# Game Proposal: Blendy's Revenge

CPSC 427 – Video Game Programming

## Team: G11

Andrew Liu  83222802

Annie Nilson 73352213

Eddie Shang 28136596

Kushagra Sethi 45293503

Timothy Yap 43665868

Xiaohan Li   41405721

## Story:

**Setting:** Groovy & Fruity Shop

**Motivation:** Revenge

**Minion enemies:** Smoothie shop workers

**Boss:** the new blender that replaces Blendy

**Background:** A blender (Blendy) happily lives and works in a smoothie shop, *Groovy & Fruity*. When the manager and workers of the smoothie shop decide to upgrade to a new blender model, Blendy gets thrown out. Blendy is betrayed and angry and sets out to get revenge on the smoothie workers and the new blender. Blendy fights the smoothie shop workers in his revenge quest and must eventually defeat his replacement in a final showdown.

**Gameplay (details are provided in the technical elements session):**

Our game is a 2D isometric shoot-em'-up and the gameplay occurs in one continuous level in the smoothie shop, with story elements explained through cut scenes and a dialogue system. The cut scenes will occur before game play begins (to provide the backstory), before the boss fight, and after winning the game.

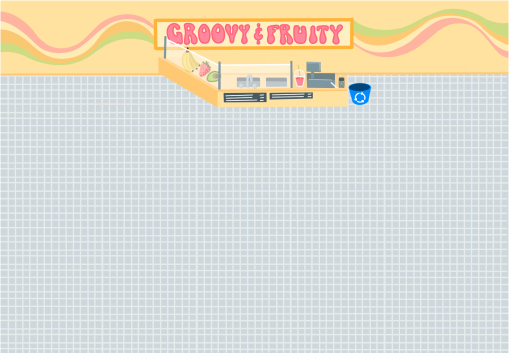
In the game, we can control Blendy's movement and attack by shooting juice as a projectile. Enemies will spawn from the edge of the smoothie shop map and attack the user following their BTree AI.. Power-ups will spawn randomly on the floor and stay there for 20 seconds before disappearing. Once Blendy consumes the power-up, it will provide him with the corresponding power.

Game progression will be tracked using a scoring system. Blendy earns points by defeating enemies. As these points accumulate, there will be enemies spawning and the amount of enemies will follow the formula $E\ = 75 + 150 * log(1 + x^2)$ . $E$ will be the amount of enemies and $x$ is the points earned by killing enemies. Once a certain score threshold is reached a final boss will appear. Additionally, some cutscenes and dialogue will be displayed after a certain score is reached, which will pause the gameplay, resuming once the cutscene/dialogue is completed.

The game is won by surviving until the end of the game and defeating the final boss (the new blender).

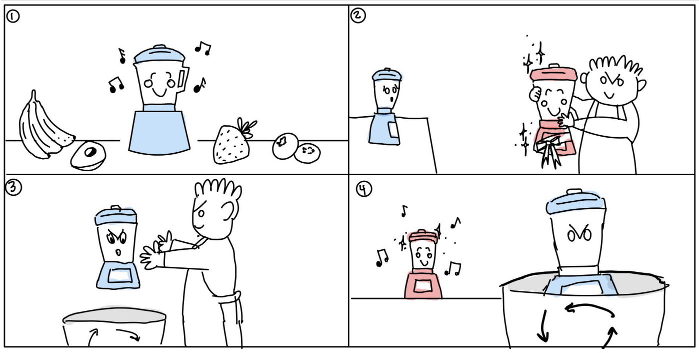
## Scenes:

**Base map (concept art):**

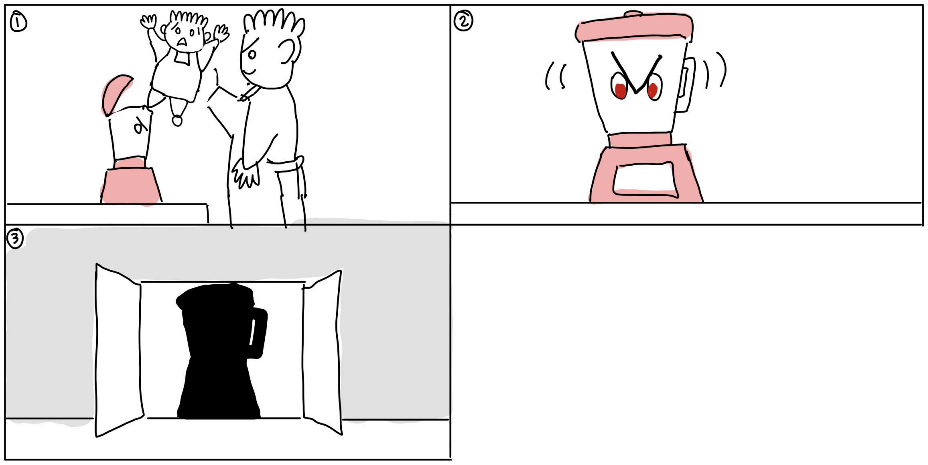


**Cutscenes:**

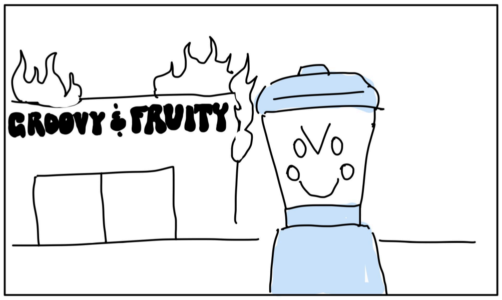
Intro (Blendy's origin story):



Pre-Boss (Boss Blender becomes more evil):

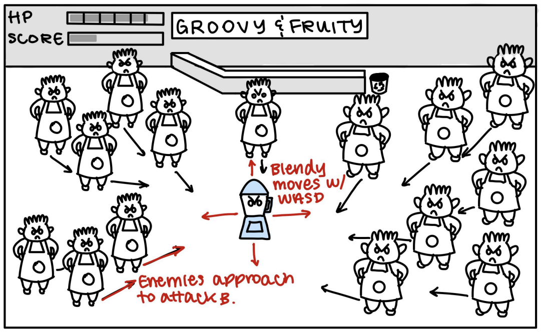


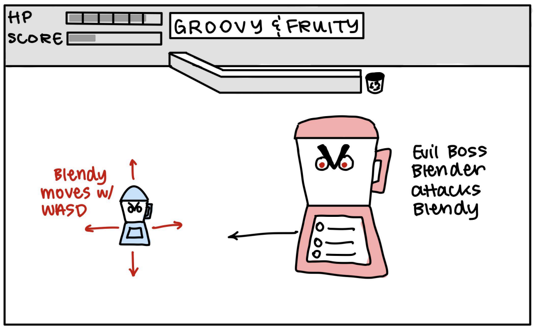
Final scene (Blendy is happy, following beating the Boss Blender and the smoothie shop):



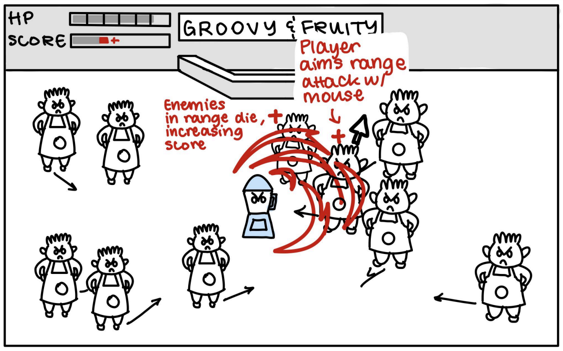
**Gameplay scenes:**

Player moving Blendy in 2D space against minions and final boss:

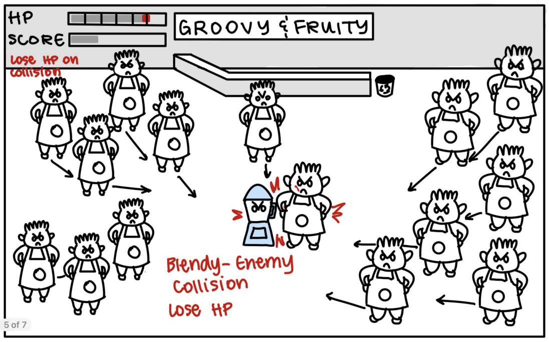




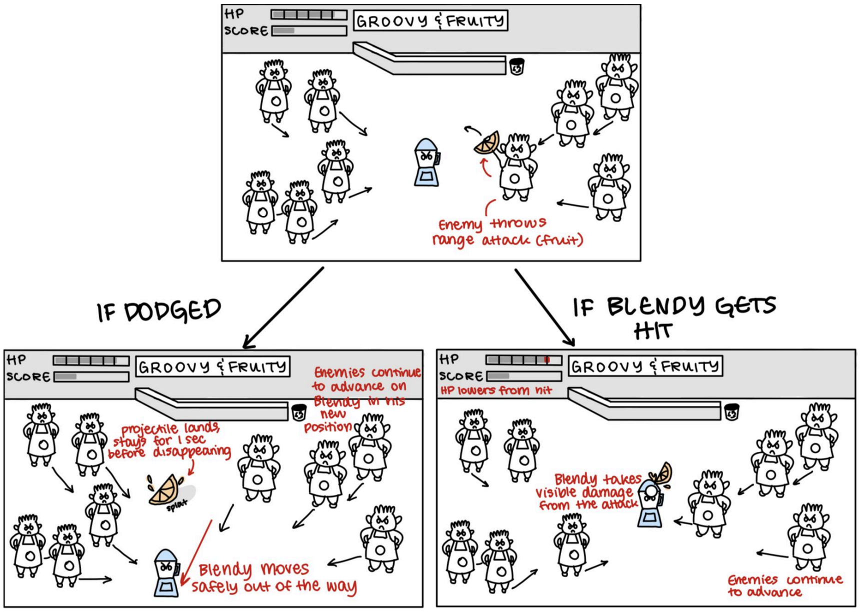
Blendy performs ranged attacks in 2D:


HP
SCORE
GROOVY & FRUITY
Player aims range attack w/ mouse
Enemies in range die, + increasing score

Minion-Blendy collision:

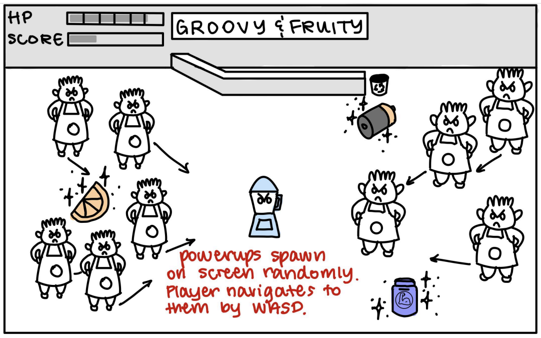


Minions (employees) performing range attacks:

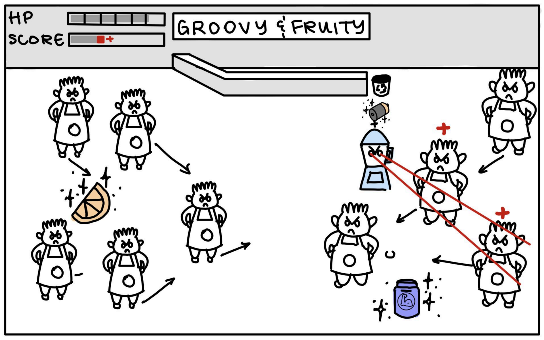

HP
SCORE
GROOVY & FRUITY
Enemy throws range attack (fruit)
IF DODGED
IF BLENDY GETS HIT
HP
SCORE
GROOVY & FRUITY
Enemies continue to advance on Blendy in his new position
projectile lands, stays for 1 sec before disappearing
splat
Blendy moves safely out of the way
HP
SCORE
GROOVY & FRUITY
HP lowers from hit
Blendy takes visible damage from the attack
Enemies continue to advance

**Powerups:**

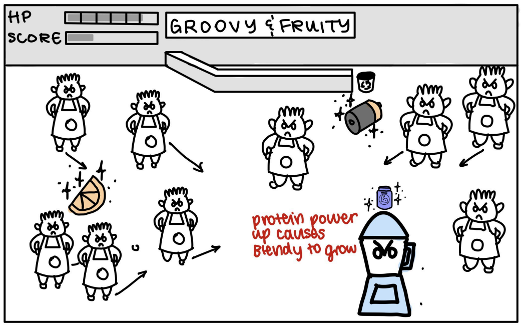
**Powerups spawn randomly on the map.**


HP
SCORE
GROOVY & FRUITY
powerups spawn on screen randomly. Player navigates to them by WASD.

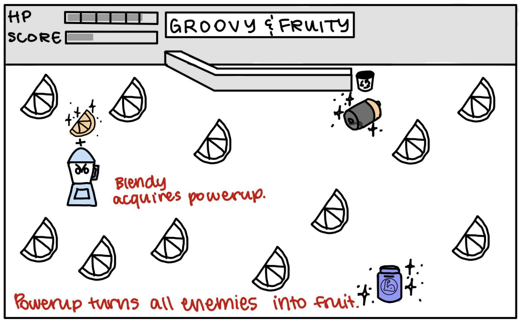
Battery Power Up:



Protein Powder Power up:



Orange Power up:



## Technical Elements:

**Rendering:**

In "Blendy's Revenge," rendering techniques such as particle effects for attacks and power-ups, Phong Local Illumination for approximating realistic lighting, and custom shaders for all game elements will be employed. These, combined with GLM for isometric projection, ensure vibrant and detailed visuals across gameplay and interface screens.

- Visual Effects (particles)
    - Particle system for when blender attacks
    - Particle system for power-ups
- Phong Local Illumination (2.5d light source, Diffuse, Specular, Ambient lighting)
- Isometric Style (perspective projection using GLM)
- Shaders for the player, enemies, powerups, and attacks

**Assets**:

Textures for platforms, enemies/projectile and the player sprite will be loaded using sprite assets. Animations for player and enemy movement will be included using sprite sheets. We will also have audio assets for sound effects and background music. Some will be publicly available; some may be created by the team members.

- Audio Assets
- Sprites for the blender/mechanics
- Sprites for special items the player can throw relevant to powerups
- Files for cut scene game design (data-driven for better customization)
    - image to load
    - SFX to play
    - length of cutscene

**2D geometry manipulation:**

The player character and enemies will need to be translated within the game world to simulate movement. We will also need to detect collisions with walls, enemies/bullets and collectibles.

- Blender taking damage - visible holes in geometry (use a shader) that showcase this.
- A powerup that, when picked up, increases the size of the blender

**Gameplay Logic**

- Player Controls
    - Blender moves using WASD
    - Mouse is used to aim an automatic attack that recurs within a given time period
- Scoring and Progression System
    - Game score shown on UI
    - Higher score => stronger enemies, enemies get more difficult as time goes on
    - Higher score => more random power-ups spawn
    - Score reaches max_level_score => spawn boss

- HP Bar for the player that goes down on receiving damage
- Powerup System
    - Powerups spawn randomly on a 2D map
    - Offer players special abilities
        - Orange Powerup
            - Convert all enemies to fruit that are running away from the blender.
            - Fruit will die immediately on contact with blender
        - Battery Pickup
            - Causes player to produce a laser that does damage within line of sight
        - Protein Powder power up:
            - Makes Blendy grow

**AI**

- Enemies follow player around (pathfinding) - (8-directional) A* search
- 3 types of enemies with behavior trees
    - Collision enemies (deal damage on collision with player and despawn after)
    - Ranged enemies (move to attack_range distance from player and throw fruit to attack player) (behavior tree)
    - Boss (can do the same attacks as Blendy but also has a dash_to_player behavior that harms Blendy)

**Physics**

- Collision2D Component
    - Detects collisions between any 2 entities
- Physics2D Component
    - Allows entity to have mass
    - Allows entity to have a velocity
    - Allows entity to have acceleration
- Player increases acceleration in the direction of WASD until they reach a max_velocity. Gives a slingshot kind of effect in each direction

**Sound (Royalty Free):**

- Sound effects when blender attacks
- Sound effects when blender picks power items
    - different sounds for different powerup
- Sound effects when enemies/bosses have attacks
- Sound effects when enemy dies,
- Sound effects when player dies,
- Sound effects when player spawns,
- Sound effects when game begins,
- Music for boss encounter,
- Generic enemy encounter music
- Royalty Free Music as .wav for Background Music - for level, for game over

## Advanced Technical Elements:

- **Catching/blocking behavior for Blendy:**
    - Impact: Blendy will be able to catch fruits within a certain number of frames to block an enemy's range attack.
    - Alternative: No catch/blocking behavior implemented and Blendy will dodge with movement only.

- **Melee attack for Blendy:**
    - Impact: Blendy will have an additional attack along with the basic projectile attack, giving the player the ability to attack enemies close range.
    - Alternative: The melee attack will not be implemented and the player will only have the ranged attack to attack enemies.

## Devices:

We will use keyboard and mouse to control the player (Blendy):

- Using mouse for UI navigation (e.g. main menu)
- Using WASD to move.
- Using the mouse cursor to aim (will shoot periodically in the direction of the cursor)

## Tools:

- GLFW: A cross-platform library for managing windows and input.
- gl3w: A header-only library for loading OpenGL function pointers.
- stb.image: A header-only library for loading images
- https://github.com/nothings/stb - for additional stb libraries
- SDL/SDL mixer: Libraries for handling music and sound playback.
- GLM (OpenGL Mathematics): A library designed to offer mathematical support for graphics programming, encompassing vectors (vec2, vec3, vec4), matrices (mat4), and functions like translate, rotate, scale, and project, closely resembling GLSL.

## Team management:

We will conduct weekly planning and design sessions using a when2meet link. Additional open working sessions will be conducted using another when2meet (2 weekly meetings).

Tasks will be tracked using a Notion Kanban Board. A local feature branch will be created corresponding to a Notion ticket, and PRs will require at least one approval before merging with main. Merge conflicts will be resolved by discussion amongst those who worked on the systems involved, and commits will be squashed when merging.

Response Time: A maximum of 2 days

## Development Plan:

**(Bold and Underline indicate M1 Requirements)**

Tasks to Complete:

1. **Set up the project environment (Initialize repo)**
2. **Use templates from A0 (ECS) and A1 (Graphics)**

**Game Systems:**

1. Rendering System
    - a. **We can render Blendy and a single minion employee (static sprites)**
    - b. **Add textures to the main character and Blendy**
    - c. **Blinn-Phong Illumination (advanced)**
    - d. Render the character, bullet, powerup (could be static for now)
    - e. UI System
        - i. HUD
            - 1. Health Bar for player health
            - 2. Score bar to count player score
2. Gameplay Controls System
    - a. Advanced player control (player should be able to aim and shoot bullet/juice here)
    - b. **Keyboard/Mouse Control - Basic player control (move left, right, up, down) (Vicky)**
    - c. **Simple collision detection (Eddie)**
        - i. **Axis Aligned Bounding Box (AABB)**
        - ii. **Blendy cannot walk through walls.**
        - iii. **Blendy cannot walk through static enemy**
3. Dialogue and Cutscene (Progression) System
    - a. Get dialogue system set up for cutscenes
    - b. Cutscenes mechanism finished for the intro.
    - c. Score counting and triggering cutscenes
4. Powerup System
    - a. Implement power up generation.
    - b. Main character is able to consume/interact with power up.
5. Audio System
    - a. Play Audio using observer pattern (events)
6. Physics
    - a. Collision2D Component
        - i. Detects collisions between any 2 entities
    - b. Physics2D Component
        - i. Allows entity to have mass
        - ii. Allows entity to have a velocity
        - iii. Allows entity to have acceleration
    - c. Player increases acceleration in the direction of WASD until they reach a max_velocity. Gives a slingshot kind of effect in each direction

7. AI
    a. Implement 8-directional A* search for enemies
    b. Behavior Tree for Collision Enemies
    c. Behavior Tree for Ranged Enemies
    d. Behavior Tree for Boss
8. Asset Management System (Templated)
    a. Load asset files into the game and access their data
9. Animation System
    a. **Keyframe/state interpolation (basic animations for Blendy) (Vicky)**
        i. **idle animation**
    b. Implement sprite sheet animation for player movement
    c. animated Blendy attacks
    d. animated enemies attacks
    e. animated enemy spawn
    f. animated enemy death
    g. animated powerups abilities
    h. animated Blendy death
    i. animated Blendy attacks
    j. animated powerups pick-up

Asset Collection:

1. Sprites
    a. Artwork for sprites
2. Audio Files
    a. Sound effects when blender attacks
    b. Sound effects when blender picks power items
    c. different sounds for different power ups
    d. Sound effects when enemies/bosses have attacks
    e. Sound effects when enemy dies,
    f. Sound effects when player dies,
    g. Sound effects when player spawns,
    h. Sound effects when game begins,
    i. Music for boss encounter,
    j. Generic enemy encounter music
    k. Royalty Free Music as .wav for Background Music - for level, for game over
3. Cutscene Images
    a. Concept art

QA Work:

1. **Test Plan for Milestone 1**
2. **Set up Google Sheet for bugs on Milestone 1**

Qualitative User Stories:

1. **Stable frame rate**
2. **Keep logic simple to reduce bugs**

Video Editing Work

1. **3 minute video for milestone 1**

## Timeline

Week 1 (Feb 2nd - Feb 9th)

- Finish blender and minion sprite art (annie)
- Finish base map art (annie)
- **Set up the project environment (Initialize repo) (Andrew)**
- **Use templates from A0 (ECS) and A1 (Graphics) (Andrew)**
    - **Set up main entities and their components**
        - **Blendy Entity**
        - **Enemy Entity**
        - **Components**
            - **Transform Component**
- **Keyboard/Mouse Control - Basic player control (move left, right, up, down) (Vicky)**
- **Game Space Boundaries - Smoothie Shop Map implemented (Vicky)**
- **Simple collision detection (Eddie)**
    - **Axis Aligned Bounding Box (AABB)**
    - **Blendy cannot walk through walls.**
    - **Blendy cannot walk through static enemy**
- Audio System (Eddie)
    - Play Audio using observer pattern (events)
    - Load and play 1 sound
- **Rendering (Kush)**
    - **We can render Blendy and a single minion employee (static sprites)**
    - **Add textures to the main character and Blendy**
- **Keyframe/state interpolation (basic animations for Blendy) (Vicky)**
    - **idle animation**
- Powerup System (Timothy)
    - Implement power up generation
    - Main character is able to consume/interact with power up

Week 2 (Feb 10th - Feb 16th)

- **Blinn-Phong Illumination (advanced) (Kush)**
- **Test Plan for Milestone 1 (Timothy)**
- **Set up Google Sheet for bugs on Milestone 1(Timothy)**
- **3 minute video for milestone 1**
- Finish sprite evil blender art (annie)

## Milestone 1: Skeletal Game (Feb 16th)

Week 3 (Feb 17th - Feb 23rd)

- UI System
    - HUD

        - Health Bar for player health
        - Score bar to count player score

Week 4 (Feb 24 - Mar 1)

- Physics
    a. Collision2D Component
        i. Detects collisions between any 2 entities
    b. Physics2D Component
        i. Allows entity to have mass
        ii. Allows entity to have a velocity
        iii. Allows entity to have acceleration
    c. Player increases acceleration in the direction of WASD until they reach a max_velocity. Gives a slingshot kind of effect in each direction

Week 5 Weekend (Mar 2 - Mar 4)

- Finish cutscene art

## Milestone 2: Minimal Playability (March 4th)

Week 6

- Dialogue and Cutscene (Progression) System
    - Get dialogue system set up for cutscenes
    - Cutscenes mechanism finished for the intro.
    - Score counting and triggering cutscenes

Week 5 Continued (Mar 5 - Mar 9)

- Implement 8-directional A* search for enemies

Week 6 (Mar 10 - Mar 16)

- Behavior Tree for Collision Enemies
- Behavior Tree for Ranged Enemies

Week 7 (Mar 17 - Mar 23)

- Sprites for boss
- Animations for boss
- Behavior Tree for Boss

Week 8 Weekend (Mar 24 - Mar 25)

- QA for M3
- Bug Fixing

## Milestone 3: Advanced game release (March 25th)

Week 9

- Polishing and shaders

Week 10

- Fix any of the previously discovered bugs
- Robust end-to-end user testing

## Milestone 4: Final Game (April 8th)