

**Organization: Python Software Foundation**

**Sub-Organization: FURY**

# FURY: Improve UI elements for drawing geometrical shapes (Full Time Project)

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## About Me:

Hello, I am **Praneeth Shetty**, **Second Year Computer Engineering** Student at **Zeal College of Engineering & Research, Maharashtra**.

I have been doing **Python** programming for almost **2 years**, due to which I have a good experience of working with various python libraries such as **numpy**, **opencv**, **mediapipe**, **tkinter**, **pygame**, etc. I have also created a few projects using python which are [Blackjack Trend Analyzer](#), [Virtual Hologram Controller](#). Apart from Python I also work with **C++** (for Competitive Programming), **Godot** (Game Engine with Python like Programming Language viz. GDScript), **p5.js** (JavaScript library for Creative Coding, [Some Examples](#)), etc.

As **Game Development** is one of my **hobbies** I have a basic understanding of how computer graphics works. I have created a simple project called [ComputerPyGraphics](#) to **visualize** various **computer graphics algorithms**. As I am working with fury I have an **introductory** understanding about **vtk** (the backbone of fury), on which I will work to learn more.

## Other Information:

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## Project Overview:

As per the Ideas page I will be **adding** new UI elements and **improving** the existing UI system to easily **visualize** and **transform** various geometric shapes and UI elements **interactively** without affecting the existing **performance**.

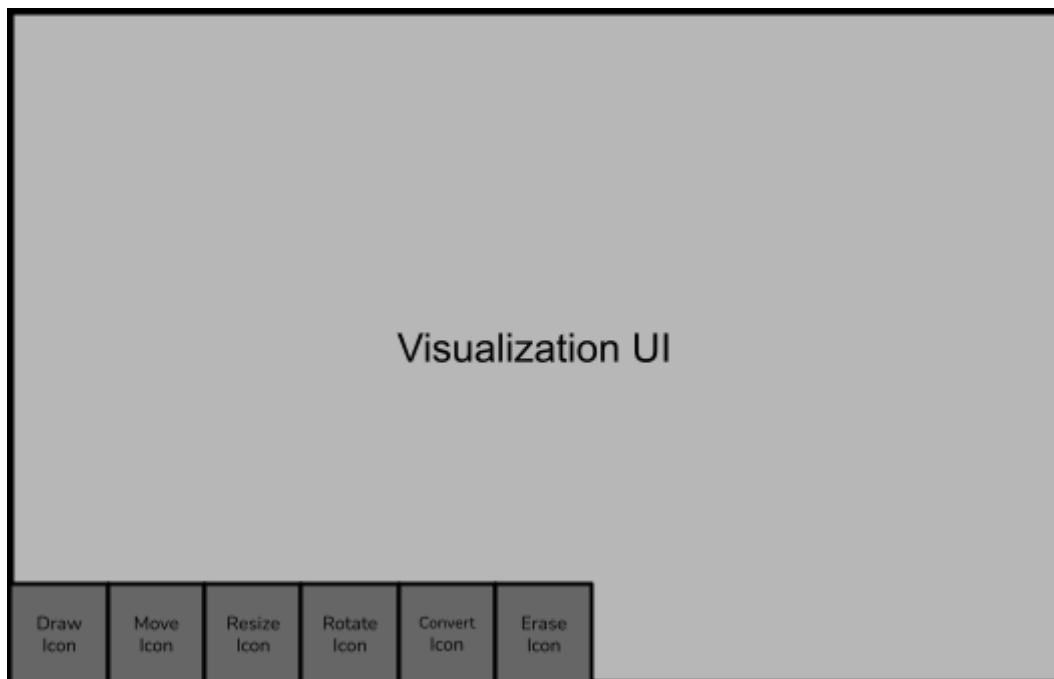
The **main objective** of this project would be to create a **UI component** using which we could **interactively create geometrical shapes, rotate, scale and convert 2D coords into 3D coords** along with the **tests and tutorials**.

Along with the above work there are some **extra works** such as **Layout Management, Creating Scrollbar as an individual element, Completing Tree UI implementation, Spin Box Implementation, Improving the Border Implementation, etc.**

## Project Description:

### Visualization UI

A parent component which would hold all the sub-components needed for visualization and transformation.



This Whole UI can be divided into two parts:-

### 1. The Main Visualization Window

This would basically be a **Scene** where various actors would be added/removed and where the main interaction would happen.

### 2. The Toolbar Overlay

This toolbar will be a **Panel** with a set of **Buttons** which will help user to change the working mode and perform various operations

The sub-components which will be added to the Visualization UI are mentioned below

### 1. Drawing Geometrical Objects

In this mode users will be able to **interactively draw** various **geometric shapes**, **polygons**, etc. They can just select the points or the values depending on which we will create the required object.

**Polygons** can be created using **vtkPolygon**

**Circles, Disks** and **Quads** can be easily created using **existing UI elements**

### 2. Moving Components

Using this mode users can easily **update** the **position** of the selected object by **dragging and dropping** the element.

We can use the **set\_position** method to set the position depending upon the **mouse coords**.

### 3. Resizing Components

This mode will help users to **resize** the required **element interactively**.

For this we will **update** the implementation of the **resize** method to automatically adjust itself whenever needed.

### 4. Rotating Components

Users can use this mode to **rotate** the object by some specific angles.

Implementing a **rotate** method which will rotate the element according to the params.

### 5. Converting 2D shapes to 3D

Using this component we could easily convert any **2D shape** into **3D**. This would be useful to easily visualize any planar object into a 3D model.

There may be various approaches but currently as per my understanding I am thinking of extruding the edges of the 2D shape with some fixed depth unit to create a 3D object which then we can modify according to our need.

## 6. Erase Components

This component would be used to **remove** the unwanted object or to **erase** any part of the object.

We could **remove** the **actor** directly from the **scene**.

## 7. Undo and Redo

Using this we can **revert back** to the previous step or **fast forward** to the next step which the user has performed.

We can use a **stack** to keep track of the **steps performed** by the users and depending on the interaction we can perform required operations.

## Project Timeline:

<b>Community Bonding Period</b> May 20 - June 12	
May 20 - May 29	<ul style="list-style-type: none"><li>• Getting to know more about mentors, admins and community</li><li>• Discussing the project goals and requirements</li><li>• Prioritizing the project objectives</li></ul>
May 30 - June 5	<ul style="list-style-type: none"><li>• Discussing and finding different approaches to work on the projects</li><li>• Discussing the stretch goals and implementation sequence</li></ul>
June 6 - June 12	<ul style="list-style-type: none"><li>• Working on some pending issues which is necessary to work on before implementation of project</li></ul>
<b>Phase - 1</b> June 13 - July 24	
June 13 - June 19	<ul style="list-style-type: none"><li>• Working on the resizing function for each UI element</li><li>• Proportionately scaling the nested elements</li></ul>
June 20 - June 26	<ul style="list-style-type: none"><li>• Fixing bugs and debugging the code</li><li>• Creating tests and tutorials for the changes</li></ul>
June 27 - July 3	<ul style="list-style-type: none"><li>• Using PickupManager to select a specific element on mouse event</li><li>• Managing the selection of required element when two or more elements overlap</li></ul>

July 4 - July 10	<ul style="list-style-type: none"> <li>• Working on interactively resizing the elements depending on user selection</li> <li>• Creating unit tests and tutorials</li> </ul>
July 11 - July 17	<ul style="list-style-type: none"> <li>• Working on creation of geometric shapes on User Interaction</li> <li>• Managing the user events to smoothen the interaction</li> <li>• Resolving collision between the callbacks to perform a specific task on interaction</li> </ul>
July 18 - July 24	<ul style="list-style-type: none"> <li>• Updating support to add new vertex to existing geometric shape</li> <li>• Repositioning vertices, scaling edges</li> </ul>
<b>Phase - 2</b> <b>July 25 - September 12</b>	
July 25 - July 31	<ul style="list-style-type: none"> <li>• Testing various test cases to ensure required working</li> <li>• Creating tutorials and documenting</li> </ul>
August 1 - August 7	<ul style="list-style-type: none"> <li>• Implementing rotation for UI elements</li> <li>• Working on rotation of geometrical objects</li> </ul>
August 8 - August 14	<ul style="list-style-type: none"> <li>• Debugging the code and adding unit tests</li> <li>• Creating tutorials to explain working of the feature</li> </ul>
August 15 - August 21	<ul style="list-style-type: none"> <li>• Working on conversion of 2D coords into 3D models</li> <li>• Making the conversion compatible with various input output formats</li> </ul>
August 22 - August 28	<ul style="list-style-type: none"> <li>• Testing the conversion with large data to efficiently scale according to data</li> <li>• Creating Demos to show the working</li> <li>• Creating unit tests</li> </ul>
August 29 - September 4	<ul style="list-style-type: none"> <li>• Creating the basic layout for the Visualization UI</li> <li>• Creating the Toolbar (Panel with Multiple Buttons)</li> <li>• Integrating the Scene and the Toolbar</li> </ul>
September 5 - September 11	<ul style="list-style-type: none"> <li>• Assigning the respective components to the toolbar buttons</li> <li>• Combining all the components together and working on the integration</li> </ul>
<b>Phase - 3 (Extended)</b> <b>September 13 - Nov 21</b>	
September 12 - September 18	<ul style="list-style-type: none"> <li>• Performing bug fixes</li> <li>• Solving integration issues</li> </ul>
September 19 - September 25	<ul style="list-style-type: none"> <li>• Adding the undo and redo function</li> </ul>

	<ul style="list-style-type: none"> <li>• Setting limits to maximum number of undo and redo</li> </ul>
September 26 - October 2	<ul style="list-style-type: none"> <li>• Implementing Erase function to remove the whole actor from the scene</li> <li>• Also trying to modify the erase function to remove the partial portion or the selected region from the actor</li> </ul>
October 3 - October 9	<ul style="list-style-type: none"> <li>• Making sure everything is integrated correctly and properly works in collaboration</li> <li>• Testing the whole Visualization UI</li> <li>• Documenting and Creating the tutorials for the same</li> </ul>
October 10 - October 16	<ul style="list-style-type: none"> <li>• Completing the SpinBoxUI Implementation</li> <li>• Adding supports for choosing values of different data types (ie. characters, list of strings, etc.)</li> </ul>
October 17 - October 23	<ul style="list-style-type: none"> <li>• Debugging the code</li> <li>• Adding unit test and demos</li> </ul>
October 24 - October 30	<ul style="list-style-type: none"> <li>• Creating Scrollbar as an individual element</li> <li>• Resizing the scrollbars</li> </ul>
October 31 - November 6	<ul style="list-style-type: none"> <li>• Testing the working and fixing bugs</li> <li>• Creating tutorials</li> </ul>
November 7 - November 13	<ul style="list-style-type: none"> <li>• Updating the UI elements which has scrollbar</li> <li>• Working on any unfinished work or Extra goals</li> </ul>
November 14 - November 20	<ul style="list-style-type: none"> <li>• Buffer Period to Complete all the remaining work and fix any issue if arises</li> <li>• Completing Docs and Blog</li> <li>• Create a Tutorial for all the work done in GSOC period</li> </ul>

## Contributions:

### Pull Requests:

1. [Resolving GridUI caption error #478](#)

Fixing the inconsistency shown by grid method while returning the actor list, as when the actor was passed with caption it returns a Container object else it used to return the actor itself. This PR solves [#463](#) issue.

2. [Adding ProgressUI to the UI #485](#)

Adding ProgressUI Widget to the UI, which can be used to show the progress of some task or the amount of work done/left from the total work.

3. [Adding SpinBoxUI to the UI module #499](#)  
Creating a SpinBoxUI which can be used to select discrete values with some specific interval.
4. [Creating an off focus hook in TextBox2D #501](#)  
Creating a hook on TextBox2D to capture the off focus event which can be used to perform some callback whenever the focus is shifted from the text box.
5. [adding numpy to vtk\\_image\\_data method to utility #509](#)  
Creating a utility function which will convert numpy arrays to vtkImageData. This PR addresses [#500](#) issue.
6. [updating methods to use numpy to vtk\\_image\\_data from utils #540](#)  
Updating the methods to use the function from utils to reduce duplication of code.

#### Issues:

1. [ListBox2D has resizing issues when added into TabUI #418](#)  
This issue was related to the resizing of ListBox2D which doesn't work properly when added to TabUI
2. [UI Textbox background doesn't resize according to text in it. #407](#)  
The background for TextBox stays at the same size (ie. the initialization size) irrespective of the data being entered.

## Commitments and Availability:

- Only applying to FURY for GSOC-22
- Semester Exams may occur in June and October for a duration of 8-10 days
- Current Mid-Sem exams are scheduled in End-April