

Game of Life

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Chapter 1

Game of Life by David Zoller

1.1 Introduction

This is a Game of Life simulator implemented in C using the SDL2 library for graphics. It is made as a project for the Programming 1 course at the Budapest University of Technology and Economics. The Game of Life is a cellular automaton devised by the British mathematician John Horton Conway in 1970. The simulator allows users to create, save, and load different game states, and control the simulation with play, pause, step forward, and step back functions.

1.2 Structure

The project is structured into several modules:

- Graphics: Handles all the graphical output using the SDL2 library.
- [Menu](#): Handles the main menu where users can create, load, and save games.
- [gameWindow](#): Handles the window where the Game of Life simulation is displayed and controlled.
- GameArea: Represents the game area where the cells live.
- File: Handles file operations for saving and loading game states.
- Color: Defines the color theme used in the graphics.
- Dither: Provides functions for dithering colors.
- Error: Provides functions for error handling.

1.3 Installation

The project uses the SDL2 and gcc libraries, which need to be installed before building the project. The project can be built using the build.sh script. The project can be run running the main GameOfLife executable. They should be run from directory where they are located.

Chapter 2

Data Structure Index

2.1 Data Structures

Here are the data structures with brief descriptions:

Color_theme	A structure representing a color theme with five colors	7
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gameArea	Represents the game area and its properties	8
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Chapter 3

File Index

3.1 File List

Here is a list of all documented files with brief descriptions:

Color.h	This file contains color-related structures and functions	13
Dither.h	This file contains functions for generating and deallocating a Bayer matrix for ordered dithering	16
Error.h	This file contains error handling macros and functions	19
File.h	File operations for the game	22
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gameWindow.h	This file contains the structures and functions for the game window	29
Graphics.h	This file contains code used for graphics	34
Menu.h	This file contains the structures and functions for the menu window	39
main.c	Main file for the Game of Life simulator	43

Chapter 4

Data Structure Documentation

4.1 Color_theme Struct Reference

A structure representing a color theme with five colors.

```
#include <Color.h>
```

Data Fields

- SDL_Color [prim](#)
- SDL_Color [primacc](#)
- SDL_Color [sec](#)
- SDL_Color [secacc](#)
- SDL_Color [bg](#)

4.1.1 Detailed Description

A structure representing a color theme with five colors.

4.1.2 Field Documentation

4.1.2.1 bg

```
SDL_Color Color_theme::bg
```

Background color of the theme

4.1.2.2 prim

```
SDL_Color Color_theme::prim
```

Primary color of the theme

4.1.2.3 primacc

```
SDL_Color Color_theme::primacc
```

Primary accent color of the theme

4.1.2.4 sec

```
SDL_Color Color_theme::sec
```

Secondary color of the theme

4.1.2.5 secacc

```
SDL_Color Color_theme::secacc
```

Secondary accent color of the theme

4.2 Fgame_file Struct Reference

Structure representing a game file.

```
#include <File.h>
```

Data Fields

- **char * path**
Path to the game file.
- **SDL_Rect location**
Location of the opening button on screen.

4.2.1 Detailed Description

Structure representing a game file.

4.3 gameArea Struct Reference

Represents the game area and its properties.

```
#include <gameArea.h>
```

Data Fields

- **size_t w**
Width of the game area.
- **size_t h**
Height of the game area.
- **uint8_t ** area**
Array representing the game area, least significant bit is the current state, from that the next 7 bits are the history of the cell.
- **uint8_t history_length**
History length of the game area, maximum 7.

4.3.1 Detailed Description

Represents the game area and its properties.

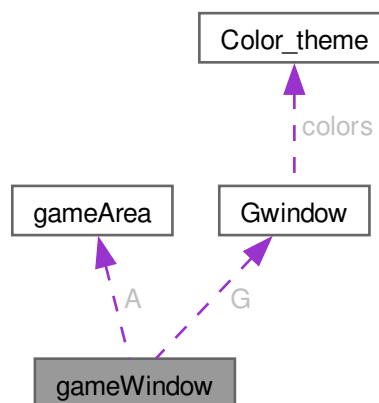
This structure should only be created with a function, and must be deleted with the Afree function.

4.4 gameWindow Struct Reference

Represents the game window and its properties.

```
#include <gameWindow.h>
```

Collaboration diagram for gameWindow:



Data Fields

- [gameArea](#) **A**
The game area.
- [Gwindow](#) **G**
The graphics window.
- char * **name**
The name of the game window.
- SDL_Texture * **pre_rendered_cells**
The pre-rendered cells.
- double **zoom**
The zoom level.
- ssize_t **x_screen_offset**
The x-coordinate screen offset.
- ssize_t **y_screen_offset**
The y-coordinate screen offset.
- SDL_TimerID **autoplay_id**
The autoplay timer ID.
- Uint32 **autoplay_delay**
The autoplay delay.

4.4.1 Detailed Description

Represents the game window and its properties.

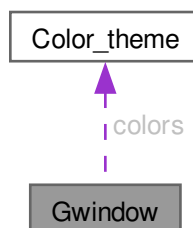
This structure should only be created with a function, and must be deleted with the Wclose function.

4.5 Gwindow Struct Reference

Represents the graphics window and its properties.

```
#include <Graphics.h>
```

Collaboration diagram for Gwindow:



Data Fields

- `SDL_Window * win`
The SDL window.
- `SDL_Renderer * ren`
The SDL renderer.
- `size_t w`
- `size_t h`
The width and height of the window.
- `TTF_Font * font_big`
The font used for the title.
- `TTF_Font * font_reg`
The font used for regular text.
- `Color_theme colors`
The color theme.

4.5.1 Detailed Description

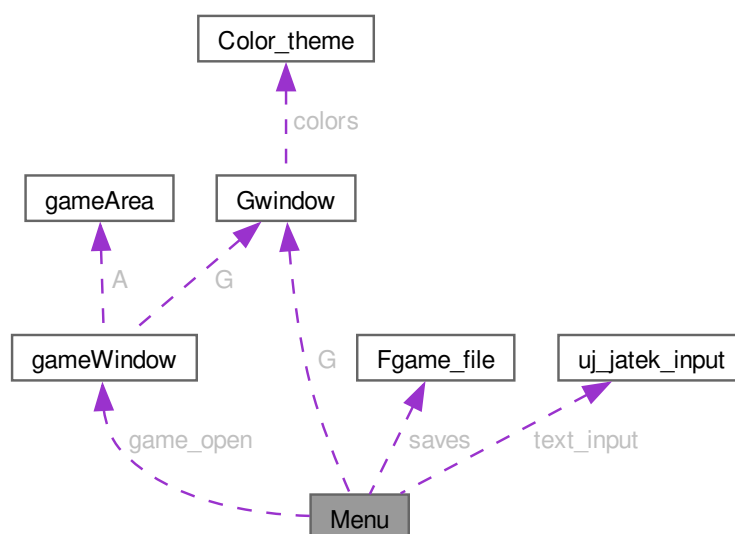
Represents the graphics window and its properties.

4.6 Menu Struct Reference

Represents the menu and its properties.

```
#include <Menu.h>
```

Collaboration diagram for Menu:



Data Fields

- [Gwindow](#) **G**
The graphics window.
- [Fgame_file](#) * **saves**
The saved games.
- `size_t` **save_cnt**
The count of saved games.
- [gameWindow](#) **game_open**
The open game window.
- [uj_jatek_input](#) **text_input**
The input for a new game.

4.6.1 Detailed Description

Represents the menu and its properties.

This structure should only be created with Minit, and must be deleted with the Mclose function.

4.7 uj_jatek_input Struct Reference

Represents the input for a new game.

```
#include <Menu.h>
```

Data Fields

- `char` **name** [INPUT_MAX LENGHT+4]
The name of the new game.
- `SDL_Rect` **name_rct**
The text box for the name input.
- `char` **width** [INPUT_MAX LENGHT]
The width of the new game.
- `SDL_Rect` **width_rct**
The text box for the width input.
- `char` **height** [INPUT_MAX LENGHT]
The height of the new game.
- `SDL_Rect` **height_rct**
The text box for the height input.
- `SDL_Rect` **button**
The bounding box for the new game button.

4.7.1 Detailed Description

Represents the input for a new game.

Chapter 5

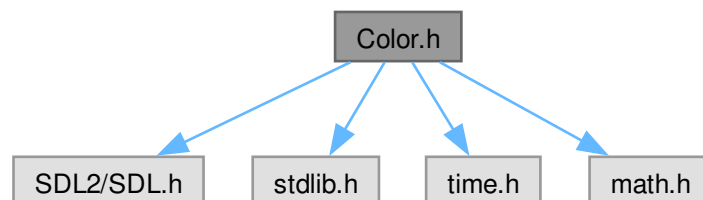
File Documentation

5.1 Color.h File Reference

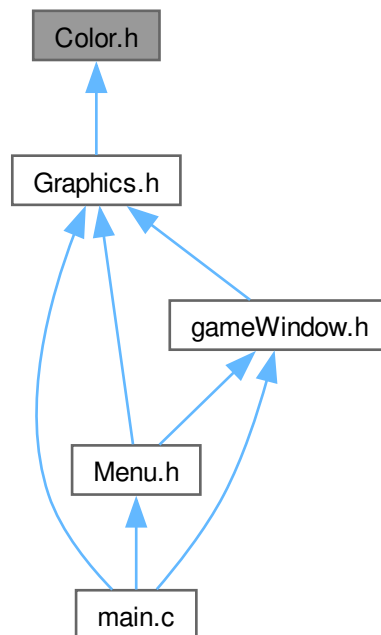
This file contains color-related structures and functions.

```
#include <SDL2/SDL.h>
#include <stdlib.h>
#include <time.h>
#include <math.h>
```

Include dependency graph for Color.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct [Color_theme](#)
A structure representing a color theme with five colors.

Typedefs

- typedef enum [Colortype](#) **Colortype**
- typedef struct [Color_theme](#) **Color_theme**

Enumerations

- enum [Colortype](#) { [primary](#) , [secondary](#) , [primary_accent](#) , [secondary_accent](#) }
An enumeration representing different color types for rendering.

Functions

- [Color_theme Cinit](#) ()
Initializes a [Color_theme](#) with a dynamically generated color scheme.

5.1.1 Detailed Description

This file contains color-related structures and functions.

5.1.2 Enumeration Type Documentation

5.1.2.1 Colortype

```
enum Colortype
```

An enumeration representing different color types for rendering.

Enumerator

primary	Primary color type
secondary	Secondary color type
primary_accent	Primary accent color type
secondary_accent	Secondary accent color type

5.1.3 Function Documentation

5.1.3.1 Cinit()

```
Color_theme Cinit ( )
```

Initializes a [Color_theme](#) with a dynamically generated color scheme.

Remarks

This function initializes a [Color_theme](#) structure with dynamically generated colors based on a random hue value that has a higher probability to be a warm color. From this hue, a complement color is generated for the secondary. The function ensures that if called multiple times, it returns the same theme.

Returns

A [Color_theme](#) structure representing the generated color scheme.

5.2 Color.h

[Go to the documentation of this file.](#)

```
00001 #ifndef COLOR_H
00002 #define COLOR_H
00003
00004 #include <SDL2/SDL.h>
00005 #include <stdlib.h>
00006 #include <time.h>
00007 #include <math.h>
00008
00018 typedef enum Colortype
00019 {
00020     primary,
```

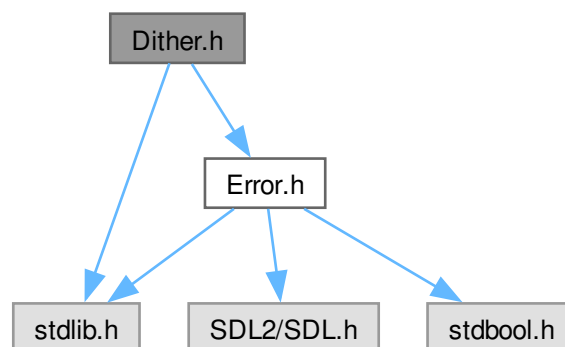
```
00021     secondary,  
00022     primary_accent,  
00023     secondary_accent  
00024 } Colortype;  
00025  
00030 typedef struct Color_theme {  
00031     SDL_Color prim;  
00032     SDL_Color primacc;  
00033     SDL_Color sec;  
00034     SDL_Color secacc;  
00035     SDL_Color bg;  
00036 } Color_theme;  
00037  
00047 Color_theme Cinit();  
00048  
00049 #endif
```

5.3 Dither.h File Reference

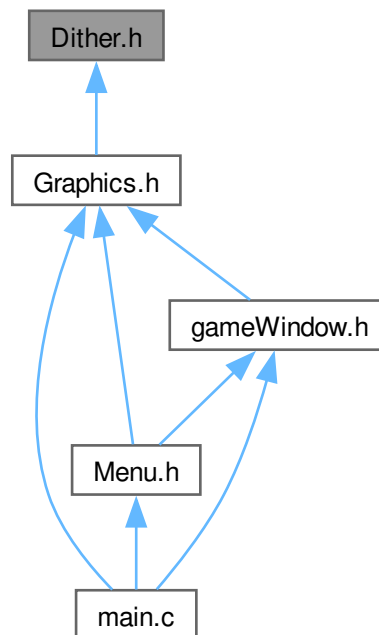
This file contains functions for generating and deallocating a Bayer matrix for ordered dithering.

```
#include <stdlib.h>  
#include "Error.h"
```

Include dependency graph for Dither.h:



This graph shows which files directly or indirectly include this file:



Functions

- `size_t ** Dgenerate_bayer_matrix (size_t n)`
Generates a Bayer matrix for ordered dithering.
- `void Dfree_bayer_matrix (size_t **matrix)`
Deallocates memory used by a Bayer matrix.

5.3.1 Detailed Description

This file contains functions for generating and deallocating a Bayer matrix for ordered dithering.

Pre-renders cells in the graphics window.

Parameters

<i>window</i>	Pointer to the game window.
---------------	-----------------------------

Returns

The texture of the pre-rendered cells.

Remarks

It uses the ordered dithering algorithm to render the fading effect.

5.3.2 Function Documentation**5.3.2.1 Dfree_bayer_matrix()**

```
void Dfree_bayer_matrix (
    size_t ** matrix )
```

Deallocates memory used by a Bayer matrix.

This function deallocates the memory used by a Bayer matrix that was generated by Dgenerate_bayer_matrix.

Parameters

<i>matrix</i>	The Bayer matrix to be freed. It should be a valid pointer to a Bayer matrix generated by Dgenerate_bayer_matrix.
---------------	---

5.3.2.2 Dgenerate_bayer_matrix()

```
size_t ** Dgenerate_bayer_matrix (
    size_t n )
```

Generates a Bayer matrix for ordered dithering.

This function generates a Bayer matrix of size $n \times n$. The generated matrix is used for ordered dithering.

Parameters

<i>n</i>	The side length of the matrix. It should be a power of 2.
----------	---

Returns

A new Bayer matrix of size $n \times n$. Memory deallocation with Dfree_bayer_matrix is the caller's responsibility.

5.4 Dither.h

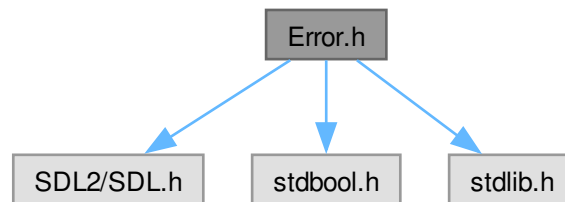
[Go to the documentation of this file.](#)

```
00001
00006 #ifndef DITHER_H
00007 #define DITHER_H
00008
00009 #include <stdlib.h>
00010 #include "Error.h"
00011
00020 size_t **Dgenerate_bayer_matrix(size_t n);
00021
00029 void Dfree_bayer_matrix(size_t **matrix);
00030
00031 #endif
```

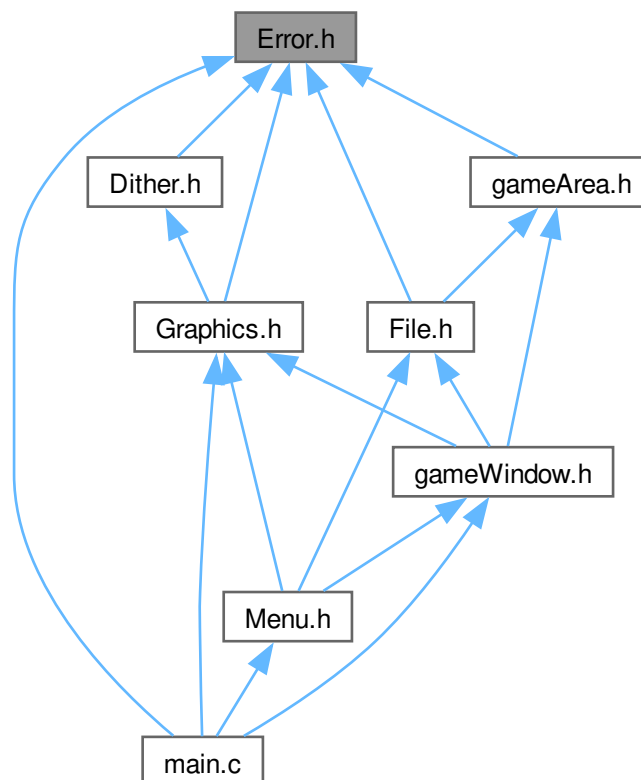

5.5 Error.h File Reference

This file contains error handling macros and functions.

```
#include <SDL2/SDL.h>
#include <stdbool.h>
#include <stdlib.h>
Include dependency graph for Error.h:
```



This graph shows which files directly or indirectly include this file:



Macros

- `#define ErrorIfTrue(test, error_msg) ErrorIfTrue_with_params(test, error_msg, __FILE__, __LINE__);`
Checks if the test is true and if so, triggers an error with the provided message.
- `#define ErrorIfNull(ptr, error_msg) ErrorIfTrue_with_params(ptr == NULL, error_msg, __FILE__, __LINE__);`
Checks if the pointer is null and if so, triggers an error with the provided message.
- `#define ErrorIfSdl(func_with_negative_error) ErrorIfTrue_with_params(func_with_negative_error < 0, "SDL hiba!", __FILE__, __LINE__);`
Checks if the SDL function returned a negative error code and if so, triggers an SDL error.
- `#define ErrorIfNoMemory(ptr) ErrorIfTrue_with_params(ptr == NULL, "Nincs eleg memoria!", __FILE__, __LINE__);`
Checks if the pointer is null due to insufficient memory and if so, triggers an error.

Functions

- `void ErrorIfTrue_with_params (bool test, char *error_msg, char *FILE, int LINE)`
Checks if the test is true and if so, triggers an error with the provided message, file name, and line number.

5.5.1 Detailed Description

This file contains error handling macros and functions.

5.5.2 Macro Definition Documentation

5.5.2.1 ErrorIfNoMemory

```
#define ErrorIfNoMemory(  
    ptr ) ErrorIfTrue_with_params(ptr == NULL, "Nincs eleg memoria!", __FILE__, __LINE__);
```

Checks if the pointer is null due to insufficient memory and if so, triggers an error.

Parameters

<i>ptr</i>	The pointer to check.
------------	-----------------------

5.5.2.2 ErrorIfNull

```
#define ErrorIfNull(  
    ptr,  
    error_msg ) ErrorIfTrue_with_params(ptr == NULL, error_msg, __FILE__, __LINE__);
```

Checks if the pointer is null and if so, triggers an error with the provided message.

Parameters

<i>ptr</i>	The pointer to check.
<i>error_msg</i>	The error message to display if the pointer is null.

5.5.2.3 ErrorIFsdl

```
#define ErrorIFsdl(
    func_with_negative_error ) ErrorIFtrue_with_params(func_with_negative_error < 0,
"SDL hiba!", __FILE__, __LINE__);
```

Checks if the SDL function returned a negative error code and if so, triggers an SDL error.

Parameters

<i>func_with_negative_error</i>	The SDL function to check.
---------------------------------	----------------------------

5.5.2.4 ErrorIFtrue

```
#define ErrorIFtrue(
    test,
    error_msg ) ErrorIFtrue_with_params(test, error_msg, __FILE__, __LINE__);
```

Checks if the test is true and if so, triggers an error with the provided message.

Parameters

<i>test</i>	The condition to check.
<i>error_msg</i>	The error message to display if the test is true.

5.5.3 Function Documentation

5.5.3.1 ErrorIFtrue_with_params()

```
void ErrorIFtrue_with_params (
    bool test,
    char * error_msg,
    char * FILE,
    int LINE )
```

Checks if the test is true and if so, triggers an error with the provided message, file name, and line number.

Parameters

<i>test</i>	The condition to check.
<i>error_msg</i>	The error message to display if the test is true.
<i>FILE</i>	The file name where the error occurred.
<i>LINE</i>	The line number where the error occurred.

5.6 Error.h

[Go to the documentation of this file.](#)

```

00001
00006 #ifndef ERROR_H
00007 #define ERROR_H
00008
00009 #include <SDL2/SDL.h>
00010 #include <stdbool.h>
00011 #include <stdlib.h>
00012
00019 #define ErrorIFtrue(test, error_msg) ErrorIFtrue_with_params(test, error_msg, __FILE__, __LINE__);
00020
00027 #define ErrorIFnull(ptr, error_msg) ErrorIFtrue_with_params(ptr == NULL, error_msg, __FILE__,
    __LINE__);
00028
00034 #define ErrorIFsdl(func_with_negative_error) ErrorIFtrue_with_params(func_with_negative_error < 0,
    "SDL hiba!", __FILE__, __LINE__);
00035
00041 #define ErrorIFnoMemory(ptr) ErrorIFtrue_with_params(ptr == NULL, "Nincs eleg memoria!", __FILE__,
    __LINE__);
00042
00050 void ErrorIFtrue_with_params(bool test, char* error_msg, char* FILE, int LINE);
00051
00052 #endif

```

5.7 File.h File Reference

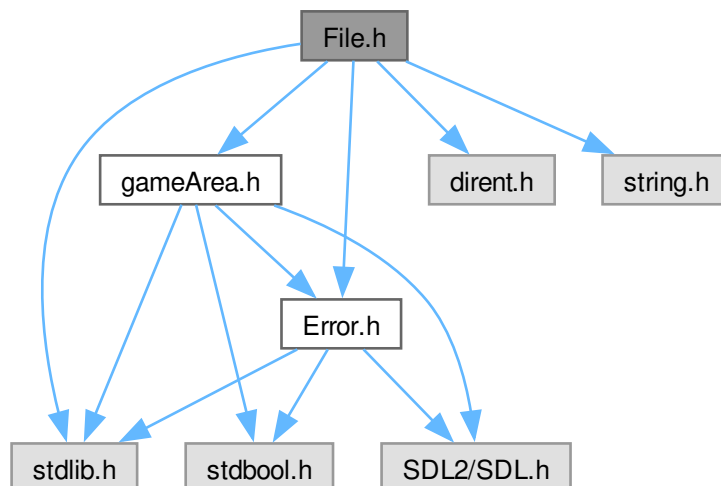
File operations for the game.

```

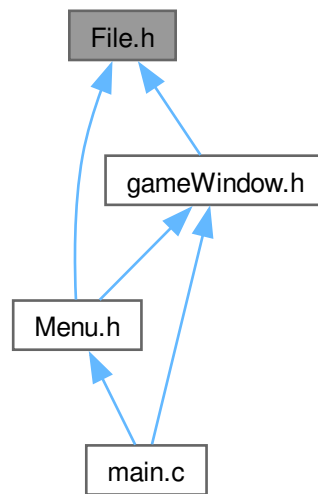
#include <stdlib.h>
#include <dirent.h>
#include <string.h>
#include "Error.h"
#include "gameArea.h"

```

Include dependency graph for File.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct [Fgame_file](#)
Structure representing a game file.

Macros

- `#define SAVES_FOLDER "saved/"`
Directory for saved games.

Typedefs

- typedef struct [Fgame_file](#) **Fgame_file**
Structure representing a game file.

Functions

- [gameArea Fopen](#) (char *path)
Opens a game file.
- void [Fsave](#) (char *path, [gameArea](#) *gamearea)
Saves a game area to a file.
- size_t [Flist](#) ([Fgame_file](#) games[], size_t max_count)
Lists game files.

5.7.1 Detailed Description

File operations for the game.

5.7.2 Function Documentation

5.7.2.1 Flist()

```
size_t Flist (
    Fgame_file games[],
    size_t max_count )
```

Lists game files.

Parameters

<i>games</i>	Array of game files.
<i>max_count</i>	Maximum number of game files to list.

Returns

The number of game files listed.

5.7.2.2 Fopen()

```
gameArea Fopen (
    char * path )
```

Opens a game file.

Parameters

<i>path</i>	Path to the game file.
-------------	------------------------

Returns

The game area.

5.7.2.3 Fsave()

```
void Fsave (
    char * path,
    gameArea * gamearea )
```

Saves a game area to a file.

Parameters

<i>path</i>	Path to the game file.
<i>gamearea</i>	Pointer to the game area to save.

5.8 File.h

[Go to the documentation of this file.](#)

```

00001
00006 #ifndef FILE_H
00007 #define FILE_H
00008
00009 #include <stdlib.h>
00010 #include <dirent.h>
00011 #include <string.h>
00012
00013 #include "Error.h"
00014 #include "gameArea.h"
00015
00016 #define SAVES_FOLDER "saved/"
00017
00021 typedef struct Fgame_file{
00022     char *path;
00023     SDL_Rect location;
00024 } Fgame_file;
00025
00031 gameArea Fopen(char *path);
00032
00038 void Fsave(char *path, gameArea *gamearea);
00039
00046 size_t Flist(Fgame_file games[], size_t max_count);
00047
00048 #endif

```

5.9 gameArea.h File Reference

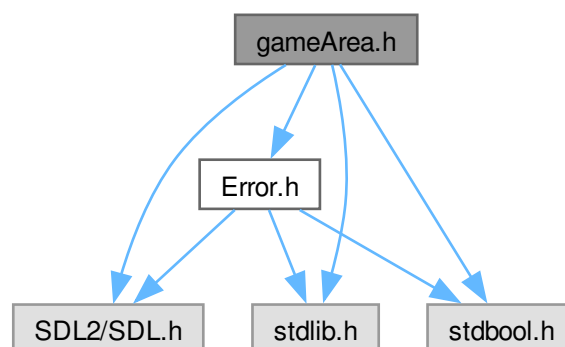
This file contains the structures and functions for the [gameArea](#).

```

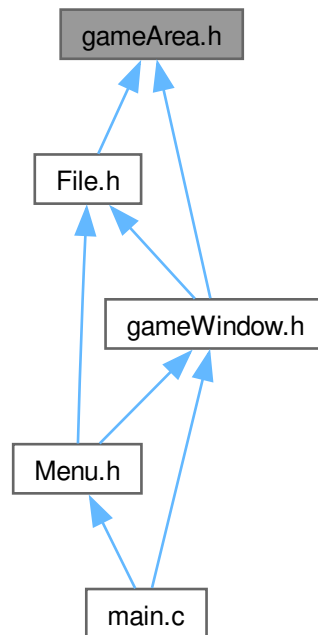
#include <SDL2/SDL.h>
#include <stdlib.h>
#include <stdbool.h>
#include "Error.h"

```

Include dependency graph for gameArea.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct [gameArea](#)
Represents the game area and its properties.

Typedefs

- typedef struct [gameArea](#) **gameArea**

Functions

- [gameArea Anew](#) (size_t width, size_t height)
Creates a new game area.
- void [Aclear](#) ([gameArea](#) *gamearea)
Clears the game area.
- void [Afree](#) ([gameArea](#) *gamearea)
Frees the memory allocated for the game area.
- ssize_t [Agetage](#) (uint8_t cell)
Gets the age of a cell.
- void [Astep](#) ([gameArea](#) *A)
Advances the simulation by one step.
- bool [Aback](#) ([gameArea](#) *A)
Steps back the simulation by one step.
- void [Aflipcell](#) ([gameArea](#) *A, double x, double y)
Flips a cell in the game area.

5.9.1 Detailed Description

This file contains the structures and functions for the [gameArea](#).

5.9.2 Function Documentation

5.9.2.1 Aback()

```
bool Aback (
    gameArea * A )
```

Steps back the simulation by one step.

Parameters

<i>A</i>	Pointer to the game area to step back.
----------	--

Returns

True if successful, false otherwise.

5.9.2.2 Aclear()

```
void Aclear (
    gameArea * gamearea )
```

Clears the game area.

Parameters

<i>gamearea</i>	Pointer to the game area to clear.
-----------------	------------------------------------

5.9.2.3 Aflipcell()

```
void Aflipcell (
    gameArea * A,
    double x,
    double y )
```

Flips a cell in the game area.

Parameters

<i>A</i>	Pointer to the game area.
<i>x</i>	The x-coordinate of the cell to flip.
<i>y</i>	The y-coordinate of the cell to flip.

Remarks

If the coordinates are out of bounds, the function does nothing.

5.9.2.4 Afree()

```
void Afree (
    gameArea * gamearea )
```

Frees the memory allocated for the game area.

Parameters

<i>gamearea</i>	Pointer to the game area to free.
-----------------	-----------------------------------

5.9.2.5 Agetage()

```
ssize_t Agetage (
    uint8_t cell )
```

Gets the age of a cell.

Parameters

<i>cell</i>	The cell to get the age of.
-------------	-----------------------------

Returns

The age of the cell.

5.9.2.6 Anew()

```
gameArea Anew (
    size_t width,
    size_t height )
```

Creates a new game area.

Parameters

<i>width</i>	Width of the game area.
<i>height</i>	Height of the game area.

Returns

A new game area.

5.9.2.7 Astep()

```
void Astep (
    gameArea * A )
```

Advances the simulation by one step.

Parameters

A	Pointer to the game area to step.
---	-----------------------------------

5.10 gameArea.h

[Go to the documentation of this file.](#)

```
00001
00006 #ifndef GAMEAREA_H
00007 #define GAMEAREA_H
00008
00009 #include <SDL2/SDL.h>
00010 #include <stdlib.h>
00011 #include <stdbool.h>
00012
00013 #include "Error.h"
00014
00020 typedef struct gameArea {
00021     size_t w;
00022     size_t h;
00023     uint8_t **area;
00024     uint8_t history_lenght;
00025 } gameArea;
00026
00033 gameArea Anew(size_t width, size_t height);
00034
00039 void Aclear(gameArea *gamearea);
00040
00045 void Afree(gameArea *gamearea);
00046
00052 ssize_t Agetage(uint8_t cell);
00053
00058 void Astep(gameArea *A);
00059
00065 bool Aback(gameArea *A);
00066
00074 void Aflipcell(gameArea *A, double x, double y);
00075
00076 #endif
```

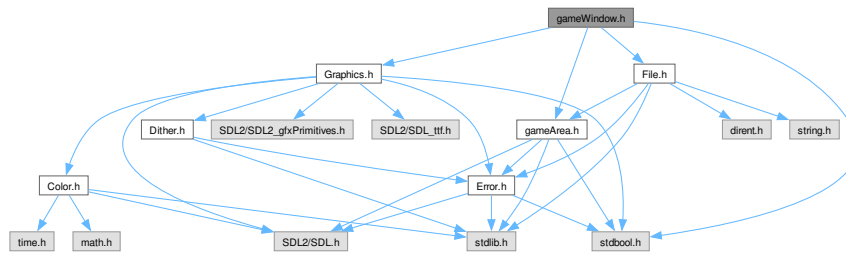
5.11 gameWindow.h File Reference

This file contains the structures and functions for the game window.

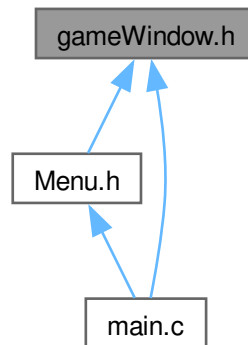
```
#include <stdbool.h>
#include "Graphics.h"
#include "gameArea.h"
```

```
#include "File.h"
```

Include dependency graph for gameWindow.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct [gameWindow](#)
Represents the game window and its properties.

Typedefs

- typedef struct [gameWindow](#) **gameWindow**

Functions

- [gameWindow Winit](#) ([gameArea](#) A, char *name)
Initializes a new game window.
- void [Wclose](#) ([gameWindow](#) *game)
Closes the game window.
- void [Wclick](#) ([gameWindow](#) *game, int x, int y)

- Handles a click event in the game window.*
 - void `Wdraw` (`gameWindow` *game, bool all_cells)
- Draws the game window.*
 - void `Wzoom` (`gameWindow` *game, double wheel, int x, int y)
- Zooms the game window.*
 - void `Wresetzoom` (`gameWindow` *game)
- Resets the zoom level of the game window.*
 - void `Wevent` (`gameWindow` *game, SDL_Event *e)
- Handles an event in the game window.*

5.11.1 Detailed Description

This file contains the structures and functions for the game window.

5.11.2 Function Documentation

5.11.2.1 Wclick()

```
void Wclick (
    gameWindow * game,
    int x,
    int y )
```

Handles a click event in the game window.

Parameters

<i>game</i>	Pointer to the game window.
<i>x</i>	The x-coordinate of the click.
<i>y</i>	The y-coordinate of the click.

5.11.2.2 Wclose()

```
void Wclose (
    gameWindow * game )
```

Closes the game window.

Parameters

<i>game</i>	Pointer to the game window to close.
-------------	--------------------------------------

5.11.2.3 Wdraw()

```
void Wdraw (
```

```
gameWindow * game,  
bool all_cells )
```

Draws the game window.

Parameters

<i>game</i>	Pointer to the game window to draw.
<i>all_cells</i>	Whether to draw all cells or just the ones that changed.

5.11.2.4 Wevent()

```
void Wevent (  
gameWindow * game,  
SDL_Event * e )
```

Handles an event in the game window.

Parameters

<i>game</i>	Pointer to the game window to handle event.
<i>e</i>	The event to handle.

5.11.2.5 Winit()

```
gameWindow Winit (  
gameArea A,  
char * name )
```

Initializes a new game window.

Parameters

<i>A</i>	The game area.
<i>name</i>	The name of the game window.

Returns

A new game window.

5.11.2.6 Wresetzoom()

```
void Wresetzoom (  
gameWindow * game )
```

Resets the zoom level of the game window.

Parameters

<i>game</i>	Pointer to the game window to reset zoom.
-------------	---

5.11.2.7 Wzoom()

```
void Wzoom (
    gameWindow * game,
    double wheel,
    int x,
    int y )
```

Zooms the game window.

Parameters

<i>game</i>	Pointer to the game window to zoom.
<i>wheel</i>	The amount to zoom.
<i>x</i>	The x-coordinate of the zoom center.
<i>y</i>	The y-coordinate of the zoom center.

5.12 gameWindow.h

[Go to the documentation of this file.](#)

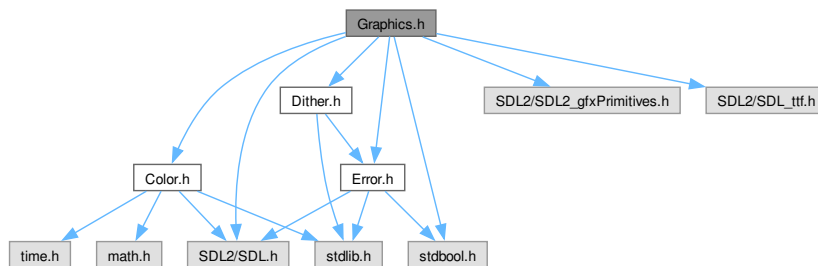
```
00001
00006 #ifndef GAMEWINDOW_H
00007 #define GAMEWINDOW_H
00008
00009 #include <stdbool.h>
00010 #include "Graphics.h"
00011 #include "gameArea.h"
00012 #include "File.h"
00013
00019 typedef struct gameWindow {
00020     gameArea A;
00021     Gwindow G;
00022     char *name;
00023     SDL_Texture *pre_rendered_cells;
00024     double zoom;
00025     ssize_t x_screen_offset;
00026     ssize_t y_screen_offset;
00027     SDL_TimerID autoplay_id;
00028     Uint32 autoplay_delay;
00029 } gameWindow;
00030
00037 gameWindow Winit(gameArea A, char *name);
00038
00043 void Wclose(gameWindow *game);
00044
00051 void Wclick(gameWindow *game, int x, int y);
00052
00058 void Wdraw(gameWindow *game, bool all_cells);
00059
00067 void Wzoom(gameWindow *game, double wheel, int x, int y);
00068
00073 void Wresetzoom(gameWindow *game);
00074
00080 void Wevent(gameWindow *game, SDL_Event *e);
00081
00082 #endif
```

5.13 Graphics.h File Reference

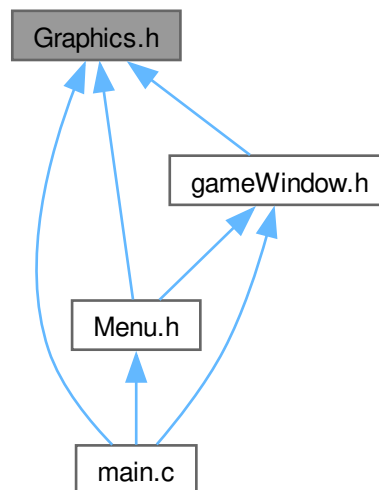
This file contains code used for graphics.

```
#include <SDL2/SDL.h>
#include <SDL2/SDL2_gfxPrimitives.h>
#include <SDL2/SDL_ttf.h>
#include <stdbool.h>
#include "Color.h"
#include "Dither.h"
#include "Error.h"
```

Include dependency graph for Graphics.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct [Gwindow](#)

Represents the graphics window and its properties.

Macros

- `#define CELL_SIZE 8`
The size of a rendered cell in pixels.

Typedefs

- `typedef struct Gwindow Gwindow`

Functions

- `void Ginit ()`
Initializes SDL2.
- `Gwindow Gnew (char title[], int width, int height, bool resizable)`
Creates a new window.
- `void Gclose (Gwindow *window)`
Closes the graphics window.
- `void Gquit ()`
Quits the SDL2 application.
- `void Gset_color (Gwindow *window, SDL_Color col)`
Sets the color of the renderer.
- `void Gfill_background (Gwindow *window)`
Fills the background of the Menu.
- `void Gprint_title (Gwindow *window)`
Prints the title of the game.
- `SDL_Rect Gprint (Gwindow *window, char *text, SDL_Rect *location, Colortype col)`
Prints text in the graphics window.
- `void Gtextbox (Gwindow *window, char *text, SDL_Rect *location, Colortype col, size_t border_width)`
Creates a textbox in the graphics window.
- `SDL_Texture * Gpre_render_cells (Gwindow *window)`
- `void Ginput_text (Gwindow *window, char *dest, size_t lenght, SDL_Rect bounding_box, bool is_file_name)`
Handles text input in the graphics window.

5.13.1 Detailed Description

This file contains code used for graphics.

5.13.2 Macro Definition Documentation

5.13.2.1 CELL_SIZE

```
#define CELL_SIZE 8
```

The size of a rendered cell in pixels.

It should be a power of 2. Smaller values will result in better performance, but worse quality.

5.13.3 Function Documentation

5.13.3.1 Gclose()

```
void Gclose (
    Gwindow * window )
```

Closes the graphics window.

Parameters

<i>window</i>	Pointer to the graphics window to close.
---------------	--

5.13.3.2 Gfill_background()

```
void Gfill_background (
    Gwindow * window )
```

Fills the background of the [Menu](#).

Parameters

<i>window</i>	Pointer to the window to fill background.
---------------	---

5.13.3.3 Ginit()

```
void Ginit ( )
```

Initializes SDL2.

Warning

This function must be called before any other function.

5.13.3.4 Ginput_text()

```
void Ginput_text (
    Gwindow * window,
    char * dest,
    size_t lenght,
    SDL_Rect bounding_box,
    bool is_file_name )
```

Handles text input in the graphics window.

Parameters

<i>window</i>	Pointer to the window to handle text input.
<i>dest</i>	The destination for the input text.
<i>lenght</i>	The length of the input text.
<i>bounding_box</i>	The bounding box for the input text.
<i>is_file_name</i>	Whether the input text is a file name or not. If it is, it will append ".con" to the end, and the destination must be 4 bytes longer than lenght.

5.13.3.5 Gnew()

```
Gwindow Gnew (
    char title[],
    int width,
    int height,
    bool resizable )
```

Creates a new window.

Parameters

<i>title</i>	The title of the window.
<i>width</i>	The width of the window.
<i>height</i>	The height of the window.
<i>resizable</i>	Whether the window is resizable or not.

Returns

A new window.

5.13.3.6 Gprint()

```
SDL_Rect Gprint (
    Gwindow * window,
    char * text,
    SDL_Rect * location,
    Colortype col )
```

Prints text in the graphics window.

Parameters

<i>window</i>	Pointer to the window to print text.
<i>text</i>	The text to print.
<i>location</i>	The location to print the text.
<i>col</i>	The color of the text.

Returns

The rectangle where the text was printed.

5.13.3.7 Gprint_title()

```
void Gprint_title (
    Gwindow * window )
```

Prints the title of the game.

Parameters

<i>window</i>	Pointer to the window to print title.
---------------	---------------------------------------

5.13.3.8 Gquit()

```
void Gquit ( )
```

Quits the SDL2 application.

Remarks

exit() should be called after this function.

5.13.3.9 Gset_color()

```
void Gset_color (
    Gwindow * window,
    SDL_Color col )
```

Sets the color of the renderer.

Parameters

<i>window</i>	Pointer to the window to set color.
<i>col</i>	The color to set.

5.13.3.10 Gtextbox()

```
void Gtextbox (
    Gwindow * window,
    char * text,
    SDL_Rect * location,
    Colortype col,
    size_t border_width )
```

Creates a textbox in the graphics window.

Parameters

<i>window</i>	Pointer to the window to create textbox.
<i>text</i>	The text for the textbox.
<i>location</i>	The location for the textbox.
<i>col</i>	The color of the textbox, only accepts primary or secondary.
<i>border_width</i>	The width of the border of the textbox.

5.14 Graphics.h

[Go to the documentation of this file.](#)

```

00001
00006 #ifndef GRAPHICS_H
00007 #define GRAPHICS_H
00008
00009 #include <SDL2/SDL.h>
00010 #include <SDL2/SDL2_gfxPrimitives.h>
00011 #include <SDL2/SDL_ttf.h>
00012 #include <stdbool.h>
00013
00014 #include "Color.h"
00015 #include "Dither.h"
00016 #include "Error.h"
00017
00023 #define CELL_SIZE 8
00024
00029 typedef struct Gwindow {
00030     SDL_Window *win;
00031     SDL_Renderer *ren;
00032     size_t w, h;
00033     TTF_Font *font_big;
00034     TTF_Font *font_reg;
00035     Color_theme colors;
00036 } Gwindow;
00037
00042 void Ginit();
00043
00052 Gwindow Gnew(char title[], int width, int height, bool resizable);
00053
00058 void Gclose(Gwindow *window);
00059
00064 void Gquit();
00065
00071 void Gset_color(Gwindow *window, SDL_Color col);
00072
00077 void Gfill_background(Gwindow *window);
00078
00083 void Gprint_title(Gwindow *window);
00084
00093 SDL_Rect Gprint(Gwindow *window, char *text, SDL_Rect *location, Color_type col);
00094
00103 void Gtextbox(Gwindow *window, char *text, SDL_Rect *location, Color_type col, size_t border_width);
00104
00112 SDL_Texture *Gpre_render_cells(Gwindow *window);
00113
00123 void Ginput_text(Gwindow *window, char *dest, size_t length, SDL_Rect bounding_box, bool
is_file_name);
00124
00125 #endif

```

5.15 Menu.h File Reference

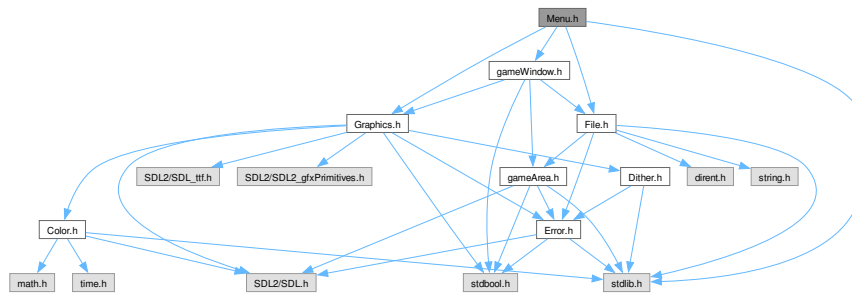
This file contains the structures and functions for the menu window.

```

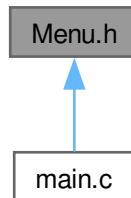
#include <stdlib.h>
#include "Graphics.h"
#include "File.h"
#include "gameWindow.h"

```

Include dependency graph for Menu.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct [uj_jatek_input](#)
Represents the input for a new game.
- struct [Menu](#)
Represents the menu and its properties.

Macros

- #define **MAX_SAVES** 13
- #define **INPUT_MAX_LENIGHT** 15

Typedefs

- typedef struct [uj_jatek_input](#) **uj_jatek_input**
- typedef struct [Menu](#) **Menu**

Functions

- [Menu Minit](#) ()
Initializes the menu.
- void [Mclose](#) ([Menu](#) *menu)
Closes the menu.
- void [Mclick](#) ([Menu](#) *menu, int x, int y)
Handles a click event in the menu.
- void [Mevent](#) ([Menu](#) *menu, [SDL_Event](#) *e)
Handles an event in the menu.

5.15.1 Detailed Description

This file contains the structures and functions for the menu window.

5.15.2 Function Documentation

5.15.2.1 Mclick()

```
void Mclick (  
    Menu * menu,  
    int x,  
    int y )
```

Handles a click event in the menu.

Parameters

<i>menu</i>	Pointer to the menu.
<i>x</i>	The x-coordinate of the click.
<i>y</i>	The y-coordinate of the click.

5.15.2.2 Mclose()

```
void Mclose (  
    Menu * menu )
```

Closes the menu.

Parameters

<i>menu</i>	Pointer to the menu to close.
-------------	-------------------------------

5.15.2.3 Mevent()

```
void Mevent (  

```

```
Menu * menu,
SDL_Event * e )
```

Handles an event in the menu.

Parameters

<i>menu</i>	Pointer to the menu to handle event.
<i>e</i>	The event to handle.

5.15.2.4 Minit()

```
Menu Minit ( )
```

Initializes the menu.

Returns

The menu.

5.16 Menu.h

[Go to the documentation of this file.](#)

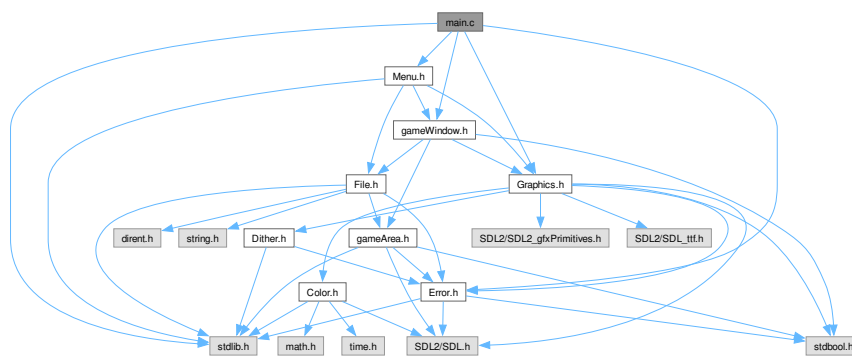
```
00001
00006 #ifndef MENU_H
00007 #define MENU_H
00008
00009 #include <stdlib.h>
00010
00011 #include "Graphics.h"
00012 #include "File.h"
00013 #include "gameWindow.h"
00014
00015 #define MAX_SAVES 13
00016 #define INPUT_MAX LENGHT 15
00017
00022 typedef struct uj_jatek_input{
00023     char name[INPUT_MAX LENGHT+4];
00024     SDL_Rect name_rct;
00025     char width[INPUT_MAX LENGHT];
00026     SDL_Rect width_rct;
00027     char height[INPUT_MAX LENGHT];
00028     SDL_Rect height_rct;
00029     SDL_Rect button;
00030 } uj_jatek_input;
00031
00037 typedef struct Menu{
00038     Gwindow G;
00039     Fgame_file *saves;
00040     size_t save_cnt;
00041     gameWindow game_open;
00042     uj_jatek_input text_input;
00043 } Menu;
00044
00049 Menu Minit();
00050
00055 void Mclose(Menu *menu);
00056
00063 void Mclick(Menu *menu, int x, int y);
00064
00070 void Mevent(Menu *menu, SDL_Event *e);
00071
00072 #endif
```


5.17 main.c File Reference

Main file for the Game of Life simulator.

```
#include <stdlib.h>
#include "Error.h"
#include "Graphics.h"
#include "Menu.h"
#include "gameWindow.h"
```

Include dependency graph for main.c:



Functions

- int **main** (int argc, char *argv[])

5.17.1 Detailed Description

Main file for the Game of Life simulator.

This file contains the main function which initializes the graphics, creates the menu, and enters the main event loop.

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