GeoDash 3D

A C++ 3D port of the popular game Geometry Dash

# Document Purpose

This document’s objective is to document the project overall, a sort of timeline of events of what I intend to accomplish and how I ended up executing.

## Project Goals

The goal for the project is to re-create the poplar game *Geometry Dash* using the Open GL API with C++ to put into practice the skills and knowledge I picked up during my time in university.

This project is a portfolio piece, so it doesn’t have a finished viable product in mind, just a showcase of skills and knowledge in software development and games development.



Figure 1: Geometry Dash

## Technical Goals

Technical goals are straightforward, use advanced low level programming techniques to establish a product that can easily be further developed by the public into their own creation.

Other outcomes I wish to achieve:

* Higher level of understanding and use of Graphics API’s
* A technical showcase of skills in developing low level programs
* Use of Object Orientation Programming paradigms, such as showing off different design patterns and optimisations
* Ability for developers to clone project and add their own features

Software tools being used:

* C++ 20
* GLAD/GLFW Libraries
* CLion IDE
* Github

A lot of inspiration on how systems will be established, such as the use of components, events, objects etc., will use Unreal Engine as an example.

# Initial Game Outline

GeoDash3D will draw heavy inspiration from the game Geometry Dash. The core objective is to guide your character through a series of platforms and obstacles to reach the end of each level. Unlike traditional platformers, the player does not control forward movement — the character moves automatically — and can only control jumps. The initial goal of development will be to replicate this game loop: a cube-shaped character progressing through levels by jumping at the right moments to avoid obstacles and reach the finish.

## Initial working prototype

What I will consider a fully working prototype will need to have the following:

* A Cube character that:
  + Player can input a button to make cube jump
  + Cube moves forward automatically
  + Cube has collision that stops it from falling through the floor
  + If a cube hits something front on it will reset the level (with other considerations based on the type of object it hits)
  + An end goal of reaching the end of the level with a win screen
* Objects & Obstacles
  + Basic wall/floor objects that player can be on top of but can’t collide head on
  + A “Spike” obstacle that destroys the player no matter how it collides with it
  + A Bounce Pad that launches the player into the air at a higher level then what a normal jump can do
* Level Editor
  + A in game level editor that allows players to create their own levels using the objects/obstacles that are built into the game
  + Levels will save into a binary file with the extension “.G3D”
  + The main menu will have a way to load in levels
    - This will open a file explorer window, asking the user to find and select their “.G3D” file to be loaded into a specific folder in the game’s files
    - The players will also be given the option to edit these files through the level editor
* Main Menu
  + Play button that opens a level select menu
  + Level editor button
  + Load level button
* Level Select Menu
  + Shows all loaded levels with preview widgets

All the above will be used as a groundwork for a prototype build of the project, it is not the final product. I will add more design and details as I further develop from this initial concept.

# Technical Design

## UML Diagrams

<https://drive.google.com/file/d/1Zo191hFVnJD_m2_beG95Pw8NEu7ZUg-m/view?usp=sharing>

## Research

<https://www.youtube.com/watch?app=desktop&v=jjaTTRFXRAk&t=3m11s>

This video discusses the OpenGL concept of a renderer. This was going to be an early issue I needed to solve before I got too deep, as I was working on the Static Shape Render I thought about the possible issue of sharing a camera system across all the instances of any Object that needed to be rendered in. The Cherno covers this concept in detail, giving me the idea of what I need to do before I go deeper in.

Changes from this:

* Added Renderer Class to UML
* Reworked code to use a global Renderer as a source for perspective rather than static “magic values”

<https://github.com/ocornut/imgui>

ImGUI will be a useful library to have, it provides a quick 2d element to the viewport, allowing me to display and edit values with ease. Initial use will be used for displaying performance metrics (fps and ms), but Ill like to play around with it more to see how it can help with debugging, such as toggles for show collision.

<https://learnopengl.com/Advanced-OpenGL/Anti-Aliasing>

This Website covers Anti Aliasing, not really needed but would be a nice addition to adopt early while developing the base rendering systems.