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Title: 2D Sea Beach Environment with Multi-Scene Animation (OpenGL)

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Introduction:

This graphics project presents a fully interactive and visually appealing 2D animated environment created using OpenGL in the C++ programming language. The project simulates a vibrant natural landscape that includes animated elements such as birds flying, a balloon floating, a moving airplane, swimming sharks, clouds drifting, and rainfall with bubbles forming upon impact with the ground. It also includes dynamic weather effects, transitioning between day and night, and toggling rain effects that visually alter the environment in real-time.

The project began with the goal of learning and applying fundamental concepts in computer graphics, such as:

- Drawing basic shapes using GL_QUADS, GL_POLYGON, and GL_TRIANGLE_FAN
- Applying transformations like glTranslatef(), glScalef(), and glRotatef() for animation
- Implementing interactive features through keyboard input

- Managing textures using the LodePNG library to load and render PNG images (airplane, shark, and balloon)
- Creating realistic rain and bubble effects with physics-like behavior

Each object in the scene is programmed to behave individually. For instance, the airplane only moves when a specific key is pressed, birds continuously flap their wings and fly across the screen, clouds move automatically, and bubbles grow and fade after raindrops hit the ground. These movements are managed through simple logic loops and timed updates using GLUT's idle function.

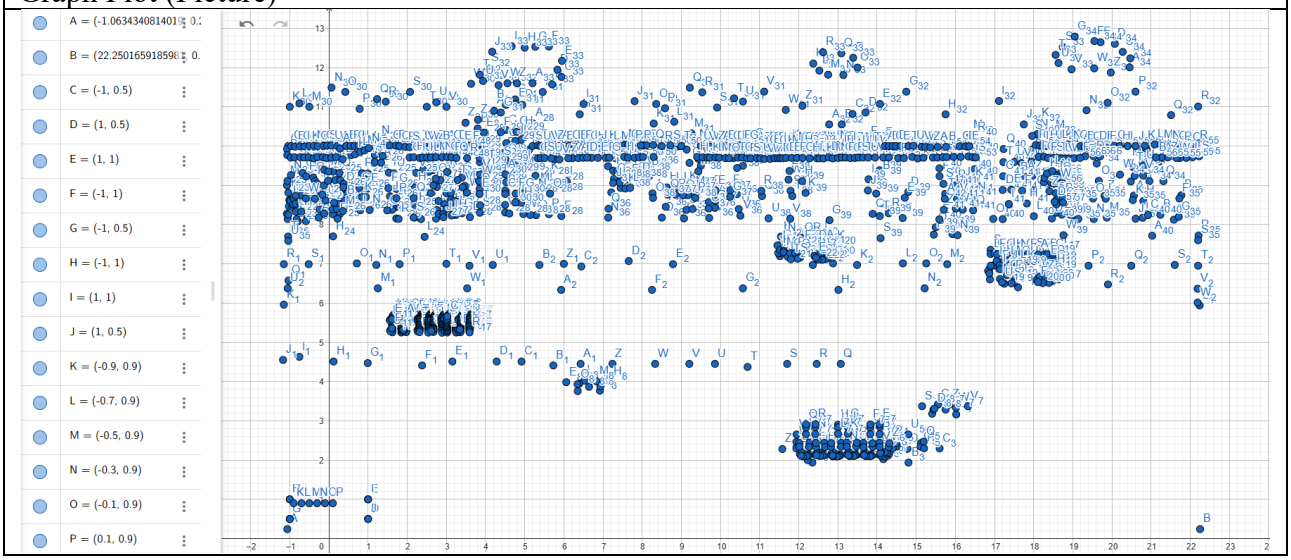
The technologies used in the project include:

1. OpenGL (GLUT): For rendering 2D graphics and managing the window and user interactions
2. C++: As the core programming language for controlling the logic, animations, and structure
3. LodePNG Library: For loading PNG textures into OpenGL
4. Math Library: To calculate circular geometry and movements
5. Windows Multimedia Library (optional): For handling sound effects, if sound was included

This project demonstrates how complex and engaging animations can be built by combining basic graphic primitives, transformations, and textures in OpenGL, even within a 2D orthographic projection. It is also a strong example of modular design, where each object-such as birds, clouds, hills, or weather-is created through a dedicated function to maintain clarity and reusability.

Project Graph:

Graph Plot (Picture)-



List of objects:

SL#	Object ID	Object Name
1.	S001	draw_sky_
2.	S002	draw_sun
3.	S003	draw_moon
4.	S004	draw_star
5.	S005	draw_hill3
6.	S006	draw_hill01
7.	S007	draw_hill5
8.	S008	draw_hill4
9.	S009	draw_hill6
10.	S0010	draw_hill2
11.	S0011	draw_cloud1
12.	S0012	draw_cloud2
13.	S0013	draw_rail_line1
14.	S0014	draw_train
15.	S0015	draw_tree1
16.	S0016	draw_tree2
17.	S0017	draw_tree3
18.	S0018	draw_tree4
19.	S0019	draw_tree5

20.	S0020	draw_house1
21.	S0021	draw_house1_windos1
22.	S0022	draw_house1_windos2
23.	S0023	draw_house1_door
24.	S0024	draw_tree2_copy
25.	S0025	draw_house2
26.	S0026	draw_car1
27.	S0027	draw_house3_royal
28.	S0028	draw_royal_windows
29.	S0029	draw_royal_windows2
30.	S0030	draw_copyrw1
31.	S0031	draw_copyrw2
32.	S0032	draw_copyrw3
33.	S0033	draw_copyrw4
34.	S0034	draw_copyrw5
35.	S0035	draw_marmad
36.	S0036	draw_again1_car1_copy1
37.	S0037	draw_again_car1_copy1
38.	S0038	draw_car1_copy1
39.	S0039	draw_hospital
40.	S0040	draw_tree_01_copy1
41.	S0041	draw_1st_roof
42.	S0042	draw_tree011
43.	S0043	draw_tree022
44.	S0044	draw_tree022_copy
45.	S0045	draw_wake_way
46.	S0046	draw_lamp1
47.	S0047	draw_lamp2
48.	S0048	draw_lamp3
49.	S0049	draw_lamp4
50.	S0050	draw_lamp5
51.	S0051	draw_lamp6
52.	S0052	draw_lamp7
53.	S0053	draw_lamp8
54.	S0054	draw_lamp9
55.	S0055	draw_lamp10
56.	S0056	draw_police
57.	S0057	draw_road2
58.	S0058	draw_bus011
59.	S0059	draw_car4_body
60.	S0060	draw_car3_body
61.	S0061	draw_bus02
62.	S0062	draw_lamp11

63.	S0063	draw_lamp12
64.	S0064	draw_lamp13
65.	S0065	draw_lamp14
66.	S0066	draw_lamp15
67.	S0067	draw_lamp16
68.	S0068	draw_lamp17
69.	S0069	draw_lamp19
70.	S0070	draw_lamp20
71.	S0071	draw_lamp21
72.	S0072	draw_sea
73.	S0073	draw_c
74.	S0074	draw_small_boat
75.	S0075	draw_small_boat2
76.	S0076	draw_big_boat
77.	S0077	draw_big_boat_pillar
78.	S0078	draw_big_boat_design
79.	S0079	drawDrops
80.	S0080	drawBubbles
81.	S0081	draw_bird
82.	S0082	draw_airplane
83.	S0083	draw_shark
84.	S0084	draw_balloon
85.	S0085	update_bird
86.	S0086	updateRainEffect

List of Functions:

SL#	Object Name	Function Name
1.	draw_sky_	void draw_sky_()
2.	draw_sun	void draw_sun()
3.	draw_moon	void draw_moon()
4.	draw_star	void draw_star()
5.	draw_hill3	void draw_hill3()
6.	draw_hill01	void draw_hill01()
7.	draw_hill5	void draw_hill5()
8.	draw_hill4	void draw_hill4()
9.	draw_hill6	void draw_hill6()
10.	draw_hill2	void draw_hill2()
11.	draw_cloud1	void draw_cloud1()
12.	draw_cloud2	void draw_cloud2()
13.	draw_rail_line1	void draw_rail_line1()
14.	draw_train	void draw_train()

15.	draw_tree1	void draw_tree1()
16.	draw_tree2	void draw_tree2()
17.	draw_tree3	void draw_tree3()
18.	draw_tree4	void draw_tree4()
19.	draw_tree5	void draw_tree5()
20.	draw_house1	void draw_house1()
21.	draw_house1_windos1	void draw_house1_windos1()
22.	draw_house1_windos2	void draw_house1_windos2()
23.	draw_house1_door	void draw_house1_door()
24.	draw_tree2_copy	void draw_tree2_copy()
25.	draw_house2	void draw_house2()
26.	draw_car1	void draw_car1()
27.	draw_house3_royal	void draw_house3_royal()
28.	draw_royal_windows	void draw_royal_windows()
29.	draw_royal_windows2	void draw_royal_windows2()
30.	draw_copyrw1	void draw_copyrw1()
31.	draw_copyrw2	void draw_copyrw2()
32.	draw_copyrw3	void draw_copyrw3()
33.	draw_copyrw4	void draw_copyrw4()
34.	draw_copyrw5	void draw_copyrw5()
35.	draw_marmad	void draw_marmad()
36.	draw_again1_car1_copy1	void draw_again1_car1_copy1()
37.	draw_again_car1_copy1	void draw_again_car1_copy1()
38.	draw_car1_copy1	void draw_car1_copy1()
39.	draw_hospital	void draw_hospital()
40.	draw_tree_01_copy1	void draw_tree_01_copy1()
41.	draw_1st_roof	void draw_1st_roof()
42.	draw_tree011	void draw_tree011()
43.	draw_tree022	void draw_tree022()
44.	draw_tree022_copy	void draw_tree022_copy()
45.	draw_wake_way	void draw_wake_way()
46.	draw_lamp1	void draw_lamp1()
47.	draw_lamp2	void draw_lamp2()
48.	draw_lamp3	void draw_lamp3()
49.	draw_lamp4	void draw_lamp4()
50.	draw_lamp5	void draw_lamp5()
51.	draw_lamp6	void draw_lamp6()
52.	draw_lamp7	void draw_lamp7()
53.	draw_lamp8	void draw_lamp8()
54.	draw_lamp9	void draw_lamp9()
55.	draw_lamp10	void draw_lamp10()
56.	draw_police	void draw_police()
57.	draw_road2	void draw_road2()

58.	draw_bus011	void draw_bus011()
59.	draw_car4_body	void draw_car4_body()
60.	draw_car3_body	void draw_car3_body()
61.	draw_bus02	void draw_bus02()
62.	draw_lamp11	void draw_lamp11()
63.	draw_lamp12	void draw_lamp12()
64.	draw_lamp13	void draw_lamp13()
65.	draw_lamp14	void draw_lamp14()
66.	draw_lamp15	void draw_lamp15()
67.	draw_lamp16	void draw_lamp16()
68.	draw_lamp17	void draw_lamp17()
69.	draw_lamp19	void draw_lamp19()
70.	draw_lamp20	void draw_lamp20()
71.	draw_lamp21	void draw_lamp21()
72.	draw_sea	void draw_sea()
73.	draw_c	void draw_c()
74.	draw_small_boat	void draw_small_boat()
75.	draw_small_boat2	void draw_small_boat2()
76.	draw_big_boat	void draw_big_boat()
77.	draw_big_boat_pillar	void draw_big_boat_pillar()
78.	draw_big_boat_design	void draw_big_boat_design()
79.	drawDrops	void drawDrops()
80.	drawBubbles	void drawBubbles()
81.	draw_bird	void void draw_bird(float Tx, float Ty, float direction, float wingY, float s = 0.001f)
82.	draw_airplane	void draw_airplane()
83.	draw_shark	void draw_shark()
84.	draw_balloon	void draw_balloon()
85.	update_bird	void update_bird()
86.	updateRainEffect	void updateRainEffect()

List of Animation Functions:

SL#	Animation Function ID	Animation Function	Object/Scene
1.	S0011	void draw_cloud1()	draw_cloud1
2.	S0012	void draw_cloud2()	draw_cloud2
3.	S0014	void draw_train()	draw_train
4.	S0026	void draw_car1()	draw_car1
5.	S0036	void draw_again1_car1_copy1()	draw_again1_car1_copy1
6.	S0037	void draw_again_car1_copy1()	draw_again_car1_copy1

7.	S0038	void draw_car1_copy1()	draw_car1_copy1
8.	S0058	void draw_bus011()	draw_bus011
9.	S0059	void draw_car4_body()	draw_car4_body
10.	S0060	void draw_car3_body()	draw_car3_body
11.	S0061	void draw_bus02()	draw_bus02
12.	S0073	void draw_c()	draw_c
13.	S0074	void draw_small_boat()	draw_small_boat
14.	S0075	void draw_small_boat2()	draw_small_boat2
15.	S0076	void draw_big_boat()	draw_big_boat
16.	S0086	void updateRainEffect()	updateRainEffect
17.	S0085	void update_bird()	update_bird
18.	S0083	void draw_shark()	draw_shark
19.	S0082	void draw_airplane()	draw_airplane
20.	S0084	void draw_balloon()	draw_balloon
21.	S0079	void drawDrops()	drawDrops
22.	S0080	void drawBubbles()	drawBubbles

Contribution:

Member Name	Implemented Functions	Implemented Animation Functions	Percentage of Contribution
SHOWRAV GHOSH	void draw_sky_()		100%
SHOWRAV GHOSH	void draw_sun()		100%
SHOWRAV GHOSH	void draw_moon()		100%
SHOWRAV GHOSH	void draw_star()		100%
SHOWRAV GHOSH	void draw_hill3()		100%
SHOWRAV GHOSH	void draw_hill01()		100%
SHOWRAV GHOSH	void draw_hill5()		100%
SHOWRAV GHOSH	void draw_hill4()		100%
SHOWRAV GHOSH	void draw_hill6()		100%
SHOWRAV GHOSH	void draw_hill2()		100%

SHOWRAV GHOSH	void draw_cloud1()	void draw_cloud1()	100%
SHOWRAV GHOSH	void draw_cloud2()	void draw_cloud2()	100%
SHOWRAV GHOSH	void draw_rail_line1()		100%
SHOWRAV GHOSH	void draw_train()	void draw_train()	100%
SHOWRAV GHOSH	void draw_tree1()		100%
SHOWRAV GHOSH	void draw_tree2()		100%
SHOWRAV GHOSH	void draw_tree3()		100%
SHOWRAV GHOSH	void draw_tree4()		100%
SHOWRAV GHOSH	void draw_tree5()		100%
SHOWRAV GHOSH	void draw_house1()		100%
SHOWRAV GHOSH	void draw_house1_windos1()		100%
SHOWRAV GHOSH	void draw_house1_windos2()		100%
SHOWRAV GHOSH	void draw_house1_door()		100%
SHOWRAV GHOSH	void draw_tree2_copy()		100%
SHOWRAV GHOSH	void draw_house2()		100%
SHOWRAV GHOSH	void draw_car1()	void draw_car1()	100%
SHOWRAV GHOSH	void draw_house3_royal()		100%
SHOWRAV GHOSH	void draw_royal_windows()		100%
SHOWRAV GHOSH	void draw_royal_windows2()		100%
SHOWRAV GHOSH	void draw_copyrw1()		100%
SHOWRAV GHOSH	void draw_copyrw2()		100%
SHOWRAV GHOSH	void draw_copyrw3()		100%
SHOWRAV GHOSH	void draw_copyrw4()		100%

SHOWRAV GHOSH	void draw_copyrw5()		100%
SHOWRAV GHOSH	void draw_marmad()		100%
SHOWRAV GHOSH	void draw_again1_car1_copy1()	void draw_again1_car1_copy1()	100%
SHOWRAV GHOSH	void draw_again_car1_copy1()	void draw_again_car1_copy1()	100%
SHOWRAV GHOSH	void draw_car1_copy1()	void draw_car1_copy1()	100%
SHOWRAV GHOSH	void draw_hospital()		100%
SHOWRAV GHOSH	void draw_tree_01_copy1()		100%
SHOWRAV GHOSH	void draw_1st_roof()		100%
SHOWRAV GHOSH	void draw_tree011()		100%
SHOWRAV GHOSH	void draw_tree022()		100%
SHOWRAV GHOSH	void draw_tree022_copy()		100%
SHOWRAV GHOSH	void draw_wake_way()		100%
SHOWRAV GHOSH	void draw_lamp1()		100%
SHOWRAV GHOSH	void draw_lamp2()		100%
SHOWRAV GHOSH	void draw_lamp3()		100%
SHOWRAV GHOSH	void draw_lamp4()		100%
SHOWRAV GHOSH	void draw_lamp5()		100%
SHOWRAV GHOSH	void draw_lamp6()		100%
SHOWRAV GHOSH	void draw_lamp7()		100%
SHOWRAV GHOSH	void draw_lamp8()		100%
SHOWRAV GHOSH	void draw_lamp9()		100%
SHOWRAV GHOSH	void draw_lamp10()		100%
SHOWRAV GHOSH	void draw_police()		100%

SHOWRAV GHOSH	void draw_road2()		100%
SHOWRAV GHOSH	void draw_bus011()	void draw_bus011()	100%
SHOWRAV GHOSH	void draw_car4_body()	void draw_car4_body()	100%
SHOWRAV GHOSH	void draw_car3_body()	void draw_car3_body()	100%
SHOWRAV GHOSH	void draw_bus02()	void draw_bus02()	100%
SHOWRAV GHOSH	void draw_lamp11()		100%
SHOWRAV GHOSH	void draw_lamp12()		100%
SHOWRAV GHOSH	void draw_lamp13()		100%
SHOWRAV GHOSH	void draw_lamp14()		100%
SHOWRAV GHOSH	void draw_lamp15()		100%
SHOWRAV GHOSH	void draw_lamp16()		100%
SHOWRAV GHOSH	void draw_lamp17()		100%
SHOWRAV GHOSH	void draw_lamp19()		100%
SHOWRAV GHOSH	void draw_lamp20()		100%
SHOWRAV GHOSH	void draw_lamp21()		100%
SHOWRAV GHOSH	void draw_sea()		100%
SHOWRAV GHOSH	void draw_c()	void draw_c()	100%
SHOWRAV GHOSH	void draw_small_boat()	void draw_small_boat()	100%
SHOWRAV GHOSH	void draw_small_boat2()	void draw_small_boat2()	100%
SHOWRAV GHOSH	void draw_big_boat()	void draw_big_boat()	100%
SHOWRAV GHOSH	void draw_big_boat_pillar()		100%
SHOWRAV GHOSH	void draw_big_boat_design()		100%
SHOWRAV GHOSH	void drawDrops()	void drawDrops()	100%

SHOWRAV GHOSH	void drawBubbles()	void drawBubbles()	100%
SHOWRAV GHOSH	void void draw_bird(float Tx, float Ty, float direction, float wingY, float s = 0.001f)		100%
SHOWRAV GHOSH	void draw_airplane()	void draw_airplane()	100%
SHOWRAV GHOSH	void draw_shark()	void draw_shark()	100%
SHOWRAV GHOSH	void draw_balloon()	void draw_balloon()	100%
SHOWRAV GHOSH	void update_bird()	void update_bird()	100%
SHOWRAV GHOSH	void updateRainEffect()	void updateRainEffect()	100%

Conclusion:

In conclusion, this project has successfully achieved the objective of building an interactive and animated 2D graphical scene using OpenGL and C++. Through this work, various graphical elements have been implemented and animated, including birds, clouds, vehicles, natural terrain (hills and sky), and dynamic weather components such as sunlight, moonlight, rainfall, and bubble formation.

The use of texture mapping added realism to key elements like the airplane and animals, while interactive controls provided by keyboard inputs allowed the user to change the scene-such as toggling rain or moving objects-making the environment feel more alive and immersive.

This project provided hands-on experience with several critical aspects of graphics programming:

- Scene rendering and layering
- Real-time animation
- Event-driven input handling
- Environmental transitions
- Object-oriented modular code organization

Overall, this graphics project demonstrates a comprehensive understanding of 2D animation techniques, and it showcases the power of OpenGL in bringing scenes to life. It lays a strong

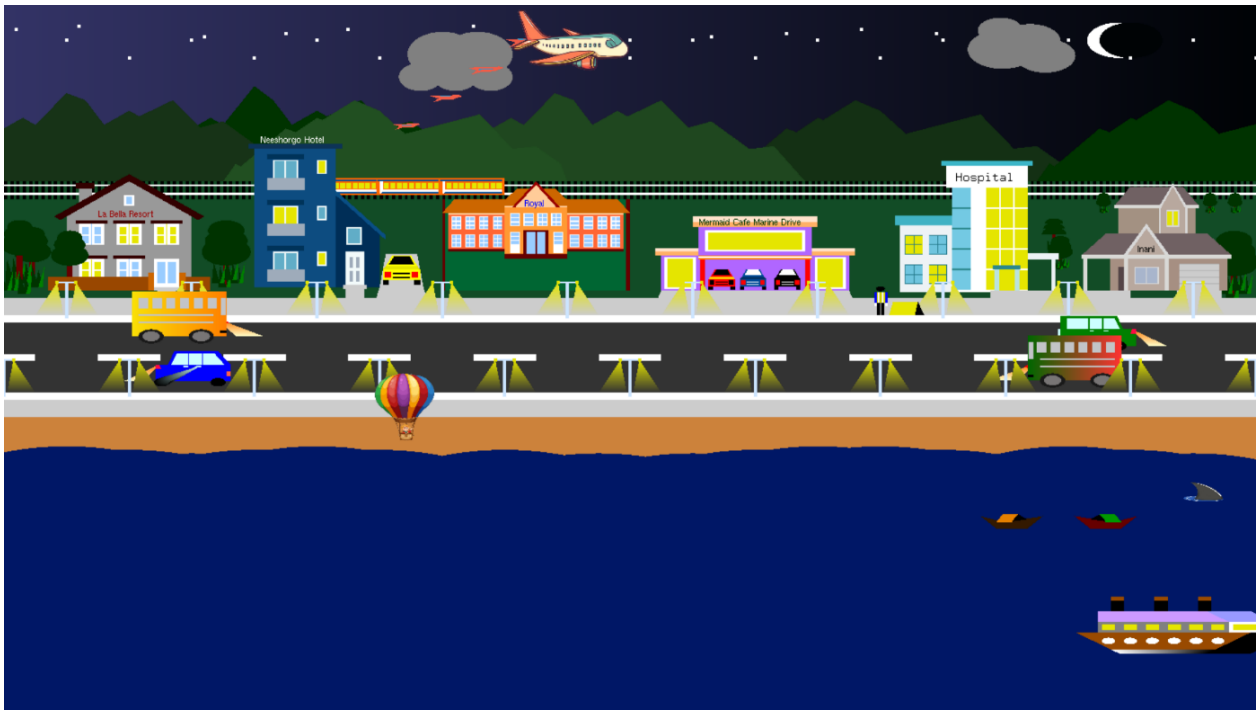
foundation for future work in 3D graphics, game development, or interactive simulations. The experience gained here will be valuable in any advanced computer graphics coursework or career-related endeavors in visual computing.

Key	Function / Purpose
1	Starts/Stops the whole animation system (on variable). Also, airplane movement starts and resets sharks' direction.
N / n	Enables **night mode**.
D / d	Enables **day mode** (turns off night).
R / r	Toggles **rain on/off**.
↑ Arrow (UP)	**Increase vehicle speed** and start movement if it is stopped.
↓ Arrow (DOWN)	**Decrease vehicle speed**, stop vehicle if speed becomes 0 or less.
+	Switch to **Full Screen mode**.
-	**Exit full screen / Set window back to default size (1024×576)**.
X / x	**Exit / Close the program**.

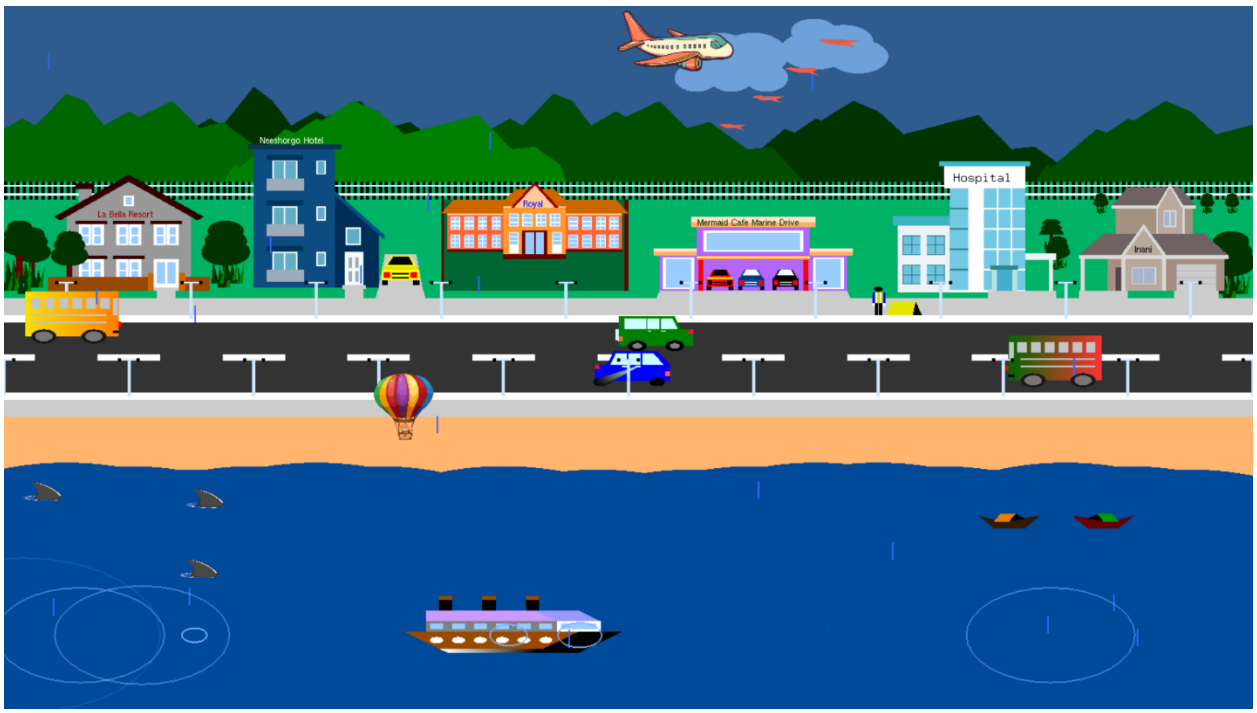
Mouse Button	Function / Purpose
Left Click	Toggles **hand up animation** (character hand movement).
Right Click	Reverses **bird flying direction**.
Middle Click / Scroll Wheel Click	The balloon animation starts and reverses balloon direction.

Day mode:

Night mode:



Rain mode:


Neeshorgo Hotel
La Bella Resort
Royal
Mermaid Cafe Marine Drive
Hospital
Imani