Space Invaders: Swarm
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Initial Design Ideas:

Circular Pathing:
Make aliens move in a circular path around the players spaceship, which can be rotated to aim. This counters the "best" strategy in space invaders, which is to shoot the aliens closest to the edge of the screen to prevent them from descending a row. Having the aliens move around the player in a circular path adds more challenge to the game as the player has to focus on fighting off aliens from all angles. This adds an element of multitasking to the game, as the player must switch focus between different areas of the screen to ward off aliens from all sides.

Player-controlled deflection shield:
Turn the destructible barriers into a single shield controllable by the player which can deflect missiles fired by the aliens. This expands on the previous idea of multitasking, as the player now must think about positioning their shield to deflect missiles and shooting oncoming aliens, and forces the player to decide whether they want to shoot the missile or deflect it.

Missiles can destroy Aliens when deflected by the Player:
Make deflected missiles destroy Aliens. This rewards the skilled player for deflecting missiles well, as they can position their shield at an angle to "aim" the deflected missile in a certain direction. Killing aliens with a missile will result in a bonus score being awarded to the player as a reward for skillful play.

28/03/2020

Project Started, created Git repository.

07/04/2020

Design decision: The player must protect the centre of the screen, and aliens have a circular path around the centre of the screen. This increases the difficulty by giving players more area to think about, and also means that they will have to destroy more aliens to clear a wave. I have decided to offset this by giving the player a "shotgun" type weapon which shoots three bullets in a narrow spread, allowing more Aliens to be killed at once, especially by skilled players. This compensates for the increase in difficulty, keeping the balance of the game around the same as the original Space invaders.

Work Done:
- Made the player object in the centre of the room, made the player object point towards the cursor so the player may use their mouse to aim, which allows them to take advantage of the PC as a platform.

- Added bullets; fired from the player's position when the spacebar is pressed; that the player can use to destroy the aliens.

- Added aliens which move in a circular path around the player using a formula involving the angle, distance, and sine and cosine calculations to find the x and y Coordinates for any point in the circular path.

- Added "Trigger angle" that aliens will move down a row when they reach.

Problems Found:
- Due to the circular pathing, the player can just rapidly fire at a single point, before the aliens move down a row, and easily beat the game.
  Possible Fix: Make aliens move down a row at random intervals, and make the direction alternate between clockwise and counterclockwise depending on row.

- Intervals are too random, some aliens are hopping down 3 rows at once and others aren't hopping at all.
  Possible Fix: Make hopping very unlikely at the start, and increase the chance of hopping proportionally to the time since last hop, this will make hops more regular yet still happen at random positions.

08/04/2020

Design Decision: The game is still missing the missile mechanic from space invaders, so I will add in a second type of alien that will sometimes spawn in place of a regular alien. This alien has the ability to fire missiles at the player.

Design Decision: Gameplay would flow better if the player knew when the weapon cooldown was over so they could fire again. To accomplish this I will use Diegetic UI. I will make a small charging animation for the player sprite which will play during the cooldown, letting the player know in an intuitive way when they can fire again.

Design Decision: I want my game to have a 'wave' system like the original space invaders, where the game repeats over and over again with added difficulty until the player dies, and the players objective is to get the highest possible score before they die. For this to work, I have to have a way to spawn a different amount of aliens every wave. For this reason, I have decided to make an AlienSpawnController object that Spawns a certain number of rows of aliens depending on what wave the player has reached, with different types of aliens and other objects such as perhaps powerups having a chance of spawning calculated from the current wave number.

Work Done:
- Made Alien Gunship object using the same movement code as the regular aliens
- Made Missile object which moves towards the player when spawned
- Made Alien Gunships have a small chance to spawn a Missile every step
- Made AlienSpawnController object, which spawns an alien every 18 degrees for each row.

Problems Found:
- Sprites for missiles are not pointing towards the direction they are fired.
  Fix: Added code in create event to make the angle of the Sprite the same as the angle of the Object.

13/04/2020

Design Decision: Due to the weapon cooldown, the player cannot shoot down missiles when there are many fired at the same time from all directions, which can feel unfair as the player has no chance at surviving all of them. The original Space Invaders has static barriers that are slowly destroyed by alien missiles over time, but I think it would be fun if the player could have a barrier that they control, that they can use to deflect missiles back at the aliens.

I have decided to implement a shield that deflects missiles. The shield is controlled by the A and D keys, which cause it to rotate around the player. The player can use this to rotate the shield to be in the path of oncoming missiles, which will deflect them and save the player from losing health.

Work Done:
- Created a shield object and added the ability to rotate the Shield around the player with the A and D keys.
- Made the missiles reverse direction when colliding with the Shield.

Problems Found:
- The Shield simply reversing the direction of the missiles on collision looks unrealistic, it would look better if the angle they are deflected to is based on the angle of the shield when a missile hits it.
  Fix: Calculate reflection angle of missiles on collision and use this to determine the new angle of the Missile.

Design Decision: Make deflected missiles destroy aliens. This game mechanic would add an extra layer of skill based reward into the game, as players can learn to deflect missiles at the optimal angle to hit an alien, which allows more skilled players to utilise this skill to perform better.

Playtest Feedback: The random row hopping mechanic is disorienting and confusing, and makes the game less fun.

Change Made: Removed random row descent mechanic and added AlienRowController object that stores the time since last alien descent, and sets a global variable to true once a specified amount of time has passed, which is used by the Alien instances to decide if they Descend that step.

16/04/2020

Problems Found:
- Missiles are sometimes passing through the shield instead of bouncing off, the cause of this is unclear but it seems to be due to problems caused by gamemakers implementation of collisions.
  Fix: Change to checking for collisions via code in the step event.

Playtest Feedback:
- Game is too repetitive, adding in more enemy types or something to make it more interesting.
- It's really jarring and disorienting when the aliens change directions or move down a row.

Changes made:
- Added blue alien which when shot will change to a normal alien, meaning it must be shot twice to be killed. Made this alien start spawning at wave 4, getting more and more likely to spawn in place of regular aliens the more waves the player clears.
- Implemented a system to gradually decelerate and accelerate when changing direction, and made aliens gradually move down a layer instead of instantly teleporting there.
- Added Player health mechanic, added Score mechanic. Aliens reaching the players ship will damage their health, and getting hit by a missile will also damage their health. Destroying aliens will increase the players score, which gives them a goal of achieving a high score. I chose to have a health percentage instead of a number of "lives" as it allows me to more finely balance the damage dealt by missiles and the amount of damage dealt by an alien reaching the player.
- Added GUI at the bottom of the screen, red bar showing health percentage, and text showing current wave, amount of enemies left in the current wave, and player score.
- Did sprite work, updated Alien sprite, added Blue Alien sprite, Updated shield and player sprites.

Design Decision: Adding blue aliens shifted the balance of the game to be significantly harder, I compensated for this by increasing the minimum delay for alien row descents and by adding health packs. Health Packs are white circular objects marked with a green plus symbol (+) design which, when shot, award health to the player. Health Packs have a chance of being spawned instead of an alien when the AlienSpawnController spawns an object, which decreases as the player progresses in the game. Health Packs move with the aliens as to avoid overlapping or visual confusion.

Problem Found:
- Players can use health packs to heal over their max health
  Fix: Added check to see if player health is above max health, and if so reduce it to be the same as max health.

23/04/2020

Work Done:
- Started Implementing Main Menu and Game over Screen
- Started implementing sound effects. Sound effects provide audio feedback to the player when they interact with the game, which makes the game easier to understand and also more rewarding to play. I used BFXR.

Design Decision: I have decided against using particle effects, as due to how my game works there are lots of objects on screen that are all moving, which means that particle effects will make the game look very cluttered.

24/04/2020

Design Decision: Have the player shoot the buttons on the main menu instead of clicking them. If I have small animations demonstrating the controls, then I can have the main menu act as a small tutorial to help the player understand how to aim and fire.

Design Decision: Make the missiles have an area of effect explosion when destroyed. This explosion destroys Aliens, and causes any other missiles in the explosion radius to also explode, allowing the skilled player to chain missile explosions by causing a missile to explode near another missile. This mechanic would be very rewarding to players, as with good shield positioning and luck, they can destroy many aliens at once in a chain of explosions.

Work Done:
- I created two objects which can be shot by the player that sit just below the "Play" and "Quit" text. When the player shoots one of these it is selected. If the player shoots "Play" then the game room loads, if the player shoots "Quit" then the game closes.
- I created an Explosion object with a sprite consisting of a simple explosion animation. The Explosion checks for collisions with aliens and destroys them, and checks for collisions with missiles, destroying them and spawning more instances of the explosion object at their coordinates. The Explosion object destroys itself once its sprite's animation has finished playing.
- Added explosion on player death, added explosion sound on player death.
- Added Gameover Room: Loaded when player health hits 0, contains text saying "Game Over" and the players score. The player can press the spacebar to be taken to the main menu.

Problems Found:
- Explosion sound playing every step once player health reaches 0
  Fix: Added boolean variable "dead" to player object, once player health is below 0 dead is set to true, sprite is changed to explosion, and the explosion sound is played. The if statement now checks if dead is already true when checking if player health is below 0.
- Game crashing when loading the Game Over screen.
  Fix: Convert player score variable to string before displaying it as text.

27/04/2020

Work Done:

- Added in "Special Alien" with a rare spawn chance that awards 20000 score when killed. These aliens can only be killed by bullets shot by the player, and not by missile explosions, as to make getting them more of a challenge and more rewarding. The Special Alien acts and looks similar to a regular alien, but it is animated with bright colours to let the player know it is something special.