# 4 Implementation Chapter

## IsWalled() function

This function will return a Boolean variable, it uses the variables “wallCheck” which is an empty game object that is placed on the side of the player, “wallLayer” which is a layer mask of all the walls with the Layer “Wall”. And “radOfCircle” (the same variable is used in “IsGrounded()”) which is the radius used to check if the player and the wall are touching this circle.

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A computer screen with white text

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This is showing the “Walls” object is tagged with the layer “Wall”

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The Wall Check object is part of the player like Ground Check.



In the inspector the Wall Layer is set on “Wall” and the Wall Check object selected.

A screen shot of a computer

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## IsGrounded() Function

This function returns a Boolean variable, it uses the variables “groundCheck”, the position of this is just under the player’s collider, “radOfCircle”, which is the radius of the circle, and the layer mask called “groundMask”. The ground mask is applied to all objects that are in the layer “Ground”. The Boolean returns true if the ground mask overlaps with the circle under the player’s collider and false if it doesn’t.

 

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The author also draws a Gizmo which can be seen in the editor but not in game. This makes it easier to see where the ground is intersecting with the player.

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## “WallSlide()” Function

This function makes the player slowly slide down a wall when the move into it if they are not on the ground already. The “Y” velocity is Clamped to not go over a certain speed. This function uses the “isWallSliding” Boolean and “wallSlidingSpeed” float which controlls the speed the player will fall at.

The player will slide down the wall as long as the are moving towards the wall.

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## Flip() Function

This function will change the direction of the object it is used on the author changes the scale of the object’s X value by multiplying it by -1 which just flips the direction the object is facing.

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This is how the flip function is used In the “Update()” function. This checks if the object is not facing right, and the direction value is greater than 0 then flip the object to the other direction and vice versa.

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## Player Movement

The author uses Unity’s new Input System for keyboard and mouse the player will use the “A” and “D” key to move direction, and the “Space” key to Jump.

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In the Events tab the author has their “PlayerScript” script that is attached to the player. They use the “Move()”, “Jump()”, “Dash(), and “Fire()” functions. For example, when the space bar is pressed the “Jump()” function checks if the action was performed and if the player has a jump available, it will make the player jump. The Author will go into more detail in the individual Functions later in this section.

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The Author created the “Move()” function which gets the direction the player is trying to move the direction is a value of 1, -1 or 0. If the player is not moving the value is 0. If the player is moving the value is 1 or -1 depending on the direction. This function also starts the run animation which happens when speed is not 0 however the jump animation take priority over the run animation. For example, if the player jumps and is moving to the side it will not play the run animation because the jump animation is being played.

### Dash

The Author created the “Fire()” function which first checks

1. if the player can attack and if they can, it will use the “Attack()” function which activates the “attack1” trigger, this plays the attack animation, it is called attack1 because the author wants there to be two swings of the attack if the player presses attack in quick succession, this might not be implemented because of time constraints.
2. Next the “Attack()” function will put all enemies that are in the attack range when the button is pressed into an array called “hitEnemies”
3. it will run the array through a foreach loop that will deal damage to all the enemies hit.
4. “Fire()” will then put the attack on a “Cooldown” where the player cannot attack again for about a second.

### Jump

The Author created the “Jump()” function which will first check

1. if the player can wall jump, which is something the player can only do when they are touching a wall. if true this will start a “Coroutine” called “WallBounce()” which will play the jump animation and set the players gravity scale to 0 so the wall jump isn’t affected by outside forces. It then pushes the player away from the wall and up into the air as if they jumped off the wall. The players gravity scale is then reset back to its original value.
2. Next if the player is not “isWallSliding” (the variable used to check if the player is sliding on the wall) and their max number of jumps is greater than the current number of jumps used. The variable “jumpForce” is applied to the player which makes the player jump. This is also where the Coyote Timer is used which will be discussed later under “Coyote Time Jump”.
3. Next “Jump()” will check if the “Jump” key was let go of or cancelled while the player was moving up (y velocity greater than 0) when this happens the y velocity is multiplied by 0.5 to make the player not instantly stop going up but look like they are slowing down, this allows the player to jump at different heights depending on how long they hold the “Jump” key for.

### Dash

The Author created the “Dash()” function which first checks

1. If the player can dash with the Boolean “canDash”
2. If true it will start the “Coroutine” “Dash()”
3. This “Coroutine” sets the “dashing” animation trigger, makes the players gravity scale 0, adds a velocity to the player and starts emitting a trail renderer. It will wait for “dashingTime” seconds
4. Once done waiting it will turn off the trail renderer, reset the players gravity scale and reset the “dashing” animation trigger. It will then wait for (dashingCooldown) seconds before setting “canDash” back to true.

## Fire() Function

The “Fire()” function is using the new input system in Unity, when the specified input is pressed (J on keyboard, Right Trigger on gamepad) the player will attack. This function needs the following variables; “attackRange” this is the circumference of the circle that is where an enemy can be hit, “attackPoint” this is a transform, this is attached to the player object and will move with them. “enemyLayers” this layer mask will be used to check for any enemy’s that have the enemy layer hit in the attack range. “attackDamage” is how much damage the player will do to the enemy that’s hit. “attacking” is used to check if the player is attacking or not. The author was planning on having a two step swing where the first swing is a down swing and the second is an up swing, if attacking back to back the player would do the first attack then the second. But there was not enough time to implement this. “attackRate” is used for a cooldown on the player attack so the player cannot attack to quickly. And the “nextAttackTime” variable is used to check if the player can do their next attack.

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When the fire Input action (J key on keyboard, Right trigger on gamepad) is pressed it checks if the current time is greater than the next attack variable, this makes it so the player cant attack while the attack cooldown is in progress. “Fire()” then uses the “Attack()” function which plays the attack animation, detects the enemies in the attack range and then damages them.

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### Detecting the enemies

The “Collider2D[]” array “hitEnemies” stores any enemies that are tagged with the “enemyLayers” layer mask in the “attackRange”

### Damaging enemies

Running a “foreach” loop it iterates through each enemy in “hitEnemies” (the array that stored all enemies hit in the attack range) then the function “TakeDamage()” is used to deal the attack damage variable amount to the enemy.

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The “TakeDamage()” function takes in a float the damage done is taken away from the “currentHealth” variable that stores the current health of the character. This will be updated so that the player and enemies will share this function with inheritance. Once the damage is done, the animation for “Hurt” will trigger. If the health is less than 0 the character will “Die()”

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The “Die()” function will play the death animation, and start the “Coroutine” “DisableOnDeath()”

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The “DisableOnDeath()” Coroutine will wait for a duration for the death animation to finish then it will disable both the “Collider2D” and the “SpriteRenderer” this will make it so the object will turn invisible and not be collided with.

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## Move() Function

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In the Update function the rigid body (the player) is given a velocity which is a Vector 2 this value is the direction multiplied by the “speed” variable which is 8 by default. Since this is only changing which direction the player moves the y value is not changed.Text

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## Updated Move() Function

This was moved to the “FixedUpdate()” function because it is better to deal with physics in the “FixedUpdate()” the player would sometimes glitch through walls and objects.A computer code on a black background

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The “Move()” function was updated because the player should not be able to move while wall jumping until the jump is finished. This code makes it so when the player tries to move, they can’t while wall jumping, but can while not wall jumping.

The author also changed the speed to not be an absolute value this made the game more unique with slight physics speed up / slow down movement, but the author preferred having snappy movement over this.

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## Player Jump

As stated in the player movement section this is using Unity’s new Input System. The Jump function takes in an Input from the controller or keyboard. When the jump button is pressed and the player has more than 0 jumps left (a variable stores how many jumps the player has left) a vertical velocity (“jumpForce”) is applied to the player and moves it up. The “jump” animation is played here. Once the player has jumped the “jumpsLeft” variable is now -1 of what it was.

If the player cancels the jump (lets go of the “jump” button) but their vertical velocity is greater than 0 i.e. they are still moving up. The velocity will be multiplied by .5 which lets the player choose how high they can jump. The player can jump the highest by holding the “jump” button or they can choose to jump lower by letting go early.

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## Jump() function Updated

The jump function is almost the same but with added functionality, it now will not let the player jump while the game is paused. It will use the “Coroutine” “WallBounce()” if the jump button is pressed while “canWallJump” is true.

A screen shot of a computer program

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“WallBounce()” is explained in detail in the “WallBounce()” function later in this chapter. Basically, it lets the player wall jump.

The “jumpsLeft” variable was changed to the more fitting name “jumps”.

When the “jump” button is pressed and “maxJumps” Is greater than “jumps” and the player isn’t wall sliding. The jump force is applied to the player rigidbody.

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When the jump is cancelled while the player is moving up (while the jump is not yet complete) it will make the player slow down its upward velocity and start to fall.

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## Coyote Time Jump

Coyote time is used to add a short window after the player leaves the ground to still be able to jump. This takes account for human error giving the player a .2 second window to jump after they leave the ground or a platform.

Two variables are needed. One to store how long the error window will be and one that can be changed.

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In the “Update()” function when the player is on the ground the coyoteTime is assigned to the variable “coyoteTimeCounter”. Once the player leaves the ground the “coyoteTimeCounter” will count down, when the timer gets to 0 or less the player will no longer be able to use their first jump.

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If the coyote timer is less than or equal to 0 then it will take away 1 jump from the “jumpsLeft” variable. This makes it so the player cant get extra jumps from the coyote timer.

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To make sure the player can’t jump indefinitely by pressing the jump button fast the timer has to be set to 0 once the jump button is released.

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The “Jump()” Function was Updated but the Coyote Timer does the same thing

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## WallBounce() Coroutine function

This Coroutine is preformed in the “Jump()” function when the canWallJump variable is true. “WallBounce()” will make “canWallJump” false, “isWallJumping”, true and trigger the “jump” animation. it will set the players gravity scale to 0 and apply the velocity wallJumpingPower to the player, the direction the player is launched is opposite to the direction the player is facing. Then it will wait for “wallJumpingTime” seconds before resetting the players gravity scale, changing “isWallJumping” to false and resetting the “jump” animation trigger.

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### WallJumpCooldown() Coroutine function

This function is used to make sure the first time the player jumps onto the wall and every time after, there will be a cooldown between jumps. In the “FixedUpdate()” it checks if the player “IsWalled()” if they are it will start the “WallJumpCooldown()” Coroutine

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This Coroutine will wait for “wallJumpingCooldown” seconds before making “canWallJump” true again, which allows the player to jump.

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## Double Jump

In “PlayerMvt.cs” the “Start()” function sets the number of jumps left equal to the “maxJumps” Variable

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In the “Update()” function ever time the player is on the ground the “jumpsLeft” variable will reset to the max number of jumps.

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In the “Jump()” function as long as there is more than 0 “jumpsLeft” the player will be able to jump. So, if “maxJumps” is at 2 the player will be able to double jump

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Once the jump is pressed the “jumpsLeft” will be updated with the new number of jumps left which is 1 less.

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In the “Update()” function “maxJumps” is set to “jumpsLeft” when the player is on the ground. This means the players “jumpsLeft” will reset to whatever value of “maxJumps” when they are on the ground.

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## Wall Jump

## Player Dash

## Interact() Function

The “Interact()” function can be improved still but for now it does its job. The author will explain how they will make it better at the end of this section. The button to Interact on Keyboard is “E” and on Gamepad is the north button on the right side. When preformed the Function “CheckInteractions()” used. The Variables that will be used in the “PlayerScript.cs” are “interactRange”, this will be the radius of the circle that surrounds the NPC or interactable object. “NPCLayers” is a layer mask used to check if the player is overlapping the “interactRange” of any NPC or Interactable object.

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### CheckInteractions() Function

This function gets an array of colliders that the player is beside (Collider2D) and stores them in a variable. Then uses a “foreach” loop to iterate through each “Collider2D” in the array and uses the Unity Function “TryGetComponent()”

The author has Created a C# script “NPCInteractable.cs” which is attached to NPCs. This script will be explained after this section.

If it gets the component it will use the “Interact()” function from that script.

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## NPCInteractable.cs

This script was created to allow the player to interact with characters, through text, but in the future can be changed to also include object interactions but the author does not have enough time with the project time constraints.

## Tile map

Tile maps are used to create 2D worlds they allow the creator to select the tile they would like to place and draw the tiles into the scene.

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## Sprite sheet

The player’s sprite sheet has been downloaded from the Unity assets store, this came with different animations that weren’t set up properly, I fixed this by just re selecting the animation frames that went together.

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## 

## Animation

In the “PlayerMvt.cs” “Update()” function when the player is on the ground the falling Boolean is set to false this will stop the fall animation from continually playing after the player falls from anywhere.

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Once the player’s velocity is less than 0 the fall animation is played and the jump trigger is reset to make it so the player can jump again. The nested if statement checking if “IsGrounded()” is true to stop the falling animation if the player is still holding one of the movement buttons

In “PlayerMvt.cs” in the “Jump()” function when the player pressed the “Space” button the trigger variable jump is toggled and the Boolean variable “falling” is set to false this will play the “Jump” animation. When the “Space” key is let go the “Jump” trigger is reset and the “falling” variable is set to true.

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The “Idle”, “Jump”, “JumptoFall” and “Run” animations all work.

## A picture containing graphical user interface Description automatically generated

When the user doesn’t press any buttons and isn’t falling the idle animation will play, if the user presses the “A” or “D” key the run animation will play. if the user presses the “jump” key

From “Idle” to “Jump” a trigger condition that checks when the parameter “jump” is toggled is needed. Once the user reaches the peak of their jump the variable “falling” is set to true

Graphical user interface, application

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When the user stops pressing the “Jump” key or when the user reaches the peak of their jump the “JumptoFall” animation will play when the falling variable is set to true

Graphical user interface, application

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Once the Character lands on the ground “falling” is set to false and will no longer play the “JumptoFall” animation.

Graphical user interface

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If the user falls off a platform the “JumptoFall” animation will play

A screenshot of a computer

Description automatically generated with low confidence

If the user presses the “A” or “D” key to move the “Run” animation will play. Checking if speed is greater than 0.0001 is making the response a bit quicker so the character will react faster to the input of the user.

Graphical user interface, application

Description automatically generated

If the user stops pressing the “A” or “D” keys the “Run” animation will stop playing. Checking if speed is less than 0.0001 is making the player character stop quicker.

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This is Updated so the JumpToFall will go back to idle at the correct time, and the player can go from “Run” to “JumpToFall” this makes it so the player isn’t running in mid-air or falling while moving on the ground.

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