

Batch: D-2 Roll No.: 16010123325

Experiment No. 3

Title: Implement spatial data analysis in QGIS/python.

Course Outcome:

CO2 Apply the data analytics in the field of geospatial system

Books/ Journals/ Websites referred:

QGIS Version 3.38-Vector Data Code File-World.shp

(Students should write)

Resources used:

(Students should write)

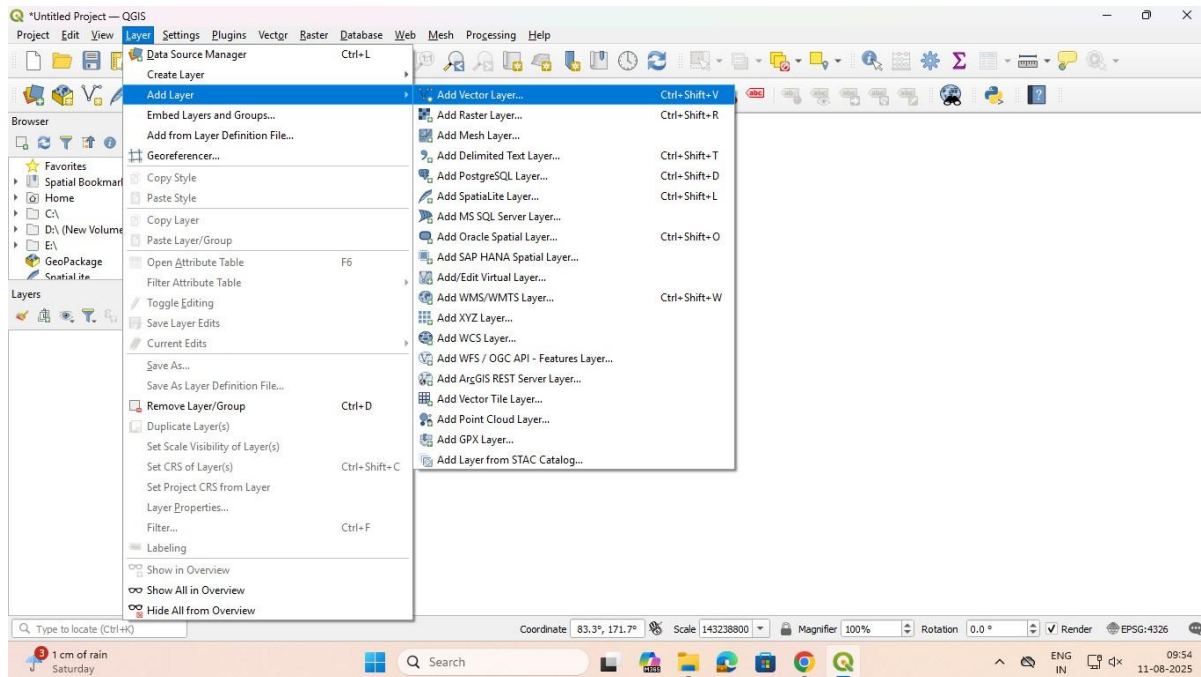
Algorithm: Spatial Data Analysis

Spatial Data type: Vector Data

Step 1: Load Your Vector Data

Open QGIS.

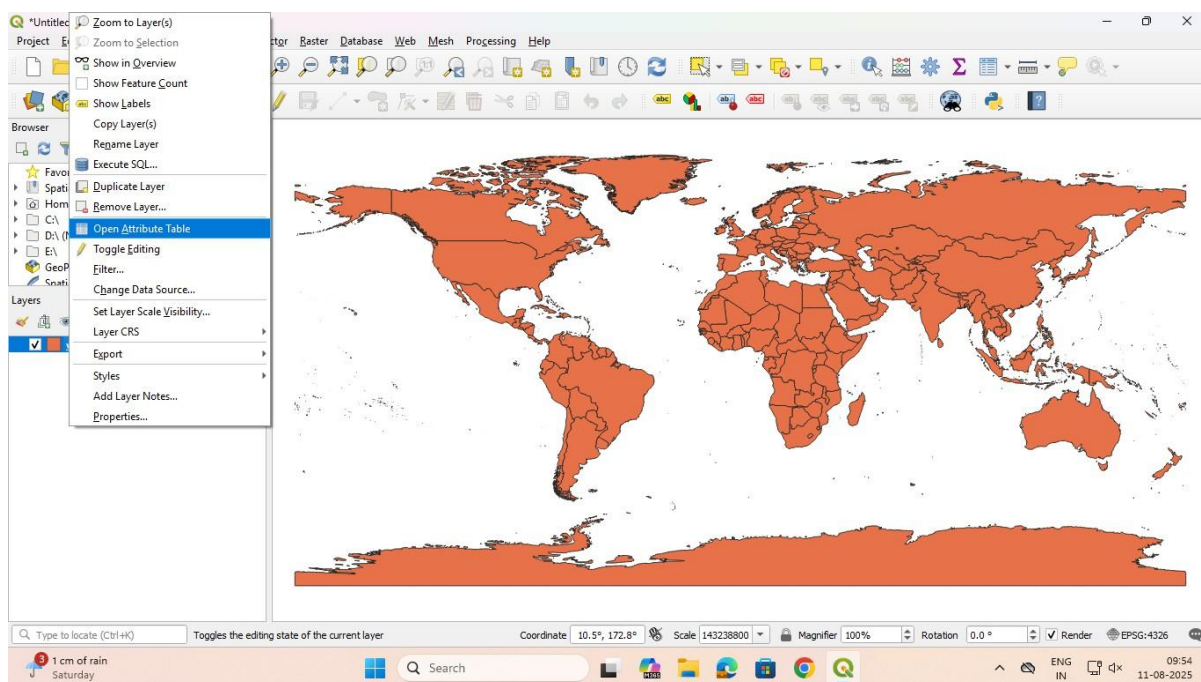
Add your vector layer: Go to Layer > Add Layer > Add Vector Layer... and browse to your shapefile or other vector data.



Step 2: Open the Attribute Table

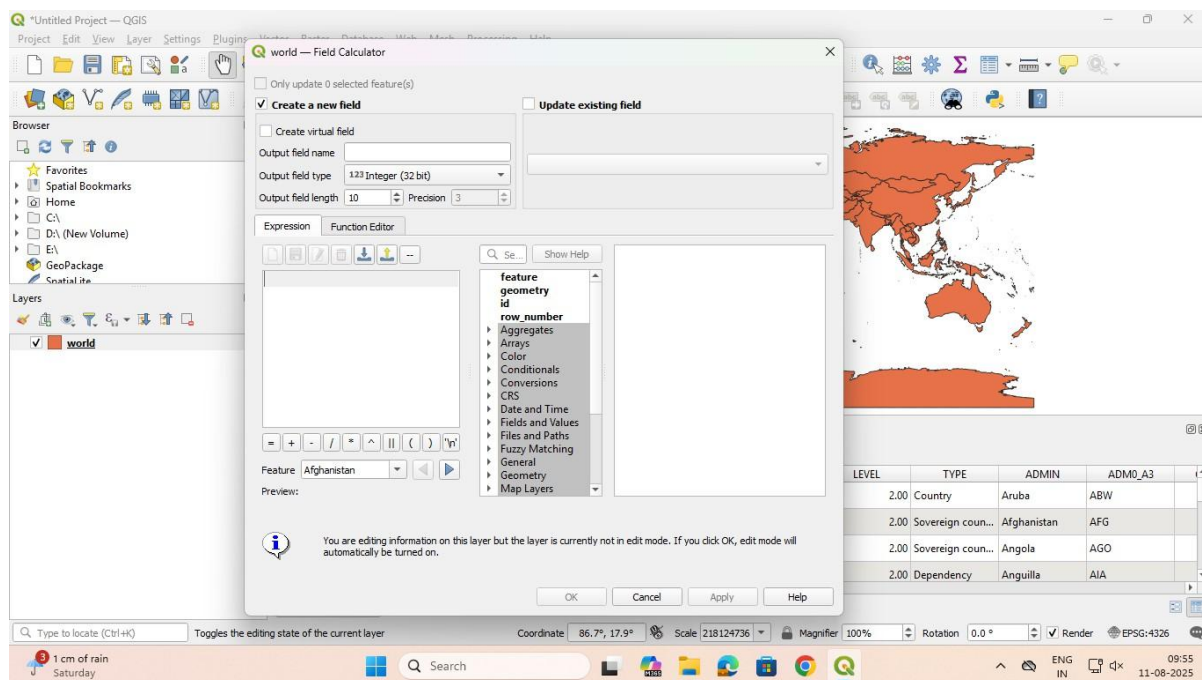
Right-click on the layer in the Layers panel.

Select Open Attribute Table.



Step 3: Add a New Field for Calculations

In the attribute table, click on the Field Calculator icon (it looks like an abacus).



Step 4: Calculate Area

In the Field Calculator dialog:

Check the option Create a new field.

Enter a name for the new field (e.g., "Area").

Set the output field type to Decimal number (real).

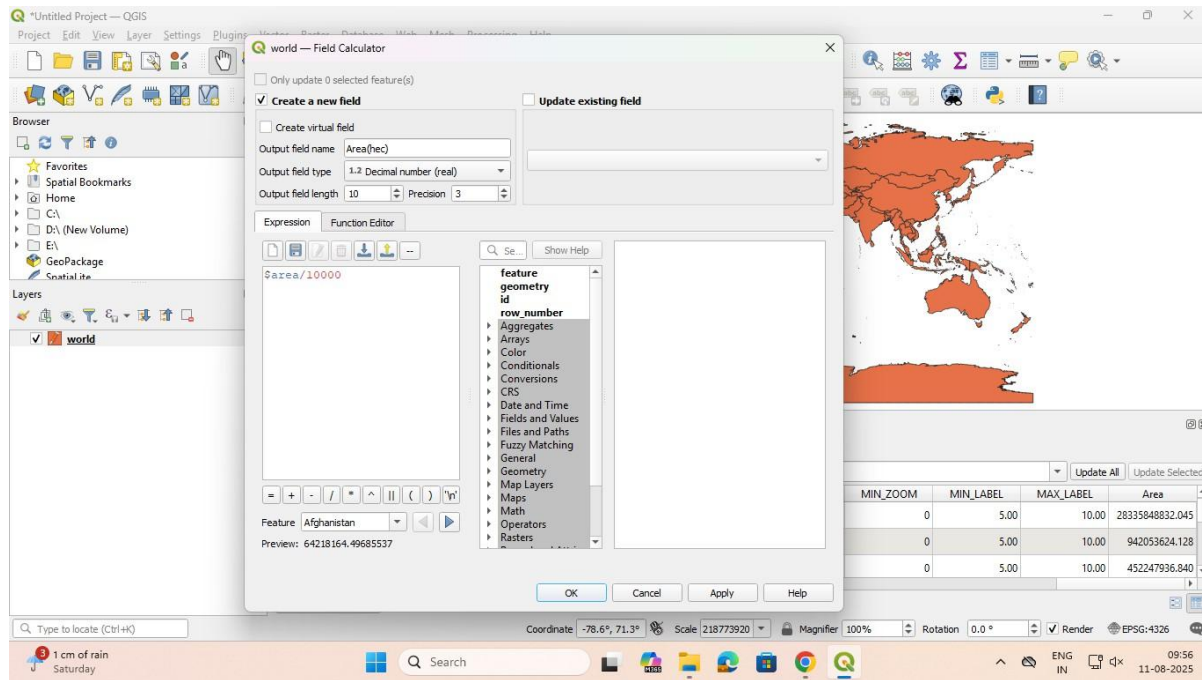
In the Expression field, enter the following expression to calculate the area in square meters:

\$area

To get the area in hectares:

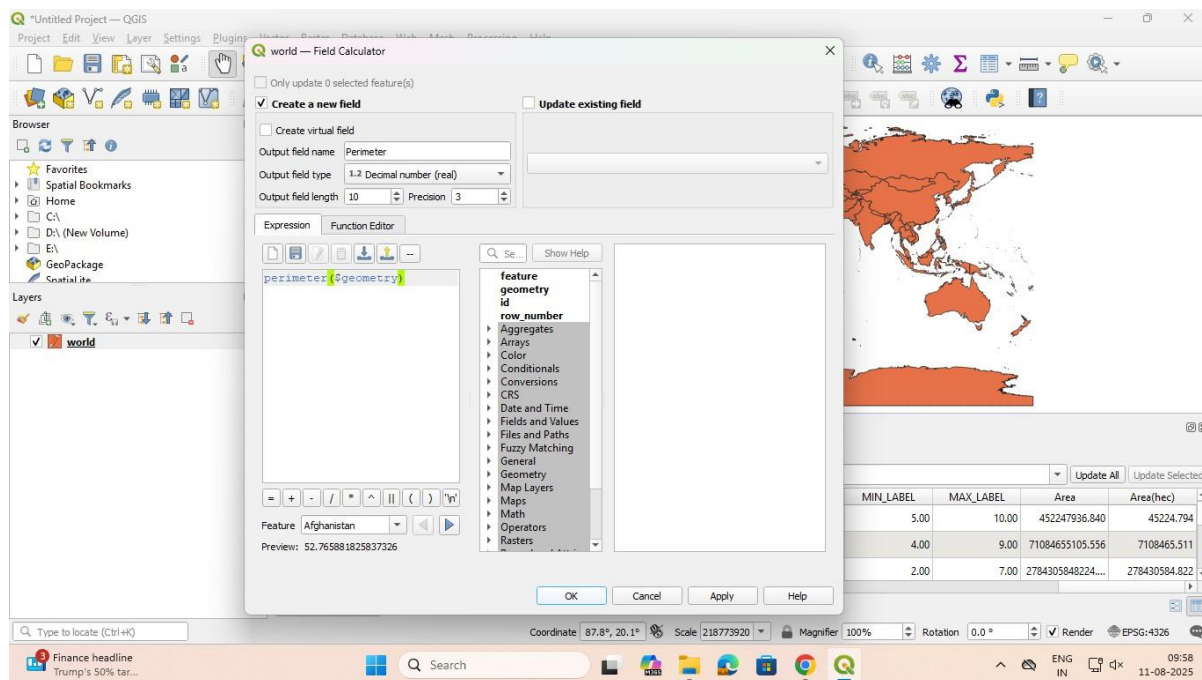
\$area / 10000

Click OK to create the new field and calculate the areas.



Step : Calculate Perimeter (for polygons):

perimeter(\$geometry)



Task: To work on other geometric properties like centroid using different expressions in the Field Calculator.

Platform used by the student:

Following points should be written by students

Different Geometric Properties used in spatial data analysis.

Students need to write comments wherever needed

Length

- **Description:** The length refers to the measure of a line geometry. This property is used in network analysis, transportation studies, and hydrological modeling.
- **Common Use:** Calculating road lengths, river lengths, or pipeline distances.

\$length

Centroid

- **Description:** The centroid is the geometric center of a polygon, often considered the center of mass or balance point. It's used in spatial distribution analysis and for locating the average position of a spatial feature.
- **Common Use:** Finding the center point of administrative regions for labeling or spatial statistics.

X(Centroid(\$geometry))

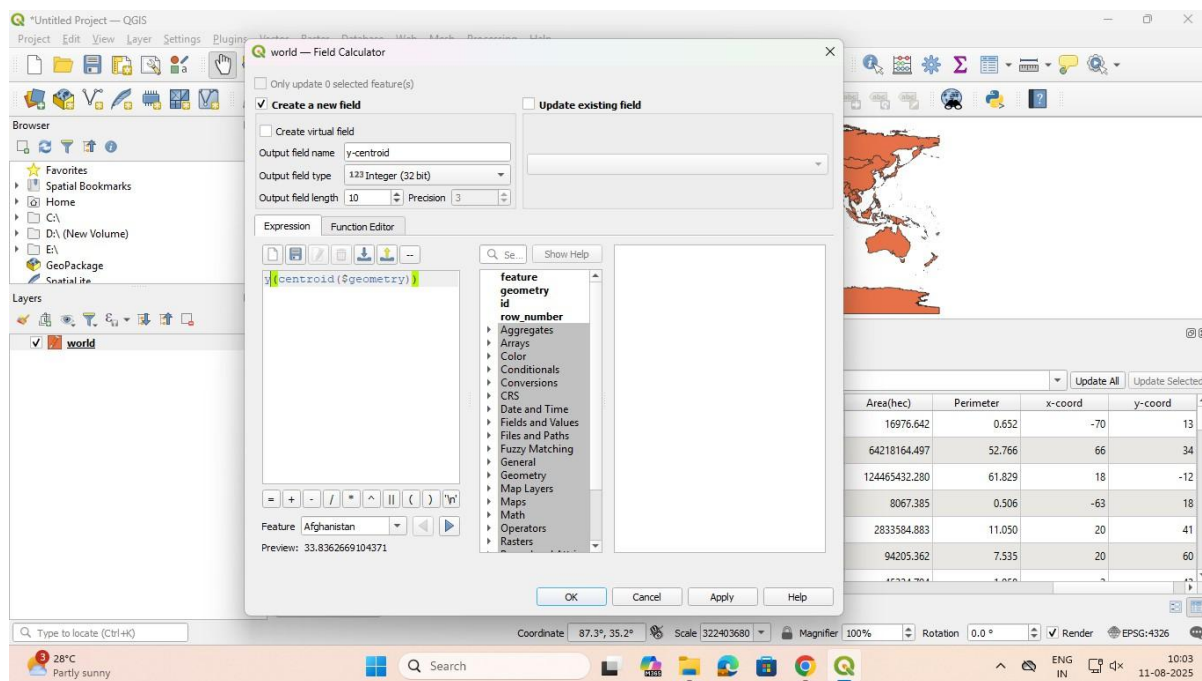
y(Centroid(\$geometry))

Centroid Distance

- **Description:** The distance between the centroids of two geometries. It's used in clustering and proximity analysis.
- **Common Use:** Comparing the spatial dispersion of different regions or features.

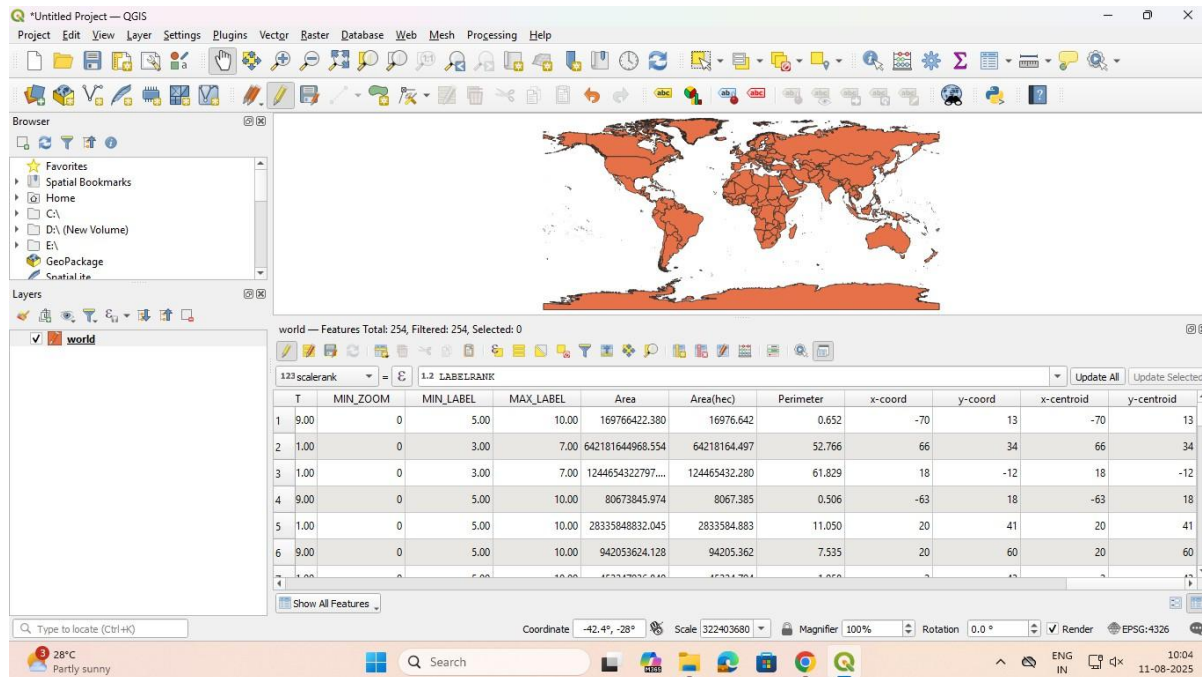
. Open the Field Calculator

- Once the centroid layer is created, you can calculate the distances between the centroids.
- If you want to calculate the distance between each centroid and a specific reference centroid (e.g., the centroid of a particular country), you will need to identify that centroid first.



4. Identify Reference Centroid (Optional)

- If you need to calculate distances from a specific centroid:
 - Open the attribute table of the `world_centroids` layer.
 - Locate the row corresponding to the reference country.
 - Note its coordinates or calculate them using the Field Calculator with the following expressions:
- X Coordinate**
 $x(\$geometry)$
- Y Coordinate:**
 $y(\$geometry)$
- Alternatively, you can save the centroid of that specific country as a separate layer.



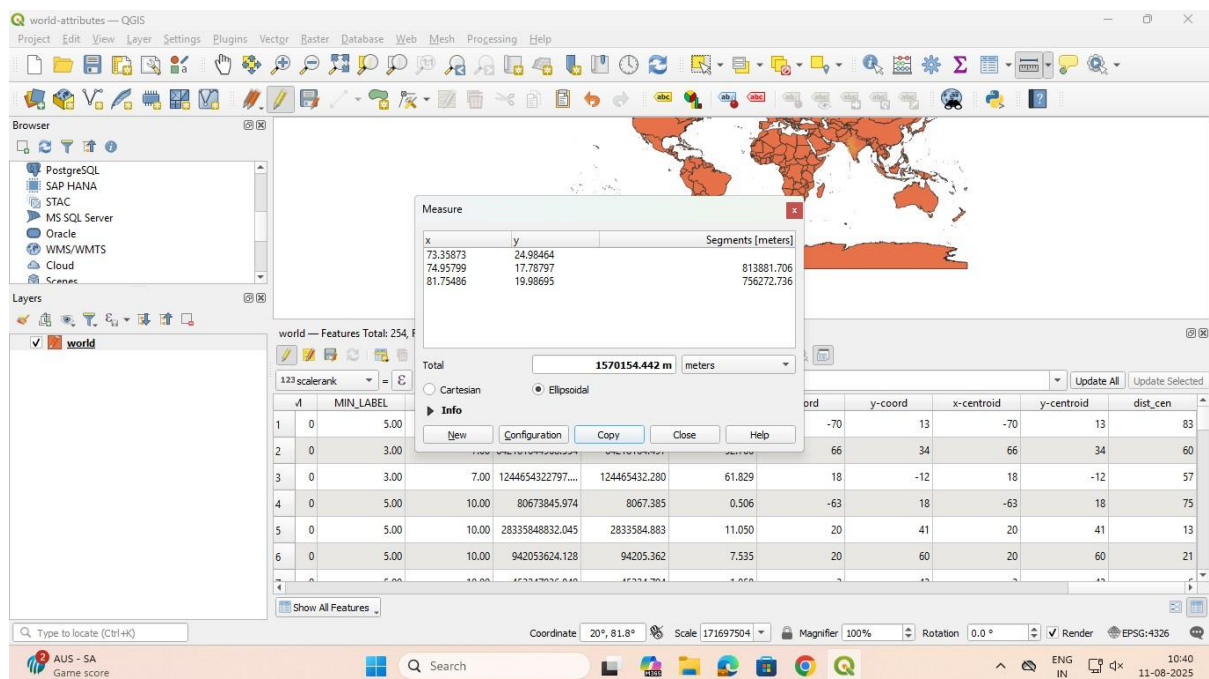
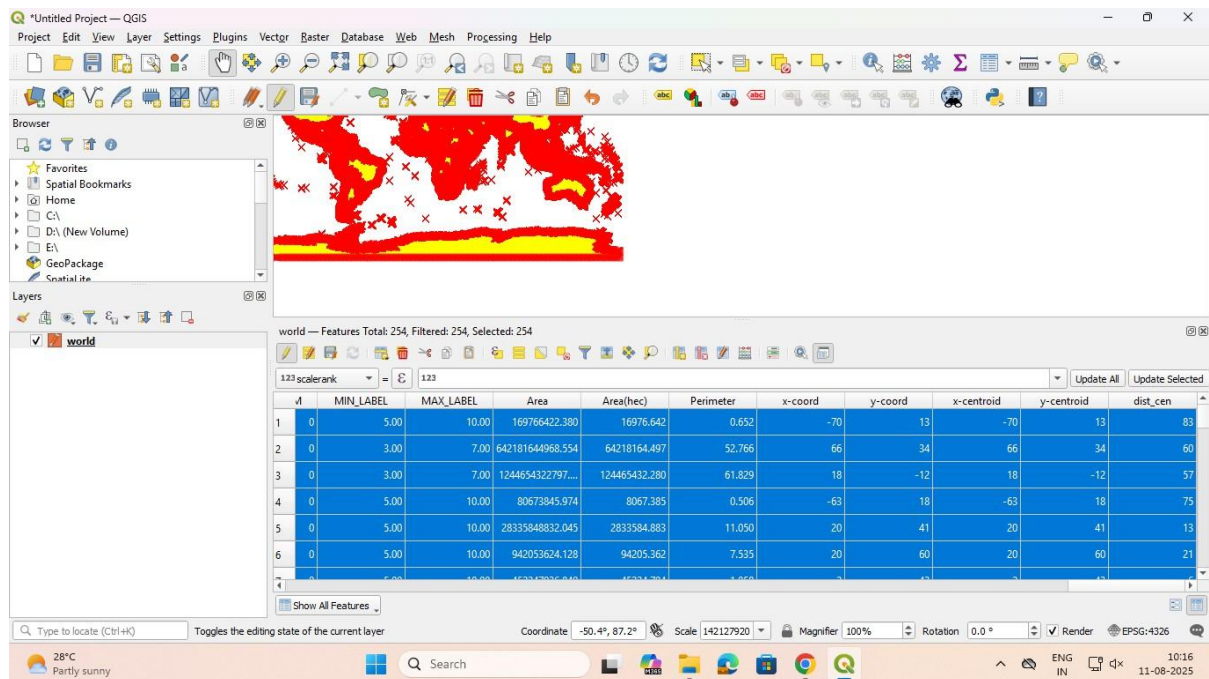
5. Calculate Centroid Distances

- To calculate the distance between centroids:
 - Open the attribute table of the `world_centroids` layer.
 - Open the `Field Calculator`.
 - Choose `Create a new field`.
 - Enter a name for the new field (e.g., `centroid_dist`).
 - Set the `Output field type` to `Decimal number (real)`.

Expression for Centroid Distance (from a specific reference centroid):

`distance(centroid($geometry), make_point(73.7154, 16.5186))`

Reference Centroid-Monaco(7,44)



Conclusion (Students should write in their own words):

Implemented spatial data analysis in QGIS/python.

Post lab questions:

Q.1 What are different geometric properties used in spatial data analysis on vector data with expression?

- **Length:** Used for line geometries to calculate the total length of features (e.g., roads, rivers).
 - Expression: `$length`
- **Area:** Used for polygon geometries to calculate the area.
 - Expression: `$area` or `$area / 10000` (for hectares)
- **Perimeter:** Used for polygons to calculate the boundary length.
 - Expression: `perimeter($geometry)`
- **Centroid:** Used to find the central point (X, Y coordinates) of a polygon.
 - Expression: `x(centroid($geometry))`,
`y(centroid($geometry))`
- **Centroid Distance:** Used to calculate the distance between two centroids.
 - Expression: `distance(centroid($geometry), make_point(longitude, latitude))`

Q2. What are different geometric properties used in spatial data analysis on raster data with expression?

Answer:

- **Cell Value:** The value of a raster cell at a given location.
 - Expression: `raster_value($geometry)`
- **Raster Area:** The total area covered by a raster dataset.
- **Slope:** The rate of change in elevation between adjacent raster cells.
 - Expression: `slope($raster)`
- **Aspect:** The direction of the steepest slope.
 - Expression: `aspect($raster)`
- **Distance from a Feature:** Distance from a given raster cell to a specific feature (e.g., a point or line).
 - Expression: `distance($geometry)`

Q3. What is spatial data analysis and its advantages?

Answer:

Spatial data analysis is the process of analyzing geographic or spatial data to understand patterns, relationships, and trends in the data. It involves operations like measuring distances, calculating areas, determining the centrality of features, and analyzing spatial distributions.

Advantages:

- Helps in decision-making by visualizing and analyzing spatial patterns.
- Allows for better planning, such as in urban development, environmental conservation, and transportation.
- Enables effective resource management and spatial planning.
- Supports predictive modeling for phenomena such as weather patterns, population growth, and disease spread.