new JButton( text: "Preference");
86 JButton categoriesButton = new JButton( text: "Categories");
87 JButton visualizeButton = new JButton( text: "Visualize");
88 JButton creationButton = new JButton( text: "Creation");
89 JButton activityButton = new JButton( text: "Activity");
90 navBar.add(preferenceButton);
91 navBar.add(categoriesButton);
92 navBar.add(visualizeButton);
93 navBar.add(creationButton);
94 navBar.add(activityButton);
95
96 // Create panel and add math box and "Math" button to it
97 JPanel mainPanel = new JPanel(new BorderLayout());
98 mainPanel.add(navBar, BorderLayout.NORTH);
99 JButton mathButton = new JButton( text: "Math");
100 mathButton.addActionListener( this );
101 mainPanel.add(mathButton, BorderLayout.CENTER);
102 mainPanel.add(mathBox, BorderLayout.SOUTH);
103
104
105 // Set window properties
106 setTitle("Math Functions");
107 setSize( width: 400, height: 200);
108 setLocationRelativeTo(null); // center window on screen
109 setDefaultCloseOperation(EXIT_ON_CLOSE);
110
111 // Add panel to window
```

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



Math Functions

Preference Categories Visualize Creation Activity

Math

Number 1:

Number 2:

Result:

Add Subtract Multiply Divide

### **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

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- ❖ 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

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