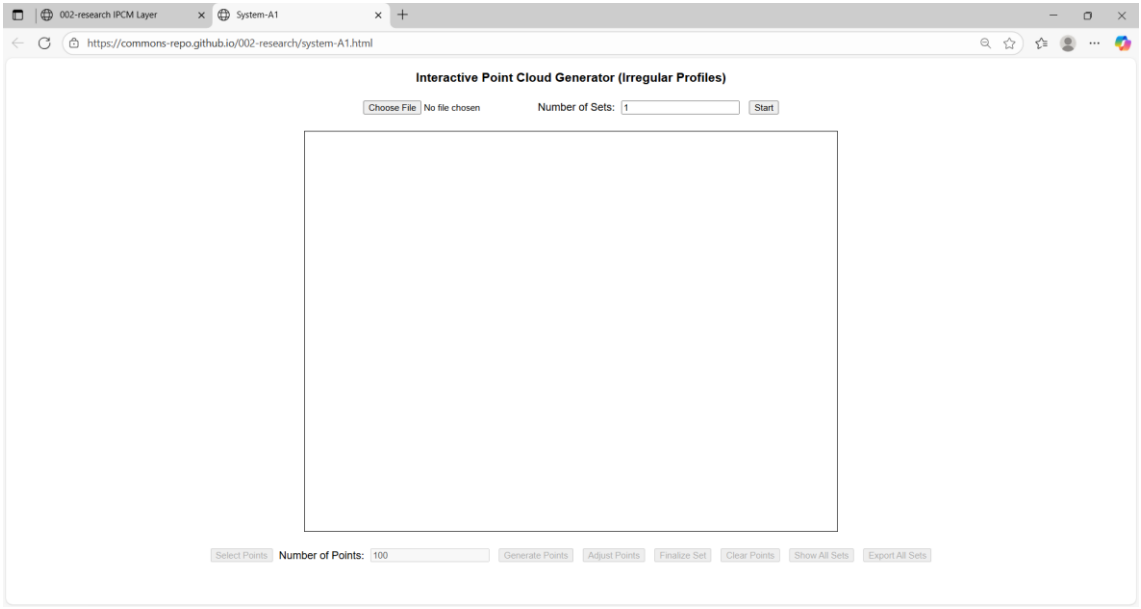
How to use System A

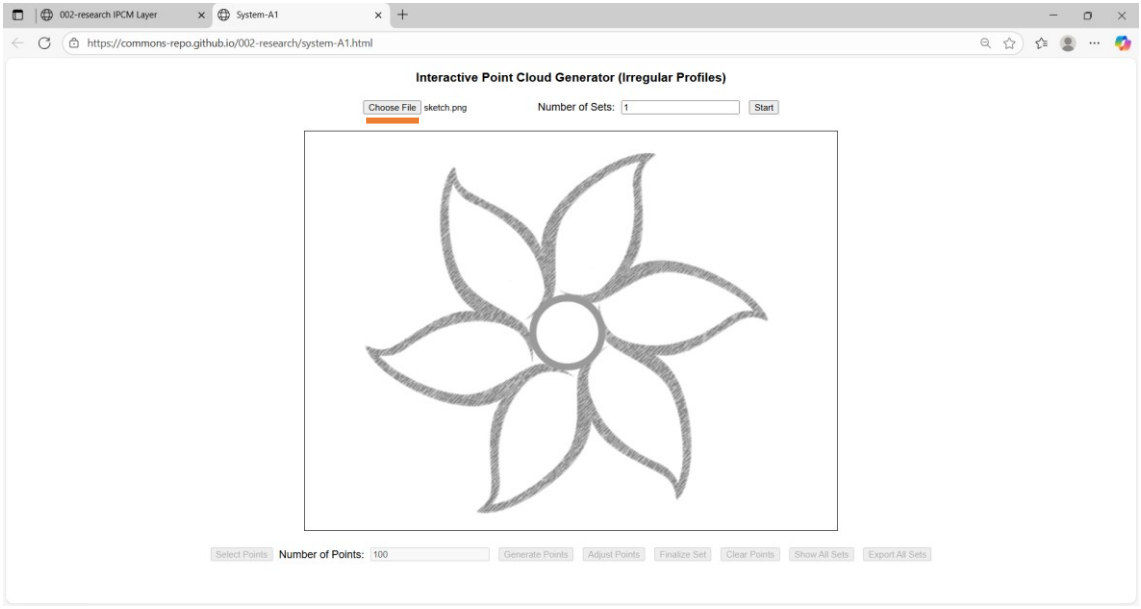
(Interactive Point Cloud Generator (Irregular Profiles))

A1: Bézier–Bernstein polynomial-based algorithm

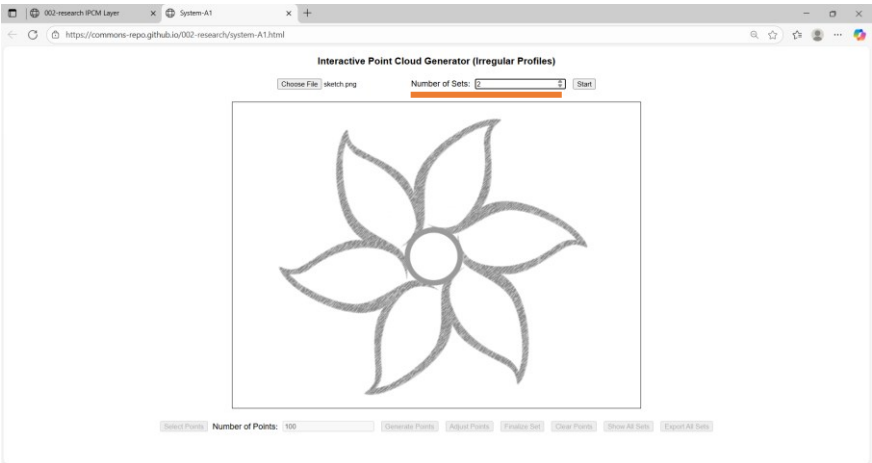
1. Open the system. An interface will be opened like below.



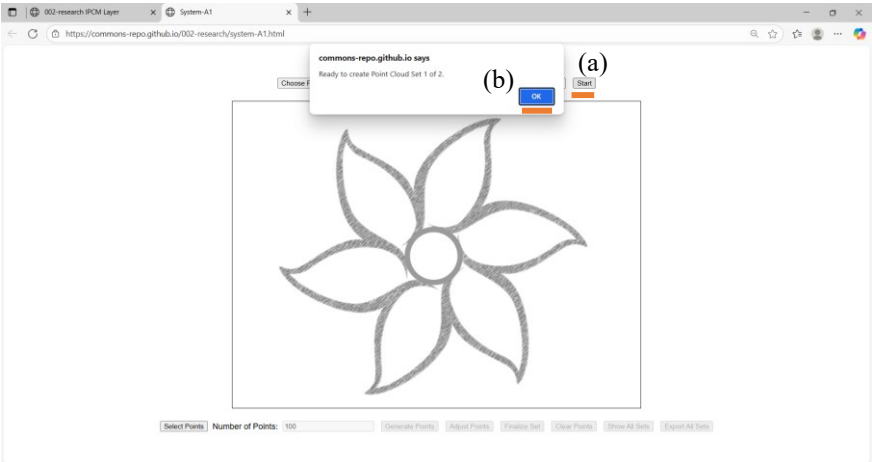
2. Load any image to use as reference to trace and create irregular curve by clicking ‘Choose File’ button on the interface. After loading an image, interface will look like below.



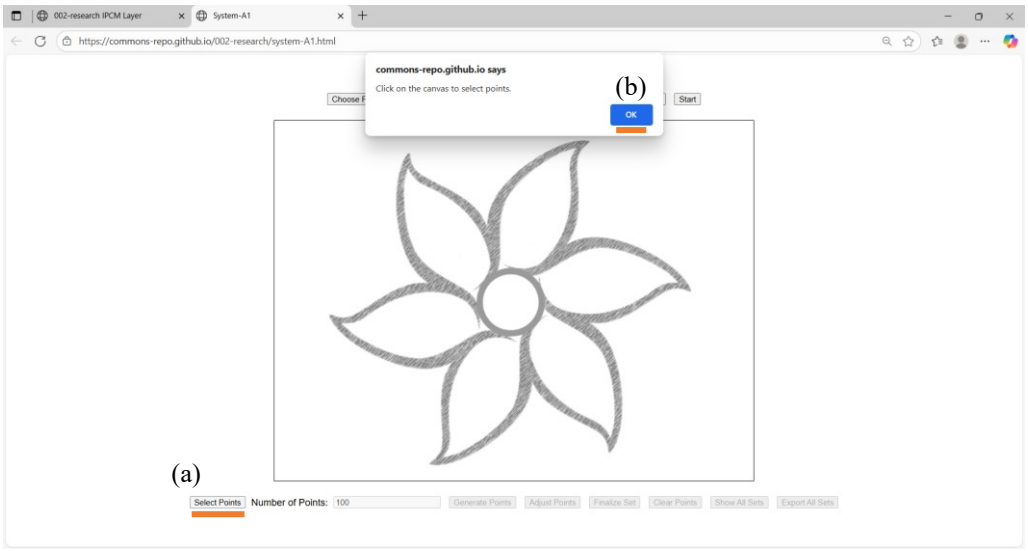
3. Set an appropriate ‘Number of Sets’, which can range from 1 to any positive integer. For example, the concept image shown above contains six symmetric circular petals. In such cases, it is sufficient to generate points for only one petal, since the remaining five can be produced later through mirroring or rotation. To generate points for a single petal, the ‘Number of Sets’ may be chosen as 2, because one petal consists of two directional segments: the first extending from the starting position to the sharp tip, and the second returning from the tip to the end position. These two directional phases naturally correspond to two separate sets. The screenshot below illustrates this setup, where the value of ‘Number of Sets’ is set to 2.



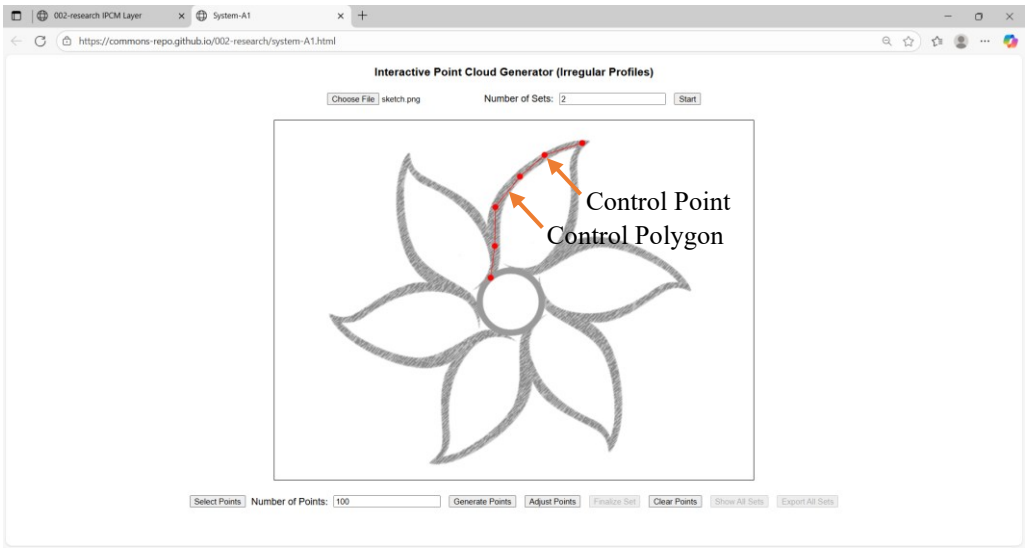
4. (a) After setting the number of sets, click the ‘Start’ button to initiate the process. (b) A pop-up window appears confirming that the process has started and that the system is ready to create Set 1 out of the total number specified (in this case, 2). Select ‘OK’ in the pop-up to proceed; the interface returns to the workspace to begin creating the first set.



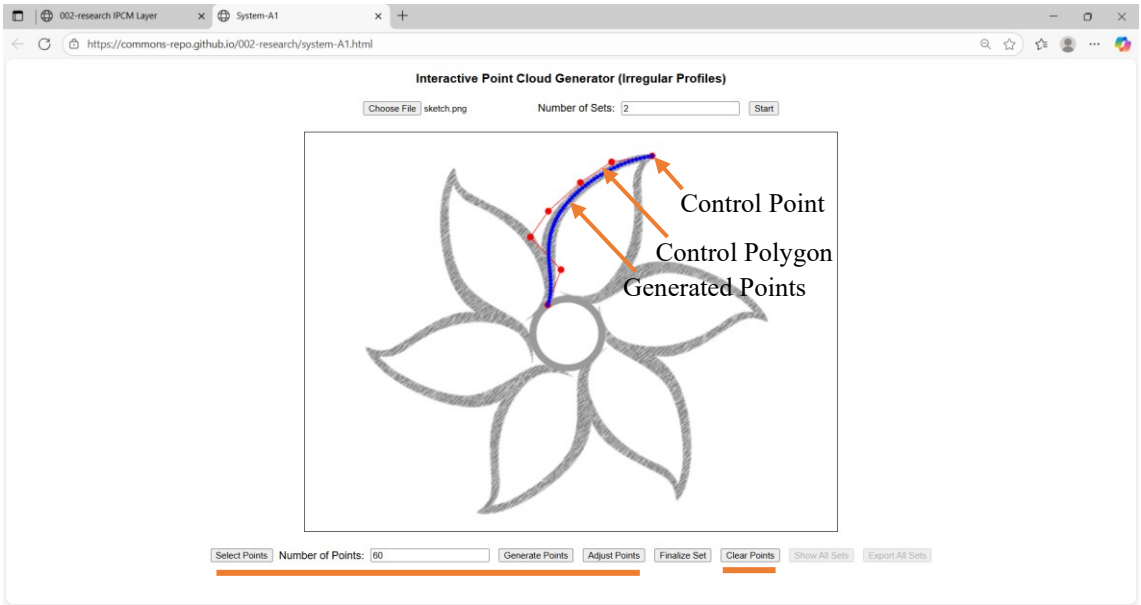
5. (a) Click the ‘Select Points’ button. This action initiates the procedure that enables placement of control points for Set 1, which is currently in progress. (b) A pop-up appears confirming this action and instructing the user to click on the canvas to place the required control points. Select ‘OK’ in the pop-up to return to the workspace and proceed with point placement.



6. Upon clicking, control points are placed and rendered on the interface in red color. The corresponding control polygon connecting these points is also rendered. The following screenshot shows an example in which six control points are placed from the starting position to the sharp tip.

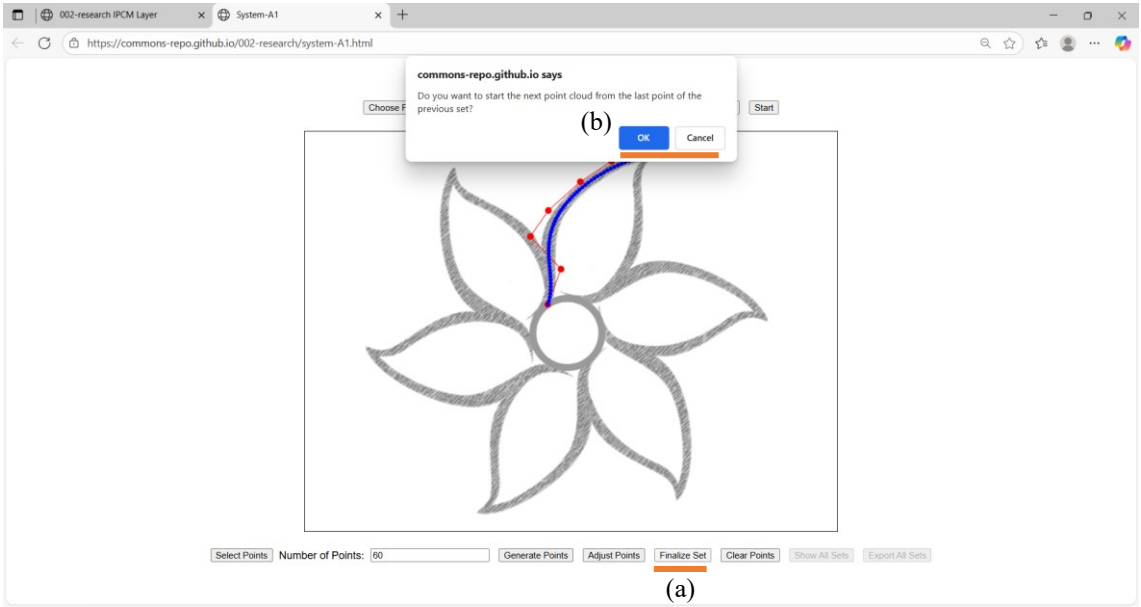


7. After placing the control points, click ‘Generate Points’ to compute and display the dense point cloud in blue. The default number of points is 100, but this value can be modified through the ‘Number of Points’ field; selecting ‘Generate Points’ again updates the result on the canvas. If the generated shape does not match the intended form, activate ‘Adjust Points’ to enable direct manipulation of the existing control points. In this mode, points can be dragged to new positions, and the curve and dense points update dynamically. A pop-up appears whenever a mode becomes active to indicate the current status. When ‘Adjust Points’ is active, placement of new control points is disabled. To add more points, select ‘Select Points’ to exit adjustment mode and restore point-placement capability. For a complete restart, ‘Clear Points’ removes both the control points and the dense points. Through iterative use of these buttons and functions, the control configuration is refined and the final dense-point set is produced. The following screenshot shows the outcome obtained after iteratively using the above buttons and functions—adjusting the previously placed control points, adding one additional control point, and generating a final set of 60 (sixty) dense points. Compared with the earlier screenshot, this shows how iterative refinement leads to the final result.

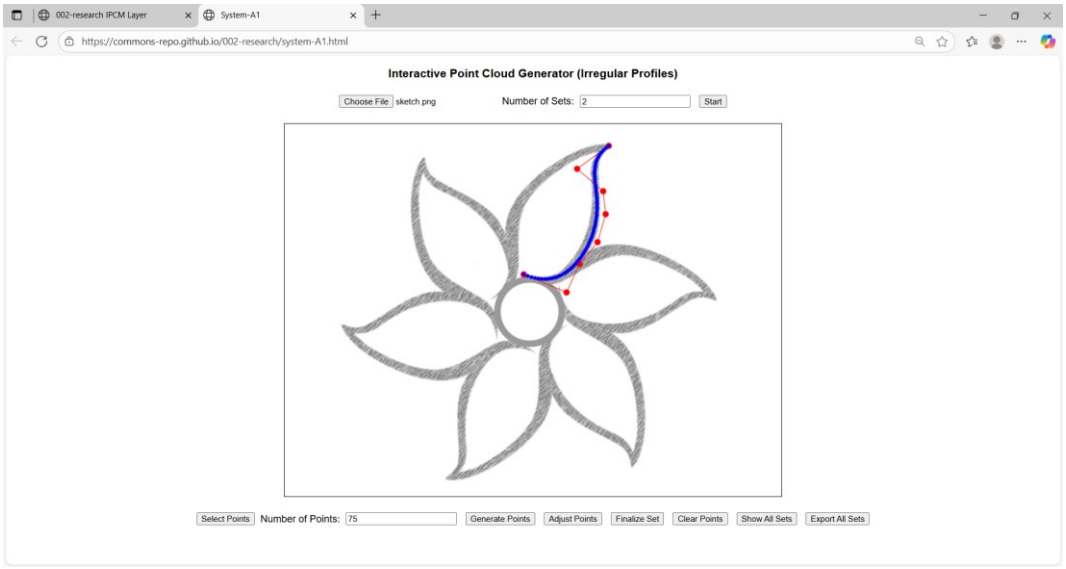


8. (a) After obtaining a satisfactory outcome, click the ‘Finalize Set’ button. This action stores the datasets for the active set—both the control points and the generated dense points—and prepares the interface for any subsequent set. In the present example, the process proceeds to Set 2. (b) A pop-up then appears to determine whether C0 continuity should be maintained between sets. The message asks whether the end point of the previous set should be connected to the start point of the current set. Selecting ‘OK’ enables this connection, while selecting

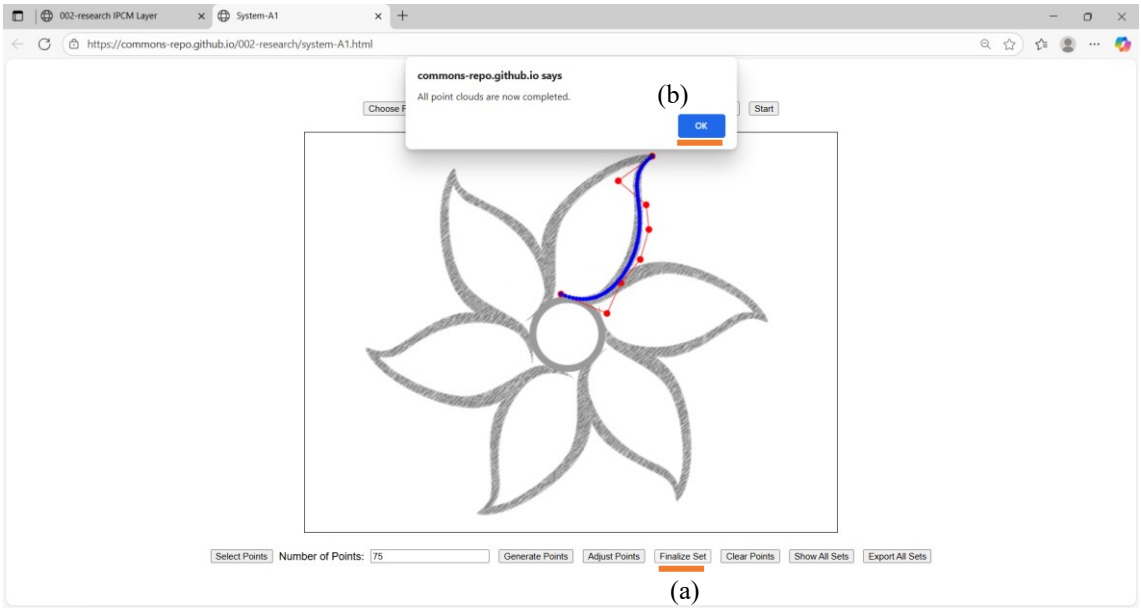
‘Cancel’ proceeds without enforcing continuity. The following screenshot illustrates this scenario.



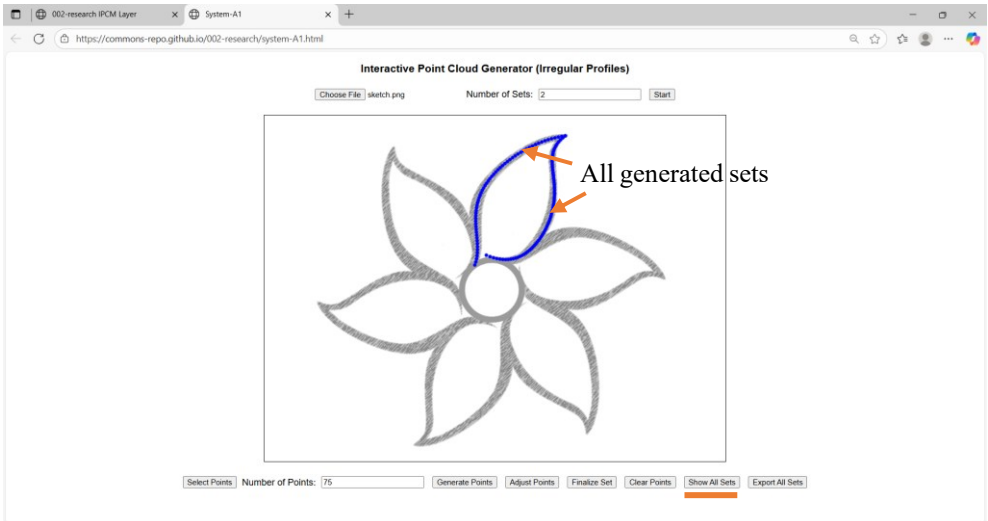
9. Since the current case requires continuity between sets, ‘OK’ is selected. When ‘OK’ is chosen, the system displays another pop-up indicating that it is ready to continue with the next set. Selecting ‘OK’ in this confirmation returns the interface to the canvas. From this point, the earlier steps (5–7) are repeated: new control points for Set 2 are placed, and the corresponding dense points are generated. The following screenshot shows this scenario. For this set, 8 (eight) control points are placed and adjusted, and the number of dense points is set to 75.



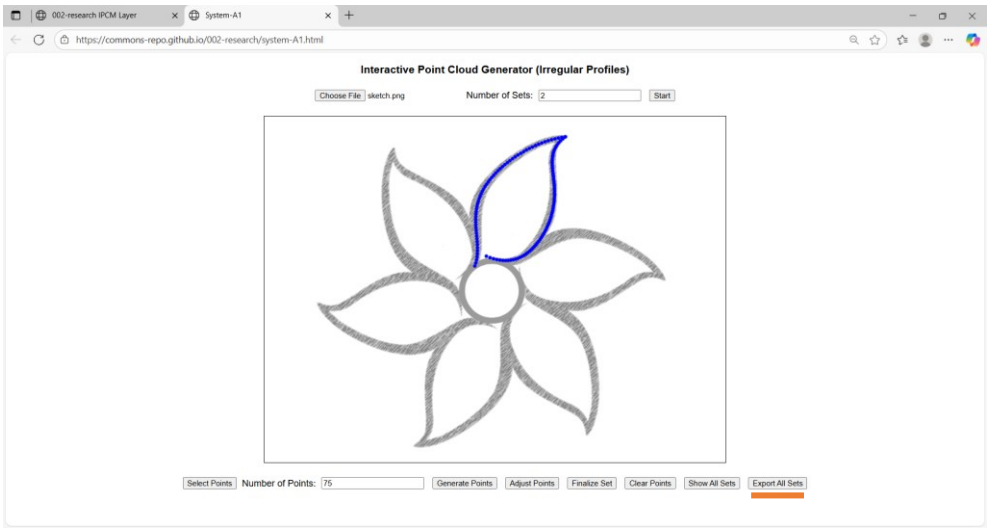
10. (a) Once a satisfactory outcome is reached, click the ‘Finalize Set’ button for the current set as well. (b) Since the total number of sets is 2 and the finalize action has now been performed twice, the process reaches completion. A pop-up appears indicating that all point-cloud sets have been generated. Selecting ‘OK’ in this pop-up returns the interface to the canvas. Note that if additional sets are specified (more than two), the same sequence of operations—placing control points, generating dense points, adjusting as needed, and finalizing—continues in the same cyclic manner for each remaining set.



11. Click the ‘Show All Sets’ button to visualize all sets together on the canvas, as shown below.



12. Click the ‘Export All Sets’ button to download the points data in CSV format.



The exported CSV file contains all sets in a consolidated format, where each row specifies the set identifier, the point type, and the corresponding coordinates. The column structure is Set, Type, X, Y. The X and Y values represent the canvas-space coordinates used during point creation, based on the 800×600 drawing canvas. For each set, the file lists the control points first, followed by the generated dense points. An example excerpt is shown below, where Set 1 includes its control points and dense points in sequence, followed by Set 2 with its corresponding entries. This format ensures that all point-cloud data are organized sequentially and remain clearly distinguishable across multiple sets.

```
Set,Type,X,Y
Set 1,Control,365.00000,259.58334
Set 1,Control,385.00000,206.58334
Set 1,Control,339.00000,157.58334
Set 1,Control,366.00000,118.58334
Set 1,Control,414.00000,75.58334
Set 1,Control,461.00000,44.58334
Set 1,Control,522.00000,35.58334
Set 1,Dense,365.00000,259.58334
Set 1,Dense,366.76280,254.21130
Set 1,Dense,368.03476,248.87691
Set 1,Dense,368.88885,243.58284
Set 1,Dense,369.39283,238.33127
Set 1,Dense,369.60940,233.12394
Set 1,Dense,369.59648,227.96215
Set 1,Dense,369.40736,222.84689
...
...
Set 2,Control,522.00000,35.58334
Set 2,Control,471.00000,72.58334
Set 2,Control,513.00000,108.58334
Set 2,Control,517.00000,145.58334
Set 2,Control,504.00000,190.58334
Set 2,Control,475.00000,225.58334
Set 2,Control,454.00000,271.58334
Set 2,Control,385.00000,242.58334
Set 2,Dense,522.00000,35.58334
Set 2,Dense,517.52118,39.07968
Set 2,Dense,513.69021,42.56946
Set 2,Dense,510.44534,46.05389
...
...
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