

Project Report

Computer Games Development

Final Year Project – Repeat

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# Project Abstract

This project is called “Wacky Blocks”.  
The objective of this project is to make a platformer game with some features added like multiplayer/server, level editor and lighting system this is a simple hack and slash with a bit of shooting involved.  
This is the scope of these features:   
The level editor is a simple tool where you can select a slider which opens up inside the slider there is tabs where you can swap into different sections so for starters there is “Blocks” where entities can walk on, different tabs are such “Traps”, “Enemies”, “Pickups”, “Miscellaneous” which are health, shop, torch and finally “Essentials” which is needed to have in the level that would be the player and portal.  
Multiplayer/Server so in another project you need to run the server first, and then the main project this is so we can send some information towards the server and then the server sends information back into the clients which basically creates multiplayer. I made it as when you click on the multiplayer button in main menu you get to choose options such as host or client the host just waits until someone joins them, and the client need to join whatever host there is after joining the host can pick a level and start the game.  
Lastly I made a lights so the game is set as dark and the player has a light source so you can see only a portion of the game depending if there are lights placed in the level.  
This project is made in Visual studios using C++ and SFML

# Project Introduction

The reason why I chose a platformer type was because I thought there was a lot of stuff I can add so for a 2D game first think came to my mind was level editor, then I added a lighting system so the game is actually set as dark/night mode and the player has a light source where light is showing and as well there is torches that can be placed around the world this will give a more nightly feeling, next I added a server so I can make multiplayer for this project, its simple 2 player co-op so one chooses to be a host and another joins that player the server is responsible for sending and retrieving data from the clients essentially making this multiplayer game. The player can go around hacking and slashing enemies while being able to shoot with the mouse if in the map there is a shop the player can buy stuff to upgrade stuff.  
  
**Game Play**: In the main menu when you select the level you want and press continue that’s when you go into the gameplay part, the player starts with few currency and ammo the player can jump onto different platforms or dodge enemy attacks if he presses space the do the normal attack and with a mouse left clicking will shoot a projectile from the players position to where the mouse position was, the player can buy upgrades only if there is a shop in the map simply by coming close to it and pressing the ley “E” to open the shops interface and you can buy whatever you want with the right amount of currency the player can get more by killing enemies upon death they drop coins where player can pick them up.  
There us 5 enemies in the game currently each one does something unique.

1. Evil Eye – this enemy is a flying unit so it finds and patrols a small area, it has 3 attacks the first one if it detects the player within certain range it will shoot a projectile towards the player, 2nd is a bite attack which this enemy will do a short leap towards the player to bite him and lastly the 3rd attack would be a spin attack which will do a knockback effect to the player if he is still inside the radius.
2. Skeleton – 3 simple attacks and 1 defence the first 2 are slash attacks 3rd is a range attack and lastly 4th is a shield where he protects himself if he detects a player projectile incoming.
3. Goblin – 2 slash attacks and 1 range attack which this range he throws a bomb where it can bounce off the blocks and upon few seconds it will explode.
4. Mushroom – 2 slash melee attacks and 1 range attack this range attack deals a wide AOE (area of effect) so it will spread gas that spreads around.
5. Demon Boss – this is a boss enemy where he deals tons of damage and has higher lifeforce he only has 1 melee attack.

The game can be dark so the player needs to be cautious while traversing the world he has a light source but there may or may not be other light sources within the world.  
There may be traps within the game and to end the game the player needs to find a portal to go inside to end the game. Upon ending the game, it will show some stats to see the progress the player made.

**Level Editor**: there needs to be a level editor for a platformer game it’s a must, when I was implementing this feature, I decided to add destructible blocks so they can be damaged and destroyed this way the player can create their own paths instead of following the normal way. Upon opening the level editor, you can see a back button and right beside it a save button at the top left on the right side there is a button that opens a slider this slider has tabs there are 5 sections

1. Blocks – simple blocks that can be destroyed and where entities walk and collide against these are blocks such as Dirt, Granite, Sand and cobblestone
2. Traps – there are 2 traps barrel and spikes the barrel is a block where if hit it will explode and the spikes are a trap that every few seconds, they will come up to deal damage if someone is inside it.
3. Enemies – 5 enemies that the player can place where they want them to be.
4. Essentials – these are objects that must be in the game that would be the player and portal to end the game.
5. Miscellaneous – these are objects that can do something different entirely so that can be health and ammo packs where the player can replenish or there can be a torch where you can light the place up not to make it darker and lastly a shop where the player can buy stuff.

There are 3 different block sizes normal ones are 1x1 and the medium are 2x2 and large would be 3x3 blocks, after finishing the level you can press save where a panel will appear where you can enter the name you want to save it as.

**Level Selection**: When clicking on single player mode a level selection screen will appear where you can select the level you want, the save file is done a bit differently it is saved as a Json file after selecting the level and pressing continue it will take a short while to load it up.

**Light**: so I decided to add a light system into this game, so the light appears on the player and the torches all it does is sets the game black and I draw a sprite on top of it I calculate the polygons to create the light and shadows, the stuff I calculate are the edges of the blocks and the screen edges its all about the vertices the further the distance I just make the colour darker to give that more realistic approach and then update the texture and set that on the sprite.

**Server/Multiplayer**: I thought adding a multiplayer feature would be cool and a good experience and reminder about how it works, so I created a separate project called server where you must run that first, the server job is to receive stuff and send data back to the appropriate clients, the server waits for commands so back into the game project when I click host button I will send a message “host” and when the server receives it he takes the TCP client and assign him as a host so when the other player presses join he will receive only the people who pressed host button and if the person presses to join that host the hosts session will be updated so he takes the person who is joining him so he can remember him and receive data like positions from that player.

# Project milestones

So how I decided to do this was create the basic functionality mechanics of the features I want to make so that would be the level editor, player, light and server/multiplayer after I do the basics of them, then I can slowly expand on them and start doing other stuff like the enemies.

The first month was to create main menu -> level editor -> loading level -> player -> then the network which took a while to do, after that I started dadding few small stuff like 1 enemy so I can go back into the player and add stuff like health and collisions since all of these features connect to each other in some way slowly then I started to work on the light and after that I went ahead and was doing a lot of features at the same time so let’s say I finished an attack combo for the player even though I can still work on the player I would take a break from him and work on something else instead, because for me personally I get fatigue working on the same thing for a long duration and I need some time off a bit.

Sometimes I might get stuck on like the shadows for the light sources and them overlapping on each other not correctly I would take a pause form that and do something else and come back later, that’s how I worked on this day to day.

# Major Technical Achievements

**Server/multiplayer**: Honestly this was the best part for me in the project I had a very hard time finding how to exactly do this but every day I could see some progress when I was working on it, at the start it was just simply sending a message to server and server sending back a simply string that’s all after that I had to slowly expand so I needed to create some kind of ID so the players would know who is who and the server as well after doing that when the players connect to each other was successful I needed to create another player for each game and instead of sending strings I needed to send information data so the player would know what each other is doing I needed only the basic of it so that would be the x and y position coordinates and the animation state and frame.

**Light**: Adding the light was very challenging at first I wasn’t exactly sure where to even begin but after reading forums online how others did it the logic wise to this and also the SFML light as well since SFML has some light stuff, I came up with a simply idea so it was to simply draw a sprite on the screen but the texture always changes I manipulated the polygons so it will cast light the light basically makes the texture transparent/white so it’s nothing there in that radius technically a blank area I take all the edges of the blocks then the radius and the position of the light source that is supposed to be and I simply calculate the polygons/vertices to be in correct positions for the shadows   
  
Example how the texture looks like:

A black and white image of a building

Description automatically generated

Its not perfect and has few problems that I am not sure how to fix but I would like to solve this eventually.

**Shop**: It’s not that big as the previous 2 but the shop was fun to do as well, I wanted to be a little RPG style so like when the player is beside it there is a small text that says press this to open the shop. I added a panel with a scroll bar handle so let’s say the mouse is over an item there will be a description that appears at the bottom that describes the item and if the item is bought it will turn green indicating its bought. I had fun adding the items in and making them work so the simple ones are expanding health or ammo but stuff like the energy wave attack for the player was fun to do and making the player shoot out more bullets.

**Enemies**: I was going for a different playstyle for each enemy so some enemies are more dangerous than others or they become dangerous when their health is low for example the mushroom enemy after it drops to 40% or so, he might do a huge AOE attack which shoots out gas and it spreads if the area is small the dangerous it is so its better to finish before they do that attack or attack them for distance, 1 enemy fly’s I made him patrol in a random area so at the beginning he sets the first patrol point at the spawn position than he finds a new patrol point if he can go there and when he arrives he finds another new patrol point so each flying enemy can go somewhere completely different if you are playing the same level, other enemy can throw a bomb like the goblin and he is much faster.

**Saving/loading**: this was hard to tackle mostly since I done that to myself, instead of creating a save file on the txt file like I did previous projects this time I tried doing a Json to make it very readable for the person who wants to see the save file or manipulate it if they wish. I done it differently so the save file reads blocks sections now I am not sure if it’s because of that or most likely its inside the “processEvents” and not in the update function that makes the loading part long the more blocks the player has made in level editor the longer the loading will take, but at least I can read the save file now unlike the other times I did so that was a good experience for me.

**Player**: creating the player was easy at the start but it got much harder when I was adding the jump I needed to create another rectangle box specifically for that which it took a bit of time and then when I wanted to add a combo that part was the hardest I had tons of problems making it work correctly the attack collision box to be enabled on the correct frame so the enemy can take damage on that part where the sprite is swinging his sword down and also I has dome trouble making the frame to go in order some times it use to go not from 0 -> 4 that would be 5 frames but it went sometimes like this 0 -> 1 -> 3 -> 4 -> 2 or its starts at frame 1 or 3 instead of 0. But I did eventual solve that problem.

# Project Review

I am proud of the work I had done for this project; it was enjoyable working on it made me want to create a new project but this time work on Unity and add the features I added in here such as server, multiplayer, level editor, enemies, lighting, player and make these features better.  
most of my tick boxes that I had in mind got successfully done, there can still be improvements like for the lighting I have made wither the polygons calculations or the overlap of different light sources and shadows can be improved on, the server and multiplayer was successful as I wanted it, the enemies, traps and player was good, the explosion barrel can be probably different way of doing it right now it’s a bit rushed work the code isn’t impressive looking at that part I had some problems with the #includes stuff I had few times that I get a error because of the infinite loop.  
  
the loading part can be better made I think I just need to move that function in the update instead in the “processEvents” function I think that’s the cause of the loading time taking forever the more blocks you have the longer it becomes. I can also finish the enemy Demon King which was suppose to be a boss monster I had few ideas what to add for him but all of them will take some time to do.  
  
If I can redo this current project I would do the same thing I did already so start making the basics mechanics first and then slowly expand on each one over time I think that was the best thing for me with the time I had but the 1 problem would be that I had too much stuff going in my head coming with new ideas and then thinking to add it or not, so right now in the project I have water and lava blocks but they don’t work neither of them. I wanted to add like a swim feature so the player can swim inside the water, and it will have a breath meter for how long it can stay. so what I shouldn’t done was only add stuff that I will finish off what I did at the start is immediately added all the blocks that I had envisioned will be in my game and slowly add 1 by 1 to work but as time was slowly running out I had to go and make the light system, enemies and whatever else I needed and I never came back to the level editor for the water and lava blocks.  
So the think is I should be more realistic of what I can do within the time I have that’s what I think I should focus on more not on what I can do or will do but what can I able to do within the time I have currently so just to lower amount of stuff I want to add and lastly coming closer to the end of August it made me realize that there are stuff I forgotten to add like if the player falls off the map there is no “you lose” screen nothing happens a bit of play testing was needed after finishing something would solve these problems I believe.

# Conclusions

This project was very hard to do, there was some stuff that I had to read upon first before randomly starting it like the server stuff like TCP, but it was fun to do and have the experience that I have right now.

The project has a good gameplay mechanic with the player, enemies, traps and the blocks that can be destroyed with the lighting system which makes it more dangerous for the player, it has a bit of sound, music and persistence so when the enemy dies you can see the body remaining there.

The technical achievement of this project was huge, the server multiplayer feature is huge thing and can be easily expanded, the lighting was very difficult to figure out and finally the level editor where the player can create their own maps and share them with anyone or manipulate the file as well since its very easy to read all these features stand out as a complex tool.

In conclusion this project has fulfilled what it is needed a basic version of a platformer game it shows my skills at making different sorts of stuff and proof that I can overcome challenges and the knowledge I obtained from this project mostly the server/multiplayer and lighting was huge for me, and I am proud of what I have done.

# Future Work

There is an incredible amount of work still needed for this project the Server/multiplayer still must be worked on to make sure the enemies are synchronized on both sides and anything else that might not be synchronized. In level editor I would like to finish the Water and lava that I had and add a load function so I can load the level to either change the structure or expand on it. The enemy boss is unfinished which I had some cool ideas to add, there are tons of stuff I can come up with and continue to work on it.

# References

This project is mostly inspired from games like Dead Cells and Blasphemous these are platformer games which I played before.