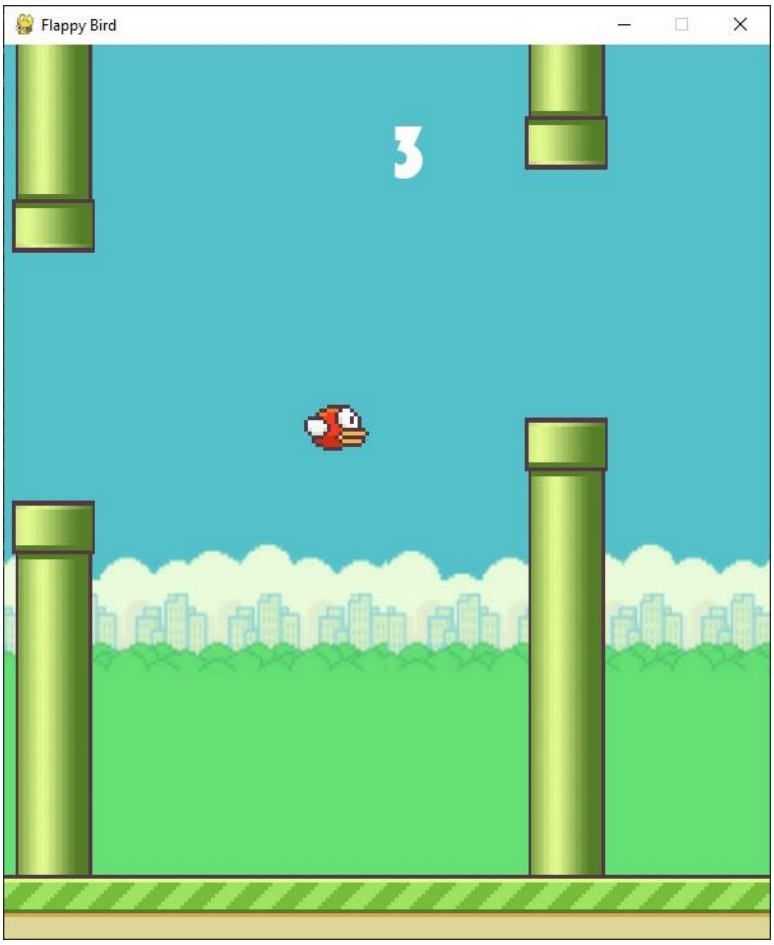

2D BIRD FLAPPING GAME ANIMATION

B.TECH MATHEMATICS AND COMPUTING
(PROGRAMING IN C)

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PROBLEM STATEMENT:

Challenge to develop a simple 2D animation system in the C programming language using external graphic library

ABOUT THE PROJECT

A simple interactive graphic based 2D flapping bird animation implemented in C programing language using Cairo graphic library

Unlike the original real time version, this uses input move sequence to control bird's motion.

The user provides commands such as UP & DOWN

The project demonstrates

- 2D graphics in C.
- Frame by Frame animation.
- User driven animation.

OBJECTIVE OF THE PROJECT

- To understand how to integrate C with external graphic libraries.
- To draw shape using Cairo.
- To stimulate object movement frame by frame.
- To implement basic collision detection.
- To export animation frames as PNG files.
- To convert PNG files into a animated video
- To demonstrate structured programming, function and use of struct in C.

ALGORITHM OF THE PROGRAM:

1) START

2) Define structs for bird and obstacle

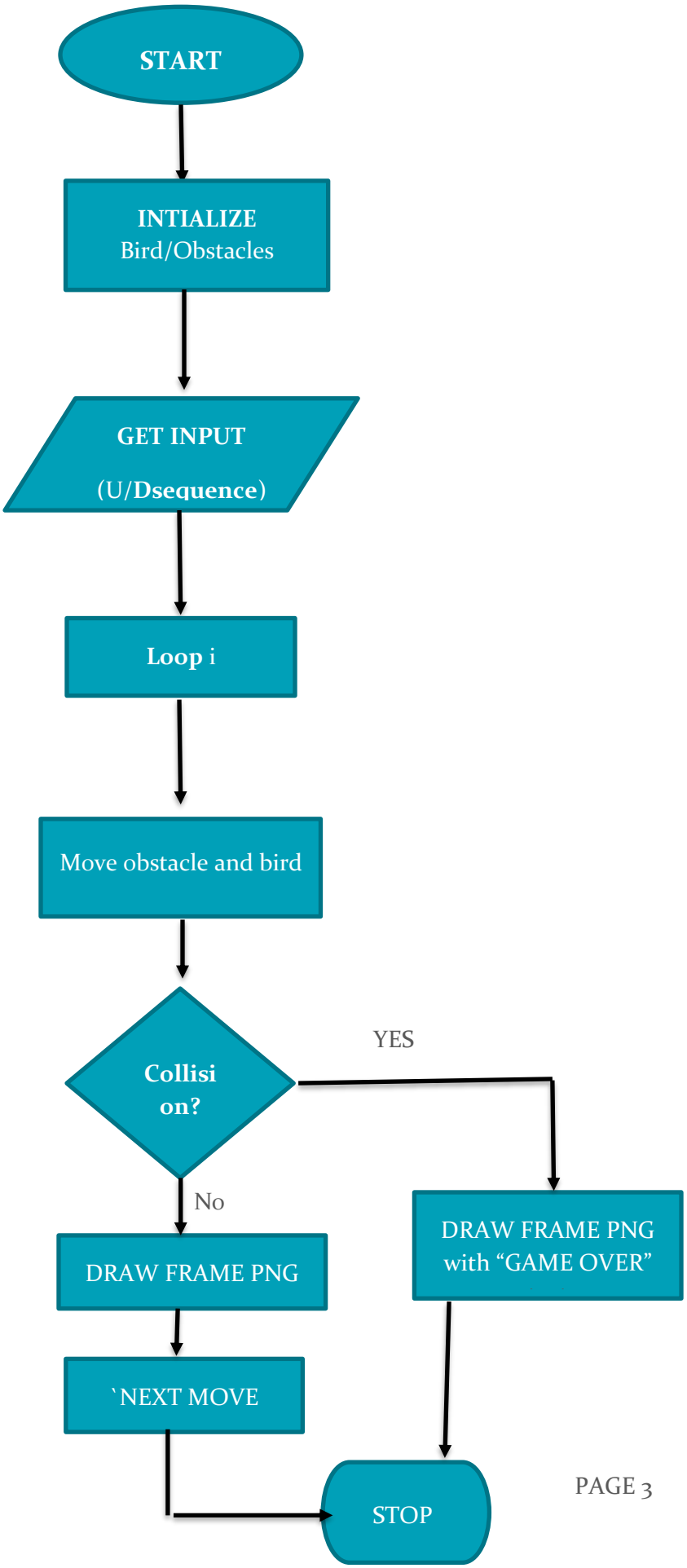
3) Intialize bird and obstacle position

4) Ask user to enter movement sequence(U/D)
   ,
5) For each movement
   - Adjust bird speed based on previous movement
   - Move bird UP/DOWN
   - Move obstacle left
   - Check for collision
   - Draw and save frame

6) If collision occur
   - Display “GAME OVER”
   - Stop animation

7) End

FLOWCHART→


START
INTIALIZE
Bird/Obstacles
GET INPUT
(U/Dsequence)
Loop i
Move obstacle and bird
Collisi
on?
YES
No
DRAW FRAME PNG
with "GAME OVER"
DRAW FRAME PNG
`NEXT MOVE
STOP

Tools and technology used:

PROGRAMMING LANGUAGE: C

Concept used	Used for	Function
Function and Modularization	Draw, Update, collision, callback	Break the game into smaller task like drawing, updating and collision
Arrays	Pipe positions	Store multiple pipe Position and update them together (Can be used in future enhancement for now I have only added 1 obstacle)
Control Statement(If/Else)	Collision, Bird movement, Reset	Make decision like collision, Movement score, and game over
Loops	Pipe movement, Drawing, Game loop	Repeat action(move pipes, Draw frame, update game)
Structures	Bird,pipes	Group bird/pipe properties in on unit
Pointers	Cairo, Struct access	Used for cairo and to modify Data across
Dynamic Memory allocation	Malloc for Pipes/struct	Create Dynamic array when size isn't fixed

LIBRARY :

1. **Cairo graphic libray(cairo/cairo.h):** A powerful 2D graphic library. These functions are used to create surface, shapes,apply colour

Functions used:

SURFACE CREATION

cairo_image_surface_create(): Creates a surface where all drawing operation are performed.

cairo_create(): Creates drawing context.

DRAWING AND COLOURING

cairo_set_source_rgb(): Sets colour using RGB values.

cairo_paint(): Fills entire canvas.

cairo_rectangle(): Draws rectangular shape

cairo_arc(): Draw circular shape

cairo_fill(): Fills defined shapes.

TEXT RENDERING

cairo_select_font_face():Select font

cairo_set_font_size():Set size of text

Cairo_move_to():Set position

cairo_show_text():Renders text

SAVING AND CLEANING

cairo_surface_write_to_png()

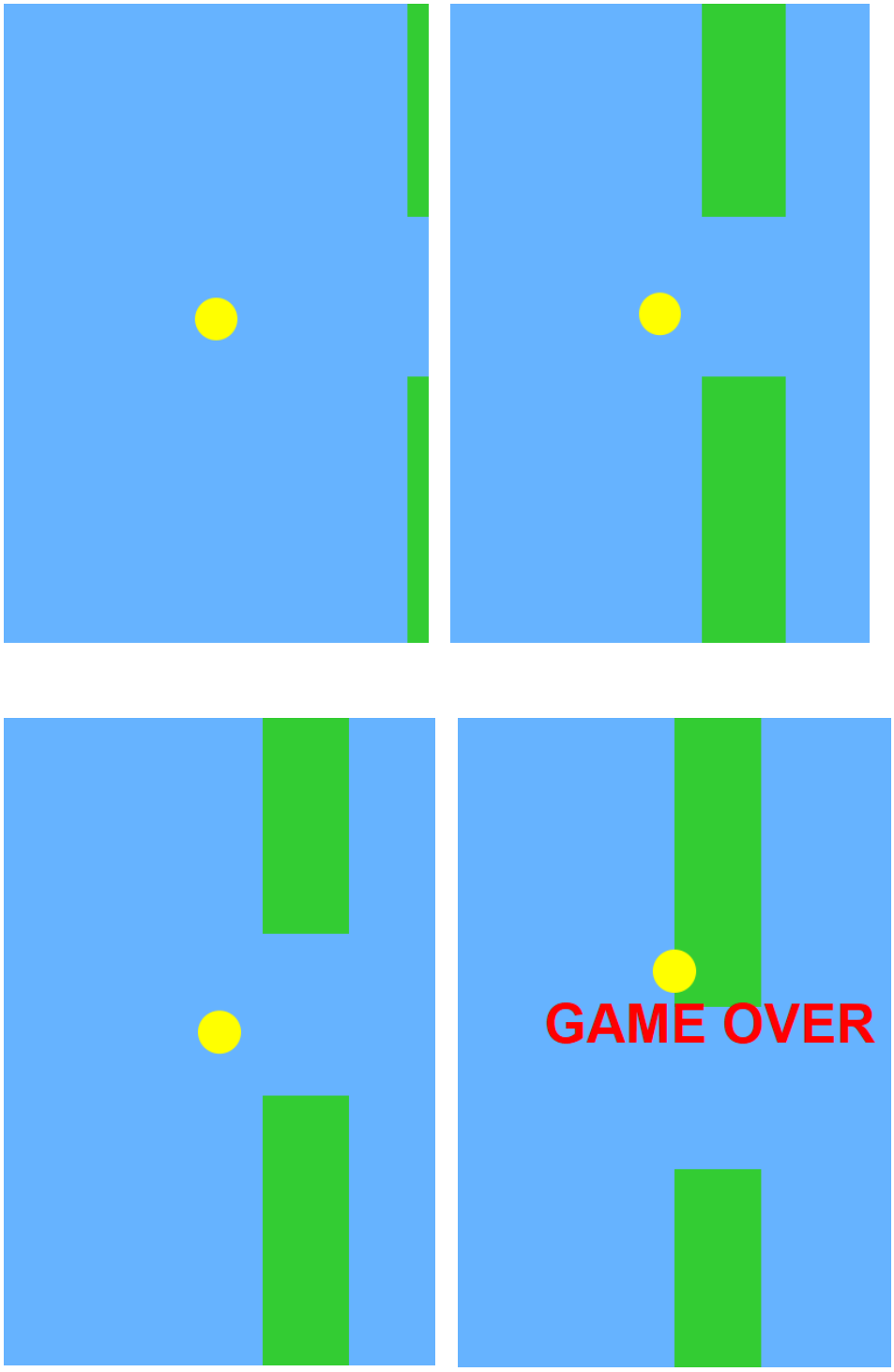
cairo_destroy()

cairo_surface_destroy()

2. **Stdio.h standard input/output library**
    - Function used:
    - printf(): Print messages and instruction to user.
    - scanf(): Read movement sequence (U/D) entered by user.
    - sprint(): Generates file name.
3. **stdlib.h standard library**
    - Function used:
    - rand(): Generates random value for vertical position of obstacle gaps
4. **String.h String handling library**
    - Strlen():Returns length of user input string

OUTPUT

Few Frames:



PNG FILES TO VIDEO

Used ffmpeg to convert PNG FILES into video

FFmpeg is a powerful, open source multimedia tool used to process video files

```
printf("Animation frames generated successfully.\n");
system("cmd /c \"ffmpeg -y -framerate 60 -i frame_%03d.png -pix_fmt yuv420p flappy_video.mp4\"");
return 0;
```

RESULT:

The program successfully

- Accept user input movement
- Move the bird and obstacles accordingly
- Detects collision
- Generate smooth animation frame using Cairo
- Display game over message when required

CONCLUSION:

This project uses the C programming language along with cairo graphic library to create simple 2D animation. It applies fundamental programing concept such as structures ,loops, function, and use of external libraries to generate visual outputs. The program also provides practical experience with collision detection, drawing graphic, updating object position and handling basic animation logic.

ADVANTAGES

- Real time animation
- Uses C graphic

- Teaches event-driven programming
- Modular and clean code
- Beginner friendly game logic

LIMITATION

- Limited and very simple graphic
- No sound
- No Menu screen
- No difficulty level

FUTURE ENHANCEMENT

- Add score counter
- Add sound effect
- Include gravity
- Use sprite images instead of shapes
- Render animation on window

REFRENEECES

https://www.cairographics.org/tutorial/

https://www.geeksforgeeks.org/c-programming-language/