# 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 |
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# 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 |

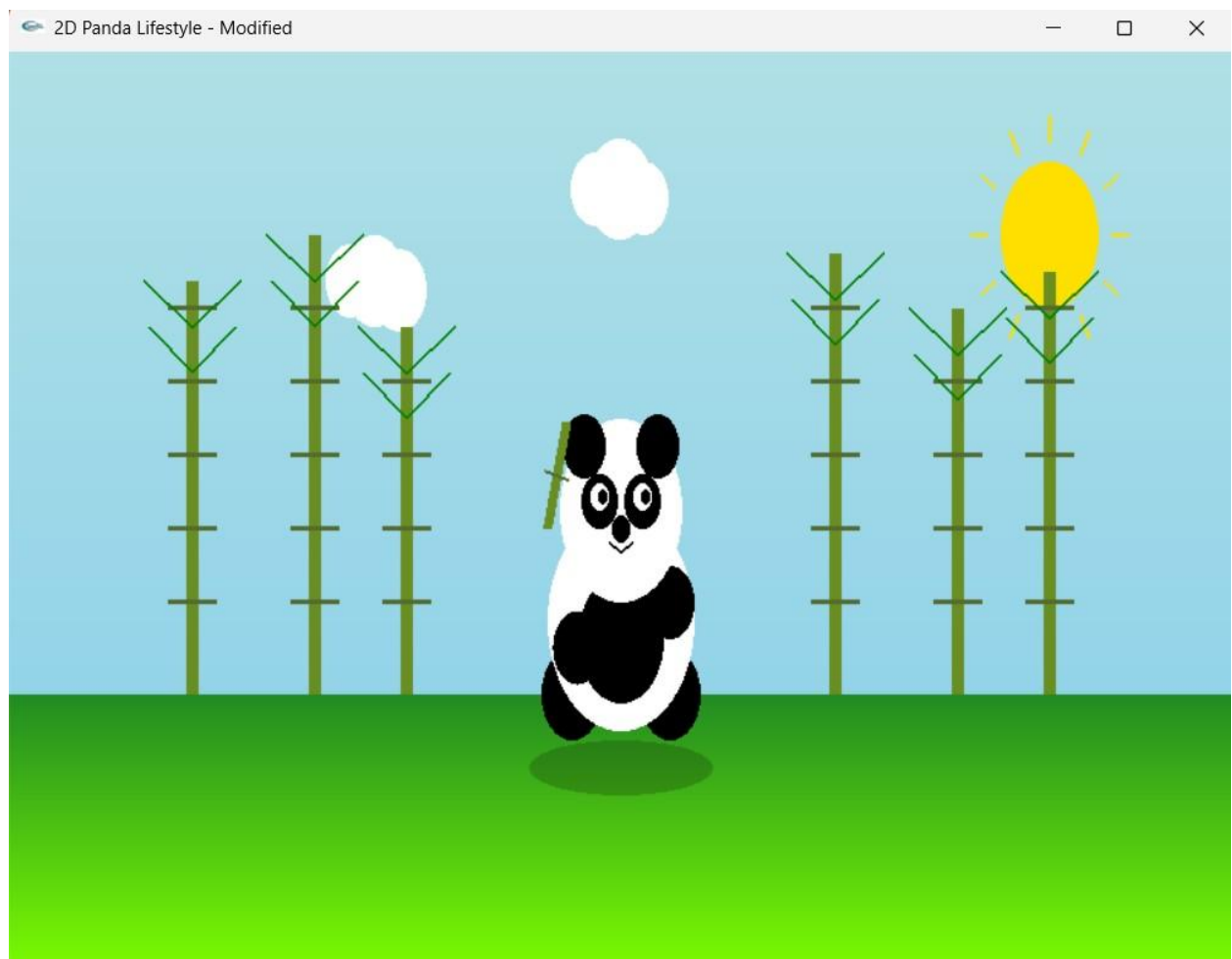**Task Assignment and Codes of Functions**

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

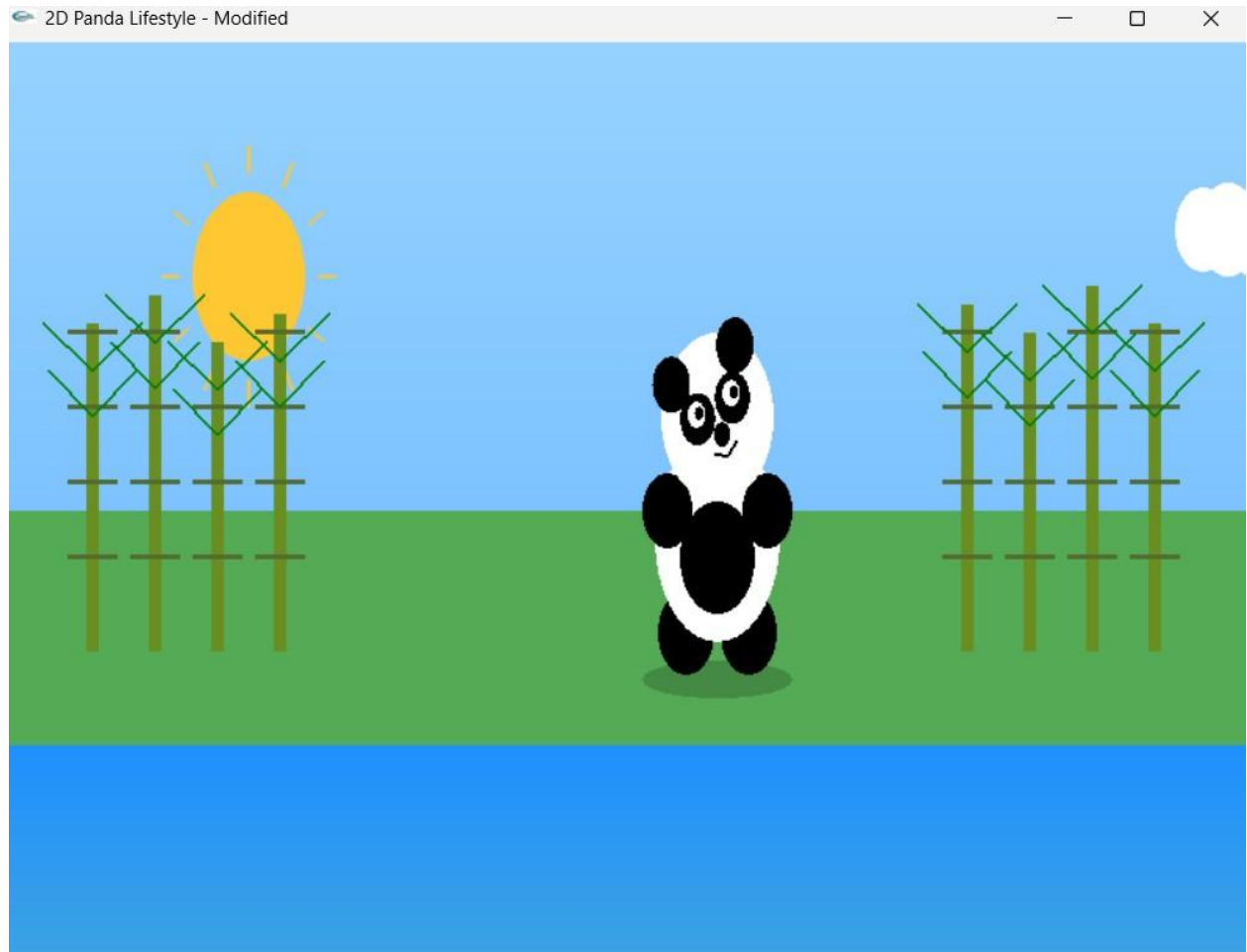| Name ／ ID | Contribution in Project |
|---|---|
| **Member-1**<br><br>**Sadia Khandaker Moumita**<br><br>**23-52278-2** | drawSky1();<br>drawSky1();<br>drawSun1() ;<br>drawClouds1();<br>drawGround1();<br>drawBamboo();<br>drawPanda1();<br>drawBambooStick();<br>updateScene1();<br>drawSky2();<br>drawSun2();<br>drawClouds2();<br>drawRiver();<br>drawGround2();<br>drawPanda2();<br>updateScene2(); |
| **Member-2**<br><br>**Sumaiya Beantey Alam Raisha**<br><br>**23-50086-1** | drawNightSky();<br>drawMoon();<br>drawStars();<br>drawFireflies();<br>drawNightGround();<br>drawNightBamboo();<br>drawCave();<br>drawSleepingPanda();<br>drawSleepingZzz();<br>updateScene3();<br>drawSky4();<br>drawSun4();<br>drawClouds4();<br>drawHills();<br>drawButterfly();<br>drawRollingPanda();<br>drawMotionLines();<br>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.
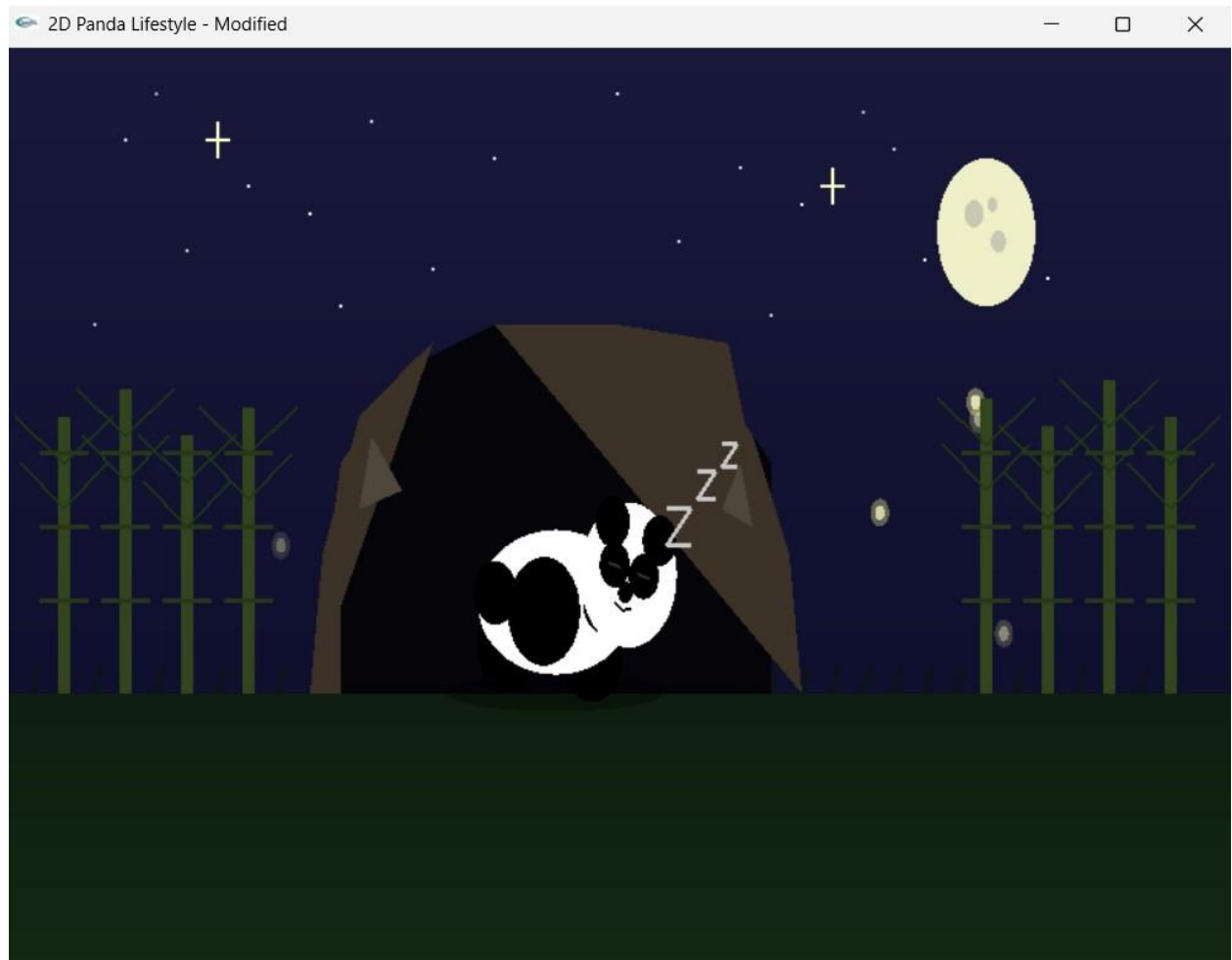
**Scene 2: By the River (Afternoon View)**

**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.



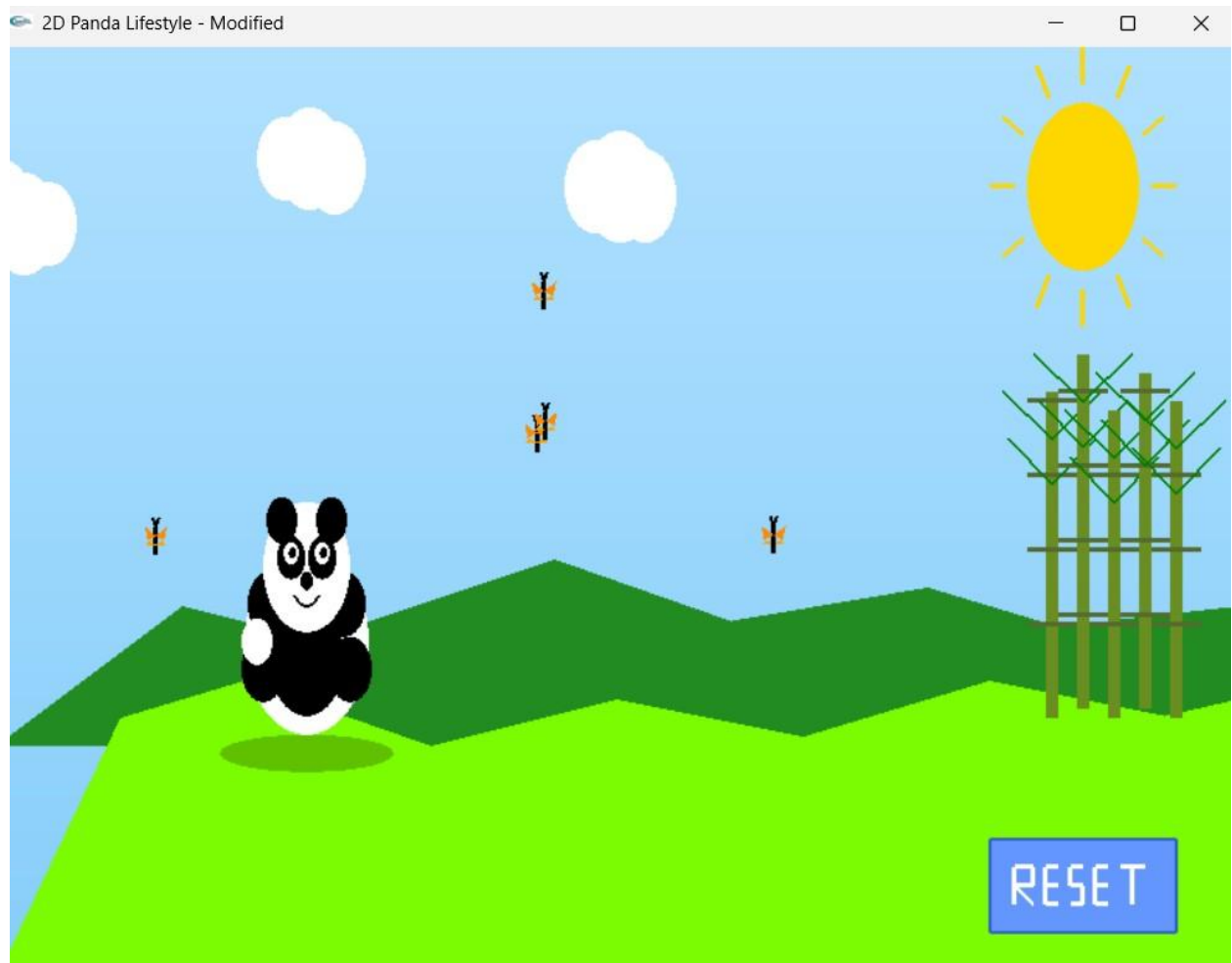**Scene 3: Sleeping in Cave (Night View)**

**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/Sumaiya-Raisha/2D-Panda-Lifestyle-Animation

## 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