AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH

COMPUTER GRAPHICS – PROJECT

Project Title: "A Day in the Life of a Panda: Interactive 2D Animation System"

Course Name	Computer Graphics
Section	I
Course Tutor	Dipta Justin Gomes

GROUP MEMBERS

Group No: C

Members	
Name	**ID**
Sadia Khandaker Moumita	23-52278-2
Sumaiya Beantey Alam Raisha	23-50086-1

Table of Content:

Content List	Page No
Introduction	03
Proposal	04
List of Objects	05
Functions to Represent the Objects	06 - 08
Interactive Functions	09
Task Assignment and Codes of Functions	10
Screenshot of the project	11-14
Code availability	15
Future Work	15
Conclusion	16
Reference	16

Introduction

OpenGL (Open Graphics Library) is a cross-language, cross-platform application programming interface (API) for rendering 2D and 3D vector graphics. It provides developers with powerful tools to create engaging visual experiences ranging from simple 2D scenes to complex animated environments.

GLUT (OpenGL Utility Toolkit) is a library that simplifies OpenGL program development by handling window management, input processing, and basic event handling. This toolkit is particularly useful for creating educational and demonstration graphics applications.

This project demonstrates the use of OpenGL and GLUT to create an interactive 2D animation system featuring a panda character in four different lifestyle scenarios. The project implements fundamental computer graphics concepts including:

- 2D primitive rendering (circles, polygons, lines)
- Color manipulation using RGB values
- Animation through transformation matrices
- User interaction via keyboard input
- Scene management and state transitions
- Smooth animation timing and updates

The application showcases a panda engaged in natural behaviors: eating bamboo, drinking by a river, sleeping in a cave, and playfully rolling on hills. Each scene features unique environmental elements and animations that bring the panda's world to life.

Proposal

Project Overview

Our project, **"A Day in the Life of a Panda: Interactive 2D Animation System"**, uses OpenGL to create an immersive visual storytelling experience featuring a panda character through different times of day and activities.

Key Features

The application presents four distinct animated scenes:

1. **Scene 1: Eating Bamboo (Daytime)** ○ Panda sitting and eating bamboo with animated hand and mouth movements ○ Bright daytime sky with animated sun and clouds ○ Bamboo forest environment with grass details
2. **Scene 2: By the River (Afternoon)** ○ Panda sitting by a flowing river ○ Animated water with wave effects and bubbles ○ Head-turning animation as the panda observes surroundings ○ Rocks, plants, and natural riverside elements
3. **Scene 3: Sleeping in Cave (Night)** ○ Nighttime scene with moon and twinkling stars ○ Panda sleeping with gentle breathing animation ○ Animated fireflies floating around
   ○ Cave environment with "Zzz" sleep indicators
4. **Scene 4: Rolling on Hills (Daytime)** ○ Panda rolling playfully across hills ○ Butterflies with flapping wing animations ○ Colorful flowers scattered across the landscape ○ Motion lines to indicate movement ○ Pause/resume functionality

Interactive Controls

- **Press '1'** - Switch to Scene 1 (Eating Bamboo)
- **Press '2'** - Switch to Scene 2 (By the River)
- **Press '3'** - Switch to Scene 3 (Sleeping in Cave)
- **Press '4'** - Switch to Scene 4 (Rolling on Hills)
- **Press SPACE** - Start/Pause rolling animation (Scene 4 only) - Panda rolls toward bamboo forest!
- **Press ESC** - Exit application

LIST OF OBJECTS

Environmental Objects
Sky Night Sky Sun Moon Clouds Stars Ground Night Ground Hills

Natural Elements
Bamboo Stalks Night Bamboo River Cave

Animated Characters
Panda (Scene 1) Panda (Scene 2) Panda (Scene 3) Panda (Scene 4) Bamboo Stick Fireflies Butterflies

Visual Effects
Shadow Sleep "Zzz" Motion Lines

Functions to Represent The Objects

Scene Management Functions

Function	ID	Purpose

display()	2001	Main display function - renders current scene
displayScene1()	2002	Render Scene 1 (Eating)
displayScene2()	2003	Render Scene 2 (River)
displayScene3()	2004	Render Scene 3 (Sleeping)
displayScene4()	2005	Render Scene 4 (Rolling)
init()	2006	Initialize OpenGL settings
initAnimations()	2007	Initialize animation variables

Environment Drawing Functions

Function	ID	Purpose
drawSky1()	2008	Day sky gradient (Scene 1)
drawSky2()	2009	Afternoon sky (Scene 2)
drawNightSky()	2010	Night sky gradient (Scene 3)
drawSky4()	2011	Day sky (Scene 4)
drawSun1()	2012	Sun with rays (Scene 1)
drawSun2()	2013	Sun with rays (Scene 2)

drawSun4()	2014	Sun with rays (Scene 4)
drawMoon()	2015	Moon with glow effect
drawClouds1()	2016	Animated clouds (Scene 1)
drawClouds2()	2017	Animated clouds (Scene 2)
drawClouds4()	2018	Animated clouds (Scene 4)
drawStars()	2019	Twinkling stars
drawGround1()	2020	Grass ground (Scene 1)
drawGround2()	2021	Grass ground (Scene 2)
drawNightGround()	2022	Dark grass (Scene 3)
drawHills()	2023	Rolling hills (Scene 4)

Natural Element Functions

Function	ID	Purpose
drawBamboo()	2024	Bamboo stalk with nodes (day)
drawNightBamboo()	2025	Darker bamboo for night scene
drawCave()	2029	Cave entrance

Panda Drawing Functions

Function	ID	Purpose
drawPanda1()	2031	Panda eating bamboo
drawPanda2()	2032	Panda by river
drawSleepingPanda()	2033	Sleeping panda
drawRollingPanda()	2034	Rolling panda

drawBambooStick()	2035	Bamboo being held

Effect Functions

Function	ID	Purpose
drawCircle()	2036	Helper to draw filled circles
drawFireflies()	2037	Animated fireflies
drawButterfly()	2038	Butterfly with wings
drawSleepingZzz()	2039	"Zzz" sleep indicator
drawMotionLines()	2040	Speed/motion lines

Interactive Functions

Interactive Functions	Interaction	ID
Updatecar1	void updatecar2 (int value)	1001
Updatecar2	void updatecar2(int value)	1002
Updatecar2	void updatecar2(int value)	1003
Updateclouds	void updatecloud(int value)	1004
Updatecloud1	void updatecloud1(int value)	1005
UpdateCloudsN	void updatecloudsN(int value)	1006
Updatesound	void updatesound(int value)	1007
updatetrain	void updatetrain(int value)	1008
updatesun	void updatesun(int value)	1009
updaterain	void updaterain(int value)	1010

Updateboat	void updateboat(int value)	1011
updatewinwheell	void updatewinwheell(int value)	1012
Updatewinfan2(int value)	void updatewinfan2(int value)	1013

Task Assignment and Codes of Functions

Member-1	Member-2	TOTAL
50%	50%	100%

Name / ID	Contribution in Project

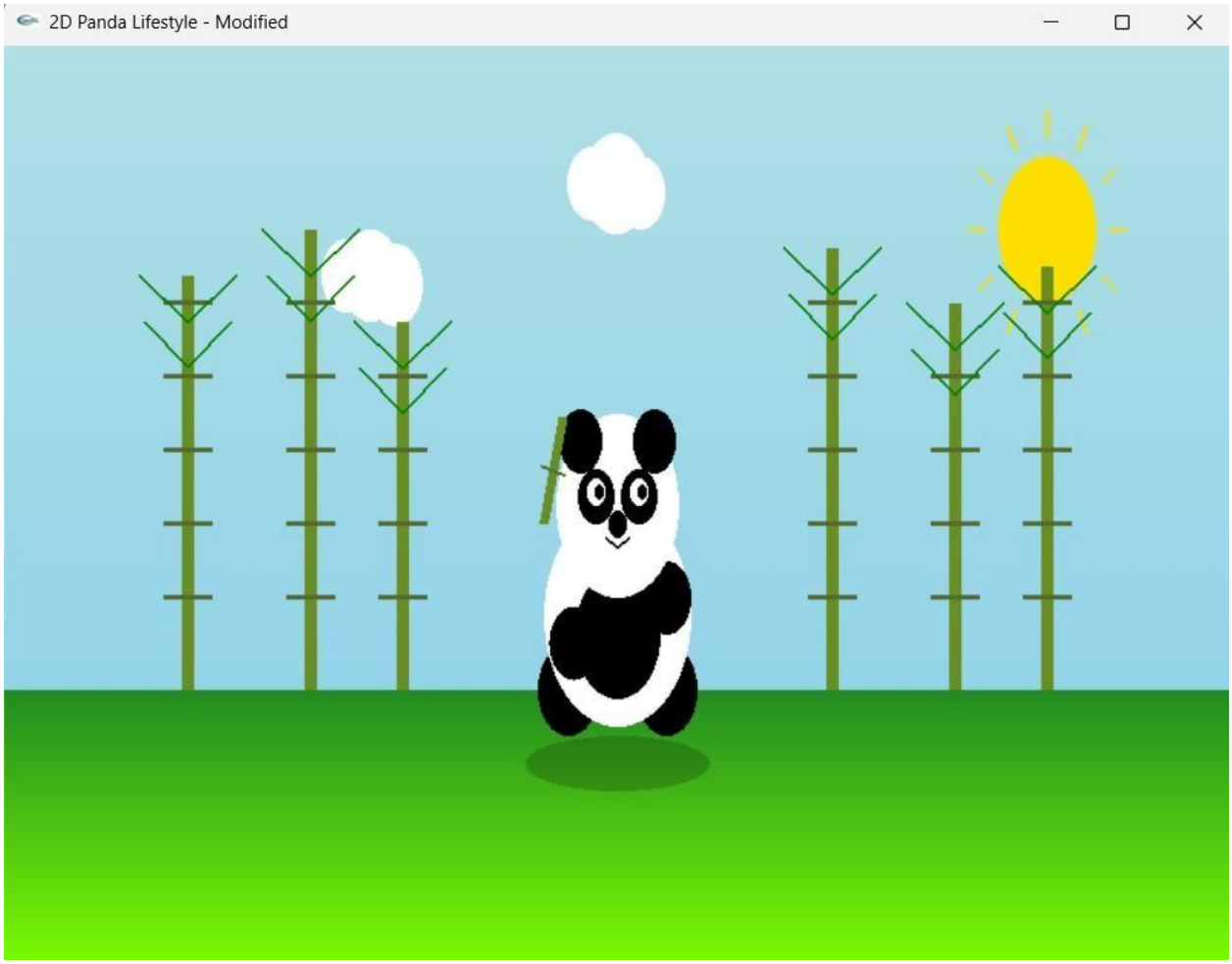
Member-1
 	
Sadia Khandaker Moumita
 	
<u>23-52278-2</u>
	drawSky1();
	drawSky1();
	drawSun1() ;
	drawClouds1();
	drawGround1();
	drawBamboo();
	drawPanda1();
	drawBambooStick();
	updateScene1();
	drawSky2();
	drawSun2();
	drawClouds2();
	drawRiver();
	drawGround2();
	drawPanda2();
	updateScene2();

Member-2
 	
<u>Sumaiya Beantey Alam Raisha</u>
 	
<u>23-50086-1</u>
	drawNightSky();
	drawMoon();
	drawStars();
	drawFireflies();
	drawNightGround();
	drawNightBamboo();
	drawCave();
	drawSleepingPanda();
	drawSleepingZzz();
	updateScene3();
	drawSky4();
	drawSun4();
	drawClouds4();
	drawHills();
	drawButterfly();
	drawRollingPanda();
	drawMotionLines();
	updateScene4()

OUTPUT

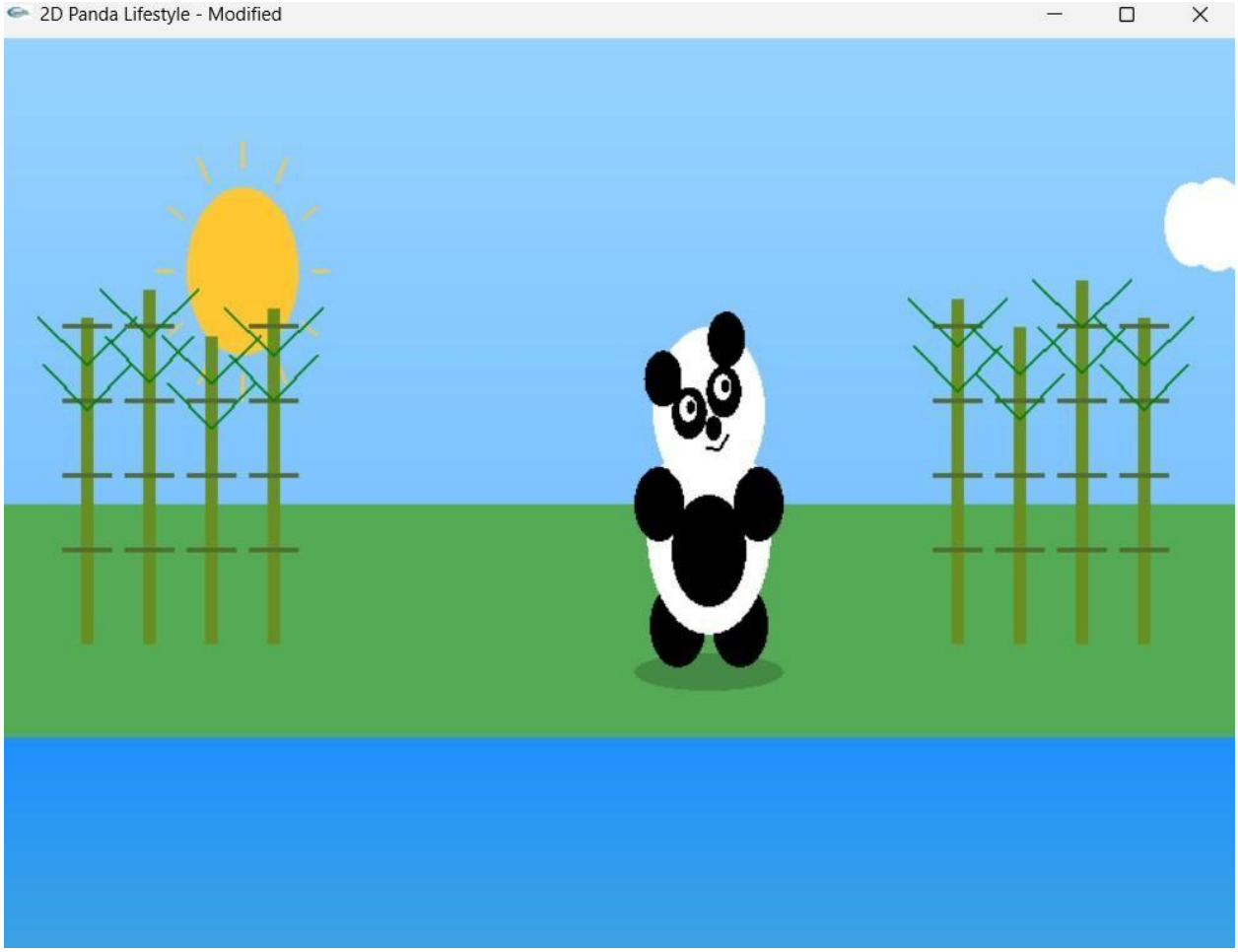
Scene 1: Eating Bamboo (Day View)

Description: The panda sits peacefully in a bamboo forest during a sunny day. The panda's hand moves rhythmically to its mouth, simulating eating behavior. Bamboo stalks surround the panda, and white clouds drift lazily across the bright blue sky.



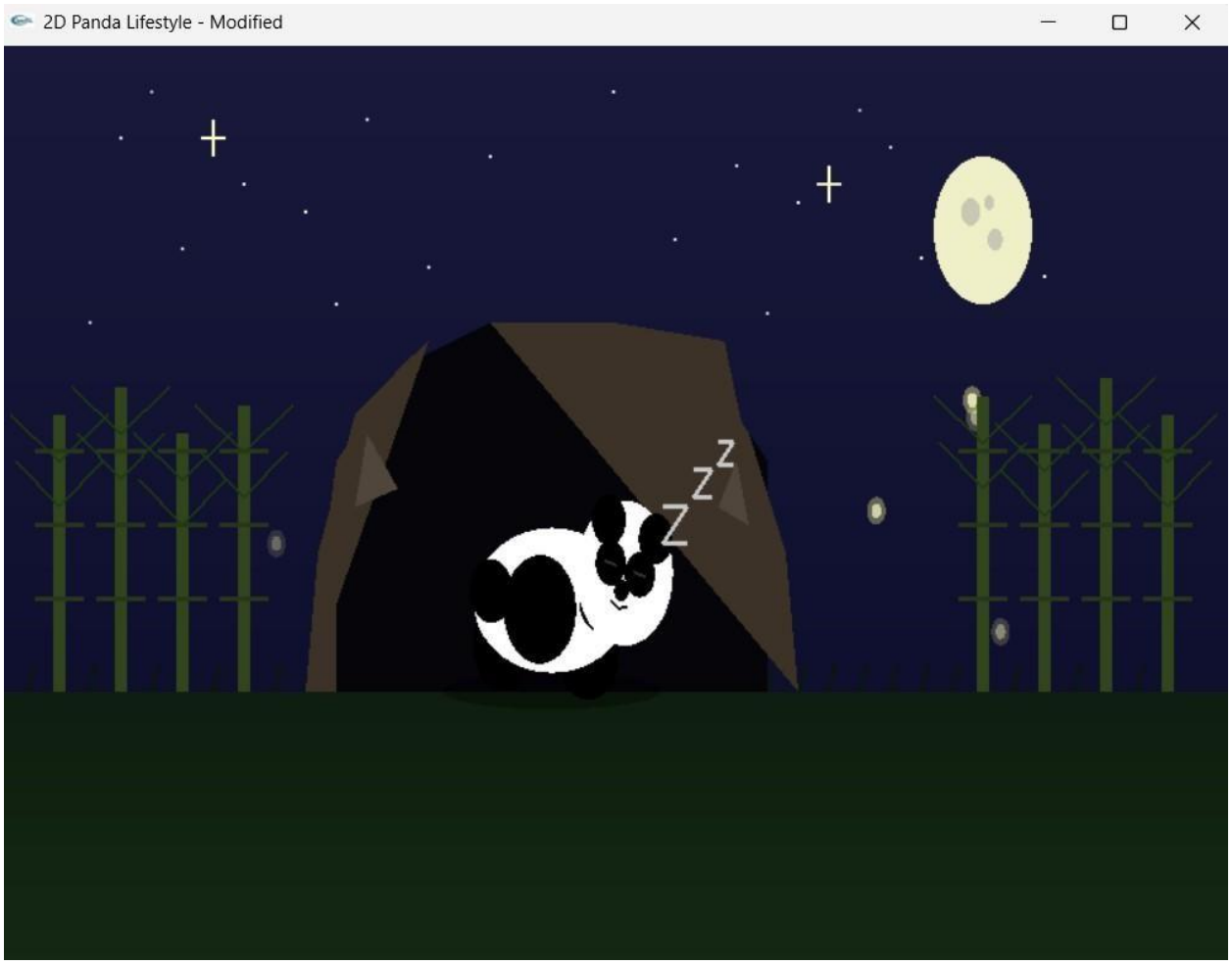
Scene 2: By the River (Afternoon View)

Description: The panda relaxes by a flowing river in the afternoon, surrounded by a bamboo forest. Its head turns from side to side, observing the peaceful surroundings.



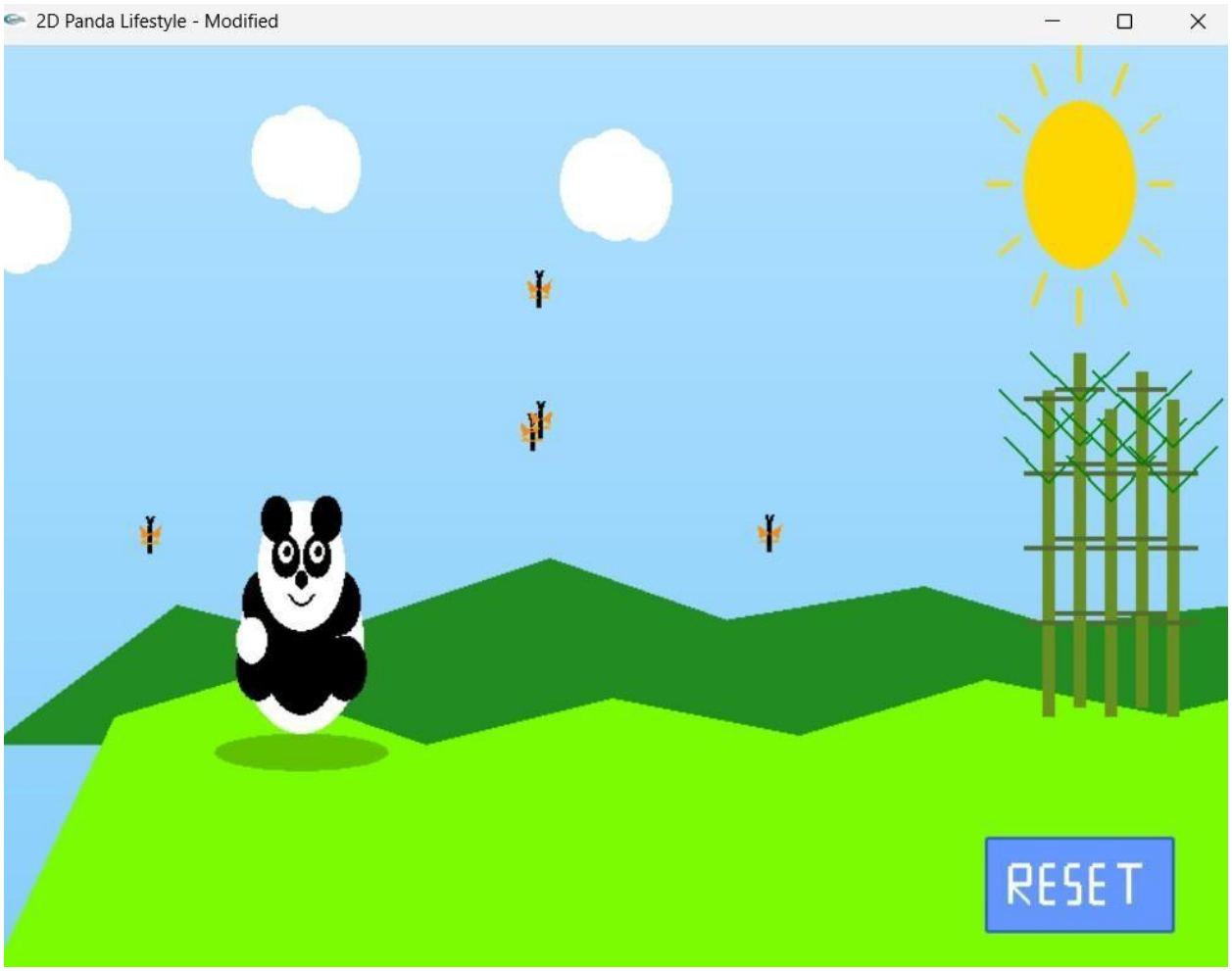
Scene 3: Sleeping in Cave (Night View)

Description: Night has fallen, and the panda sleeps soundly inside a dark cave. The moon glows softly in the sky, stars twinkle overhead, and fireflies dance through the air with their gentle luminescence. The panda's body rises and falls with breathing animation. A dark bamboo forest surrounds the cave.



Scene 4: Rolling on Hills (Day View)

Description: In the most playful scene, the panda can roll toward a bamboo forest on the right side of the screen. When activated with the spacebar, the panda rolls joyfully across rolling hills toward the bamboo. Butterflies flutter with animated wings, and motion lines emphasize the panda's movement. The rolling can be started using reset button and paused using the spacebar, and the panda stops when it reaches the bamboo forest.



Code Availability

GitHub link: https://github.com/mou-sadia/graphics-project

Future work

The project **"A Day in the Life of a Panda: Interactive 2D Animation System"** demonstrates a strong practical understanding of fundamental **computer graphics concepts using OpenGL and GLUT**. The project is limited to **2D graphics** only. The project has strong potential for expansion. The following future enhancements can significantly increase functionality, realism, and usability:

1. Advanced Interaction Features

2. Sound and Audio Integration

3. Artificial Intelligence (AI) Behavior

4. More Scenes and Story Expansion

5. Transition to 3D Graphics

6. Performance and Visual Enhancements

7. Educational and Real-World Applications

8. Cross-Platform and Modern Framework Support

This project serves as a strong foundation for advanced graphics programming. With added interactivity, intelligence, audio, and possibly 3D rendering, it can evolve from an academic assignment into a fully interactive animated application or game prototype.

Conclusion

The project successfully met all objectives and demonstrates comprehensive understanding of 2D computer graphics principles. The panda animation system is fully functional, visually appealing, and provides an engaging interactive experience. The modular code structure makes it easy to maintain and extend.

The implementation showcases practical application of computer graphics concepts including primitive rendering, transformations, animations, and user interaction. The project serves as an excellent foundation for more advanced graphics programming and demonstrates the creative possibilities of OpenGL.

References

Technical Documentation

1. OpenGL Programming Guide (Red Book) https://www.opengl.org/documentation/
2. GLUT API Reference https://www.opengl.org/resources/libraries/glut/
3. OpenGL Tutorial Resources

- LearnOpenGL: https://learnopengl.com/
- OpenGL Programming: http://www.glprogramming.com/red/

Academic References

4. Computer Graphics: Principles and Practice (3rd Edition)

- Authors: John F. Hughes, Andries van Dam, Morgan McGuire, David F. Sklar, James D. Foley, Steven K. Feiner, Kurt Akeley

5. OpenGL SuperBible: Comprehensive Tutorial and Reference (7th Edition)

- Authors: Graham Sellers, Richard S. Wright Jr., Nicholas Haemel **Course**

Materials

6. Computer Graphics Course Notes
   - American International University-Bangladesh (AIUB)
   - Course Code: Computer Graphics, Section I
   - Instructor: Dipta Justin Gomes **Online Resources**
7. OpenGL Wiki https://www.khronos.org/opengl/wiki/
8. GLUT Tutorials https://www.lighthouse3d.com/tutorials/glut-tutorial/
9. 2D Graphics Programming Concepts

- Various online tutorials and documentation