* **Project Choice**
  + **Option**: Web Game Design
  + **Game Title**: "Zombie Apocalypse: Last Stand"
* **Purpose of the Game**
  + **Goal**: Create an intense survival shooter experience where players must defend against waves of zombies while managing resources and positioning. Players need to survive increasingly difficult waves while accumulating points through accurate shooting and strategic play.
  + **Target Audience**:
    1. **Age Group**: Ages 13-35, focusing primarily on teenagers and young adults
    2. **Interests**: Action game enthusiasts, zombie genre fans, players who enjoy both casual and competitive gaming experiences with progression systems
* **Design**
  + **A. Functionality** **Core Features**
    1. **Player Movement and Combat**:
       - WASD movement controls with mouse-aimed shooting
       - Various weapons with different characteristics and tradeoffs
    2. **Resource Management**:
       - Limited ammunition requires strategic use
       - Health packs and power-ups spawn periodically
    3. **Zombie Behavior**:
       - Different zombie types with unique movement patterns and abilities
       - Progressive difficulty scaling with each wave
    4. **Lives and Health System**:
       - Health bar depletes upon zombie contact
       - Game ends when health reaches zero
    5. **Wave Progression**:
       - Each survived wave increases difficulty and rewards
       - Boss zombies appear at milestone waves

**User Flow** 1. **Start Screen**: \* Options: Start Game, Tutorial, Loadout Selection, Settings \* **Tutorial**: Interactive guide teaching basic mechanics 2. **Gameplay**: \* Player spawns in arena, waves begin after ready confirmation \* Combat and survival until wave completion 3. **Wave Transition**: \* Short reprieve between waves for preparation \* Display score and wave statistics 4. **Game Over Screen**: \* Final score, zombies killed, waves survived \* Option to retry or return to menu

**Mechanics** \* **Movement:** Free directional movement with sprint capability \* **Combat:** Various weapons with different firing patterns \* **Zombie Behavior:** Pathfinding towards player with varied attack patterns \* **Resource Management:** Limited ammo and health resources \* **Wave System:** Increasingly difficult waves with special events

**Interactive Elements** \* **Buttons**: Menu, Pause, Weapon Switch, Reload \* **HUD (Heads-Up Display)**: \* **Score Display**: Updates with each zombie kill \* **Health Bar**: Shows current player health \* **Ammo Counter**: Displays current/total ammunition \* **Wave Counter**: Shows current wave and remaining zombies

* **B. Aesthetics**:
  + **Visual Style**
    - **Theme**: Dark, post-apocalyptic environment with modern graphics
    - **Imagery and Iconography**:
      * **Arena**: Detailed urban environment with destructible elements
      * **Characters**: Realistic player model and varied zombie designs
      * **Effects**: Dynamic lighting, particle effects for gunfire and gore

**Color Scheme** \* **Palette**: Dark and atmospheric with high-contrast elements: \* **Environment**: Muted grays and browns for urban decay \* **Zombies**: Sickly greens and rotting flesh tones \* **UI Elements**: Bright red for health, yellow for ammo counts \* **Effects**: Orange muzzle flashes, red blood effects

**Typography** \* **Font Style**: Modern, military-style font for UI elements \* **Readability**: High contrast against dark backgrounds

**Layout** \* **Screen Arrangement**: \* **Game Area**: Full-screen with minimal UI obstruction \* **HUD**: Critical info at screen edges \* **Minimap**: Optional corner minimap showing zombie positions

* **Technical Specifications**
  1. **Technology Stack**
     + **Programming Language:** JavaScript
     + **Game Framework:** Three.js
     + **Frontend:** HTML5, CSS3
     + **Backend:** Node.js with Express
  2. **Architecture**
     + **Component System:** Entity-Component System for game objects
     + **State Management:** Redux for game state handling
  3. **Data Model**
     + **Player:** Position, health, inventory, statistics
     + **Zombies:** Type, health, behavior patterns, spawn data
     + **Weapons:** Damage values, fire rates, reload times
  4. **Security and Performance**
     + **Optimization:** LOD system, object pooling
     + **Anti-cheat:** Server-side validation
  5. **Specific Functionalities** a. **Combat System**
     + **Specification:** Raycasting for shooting, hitbox detection, recoil patterns b. **AI and Pathfinding**
     + **Specification:** A\* pathfinding, behavior trees for zombie AI c. **Physics Engine**
     + **Specification:** Custom physics for movement and projectiles d. **Resource Management**
     + **Specification:** Dynamic spawn system for items and enemies e. **Audio System**
     + **Specification:** Spatial audio for positional sound effects