Nucleon

Design Document rev. 5
Team Awesome Fabulous

1. Overview

This is a defense game in which the player controls an electron that flies around the area of an atom, protecting the nucleus against destructive collisions from invading radiation particles. The player controls the flight of the electron and the firing of its attacks. The game's objective is to keep the nucleus alive as long as possible while earning a high point score by defeating enemy radiation.

The game is developed using XNA and will be playable using either an Xbox 360 controller or a keyboard.

The game's movement takes place in 2d, and the art consists of 2d sprites. The game takes place in one room in one level that never changes except for a gradually increasing number of enemies.

For the player's main attack, the electron briefly transforms into a chain of lightning that leaps from enemy to enemy in a sequence. Every time the lightning hits an enemy radiation particle, the enemy is damaged and the electron builds up special attack energy. When the special energy fills up to a limit, the player may unleash the special attack in a tremendous blast that clears the screen of all enemies.

Destroying enemies earns points for the player. After the player earns enough points, the nucleus grows a neutron, getting larger.

The nucleons (the proton and neutrons) that comprise the atom's nucleus can be struck by incoming radiation particles. As each one is hit, it is destroyed, while the colliding radiation particle vanishes. The neutrons surround the proton, acting as a destructible barrier. If the proton is destroyed, the player loses the game.

Lead Designer Craig Brown proposed the original premise for the game. Designer/Producer Thomas Iu is responsible for designing some of the gameplay features, and for authoring the design documentation.

2. Game Mechanics

2.1 Gameplay Controls

The player controls the atom's single electron with either a keyboard or an Xbox 360 controller.

Player Action	Xbox Input	Keyboard Input
Movement	Analog Stick	Arrow Keys or WASD
Chain Lightning	Right Trigger	Spacebar
Special Attack	Left Trigger	Left Shift

2.1.1 Movement

The electron flies swiftly in the chosen direction, such as up toward the top of the screen if the player presses up on the controls, or moving toward the left of the screen if the player presses left. On a keyboard, diagonal movement is possible by pressing multiple direction keys simultaneously, such as up and left together. Movement is not blocked by anything aside from the perimeter of the circular playing field. While the electron is moving, it plays a faint sound effect.

Electron Move Speed should be defined.

Electron Collision against the perimeter should be defined.

2.1.2 Chain Lightning

When this attack is activated, the electron selects the nearest valid target and changes into a bolt of lightning that forms a chain between the target and the location where the electron was when the attack was activated. Valid targets are any of the enemy radiation particles and any point on the circular perimeter of the playing field. The lightning forms instantly so it does not need to travel from place to place to reach a target. The lightning cannot miss a target. The player does not control the lightning's directional movement.

If the lightning links to a radiation target, the radiation is struck and destroyed afterward. After striking radiation, the lightning selects the next closest target and proceeds to link to that. There is a brief time delay between striking a target and selecting a new one to link to.

After the lightning link forms between two targets, it leaves a trail of electricity between the target points, which lingers there briefly before fading away. Meanwhile, the chain lightning continues to find and link to new valid targets, leaving trails between each link. The gradually fading trails show the sequence of links that were made.

If the lightning links to the perimeter of the playing field, it reverts back to being an electron that appears at the edge of the field where the lightning linked to, and the bounces back from the perimeter slightly toward the center of the screen. The player regains directional control over the electron at this point.

As the lightning strikes each radiation, the player gains special attack energy and score points. When multiple radiation particles are struck in a series by one use of chain lightning, each successive struck radiation grants a bonus multiplier to the amount of special energy and score points gained during that lightning usage.

The lightning starts playing a firing sound effect when it links to target. Each time the lightning begins a link to a new target after hitting a prior one in the series, the firing sound effect plays again but at a higher pitch than the last time it played during the series. When the player activates a new lightning chain, the pitch shift for the firing sound effect is reset so that the first firing plays a normal version of the sound effect.

After activating the chain lightning, there begins a cooldown period during which the lightning cannot be activated again. Regardless of whether the cooldown has ended, the player cannot activate the lightning again while still in the middle of a lightning attack.

Lightning has animation frames and time per frame.

Lightning graphics may need to be tiled or stretched or have parts left masked or not drawn to fit various distances between targets. Distances between targets must be factored into how to draw the lightning onscreen.

Time between striking a target and attacking the next one in a sequence should be defined.

Time during which the lightning trail graphics stay on screen before fading away should be defined.

Lightning collision against radiation should be defined.

Amount of special energy gained per strike should be defined. Size of multiplier gained from each sequential strike should be defined.

Lightning Firing Sound pitch shift should be defined.

2.1.3 Special Attack

This attack may only be activated once the special attack energy meter has been filled up by hitting enemies with the chain lightning attack. Activating the special attack reduces the special attack energy meter to zero.

The Special Attack destroys every enemy in the playing field instantly upon activation, and earns the player their normal value in score points for defeating them.

Visually, the effect looks like the area of the circular playing field fading to white while a bright, circular shockwave expands from the electron's position to flood the field. This brilliant effect will obscure the gameplay field momentarily before dissolving back to the normal gameplay visuals. No enemies spawn or come into the playing field for the duration of this special effect.

The special attack plays a sound effect while also muffling other game sounds, including other sound effects and music. These other sounds gradually fade back in as the special attack ends.

The duration of the Special Attack effect should be defined, including the speeds of its dissolve transitions.

2.2 Survival

The player must survive for as long as possible by destroying enemy radiation particles before they collide with the neutrons and proton of the nucleus. If the nucleus is destroyed, the game ends.

2.2.1 Proton

The player's atom begins the game with one proton to match its one electron. The proton is positioned at the center of the nucleus at the center of the screen. Radiation particles may collide with this proton. The proton is destroyed upon such a collision and the radiation particle disappears. There is a sound effect and fade out animation when the proton is destroyed.

The Proton's collision field against the radiation should be defined.

2.2.2 Neutron

The nucleus at the center of the atom starts the game with a number of neutrons arranged around the proton. Radiation particles may collide with this neutron. The neutron is destroyed upon such a collision and the radiation particle disappears. There is a sound effect and fade out animation when a neutron is destroyed.

The player gains points by destroying radiation. Each time the player gains a certain number of points, a new neutron appears and joins the nucleus. There is a sound effect and fade in animation when a neutron is born.

Having more neutrons around the proton helps to shield the proton from radiation, since the neutrons will take the hits instead of the more important proton.

The Neutron's collision field against the radiation should be defined.

The arrangement locations in which a Neutron can appear around the proton should be defined.

The formula for increments of points necessary to earn each new Neutron should be defined.

2.2.3 Losing the Game

When the proton is destroyed, the game ends.

2.3 Enemies

The enemies are various kinds of radiation particles. Each type has its own movement pattern and point value for destroying it.

2.3.1 Alpha Radiation

This type of radiation particle enters the playing field from the perimeter and moves quickly along a spiral path that gradually approaches the center of the screen.

If the alpha radiation collides with a proton or neutron, it destroys them while disappearing itself.

If the alpha radiation is struck by chain lightning, it is destroyed in a fade out animation while playing a sound effect.

The alpha's movement speed and spiral turn rate should be defined.

The alpha's collision field against protons and neutrons and lightning should be defined.

The alpha's basic point value for being destroyed by the player should be defined.

2.3.2 Beta Radiation

This type of radiation particle enters the playing field from the perimeter and moves slowly in a straight line toward the center of the screen.

If the beta radiation collides with a proton or neutron, it destroys them while disappearing itself.

If the beta radiation is struck by chain lightning, it is destroyed in a fade out animation while playing a sound effect.

The beta's movement speed should be defined.

The beta's collision field against protons and neutrons and lightning should be defined.

The beta's basic point value for being destroyed by the player should be defined.

2.3.3 Gamma Radiation

This type of radiation particle enters the playing field from the perimeter and moves erratically in random directions for random amounts of time, but tends to move toward the center of the screen more often than not. It does not move out of the playing field so it chooses a new random direction if it starts to move past the perimeter.

If the gamma radiation collides with a proton or neutron, it destroys them while disappearing itself.

If the gamma radiation is struck by chain lightning, it is destroyed in a fade out animation while playing a sound effect.

The gamma's movement speed and the randomness of its movement directions and the duration of movement in each direction should be defined.

The gamma's collision field against protons and neutrons and lightning should be defined.

The gamma's basic point value for being destroyed by the player should be defined.

3. Graphical Interface

3.1 Playing Field

The main game screen has a circular playing field in the middle of it. The player can only move within the confines of this circular field, and enemies only appear when entering the field from the perimeter. Gameplay background music loops during main gameplay.

3.2 Gameplay Meters

The main game screen shows various meters positioned outside the circular playing field.

3.2.1 Chain Lightning Cooldown Meter

This horizontal bar graph indicates how much longer the player must wait for the Chain Lightning to be useable again after the previous use. When the player fires chain lightning, the bar empties out and begins to refill over time. The bar fills out when the Chain Lightning finishes its cooldown and is usable again. The Cooldown Meter is filled and ready to fire when a new game starts.

3.2.2 Special Attack Energy Meter

This is a horizontal bar graph that shows how much special attack energy the player has built up from hitting radiation particles with the chain lightning attack. For each additional enemy beyond the first hit in a single chain lightning activation, an energy multiplier increases, which modifies the special energy gained during that particular chain. The multiplier resets to a default of one when the player activates a new chain lightning. When the meter fills up entirely, it briefly glows and plays a sound effect. While the meter is full, the player may activate the special attack, which expends the special attack energy and empties the meter. The Special Attack Energy Meter is empty when a new game starts.

3.2.3 Score Counter

This numeric counter shows how many points the player has gained during the current playthrough from destroying radiation particles with any of the electron's attacks. For each additional enemy beyond the first hit in a single chain lightning activation, score multiplier increases, which modifies the score points gained during that particular chain. The multiplier resets to a default of one when the player activates a new chain lightning. The score itself starts at zero when a new game begins.

3.3 Game Over Menu

After the player's nucleus is destroyed and those animations finish, the gameplay background music and sounds terminate and a game over menu appears in front of the gameplay level images. The menu gives the player the options to restart the gameplay or return to the title menu. The player loses control over the electron and instead navigates the menu using the controls to highlight and then select options.

Menu Action	Xbox 360	Keyboard and Mouse
Highlight Menu Option	Analog Stick	Arrow Keys or Mouse Point
Select Highlighted Option	A	Enter, Spacebar, or Mouseclick

3.4 Title Menu

The title menu gives players the option to start a new game or to exit the program. The player uses the controls to highlight and then select options.

Menu Action	Xbox 360	Keyboard and Mouse
Highlight Menu Option	Analog Stick	Arrow Keys or Mouse Point
Select Highlighted Option	A	Enter, Spacebar, or Mouseclick

The screen also shows the title of the game and provides gameplay control instructions.

Title background music loops during the title menu.

4. Artwork

4.1 Electron

4.1.1 Idle Animation

The electron jitters randomly within a minor distance from a central point while leaving afterimages. The jittering is minor enough that players do not have trouble understanding where the electron really is.

4.1.2 Move Animation

The electron leaves a few afterimages in its trail as it moves.

4.2 Proton

4.2.1 Idle Sprite

4.2.2 Death Animation

4.3 Neutron

4.3.1 Idle Sprite

4.3.2 Death Animation

4.4 Chain Lightning Bolt

4.4.1 Impact Sphere Animation

The sphere of electricity appears centered on the valid target point that the chain lightning links to, and acts as a joining point between different link segments on the lightning chain.

4.4.2 Lightning Trail Animation

This is a trail of lightning that forms a link between two valid targets in a chain lightning series. The animation is used for each link on the chain, and may be as long as half the length of the playing field to link some targets.

4.5 Special Attack

The special attack gradually dissolves everything in the circular playing field to white while a circular shockwave originates from location of the electron and expands to flood the whole playing field. The shockwave is drawn in front of the other playing field contents and obscures them as it expands. The shockwave is given enough speed and time to fill the field before it and the whiteness dissolve back to the normal playing field visuals.

4.6 Alpha Radiation Particle

4.6.1 Normal Movement Sprite

4.6.2 Death Animation

4.7 Beta Radiation Particle

4.7.1 Normal Movement Sprite

4.7.2 Death Animation

4.8 Gamma Radiation Particle

4.8.1 Normal Movement Sprite

4.8.2 Death Animation

4.9 Main Playing Field Background

The background marks the circular playing field within which the electrons, nucleus, radiation, and player attacks exist. This background is the rearmost visible layer of image in the game level and is drawn behind everything else.

4.10 Border Around Playing Field

This border is the circular ring around the perimeter of the playing field and the background between the ring and the edge of the screen. This border layer is drawn in front of and obscures any game characters such as the radiation particles which might spawn outside the perimeter of the playing field before moving into it. This layer is drawn behind any of the meters and counters that are displayed outside the perimeter of the playing field.

4.11 Chain Lightning Cooldown Meter

The meter is outside the perimeter of the circular playing field. It is drawn in front of the layer in which the playing field border is drawn.

4.11.1 Meter Border and Background

The meter background is drawn behind the meter fill.

4.11.2 Meter Fill

The meter fill shows how much of the meter is filled and is drawn in front of the meter background.

4.12 Special Attack Energy Meter

The meter is outside the perimeter of the circular playing field. It is drawn in front of the layer in which the playing field border is drawn.

4.12.1 Meter Border and Background

The meter background is drawn behind the meter fill.

4.12.2 Meter Fill

The meter fill shows how much of the meter is filled and is drawn in front of the meter background.

4.13 Score Counter

4.13.1 Counter Border and Background

4.13.2 Numbers 0-9

The counter numbers are written in a chosen font.

4.14 Title Menu

4.14.1 Background

The background shows the game title written in the chosen font, as well as menu background art. The background fills the whole screen.

4.14.2 Control Instructions

The instructions are written in a chosen font.

4.14.3 Start Game Button

The button has several states. All states display text with a chosen font.

Normal

Highlighted

Pressed

4.14.4 Quit Button

Normal

Highlighted

Pressed

4.15 Game Over Menu

This small menu takes up a small part of the screen and appears in the middle of the screen on in front of any gameplay level images.

4.15.1 Game Over Menu Background

The menu background covers any gameplay images behind it, and displays text in a chosen font informing the player that the game is over.

4.15.2 Restart Game Button

Normal

Highlighted

Pressed

4.15.3 Quit to Title Menu Button

Normal

Highlighted

Pressed

5. Audio

5.1 Sound Effects

5.1.1 Electron Movement

5.1.2 Chain Lightning Firing

5.1.3 Special Attack

This explosion is a brief, low-pitched shockwave dissolves to silence and then dissolves into a faint ringing sound as if the explosion damaged the player's ears. All other game sounds like background music and other sound effects are muffled for the duration of the special attack.

5.1.4 Special Attack Meter Filled Up

5.1.5 Neutron Dies

5.1.6 Neutron Spawns

5.1.7 Proton Dies (Game Over)

5.1.8 Alpha Radiation Particle Struck by Chain Lightning

5.1.9 Beta Radiation Particle Struck by Chain Lightning

5.1.10 Gamma Radiation Particle Struck by Chain Lightning

5.1.11 Menu Button Highlight

5.1.12 Menu Button Selection

5.2 Music

The music style is electronic trance music.

5.2.1 Game Level Music

5.2.2 Title Menu Music