UNIVERSIDAD TECNOLÓGICA DE SANTIAGO, UTESA

SISTEMA CORPORATIVO

Facultad Arquitectura e Ingeniería

Carrera de Ingeniería en Sistemas Computacionales

PROGRAMACION DE VIDEOJUEGOS

PROYECTO FINAL: CAPITULO III

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24 de abril, 2022

Santiago de los Caballeros,

Rep. Dominicana

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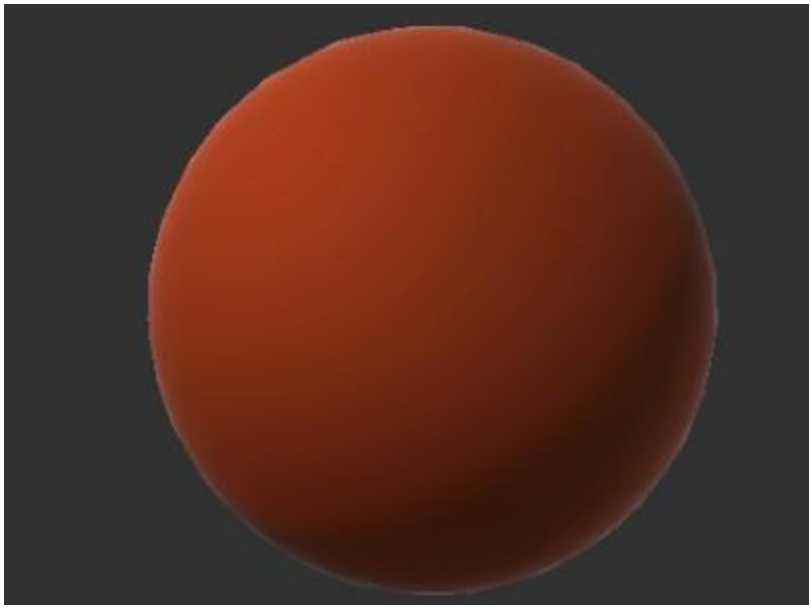
CAPITULO III: DESARROLLO

3.1. CAPTURAS DE LA APLICACION

3.1.1. PREFABS

3.1.1.1 ENEMIGO FUERTE (COLOSO)



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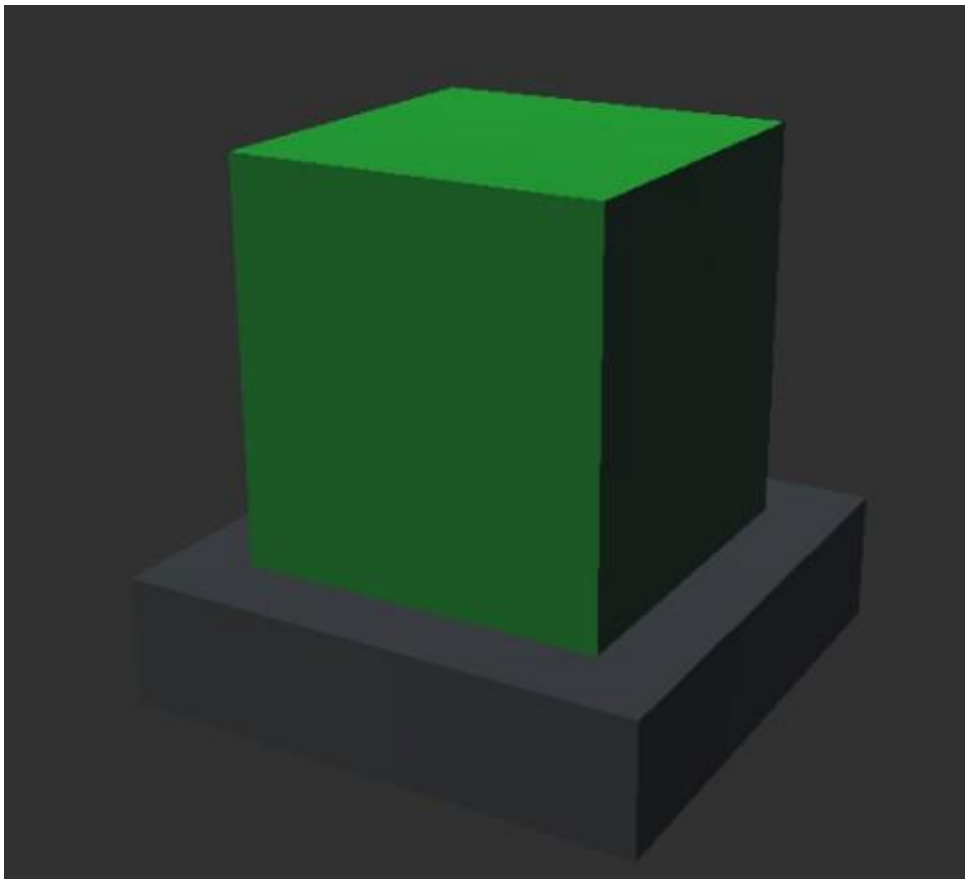

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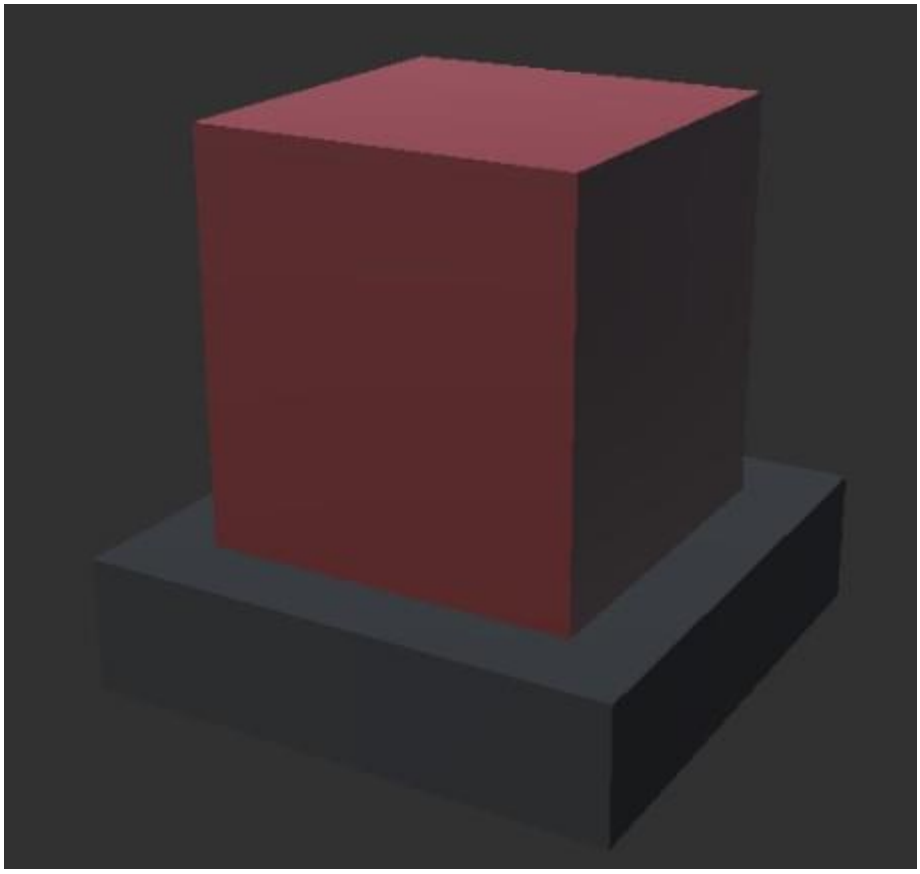

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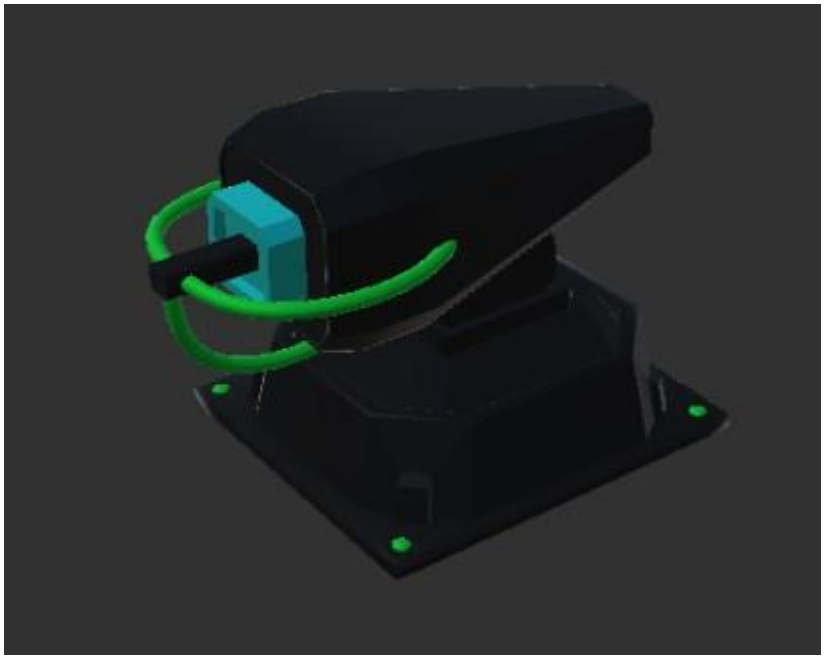

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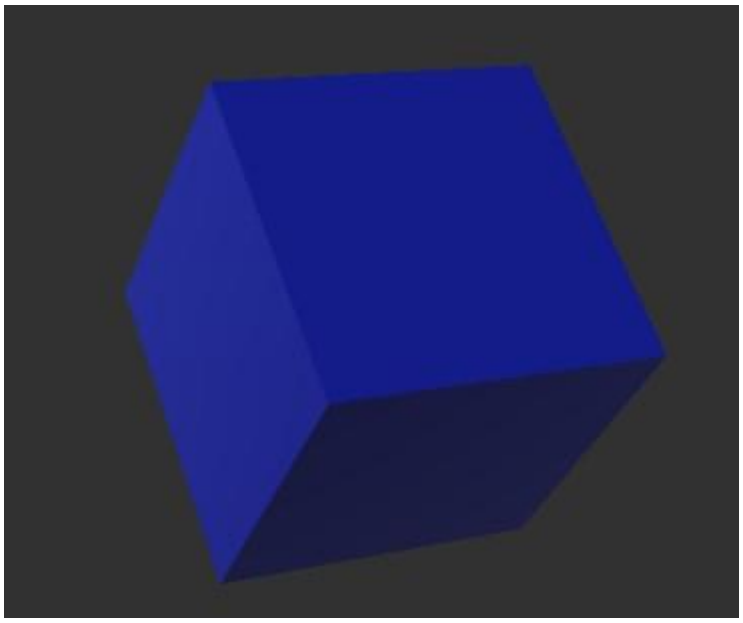

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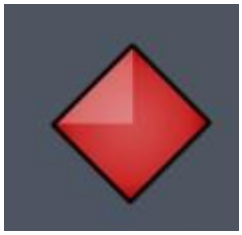

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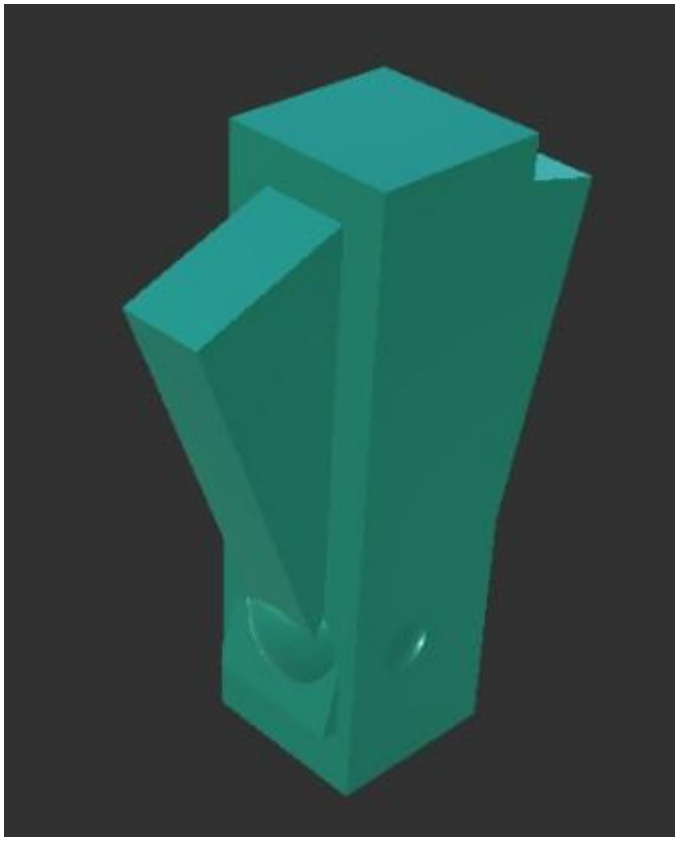

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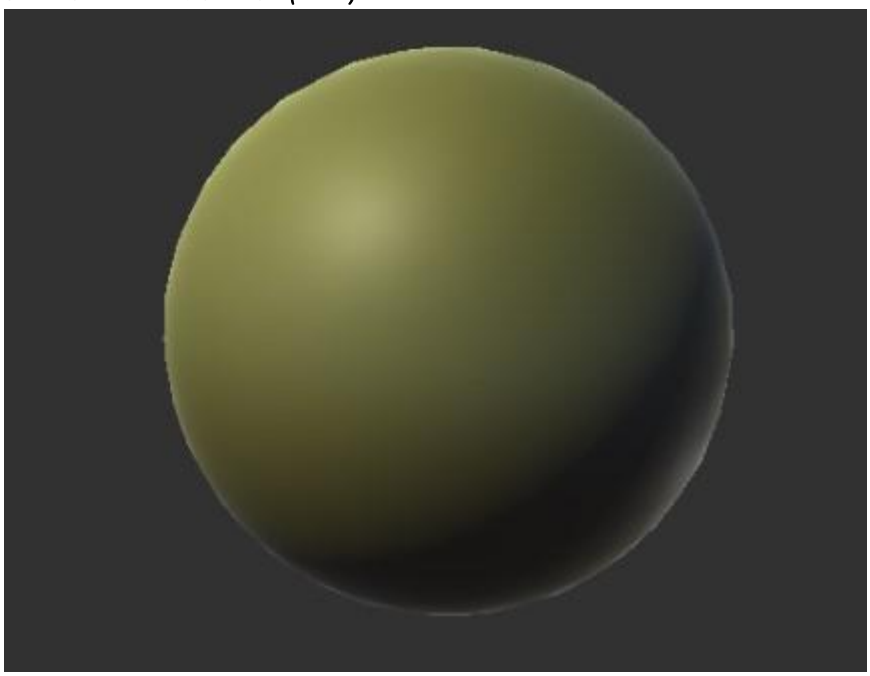
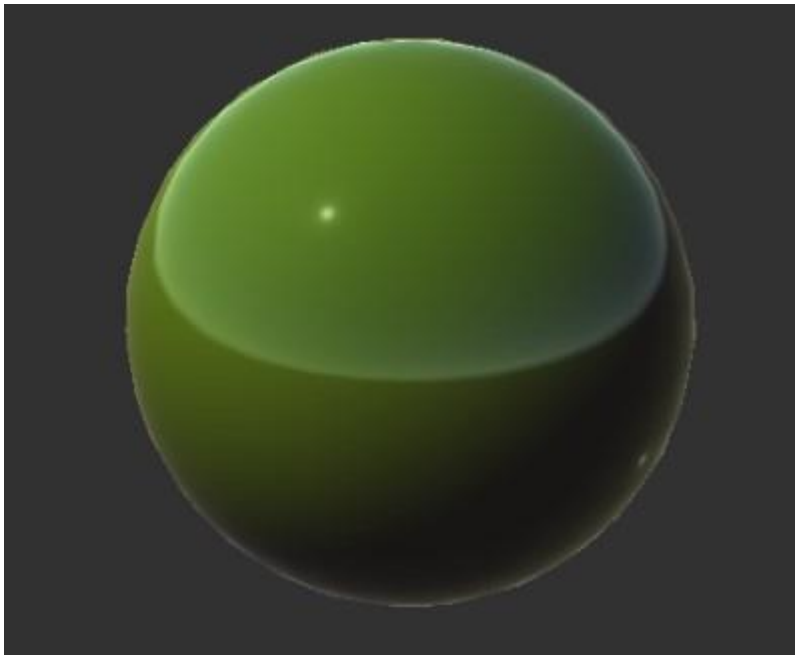


3.1.1.10. TORRETA DE ENERGIA

3.1.1.11. ENEMIGO RAPIDO (FLASH)



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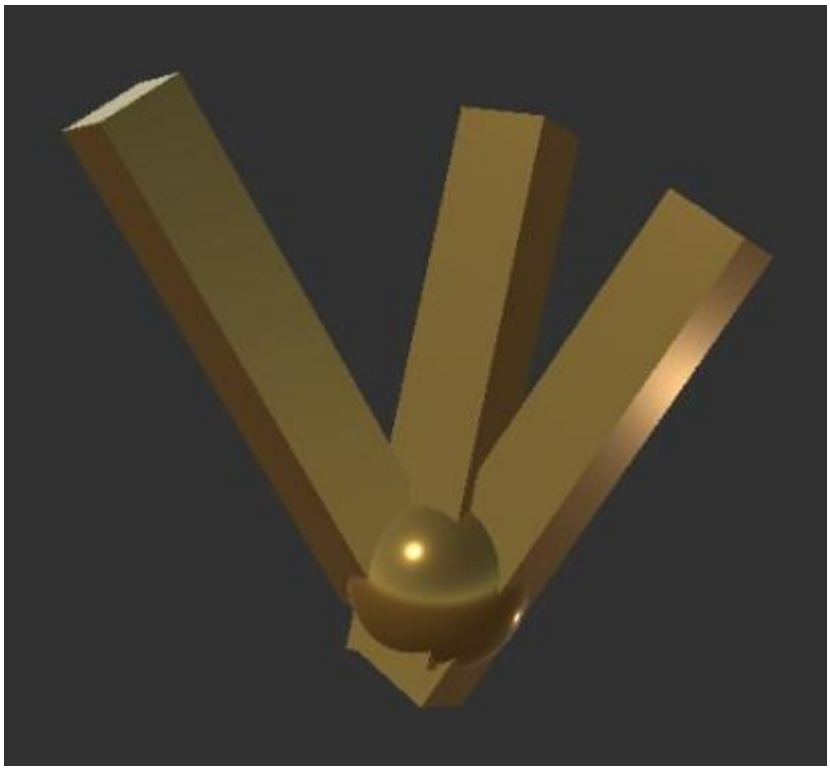
3.1.1.13. MINERAL ORE



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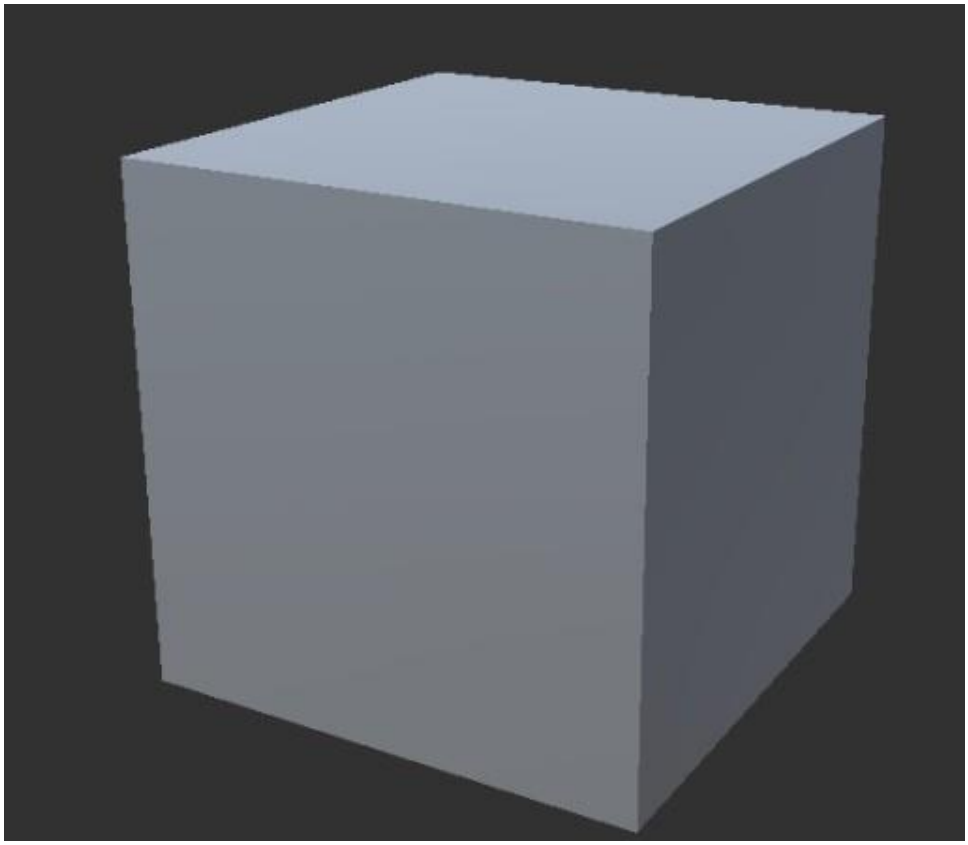

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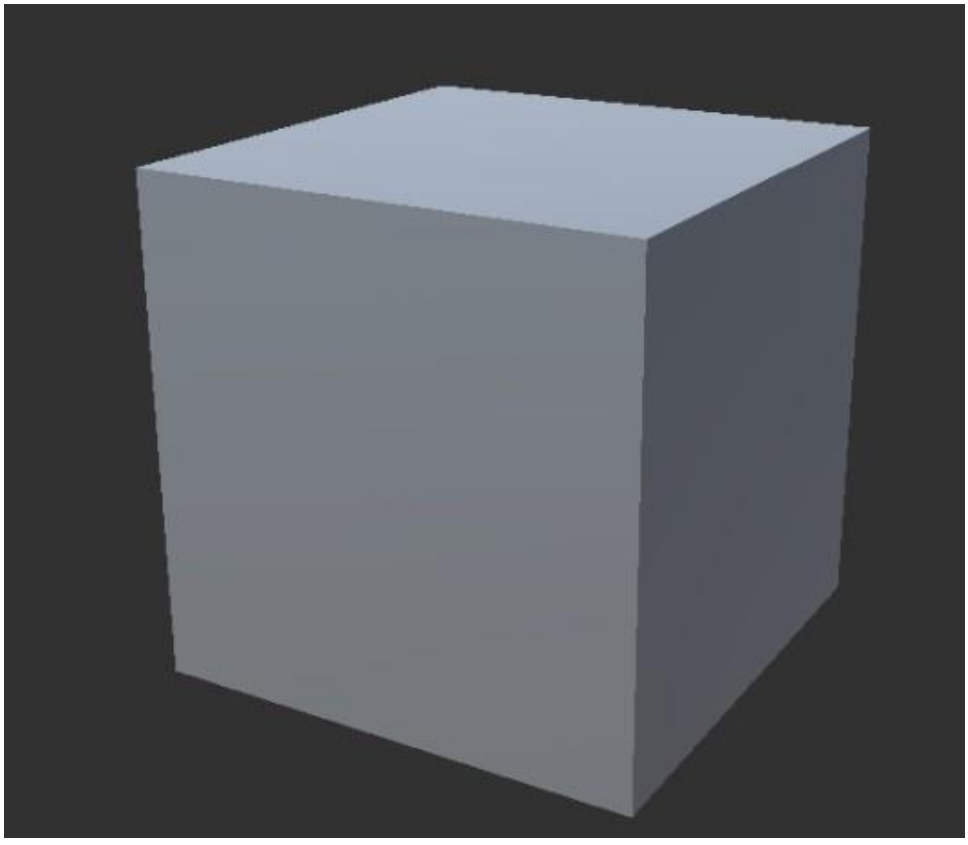
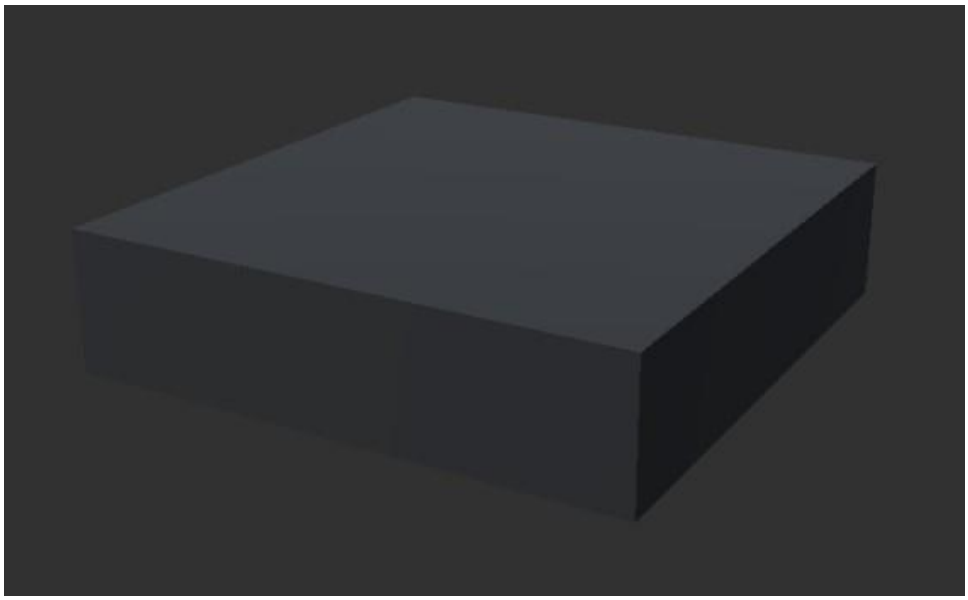


3.1.1.16. LANZA MISILES

3.1.1.17. TORRETA REPARADORA

3.1.1.18. TORRETA ESTANDAR

3.1.1.19. SUELO



3.1.2. SPRITES

3.1.2.1. TORRETA MINERA

3.1.2.2. TORRETA ESTANDAR

3.1.2.3. SIMBOLO DE ENERGIA

3.1.2.4. SIMBOLO DE MINERALES

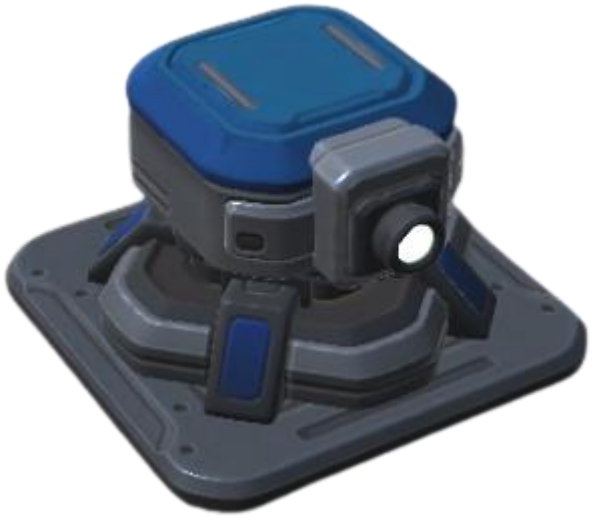
3.1.2.5 TORRETA LASER

3.1.2.6 TORRETA REPARADORA

3.1.2.7 LANZADOR DE MISILES

3.1.2.8 TORRETA ELECTRICA

3.1.2.9 TORRETA DE ENERGIA



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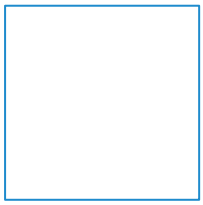
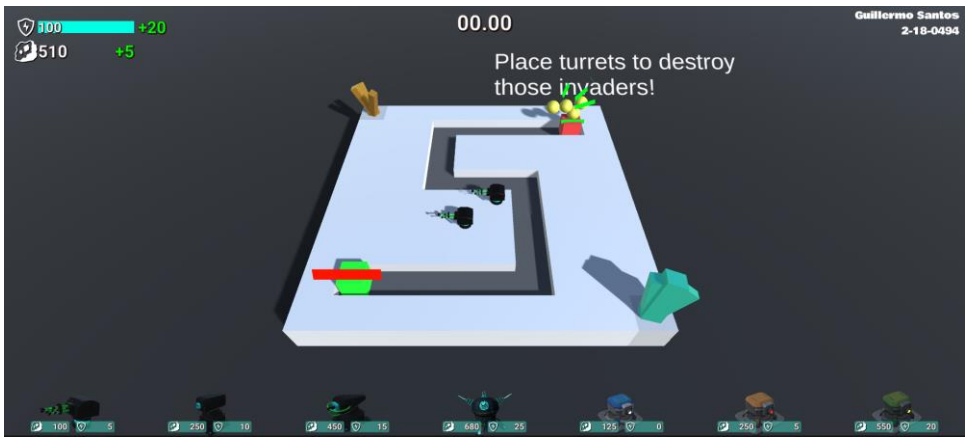


3.1.3. SONIDOS

3.1.4. NIVELES

3.1.4.1. NIVEL 1



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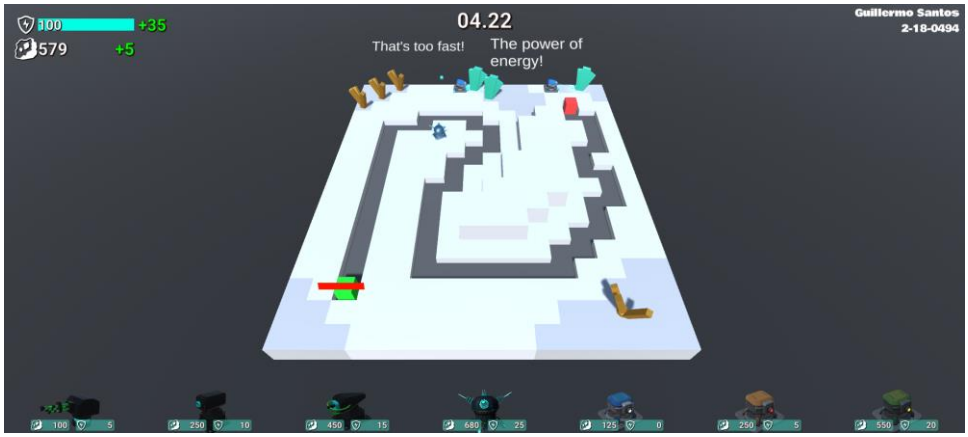
3.1.4.3. NIVEL 3

3.1.4.4. NIVEL 4



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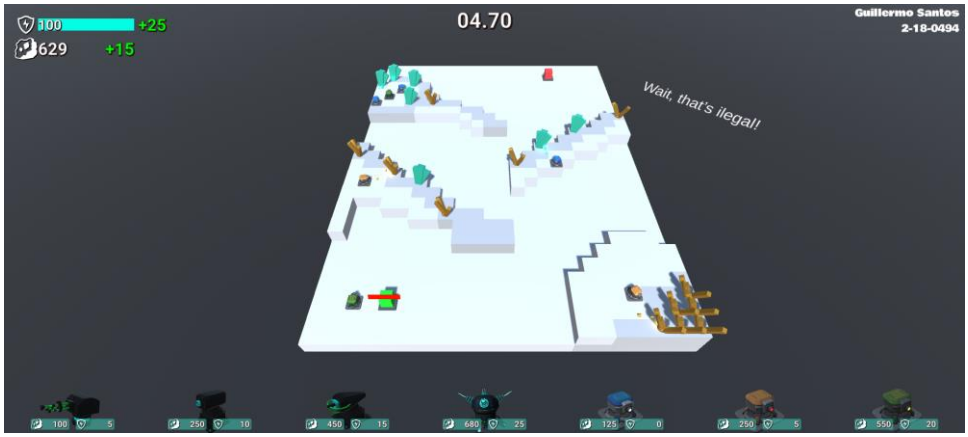

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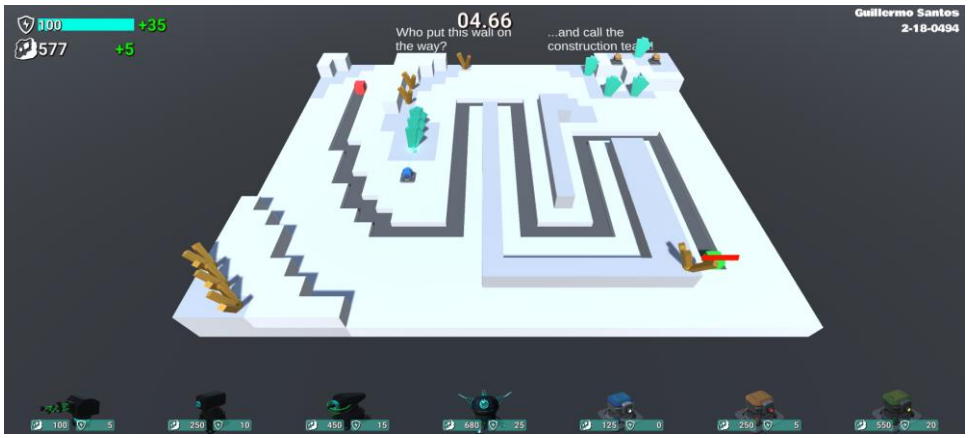
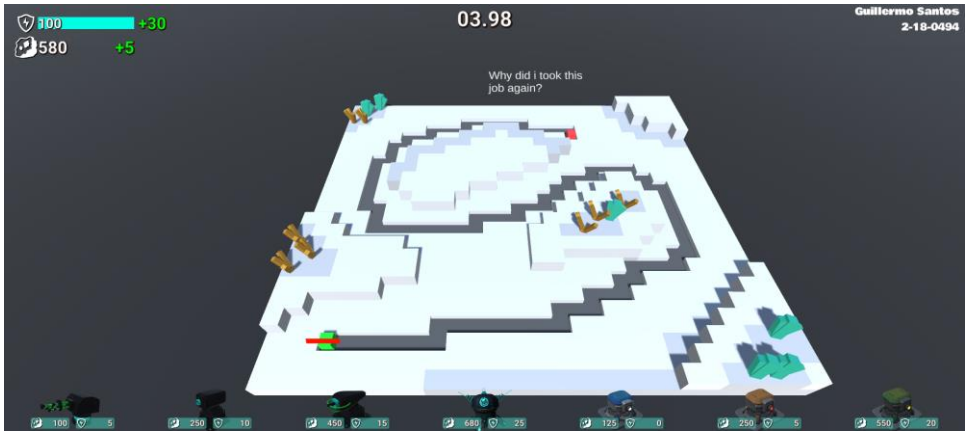
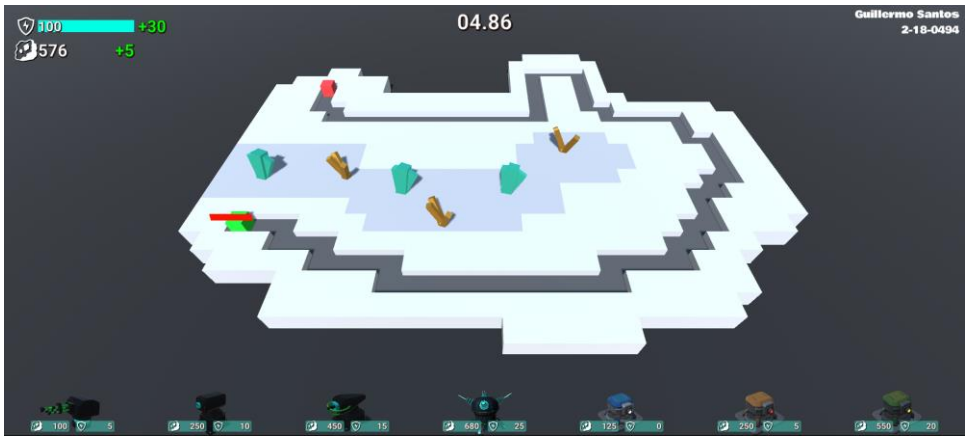


3.1.4.7. NIVEL 7



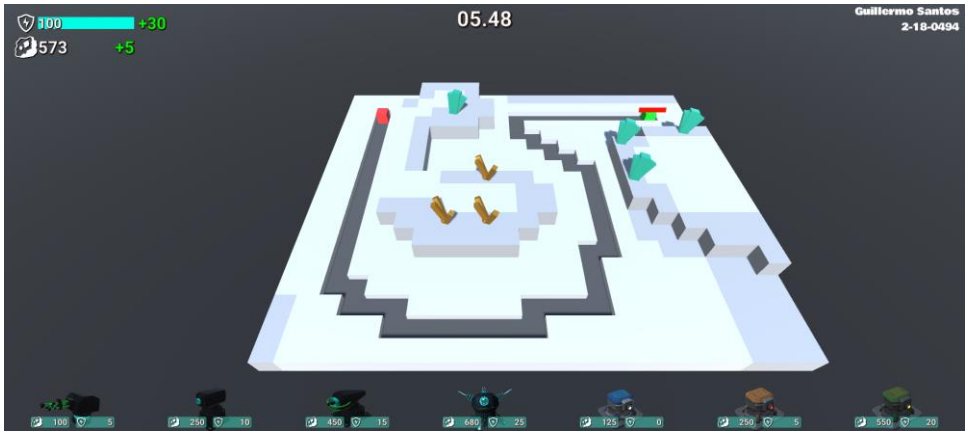
3.1.4.8. NIVEL 8

3.1.4.9. NIVEL 9



3.1.4.10. NIVEL 10

3.1.4.11. NIVEL 11



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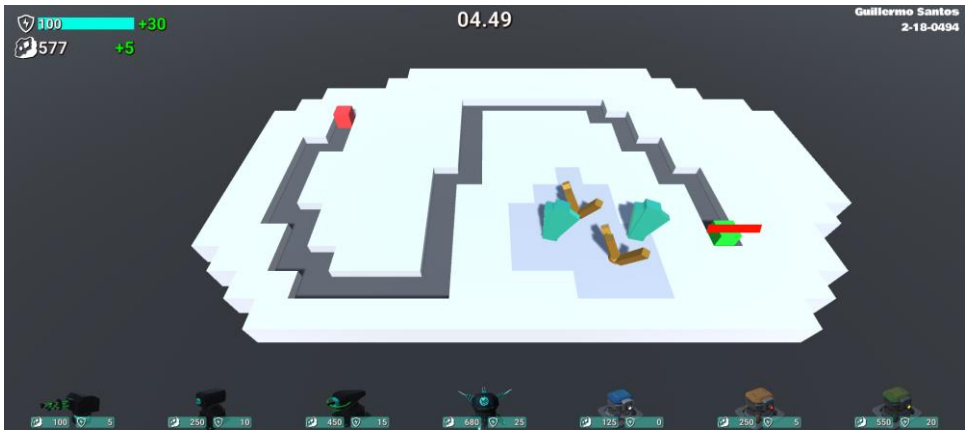
3.1.4.13. NIVEL 13



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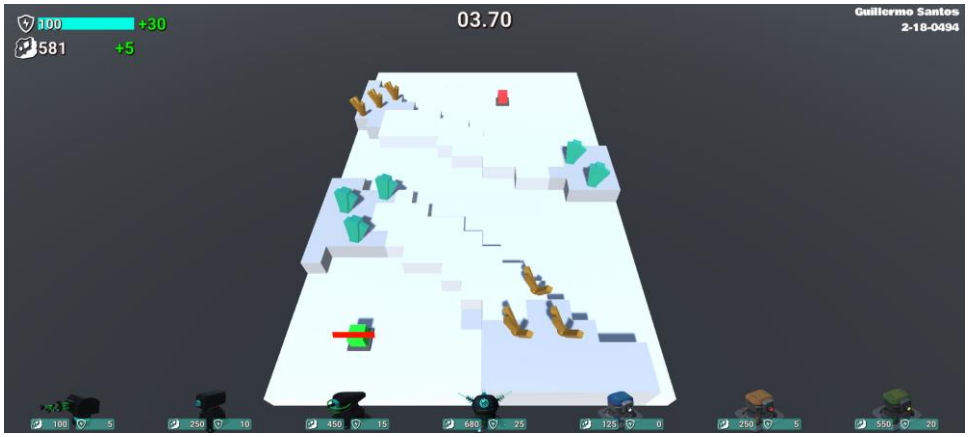

3.1.4.15. NIVEL 15

3.1.5. SCRIPTS

3.1.5.1. Enemigos

3.1.5.1.1 Ataque de enemigos

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class EnemyAtack : MonoBehaviour
{
    EnemyStats stats;
    Transform target;
    StructureStats targetStats;

    void Start()
    {
        stats = GetComponent<EnemyStats>();
        InvokeRepeating("UpdateTarget", 0f, 0.5f);
    }

    void UpdateTarget()
    {
        GameObject[] turrets =
GameObject.FindGameObjectsWithTag(stats.Objetive_Tag);
```

```
        if (turrets.Length <= 0)
            turrets = GameObject.FindGameObjectsWithTag(stats.CoreTag);
        float MinDistance = Mathf.Infinity;
        float distanceToTurret;
        GameObject nearestTurret = null;
        foreach (GameObject turret in turrets)
        {
            distanceToTurret = Vector3.Distance(transform.position,
turret.transform.position);
            if (distanceToTurret < MinDistance)
            {
                MinDistance = distanceToTurret;
                nearestTurret = turret;
            }
        }

        if (nearestTurret != null && MinDistance <= stats.range)
        {
            target = nearestTurret.transform;
            stats.canMove = false;
            stats.canAtack = true;
            targetStats = nearestTurret.GetComponent<StructureStats>();
        }
        else
        {
            target = null;
            stats.canAtack = false;
            stats.canMove = true;
        }
    }

    // Update is called once per frame
    void Update()
    {
        if (!stats.canMove && stats.canAtack)
        {
            Utility.LookOnTarget(transform,(target.position -
transform.position).normalized,stats.speed);
            if (stats.fireCountdown <= 0)
            {
                Shoot();
                stats.fireCountdown = 1f / stats.fireRate;
            }

            stats.fireCountdown -= Time.deltaTime;
        }
    }


    void Shoot()
```

```
    {
        GameObject Bullet_O = Instantiate(stats.bullet,
stats.firePoint.position, stats.firePoint.rotation);
        EnemyBullet bullet_sc = Bullet_O.GetComponent<EnemyBullet>();
        if (bullet_sc != null)
            bullet_sc.Seek(target);
    }
}
```

3.1.5.1.2 Bala de enemigos

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class EnemyBullet : MonoBehaviour
{
      private Transform target;

      public int damage = 15;
      public float speed = 10f;
      public float explosionRadius = 0f;
      public GameObject ImpactEffect;

      private AudioSource impactSource;

      public void Seek(Transform _target)
      {
            target = _target;
      }

    private void Start()
    {
            impactSource = GetComponent<AudioSource>();
      }

    // Update is called once per frame
    void Update()
      {
            if (target == null)
            {
                  Destroy(gameObject);
                  return;
            }

            Vector3 dir = target.position - transform.position;

            float distanceFPS = speed * Time.deltaTime;

            if (dir.magnitude <= distanceFPS)
            {
```

```
                  HitTarget();
                  return;
            }

            transform.Translate(dir.normalized * distanceFPS,
Space.World);
            transform.LookAt(target);
      }

      void HitTarget()
      {
            impactSource.Play();
            GameObject effect = (GameObject)Instantiate(ImpactEffect,
transform.position, transform.rotation);
            effect.transform.GetComponent<ParticleSystem>().Play();
            Destroy(effect, 5f);
            if (explosionRadius > 0f)
            {
                  Explode();
            }
            else
            {
                  Damage(target);
            }
            Destroy(gameObject);
      }
      void Damage(Transform enemy)
      {
            StructureStats e = enemy.GetComponent<StructureStats>();
            if (e != null)
            {
                  e.TakeDamage(damage);
            }
      }

      void Explode()
      {
            Collider[] colliders =
Physics.OverlapSphere(transform.position, explosionRadius);
            foreach (Collider collider in colliders)
            {
                  if (collider.tag == "StrategicTurret")
                  {
                        Damage(collider.transform);
                  }
            }
      }

      private void OnDrawGizmosSelected()
      {
```

```
            Gizmos.color = Color.red;
            Gizmos.DrawWireSphere(transform.position, explosionRadius);
        }
}
```

3.1.5.1.3 Movimiento de enemigos

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public enum Targets
{
    WayPoints,
    StrategicTurrets
}

[RequireComponent(typeof(EnemyStats))]
public class EnemyMovement : MonoBehaviour
{
    private Transform target;

    private int wavepointIndex;

    private EnemyStats stats;
    private Vector3 Direction;
    // Start is called before the first frame update
    void Start()
    {
        stats = GetComponent<EnemyStats>();
        if(stats.Target == Targets.WayPoints)
        {
            resetTarget();
        }
        else if(stats.Target == Targets.StrategicTurrets)
        {
            InvokeRepeating("SearchForTurretTargets", 0f, 0.5f);
        }
    }

    void resetTarget()
    {
        wavepointIndex = 0;
        target = WayPoints.points[wavepointIndex];
        setDirection();
    }

    void SearchForTurretTargets()
    {
        GameObject[] turrets =
GameObject.FindGameObjectsWithTag(stats.Objetive_Tag);
```

```
        if(turrets.Length <= 0)
            turrets = GameObject.FindGameObjectsWithTag(stats.CoreTag);
        float MinDistance = Mathf.Infinity;
        float distanceToTurret;
        GameObject nearestTurret = null;
        foreach (GameObject turret in turrets)
        {
            distanceToTurret = Vector3.Distance(transform.position,
turret.transform.position);
            if (distanceToTurret < MinDistance)
            {
                MinDistance = distanceToTurret;
                nearestTurret = turret;
            }
        }

        if (nearestTurret != null)
        {
            target = nearestTurret.transform;
        }
        else
        {
            stats.canMove = false;
            target = null;
        }

        if(stats.canMove)
            setDirection();

    }

    void Update()
    {
        HeightControl();

        if (stats.canMove)
        {
            Move();
            Utility.LookOnTarget(transform, Direction, stats.speed);

            if (stats.Target == Targets.WayPoints)
            {
                if (Vector2.Distance(new Vector2(transform.position.x,
transform.position.z), new Vector2(target.position.x, target.position.z))
<= 0.1f)
                {
                    NextAction();
                }
            }
        }
```

```
        else
        {
            Stop();
        }


        stats.speed = stats.startSpeed;
    }

    void NextAction()
    {
        StructureStats targetstats;
        if (target.TryGetComponent<StructureStats>(out targetstats))
        {
            EndPath(targetstats);
            return;
        }
        getNextWaypoint();
    }

    void HeightControl()
    {
        DownControl();
        FwdControl();

    }

    void DownControl()
    {
        Vector3 down = transform.TransformDirection(Vector3.down);
        RaycastHit Downhit;
        if (Physics.Raycast(transform.position, down * 2, out Downhit, 2,
stats.moveOverMask))
        {
            if (Downhit.collider != null)
            {
                float Distance =
Vector3.Distance(Downhit.collider.transform.position, transform.position);
                if (Distance < stats.floorDistance)
                {
                    Direction.y = Direction.y + stats.floorDistance;
                    MoveUp(new Vector3(transform.position.x, Direction.y +
stats.floorDistance, transform.position.z));
                    Debug.DrawRay(transform.position, down *
Downhit.distance, Color.yellow);
                }
                else
                {
                    Stop();
                    setDirection();
```

```
                    Debug.DrawRay(transform.position, down *
Downhit.distance, Color.green);
                }
            }
            else
            {
                Debug.DrawRay(transform.position, down *
stats.floorDistance, Color.red);
            }

        }
        else
        {
            Debug.DrawRay(transform.position, down * stats.floorDistance,
Color.red);
        }
    }

    void FwdControl()
    {
        Vector3 fwd = transform.TransformDirection(Vector3.forward);
        RaycastHit Fwdhit;

        if (Physics.Raycast(transform.position, fwd * 2, out Fwdhit, 2,
stats.moveOverMask))
        {
            if (Fwdhit.collider != null)
            {
                Direction.y = Direction.y + stats.floorDistance;
                MoveUp(new Vector3(transform.position.x, Direction.y +
stats.floorDistance, transform.position.z));
                Debug.DrawRay(transform.position, fwd * Fwdhit.distance,
Color.yellow);
            }
            else
            {
                Stop();
                setDirection();
                Debug.DrawRay(transform.position, fwd * Fwdhit.distance,
Color.green);
            }

        }
        else
        {
            Debug.DrawRay(transform.position, fwd * stats.floorDistance,
Color.red);
        }
    }
```

```
    void Move()
    {
        transform.Translate(Direction.normalized * stats.speed *
Time.deltaTime, Space.World);
    }

    void MoveUp(Vector3 pos)
    {
        transform.Translate(pos.normalized * stats.speed * Time.deltaTime,
Space.World);
    }

    private void Stop()
    {
        transform.Translate(Direction.normalized * 0, Space.World);
    }

    void setDirection()
    {
        if (target == null)
        {
            Stop();
            return;
        }
        Direction = (target.position - transform.position).normalized;
    }

    void getNextWaypoint()
    {
        //as this method is called when the waypoint is not a core or
structure, this if
        //prevent any errors by restaring the waypoints so that the enemy
move on a loop when there is not a core
        //on the way
        if (wavepointIndex >= WayPoints.points.Count - 1)
        {
            resetTarget();
            return;
        }

        wavepointIndex++;
        target = WayPoints.points[wavepointIndex];
        setDirection();
    }

    void EndPath(StructureStats target)
    {
        target.TakeDamage(stats.impactDamage);
        WaveSpawner.EnemiesAlive--;
        Destroy(gameObject);
```

```
        // This line is for testing. it make the enemy to restart from the
firstwaypoint
        //resetTarget();
    }

}
```

3.1.5.1.4 Estadísticas de enemigo

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;

public class EnemyStats : MonoBehaviour
{
    [Header("Enemy Stats")]
    public float startHealth = 100f;
    public int MoneyDrop = 50;
    public float startSpeed = 2f;
    public int impactDamage = 5;

    [Header("Enemy Movement")]
    [Range(0f, 2f)]
    public float floorDistance = 1f;
    public LayerMask moveOverMask;
    public Targets Target = Targets.WayPoints;
    public bool canMove = true;
    public bool canAtack = false;
    [Header("Enemy Atack")]
    public Transform firePoint;
    public LayerMask targetMask;
    public string Objetive_Tag;
    public Transform lastObjetive;
    public GameObject bullet;
    [Range(0f,10f)]
    public float range;
    public float fireRate = 1f;
    public float fireCountdown = 1f;

    [Header("Unity Objects")]
    public GameObject DeadEffect;
    public Image healthBar;

    [HideInInspector]
    public float health;
    [HideInInspector]
    public float speed;
    [HideInInspector]
    public string CoreTag;
    private bool isDead = false;
```

```
    private void Start()
    {
        speed = startSpeed;
        health = startHealth;
        if(lastObjetive != null)
            CoreTag = lastObjetive.tag;
    }

    public void TakeDamage(float amount)
    {
        health -= amount;
        healthBar.fillAmount = health / startHealth;
        if (health <= 0 && !isDead)
        {
            Die();
        }
    }

    public void Slow(float pct)
    {
        speed = startSpeed * (1f - pct);
    }

    void Die()
    {
        isDead = true;

        GameObject effect =
Instantiate(DeadEffect,transform.position,Quaternion.identity);
        Destroy(effect,1.5f);
        PlayerStats.materials += MoneyDrop;
        WaveSpawner.EnemiesAlive--;
        Destroy(gameObject);
    }

    void OnDrawGizmosSelected()
    {
        Gizmos.color = Color.red;
        Gizmos.DrawWireSphere(transform.position, range);
    }
}
```

3.1.5.2. Managers

3.1.5.2.1 Manager de construcción

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
```

```
public class BuildManager : MonoBehaviour
{
    private TurretBlueprint turretToBuild;
    private Nodo selectedNode;

    public static BuildManager instance;
    public GameObject BuildEffect;
    public GameObject SellEffect;
    public NodoUI nodoUI;
    public bool CanBuild { get { return turretToBuild != null; } }
    public bool HasMoney { get { return PlayerStats.materials >=
turretToBuild.materialCost; } }
    void Awake()
    {
        if (instance != null)
        {
            Debug.LogError("More than one BuildManager in scene!");
            return;
        }
        instance = this;
    }
    public void SelectNode(Nodo nodo)
    {
        if (selectedNode == nodo)
        {
            DeselectNode();
            return;
        }
        selectedNode = nodo;
        turretToBuild = null;
        nodoUI.SetTarget(nodo);
    }

    public void DeselectNode()
    {
        selectedNode = null;
        nodoUI.Hide();
    }

    public void SelectTurretToBuild(TurretBlueprint turret)
    {
        turretToBuild = turret;
        DeselectNode();
    }

    public TurretBlueprint GetTurretToBuild()
    {
        return turretToBuild;
    }
```

```
}
```

3.1.5.2.2 Controlador de cámara

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.EventSystems;
using UnityEngine.InputSystem;

public class CameraController : MonoBehaviour
{
    public float panSpeed = 30f;
    public float panBorderScreen = 30f;
    public float ScroolSpeed = 0.5f;
    public LayerMask NodeMask;

    [Header("Limits")]
    public float minY = 3.5f;
    public float maxY = 30f;

    private PlayerInput playerInput;
    private Vector2 mousePos;
    private RaycastHit lastHit;
    private IMouse lastMouseMove;

    private void Awake()
    {
        playerInput = new PlayerInput();
    }

    private void OnEnable()
    {
        playerInput.Enable();
        playerInput.Camera.MousePosition.performed += Move;
        playerInput.Camera.Scrolling.performed += scroll;
        playerInput.GamePlay.MouseLeftClick.performed += MouseLeftClick;
    }

    private void OnDisable()
    {
        playerInput.Disable();
        playerInput.Camera.MousePosition.performed -= Move;
        playerInput.Camera.Scrolling.performed -= scroll;
        playerInput.GamePlay.MouseLeftClick.performed -= MouseLeftClick;
    }

    // Update is called once per frame
    void Update()
    {
```

```
        if (GameManager.isGameOver)
        {
            this.enabled = false;
            return;
        }

        if (playerInput.Camera.ForwardMove.IsPressed() || mousePos.y >=
Screen.height - panBorderScreen)
        {
            transform.Translate(Vector3.forward * panSpeed *
Time.deltaTime, Space.World);
        }

        if (playerInput.Camera.BackwardMoce.IsPressed() || mousePos.y <=
panBorderScreen)
        {
            transform.Translate(Vector3.back * panSpeed * Time.deltaTime,
Space.World);
        }

        if (playerInput.Camera.RightMove.IsPressed() || mousePos.x >=
Screen.width - panBorderScreen)
        {
            transform.Translate(Vector3.right * panSpeed * Time.deltaTime,
Space.World);
        }

        if (playerInput.Camera.LeftMove.IsPressed() || mousePos.x <=
panBorderScreen)
        {
            transform.Translate(Vector3.left * panSpeed * Time.deltaTime,
Space.World);
        }
        /*
        */
    }

    void Move(InputAction.CallbackContext ctx)
    {
        mousePos = ctx.ReadValue<Vector2>();
        if (ctx.phase == InputActionPhase.Performed &&
            Physics.Raycast(
                Camera.main.ScreenPointToRay(mousePos),
                out RaycastHit hit, NodeMask))
        {
            IMouse mouseMove =
hit.collider.gameObject.GetComponent<IMouse>();
            if (!hit.collider.Equals(lastHit.collider))
            {
                mouseMove?.OnMouseEnter();
```

```
                lastMouseMove?.OnMouseExit();
            }

            lastHit = hit;
            lastMouseMove = mouseMove;
        }
    }
    void scroll(InputAction.CallbackContext ctx)
    {
        //float scroll = Input.GetAxis("Mouse ScrollWheel");
        float scroll = ctx.ReadValue<float>();
        Vector3 pos = transform.position;

        pos.y -= scroll * 1000 * ScroolSpeed * Time.deltaTime;
        pos.y = Mathf.Clamp(pos.y, minY, maxY);
        transform.position = pos;
    }

    public void MouseLeftClick(InputAction.CallbackContext ctx)
    {
        if (ctx.phase == InputActionPhase.Performed &&
            Physics.Raycast(
                Camera.main.ScreenPointToRay(
                    Mouse.current.position.ReadValue()),
                out RaycastHit hit, NodeMask))
        {
            IMouse mouseDown =
hit.collider.gameObject.GetComponent<IMouse>();

            mouseDown?.OnMouseDown();
        }
    }

}
```

3.1.5.2.3 Completacion de nivel

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class CompleteLevel : MonoBehaviour
{
    public SceneFader sceneFader;
    public string menuSceneName = "MainMenu";
    public string nextLevl = "Lv2";
    public int levelToUnlock = 2;

    public void Continue()
    {
```

```
        PlayerPrefs.SetInt("levelReached", levelToUnlock);
        sceneFader.FadeTo(nextLevl);
    }

    public void Menu()
    {
        sceneFader.FadeTo(menuSceneName);
    }

}
```

3.1.5.2.4 GameManager

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class GameManager : MonoBehaviour
{

    public GameObject gameOverUI;
    public AudioClip gameOverClip;
    public GameObject completeLevelUI;
    public AudioClip completeLeveClip;
    public GameObject CORE;
    public SceneFader sceneFader;
    public bool Editor = false;
    [HideInInspector]
    public static bool isGameOver;
    public static bool isEditor;
    private AudioSource audioSource;
    void Start()
    {
        audioSource = GetComponent<AudioSource>();
        isGameOver = false;
        isEditor = Editor;
    }

    // Update is called once per frame
    void Update()
    {
        if (isGameOver)
            return;
        if(CORE == null)
        {
            EndGame();
            return;
        }
    }

    void EndGame()
```

```
    {
        if (isGameOver)
            return;
        audioSource.loop = false;
        audioSource.clip = gameOverClip;
        audioSource.Play();
        isGameOver = true;
        gameOverUI.SetActive(true);
    }

    public void WinLevel()
    {
        if(isGameOver)
            return;
        audioSource.loop = false;
        audioSource.clip = completeLeveClip;
        audioSource.Play();
        isGameOver = true;
        completeLevelUI.SetActive(true);
    }
}
```

3.1.5.2.5 GameOver

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class GameOver : MonoBehaviour
{

    public SceneFader sceneFader;
    public string menuSceneName = "MainMenu";



    public void Retry()
    {
        sceneFader.FadeTo(SceneManager.GetActiveScene().name);
    }

    public void Menu()
    {
        sceneFader.FadeTo(menuSceneName);
    }
}
```

3.1.5.2.6 Selector de niveles

```
using System.Collections;
using System.Collections.Generic;
```

```
using UnityEngine;
using UnityEngine.UI;

public class LevelSelector : MonoBehaviour
{
    public SceneFader sceneFader;

    public Button[] levelButtons;

    void Start()
    {
        int levelReached = PlayerPrefs.GetInt("levelReached", 1);

        for (int i = 0; i < levelButtons.Length; i++)
        {
            if( (i + 1) > levelReached)
            {
                levelButtons[i].interactable = false;
            }
            else
            {
                levelButtons[i].interactable= true;
            }

        }

    }

    public void Select(string levelname)
    {
        sceneFader.FadeTo(levelname);
    }
}
```

3.1.5.2.7 Menu principal

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class MainMenu : MonoBehaviour
{
    public string levelToLoad = "MainLevel";
    public SceneFader sceneFader;
    public void Play()
    {
        sceneFader.FadeTo(levelToLoad);
    }
    public void Quit()
    {
```

```
        Application.Quit();
    }
}
```

3.1.5.2.8 Menu de pausa

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.InputSystem;
using UnityEngine.SceneManagement;

public class PauseMenu : MonoBehaviour
{
    public GameObject ui;
    public SceneFader sceneFader;
    public string menuSceneName = "MainMenu";

    private PlayerInput playerInput;

    private void Awake()
    {
        playerInput = new PlayerInput();
    }

    private void OnEnable()
    {
        playerInput.Enable();
        playerInput.GamePlay.Pause.performed += Pause;
    }

    private void OnDisable()
    {
        playerInput.Disable();
        playerInput.GamePlay.Pause.performed -= Pause;
    }

    private void Pause(InputAction.CallbackContext ctx)
    {
        Toggle();
    }

    public void Toggle()
    {
        //if false = true, if true = false
        ui.SetActive(!ui.activeSelf);

        if (ui.activeSelf)
        {
            Time.timeScale = 0f;
        }
```

```
        else
        {
            Time.timeScale = 1f;
        }
    }

    public void Retry()
    {
        Toggle();
        sceneFader.FadeTo(SceneManager.GetActiveScene().name);
    }

    public void Menu()
    {
        Toggle();
        sceneFader.FadeTo(menuSceneName);
    }


}
```

3.1.5.2.9 SceneFader

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;
using UnityEngine.SceneManagement;

public class SceneFader : MonoBehaviour
{
    public Image Image;
    public AnimationCurve fadeCurve;
    void Start()
    {
        StartCoroutine(FadeIn());
    }

    public void FadeTo(string scene)
    {
        StartCoroutine(FadeOut(scene));
    }

    IEnumerator FadeIn()
    {
        float t = 1f;

        while(t > 0f)
        {
            t -= Time.deltaTime;
            float a = fadeCurve.Evaluate(t);
            Image.color = new Color(0f,0f,0f,a);
            yield return 0;
        }
    }
```

```
    IEnumerator FadeOut(string scene)
    {
        float t = 0f;

        while (t < 1f)
        {
            t += Time.deltaTime;
            float a = fadeCurve.Evaluate(t);
            Image.color = new Color(0f, 0f, 0f, a);
            yield return 0;
        }
        SceneManager.LoadScene(scene);
    }

}
```

3.1.5.3. Torretas

3.1.5.3.1. Controlador de torreta electrica

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class ElectricTurretController : MonoBehaviour
{
    public StructureStats stats;

    public string Objetive_Tag = "Enemy";
    [Range(0f, 1f)]
    public float SlowPct = .75f;
    [HideInInspector]
    public List<EnemyStats> targets;
    private AudioSource audioSource;
    // Start is called before the first frame update
    void Start()
    {
        audioSource = GetComponent<AudioSource>();
        stats = GetComponent<StructureStats>();
    }

    // Update is called once per frame
    void Update()
    {
        if (stats.isWorking)
        {
            UpdateTarget();
            SlowTargets();
        }
    }

    void UpdateTarget()
    {
```

```
        targets.Clear();
        GameObject[] enemies =
GameObject.FindGameObjectsWithTag(Objetive_Tag);
        float distanceToEnemy;
        foreach (GameObject enemy in enemies)
        {
            distanceToEnemy = Vector3.Distance(transform.position,
enemy.transform.position);
            if (distanceToEnemy <= stats.range)
            {
                targets.Add(enemy.GetComponent<EnemyStats>());
            }
        }
    }

    void SlowTargets()
    {
        if (targets.Count > 0)
        {
            if(!audioSource.isPlaying)
                audioSource.Play();
            foreach (EnemyStats target in targets)
            {
                target.Slow(SlowPct);
            }
        }
    }
}
```

3.1.5.3.2. Controlador de torreta estrategica

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class StrategicTurretController : MonoBehaviour
{
    //Important variables
    private Transform target;
    private StructureStats targetStats;
    [HideInInspector]
    public StructureStats stats;

    [Header("Lase effects")]
    public LineRenderer lineRenderer;
    public ParticleSystem impactEffect;
    public Light impactLight;

    [Header("Unity Setups")]
    public List<string> Objetive_Tag;
    public Transform edge;
```

```
    public float edge_speed = 4f;
    public Transform fireLine;
    public Transform firePoint;
    public LayerMask targetMask;
    public LayerMask obstacleMask;


    private bool canSee;
    private bool isProducing;
    private AudioSource audioSource;

    // Start is called before the first frame update
    void Start()
    {
        audioSource = GetComponent<AudioSource>();
        stats = GetComponent<StructureStats>();
        InvokeRepeating("UpdateTarget", 0f, 0.5f);
    }

    GameObject[] posibleTargets()
    {
        List<GameObject> pTargets = new List<GameObject>();
        foreach(string tag in Objetive_Tag)
        {
            GameObject[] found = GameObject.FindGameObjectsWithTag(tag);
            if(found != null && found.Length > 0)
                foreach(GameObject target in found)
                    if(target != null)
                        pTargets.Add(target);
        }
        return pTargets.ToArray();
    }

    void UpdateTarget()
    {
        if (stats.isWorking)
        {
            GameObject[] targets = posibleTargets();
            float MinDistance = Mathf.Infinity;
            float distanceToTarget;
            GameObject nearestTarget = null;
            foreach (GameObject target in targets)
            {
                //this condition prevent the healer turret to select it
selft
                if (!this.gameObject.Equals(target))
                {
                    distanceToTarget =
Vector3.Distance(transform.position, target.transform.position);
                    if (stats.isHealer)
```

```
                    {
                        StructureStats structure;
                        if (target.TryGetComponent<StructureStats>(out
structure))
                        {
                            if ((distanceToTarget < MinDistance) &&
(structure.health < structure.maxHealth))
                            {
                                MinDistance = distanceToTarget;
                                nearestTarget = target;
                            }
                        }
                    }
                    else if (distanceToTarget < MinDistance)
                    {
                        MinDistance = distanceToTarget;
                        nearestTarget = target;
                    }
                }
            }

            if (nearestTarget != null && MinDistance <= stats.range)
            {
                target = nearestTarget.transform;
                canSee = true;
            }
            else
            {
                target = null;
                canSee = false;
            }
        }
        else {
            if (target != null)
            {
                target = null;
                canSee = false;
                StopProduction();
            }
        }
    }

    // Update is called once per frame
    void Update()
    {
        if (target == null)
        {
            if (lineRenderer.enabled)
            {
                lineRenderer.enabled = false;
```

```
                impactEffect.Stop();
                impactLight.enabled = false;
            }
            return;
        }
        //Tracking target
        Utility.LookOnTarget(edge, (target.position -
edge.position).normalized, edge_speed);
        //Tracking();
        //Fire
        if (canSee)
        {
            Laser();
            Produce();
        }else
        {
            StopProduction();
        }
    }

    void Laser()
    {
        if(!audioSource.isPlaying)
            audioSource.Play();
        //Visual
        if (!lineRenderer.enabled)
        {
            lineRenderer.enabled = true;
            impactEffect.Play();
            impactLight.enabled = true;
        }
        lineRenderer.SetPosition(0, firePoint.position);
        lineRenderer.SetPosition(1, target.position);

        Vector3 iEdir = firePoint.position - target.position;
        impactEffect.transform.position = target.position +
iEdir.normalized * .3f;
        impactEffect.transform.rotation = Quaternion.LookRotation(iEdir);
    }

    void Produce()
    {
        if (!isProducing)
        {
            foreach (Product product in stats.products)
            {
                if (product.productionType == Production.Energy)
                {
                    PlayerStats.EnGeneration += product.production;
                    isProducing = true;
```

```
                }
                else if (product.productionType == Production.Material)
                {
                    PlayerStats.MatGeneration += product.production;
                    isProducing = true;
                }
                else if (product.productionType == Production.Health)
                {
                    targetStats = target.GetComponent<StructureStats>();
                    if (targetStats.health < targetStats.maxHealth)
                        targetStats.heal(product.production *
Time.deltaTime);
                }
            }
        }
    }

    void StopProduction()
    {
        if (isProducing)
        {
            foreach (Product product in stats.products)
            {
                if (product.productionType == Production.Energy)
                {
                    PlayerStats.EnGeneration -= product.production;
                }
                else if (product.productionType == Production.Material)
                {
                    PlayerStats.MatGeneration -= product.production;
                }
            }
            isProducing = false;
        }
    }

    private void OnDestroy()
    {
        StopProduction();
    }

    void OnDrawGizmosSelected()
    {
        Gizmos.color = Color.red;
        Gizmos.DrawWireSphere(transform.position,
GetComponent<StructureStats>().range);
    }
}
```

3.1.5.3.3. Estadistica de estructura

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;

//a little list of production types
public enum Production
{
    Damage, // not implemented
    Health,
    Energy,
    Material
}

public class StructureStats : MonoBehaviour
{
    [Header("Structure Stats")]
    public float maxHealth = 100f;
    public float range = 3f;
    public int energyCost = 5;

    [Header("Production")]
    public bool isHealer = false;
    public bool isCore = false;
    public List<Product> products = new List<Product>();

    [Header("Unity Objects")]
    public Image healthBar;
    public GameObject ExplosionEffect;
    [HideInInspector]
    public float health;
    public bool isWorking = false;
    bool isDestroyed = false;
    bool isCoreProducing = false;
    // Start is called before the first frame update
    void Start()
    {
        health = maxHealth;
        PlayerStats.EnConsumption += energyCost;
    }

    void Update()
    {
        //turn off the structure if there is no energy.
        if(PlayerStats.Energy <= 0 && energyCost > 0)
        {
            isWorking = false;
            //if is core then stop production
            if (isCore)
```

```
            {
                StopCoreProduction();
            }

        }else if (!isWorking) // if there is energy and the structure is
turned off then turn it on
        {
            isWorking = true;
            // if is core then start production (production of turrets are
handled by the strategic turret controller script)
            if (isCore)
            {
                CoreProduce();
            }
        }

        //update healthbar if exist.
        if(healthBar != null)
        {
            healthBar.fillAmount = health / maxHealth;
        }

    }

    /// <summary>
    /// method called when the structure recive damage.
    /// </summary>
    /// <param name="amount"> Amount of damage that the structure will
recive</param>
    public void TakeDamage(float amount)
    {
        health -= amount;
        if(health <= 0 && !isDestroyed)
        {
            Explode();
        }
    }

    /// <summary>
    /// method called when the structure is healed / repaired
    /// </summary>
    /// <param name="amount"> amount of heal to recive</param>
    public void heal(float amount)
    {
        if((health + amount) > maxHealth)
        {
            heal(maxHealth-health);
            return;
        }
        health += amount;
```

```
    }

    /// <summary>
    /// Method called when the structure will explode / die
    /// </summary>
    void Explode()
    {
        isDestroyed = true;

        GameObject effect = Instantiate(ExplosionEffect,
transform.position, Quaternion.identity);
        Destroy(effect, 1.5f);
        Destroy(gameObject);
    }

    /// <summary>
    /// Method called to start the production of the core if the structure
is a core
    /// </summary>
    void CoreProduce()
    {
        if (!isCoreProducing)
        {
            foreach (Product product in products)
            {
                if (product.productionType == Production.Energy)
                {
                    PlayerStats.EnGeneration += product.production;
                }
                else if (product.productionType == Production.Material)
                {
                    PlayerStats.MatGeneration += product.production;
                }
            }
            isCoreProducing = true;
        }
    }

    /// <summary>
    /// Method called to stop the production of the core.
    /// </summary>
    void StopCoreProduction()
    {
        if (isCoreProducing)
        {
            foreach (Product product in products)
            {
                if (product.productionType == Production.Energy)
                {
                    PlayerStats.EnGeneration -= product.production;
```

```
                }
                else if (product.productionType == Production.Material)
                {
                    PlayerStats.MatGeneration -= product.production;
                }
            }
            isCoreProducing = false;
        }
    }

    /// <summary>
    /// Called when the structure is destroyed
    /// </summary>
    private void OnDestroy()
    {
        PlayerStats.EnConsumption -= energyCost;
        StopCoreProduction();
    }

    /// <summary>
    /// Called when you select the prefab on scene to show the structure
range.
    /// </summary>
    void OnDrawGizmosSelected()
    {
        Gizmos.color = Color.red;
        Gizmos.DrawWireSphere(transform.position, range);
    }

}
```

3.1.5.3.4. Controlador de torreta

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class TurretController : MonoBehaviour
{
    private Transform target;
    private EnemyStats targetEnemy;
    [HideInInspector]
    public StructureStats stats;

    [Header("Use Bullets (default)")]
    public float fireRate = 1f;
    private float fireCountdown = 1f;
    public GameObject bullet;

    [Header("Use Laser")]
    public bool useLaser = false;
```

```
    public int damageOverTime=30;
    [Range(0f, 1f)]
    public float SlowPct = .5f;

    public LineRenderer lineRenderer;
    public ParticleSystem impactEffect;
    public Light impactLight;

    [Header("Unity Setups")]
    public string Objetive_Tag = "Enemy";
    public Transform edge;
    public float edge_speed = 4f;
    public Transform fireLine;
    public Transform firePoint;
    public LayerMask targetMask;
    public LayerMask obstacleMask;

    private bool canSee;
    private AudioSource audioSource;
    // Start is called before the first frame update
    void Start()
    {
        audioSource = GetComponent<AudioSource>();
        stats = GetComponent<StructureStats>();
        InvokeRepeating("UpdateTarget", 0f, 0.5f);
    }

    void UpdateTarget()
    {
        if (stats.isWorking)
        {
            GameObject[] enemies =
GameObject.FindGameObjectsWithTag(Objetive_Tag);
            float MinDistance = Mathf.Infinity;
            float distanceToEnemy;
            GameObject nearestEnemy = null;
            foreach (GameObject enemy in enemies)
            {
                distanceToEnemy = Vector3.Distance(transform.position,
enemy.transform.position);
                if (distanceToEnemy < MinDistance)
                {
                    MinDistance = distanceToEnemy;
                    nearestEnemy = enemy;
                }
            }

            if (nearestEnemy != null && MinDistance <= stats.range)
            {
                target = nearestEnemy.transform;
```

```
                targetEnemy = nearestEnemy.GetComponent<EnemyStats>();
            }
            else
            {
                target = null;
            }
        }else
        {
            if (target != null)
            {
                target = null;
            }
        }
    }


    void Shoot()
    {

        if (!audioSource.isPlaying)
            audioSource.Play();
        GameObject Bullet_O = (GameObject)Instantiate(bullet,
firePoint.position, firePoint.rotation);
        Bullet bullet_sc = Bullet_O.GetComponent<Bullet>();
        if (bullet_sc != null)
            bullet_sc.Seek(target);
    }

    // Update is called once per frame
    void Update()
    {
        if (target == null)
        {
            if (useLaser)
            {
                if (lineRenderer.enabled)
                {
                    lineRenderer.enabled = false;
                    impactEffect.Stop();
                    impactLight.enabled = false;
                }
            }
            return;
        }

        Utility.LookOnTarget(edge, (target.position -
edge.position).normalized, edge_speed);
        Tracking();
        //Fire
        if (canSee)
```

```
        {
            if (useLaser)
            {
                Laser();
            }
            else
            {
                if (fireCountdown <= 0)
                {
                    Shoot();
                    fireCountdown = 1f / fireRate;
                }

                fireCountdown -= Time.deltaTime;
            }
        }

    }

    void Tracking()
    {
        // fl = Fire line Direction
        Vector3 fld = fireLine.TransformDirection(Vector3.forward);
        RaycastHit Obstaclehit;
        RaycastHit enemyhit;

        if (Physics.Raycast(fireLine.position, fld * stats.range, out
Obstaclehit, stats.range, obstacleMask))
        {
            if (Obstaclehit.collider!= null)
            {
                canSee = false;
                Debug.DrawRay(fireLine.position, fld *
Obstaclehit.distance, Color.red);
            }
            else
            {
                canSee = false;
                Debug.DrawRay(fireLine.position, fld *
Obstaclehit.distance, Color.red);
            }

        }else if (Physics.Raycast(fireLine.position, fld * stats.range,
out enemyhit, stats.range, targetMask))
        {
            if (enemyhit.collider.CompareTag(Objetive_Tag))
            {
                canSee = true;
                Debug.DrawRay(fireLine.position, fld * enemyhit.distance,
Color.green);
```

```
            }
            else
            {
                canSee = false;
                Debug.DrawRay(fireLine.position, fld * enemyhit.distance,
Color.red);
            }

        }
        else
        {
            canSee = false;
            Debug.DrawRay(fireLine.position, fld * stats.range,
Color.red);
        }

    }

    void Laser()
    {
        if(!audioSource.isPlaying)
            audioSource.Play();
        //Laser damage

        targetEnemy.TakeDamage(damageOverTime * Time.deltaTime);
        targetEnemy.Slow(SlowPct);
        //Visual
        if (!lineRenderer.enabled)
        {
            lineRenderer.enabled = true;
            impactEffect.Play();
            impactLight.enabled=true;
        }
        lineRenderer.SetPosition(0,firePoint.position);
        lineRenderer.SetPosition(1,target.position);

        Vector3 iEdir = firePoint.position - target.position;
        impactEffect.transform.position = target.position +
iEdir.normalized * .3f;
        impactEffect.transform.rotation = Quaternion.LookRotation(iEdir);
    }

}
```

3.1.5.4. UI

3.1.5.4.1 Estadisticas del juego UI

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;
```

```
using TMPro;

public class GameStatsUI : MonoBehaviour
{
    public PlayerStats stats;

    public TextMeshProUGUI EnergyAmount;
    public TextMeshProUGUI EnergyGeneration;
    public TextMeshProUGUI MineralAmount;
    public TextMeshProUGUI MineralGeneration;

    public Image EnergyBar;

    // Update is called once per frame
    void Update()
    {
        EnergyBar.fillAmount = stats.getEnergyAmount();
        EnergyAmount.text = string.Format("{0:N0}", PlayerStats.Energy);
        EnergyGeneration.text = textFormater(stats.getEnProduction());
        MineralAmount.text = string.Format("{0:N0}",
PlayerStats.materials);
        MineralGeneration.text = textFormater(stats.getMatProduction());
    }

    string textFormater(float amount)
    {
        if(amount == 0)
        {
            return "<color=#" + ColorUtility.ToHtmlStringRGB(Color.white)
+ "> - </color>";
        }
        else if(amount > 0)
        {
            return "<color=#" + ColorUtility.ToHtmlStringRGB(Color.green)
+ "> +" + amount + "</color>";
        }
        else
        {
            return "<color=#" + ColorUtility.ToHtmlStringRGB(Color.red) +
"> " + amount + "</color>";
        }
    }
}
```

3.1.5.4.2 IMouse

```
/// <summary>
/// <para>
///     Interface to use for mouse movement over gameobject colliders.
/// </para>
/// Used to beat the limitation of the new input system where this
```

```
/// options on the monobehavior do not work by default.
/// </summary>
public interface IMouse
{
    /// <summary>
    /// Method to use for mouse clicks.
    /// </summary>
    void OnMouseDown();
    /// <summary>
    /// Method to use when mouse is over the gamebject.
    /// </summary>
    void OnMouseEnter();
    /// <summary>
    /// Method to use when the mouse isn't over the gameobject anymore.
    /// </summary>
    void OnMouseExit();
}
```

3.1.5.4.3 Nodo UI

```
using UnityEngine;
using UnityEngine.UI;

public class NodoUI : MonoBehaviour
{
    public GameObject ui;
    [Header("Turret Info")]
    public Text turretName;
    public Text turretRange;
    public Text turretDamage;
    [Header("Upgrade Info")]
    public Button upgradeButton;
    public Text upgradeCost;
    [Header("Sell Info")]
    public Button sellButton;
    public Text sellGains;

    private Nodo target;
    public void SetTarget(Nodo nodo)
    {
        target = nodo;
        transform.position = target.GetBuildPosition();
        if (!target.isUpgraded)
        {
            upgradeCost.text = "$" + target.turretBlueprint.upgradedCost;
            upgradeButton.interactable = true;
        }
        else
        {
            upgradeCost.text = "DONE";
            upgradeButton.interactable = false;
```

```
        }
        sellGains.text = "$" + target.turretBlueprint.GetSellAmount();


        turretName.text = target.turretBlueprint.Name;
        TurretController turret;
        ElectricTurretController electricTurret;
        if (nodo.turret.TryGetComponent<TurretController>(out turret))
        {
            SetTurretInfo(turret);
        }
        else if(nodo.turret.TryGetComponent<ElectricTurretController>(out
electricTurret))
        {
            SetTurretInfo(electricTurret);
        }
        else{
            SetTurretInfo(nodo.turret.GetComponent<StructureStats>());
        }
        ui.SetActive(true);
    }

    public void SetTurretInfo(TurretController turret)
    {
        turretRange.text = "Range: " + turret.stats.range;
        if (turret.useLaser)
        {
            turretDamage.text = "Damage: " + turret.damageOverTime + "/s";
        }
        else
        {
            turretRange.text = turretRange.text + "\nFire rate: " +
turret.fireRate + "/s";
            turretDamage.text = "Damage: " +
turret.bullet.GetComponent<Bullet>().damage;
        }
    }

    public void SetTurretInfo(ElectricTurretController turret)
    {
        turretRange.text = "Range: " + turret.stats.range;
        turretDamage.text = "Slownes: " + turret.SlowPct * 100 + "%";
    }

    public void SetTurretInfo(StructureStats turret)
    {
        turretRange.text = "Range: " + turret.range;
        turretDamage.text = "Prodution: " +
turret.products[0].productionType.ToString() + "\nAmount: " +
turret.products[0].production;
```

```
    }
    public void Hide()
    {
        ui.SetActive(false);
    }

    public void Upgrade()
    {
        target.UpgradeTurret();
        BuildManager.instance.DeselectNode();
    }

    public void Sell()
    {
        target.SellTurret();
        BuildManager.instance.DeselectNode();
    }

}
```

3.1.5.4.4 Oleadas sobrevividas

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;

public class RoundsSurvived : MonoBehaviour
{

    public Text roundText;

    void OnEnable()
    {
        StartCoroutine(AnimateText());
    }

    IEnumerator AnimateText()
    {
        roundText.text = "0";
        int round = 0;

        yield return new WaitForSeconds(.7f);

        while (round < PlayerStats.Rounds)
        {
            round++;
            roundText.text = round.ToString();

            yield return new WaitForSeconds(.05f);
        }
```

```
    }

}
```

3.1.5.4.5 Tienda

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;

public class Shop : MonoBehaviour
{
    BuildManager buildManager;
    //BuildingCreator buildingCreator;
    public TurretBlueprint[] TurretBlueprints;
    public Button ButtonPrefab;
    public Transform ShopContent;
    private void Start()
    {
        //buildingCreator = BuildingCreator.GetInstance();
        buildManager = BuildManager.instance;
        foreach(TurretBlueprint turret in TurretBlueprints)
        {
            Button button = Instantiate(ButtonPrefab, ShopContent);
            button.name = turret.Name;
            button.image.sprite = turret.Sprite;

button.GetComponent<ShopButtonComponents>().setComponents(turret.materialC
ost.ToString(),getEnCost(turret.prefabs[0]).ToString());
            button.onClick.AddListener(delegate { SelectTurret(turret);
});
        }
    }

    int getEnCost(GameObject turret)
    {
        return turret.GetComponent<StructureStats>().energyCost;
    }

    public void SelectTurret(TurretBlueprint Blueprint)
    {
        //buildingCreator.BlueprintSelected(Blueprint);
        buildManager.SelectTurretToBuild(Blueprint);
    }
}
```

3.1.5.4.6 Componentes de boton de tienda

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
```

```
using TMPro;

public class ShopButtonComponents : MonoBehaviour
{

    public TextMeshProUGUI materialCost;
    public TextMeshProUGUI energyCost;

    public void setComponents(string materialCost, string energyCost)
    {
        this.materialCost.text = materialCost;
        this.energyCost.text = energyCost;
    }

}
```

3.1.5.5. Oleadas

3.1.5.5.1 Oleada

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

[System.Serializable]
public class Wave
{
    public List<WaveEnemy> enemies;
    public int count;
    public float spawnRate;
}
```

3.1.5.5.2 Enemigo de oleada

```
using System;
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

[Serializable]
public class WaveEnemy
{
    public GameObject enemy;
    [Range(1, 5)]
    public int priority;
}
```

3.1.5.5.3 Iniciador de oleada

```
using System.Collections;
using System.Collections.Generic;
using TMPro;
using UnityEngine;
using UnityEngine.UI;
```

```
public class WaveSpawner : MonoBehaviour
{

    public static int EnemiesAlive = 0;

    public Wave[] waves;

    public Transform SpawnPoint;
    public TextMeshProUGUI WaveCountDownText;
    public GameManager gameManager;

    public float WaveCountDown = 10f;
    public float CountDown = 30f;
    private int waveIndex = 0;
    private int partitions;


    // Update is called once per frame
    void Update()
    {
        if(EnemiesAlive > 0)
        {
            return;
        }else if (waveIndex >= waves.Length)
        {
            gameManager.WinLevel();
            this.enabled = false;
            return;
        }
        if (CountDown <= 0f)
        {
            StartCoroutine(SpawnWave());
            CountDown = WaveCountDown;
            return;
        }
        CountDown -= Time.deltaTime;
        CountDown = Mathf.Clamp(CountDown,0f,Mathf.Infinity);
        WaveCountDownText.text = string.Format("{0:00.00}",CountDown);
    }

    private struct rarity
    {
        public int index;
        public int minPartitions;
        public int maxPartitions;
    }

    IEnumerator SpawnWave()
```

```
    {
        PlayerStats.Rounds++;

        Wave wave = waves[waveIndex];

        EnemiesAlive = wave.count;

        partitions = 0;

        List<rarity> rarityList = new List<rarity>();

        for(int cont = 0; cont < wave.enemies.Count; cont++)
        {
            rarity rarity = new rarity();
            rarity.index = cont;
            rarity.minPartitions = partitions;
            rarity.maxPartitions = partitions +
wave.enemies[cont].priority;
            rarityList.Add(rarity);
            partitions += wave.enemies[cont].priority;
        }
        for (int i = 0; i < wave.count; i++)
        {
            int partition = Random.Range(0, partitions);
            foreach (rarity rarity in rarityList)
            {
                if (partition <= rarity.maxPartitions && partition >=
rarity.minPartitions)
                {
                    SpawnEnemy(wave.enemies[rarity.index].enemy);
                    break;
                }
            }
            yield return new WaitForSeconds(wave.spawnRate);
        }
        waveIndex++;
    }

    void SpawnEnemy(GameObject enemy)
    {
        Instantiate(enemy, SpawnPoint.position, SpawnPoint.rotation);
    }


}
```

3.1.5.6. Waypoints

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
```

```
public class WayPoints : MonoBehaviour
{
    public static List<Transform> points;
    private List<Transform> pointsList = new List<Transform>();
    void Awake()
    {
        InvokeRepeating("updatePoints",0f,2f);
    }

    void updatePoints()
    {
        pointsList.Clear();

        int points = transform.childCount;
        for (int i = 0; i < points; i++)
        {
            this.pointsList.Add(transform.GetChild(i));
        }

        WayPoints.points = pointsList;
    }

}
```

3.1.5.7. ScriptableObjects

3.1.5.7.1 Plano

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

[CreateAssetMenu(menuName = "MyGame/BluePrints/NodeBlueprint", fileName =
"NodeBlueprint")]
public class Blueprint : ScriptableObject
{
    public string Name;
    public List<GameObject> prefabs;
    public Sprite Sprite;
}
```

3.1.5.7.2 Plano de torreta

```
using System;
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
[CreateAssetMenu(menuName = "MyGame/BluePrints/TurretBlueprint", fileName
="TurretBlueprint")]
public class TurretBlueprint : Blueprint
{
    public int materialCost;
```

```
    public int upgradedCost;

    public int GetSellAmount()
    {
        return materialCost / 2;
    }

    public int MaxLevel => prefabs.Count;

}
```

3.1.5.8. Variados

3.1.5.8.1 Bala

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class Bullet : MonoBehaviour
{

      private Transform target;

      public int damage=15;
      public float speed = 10f;
      public float explosionRadius = 0f;
      public GameObject ImpactEffect;

      private AudioSource impactSource;
      private bool hasHit = false;
      public void Seek (Transform _target)
      {
            target = _target;
      }

    private void Start()
    {
        impactSource = GetComponent<AudioSource>();

      }

    // Update is called once per frame
    void Update()
      {
            if (target == null)
            {
                  Destroy(gameObject);
                  return;
            }

            Vector3 dir = target.position - transform.position;
```

```
            float distanceFPS = speed * Time.deltaTime;

            if ( dir.magnitude <= distanceFPS)
            {
                  HitTarget();
                  return;
            }

            transform.Translate(dir.normalized * distanceFPS,
Space.World);
            transform.LookAt(target);
      }

      void HitTarget()
      {
            if (hasHit)
                  return;
            hasHit = true;


            GameObject effect =
(GameObject)Instantiate(ImpactEffect,transform.position,transform.rotation
);
            effect.transform.GetComponent<ParticleSystem>().Play();
            Destroy(effect, 5f);
            if(explosionRadius > 0f)
        {
                  Explode();
        }
        else
        {
                  Damage(target);
        }
            if(!impactSource.isPlaying)
                  impactSource.Play();

            Destroy(gameObject, impactSource.clip.length);
      }
      void Damage(Transform enemy)
      {
            EnemyStats e = enemy.GetComponent<EnemyStats>();
            if (e != null)
        {
                  e.TakeDamage(damage);
            }
      }

      void Explode(){
```

```
            Collider[] colliders =
Physics.OverlapSphere(transform.position, explosionRadius);
            foreach(Collider collider in colliders)
        {
                  if (collider.tag == "Enemy")
            {
                        Damage(collider.transform);
            }
        }
    }

    private void OnDrawGizmosSelected()
    {
        Gizmos.color=Color.red;
            Gizmos.DrawWireSphere(transform.position, explosionRadius);
    }
}
```

3.1.5.8.2 Nodo

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.EventSystems;
using UnityEngine.InputSystem;

public class Nodo : MonoBehaviour, IMouse
{
    public Color hoverColor;
    public Vector3 positionOffset;
    public Color BlockedColor;
    [HideInInspector]
    public GameObject turret;
    public TurretBlueprint turretBlueprint;
    public bool isUpgraded = false;

    private int upgradeIndex;
    private Renderer rend;
    private Color StartColor;

    BuildManager buildManager;

    public Vector3 GetBuildPosition()
    {
        return transform.position + positionOffset;
    }

    void Start()
    {
        rend = GetComponent<Renderer>();
        StartColor = rend.material.color;
```

```
        buildManager = BuildManager.instance;
        upgradeIndex = 0;
        if (turretBlueprint != null)
        {
            buildManager.SelectTurretToBuild(turretBlueprint);
            BuildTurret(turretBlueprint, true);
        }
    }

    void BuildTurret(TurretBlueprint blueprint, bool isFree)
    {
        if (!buildManager.HasMoney && !isFree)
        {
            return;
        }

        if (!isFree) {
            PlayerStats.materials -= blueprint.materialCost;
        }

        GameObject _turret = Instantiate(blueprint.prefabs[0],
GetBuildPosition(), blueprint.prefabs[0].transform.rotation);
        turret = _turret;
        turretBlueprint = blueprint;

        if(!(blueprint.prefabs.Count > 1))
            isUpgraded = true;

        GameObject effect = Instantiate(buildManager.BuildEffect,
GetBuildPosition(), Quaternion.identity);
        Destroy(effect, 2f);
    }

    public void UpgradeTurret()
    {
        upgradeIndex++;
        if (PlayerStats.materials < turretBlueprint.upgradedCost)
        {
            return;
        }
        PlayerStats.materials -= turretBlueprint.upgradedCost;
        //Destroy old turret
        Destroy(turret);
        //Build Upgraded turret
        GameObject _turret =
Instantiate(turretBlueprint.prefabs[upgradeIndex], GetBuildPosition(),
turretBlueprint.prefabs[upgradeIndex].transform.rotation);
        turret = _turret;
        turretBlueprint.materialCost += turretBlueprint.upgradedCost;
```

```
        GameObject effect = Instantiate(buildManager.BuildEffect,
GetBuildPosition(), Quaternion.identity);
        Destroy(effect, 2f);
        if(upgradeIndex >= turretBlueprint.prefabs.Count - 1)
            isUpgraded = true;
    }
    public void SellTurret()
    {
        PlayerStats.materials += turretBlueprint.GetSellAmount();

        GameObject effect = Instantiate(buildManager.SellEffect,
GetBuildPosition(), Quaternion.identity);
        Destroy(effect, 2f);

        //Destroy old turret
        Destroy(turret);
        turretBlueprint = null;


        upgradeIndex = 0;
        isUpgraded = false;
    }

    void IMouse.OnMouseEnter()
    {

        if (EventSystem.current.IsPointerOverGameObject())
            return;
        if (!buildManager.CanBuild)
            return;
        if (buildManager.HasMoney)
        {
            rend.material.color = hoverColor;
        }else
        {
            rend.material.color = BlockedColor;
        }
    }

    void IMouse.OnMouseExit()
    {
        rend.material.color = StartColor;
    }

    void IMouse.OnMouseDown()
    {

        if (EventSystem.current.IsPointerOverGameObject())
```

```
            return;
        if (turret != null)
        {
            buildManager.SelectNode(this);
            return;
        }
        if (!buildManager.CanBuild)
            return;

        BuildTurret(buildManager.GetTurretToBuild(),false);
    }


}
```

3.1.5.8.3 Estadisticas de jugador

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class PlayerStats : MonoBehaviour
{
    public int startMaterials = 150;
    public int maxEnergy = 100;
    [HideInInspector]
    public static float materials;
    public static int Rounds;
    public static float Energy;
    public static int MatGeneration = 0;
    public static int EnGeneration = 0;
    public static int EnConsumption = 0;
    // Start is called before the first frame update
    void Start()
    {
        materials = startMaterials;
        Energy = maxEnergy;
        Rounds = 0;
    }

    // Update is called once per frame
    void Update()
    {
        EnergyGeneration();
        MaterialGeneration();
    }

    public float getEnProduction()
    {
        return EnGeneration - EnConsumption;
    }
```

```
    public float getMatProduction()
    {
        return MatGeneration;
    }

    public float getEnergyAmount()
    {
        return Energy / maxEnergy;
    }
    void MaterialGeneration()
    {
        materials += (MatGeneration * Time.deltaTime);
    }

    void EnergyGeneration()
    {
        EnGenerate((getEnProduction() * Time.deltaTime));
    }

    void EnGenerate(float amount)
    {
        if ((Energy + amount) > maxEnergy)
        {
            Energy = maxEnergy;
            return;
        }
        if((Energy + amount) < 0)
        {
            if(Energy != 0)
                EnGenerate(-Energy);
            return;
        }

        Energy += amount;
    }
}
```

3.1.5.8.4 Producto

```
using System;

[Serializable]
public class Product
{
    public Production productionType;
    public int production;
}
```

3.1.5.8.5 Utileria

```
using System;
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public static class Utility
{
    /// <summary>
    /// NOT IMPLEMENTET
    /// Shuffle the array on random
    /// </summary>
    /// <typeparam name="T"> type of the array </typeparam>
    /// <param name="array"> array of data to sort </param>
    /// <param name="seed"> seed for randomizer </param>
    /// <returns></returns>
    public static T[] ShuffleArray<T>(T[] array, int seed)
    {
        System.Random random = new System.Random(seed);

        for(int i = 0; i < array.Length-1; i++)
        {
            int randomIndex = random.Next(i,array.Length-1);
            T result = array[randomIndex];
            array[randomIndex] = array[i];
            array[i] = result;
        }

        return array;
    }
    /// <summary>
    /// Rotate the GameObject to look on target
    /// </summary>
    /// <param name="obj"> Is the transform of the GameObject to be
rotated</param>
    /// <param name="Direction">Is the direction the transform has to
look</param>
    /// <param name="speed">Is the speed of the rotation</param>
    public static void LookOnTarget(Transform obj, Vector3 Direction,
float speed)
    {
        Quaternion lookRotation =
Quaternion.LookRotation(Direction.normalized);
        Vector3 rotation = Quaternion.Lerp(obj.rotation, lookRotation,
Time.deltaTime * speed).eulerAngles;
        obj.rotation = Quaternion.Euler(rotation.x, rotation.y,
obj.rotation.z);
    }
```

}

3.2. PROTOTIPOS

Los prototipos del juego se han dividido en 2 categorías, Lo-Fi, Hi-Fi. Y se expresan de la siguiente forma:

- **Lo-Fi:** un prototipo compuesto solo por un nivel básico, este prototipo nunca verá la luz del día pues solo sirve como base para el desarrollo.
- **Hi-Fi:** 2 prototipos;
    - El primer prototipo Hi-Fi incorpora el menú principal, menú selector de niveles y 4 niveles básicos.
    - El segundo prototipo Hi-Fi extiende las funcionalidades al agregar los sonidos, más mecánicas, enemigos, torretas y niveles.

3.3. PERFILES DE USUARIOS

El público objetivo es:

- Personas mayores de 10 años.
- Personas que busquen algo para pasar el rato.
- Personas que busquen un desafío.
- Personas que le gusten los juegos de estrategia.

3.4. USABILIDAD

Cuando inicias el juego lo primero que vez es el menú de inicio, un pequeño menú donde encuentras las opciones de salir del juego y jugar.

Si presionas la opción de jugar, entraras al menú de niveles, aquí se encuentran 15 botones, 1 por nivel, más un botón para regresar al menú principal, los botones de los niveles que aún no ha alcanzado estarán bloqueados, por lo que deberás acceder a los niveles jugables para poder desbloquearlos todos.

En la escena del juego encontraras el mapa del juego con el core a defender y el enemy core, además de todos los otros aspectos del nivel, aquí tendrás 7 botones referentes a cada tipo de torre, un contador de recursos, un contador de tiempo para las oleadas y la barra de energía que decide si las torretas funcionan y no. Para los recursos y energía, se encuentran unos contadores especiales que indican cuanto de esto generas por segundo.

Finalmente tenemos el menú de victoria con 3 opciones, continuar, reintentar y salir al menú principal. Mientras el menú de derrota cuenta con la opción de volver a intentar y salir al menú principal.

3.5. TEST

Se realizo un test con dos personas, estos fueron los resultados

Sexo	Masculino	
Edad	24	
Nivel de estudios	Universitario	
Aficiones	Mecánica automotriz	
Tareas	Puntuación	Comentarios
Jugabilidad	4	
Control del personaje	4	
Guía del usuario	5	Bastante intuitivo
Diseño visual	3	¿Cuál es la diferencia entre donde puedo construir y no?
Mecánica del juego	5	

Con este individuo obtuvimos una puntuación de 4.2, se detectó un grabe fallo, y es que como los obstáculos tenían el mismo color que los nodos normales, se podría malinterpretar y pensar que no puedes construir por fallo del juego. Por lo que se ha propuesto la tarea de retocar este punto en antes de la salida del juego.

Sexo	Masculino	
Edad	22	
Nivel de estudios	Universitario	
Aficiones	Computación	
Tareas	Puntuación	Comentarios
Jugabilidad	5	
Control del personaje	4	
Guía del usuario	5	
Diseño visual	4	Me gusta como se ve el juego
Mecánica del juego	5	Me gustan los tricksters

Con la segunda persona obtuvimos una puntuación de 4.6 gracias a los cambios realizados obtuvimos una mejor puntuación, aun se debe mejorar el diseño visual y el control de personajes.

3.6. VERSIONES DE LA APLICACION

El juego cuenta con 3 versiones:

- **Versión Alpha:** una versión no disponible para el público conformada por un solo nivel básico.
- **Versión Beta:** una versión que cuenta con el menú principal, menú de selección de niveles y 4 niveles básicos.
- **Versión 1.0:** versión completa del juego, con 15 niveles, 4 variantes de enemigos, 7 tipos de torretas y la implementación de sonidos y nuevas mecánicas en el juego.

LINK DE ITCH.IO: Defend the core by SanctusForce (itch.io)

LINK DEL PROYECTO: Guillermo-Santos/DefendTheCore (github.com)

LINK DE CAPITULOS: DefendTheCore/Capitulos del proyecto at santo · Guillermo-Santos/DefendTheCore (github.com)