Physics example game

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An example of a box2d game using C++ and hardware accelerated graphics

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# Introduction

This will be an example of a 2d physics based game that uses box2d for simulation and some hardware accelerated graphics library (Such as DX 11,12, opengl or vulkan). In the game the player can create small explosions. There are bank robbers that have taken some people hostage, your goal is to take out all the bank robbers well at the same time preventing the loss of money (Kept in safe) and not losing yourself or any hostages. The game starts out with a tutorial that instructs the player how he can play. The game features simple graphics (Because that’s all I know how to do) and sound but demonstrates some actual intuitive gameplay. Also, I will probably put this project online as a tutorial for anyone to follow at some time.

(An interesting fact is that I originally came up with this idea in an old game maker game I made)

# Required tools

* Visual studio 2017(Has some useful graphics debugging features)
* Visual studio code (For some content files in a lightweight environment)
* Git(Installed in the windows command prompt)
* Linux bash for windows (Installed from windows features and runs in the command prompt)
* Paint.net (Used for graphics)
* Sonic PI (Used for sound)

# Time line

The game starts out the player in a empty room with an exit on the other side, the player must use explosion power to move to the other side of the room while avoiding going out of the bounds of the room himself. There will be other tutorials that follow that show the player how to move other things with his explosion power and how to save the hostages and prevent as many casualty’s as possible to the banks financial reserves. The goal of the game will always be to stop the bank robbers (by knocking them out of the room) and to save the hostages(If any of them die the player must restart the level) and by saving the bank as much money as possible. Throughput the game the environment the player is in changes, for example there could be a water level with lower gravity or no gravity or artificial gravity in a space environment. There will also be special blocks such as TNT(Creates an explosion when an explosion hits it or flaming thing such as a camp fire hits it), glass(Breaks when any explosion or rocks hit it). Rocks(Big round boulders that the player can use to destroy things), Anti-gravity block(Blocks that defy gravity), and dense blocks(Blocks that are extra heavy). The goal of the game is for the player to finish every level.

# Blocks described in detail

* Player
  + Camera is centered on the player but does not leave the bounds of the room
  + Must get to the exit to advance to the next level
  + Must not leave the bounds of the room
  + Dynamic object
* Hostage
  + Must not ever leave the bounds of the room
  + All hostages must survive for the player to advance to the next level
  + Dynamic object
* Bank robber
  + Must be knocked out the room using explosions
  + All bank robber must be knocked out to advance
  + Dynamic object
* Boulder
  + Simply a round object that is relatively heavy
  + Breaks glass is it is moving in a high enough velocity
  + Dynamic object
  + If a boulder hits the player or a hostage with high velocity then they are killed and the level restarts
* Glass
  + Breaks instantly if hit by an explosion
  + Breaks if hit by a boulder with enough velocity
  + Static object
* Metal wall
  + Can not be destroyed
  + Static object
* Wood wall
  + Can be destroyed if kicked out of the room
  + Dynamic object
* Heavy block
  + Extremely heavy
  + Can be destroyed if it leaves the room
  + Dynamic object
* Antigravity object
  + Dense
  + Not affected by gravity
  + Dynamic object
  + Can be destroyed if it leaves the room
* TNT
  + Creates an explosion and is destroyed if hit by any sort of explosion
  + Dynamic object
* Door
  + The player must get to this after all robber have been eliminated
  + Advances the player to the next level
* Spawn point
  + Not actually drawn
  + The place the player starts at
* Safe
  + Each safe is worth 1000 dollars
  + At the end of the game this score is displayed
  + Scores are stored in a binary high score format
  + The top ten scores are displayed in the main menu

# Necessary features

* The player can create an explosion
* All described blocks function
* There is a few levels
* Working menu
* Particle and lighting system for the explosions
* Backgrounds
* Background music
* Sound effects
* Textures
* Camera

# Levels

When a level starts up a message will be displayed to the player giving him a hint on how he should or can advance to the next level. The player always starts at the start position and must not harm any of the hostages(By throwing them out of the bounds of the room, its perfectly fine to blow them up as they will take no damage). IF the players gets rid of all of the bank robbers then the exit door will open and the player may exit and advance to the next level

Level editing will be done using a text file to describe level elements and a texture to read the level components in.

# Tutorial level one

After the player starts he will be instructed with a message telling him to use his explosive power to reach the exit on the other side of the room.

# Tutorial level two

After the plyer spawns in he will be given a message telling him to move the boulder out of the way to advance.

# Tutorial level three

In this level a message will be displayed telling the player he has to move past a few hostages and not knock them out of the room to reach the exit and advance.

# Tutorial level four

In this level the player must get rid of all of the bank robbers to unlock the door to advance to the next level

# Tutorial level five

In this level the player will be instructed to eliminate all bank robbers, not harm any hostages and not destroy as many of the safe as possible

# Level 1

A simple level with a few hostages and bank robbers, only steel walls

# Level 2

A level with only steel walls and wood walls

# Level 3

In this level boulders will be introduced.

# Level 4

In this level glass will be introduced

# Level 5

In this level tnt will be introduced

# Level 6

In this level dense blocks will be introduced

# Level 7

In this level anti gravity blocks will be introduced

# End

The player will be shown a congratulations message and will then be redirected to the main menu

# Main menu

The game starts here. In the main menu, there will be 3 buttons organized in a horizontal order. The buttons are play, select level and exit. The games title will also be displayed above the buttons in a large text

Clicking on the play button will start the player off at the first tutorial level

Clicking on the select level button will take the player to a screen where he can select a level he has already played

Clicking on the exit button will obviously exit the game

## Controls

This is designed to be a one button type of game. The player can create an explosion pressing and holding the left mouse button to charge to explosion. Releasing the left mouse button will release the explosion with the size and the intensity of the explosion being equal to the length it was held down (With a certain limit). The controls really are very simple.

# Publishing

I plan on publishing this game to game volt so that others may play it. I will also make a temporary website with perhaps a tutorial on a blog published to Heroku.

# Programming

This section describes the different kind of objects I will need and their relationships.

* Texture
  + -m\_width:int
  + -m\_height:int
  + -m\_texture:ID3D11ShaderResourceView\*
  + +Texture(const char\* filepath)
  + +GetShaderResourceView():ID3D11ShaderResourceView\*
  + +GetWidth():int
  + +GetHeight():int
  + +Delete():void
* Initable
  + -m\_error:char
  + +Init():bool = 0
  + +Delete():void = 0
  + +GetErrorMessage():char\*
* Form : Initable
  + -m\_width:int
  + -m\_height:int
  + -m\_fullscreen:bool
  + -m\_hwnd:HWND
  + -m\_name:LPCWSTR
  + -m\_error:char\*
  + +Form(name:LPCWSTR,width:int,height:int,fullscreen:bool):
  + -InitWindows():void
  + +Delete():void
  + +Init():bool
  + +GetWidth():int
  + +GetHeight():int
  + +GetFullscreen():int
* RenderInterface : Initable
  + -m\_device:ID3D11Device\*
  + -m\_deviceContext:ID3D11DeviceContext\*
  + -m\_swapchain:ID3D11SwapChain\*
  + -m\_renderTargetView:ID3D11RenderTargetView\*
  + -m\_depthStencilBuffer:ID3D11Texture2D\*
  + -m\_depthStencilState:ID3D11DepthStancilState\*
  + -m\_rasterizerState:ID3D11RasterizerState\*
  + -m\_backColor:float[4]
  + -m\_form:Form\*
  + -m\_error:char\*
  + -m\_verticalSync:bool
  + +RenderInterface(Form\* form,backColor)
  + +Init():bool
  + +Delete():void
  + +SetBackColor(float[4] color):void
  + +GetBackColor():float[4]
  + +Clear():void
  + +Present():void
* Renderer: Initable
  + -m\_renderInterface:RenderInterface\*
  + +Renderer(RenderInterface\* renderInterface)
  + +Init():bool
  + +Delete():void
  + +Render():void
* Injector:Initable
  + -m\_form:Form\*
  + -m\_renderInterface:RenderInterface\*
  + -m\_renderer:Renderer\*
  + +Injector();
  + +Init():bool
  + +Run():void
  + +Delete():void