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Computer Graphics [O]

Project Title

Seaside City

Project report submit by:

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Project Overview: 2D Animated Seaside City using OpenGL and GLUT.

Introduction:

The goal of this project is to create a 2D animated coastal city using OpenGL and GLUT in C++. The animation will show a lively environment that combines nature with city life. It will include a large ocean, high mountains, moving ships, vehicles, buildings, wind turbines. The city will be shown in both day and night time. This project will show basic graphics skills like drawing objects, making them move, and using transformations in OpenGL and GLUT.

Description:

Scene : Sunny Seaside City View

Overview:

This scene shows a bright and busy coastal city during the daytime. In front, there is a calm blue ocean with ships moving on the water. A busy road runs beside the ocean with many vehicles moving. On the other side of the road, there are buildings, trees, and wind turbines. In the background, there are tall mountains with watchtowers on top. The sky has some clouds and a hot air balloon floating. A plane is flying in the sky. There is also a day and night mode and rain.

Objects in the Scene:

Ocean:

- A cruise ship, a cargo ship, and a fishing ship move across the water.
- Each ship can be started or stopped using the keyboard.

Road:

- A busy road with these vehicles:
  - Two buses: Bus1 and Bus2
  - One ambulance
  - One car (Car1)
  - One police car (Car2)
- Street lights on both sides of the road
- A traffic lights
- A zebra crossing
- All vehicles move automatically, and you can pause or continue them using the keyboard.

City Area (Opposite Side of the Road):

- A tall office building named Tower
- Three houses: House1, House2, House3
- A school with a working clock with rotating hands
- Trees and wind turbines on both sides of the city

Background:

- Mountains with watchtowers on top

Sky:

- Sunny sky with some floating clouds
- A hot air balloon that gently moves to look realistic
- A plane is flying horizontally through the sky
- During day mode, you see the sun
- During night mode, you see the moon

Day and Night Modes:

Day Mode:

- Bright sun
- Clear blue sky
- Some clouds in the sky
- Everything and all objects look bright and sunny

Night Mode:

- Dark sky
- The moon is visible
- Everything and all objects look slightly dark for a realistic night vibe
- Lights from the lampposts are glowing

Animations:

- Plane move smoothly, and can be paused or resumed also can be speedup or slowdown
- Ships move smoothly, and each ship can be paused or resumed
- Vehicles move on the road and can also be paused or resumed
- Clouds move slowly in the sky
- The hot air balloon gently moves to make it look real
- You can turn rain on or off
- There is a day and night switch to change the time
- Wind turbines spin all the time
- The clock at the school has moving hands like a real clock

Mouse Interactions:

- Left Click: Switch to Day Mode
- Right Click: Switch to Night Mode
- Mouse Scroll Up: Increase plane speed
- Mouse Scroll Down: Decrease plane speed (but not below 0.01)

Keyboard Interactions:

- Press ‘1’: Show Screen 1
- Press ‘2’: Show Screen 2

Rain Control:

- Press ‘r’: Turn on rain
- Press ‘R’: Start or stop the rain toggle

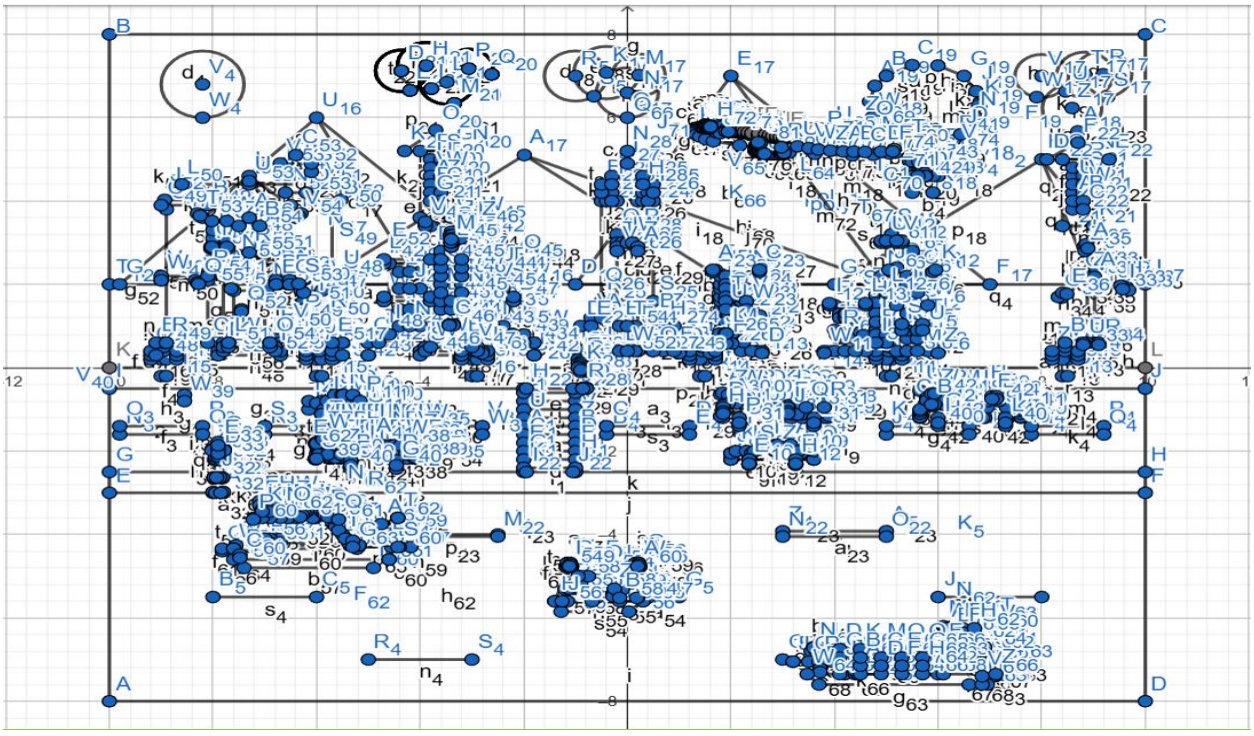
Vehicle Controls:

- Press ‘P’ or ‘p’: Stop/Move Plane
- Press ‘N’ or ‘n’: Stop/ Move Car 1
- Press ‘U’ or ‘u’: Stop/ Move Bus 1
- Press ‘M’ or ‘m’: Stop/ Move Bus 2
- Press ‘A’ or ‘a’: Stop/ Move Police Car
- Press ‘S’ or ‘s’: Stop/ Move Ambulance

Ship Controls:

- Press ‘F’ or ‘f’: Stop/ Move Fishing Ship
- Press ‘C’ or ‘c’: Stop/ Move Cruise Ship
- Press ‘K’ or ‘k’: Stop/ Move Cargo Ship.

Project Graph Scene1:



List of objects Scene1:

SL#	Object ID	Object Name
01	SKY01	Sky
02	SUN02	Sun
03	CLD03	Cloud
04	HAB04	Hot Air Balloon
05	MUN05	Mountain
06	WTWR06	Watch Tower
07	LND07	Land
08	WINDT08	Wind Turbine
09	TWR09	Tower (Office Building)
10	HUS10	House1
11	HUS11	House2
12	HUS12	House3
13	SCL13	School
14	ROD14	Road
15	RST15	Road Side Tree
16	TL16	Traffic Light
17	LMPL17	Lamppost Light
18	CAR18	Car1
19	CAR19	Car2
20	BUS20	Bus1
21	BUS21	Bus2
22	AMB22	Ambulance
23	SEA23	Sea
24	CRUISE24	Cruise Ship
25	FISH25	Fish Ship
26	CARGO26	Cargo Ship
27	PLN27	Plane

List of Functions To Represent Objects:

SL#	Object Name	Function Name
01	Sky	Sky()
02	Sun	Sun()
03	Cloud	Cloud()
04	Hot Air Balloon	Hot_Air_Balloon()
05	Mountain	Mountain()
06	Watch Tower	Watch_Tower()
07	Land	Land()
08	Wind Turbine	Wind_Turbine()
09	Tower (Office Building)	Tower()

10	House1	House1()
11	House2	House2()
12	House3	House3()
13	School	School()
14	Road	Road()
15	Road Side Tree	Road_Side_Tree()
16	Traffic Light	Traffic_Light()
17	Lamppost Light	Lamppost_Light()
18	Car1	Car1()
19	Car2	Car2()
20	Bus1	Bus1()
21	Bus2	Bus2()
22	Ambulance	Ambulance()
23	Sea	Sea()
24	Cruise Ship	Cruise_Ship()
25	Fish Ship	Fish_Ship()
26	Cargo Ship	Cargo_Ship()
27	Plane	Plane()

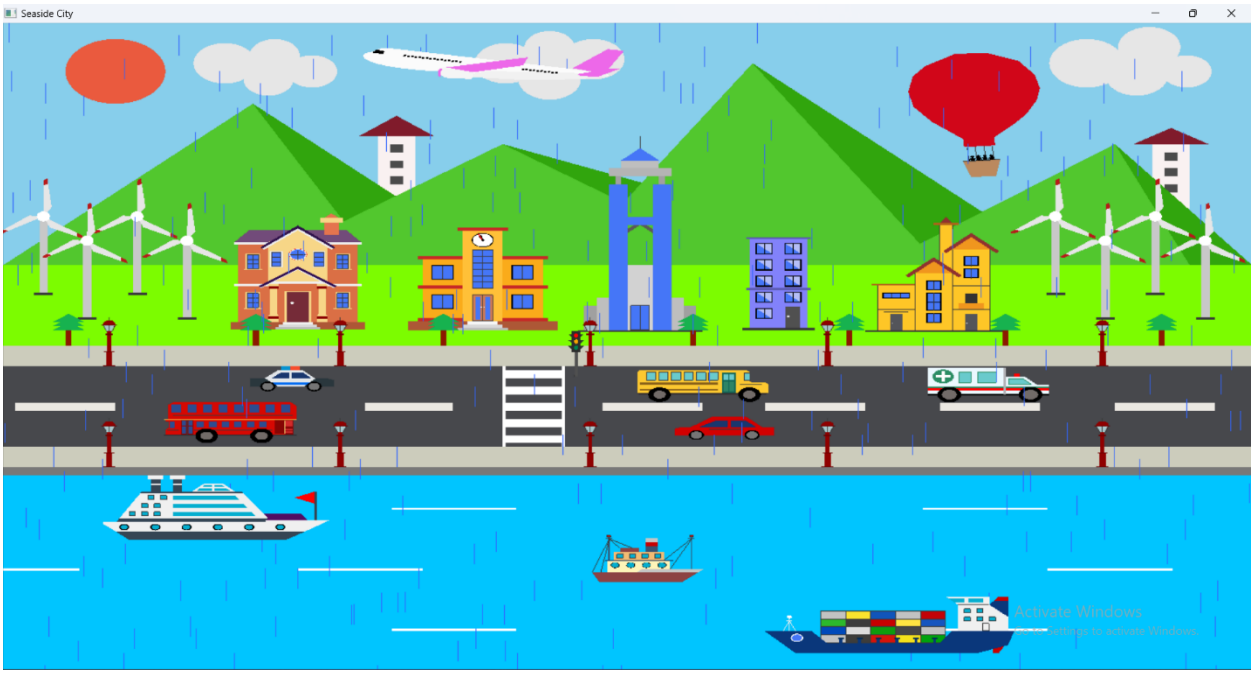
List of Animation Functions with ID:

SL#	Animation Function ID	Animation Function	Object/Scene
01	URAIN01	RainUpdate()	Rain Drop
02	UCLD02	Updatecloud()	Moving Cloud
03	UHAB03	Hot_Air_Ballon_update()	Hot Air Balloon Swaying in air
04	UWINDT04	Wind_Turbine_update()	Rotating Wind Turbine
05	USCLC05	School_Clock_update()	Rotating Clock Hands
06	UCAR06	UpdateCar1()	Moving Car1
07	UCAR07	UpdateCar2()	Moving Car2
08	UBUS08	UpdateBus1()	Moving Bus1
09	UBUS09	UpdateBus2()	Moving Bus2
10	UAMB10	UpdateAmbulance()	Moving Ambulance
11	UWAVE11	Wavemoving()	Moving Wave
12	UCRUISES12	updateCruise_Ship()	Moving Cruise Ship
13	UFISHS13	updateFishShip()	Moving Fishing Ship
14	UCARGOS14	updateCargo_Ship()	Moving Cargo Ship
15	UPLN15	update_Plane()	Moving Plane
16	Handle key press	handleKeypress()	Bus, ship movement, Rain and Scene change
17	Handle mouse press	handleMouse()	Day and night

Output Scene1:

Output: Sunny day - Clear sky with bright sunlight and vivid surroundings.

Output: Night - Dark sky with moonlight.



Output: Rainy Day - Falling rain in daylight.

Output: Rainy Night - Nighttime scene with rain

Contribution:

Member name	Implemented function	Implemented animation function	Percentage of contribution
MD. Nazmus Sadat Numan	Scene1	Scene1	100%

Conclusion:

This project successfully shows a 2D animated city using OpenGL and GLUT in C++. It includes two different scenes - a bright seaside city during the day and night, and an urban-industrial area. Each scene uses various objects like buildings, roads, vehicles, ships, plane, trees, wind turbines and natural elements like clouds, sun, and moon.

We added smooth animations for moving vehicles, ships, clouds, wind turbines, and even effects like rain. The day-night and sunset transitions make the scenes feel more real. Users can interact with the scene using the keyboard and mouse to control different objects and switch between modes.

This project helped us practice and understand basic graphics concepts such as object drawing, animation, transformation, and user interaction in OpenGL. It shows how graphics programming can create rich visual environments that feel alive and dynamic.