UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

FACULTAD DE INGENIERÍA

DIVISIÓN DE INGENIERÍA ELÉCTRICA

INGENIERÍA EN COMPUTACIÓN

LABORATORIO DE COMPUTACIÓN GRÁFICA e
INTERACCIÓN HUMANO COMPUTADORA

Technical Manual

- 317344376

REQUIREMENTS

In order to run the program, the computer equipment must have the following characteristics:

- Hardware
  - Minimum 2-threaded CPU, minimum frequency 2.9 [GHz].
  - 4 - 8 GB RAM minimum (the speed of this is indifferent).
  - Minimum disk space of 175 [MB].
  - Dedicated graphics card indifferent (also works with integrated graphics)
- Software
  - Windows 10 or 11 operating system (any version) is required.
- Additional files
  - o Those contained in the tablet
    - assimp-vc140-mt.dll
    - glew32.dll
    - glfw3.dll
    - ProyectoFinal.pdb
  - Folders
    - Models
    - Shaders
    - Textures

The following is used to carry out this project:

- Visual Studio 2017 onwards.
- Graphics Library: OpenGL version 3.1 and up.
- Interface Library: GLFW

Modeling software used:

- Maya
- 3Ds
- Blender

Important WEB pages:

- - For downloading 3D models.
  - https://open3dmodel.com/es/3d-models/obj
  - https://free3d.com/es/
  - https://www.turbosquid.com/es/Search/3D-Models/free/obj
- F or repository creation
  - https://github.com/

Loaded models

- kunai
- Bijudama
- Shuriken
- Bijus
- Bandana
- Katana Sasuke Uchiha
- Crimson 4-leaf clover
- Kubikiribōchō
- Naruto
- Kama
- Tobi Character
- Restaurant

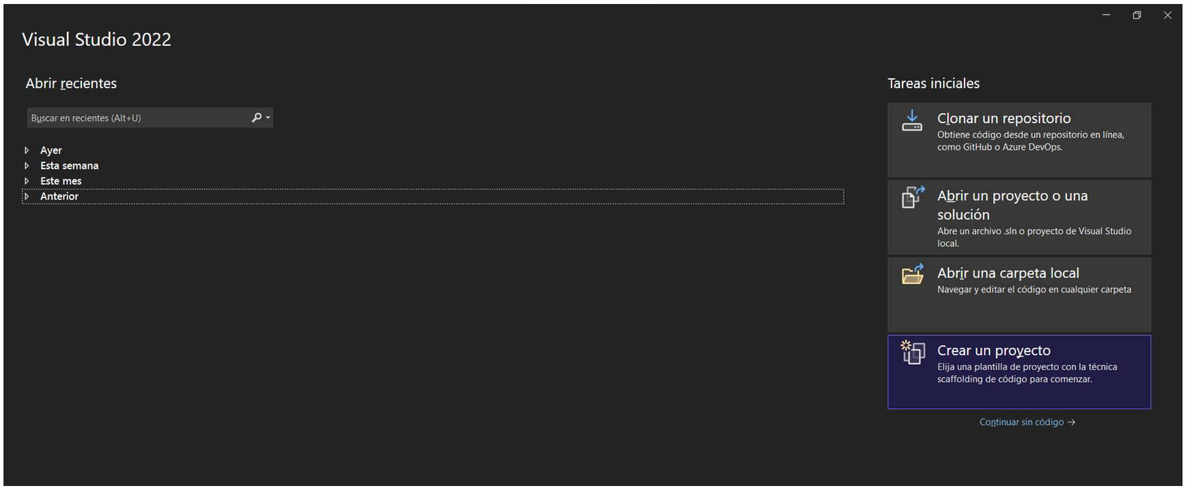
On the other hand there will be animations not linked to this TV series such as:

- The death star (Star Wars).
- The golden snitch (Harry Potter).
- Throat (Interstellar)

MODIFICATION

If you need to make adjustments regarding the execution of the program, either by adding models, animations, lights or other things, you will have to work from the code level. To do this you must clone the repository in your Visual Studio by following the steps below:

1. Linking Visual Studio and GitHub
    a. You must first open your Visual Studio application and start with "Create a Project" (Figure 1.1).



Obtiene código desde un repositorio en línea, como GitHub o Azure DevOps.

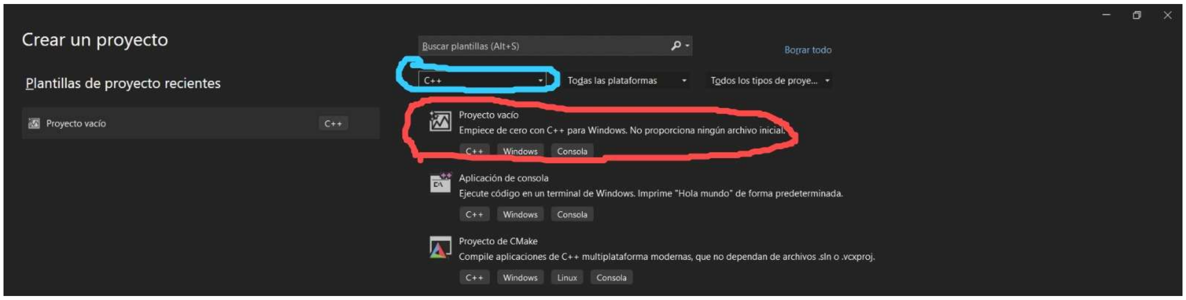
Abre un archivo .sln o proyecto de Visual Studio local.

Navegar y editar el código en cualquier carpeta

Elija una plantilla de proyecto con la técnica scaffolding de código para comenzar.

Figure 1.1 Creating a Project

    b. Then select "Empty Project", for this purpose in the section de "Languages" must be selected C++



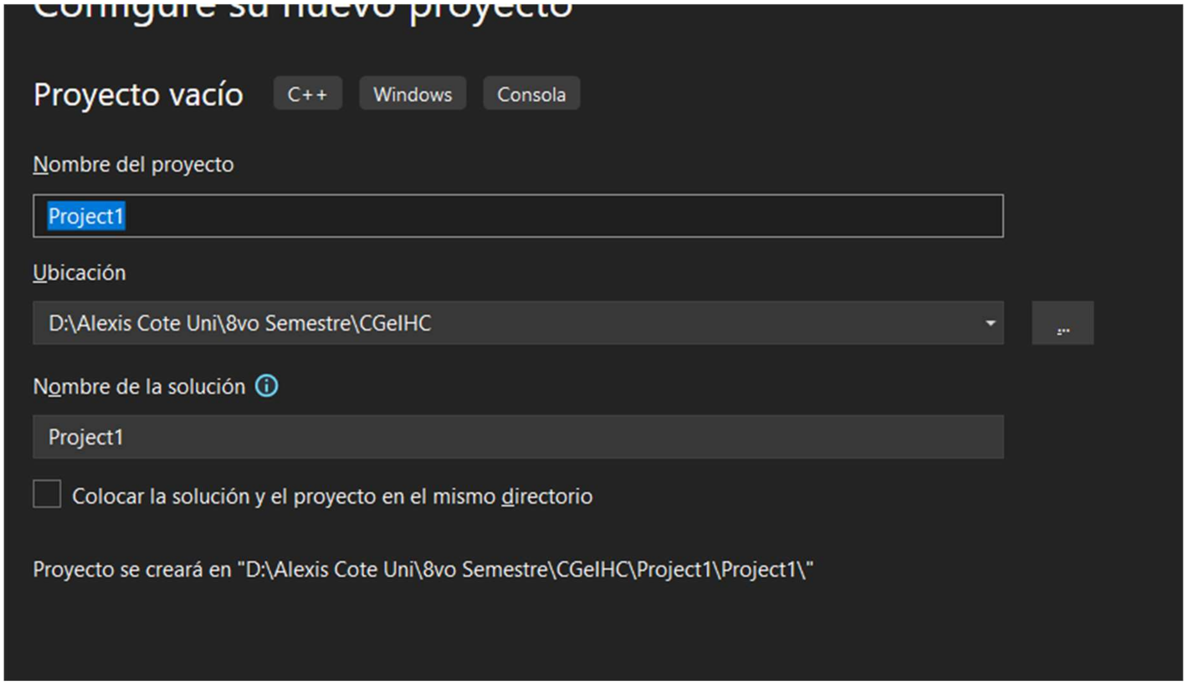
Empiece de cero con C++ para Windows. No proporciona ningún archivo inicial.

Ejecute código en un terminal de Windows. Imprime "Hola mundo" de forma predeterminada.

Compile aplicaciones de C++ multiplataforma modernas, que no dependan de archivos .sln o .vcxproj.

Figure 1.2 Project Void

c. Select a name for your project and a destination folder, then click on the "create" button.



Configure su nuevo proyecto

Proyecto vacío   C++   Windows   Consola

Nombre del proyecto

Project1

Ubicación

D:\Alexis Cote Uni\8vo Semestre\CGeIHC

Nombre de la solución

Project1

□ Colocar la solución y el proyecto en el mismo directorio

Proyecto se creará en "D:\Alexis Cote Uni\8vo Semestre\CGeIHC\Project1\Project1\"

Figure 1.3 Project name and location

d. Look for the option where it says "Add to source code control", select it and click on Git.

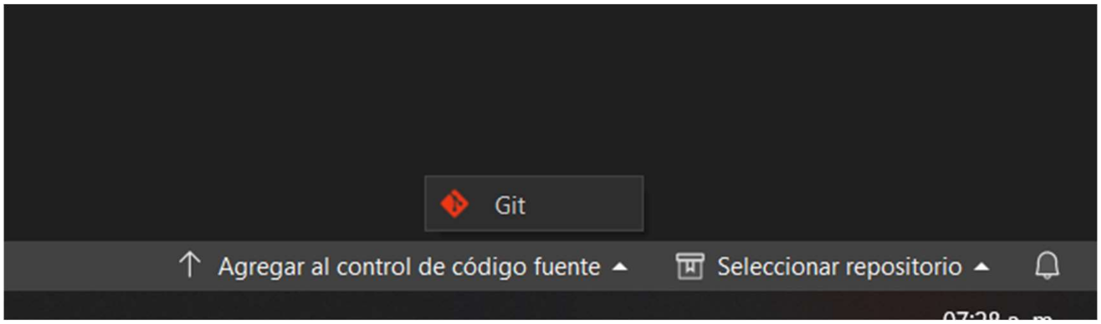
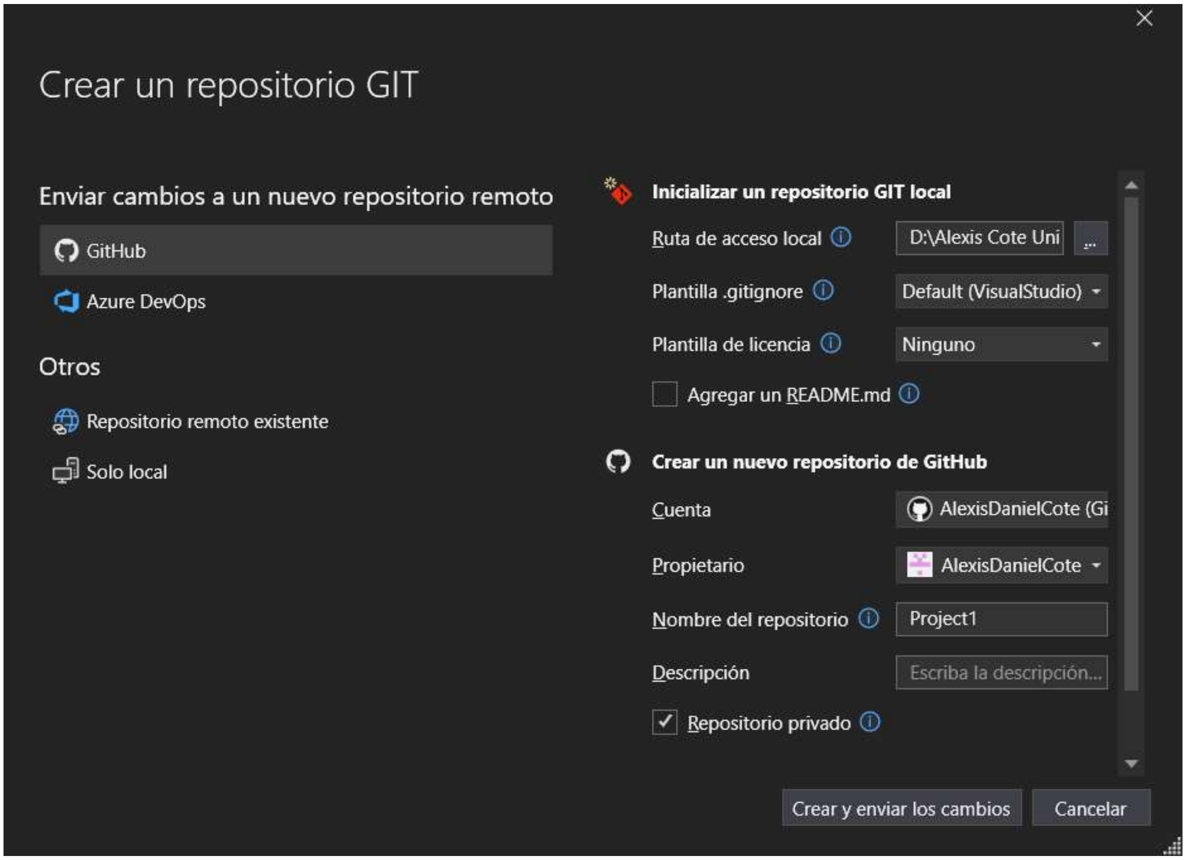


Figure 1.4 Git

e. A window like the one in Figure 1.5 will appear, in that window you will fill in the data regarding GitHub (if it is the first time it will send you to the web to confirm the login and the account linking) selecting account, owner, repository name and description of the repository.



Crear un repositorio GIT

Enviar cambios a un nuevo repositorio remoto

GitHub

Azure DevOps

Otros

Repositorio remoto existente

Solo local

Inicializar un repositorio GIT local

Ruta de acceso local: D:\Alexis Cote Uni

Plantilla .gitignore: Default (VisualStudio)

Plantilla de licencia: Ninguno

☐ Agregar un README.md

Crear un nuevo repositorio de GitHub

Cuenta: AlexisDanielCote (Gi

Propietario: AlexisDanielCote

Nombre del repositorio: Project1

Descripción: Escriba la descripción...

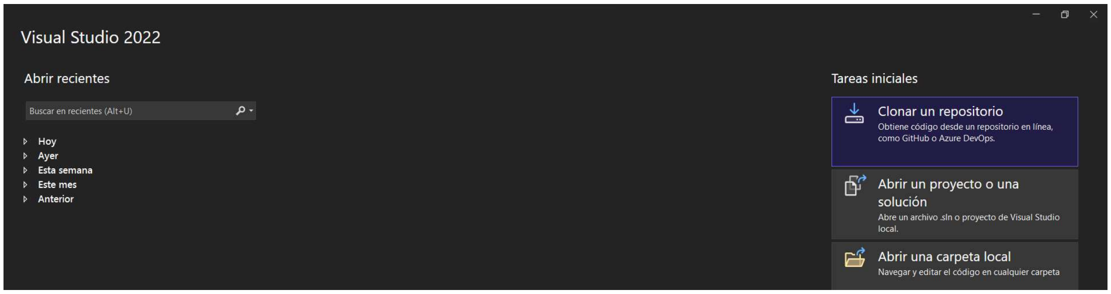
☑ Repositorio privado

Figure 1.5 Repository creation.

f. Finally, select "Create and submit changes".

2. Clone repository

a. Open Visual Studio and select where it says "Clone Repository".



Visual Studio 2022

Abrir recientes

Buscar en recientes (Alt+U)

- Hoy
- Ayer
- Esta semana
- Este mes
- Anterior

Tareas iniciales

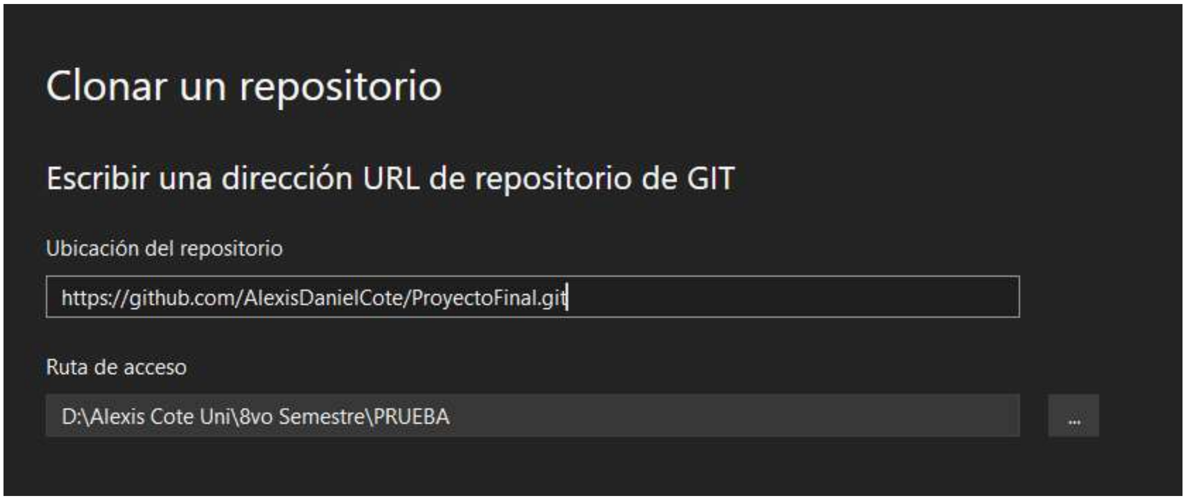
Clonar un repositorio
Obtiene código desde un repositorio en línea, como GitHub o Azure DevOps.

Abrir un proyecto o una solución
Abre un archivo .sln o proyecto de Visual Studio local.

Abrir una carpeta local
Navegar y editar el código en cualquier carpeta

Figure 1.6 Cloning a repository

b. Indicate the link of the repository to clone, in this case it will be: https://github.com/AlexisDanielCote/ProyectoFinal.git and also select/enter the folder where the repository will be saved in your virtual machine. Finally click on the "clone" button.



Clonar un repositorio

Escribir una dirección URL de repositorio de GIT

Ubicación del repositorio

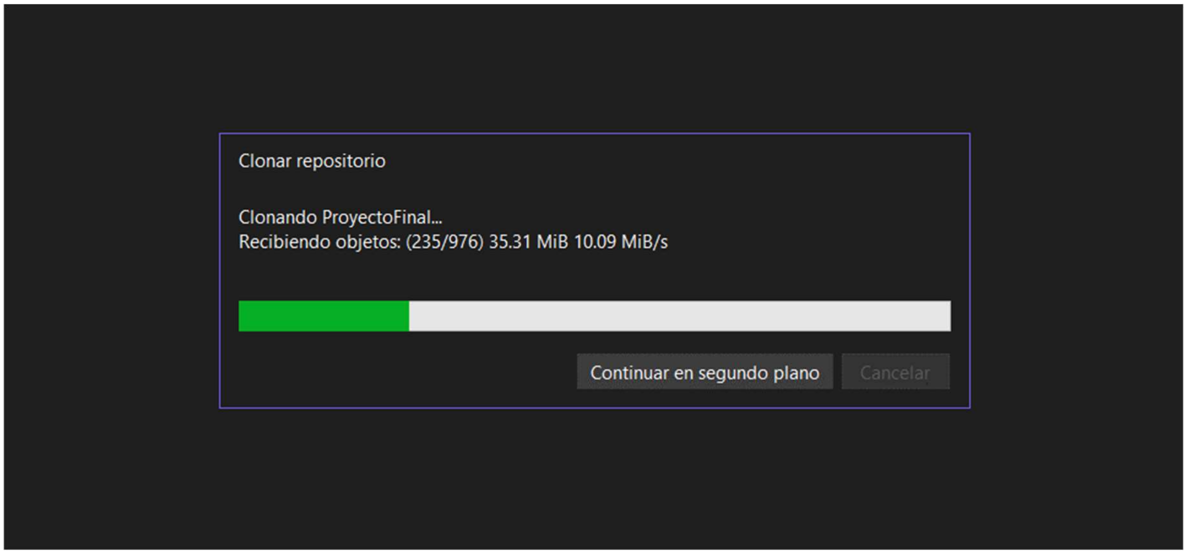
https://github.com/AlexisDanielCote/ProyectoFinal.git

Ruta de acceso

D:\Alexis Cote Uni\8vo Semestre\PRUEBA

Figure 1.7 League and folder for cloning

c. Wait for the repository to finish cloning (it may take a few minutes depending on your internet speed).

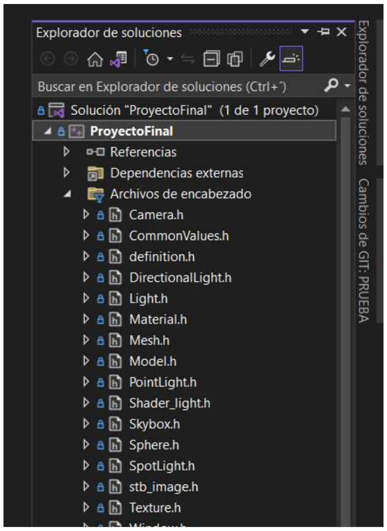


Clonar repositorio

Clonando ProyectoFinal...
Recibiendo objetos: (235/976) 35.31 MiB 10.09 MiB/s

Figure 1.8 Downloading the repository

d. When finished, open the "Solution Explorer" section and, by displaying the "Header files" and "Source files" subsections, you should be able to view the documents.



Solución "ProyectoFinal" (1 de 1 proyecto)
ProyectoFinal
Referencias
Dependencias externas
Archivos de encabezado
Camera.h
CommonValues.h
definition.h
DirectionalLight.h
Light.h
Material.h
Mesh.h
Model.h
PointLight.h
Shader_light.h
Skybox.h
Sphere.h
SpotLight.h
stb_image.h
Texture.h

Figure 1.9 Files

e. To be able to debug/execute the program we must make modifications in the compiler, for it in the superior part we must locate the section of "Local Debugger of Windows", of the left side it will have two options "Debug" and "x64", we deploy the one of "x64" and we change it for the option "x86".

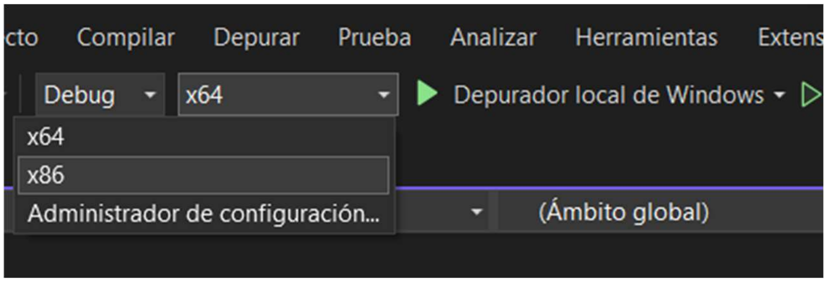
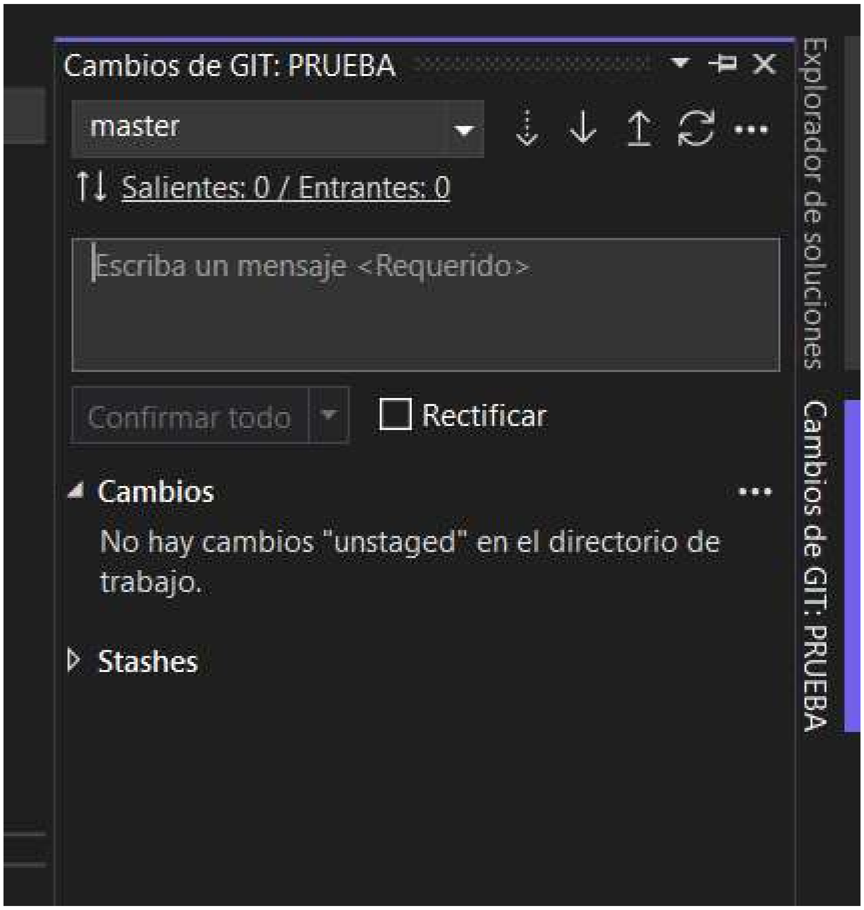


Figure 1.10 Compiler modification.

f. After each modification in the code, textures, models or documents you must make a comit and push in the repository, for it in the section of

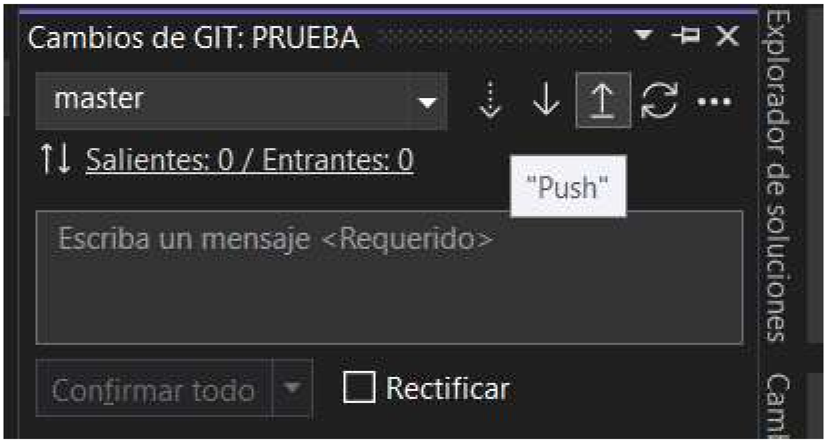
"GIT Changes" will be displayed in the section of changes all the modifications made in the files, either within Visual Studio itself or through the document manager.



No hay cambios "unstaged" en el directorio de trabajo.

Figure 1.11 GIT changes

g. In Figure 1.11 where it says "Write a message <Required>" you must provide a brief description of the change made in the project, then click on the "Confirm all" button to finish with the selection of the "Push" button.


Cambios de GIT: PRUEBA

master

Salientes: 0 / Entrantes: 0

"Push"

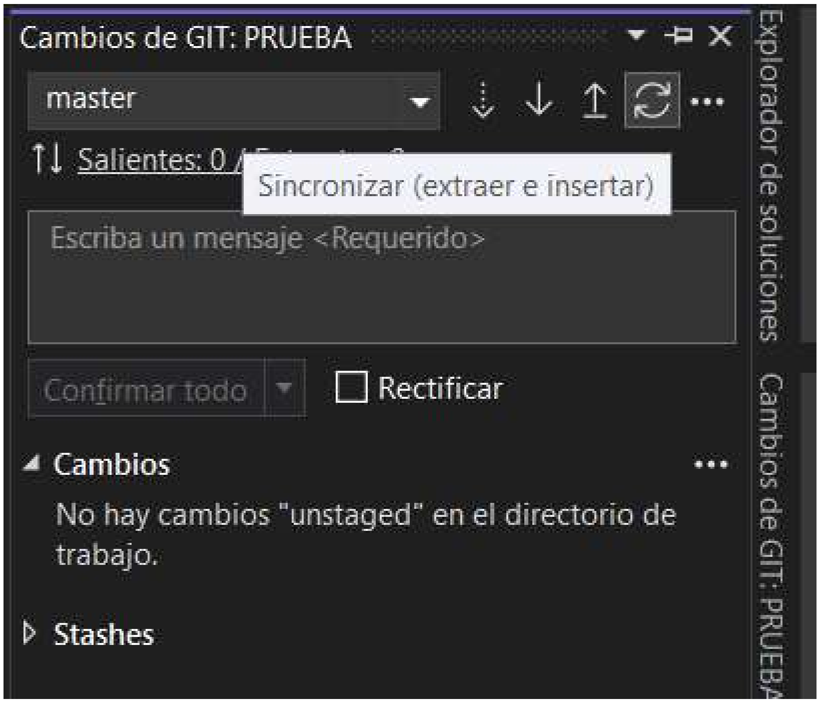
Escriba un mensaje <Requerido>

Confirmar todo

□ Rectificar

Figure 1.12 Push

h. If you make changes from the web in the repository or if someone else made changes from Visual Studio, you must update the project before making changes, comits and pushes. To do this you must select the "Synchronize" button.


Cambios de GIT: PRUEBA

master

Salientes: 0 /

Sincronizar (extraer e insertar)

Escriba un mensaje <Requerido>

Confirmar todo

□ Rectificar

Cambios

No hay cambios "unstaged" en el directorio de trabajo.

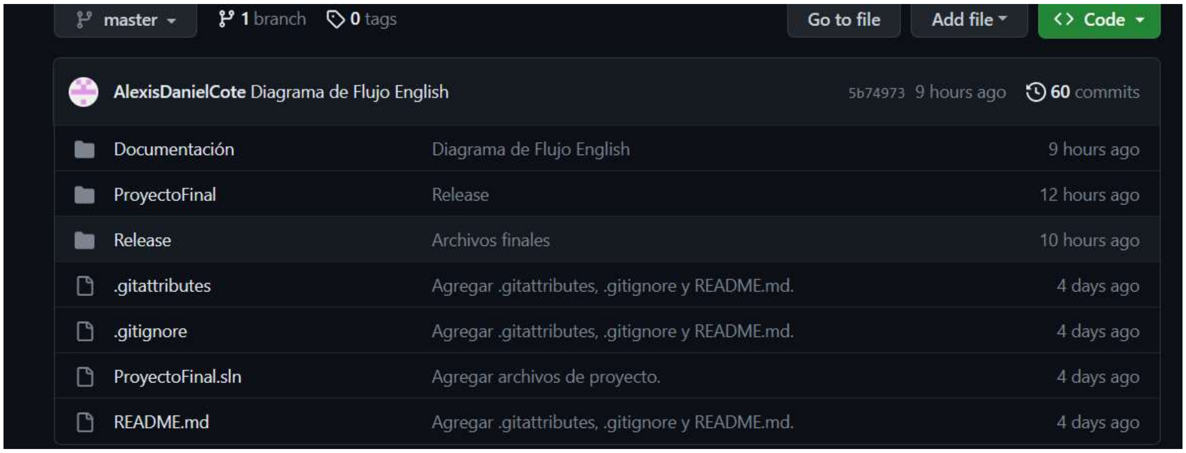
Stashes

Figure 1.13 Synchronize

RUN

In order to run the program you must download all the files inside the repository release folder, or if you prefer download the entire repository in a ZIP file (Figure 2.2), extract the information and work with the executable located in the aforementioned folder.

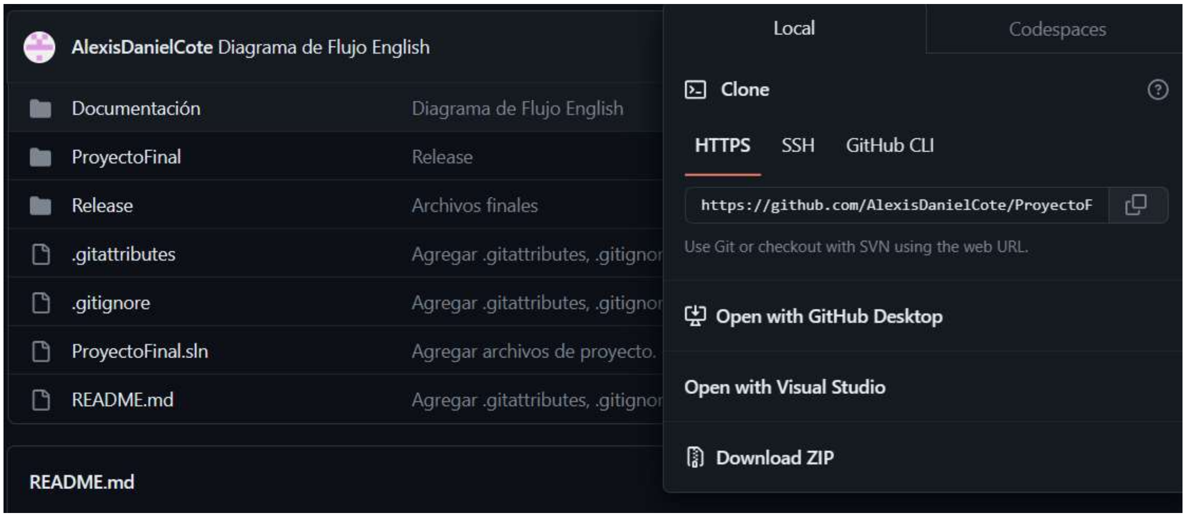
https://github.com/AlexisDanielCote/ProyectoFinal.git



AlexisDanielCote Diagrama de Flujo English — 5b74973 9 hours ago — 60 commits

Documentación	Diagrama de Flujo English	9 hours ago
ProyectoFinal	Release	12 hours ago
Release	Archivos finales	10 hours ago
.gitattributes	Agregar .gitattributes, .gitignore y README.md.	4 days ago
.gitignore	Agregar .gitattributes, .gitignore y README.md.	4 days ago
ProyectoFinal.sln	Agregar archivos de proyecto.	4 days ago
README.md	Agregar .gitattributes, .gitignore y README.md.	4 days ago

Figure 2.1 Repository, release folder



AlexisDanielCote Diagrama de Flujo English

Documentación	Diagrama de Flujo English
ProyectoFinal	Release
Release	Archivos finales
.gitattributes	Agregar .gitattributes, .gitignor
.gitignore	Agregar .gitattributes, .gitignor
ProyectoFinal.sln	Agregar archivos de proyecto.
README.md	Agregar .gitattributes, .gitignor

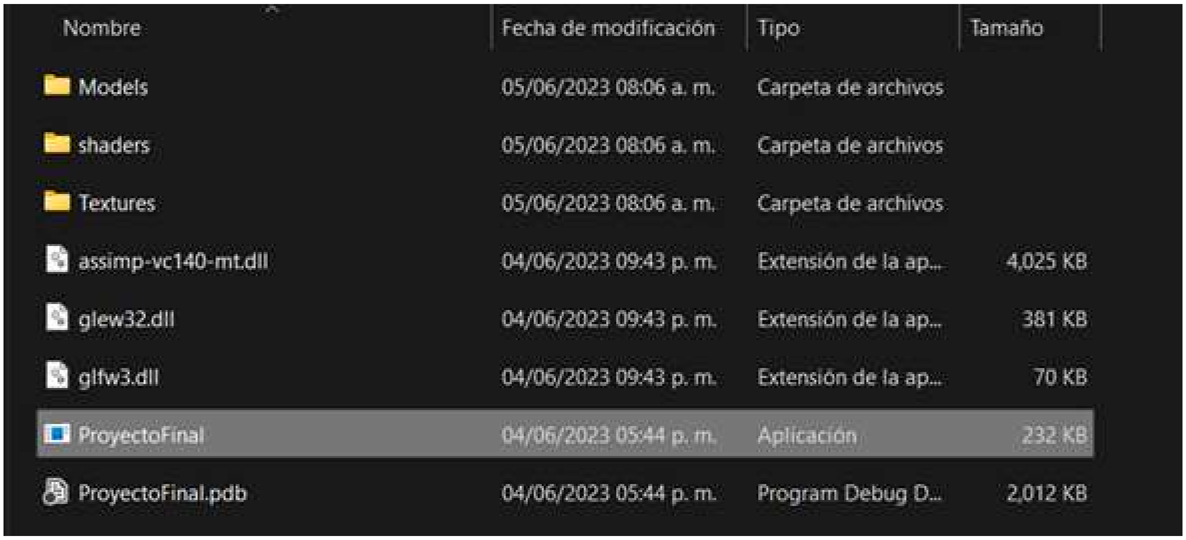
README.md

```
https://github.com/AlexisDanielCote/ProyectoF
```

Use Git or checkout with SVN using the web URL.

Figure 2.2 Repository download

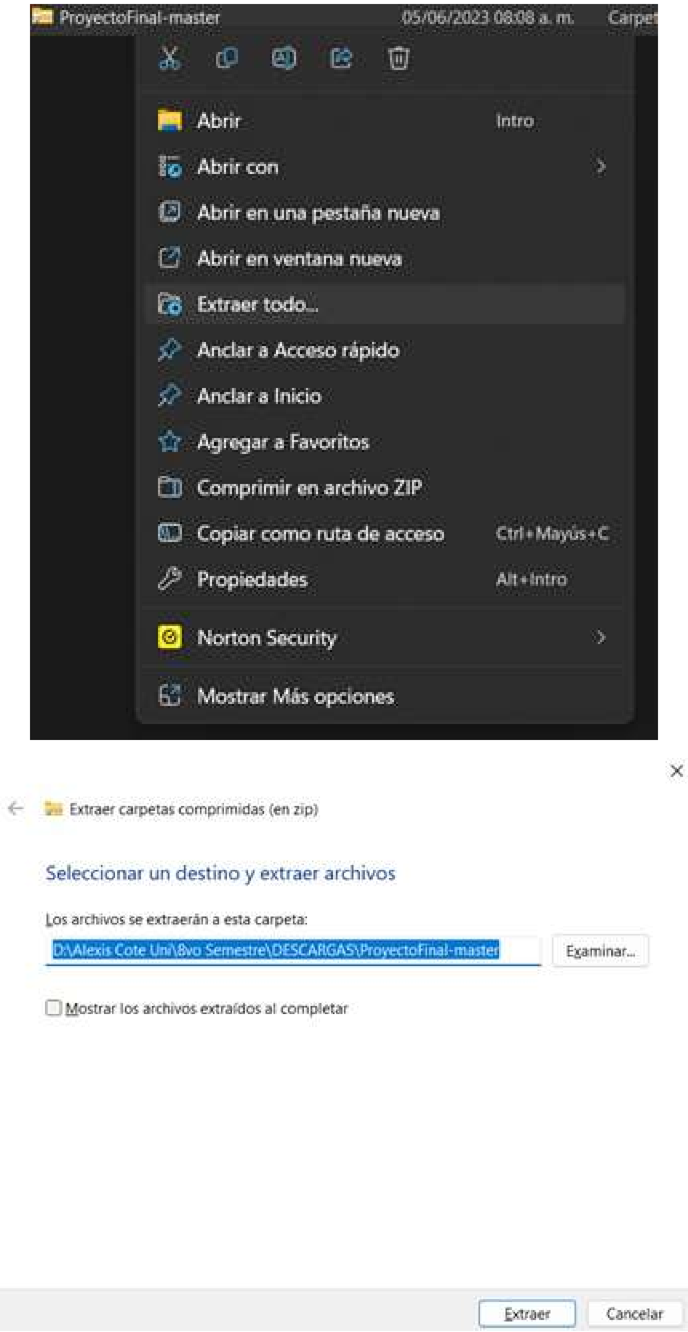
If you download only the folder, it should look like this in your document manager.



Nombre	Fecha de modificación	Tipo	Tamaño
Models	05/06/2023 08:06 a. m.	Carpeta de archivos	
shaders	05/06/2023 08:06 a. m.	Carpeta de archivos	
Textures	05/06/2023 08:06 a. m.	Carpeta de archivos	
assimp-vc140-mt.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	4,025 KB
glew32.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	381 KB
glfw3.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	70 KB
ProyectoFinal	04/06/2023 05:44 p. m.	Aplicación	232 KB
ProyectoFinal.pdb	04/06/2023 05:44 p. m.	Program Debug D...	2,012 KB

Figure 2.3 Release folder in Document Manager

If you download the whole repository in a ZIP file you must unzip the zip file in a folder of your choice; right click on the file to unzip, then left click where it says "Extract all..." and at the end just select the folder where it will be extracted and click on the extract button.



Extraer carpetas comprimidas (en zip)

Seleccionar un destino y extraer archivos

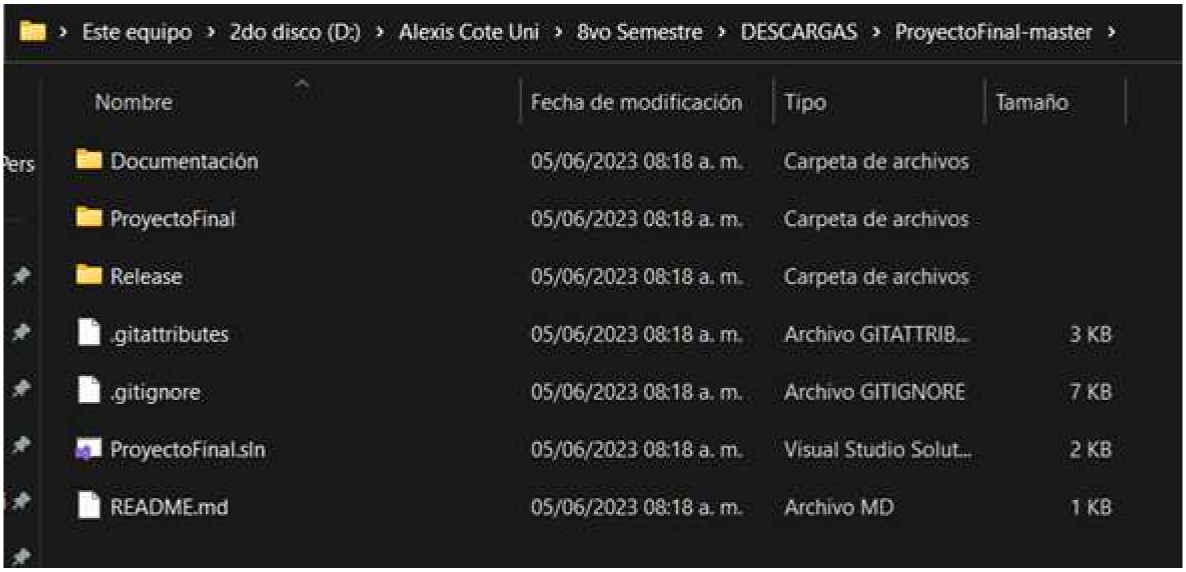
Los archivos se extraerán a esta carpeta:

D:\Alexis Cote Uni\8vo Semestre\DESCARGAS\ProyectoFinal-master

☐ Mostrar los archivos extraídos al completar

Figure 2.4 File Extraction

We wait for it to finish extracting the documents and when it is finished, entering the folder, you should see something similar to the following image.

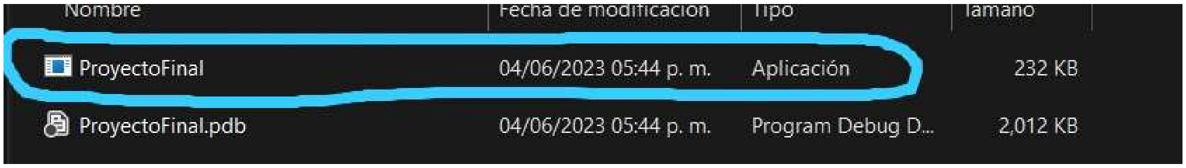


Este equipo › 2do disco (D:) › Alexis Cote Uni › 8vo Semestre › DESCARGAS › ProyectoFinal-master ›

Nombre	Fecha de modificación	Tipo	Tamaño
Documentación	05/06/2023 08:18 a. m.	Carpeta de archivos	
ProyectoFinal	05/06/2023 08:18 a. m.	Carpeta de archivos	
Release	05/06/2023 08:18 a. m.	Carpeta de archivos	
.gitattributes	05/06/2023 08:18 a. m.	Archivo GITATTRIB...	3 KB
.gitignore	05/06/2023 08:18 a. m.	Archivo GITIGNORE	7 KB
ProyectoFinal.sln	05/06/2023 08:18 a. m.	Visual Studio Solut...	2 KB
README.md	05/06/2023 08:18 a. m.	Archivo MD	1 KB

Figure 2.5 Extracted files

After that you should look for the file in the Release folder that has the .exe extension or says that it is an Application.



Nombre	Fecha de modificación	Tipo	Tamaño
ProyectoFinal	04/06/2023 05:44 p. m.	Aplicación	232 KB
ProyectoFinal.pdb	04/06/2023 05:44 p. m.	Program Debug D...	2,012 KB

Figure 2.6 Executable file.

Double left click on the file and wait for the execution, at the beginning you will see a black window followed by a blank one, do not be alarmed, it is normal, just wait for the animation to appear in the blank window as shown in Figure 2.8.

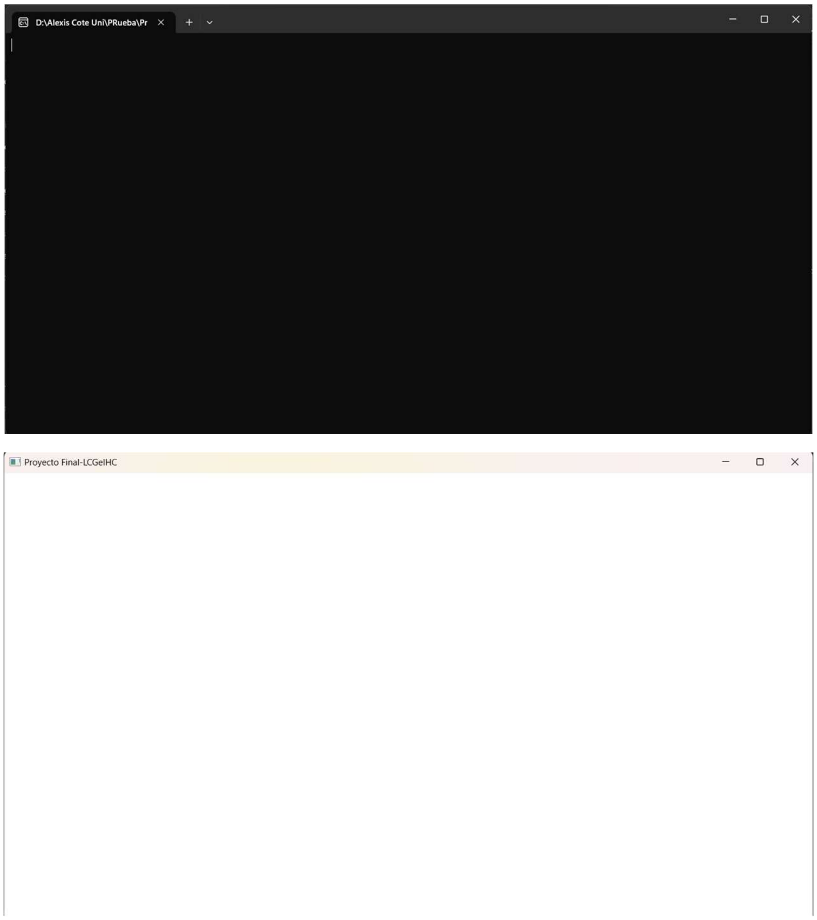


Figure 2.7 First execution windows

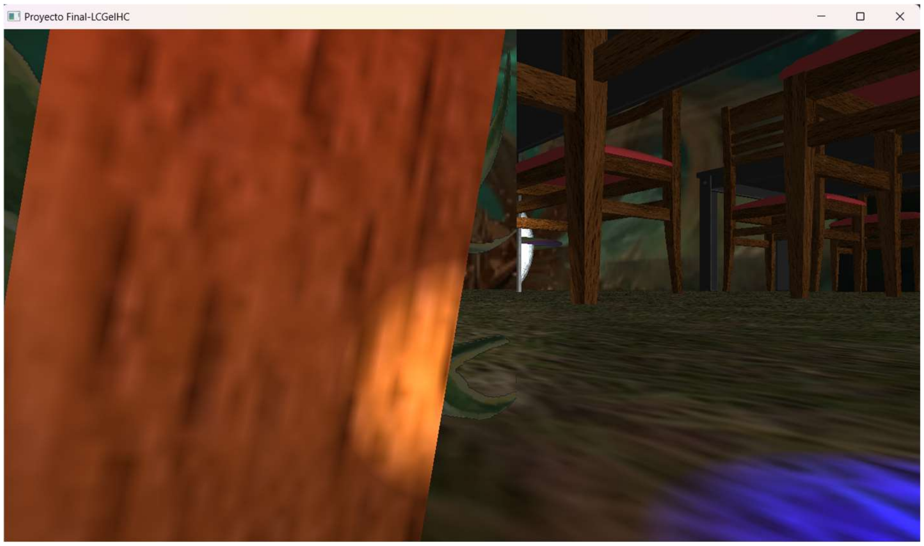


Figure 2.8 Program loaded and running

It is recommended that you deactivate your antivirus when you want to run the program because, as it is an application with .exe extension without any certificate, the antivirus may block it or even delete it as it would consider it a threat; in case you delete it, you will have to deactivate your antivirus and extract the files again.

PROJECT

Inside this project you will find several documents and folders extremely essential for the execution and manipulation of our application.

There are 16 files with .h extension:

- Camera.h
- CommonValues.h
- definition.h
- DirectionalLight.h
- Light.h
- Material.h
- Mesh.h
- Model.h
- PointLight.h
- Shader_light.h
- Skybox.h
- Sphere.h
- SpotLight.h
- stb_image.h
- Texture.h
- Window.h

On the other hand, we also have a total of 14 files with .cpp extension:

- Camera.cpp
- DirectionalLight.cpp
- Light.cpp
- Material.cpp
- Mesh_tn.cpp
- Model.cpp
- PointLight.cpp
- ProyectoFinal.cpp
- Shader_light.cpp
- Skybox.cpp
- Sphere.cpp
- SpotLight.cpp
- Texture.cpp
- Window.cpp

The .h files are in charge of using OpenGL libraries and at the same time to declare variables that will be constants, structures or classes to use in their respective cpp code, on the other hand, the .cpp files are in charge of defining functions, objects and at the same time to use their respective library and variables that are passed to each function/object.

- Camera.h and Camera.cpp as its name indicates is used to create and manipulate a synthetic camera which allows us to move in the environment of our animation.
- definition.h and CommonValues.h what it does is to define variables, structures that will be used in other codes as reference for declaration of vectors or creation of the same ones.
- DirectionalLight.h and DirectionalLight.cpp are in charge of the declaration of variables, functions, structures and manipulation of directional lights used in our program.
- Light.h and Light.cpp are in charge of the creation of the environment light which allows us to observe our program as if it were night or day.
- Material.h and Material.cpp allows us to give characteristics to our materials in such a way that the diffuse, specular and intensity components give the characteristic of opaque or bright material.
- Mesh.h and Mesh.cpp creates the meshes and allows to manipulate them.
- Model.h and Model.cpp allows us to read the obj files and their respective mtl files to load the models in the program and also allows us to modify them regarding rotations, translations and scales.
- PointLight.h and PointLight.cpp allow us to create the point lights that will be assigned to objects in our program.
- Shader_Light.h and Shader_Light.cpp are in charge of the creation of the shaders.
- Skybox.h and Skybox.cpp what it makes is the creation of the functions, variables and manipulation of the same ones to be able to create our environment based on images giving the characteristic that this will never be reached by the user due to the perspective that will be created as the camera moves.
- Sphere.h and Sphere.cpp are used for the creation of spheres from primitives (triangles).
- SpotLight.h and SpotLight.cpp create our SpotLight's.
- stb_image.h allows us to do the manipulation of images at OpenGL level.
- Texture.h and Texture.cpp allows us to make the manipulation of images so that we create static or dynamic textures in the program.
- Window.h and Window.cpp are in charge of the creation of our window where all our animation will be loaded, also it allows us to make the interaction with this one by means of the keyboard and the mouse.
- ProyectoFinal.cpp is where practically all the declarations of our objects to work, textures, and animations are concentrated.

- As first step what we do is to include all the libraries to use, so much the personal libraries that are the files .h previously enlisted and other libraries of OpenGL and of the same compiler.
- Later from line 34 to 71 we will have the declaration of our variables to use for our animations as much of objects as of lights, these in their majority are of floating type but we have some of Boolean type.
- From line 74 to line 76 we have the declaration of our work window.
- Then we have the declaration of a sphere to be used for animation.
- We will find the declaration of our synthetic camera.
- From line 81 to 84 we have the declaration of textures.
- 86 and 87 we have the declaration of our SkyBoxes.
- From line 89 to 120 we have the declaration of our models to be used to export our objects.
- Later we will have the declaration of our materials, GLfloat, DirectionalLight's, PointLight's, SpotLight's among other variables.
- From line 146 to 172 we will have the declaration of our normals and their assignments to be able to have our respective shadings.
- From 174 to 257 we have the declaration of vertices and sides of mesh objects.
- From 258 to 263 we have the creation of our shaders.
- From 265 to line 2106 we will have our main function which is responsible for the creation of our entire program, there are variable declarations that allow us to generate animations, we also find the loading of models and textures, as the rendering of these, along with their respective translations, positions, scaling and rotations.

PREDEFINED KEYS

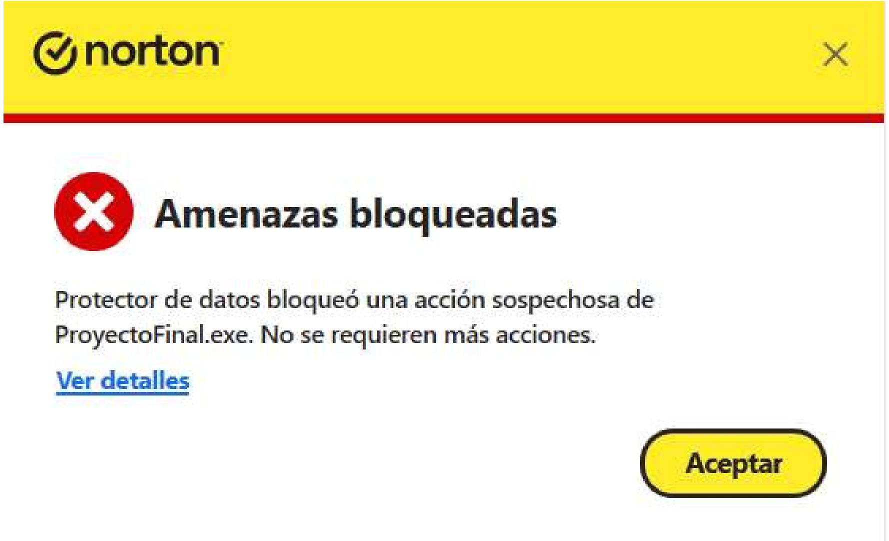
The program has keyboard-activated animations.

- Esc: It is in charge to finish with the execution of the program closing the window.
- Mouse: We indicate the direction to which our synthetic camera will be pointing.
- W: Moves the synthetic camera positively (forward).
- S: Moves the synthetic camera in a negative way (backwards).
- A: Shifts the synthetic camera laterally to the left.
- D: Moves the synthetic camera laterally to the right.
- Up Arrow: Moves our Avatar positively on the Z axis.
- Down Arrow: Moves our Avatar in a negative way on the Z axis.
- Right Arrow: Moves our Avatar positively on the X axis.
- Left Arrow: Moves our Avatar negatively on the X axis.
- F1: Rotates our avatar counterclockwise on the Y axis to our avatar counterclockwise.
- F2: Rotates our avatar on the Y axis to our avatar clockwise.
- F3: Allows the avatar to duck its head.
- F4: Allows the avatar to raise its head.
- F5: Allows the avatar to rotate its head counterclockwise.
- F6: Allows the avatar to rotate its head clockwise.
- P: Activates the animation of the noodle dishes being placed and served.
- O: Activates the animation of the noodle dishes by removing them from the tables.

ERRORS

Some of the possible failures are:

- At the moment of execution, the program closes automatically and instantly and a notification from your antivirus appears. This may be because the Antivirus detects the program as a virus, to solve it deactivate its protection for 15 minutes and run it again.



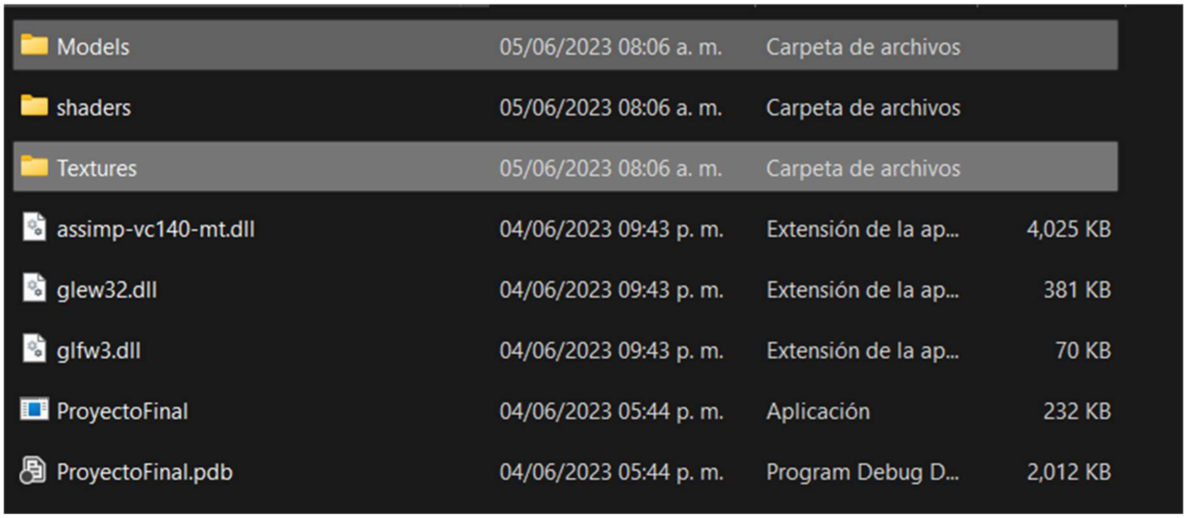
Amenazas bloqueadas

Protector de datos bloqueó una acción sospechosa de ProyectoFinal.exe. No se requieren más acciones.

Ver detalles

Figure 5.1 Antivirus problems

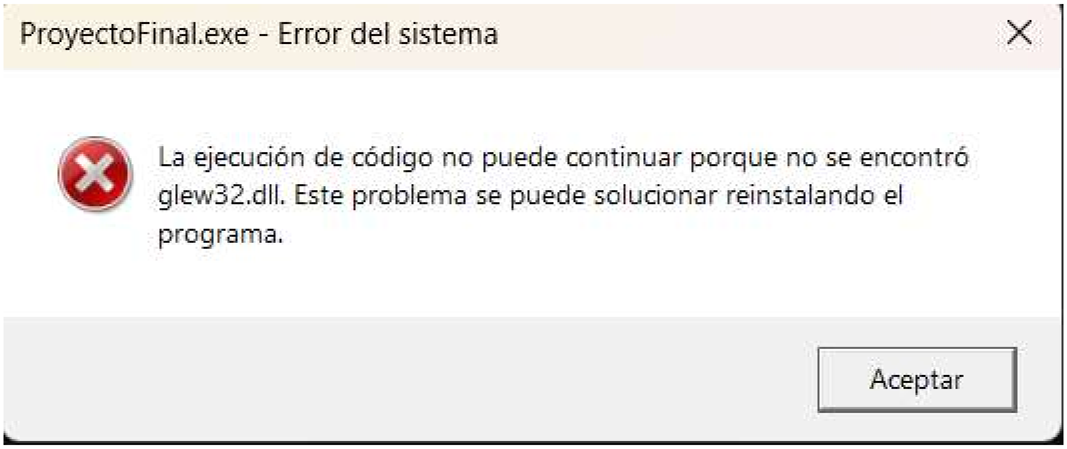
Another reason may be due to missing files, make sure you have the Models and Textures folders.



Models	05/06/2023 08:06 a. m.	Carpeta de archivos	
shaders	05/06/2023 08:06 a. m.	Carpeta de archivos	
Textures	05/06/2023 08:06 a. m.	Carpeta de archivos	
assimp-vc140-mt.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	4,025 KB
glew32.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	381 KB
glfw3.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	70 KB
ProyectoFinal	04/06/2023 05:44 p. m.	Aplicación	232 KB
ProyectoFinal.pdb	04/06/2023 05:44 p. m.	Program Debug D...	2,012 KB

Figure 5.2 Models and Textures Folders

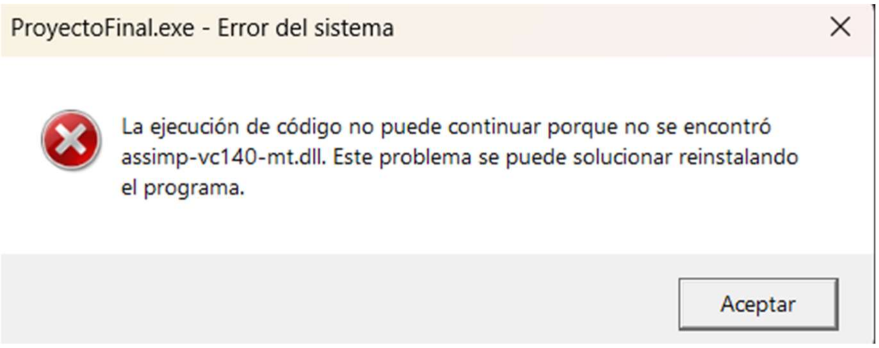
- Aparezca un Error de sistema tal como el de las siguientes figuras provocando que el programa no se ejecute. A System Error like the one in the following figures appears causing the program not to run.



ProyectoFinal.exe - Error del sistema

La ejecución de código no puede continuar porque no se encontró glew32.dll. Este problema se puede solucionar reinstalando el programa.

Figure 5.3 System Error 1

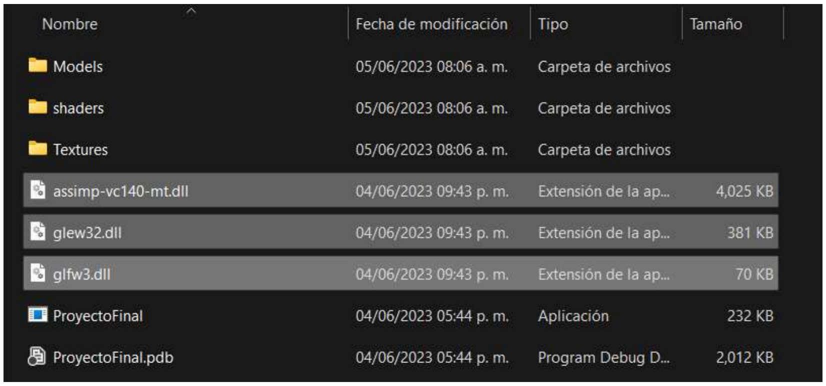


ProyectoFinal.exe - Error del sistema

La ejecución de código no puede continuar porque no se encontró assimp-vc140-mt.dll. Este problema se puede solucionar reinstalando el programa.

Figure 5.4 System Error 2

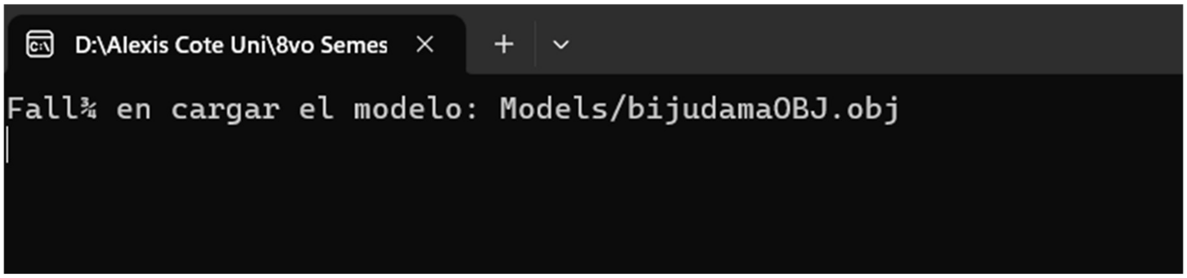
This is because the dll files are missing, to solve this problem make sure that the following 3 dll files are inside the application folder.



Nombre	Fecha de modificación	Tipo	Tamaño
Models	05/06/2023 08:06 a. m.	Carpeta de archivos	
shaders	05/06/2023 08:06 a. m.	Carpeta de archivos	
Textures	05/06/2023 08:06 a. m.	Carpeta de archivos	
assimp-vc140-mt.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	4,025 KB
glew32.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	381 KB
glfw3.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	70 KB
ProyectoFinal	04/06/2023 05:44 p. m.	Aplicación	232 KB
ProyectoFinal.pdb	04/06/2023 05:44 p. m.	Program Debug D...	2,012 KB

Figure 5.5 Required dll files.

- If at the moment of executing the application, the console displays something like the following.



```
Fall¾ en cargar el modelo: Models/bijudamaOBJ.obj
```

Figure 5.6 Lack of Model.

This may be because the corresponding model was not downloaded, enter the repository and search for the corresponding file to download it. This problem can also occur with texture loading, the solution is the same, look for the missing file in the repository and download it.

- If the application does not load the animation when running, only a blank screen appears.

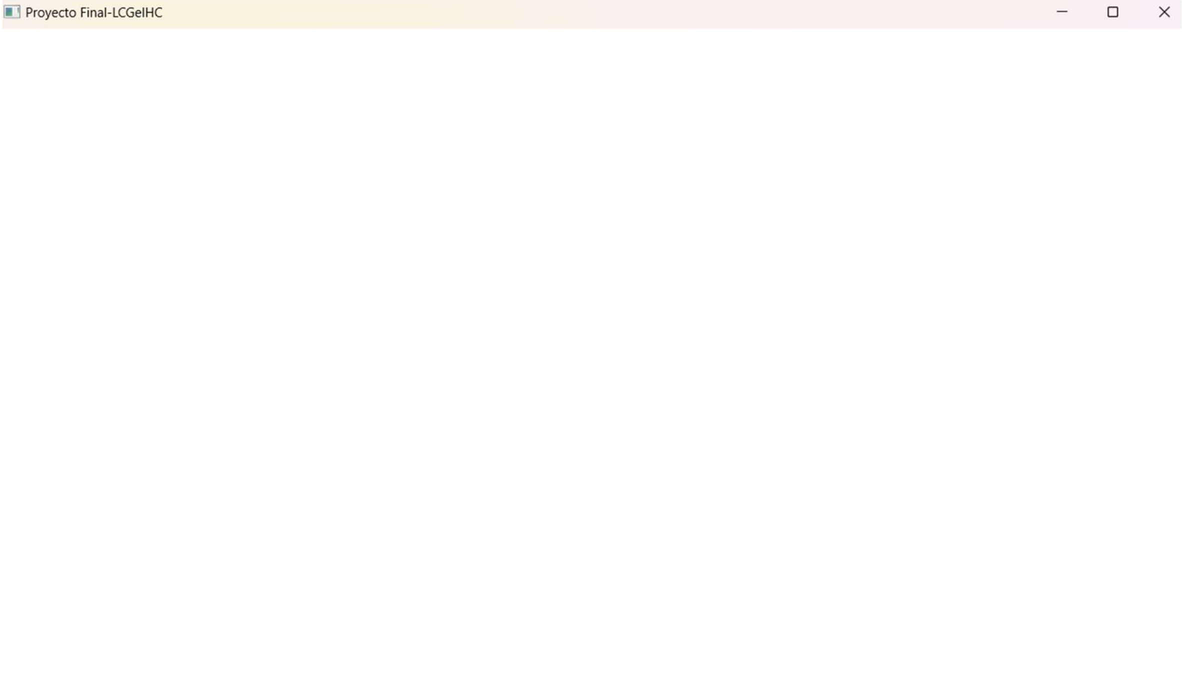
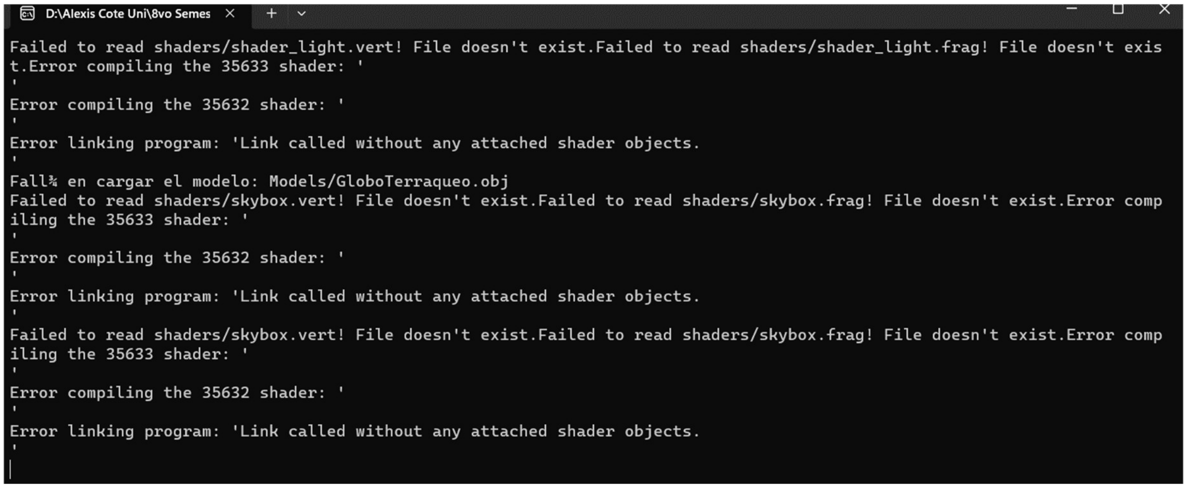


Figure 5.7 Blank window

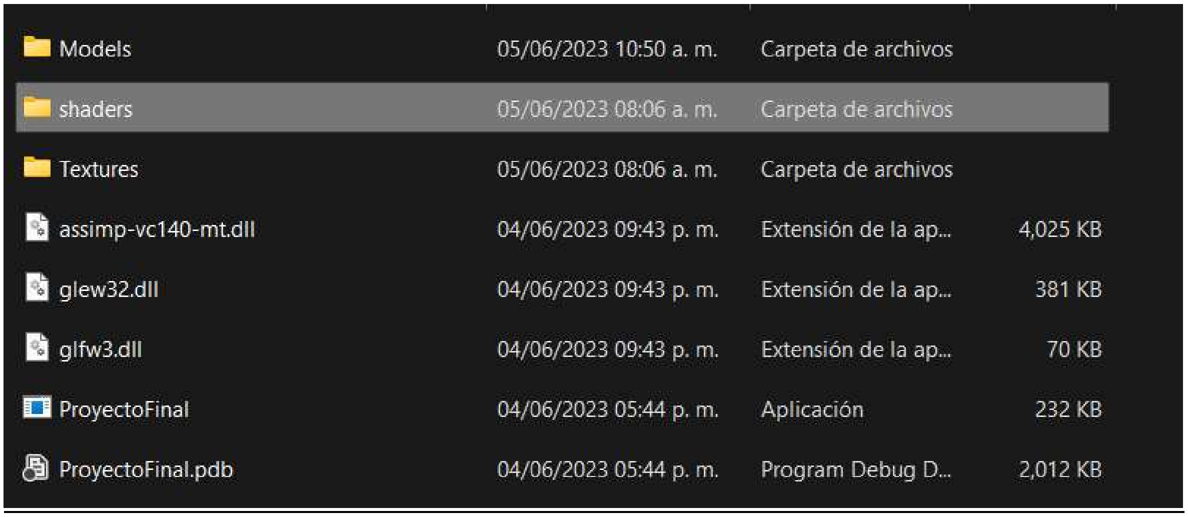
And it appears in the console window something like the following.



```
Failed to read shaders/shader_light.vert! File doesn't exist.Failed to read shaders/shader_light.frag! File doesn't exis
t.Error compiling the 35633 shader: '
'
Error compiling the 35632 shader: '
'
Error linking program: 'Link called without any attached shader objects.
'
Fall¾ en cargar el modelo: Models/GloboTerraqueo.obj
Failed to read shaders/skybox.vert! File doesn't exist.Failed to read shaders/skybox.frag! File doesn't exist.Error comp
iling the 35633 shader: '
'
Error compiling the 35632 shader: '
'
Error linking program: 'Link called without any attached shader objects.
'
Failed to read shaders/skybox.vert! File doesn't exist.Failed to read shaders/skybox.frag! File doesn't exist.Error comp
iling the 35633 shader: '
'
Error compiling the 35632 shader: '
'
Error linking program: 'Link called without any attached shader objects.
'
```

Figure 5.8 Errors

Make sure that the Shaders folder is found, otherwise download it from the repository.



Models	05/06/2023 10:50 a. m.	Carpeta de archivos	
shaders	05/06/2023 08:06 a. m.	Carpeta de archivos	
Textures	05/06/2023 08:06 a. m.	Carpeta de archivos	
assimp-vc140-mt.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	4,025 KB
glew32.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	381 KB
glfw3.dll	04/06/2023 09:43 p. m.	Extensión de la ap...	70 KB
ProyectoFinal	04/06/2023 05:44 p. m.	Aplicación	232 KB
ProyectoFinal.pdb	04/06/2023 05:44 p. m.	Program Debug D...	2,012 KB

Figure 5.9 Shaders folder