



Revisión del avance 2

Equipo 2:

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Actualización del diagrama de clases

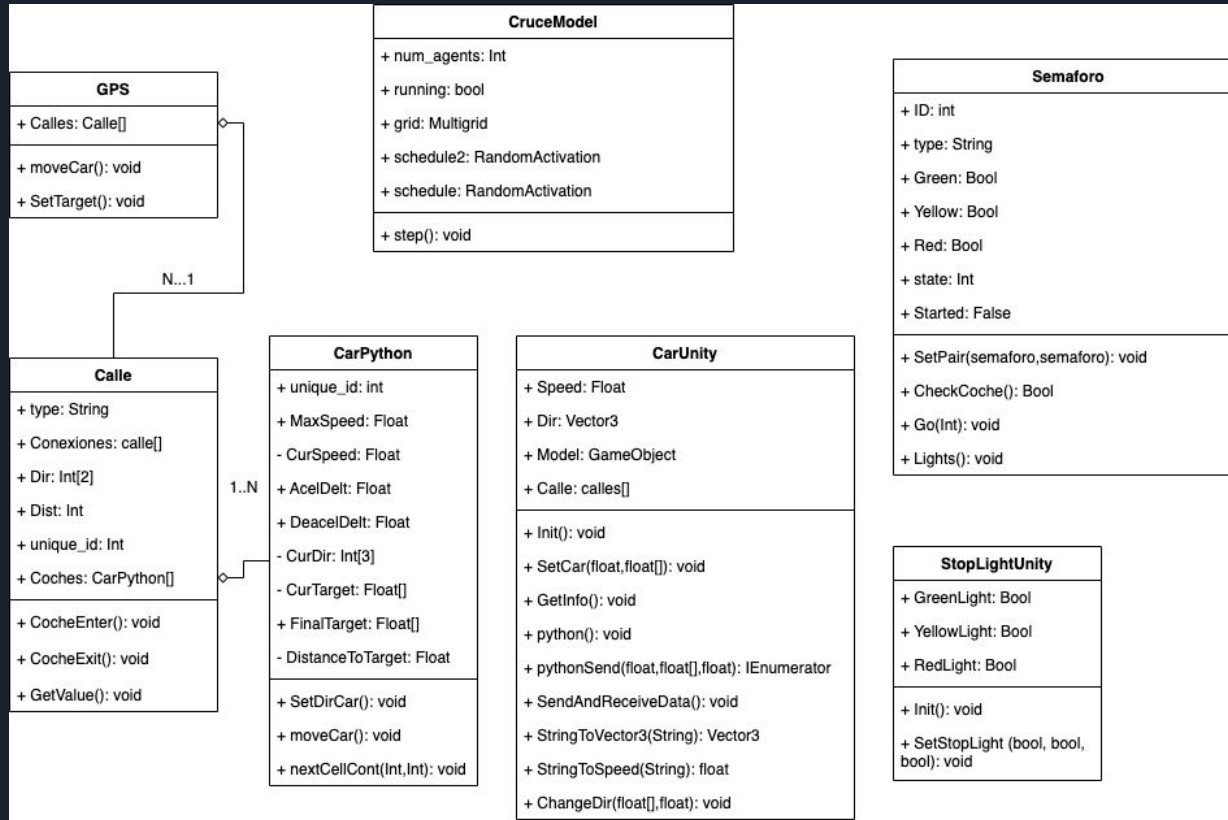
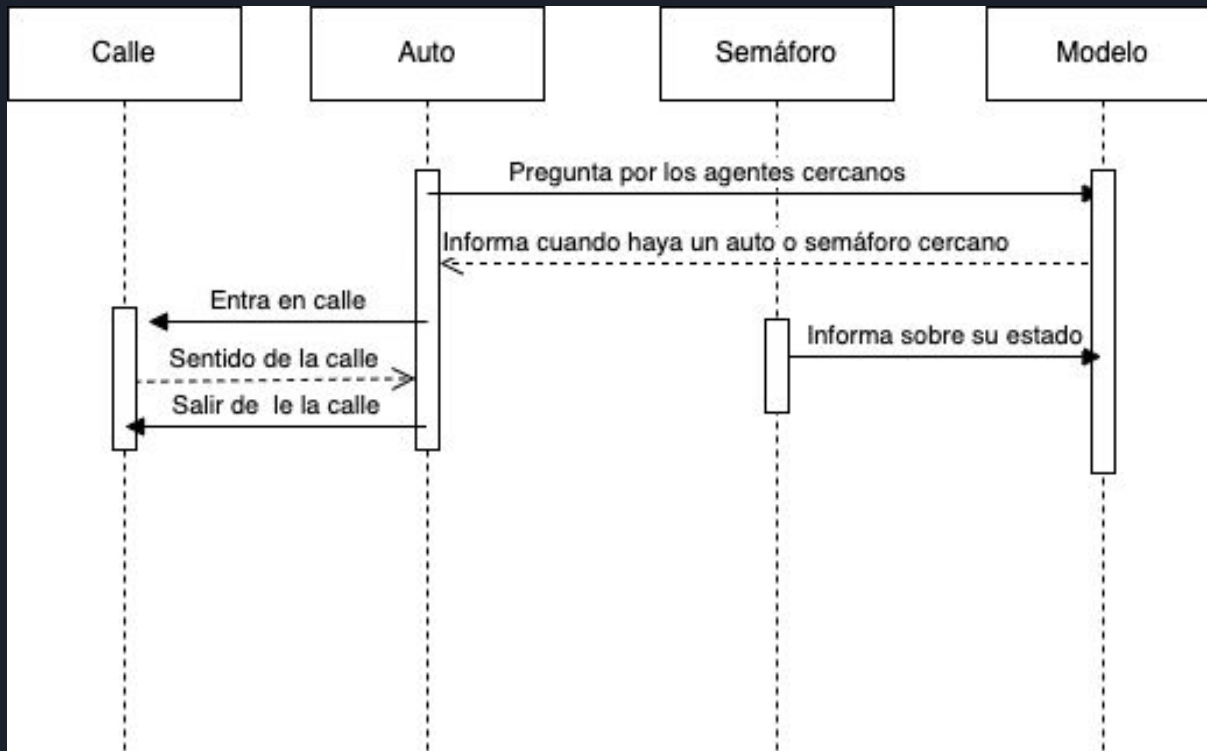


Diagrama de interacción actualizado



Código Python

```
from mesa import Agent, Model
from mesa.time import RandomActivation
from mesa.space import MultiGrid
from mesa.visualization.modules import CanvasGrid
from mesa.visualization.ModularVisualization import ModularServer
from mesa.visualization.UserParam import UserSettableParameter
import random

class Semaforo(Agent):
    def __init__(self, unique_id, model, s):
        super().__init__(unique_id, model)
        self.type = "SEMAFORO"
        self.state = s
        self.Yellow = True
        self.Green = False
        self.Red = False
        self.Started = False
        self.rpos = [0.0, 0.0]
        self.dir = 0

    def SetPair(self, Ne, No):
        self.Spar = Ne
        self.Sop = No

    def CheckCoche(self):
        cellCont = self.model.grid.get_cell_list_contents((self.pos[0], self.pos[1]))
        d = [0, 0]
        if len(cellCont) > 0:
            for index in range(len(cellCont)):
                if cellCont[index].type == "CALLE":
                    d = cellCont[index].Dir
                    if d[0] < 0:
                        self.rpos = [self.pos[0], self.pos[1]+0.5]
                        self.dir = 0
                    elif d[0] > 0:
                        self.rpos = [self.pos[0], self.pos[1]-0.5]
                        self.dir = 1
                    elif d[0] == 0:
                        if d[1] < 0:
                            self.rpos = [self.pos[0]-0.5, self.pos[1]]
                            self.dir = 2
                        elif d[1] > 0:
                            self.rpos = [self.pos[0]+0.5, self.pos[1]]
                            self.dir = 3
            else:
                return False
```

```
cellCont = self.model.grid.get_cell_list_contents(self.model.grid.torus_adj((self.pos[0]-d[0], self.pos[1]-d[1])))
if len(cellCont) > 0:
    for index in range(len(cellCont)):
        if cellCont[index].type == "COCHE":
            self.Sop.Go(8)
            self.Sop.Spar.Go(0)
            self.Spar.Go(0)

            self.Go(8)
            return True
else:
    return False

def Go(self, t):
    if self.Started == False:
        self.Started = True
        self.state = t

def Lights(self):
    if self.Started == True:
        if self.state > 0:
            if self.state < 4:
                self.Red = False
                self.Green = False
                self.Yellow = True
            else:
                self.Yellow = False
                self.Green = True
                self.Red = False
        elif self.state == 0:
            self.Yellow = False
            self.Green = False
            self.Red = True
        self.state -= 1
        if self.state <= -8:
            self.state = 8
        if self.Started == False:
            self.Started = self.CheckCoche()

def step(self):
    self.Lights()
```

```

class Calle(Agent):
    def __init__(self, unique_id, model, dir):
        super().__init__(unique_id, model)
        self.type = "CALLE"
        self.Dir = [0,0]
        self.Dir[0] = dir[0]
        self.Dir[1] = dir[1]

class Cruce(Agent):
    def __init__(self, unique_id, model, dir,dir2):
        super().__init__(unique_id, model)
        self.type = "CRUCE"
        self.Dir = [0,0]
        self.Dir[0] = dir[0]
        self.Dir[1] = dir[1]
        self.Dir2 = [0,0]
        self.Dir2[0] = dir2[0]
        self.Dir2[1] = dir2[1]
        print(self.Dir,self.Dir2)

class Obstaculo(Agent):
    def __init__(self, unique_id, model):
        super().__init__(unique_id, model)
        self.type = "OBSTACULO"

class Coche(Agent):
    def __init__(self, unique_id, model):
        super().__init__(unique_id, model)
        self.type = "COCHE"
        self.isCollecting = True
        self.curpos = [4,4]
        self.target = [4,4]
        self.Dir = [0,0]
        self.cruzando = False

    def nextCellCont(self,X,Y):
        return self.model.grid.get_cell_list_contents(self.model.grid.torus_adj((self.pos[0]+X, self.pos[1]+Y)))

```

```

def GetDir(self):
    cellCont = self.model.grid.get_cell_list_contents((self.pos[0], self.pos[1]))

    if len(cellCont) > 0:
        for index in range(len(cellCont)):
            if cellCont[index].type == "CALLE":
                self.cruzando = False
                return cellCont[index].Dir
            elif cellCont[index].type == "CRUCE":
                if self.cruzando == False:
                    self.cruzando = True
                    rng1 = random.randrange(0,2)
                    if rng1 == 0:
                        return cellCont[index].Dir
                    if rng1 == 1:
                        return cellCont[index].Dir2

        return self.Dir

def Obstacle(self, cellCont):
    if len(cellCont) > 0:
        for index in range(len(cellCont)):
            if cellCont[index].type == "COCHE":
                return True
            elif cellCont[index].type == "OBSTACULO":
                return True
            elif cellCont[index].type == "SEMAFORO":
                if cellCont[index].Red == True:
                    return True

        return False

def move(self):

    self.curpos[0] = self.pos[0]
    self.curpos[1] = self.pos[1]

    self.Dir = self.GetDir()
    X = self.Dir[0]
    Y = self.Dir[1]

    nextCell = self.nextCellCont(X,Y)
    obstruct = self.Obstacle(nextCell)
    if (obstruct == False):
        self.model.grid.move_agent(self, (self.pos[0]+X, self.pos[1]+Y))

    def step(self):
        self.move()

```

```

class CruceModel(Model):
    def __init__(self, N, width, height):
        self.num_agents = N
        self.running = True
        self.grid = MultiGrid(width, height, True)
        self.schedule2 = RandomActivation(self)
        self.schedule = RandomActivation(self)
        self.Calles = []

        dirx = 1
        diry = -1
        for g in range(round((width/2)-1), round((width/2)+1)):
            for p in range(round((width/2)-1), round((width/2)+1)):
                o = Cruce(g, self, [dirx, 0], [0, diry])
                dirx *= -1
                self.grid.place_agent(o, (g, p))
                self.Calles.append(o)
            diry *= -1

        o = Cruce(1000, self, [0, -1], [0, -1])
        self.grid.place_agent(o, (0, 5))
        obs1 = Calle(1000, self, [1, 0])
        self.grid.place_agent(obs1, (0, 4))
        self.Calles.append(o)
        self.Calles.append(obs1)

        o = Cruce(1001, self, [0, 1], [0, 1])
        self.grid.place_agent(o, (9, 4))
        obs1 = Calle(1001, self, [-1, 0])
        self.grid.place_agent(obs1, (9, 5))
        self.Calles.append(o)
        self.Calles.append(obs1)

        o = Cruce(1002, self, [1, 0], [1, 0])
        self.grid.place_agent(o, (4, 0))
        obs1 = Calle(1002, self, [0, 1])
        self.grid.place_agent(obs1, (5, 0))
        self.Calles.append(o)
        self.Calles.append(obs1)

        o = Cruce(1003, self, [-1, 0], [-1, 0])
        self.grid.place_agent(o, (5, 9))
        obs1 = Calle(1003, self, [0, -1])
        self.grid.place_agent(obs1, (4, 9))
        self.Calles.append(o)
        self.Calles.append(obs1)

```

```

s1 = Semaforo(111, self, 0)
self.grid.place_agent(s1, (round((width/2)-1), round((height/2)+1)))
s2 = Semaforo(112, self, 0)
self.grid.place_agent(s2, (round((width/2)), round((height/2)-2)))

s3 = Semaforo(113, self, 8)
self.grid.place_agent(s3, (round((width/2)-2), round((height/2)-1)))

s4 = Semaforo(114, self, 8)
self.grid.place_agent(s4, (round((width/2)+1), round((height/2))))
s4.SetPair(s2, s3)
s2.SetPair(s4, s1)
s3.SetPair(s1, s4)
s1.SetPair(s3, s2)

self.schedule2.add(s1)
self.schedule2.add(s2)
self.schedule2.add(s3)
self.schedule2.add(s4)

for g in range(round((width-1)/2)):
    for p in range(round((width-1)/2)):
        o = Obstaculo(g, self)
        self.grid.place_agent(o, (g, p))

for g in range(round((width-1)/2)):
    for p in range(round((width+2)/2), width):
        o = Obstaculo(g, self)
        self.grid.place_agent(o, (g, p))

for g in range(round((width+2)/2), width):
    for p in range(round((width+2)/2), width):
        o = Obstaculo(g, self)
        self.grid.place_agent(o, (g, p))

for g in range(round((width+2)/2), width):
    for p in range(round((width-1)/2)):
        o = Obstaculo(g, self)
        self.grid.place_agent(o, (g, p))

for i in range(self.num_agents):
    a = Coche(i, self)
    self.grid.place_agent(a, (4, 4))
    self.grid.move_to_empty(a)
    print(a.pos)

    self.schedule.add(a)

```



```
for x in range(1, round((width-1)/2)):
    obs1 = Calle(x, self, [1, 0])
    self.grid.place_agent(obs1, (x, round((width-1)/2)))
    obs2 = Calle(x+10, self, [-1, 0])
    self.grid.place_agent(obs2, (x, round(width/2)))
    self.Calles.append(obs2)
    self.Calles.append(obs1)

for x in range(round((width+1)/2), width-1):
    obs1 = Calle(x, self, [1, 0])
    self.grid.place_agent(obs1, (x, round((width-1)/2)))
    obs2 = Calle(x+10, self, [-1, 0])
    self.grid.place_agent(obs2, (x, round(width/2)))
    self.Calles.append(obs2)
    self.Calles.append(obs1)

for y in range(1, round((height-1)/2)):
    obs1 = Calle(y, self, [0, -1])
    self.grid.place_agent(obs1, (round((height-1)/2), y))
    obs2 = Calle(y+10, self, [0, 1])
    self.grid.place_agent(obs2, (round(height/2), y))
    self.Calles.append(obs2)
    self.Calles.append(obs1)

for y in range(round((height+1)/2), height-1):
    obs1 = Calle(y, self, [0, -1])
    self.grid.place_agent(obs1, (round((height-1)/2), y))
    obs2 = Calle(y+10, self, [0, 1])
    self.grid.place_agent(obs2, (round(height/2), y))
    self.Calles.append(obs2)
    self.Calles.append(obs1)

def step(self):
    self.schedule.step()

    ps = []
    for i in range(self.num_agents):
        xy = self.schedule.agents[i].pos
        p = [xy[0], 0, xy[1]]
        ps.append(p)
    return ps

def step2(self):
    self.schedule2.step()
    ps = []
    for i in range(len(self.schedule2.agents)):
        p = self.schedule2.agents[i]
        print(p)
        ps.append(p)
    return ps
```


Servidor

```
# TC2008B. Sistemas Multiagentes y Gráficas Computacionales
# Python server to interact with Unity
# Sergio. Julio 2021
```

```
from http.server import BaseHTTPRequestHandler, HTTPServer
from flask import Flask, render_template, request, jsonify
import logging
import json, os, atexit
```

```
import numpy as np
from model import CruceModel
```

```
app = Flask(__name__, static_url_path = '')
```

```
model = CruceModel(4,10,10)
```

```
def positionsToJSON(ps):
    posDICT = []
    for p in ps:
        pos = {
            "x" : p[0],
            "y" : p[1],
            "z" : p[2]
        }
        posDICT.append(pos)
    return json.dumps(posDICT)
```

```
def BoolsToJSON(g):
    posDICT = []
    for p in g:
        pos = {
            "Green" : p.Green,
            "Yellow" : p.Yellow,
            "Red" : p.Red,
            "PosX" : p.rpos[0],
            "Posz" : p.rpos[1],
            "dir" : p.dir
        }
        posDICT.append(pos)
    return json.dumps(posDICT)
```

```
def CallesToJSON(g):
    posDICT = []
    for p in g:
        pos = {
            "x" : p.pos[0],
            "y" : -1,
            "z" : p.pos[1]
        }
        posDICT.append(pos)
    return json.dumps(posDICT)
```

```
port = int(os.getenv('PORT',8585))
```

```
@app.route('/')

```

```
def root():
    return jsonify([{"message":"Hello"}])
```

```
@app.route('/calles', methods=['GET','POST'])

```

```
def calles():
    positions = model.Calles
    return CallesToJSON(positions)
```

```
@app.route('/multiagentes', methods=['GET','POST'])

```

```
def multiagentes():
    positions = model.step()
    return positionsToJSON(positions)
```

```
@app.route('/semaforos', methods=['GET','POST'])

```


```
def semaforos():
    lights = model.step2()
    return BoolsToJSON(lights)
```

```
if __name__ == '__main__':
    app.run(host='0.0.0.0',port = port, debug = True)
```


Código Unity

```
CarTest.cs x CallesClient.cs x SemaforosClient.cs x
1 using System;
2 using System.Collections;
3 using System.Collections.Generic;
4 using UnityEditor;
5 using UnityEngine;
6 using UnityEngine.Networking;
7
8 public class CarTest : MonoBehaviour
9 {
10     public List<Robot> agents;
11     public List<Vector3> Positions;
12     public float timeToUpdate = 5.0f;
13     private float timer;
14     bool started = false;
15     public GameObject CarPref;
16
17     IEnumerator SendData(string data)
18     {
19         WWWForm form = new WWWForm();
20         form.AddField("bundle", "the data");
21         string url = "http://localhost:8585/muliagentes";
22         //using (UnityWebRequest www = UnityWebRequest.Post(url, form))
23         using (UnityWebRequest www = UnityWebRequest.Get(url))
24         {
25             byte[] bodyRaw = System.Text.Encoding.UTF8.GetBytes(data);
26             www.uploadHandler = (UploadHandler)new UploadHandlerRaw(bodyRaw);
27             www.downloadHandler = (DownloadHandler)new DownloadHandlerBuffer();
28             //www.SetRequestHeader("Content-Type", "text/html");
29             www.SetRequestHeader("Content-Type", "application/json");
30
31             yield return www.SendWebRequest(); // Talk to Python
32             if (www.isNetworkError || www.isHttpError)
33             {
34                 Debug.Log(www.error);
35             }
36             else
37             {
38                 List<Vector3> newPositions = new List<Vector3>();
39                 string txt = www.downloadHandler.text.Replace('\\', '\n');
40                 txt = txt.TrimStart('"', '{', 'd', 'a', 't', 'a', ':', '[');
41                 txt = "{\"" + txt;
42                 txt = txt.TrimEnd(']', '}');
43                 txt = txt + '"';
44                 string[] strs = txt.Split(new string[] { "\", {" }, StringSplitOptions.None);
45
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```
84     // Start is called before the first frame update
85     void Start()
86     {
87         InvokeRepeating("CallServer", 2, 1);
88         /*
89     #if UNITY_EDITOR
90
91         Vector3 fakePos = new Vector3(3.44f, 0, -15.707f);
92         string json = EditorJsonUtility.ToJson(fakePos);
93
94         StartCoroutine(SendData(json));
95         timer = timeToUpdate;
96     #endif*/
97     }
98
99     void CallServer()
100    {
101        Vector3 fakePos = new Vector3(3.44f, 0, -15.707f);
102        string json = EditorJsonUtility.ToJson(fakePos);
103
104        StartCoroutine(SendData(json));
105    }
106 }
107
```

```

1 using System;
2 using System.Collections;
3 using System.Collections.Generic;
4 using UnityEditor;
5 using UnityEngine;
6 using UnityEngine.Networking;
7
8 public class CallesClient : MonoBehaviour
9 {
10     List<Vector3> Positions;
11
12     public GameObject calle;
13
14     IEnumerator SendData(string data)
15     {
16         WWWForm form = new WWWForm();
17         form.AddField("bundle", "the data");
18         string url = "http://localhost:8585/calles";
19         //using (UnityWebRequest www = UnityWebRequest.Post(url, form))
20         using (UnityWebRequest www = UnityWebRequest.Get(url))
21         {
22             byte[] bodyRaw = System.Text.Encoding.UTF8.GetBytes(data);
23             www.uploadHandler = (UploadHandler)new UploadHandlerRaw(bodyRaw);
24             www.downloadHandler = (DownloadHandler)new DownloadHandlerBuffer();
25             //www.SetRequestHeader("Content-Type", "text/html");
26             www.SetRequestHeader("Content-Type", "application/json");
27
28             yield return www.SendWebRequest(); // Talk to Python
29             if (www.isNetworkError || www.isHttpError)
30             {
31                 Debug.Log(www.error);
32             }
33             else
34             {
35
36                 List<Vector3> newPositions = new List<Vector3>();
37                 string txt = www.downloadHandler.text.Replace('\\', '\');
38                 txt = txt.TrimStart(' ', '{', 'd', 'a', 't', 'a', ':', '[');
39                 txt = "{\"" + txt;
40                 txt = txt.TrimEnd(' ', '}');
41                 txt = txt + '"}';
42                 string[] str = txt.Split(new string[] { " ", "{" }, StringSplitOptions.None);
43                 Debug.Log("str.Length:" + str.Length);
44                 for (int i = 0; i < str.Length; i++)
45                 {
46                     Debug.Log(strs[i]);
47                     str[i] = str[i].Trim();
48                     if (i == 0) str[i] = str[i] + ' ';
49                     else if (i == str.Length - 1) str[i] = '{' + str[i];
50                     else str[i] = '{' + str[i] + ' ';
51

```

```

51
52         Debug.Log(strs[i]);
53         Vector3 test = JsonUtility.FromJson<Vector3>(strs[i]);
54         newPositions.Add(test);
55     }
56
57     Positions = newPositions;
58
59     foreach (Vector3 p in Positions)
60     {
61         Vector3 vec = p;
62         vec.x *= 5;
63         vec.z *= 5;
64
65         GameObject a = Instantiate(calle, vec, Quaternion.identity, null);
66     }
67 }
68
69 // Start is called before the first frame update
70 void Start()
71 {
72     CallServer();
73 }
74
75 #if UNITY_EDITOR
76
77 Vector3 fakePos = new Vector3(3.44f, 0, -15.707f);
78 string json = EditorJsonUtility.ToJson(fakePos);
79
80 StartCoroutine(SendData(json));
81 timer = timeToUpdate;
82
83 #endif
84
85 void CallServer()
86 {
87     Debug.Log("hola");
88     Vector3 fakePos = new Vector3(3.44f, 0, -15.707f);
89     string json = EditorJsonUtility.ToJson(fakePos);
90
91     StartCoroutine(SendData(json));
92 }
93
94 }

```

```

CarTest.cs x CallesClient.cs x SemaforosClient.c
1 using System;
2 using System.Collections;
3 using System.Collections.Generic;
4 using UnityEditor;
5 using UnityEngine;
6 using UnityEngine.Networking;
7
8 public class SemaforosClient : MonoBehaviour
9 {
10     public List<Semaforo> agents;
11     public List<DataSemaforo> Positions;
12     public float timeToUpdate = 5.0f;
13     private float timer;
14     public GameObject s1,s2,s3,s4;
15     bool started = false;
16
17     IEnumerator SendData(string data)
18     {
19         WWWForm form = new WWWForm();
20         form.AddField("bundle", "the data");
21         string url = "http://localhost:8585/semaforos";
22         //using (UnityWebRequest www = UnityWebRequest.Post(url, form))
23         using (UnityWebRequest www = UnityWebRequest.Get(url))
24         {
25             byte[] bodyRaw = System.Text.Encoding.UTF8.GetBytes(data);
26             www.uploadHandler = (UploadHandler)new UploadHandlerRaw(bodyRaw);
27             www.downloadHandler = (DownloadHandler)new DownloadHandlerBuffer();
28             //www.SetRequestHeader("Content-Type", "text/html");
29             www.SetRequestHeader("Content-Type", "application/json");
30
31             yield return www.SendWebRequest(); // Talk to Python
32             if (www.isNetworkError || www.isHttpError)
33             {
34                 Debug.Log(www.error);
35             }
36             else
37             {
38


```

```

36 else
37 {
38
39     List<DataSemaforo> newPositions = new List<DataSemaforo>();
40     string txt = www.downloadHandler.text.Replace('\\', '\\');
41     txt = txt.TrimStart(' ', '{', 'd', 'a', 't', 'a', ':', '[');
42     txt = "{\"" + txt;
43     txt = txt.TrimEnd(']', ' ');
44     txt = txt + '"';
45     string[] strs = txt.Split(new string[] { " ", "{" }, StringSplitOptions.None);
46     Debug.Log("strs.Length:" + strs.Length);
47     for (int i = 0; i < strs.Length; i++)
48     {
49         Debug.Log(strs[i]);
50         strs[i] = strs[i].Trim();
51         if (i == 0) strs[i] = strs[i] + ' ';
52         else if (i == strs.Length - 1) strs[i] = '{' + strs[i];
53         else strs[i] = '{' + strs[i] + ' ';
54
55         Debug.Log(strs[i]);
56         DataSemaforo test = JsonUtility.FromJson<DataSemaforo>(strs[i]);
57         newPositions.Add(test);
58     }
59
60     Positions = newPositions;
61

```

```
62         if (!started)
63         {
64             started = true;
65             foreach (DataSemaforo p in Positions)
66             {
67                 Semaforo a = null;
68
69                 if (p.dir == 0) {
70                     a = Instantiate(s1, this.transform.position, Quaternion.identity, null).GetComponent<Semaforo>();
71                 }
72
73                 else if (p.dir == 1)
74                 {
75                     a = Instantiate(s1, this.transform.position, Quaternion.identity, null).GetComponent<Semaforo>();
76                     a.transform.eulerAngles = new Vector3(0, 180, 0);
77                 }
78                 else if (p.dir == 2)
79                 {
80                     a = Instantiate(s1, this.transform.position, Quaternion.identity, null).GetComponent<Semaforo>();
81                     a.transform.eulerAngles = new Vector3(0, -90, 0);
82                 }
83                 else if (p.dir == 3)
84                 {
85                     a = Instantiate(s1, this.transform.position, Quaternion.identity, null).GetComponent<Semaforo>();
86                     a.transform.eulerAngles = new Vector3(0, 90, 0);
87                 }
88
89                 EqualSemaforo(a, p);
90                 agents.Add(a);
91             }
92         }
93         else
94         {
95
96             for (int i = 0; i < agents.Count; i++)
97             {
98                 EqualSemaforo(agents[i], Positions[i]);
99             }
100         }
101     }
102 }
103
104 }
105
106 }
```



```
107     void EqualSemaforo(Semaforo s, DataSemaforo ds)
108     {
109         s.Posz = ds.Posz*5;
110         s.Green = ds.Green;
111         s.Yellow = ds.Yellow;
112         s.Red = ds.Red;
113         s.Posx = ds.Posx*5;
114     }
115
116     // Start is called before the first frame update
117     void Start()
118     {
119         InvokeRepeating("CallServer", 2, 1);
120         /*
121         #if UNITY_EDITOR
122             Vector3 fakePos = new Vector3(3.44f, 0, -15.707f);
123             string json = EditorJsonUtility.ToJson(fakePos);
124
125             StartCoroutine(SendData(json));
126             timer = timeToUpdate;
127         #endif*/
128     }
129
130     void CallServer()
131     {
132         Debug.Log("hola");
133         Vector3 fakePos = new Vector3(3.44f, 0, -15.707f);
134         string json = EditorJsonUtility.ToJson(fakePos);
135
136         StartCoroutine(SendData(json));
137     }
138 }
139
140
```

Plan de trabajo actualizado





Lo que se realizó esta semana

Cuarta semana (22 al 26 de noviembre)

- **Introducir nuestro proyecto a IBM Cloud**
 - Responsables: Victoria, Diógenes y Rodolfo
 - Tiempo empleado aproximado: 3 horas
- **Conectar Unity con nuestro servidor**
 - Responsables: Rodolfo
 - Tiempo empleado aproximado: 4 horas
- **Terminar las clases para los agentes en Python**
 - Responsables: Victoria
 - Tiempo empleado aproximado: 5 horas
- **Terminar el código de la parte gráfica en Unity**
 - Responsables: Diógenes
 - Tiempo empleado aproximado: 7 horas



Quinta semana (29 de noviembre al 1 de diciembre)

- Ajustar el algoritmo Dijkstra en python para que los agentes encuentren la ruta más corta
 - Responsables: Victoria, Diógenes y Rodolfo
 - Esfuerzo estimado: 7 horas
- Realizar las conexiones finales entre Unity-IBMCloud-Python
 - Responsable: Rodolfo
 - Esfuerzo estimado: 6 horas
- Generar el mapa final en Unity
 - Responsable: Diógenes
 - Esfuerzo estimado: 5 horas
- Realizar pruebas de errores
 - Responsable: Victoria
 - Esfuerzo estimado: 3 horas