RAINBOW

Submitted in partial fulfilment of the requirements

of the degree

BACHELOR OF ENGINEERING IN

COMPUTER ENGINEERING

By

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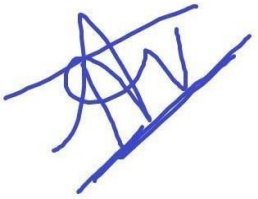
(AY 2021-22)

CERTIFICATE

This is to certify that the Mini Project entitled **"RAINBOW"** is a bonafide work of **MITALI DESAI (10), SINCEE HARRIET (24), AMISHA KHOT (30) and STEPHENY LUCAS (34)** submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the degree of **"Bachelor of Engineering"** in **"Computer Engineering".**



(Prof. Teena Verma)
Supervisor

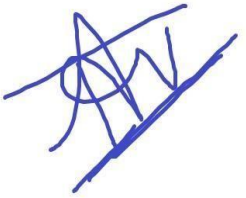
(Prof. Dr. Saurabh Patil)
Head of Department

(Prof. Dr. Y.D. Venkatesh)
Principal

Mini Project Approval

This Mini Project entitled **"RAINBOW"** by **Mitali Desai (10), Sincee Harriet (24), Amisha Khot (30) and Stepheny Lucas (34)** is approved for the degree of **Bachelor of Engineering** in **Computer Engineering.**

Examiners



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(Prof. Teena Varma)

2……
(External Examiner name & Sign)

Date:

Place: Mumbai

Contents

i. Abstract:

Animation, which is basically a form of pictorial presentation, has become the most prominent feature of technology-based learning environments. It refers to simulated motion pictures showing movement of drawn objects.

In this project, we implement the life cycle of the rainbow using computer graphics technologies. We will also look into the implementation, challenges faced during implementations and steps taken to overcome them. We will also look into the future prospects of this project.

ii. Acknowledgements:

We would like to express our special thanks of gratitude to our Prof. Teena Verma as well as our principal Dr. Y.D. Venkatesh and Head of Department Dr. Saurabh Patil who gave us the golden opportunity to do this wonderful animation project on the topic Rainbow, which also helped us in doing a lot of Research and we came to know about so many new things we are really thankful to them.

iii. List of figures:

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1. INTRODUCTION

1.1 INTRODUCTION

Animation refers to the movement on the screen of the display device created by displaying a sequence of still images. Animation is the technique of designing, drawing, making layouts and preparation of photographic series which are integrated into the multimedia and gaming products. Animation connects the exploitation and management of still images to generate the illusion of movement.

Graphics today is used in many different areas. Graphics provides one of the most natural means of communicating within a computer, since our highly developed 2D and 3D pattern-recognition abilities allow us to perceive and process pictorial data rapidly and effectively.

Interactive computer graphics is the most important means of producing pictures since the invention of photography and television. It has the added advantage that, with the computer, we can make pictures not only of concrete real-world objects but also of abstract, synthetic objects, such as mathematical surfaces and of data that have no inherent geometry, such as survey results.

A rainbow is a meteorological phenomenon that is caused by reflection, refraction and dispersion of light in water droplets resulting in a spectrum of light appearing in the sky. It takes the form of a multi-coloured circular arc. Rain is liquid precipitation: water falling from the sky. Raindrops fall to Earth when clouds become saturated, or filled, with water droplets.

In Turbo C graphics we use graphics.h functions to draw different shapes(like circle, rectangle etc), display text(any message) in different format(different fonts and colors). By using graphics.h we can make programs, animations and also games.

1.2 MOTIVATION

“Animation is not the art of drawings that move but the art of movements that are drawn.” – Norman McLaren.

The animation is an art that plays a very crucial role in the business world as well as impacts the lives of general masses. The need for animation appears as a form of an exceptional means of interaction that helps to convey the message and communicate with theaudience. The animation is a medium that can bring concepts or imaginations to real life through character sketching. As multimedia and computer graphic technology have developed and become widely available, animations have been increasingly incorporated intolearning materials.

Although there may be domains where animation is an important characteristic of the domain that needs to be understood by learners, closer comparison of the graphics in these studies reveals that the animated graphics portrayed more information than the static ones. One of the main reasons for the growing popularity of animation seems to be the belief that animation is more interesting, aesthetically appealing, and therefore more motivating.

Animated graphics are bound to have more information about the form and details of movement than static graphics. However, the dynamic details that characterize animated graphics may only be seductive details that provide emotional interest but distract learners from making sense of the material.

Animated graphics, in essence, have seductive details that increase emotional interest, but not cognitive interest. It has been well documented that individuals offered choice show more enjoyment, better performance, and greater persistence at a variety of activities due to the increased interactivity or controllability. One strategy for enhancing the learner’s motivation is to increase his or her sense of control and self-determination by providing choice or locus of control. With simulations, videos, graphics, animations, audio and multimedia learning elements such as text, students have the potential to engage, which ensures their effective participation in the course.

Interactive animation holds the audience's attention and the use of audio, graphics, and video interactive animation makes it interesting, engaging. Real-life experiments hazardous in nature can be sorted using animation. It provides flexibility and safety in re-attempting the experiment.

Animation would also be expected to help students to visualize a dynamic process that is difficult or impossible for them to visualize on their own, such as the sequence of an operating internal combustion engine.

Even if the visualization of motion and trajectory are important cognitive skills for a given task and are externally provided in a lesson display through animation, learners must still be able to attend to the salient features of the display'.

Computer animation is made for a flexible interactive way of learning. This builds interest in students wanting to learn more and motivates them. Animation allows one to assess their skills and abilities and attempt risk-free experiments in a safe environment.

1.3 PROBLEM STATEMENT

The main aim of the project is to display animation of rainbow using computer graphics. This project demonstrates two scenes.

1. The first scene depicts the rain animation, where it waits for the user to enter a character to display the next scene.
2. The second scene comprises of rainbow animation.

Other objects like the sun, house and the cloud have also been included.

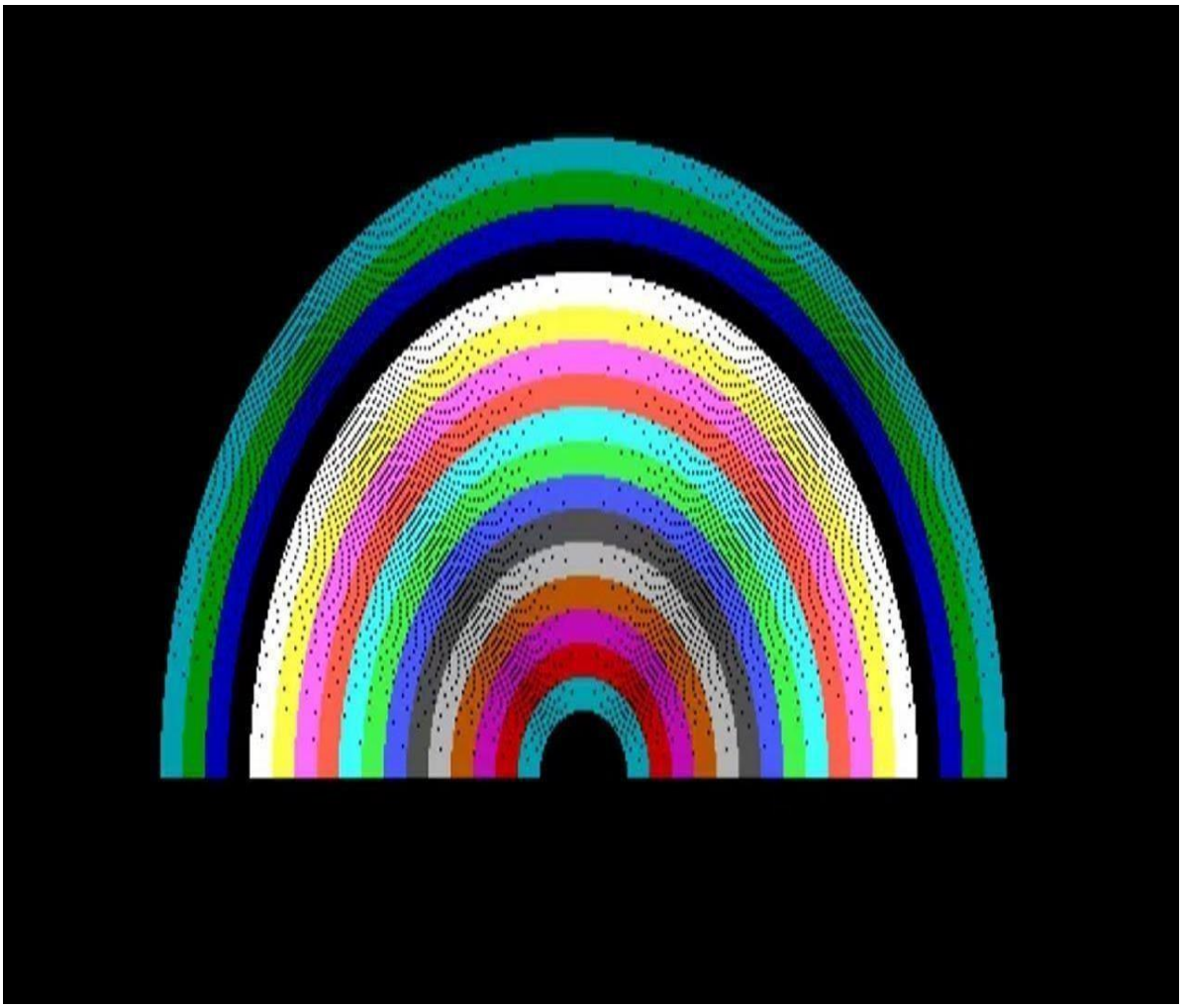


Fig 1.3.1
Rainbow

1.3 OBJECTIVE:

Computer graphics is the creation of pictures with the help of a computer.

1. The objective of our project is to understand the basic concepts of computer graphics with the help of C programming.
   To start with graphics programming, Turbo C is a good choice. Even though DOS has its own limitations, it is having a large number of useful functions and is easy to program.

2. Implementation of the algorithms studied in class.
   Graphics on the computer are produced by using various algorithms and techniques. For example, floodfill function is used to fill colour to an enclosed area.

3. To accustom ourselves with graphics and its logical coding.

4. Creation of primitives.
   In graphics, primitives are basic elements, such as lines, curves, and polygons, which can be combined to create more complex graphical images.

5. Make use of the built-in functions available in the graphics.h header file.
   The first step in any graphics program is to include graphics.h header file. Thegraphics.h header file provides access to a simple graphics library that makes itpossible to draw lines, rectangles, ovals, arcs, polygons, images, and strings on a graphical window.

6. Lastly to learn to implement animation to an object.
   Computer animation is the art of creating moving images via the use of computers. It is a subfield of computer graphics and animation.

2. LITERATURE SURVEY

2.1 LIMITATIONS OF EXISTING SYSTEM OR REASEARCH GAP

1. **Low frame rate which causes flickering of the screen.**

   As turbo c doesn't run natively in windows 10, it cannot render the frames efficiently. Turbo c was not fast enough in drawing the whole frame in enough time to have a proper frame.

   Moreover, using cleardevice() function after drawing each frame coupled with the low speed of drawing frame, overloaded the complier. Hence, this caused flickering of the screen and low frame rate.

2. **Limited colour options supported by complier**

   Turbo c supports only sixteen colours which are declared in graphics.h header file. These colours are used to set the current drawing colour, change the colour of background, change the colour of text, to colour a closed shape etc (Foreground and Background Colour).

   As the topic chosen for the project was to draw a rainbow, this became a major limitation, as the sixteen colours supported by turbo c do not even include the seven main colours of the rainbow.

3. **Static nature of clouds**

   Another major limitation imposed was the static nature of the clouds as making them dynamic would require clearing the screen and re-rendering the frame again and again, leading to the first limitation i.e., the flicking of the screen.

4. **Turbo C does not support modern 32-bit graphic method**

   As turbo c was introduced in 1987 by Borland and at that time it only supported 16 bits graphic. Hence, it supports only 16 colours and all the technology developed until 1987.

   As it is a 16-bit complier, it cannot take complete advantage of the current computing technology such as multi-threading. Thus, the complier is slow and does not support modern 32-bit graphic methods.

2.2 MINI PROJECT CONTRIBUTION

The whole group has actively participated in the making of the Rainbow Animation. The groups were divided into pairs of two one being Amisha and Sincee and the other pair being Mitali and Stepheny.

The project was divided into pair of two wherein the first pair being Amisha and Sincee programmed the Rain Scene. The second pair being Stepheny and Mitali programmed the Rainbow Scene. The topics of the report was also equally divided among all the group members.

3. PROPOSED SYSTEM

3.1 INTRODUCTION

The term “computer graphics” refers to anything involved in the creation or manipulation of images on a computer, including animated images. It is a very broad field, and one in which changes and advances seem to come at a dizzying pace.

Graphics today is used in many different areas. Graphics provides one of the most natural means of communicating within a computer, since our highly developed 2D and 3D pattern-recognition abilities allow us to perceive and process pictorial data rapidly and effectively. Interactive computer graphics is the most important means of producing pictures since the invention of photography and television. It has the added advantage that, with the computer, we can make pictures not only of concrete real-world objects but also of abstract, synthetic objects, such as mathematical surfaces and of data that have no inherent geometry, such as survey results.

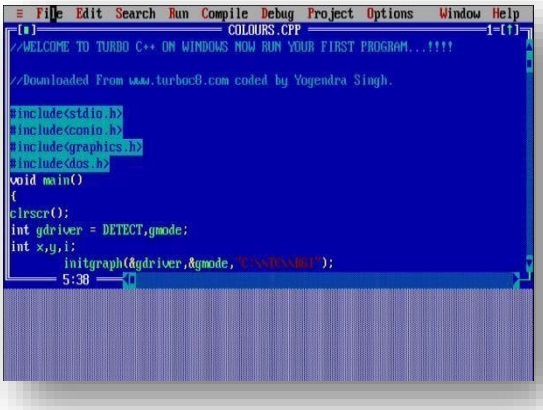
We have used computer graphics in a similar way for the mini project. The main motive of the project was to show the animation of ‘Rainbow’. To enhance the project other elements are added with the still picture being of that of house. The time lapse from rain time to that of appearance of the rainbow is also depicted.

The animation starts with raining and the appearance of rainbow. The background changes from a heavy rainy scene to a Rainbow scene. We have added colours such as blue for the sky, green for the grass, yellow for the sun as well as a light gray cloud in the first scene and white cloud in the second scene the animation. The rainbow than starts appearing after raining.

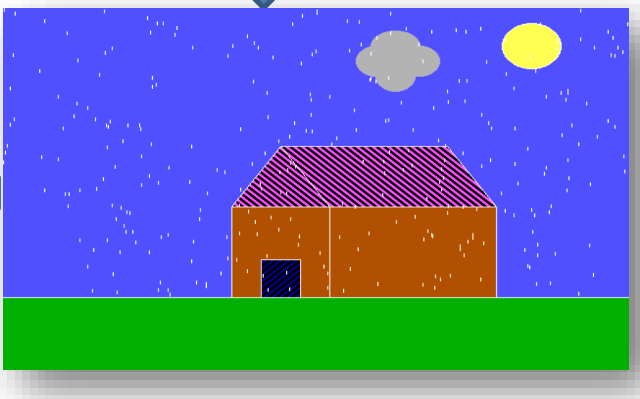
Throughout the animation the house is still at the centre-bottom so as the show the change of time at the same place. The software used for attempting all the above-mentioned details in the project is Turbo C. Turbo C is a software development tool for writing programsin the C language.

3.2 ARCHITECHTURE / FRAMEWORK

Run as C application

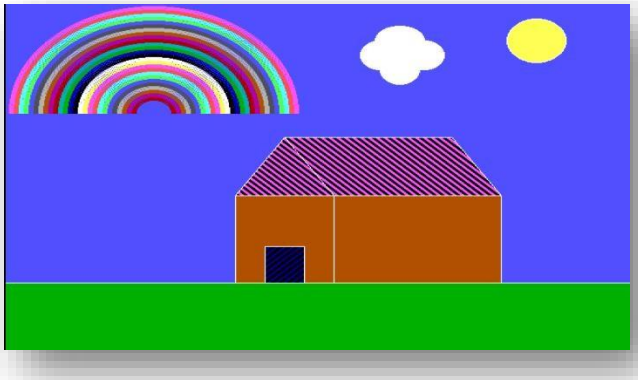


After running the code, a rainy scene is being displayed.

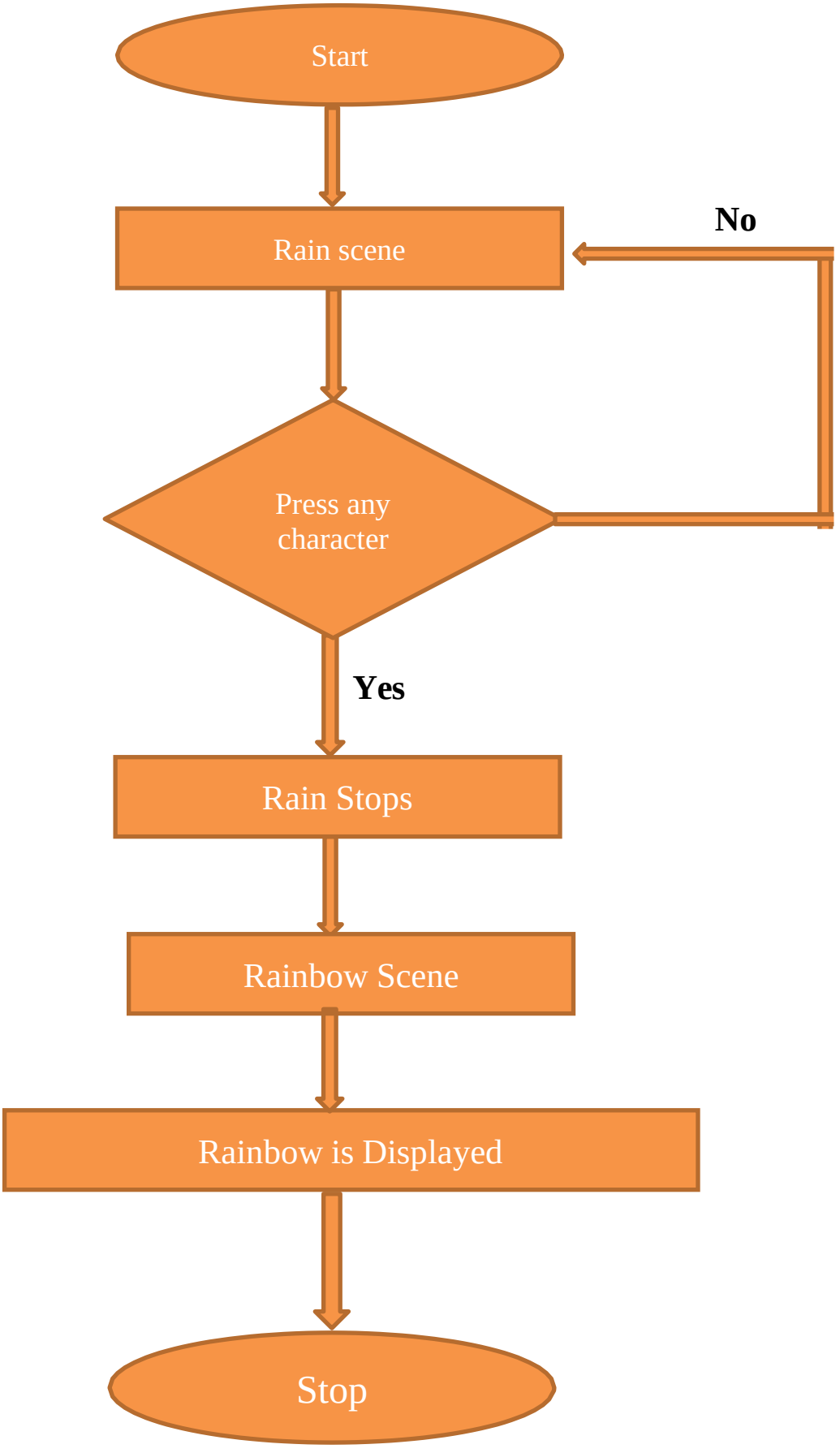


As the rain stops, in the rainbow scene a rainbow is appearing

A Rainbow is displayed as the final output.



3.3 ALGORITHM AND PROCESS DESIGN



3.4 DETAILS OF HARDWARE AND SOFTWARE

HAREDWARE REQUIREMENTS	
Minimum RAM size	5MB
Minimum Hard Drive Space	30 MB
Minimum Processor Type	Intel 386 or higher
Compiler Used	TURBO C++

Table 3.4.1
Hardware Requirements

SOFTWARE REQUIREMENTS	
Technology used	C Language & graphics.h library
OS Required	Microsoft DOS, Microsoft Windows 3.1 or later, PC DOS

Table 3.4.2
Software Requirements

3.5 EXPERIMENT AND RESULTS

In the project we have successfully implemented the rainbow animation and the two scenes mentioned in the problem statement using C language and pre-defined functions present in graphics.h header file.

Pre-Defined Function	Use
1) getmaxx()	The header file graphics.h contains getmaxx() function which returns the maximum X coordinate for current graphics mode and driver.
2) getmaxy()	The header file graphics.h contains getmaxy() function which returns the maximum Y coordinate for current graphics mode and driver.
3) setcolor()	The header file graphics.h contains setcolor() function which is used to set the current drawing color to the new color.
4) rectangle()	It is used to draw a rectangle. Coordinates of left top and right bottom corner are required to draw the rectangle. left specifies the X-coordinate of top left corner, top specifies the Y-coordinate of top left corner, right specifies the X-coordinate of right bottom corner, bottom specifies the Y-coordinate of right bottom corner.
5) line()	line function is used to draw a line from a point(x1,y1) to point(x2,y2) i.e. (x1,y1) and (x2,y2) are end points of the line
6) setfillstyle() and floodfill()	The header file graphics.h contains setfillstyle() function which sets the current fill pattern and fill color. floodfill() function is used to fill an enclosed area. Current fill pattern and fill color is used to fill the area.

7) circle()	The header file graphics.h contains circle() function which draws a circle with center at (x, y) and given radius.
8) rand()	It is used in C to generate random numbers. If we generate a sequence of random number with rand() function, it will create the same sequence again and again every time program runs.
10) delay()	delay function is used to suspend execution of a program for a particular time.
11) arc()	The header file graphics.h contains arc() function which draws an arc with center at (x, y) and given radius. start_angle is the starting point of angle and end_angle is the ending point of the angle. The value of the angle can vary from 0 to 360 degree.
12) kbhit()	Function kbhit in C is used to determine if a key has been pressed or not. To use it in a program you should include the header file "conio. h". If a key has been pressed, then it returns a non zero value otherwise it returns zero.

Table 3.5.1
Pre-Defined functions used

In the code we have implemented the following user defined functions:

hut()

cloud()

rainbow()

Rain()

SOURCE CODE:

```
#include<stdio.h>
#include<conio.h>
#include<graphics.h>

#define ScreenWidth getmaxx()
#define ScreenHeight getmaxy()
#define GroundY ScreenHeight*0.80



void hut(){
  setcolor(WHITE);
    rectangle(233,263,333,383);
    rectangle(333,263,503,383);
    rectangle(263,333,303,383);

    line(283,183,233,263);
    line(283,183,333,263);
    line(283,183,453,183);
    line(453,183,503,263);

    setfillstyle(SOLID_FILL, BROWN);
    floodfill(235, 265, WHITE);
    floodfill(335, 265, WHITE);

    setfillstyle(SLASH_FILL, BLUE);
    floodfill(265, 335, WHITE);

    setfillstyle(BKSLASH_FILL, LIGHTMAGENTA);
    floodfill(283, 188, WHITE);
    floodfill(293, 188, WHITE);
}
```

```
void Rain(int x)
{
int i,rx,ry;
for(i=0;i<400;i++)
{
 rx=rand() % ScreenWidth;
 ry=rand() % ScreenHeight;
 if(ry<GroundY-4)
 {
  if(ry<GroundY-120 || (ry>GroundY-120 && (rx<x-20 || rx>x+60)))
  line(rx,ry,rx+0.5,ry+4);
 }
}

}
void cloud()
{
setcolor(WHITE);
setfillstyle(SOLID_FILL,WHITE);
ellipse(400,50,0,180,25,20);
ellipse(425,70,260,90,20,20);
ellipse(400,90,180,360,20,20);
ellipse(380,70,90,270,20,20);
floodfill(400,80,WHITE);
}

void cloud1()
{
setcolor(LIGHTGRAY);
setfillstyle(SOLID_FILL,LIGHTGRAY);
ellipse(400,50,0,180,25,20);
ellipse(425,70,260,90,20,20);
ellipse(400,90,180,360,20,20);
ellipse(380,70,90,270,20,20);
floodfill(400,80,LIGHTGRAY);
}
```

```
void rainbow()
{
   int x, y, i;
//SUN
   circle(ScreenWidth-100,50,30);
   setfillstyle(SOLID_FILL, YELLOW);
   floodfill(ScreenWidth-100, 50, WHITE);


  hut();
   x = getmaxx() / 2;
   y = getmaxy() /2;


   for (i=20; i<150; i++)
   {
         delay(100);
         setcolor(i/5);
         arc(150, 150, 0, 180, i-2);
   }
   getch();
}


void main()
{
 int gd=DETECT,gm,x=0;
 initgraph(&gd,&gm,"C:\\TurboC3\\BGI");
 while(!kbhit())
 {
   //LINE BTW SKY AND GRASS
line(0,getmaxy()*0.80, getmaxx(),getmaxy()*0.80);
 //SKY
 setfillstyle(SOLID_FILL,LIGHTBLUE);
 floodfill(0,0,WHITE);
```

```
 //GRASS
 setfillstyle(SOLID_FILL,GREEN);
floodfill(getmaxx(),getmaxy(),WHITE);

     circle(ScreenWidth-100,50,30);
    setfillstyle(SOLID_FILL, YELLOW);
    floodfill(ScreenWidth-100, 50, WHITE);

//cloud();
  cloud1();
  hut();

   line(0,GroundY,ScreenWidth,GroundY);
   Rain(x);

 delay(500);
   cleardevice();
   x=(x+2)%ScreenWidth;
}

  cloud();
//LINE BTW SKY AND GRASS
line(0,getmaxy()*0.80, getmaxx(),getmaxy()*0.80);

 //GRASS
 setfillstyle(SOLID_FILL,GREEN);
floodfill(getmaxx(),getmaxy(),WHITE);

 //SKY
 setfillstyle(SOLID_FILL,LIGHTBLUE);
 floodfill(0,0,WHITE);
  rainbow();
  getch();
}
```

Scene 1:

Fig 3.5.1
Rain Scene

Scene 2:

Fig 3.5.2
Rainbow Scene

3.6 CONCLUSION AND FUTURE WORK:

The project ended up being a great learning experience for us, we got to learn about the graphicheaders and the powerful tools in c language. We also got the opportunity to use a turbo C ide to develop this animation. This animation was depicting the complete cycle of the formation of the Rainbow.

We used multiple function as Bresenham's line drawing algorithm, Flood fill algorithm, Mid- point circle generation algorithm and Mid-point ellipse drawing algorithm and many more for creatingthe various elements of the animation.

We would further like to improve in this by add more audiovisual effects, animations and reducing latency of the animation.

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