CS104 project
Angry Birds

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1 Project Overview

This project involves the development of a simplified two-player version of the classic game Angry Birds using Pygame. The goal for each player is to use a slingshot mechanism to launch birds, aiming to destroy blocks and score points. Players alternate turns, and the winner is determined either by achieving the highest score or by successfully demolishing the opponent's fortress first depending on the game mode selected.

The game features a variety of blocks with different properties, such as wood, stone, and ice, each requiring different strategies to destroy. The game also has custom options for dimensions of fortresses, wind effects, moving fortress blocks, and aim assist.

2 Modules

List of external libraries used and their purpose.
Example:

- **pygame**: Used for game rendering, event handling, sound, etc.
- **random**: For randomness in game elements like bird generation, fortress generation and deciding which player plays first.
- **math**: For calculations related to angles and distances(calculating sines and cosines of angle of projection).

3 Directory Structure

main.py Entry point of game. Imports functions from other files and initializes the game loop.

interface.py Contains the function `interface_screen()` which is used to create the interface of the game.

game.py Contains the function `gameStart()` which handles the game logic, including player turns and scoring as well as manages projectile physics.

end.py Contains the function `end_screen()` which displays the game result at the end of the game.

bird.py Contains the Bird class and several bird functions which handle the bird's properties and actions.

blocks.py Contains the Block class and several block functions which handle the blocks' properties and actions.

Images Directory containing all images used in the game, including backgrounds, blocks, and birds.

parameters.py

Contains the various parameters for the game, including several boolean variables for game options, ints and lists for dimensions and several functions for setting the game options and getting the results.

4 Running Instructions

- Run the game using `python3 main.py`
- The Interface screen will appear with the game title and options.
- Enter player names by clicking in the textboxes below the prompts. The names can also be edited by clicking in the box again.
- Select the game mode by clicking on one of the options:

  Last Stand Players take turns to destroy the opponent's fortress. The player who destroys the opponent's fortress first wins the game and to make it fair the player who starts second gets a chance gets one chance even after the player who started first destroed the former's fortress.

  Timed Assault Players have a limited time to destroy as many blocks as possible turn by turn. The player with the highest score at the end of the time wins. If a player's fortress is destroyed before the time runs out, a new fortress is generated for the player and the game continues.

- Select either the difficulty level or the options to customize the game.
  - Difficulty levels:

    Beginner Less number of blocks in the fortress, no wind, no moving blocks and with aim assist.

    Intermediate More number of blocks in the fortress, wind effect, no moving blocks and with aim assist.

    Advanced More number of blocks in the fortress, wind effect, moving blocks and without aim assist.

  - Custom options:

    Dimensions Select the dimensions of the fortress. The default is 2x3.

    Wind Select the wind effect. The default is no wind.

    Moving Blocks Select whether blocks can move. The default is no moving blocks.

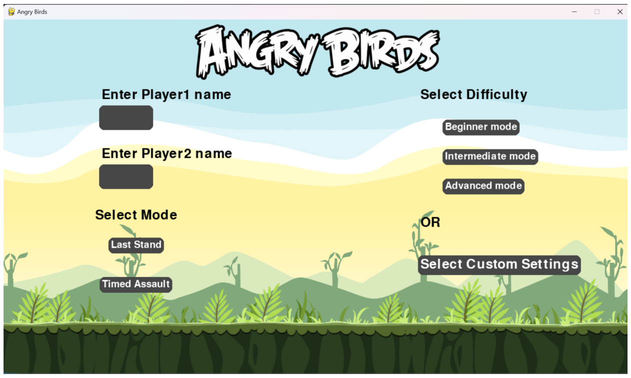
    Aim Assist Select whether aim assist is enabled. By default, it is enabled.

- The play button will show up when all options are selected. Click on the play button to start the game.
- The game screen will appear with a countdown timer of 3 seconds after which the players can start playing. The screen also shows the player names and their scores.
- Use mouse to drag and release the bird.
- Birds have different abilities which can be used by clicking on the screen after the bird is released.
- The game can be paused by clicking the pause button on the top right and aim assist can be turned on or off by selecting the settings options and clicking on the toggle button.
- The result screen will appear at the end of the game showing the winner and the scores of both players.
- The game can be exited by clicking the exit button on the top right of the screen.

5 Basic & Advanced Features

5.1 Basic Features

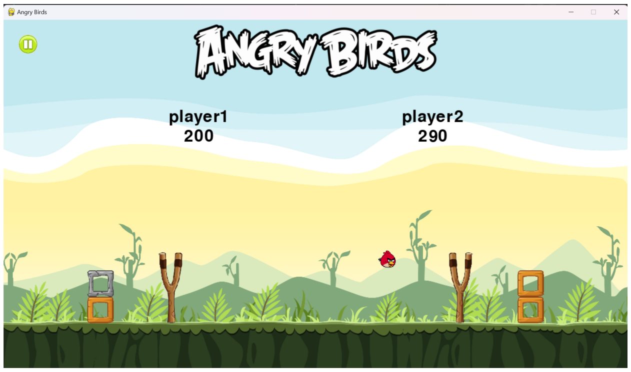
- **Game Interface**



Game Interface Screen

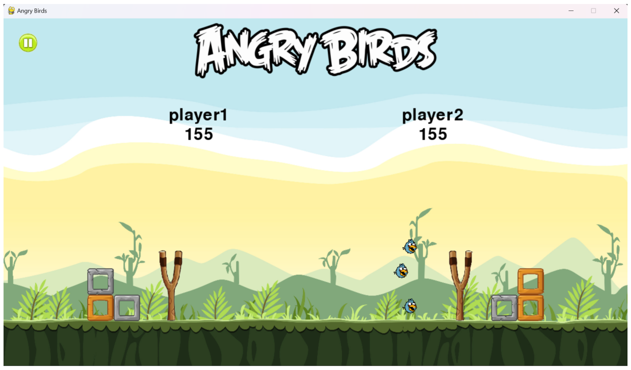
- **2-Player Gameplay** The two-player gameplay is handled by assigning a random value to the player variable at the start of the game and then switching the player variable at the end of each turn. The bird generation is random and the blocks are generated randomly at the start of the game.
- **Projectile Mechanics** The initial speed is controlled by the mouse drag distance and the angle is controlled by the mouse position. The bird is launched when the mouse is released. The bird has a gravity effect which is handled by changing the position of the bird (the bird's rect) in the game loop. The bird has a collision detection with the blocks as well it can bounce off the ground. There is no limit to which the bird can be dragged except for the screen size and the bird can be launched in any direction.
- **Game Over Conditions** The game over conditions are handled by checking the score of both players or the blocks remaining in the fortress. The game ends when one of the players destroys the opponent's fortress or when the time runs out in the timed assault mode as described in the running instructions.
- **Projectile Effects** The bird has different abilities which can be used by clicking on the screen after the bird is released. The image of the bird changes when its abilities are used and also when it hits a block.
  The projectiles are:

  Red Bird It does equal damage to all blocks which is equal to 35%.
  Ability Speed increases downward on click.



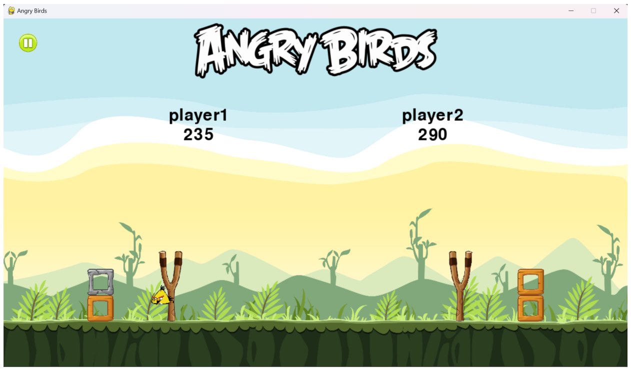
Red Bird Ability

Blue Bird It does more damage to glass blocks which is equal to 55% and to other blocks 35%.
Ability Splits into 3 smaller birds but the damage decreases to 35% for glass blocks and 15% for others.



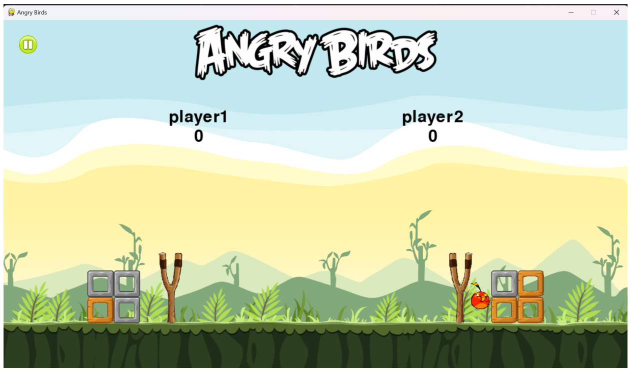
Blue Bird Ability

Yellow Bird It does more damage to wooden blocks which is equal to 55% and 35% for others.
Ability Gets speed boost and damage increases to 75% for wooden blocks and 55% for others.



Yellow Bird Ability

Black Bird It does more damage to stone blocks which is equal to 55% and 35% for others.
Ability Damage increases heavily to 100% for stone blocks and 80% for others.



Black Bird Ability

5.2 Advanced Features

- **Game Levels** Three levels have been implemented in the game. The levels and their descriptions are:

  Beginner
  - Fortress dimension - 2x2
  - No wind effect
  - No moving blocks
  - Aim assist enabled

  Intermediate
  - Fortress dimension - 2x4
  - Wind effect (low)
  - No moving blocks
  - Aim assist enabled

  Advanced
  - Fortress dimension - 3x4
  - Wind effect (high)
  - Moving blocks
  - Aim assist disabled

- **Custom Options** The custom options are handled by creating a new class for each option and then using the values of the options in the game loop. The options are:

  Dimensions Select the dimensions of the fortress. The default is 2x3.

  Wind Select the wind effect. The default is no wind.

  Moving Blocks Select whether blocks can move. The default is no moving blocks.

  Aim Assist Select whether aim assist is enabled. By default, it is enabled.

- **Background music** Handled with `pygame.mixer`.

- **Destructible Structures** Different images for each block have been used to show the health of the block.

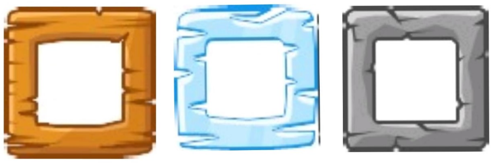
  - health $> 75\%$

Blocks with health $> 75\%$

  - $75\% \geq$ health $> 50\%$

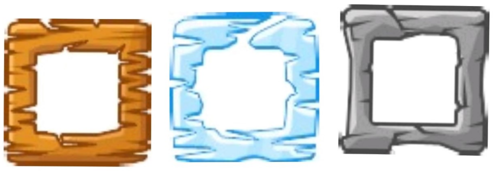
Blocks with 50%-75% health

  - $50\% \geq$ health $> 25\%$



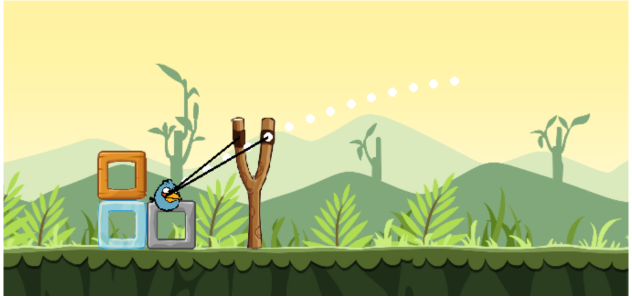
Blocks with 25%-50% health

- $25\% \geq$ health $> 0\%$



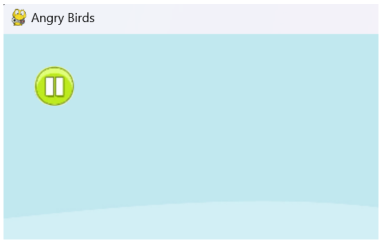
Blocks with 0%-25% health

- **Multiple Damage** A bird can damage multiple blocks even after it collided with one, but the damage decreases with each block it hits by 40% when the block is favoured by the bird (it delivers more damage to it than others) and by 10% otherwise.
- **Falling Blocks** Blocks fall under gravity when a block bebeath them is destroyed.
- **Moving Blocks** Blocks move horizontaly to and fro when the game starts if the moving blocks option is selected.
- **Aim Assist** Shows trajectory line for some distance (depends upon the speed) when enabled.

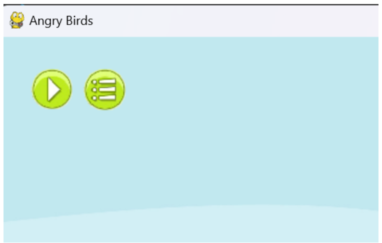


Aim Assist

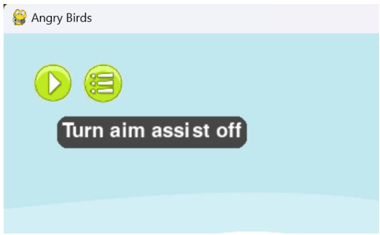
- **Pause Menu** Game can be paused and resumed. The pause menu looks like this:



Pause button



Resume button



Aim assist toggle button

6 Project Journey

- **Key learnings** Learned Pygame and basic game functioning.
- **Challenges faced**
  - Difficulty in debugging funcitons especially the fallingBlocks(), blockDestroyed() and detectCollision() functions when the ability of blue bird is used .
  - Difficulty in implementing different projectile effects.
- **Solutions** Used print statements to debug the functions and check the values of variables at each step.

7 Bibliography

- Pygame Documentation: https://www.pygame.org/docs/
- Pygame tutorials
  - **Geeks for Geeks** :https://youtu.be/AY9MnQ4x3zk?si=7h5Sa2yIWRDVps6M
  - **Youtube** :https://www.geeksforgeeks.org/pygame-tutorial/
- Pygame examples from GitHub:
  - https://github.com/estevaofon/angry-birds-python
  - https://github.com/marblexu/PythonAngryBirds