VISVESVARAYA TECHNOLOGICAL UNIVERSITY BELAGAVI

Mini Project Report on

"HOT AIR BALLOON"

Submitted in the partial fulfillment for the requirements of Computer Graphics & Visualization Laboratory of 6th semester CSE requirement in the form of the Mini Project work

Submitted By

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CERTIFICATE

This is to certify that the Project work entitled **"HOT AIR BALLOON"** is a bonafide work carried out by **Siddharth Vaddem (1BY19CS150) and Sohankumar T R (1BY19CS154)** in partial fulfillment for *Mini Project* during the year 2021-2022. It is hereby certified that this project covers the concepts of *Computer Graphics & Visualization*. It is also certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in this report.

Signature of the Guide	**Signature of the HOD**
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PROGRAM EDUCATIONAL OBJECTIVES

1. Lead a successful career by designing, analyzing and solving various problems in the field of Computer Science & Engineering.
2. Pursue higher studies for enduring edification.
3. Exhibit professional and team building attitude along with effective communication.
4. Identify and provide solutions for sustainable environmental development.

PROGRAM SPECIFIC OUTCOMES

1. Analyze the problem and identify computing requirements appropriate to its solution.
2. Apply design and development principles in the construction of software systems of varying complexity.

ACKNOWLEDGEMENT

ABSTRACT

The main objective of ***Hot Air Balloon*** Computer Graphics Mini Project is to illustrate the concepts and usage of pre-built functions in OpenGL. The development of this project provides a good insight into the concepts of Computer Graphics and Visualization. We will be using the OpenGL utility toolkit to implement the animation of the Hot Air Balloon, written in C++ language.

The main idea of this project is to visualize fun animations with the help of computer graphics. Also an effective way of conveying messages through stories with great visual experience. The user has a menu provided to him for choosing the actions to simulate the hot air balloon moving.

We have tried to implement the project making it as user-friendly and error free as possible. We regret any errors that may have inadvertently crept in.

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CHAPTER 1

INTRODUCTION

1.1 Brief Introduction

Computer graphics are graphics using computers and, more generally, the representation and manipulation of image data by a computer hardware and software. The development of computer graphics, or simply referred to as CG, has made computers easier to interact with, and better for understanding and interpreting many types of data. Developments in computer graphics have had a profound impact on many types of media and have revolutionized the animation and video game industry. 2D computer graphics are digital images-mostly from two dimensional models, such as 2D geometric models, text, and 2D data. 3D computer graphics in contrast to 2D computer graphics are graphics that use a three dimensional representation of geometric data that is stored in the computer for the purposes of performing calculations and rendering images.

OpenGL is the most extensively documented 3D graphics API (Application Program Interface) to date. OpenGL is a low-level graphics library specification. It makes available to the programmer a small set of geometric primitives - points, lines, polygons, images, and bitmaps. OpenGL provides a set of commands that allow the specification of geometric objects in two or three dimensions, using the provided primitives, together with commands that control how these objects are rendered (drawn).

The OpenGL Utility Toolkit (GLUT) is a library of utilities for OpenGL programs, which primarily perform system-level I/O with the host operating system. Functions performed include window definition, window control, and monitoring of keyboard and mouse input. Routines for drawing a number of geometric primitives (both in solid and wireframe mode) are also provided, including cubes, spheres, and cylinders. GLUT even has some limited support for creating pop-up menus. The two aims of GLUT are to allow the creation of rather portable code between operating systems (GLUT is cross platform) and to make learning OpenGL easier.

1.2 Scope and Motivation

There probably isn't a person on earth that hasn't dreamt about taking to the skies and seeing the world above. Hot air balloons are one of the oldest forms of transport dating back to the 18th century. It helped the early human communities by providing them a means of transportation. In this project we aim to develop an easy application to simulate the movement of a hot air balloon in the sky.

This project has been developed in order to help the tourism industry, by providing them with animated video marketing campaigns.

1.3 Problem Statement

The 21st century has seen a huge boom in the tourism sector with tourists flowing in from different parts of the world. In order to provide better visuals and animations for tourism companies to carry out their marketing activities. So the main objective of this project is to simulate the movement of a hot air balloon in the sky.

1.4 Proposed System

We need to build something that is simple and interesting for a tourism industry marketing video campaign.

So we are adding a good visual and making a simulation of the hot air balloon which will entice the consumers with this unique 2D approach. With the use of different functionality like making polygons, using various functions of mouse and creation of menu, the whole story is plotted in this project.

1.5 Limitations

The current industry doesn't have an innovative unique 2d pixelated video marketing campaign approach to promote tourism which we believe is very much in the interests of the current generation. We would like to solve it by simulating a hot air balloon which is a good tourist attraction among the current generation.

CHAPTER 2

LITERATURE SURVEY

[1]"*The Development of 2D Animation media to promote tourism in Wat Phra That Lampang Luang, Lampang Province*" -Wisoot Kaenmueang; Patipon Boonsri; Ramin Komplong.

The development of 2D animation media is a tool that uses the strength and power of animation to communicate easily. It serves to make content memorable and this media then helps to promote tourism more effectively in Wat Phra That Lampang Luang, Lampang Province. The research process uses a target audience of those interested in tourist attractions in Lampang Province, rely on online travel information and are aged from 15 to 30 years old, the assessment is divided into two parts: first to assess the effectiveness of the media to promote tourism. And the second is to assess the production quality of the media. Part one of the study noted the effectiveness of 2D animation media to promote tourism, show value and importance, and encourage interest in travel and aesthetics. Satisfaction was very good, which suggests that 2D animation media indeed has an effect on tourism interest. The second part of the study found that the production quality, content, design, visual aspects and animation of the 2D media was of a high standard. The audio aspect is sufficient, which shows that the quality of 2D animation production affects perception because it is consistent with the results of the first part of the study.

Tourism is a popular activity because it can create enjoyment, relaxation and experience in new ways. There are many different types of tourism, from natural origin to man-made tourism, and each attraction is different. In current times, tourism to temple is one of the great options, where temples contain both fine art and are beautiful into themselves. They are a unique part of the past ancient relics of generations ago have been stored and preserved to this day. In Thailand there are many temples that are important tourist attractions. Temples are found in all regions and Wat Phra That Lampang Luang is located in the northern region. In Lampang, it is a temple with the potential to promote tourism. The history of Wat Phra That Lampang Luang shows it was built during the period of Phra Nang Chamdevi, the ruler of the city of Hari Phuonchai in Lamphun province. It was built for her son Pha Chao Anantayed to be at the center of the religion. The temple is more than 1500 years old and is one of the most important double temples, very important for buddhism and is a main tourist attraction in

Lampang Province. Currently, Wat Phra That Lampang Luang in addition to being a place for religious activities, is a tourist destination of interest. However, a preliminary survey found that people tend to visit during holidays or festivals, it is popularity dwindling over the years.

Therefore, to promote and stimulate tourism in the area and have more and more people interested in visiting Wat Phra That Lampang Luang, the researchers created a 2D animation medium to encourage people to visit. The benefits of 2D animation makes the media interesting to consume. It transforms a narrative of words to an animated medium that communicates easily. This serves to make it quicker to remember as the human brain has better visual recognition than with words and letters.

[2]*"The Research of Using Animation Design to Promote the Tourism Economy Under the Guilin Folk Cultural Characteristics"*- ZHANG Yu-ting, Liu Zhi-hong

In recent years, China's rapid development of animation industry shows a vigorous development of the state of affairs. In particular, the application of network technology, such as online advertising, MMS, mobile media, provides more ways and broader platform for the dissemination of commercial animation. Fairy color Ocean Park in Hong Kong is the only one to enter the Forbes top ten theme parks around the world ranked seventh. Shenzhen Window of the World and China Folk Customs Park created by OCT Group draw on Western fairy tale theme park mode, by folk cultural propaganda, they access to the economic and cultural effects of attention, and promote the development of tourism The rapid development of the Anime tourism and creative industries in the Yangtze River Delta region, where established a Water Margin City, Three City and so on, has been the success stories of native culture used in the animation industry and tourism phase conjugate. 2010 China.

CHAPTER 3

SYSTEM REQUIREMENTS

Hardware Requirements

- Processor: INTEL / AMD
- Main memory: 2 GB RAM (Min.)
- Hard Disk: Built-in
- Keyboard: QWERTY
- Mouse: 2 or 3 Button mouse
- Monitor: 1024 x 768

Software Requirements

- Programming language-C/C++ using OpenGL
- Operating system –Windows/Linux
- Compiler – C/C++ Compiler (GCC compiler)
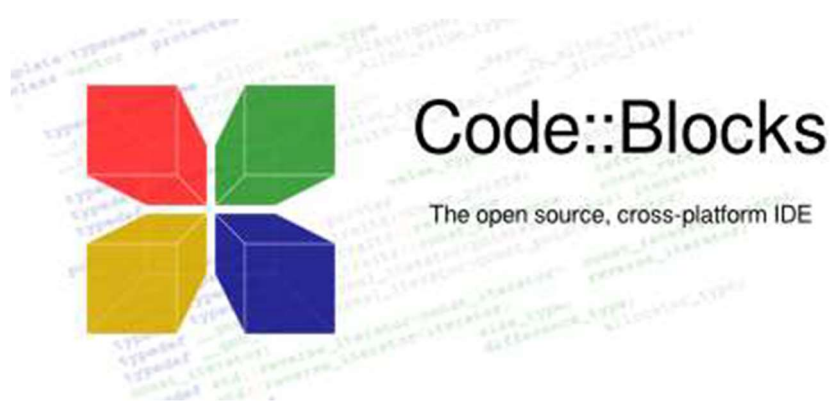- IDE – Code blocks
- Functional Requirement – <GL/glut.h>

FIGURE 1. The code blocks IDE

Non-Functional Requirements

These are constraints on the services or functions offered by the system. They include timing constraints, constraints on the development process and standards. Non-functional requirements often apply to the system as a whole.

Non-Functional Requirements are as follows:

- **Dependability:** The dependability of a computer system is a property of the system that equates to its trustworthiness. Trustworthiness essentially means the degree of user confidence that the system will operate as they expect and that the system will not 'fail' in normal use.
- **Availability:** The ability of the system to deliver services when requested. There is no error in the program while executing the program.
- **Reliability:** The ability of the system to deliver services as specified. The program is compatible with all types of operating system without any failure.
- **Safety:** The ability of the system to operate without catastrophic failure.
- **Security:** The ability of the system to protect itself against accidental or deliberate intrusion.

Functional Requirements

In software engineering, a functional requirement defines a function of a software system or its component. A function is described as a set of inputs, the behavior, and outputs (see also software). Functional requirements may be calculations, technical details, data manipulation and processing and other specific functionality that define *what* a system is supposed to accomplish. Behavioral requirements describing all the cases where the system uses the functional requirements are captured in use cases.

The various methods used in this project are as follows :-

- **Display:** The module draws the output on the screen and the functions in it.
- **Menu:** This module specifies the action corresponding to menu entry.
- **Keyboard:** The module specifies the action corresponding to the key board.
- **Idle:** This module is used to display the object more times using some delay.

CHAPTER 4

SYSTEM ANALYSIS

After the purpose and specifications of software are determined, software developers will design or employ designers to develop a plan for a solution. It includes low-level component and algorithm implementation issues as well as the architectural view.

1. Abstraction - Abstraction is the process or result of generalization by reducing the information content of a concept or an observable phenomenon, typically in order to retain only information which is relevant for a particular purpose.

2. Refinement - It is the process of elaboration. A hierarchy is developed by decomposing a macroscopic statement of function in a stepwise fashion until programming language statements are reached. In each step, one or several instructions of a given program are decomposed into more detailed instructions. Abstraction and Refinement are complementary c

3. Modularity - Software architecture is divided into components called modules.

4. Software Architecture - It refers to the overall structure of the software and the ways in which that structure provides conceptual integrity for a system. A good software architecture will yield a good return on investment with respect to the desired outcome of the project, e.g. in terms of performance, quality, schedule and cost.

5. Control Hierarchy - A program structure that represents the organization of a program component and implies a hierarchy of control.

6. Structural Partitioning - The program structure can be divided both horizontally and vertically. Horizontal partitions define separate branches of modular hierarchy for each major program function. Vertical partitioning suggests that control and work should be distributed top down in the program structure.

7. Data Structure - It is a representation of the logical relationship among individual elements of data.

8. Software Procedure - It focuses on the processing of each modules individually

9. Information Hiding - Modules should be specified and designed so that information contained within a module is inaccessible to other modules that have no need for such information.
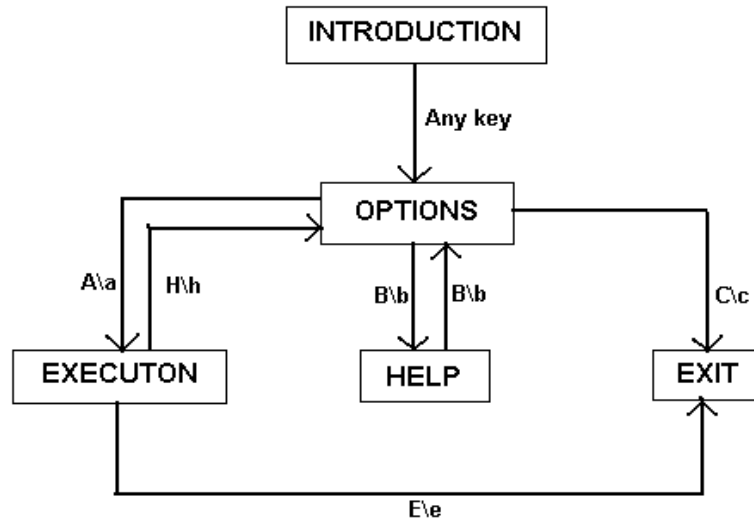
FIGURE 2. System Design

The animation of "HOT AIR BALLOON" is designed using some of the OpenGL inbuilt functions along with some other user defined functions. So, this section comprises the complete explanation of the design of the project using various openGL functions and user defined methods along with its explanation. This chapter is divided into two sections –

- OPENGL Functions: This section throws light on the various openGL functions used and its uses.
- USER DEFINED Functions: This section demonstrates the various user defined functions and its purpose.

The system is a menu driven program where the users will be choosing the action to be performed. The following section goes in detail with the implementation of the said functions above along with their screenshots.

CHAPTER 5

SYSTEM IMPLEMENTATION

5.1 OpenGL Functions

- **glutInit(&argc,argv)** :- glutInit is used to initialize the GLUT library. glutInit will initialize the GLUT library and negotiate a session with the window system. During this process, glutInit may cause the termination of the GLUT program with an error message to the user if GLUT cannot be properly initialized. glutInit also processes command line options, but the specific options parse are window system dependent.

- **glutInitDisplayMode(GLUT_DOUBLE|GLUT_RGB)** :- sets the initial display mode. The initial display mode is used when creating top-level windows, subwindows, and overlays to determine the OpenGL display mode for the to-be-created window or overlay

- **glutInitWindowSize(500,500)** :- set the initial window size . Windows created by glutCreateWindow will be requested to be created with the current initial window position and size. The initial value of the initial window size GLUT state is 300 by 300. The initial window size components must be greater than zero.The intent of the initial window position and size values is to provide a suggestion to the window system for a window's initial size and position. The window system is not obligated to use this information. A GLUT program should use the window's reshape callback to determine the true size of the window.

- **glutCreateWindow("Hot air balloon")** :- creates a top-level window. The name will be provided to the window system as the widow's name. The intent is that the window system will label the window with the name.Implicitly, the current window is set to the newly created window.

- **glutDisplayFunc(display)** :- registers the callback function (or event handler) for handling window-paint events. The OpenGL graphic system calls back this handler when it receives a window repaint request. In the example, we register the function display() as the handler.

- **glutReshapeFunc(reshape)** :- This function sets the reshape callback. This function is triggered when the window is reshaped.

- **glutMainLoop()** :- glutMainLoop enters the GLUT event processing loop. This routine should be called at most once in a GLUT program. Once called, this routine will never return. It will call as necessary any callbacks that have been registered.

- **glutCreateMenu(AnimateMenu) :-** used to create a menu that can be used to handle various onClick events.

- **glutAddMenuEntry("MENU", 0) :-** this function has been used multiple times in the program to add various entries to the menu that the users can select from

- **glutAttachMenu(GLUT_RIGHT_BUTTON)** :- This function is used to set up the mouse button,which when clicked would open the menu.

- **glClearColor(0, 0.7, 1, 0) :-** glClearColor() specifies the red, green, blue, and alpha values used by glClear() to clear the color buffers. Values specified by glClearColor() are clamped to the range 0, 1

- **glClear(GL_COLOR_BUFFER_BIT)** :- GL_COLOR_BUFFER_BIT. Indicates the buffers currently enabled for color writing.

- **glLoadIdentity() :-** glLoadIdentity replaces the current matrix with the identity matrix. It is semantically equivalent to calling glLoadMatrix with the identity matrix

- **glBegin(GL_POLYGON)** :- delimit the vertices of a primitive or a group of like primitives. glBegin and glEnd delimit the vertices that define a primitive or a group of like primitives. glBegin accepts a single argument that specifies in which of ten ways the vertices are interpreted.

- **glVertex3f(x1_position - 0.22, y1_position + 0, 0.1) :-** specify a vertex. glVertex commands are used within glBegin/glEnd pairs to specify point, line, and polygon vertices. The current color, normal, texture coordinates, and fog coordinate are associated with the vertex when glVertex is called.

- **gluOrtho2D(-0,0,-0,0)** :- define a 2D orthographic projection matrix. left, right-Specify the coordinates for the left and right vertical clipping planes. bottom, top - Specify the coordinates for the bottom and top horizontal clipping planes.

5.2 User Defined Functions

The whole project is divided into many small parts known as functions and these functions would take care of implementing particular parts of this project which makes the programming easy and effective.

- ❖ **void display()** :- This function is responsible for setting up the balloon, the basket and the ropes that connect the balloon to the basket.

- ❖ **void AnimateMenu(int option) :-** This function is responsible for setting the values on each click for an option in the menu.

- ❖ **void reshape(int w, int h)** :- This function is responsible for resetting the values whenever the window reshape event occurs.

- ❖ **void timer(int)** :- This function is the main logic center of the project and is responsible for handling all the translations of the hot air balloon.

- ❖ **void myInit()** :- This function is basically used for initialization purposes.

- ❖ **int main()** :- this is the main function of the program that is responsible for calling all the other functions in the project

CHAPTER 6

INTERPRETATION OF RESULTS

This section speaks about the implementation of the project via the snapshots. It gives a detailed description of the way in which the various actions are implemented.
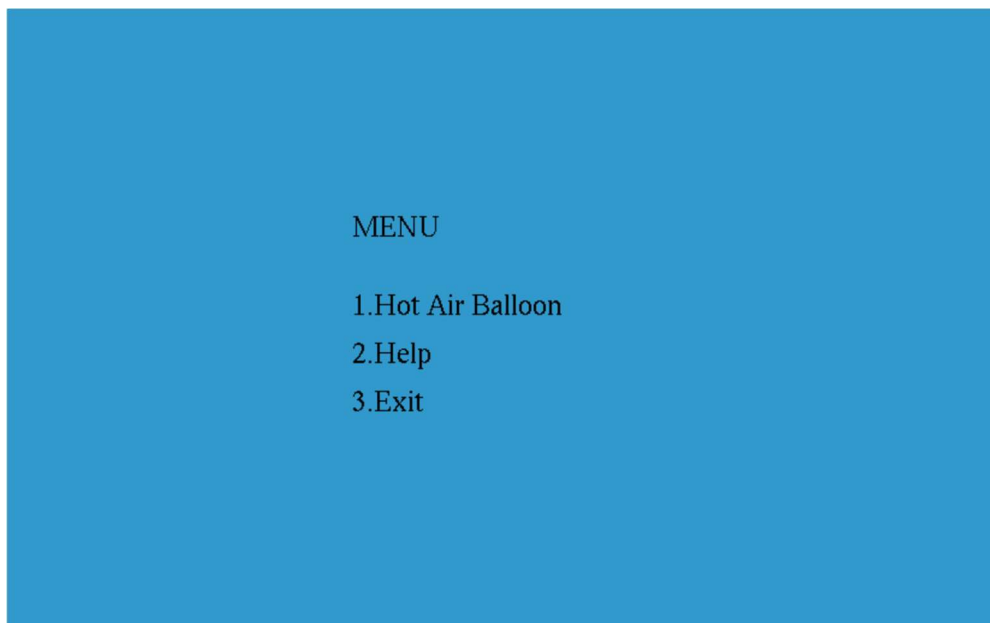

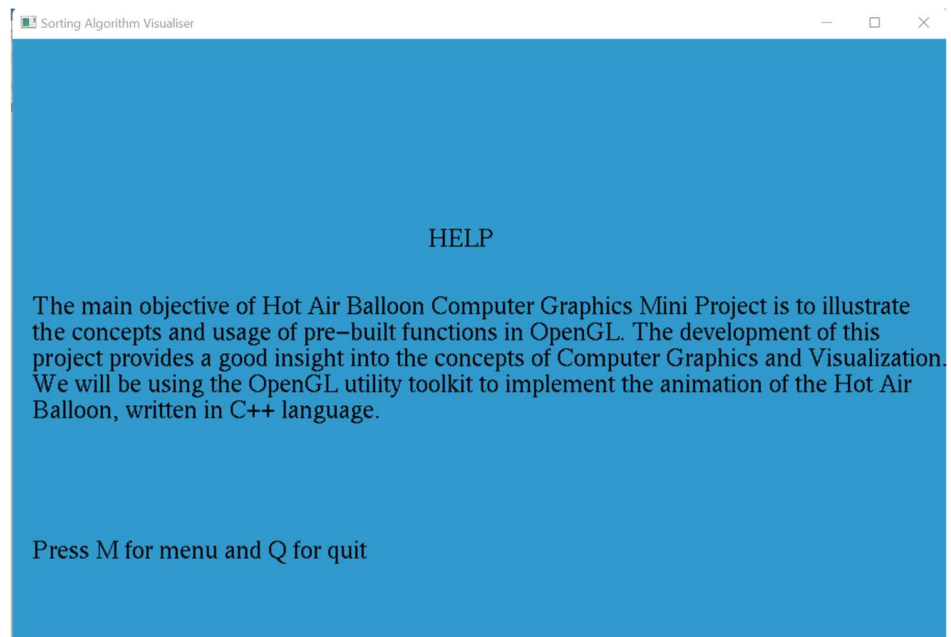
FIGURE 3. Home Screen

FIGURE 4. Menu Screen
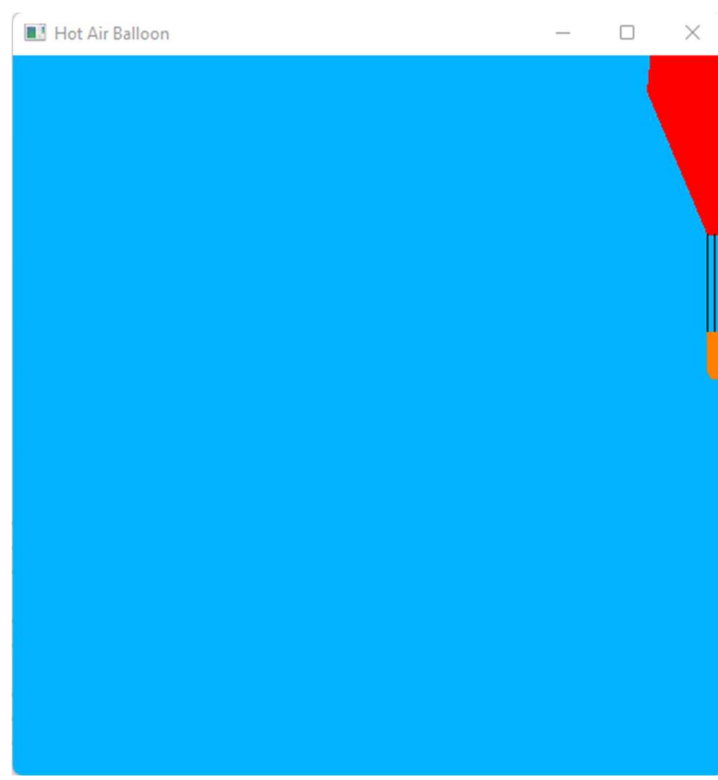
FIGURE 5. Help Screen
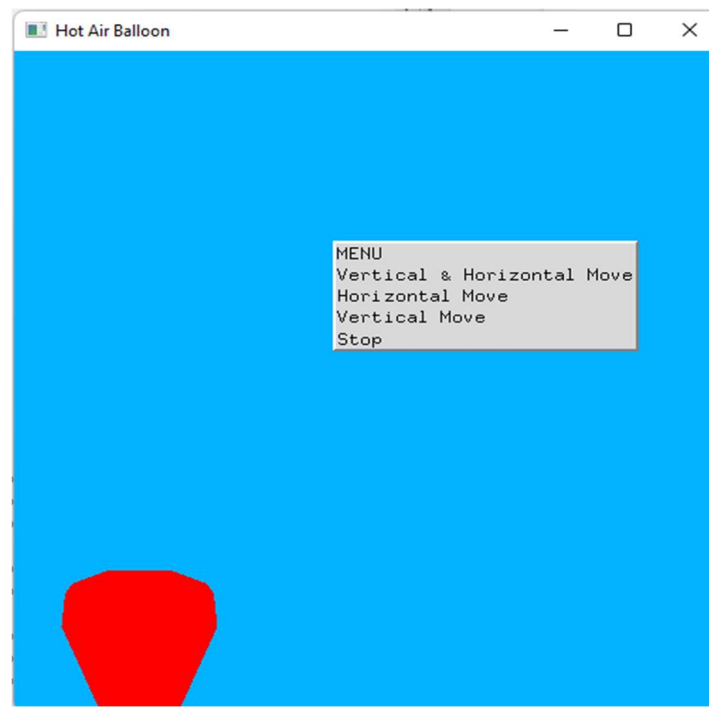

FIGURE 6: Hot Air Balloon Animation

FIGURE 7: The menu items in animation

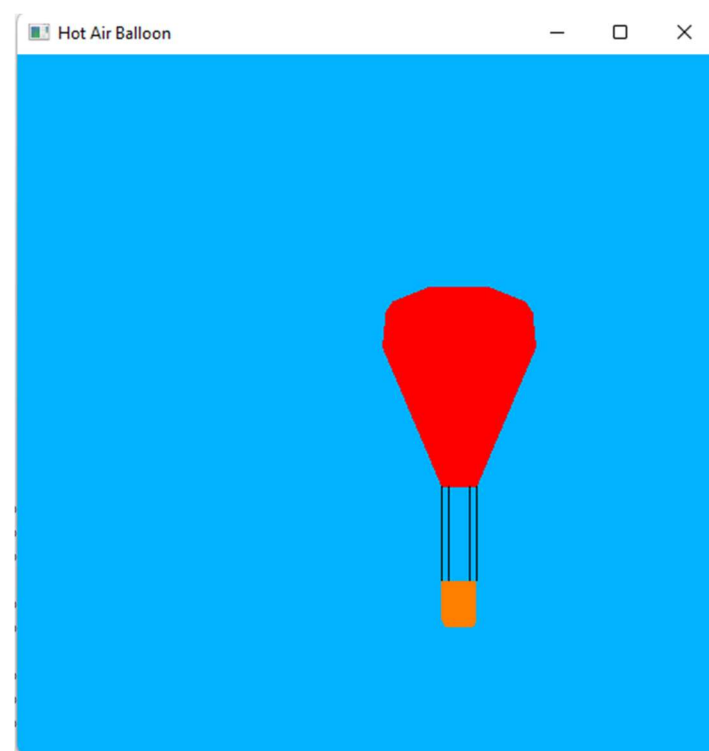On clicking the right mouse button the menu shows up with the following options.

FIGURE 8: Hot air Balloon moving

CHAPTER 7

CONCLUSION

The very purpose of developing this project is to exploit the strength of OpenGL graphics capabilities for an interesting cause. The Hot Air Balloon Simulation has been tested under Windows 10, and has been found to provide ease of use and manipulation to the user. It has a very simple and effective user interface. We found designing and developing this animation as a very interesting and learning experience. It helped us to learn about computer graphics, design of Graphical User Interfaces, interface to the user, user interaction handling and screen management. The graphics editor provides all and more than the features that have been detailed in the university syllabus

CHAPTER 8

FUTURE ENHANCEMENTS

Some of the future enhancements would be:

- Support for advanced 3D representation of the entire scenario.
- Support for transparency of layers and originality that is, simulating the hot air balloon in a more realistic way.
- Making the user interface of this project more user friendly which will certainly be more effectively and efficiently narrated.

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