Ministry of high education,

Culture and science city at Oct 6,

The High institute of computer Science & information systems

المعهد العالي لعلوم الحاسب ونظم المعلومات

Graduation Project:

Design of underground semiautomatic parking system

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Chapter 1

Introduction

Introduction:

Now a day's vehicle parking is an important issue and day by day its necessity is increasing. In Egypt we are still using the manual vehicle parking system and that is why we are facing problems like wastage of time and fuel finding free space around the parking ground when we need to park our car which requires a good amount of lighting.

Fig 1.1 : Traffic in Egypt

Another issue is chaos that happens while parking because there is no particular system anyone can park anywhere that sometime causes damage to the vehicles while moving out or in the parking lot.

Fig1.2: Traditional Parking in Egypt

Over the decades our country has been developed radically, now we are in this city that we have a lot of well contacted roads, commercial building and increasing number of automobiles.

To park these automobiles in parking space we use the manual procedure of parking which in most of the cases is unplanned and lack of discipline due to this, people can park their cars anywhere they want creating a mess as people do not follow the particular cue most of the time.

As a result of this, a huge traffic jam takes place in that place. While parking in and retrieving car due mismanagement cars can get dent by bumping with each other as there is lack of sufficient space. This leads to arguments, fights among people which sometimes makes huge traffic jam. This is also an economical loss as we need to repair our damaged car and also cars consume extra fuel while parking in or out.

Traffic jam is an issue here as it kills our precious time. Due to this chaos in parking our valuable time gets wasted. It harms the students, office going staffs and emergency patients to a great extent.

Related works:

As more and more people got cars, the need for a place to park it was growing bigger and bigger. Parking became a problem and cities were looking for a solution to **park as many cars as possible on as little space as possible**.

The first cars weren't as weather-resistant as today's cars. Back in the days they had open tops, leather seats and were remarkably sensitive. Therefore, **they had to be parked inside** where they were safe from the cold, the rain and other bad weather conditions. The first parking garages looked like other buildings where people would **store stuff.** A car was by most people considered as a machine and nothing more than just a machine, in contrast with today's idea of cars. The parking garages blended in with the neighborhood; you couldn't really tell that they were places to store cars. Sometimes parking garages were horse stables, where they would charge the same for parking a car as they did for stalling a horse.

Multi-storey parking garage

The first multi-storey parking garage that we know of, was built in 1918. The parking garage was built for the hotel La Salle and was designed by Holabird and Roche. The parking garage was several blocks away from the hotel. When the hotel was demolished in 1976, the parking structure stayed. Unfortunately the parking garage was demolished in 2005.

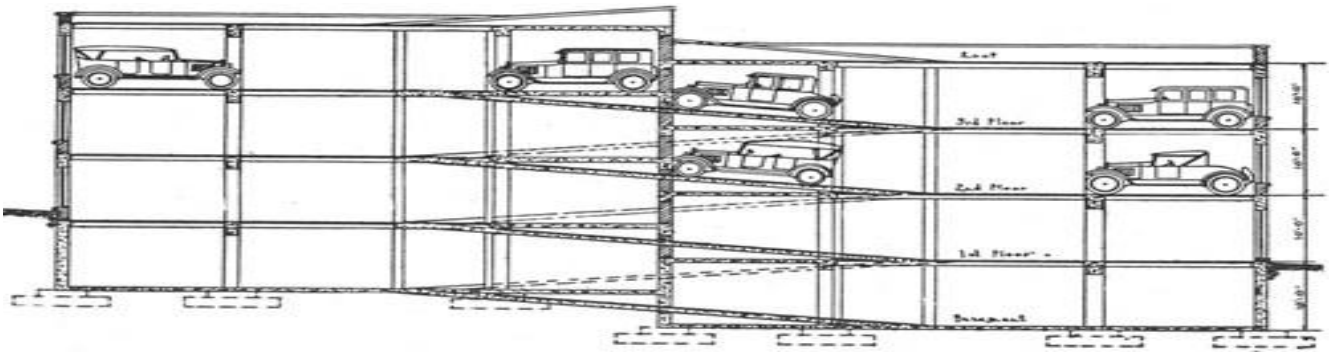


Fig1.3: The first multi storey parking

There were two different ideas about cars. One was that it was just a machine, and the other one was about the feeling of freedom that was associated with driving the car and being mobile.

These two different ideas were responsible for two different types of parking garages: **The mechanized garage and the garage with ramps**.

Mechanized garage

The early parking garages were staffed with parking attendees. You didn't drive your car inside and to the parking space yourself. You would drive up to the garage, hand over your car to the parking attendant and he would take care of the rest. The car was placed on a platform and with **car lifts and turn tables**, the car would automatically be moved to an available parking space. In the 1920's there were different designs drawn up for car lifts to move cars from one parking deck to another. One of these designs was called the "Double Helix" because it had two spiral ramps to move the cars in the structure. These mechanical garages were forerunners of the automated parking systems of today. But this type of parking garage didn't have one thing: the freedom to park your car yourself and to enter and exit whenever you want.

Garage with ramps

The parking garages with ramps to move from one floor to the other, made it possible to **park your car yourself**. It was a challenge to build the ramps: They couldn't be too long because than you would lose parking space, but it couldn't be too short and steep either because otherwise cars wouldn't be able to drive up the ramps. This type of parking garage did come with a downside: less cars could be parked in the same amount of space in contrast to a mechanical garage because the ramps took more space. This meant that garages got bigger, in order to have enough capacity.

The parking garages with ramps is the one that replaced the automatic parking garages. Even with all the disadvantages of the ramps, the ability to park your car yourself was more important to people. Having to turn your car over to an attendant and then having to wait in line at the end of the day for your car to appear again was considered inconvenient.

In the **1950**'s there was a **construction boom** when it comes to parking garages. There were several innovations in the construction and design of the parking ramps. This construction boom was because the parking garages allowed people and employees to spend time and money downtown. Also, self-parking became more popular.

Fig1.4: Parking garage with ramps

How does Roxy Garage work?

The benefit to the citizen of the «intelligent garage» :-

The project helps to achieve an increase in the traffic flow in the streets of Heliopolis, because of the traffic congestion in this area because of the activities and shopping centers and housing, and also parking on the phenomenon of waiting cars in the second row; due to lack of waiting places, and protects motorists from the exploitation of " , And scratching their cars on the street.

How does a car owner deal with Smart Garage?

As soon asthe entire of the driver found Gates of industrial designationPull out the garage card and open the gate,Where he finds a guiding board that directs him to what he must doOnce the instructions are executedThe car enters automatically in the designated space,The driver returns after his journey, enters the ticket back and retrieves his car.

What time does the car need to enter or exit the garage?

It takes about 2 minutes for the car to reach theTo the farthest point in the garage .
And the duration of its exit from the farthest point is 3 minutes.
This is because the garage is supported by 12 electronic elevators,
And equipped with batteries to transport cars from the inside out and vice versa,
Which helps to speed up the presence of the car at the time of request.

Why is the Roxy Garage the safest?

As soon as the car enters the garage,and then parking on the elevator,They are fully checked electronically,
and the entrance of the vehicle to the garage is suspended if a bomb or a person is suspected inside the vehicle.

How Much Does a Roxy Garage can accommodate?

It will accommodate about 1,700 cars, 900 vehicles for the first phase of the project, and the second stage will accommodate up to 850 cars.

The most important problems expected to come across the project and how to avoid it:-

One of the problems facing the project is the possibility of power failures. To avoid these two problems, he said Engineer Mahmoud Farraj, responsible for the design and implementation of the Roxy Garage- project, explained that the first problem was solved by connecting electricity from two different sources.

The second problem was solved by using an advanced fire extinguishing system, automatic fire extinguishers, sensors and surveillance cameras.

Fig1.5: Roxy garage

Project Scope:

Comparing to Roxi Garage, we thought to start with new idea that has more benefits.

The purpose of this research is therefore the design of a car parked in a semi automatic way and where particular attention is paid to the space used.

In the same time we took in cost of the project that is surely less than Roxi Garage.

The semiautomatic parking system consists off a container / warehouse of cars with more floors, equipped with a system of movement and storage of cars totally computerized, the only operation that requires the user is to deposit the car in special rooms.

My idea is that the Egyptian state intervenes to solve this problem by building this project in some urban centers, so all the inhabitants are forced to park in these semiautomatedparkings, As for the monthly cost it will certainly be reduced as there is no limit in the number of floors for the single 20 m^2, and in thefuture If the number of the cars will increase we willn’t have any traffic.

Thus Egypt can once again return to an orderly and civilized country.

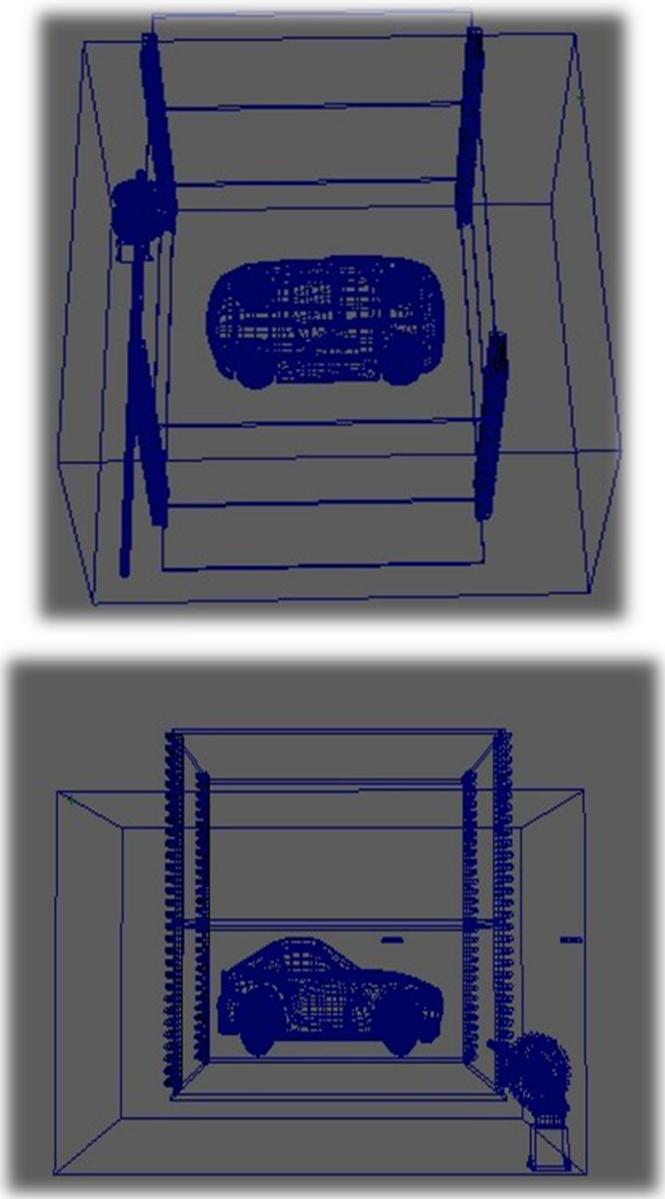


Fig1.6: Design of our underground garage

This car park, compared to traditional and automatic parking, has the following vatages:

- *Greater exploitation of surfaces and volumes, with a consequent increase in the number of places that can be built.*
- *Allows the people to exploit the public place in other activities.*
- *Above all, reduce traffic.*

- *Complete automation without the presence of "some thiefs".*
- *Safety for the car from accidents.*
- *Also your space is saved, no one can take it.*

Chapter 2

System Analysis and Design

2.1 System domain

Car parking is very important in a huge country, everyday new car add in each city, no more place to park new park new cars, so we need to park more cars in the same area, the team think about underground parking, where can park more cars in the same area each car above another, we can save the space specially in traffic cities. Our car parking is use the space of one car to park more depends on the depth of the parking in the ground.

In this project the client can use the park one time or more, if the client the first time to use this park he can choose if he need more times or this once, if this once he will pay in depend on the time stay in parking, or he can pay every month park as he need ever the month with no limit , system users can manage clients and payment.

2.2 System Components

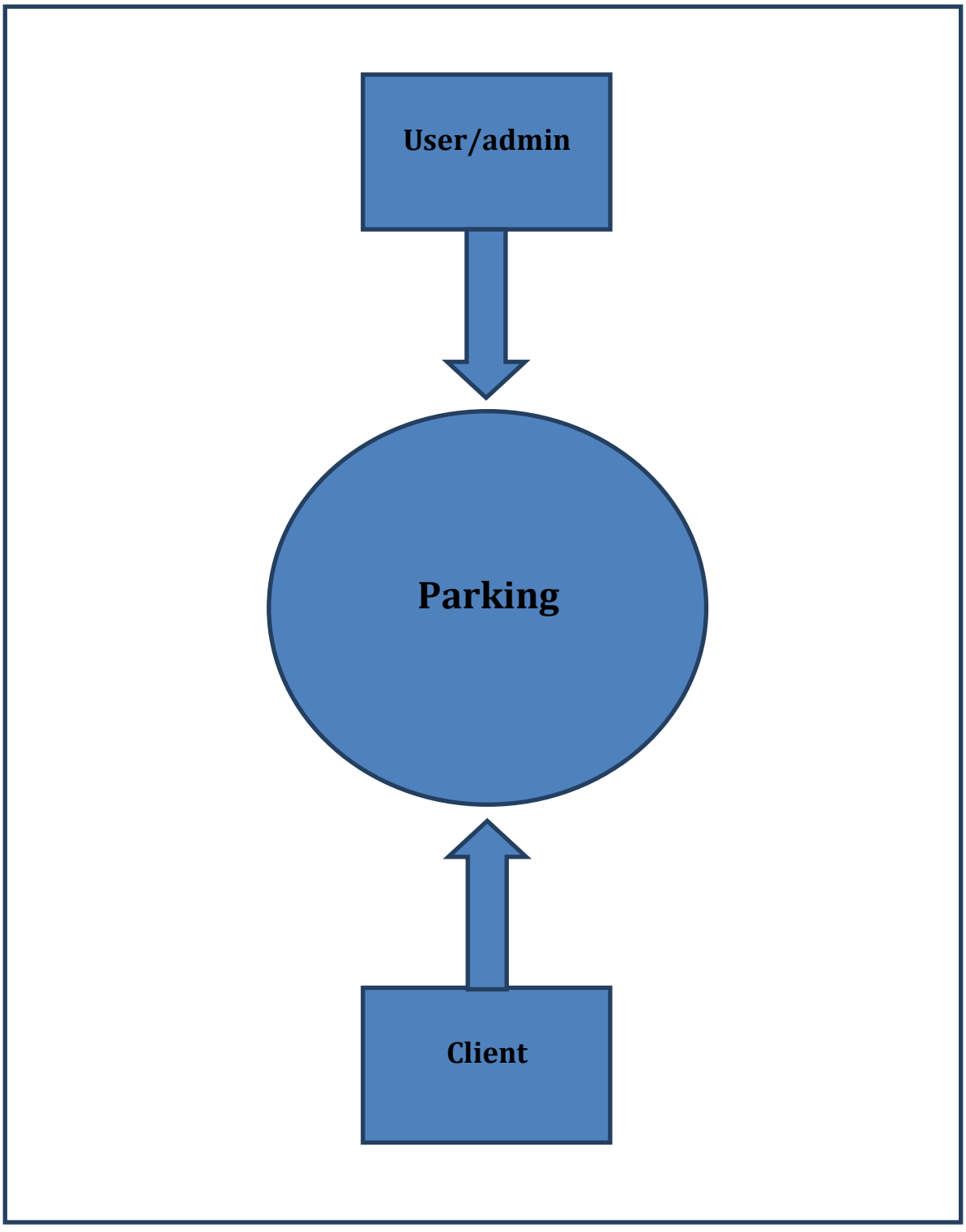


Fig2.1: System Components

2.3 System Components Description

User	Description
Admin	user can log into system for controlling of system, admin can add, edit and remove the client, mange transactions and cards .
Client	Client in system can use his card to park his can or receive card from system and update his card data by system admin .

Fig2.2: System Components Description

2.4 Use Case

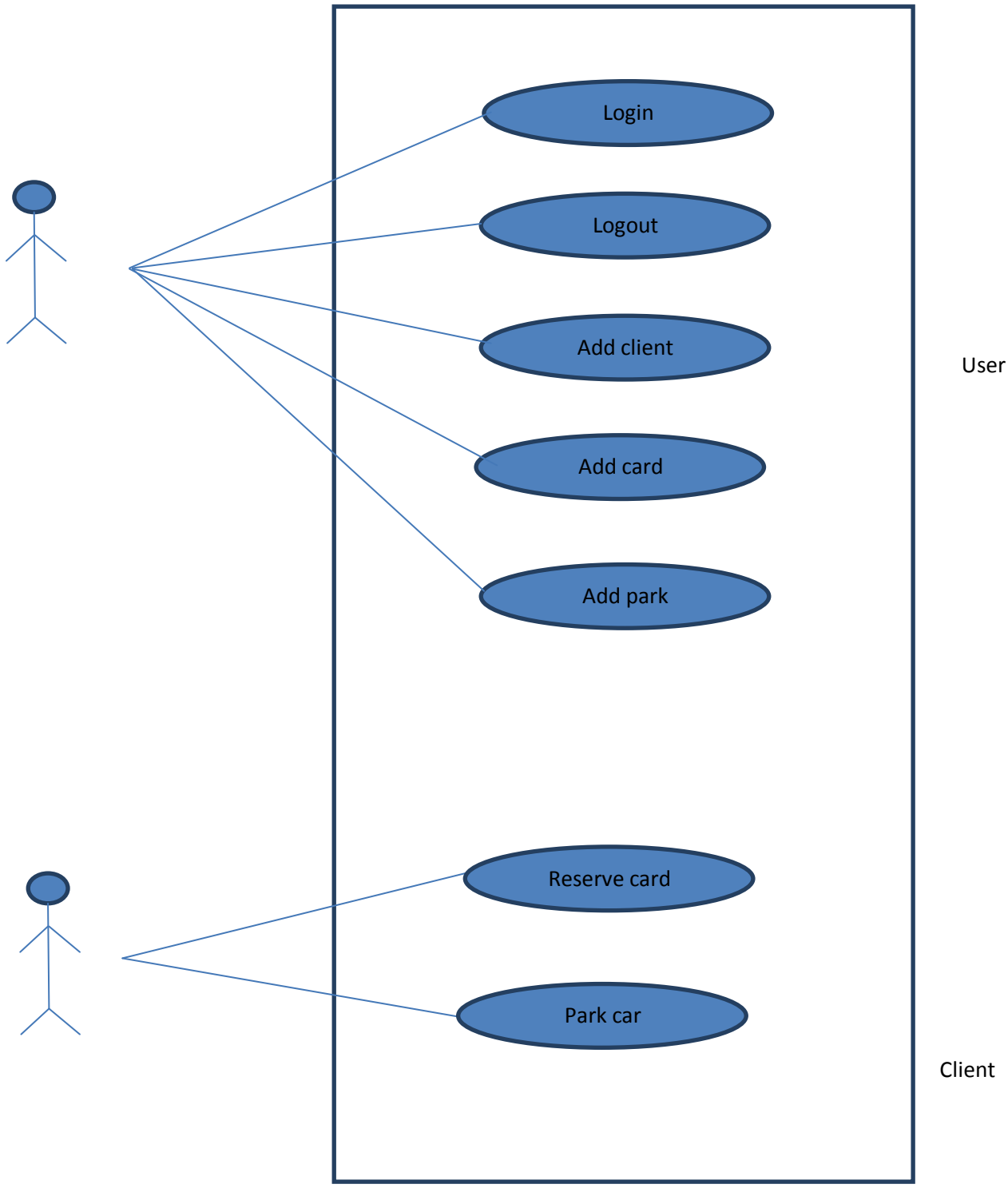


Fig2.3: Use Case

2.5 Activity Diagram (park car)

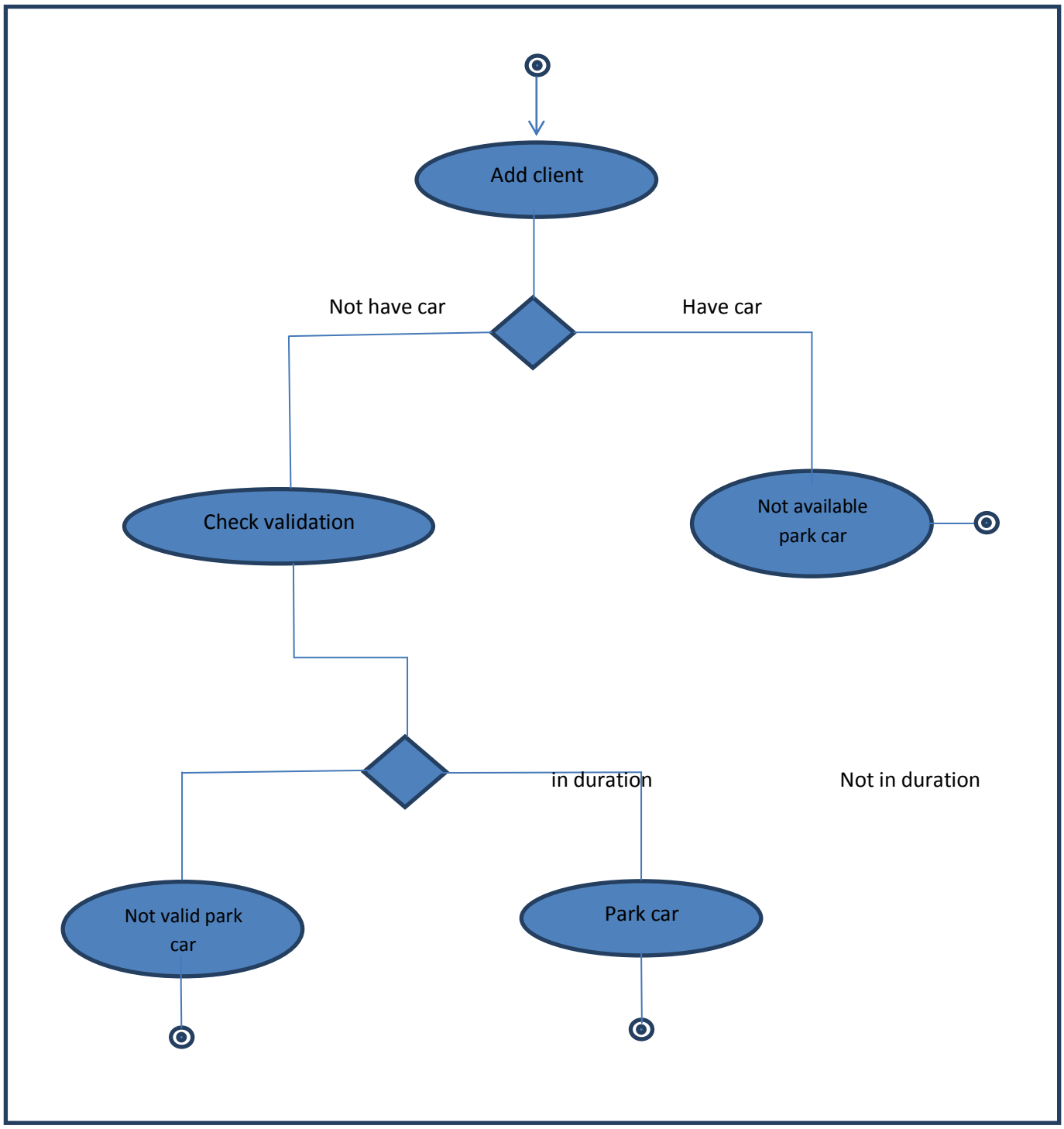


Fig2.4: Activity Diagram (park car)

2.6 Flow Chart

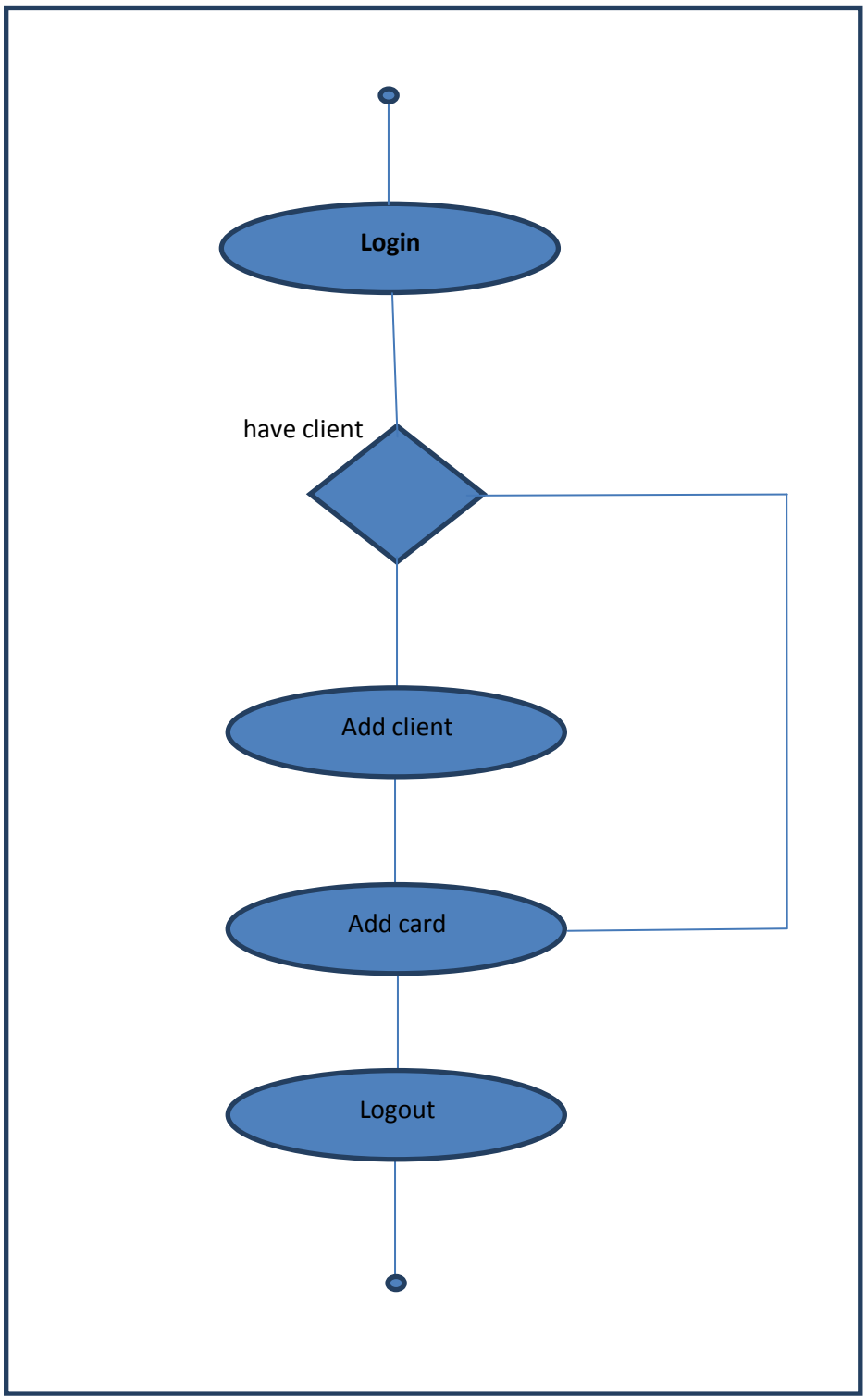


Fig2.5: Flow Chart

2.7 ERD Diagram

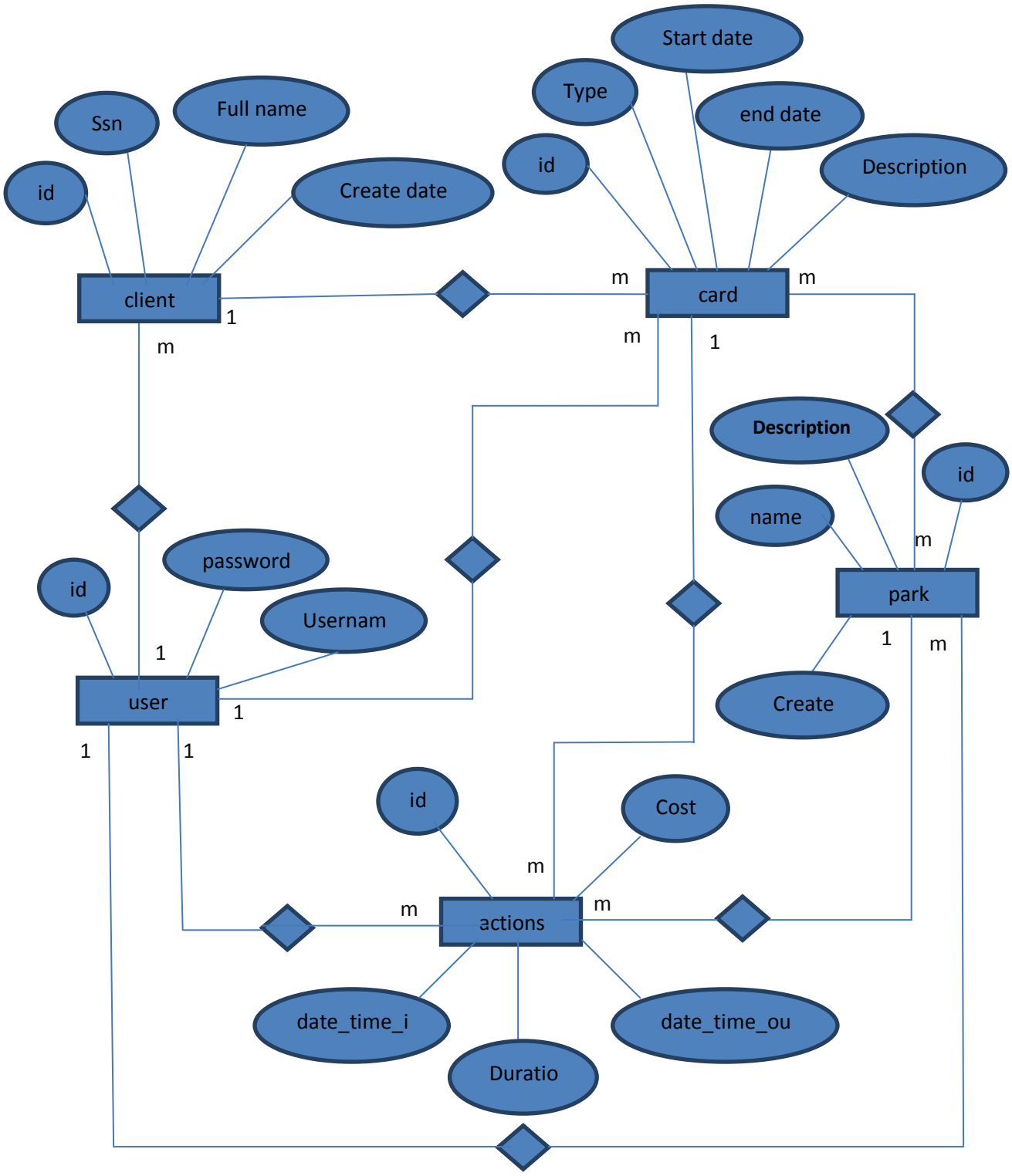


Fig2.6: ERD Diagram

2.8Sequence Diagram

2.8.1 User Sequence

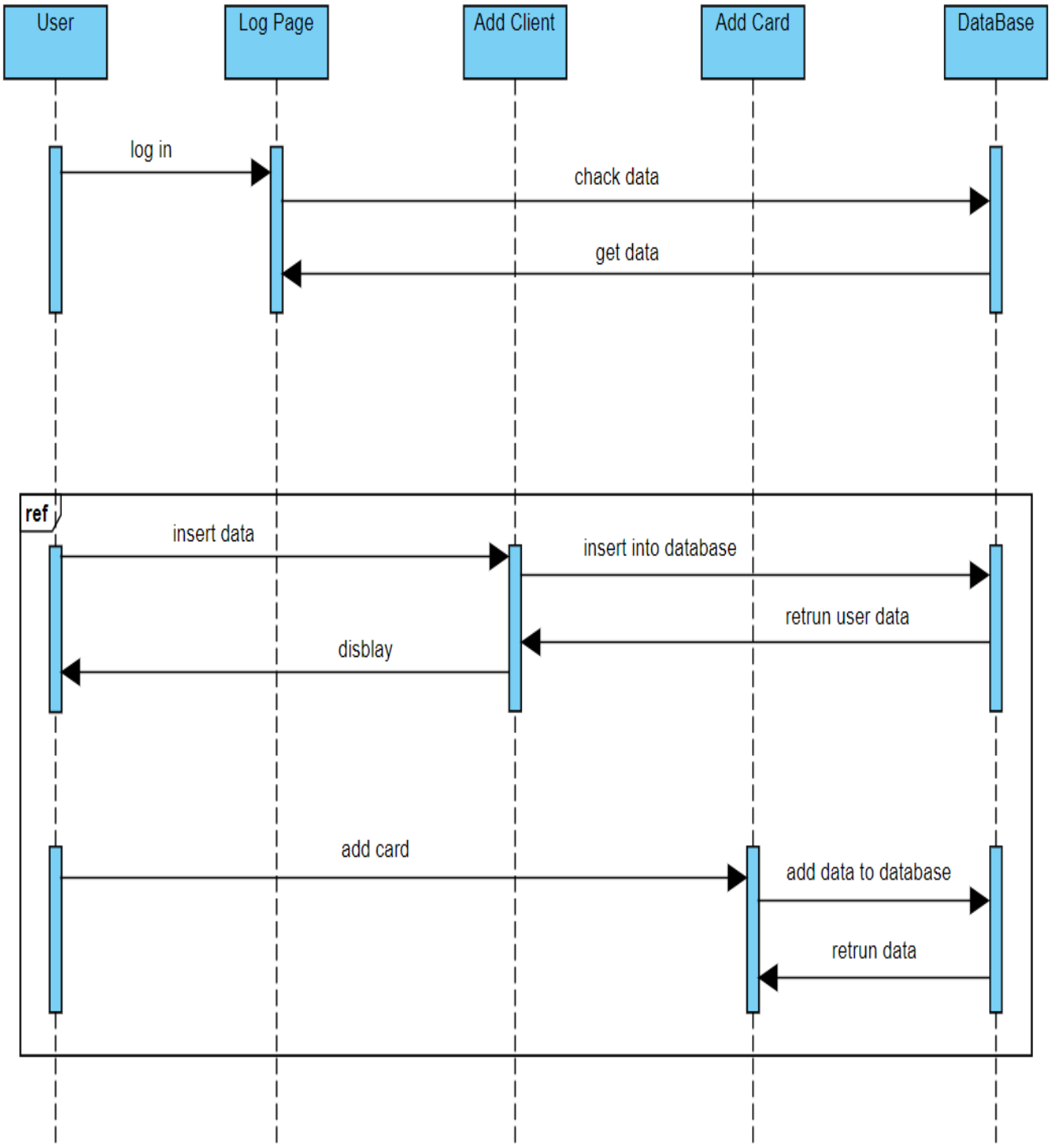


Fig2.7: Sequence Diagram and

Fig2.8: User Sequence

2.8.2Client Sequence

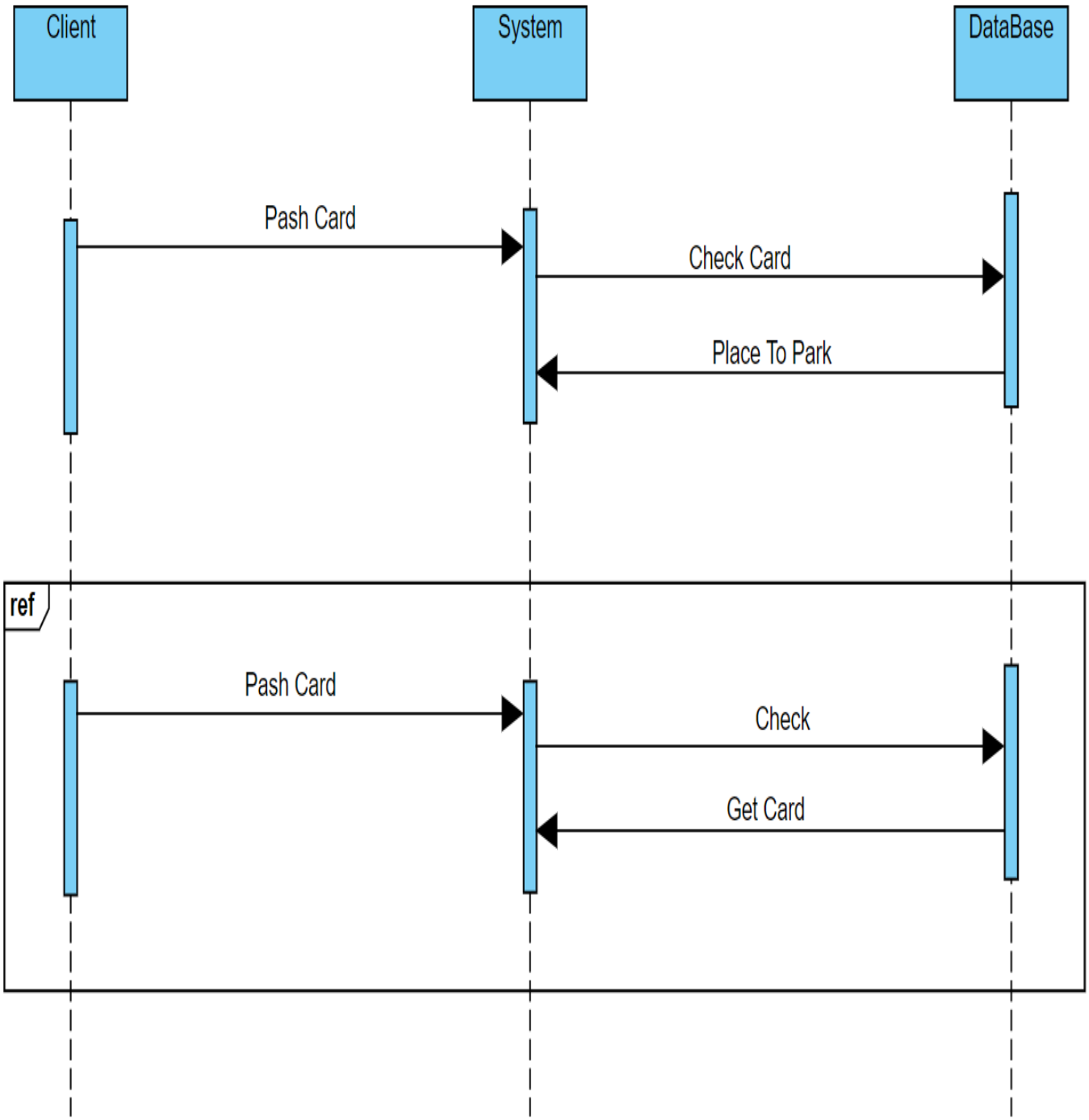


Fig2.9: Client Sequence

2.9System Schema

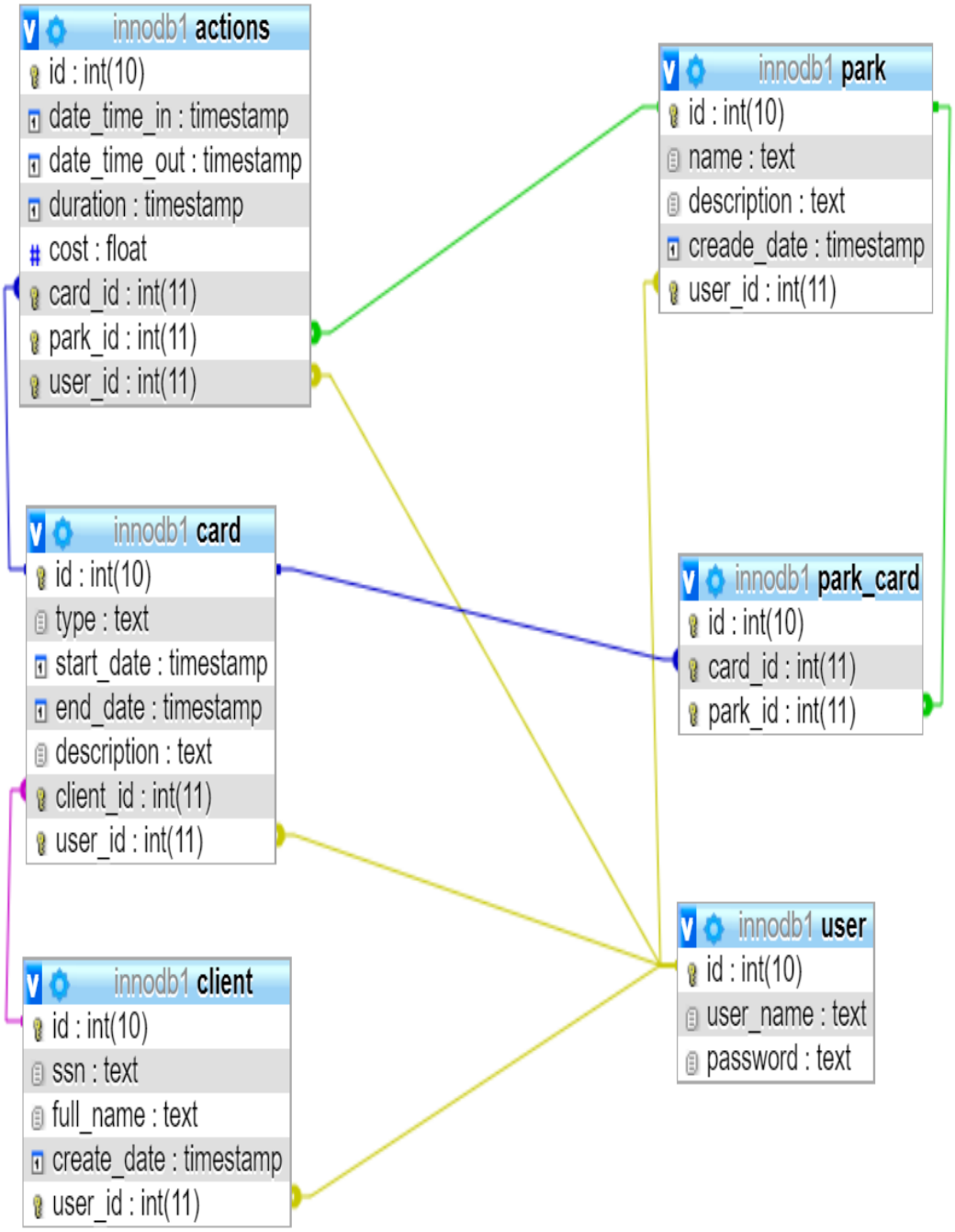


Fig2.10 System Schema

Chapter 3

Implementation

Introduction:

Before starting the implementation of our project we have taken into consideration that numberof vehicles circulating in Egypt is over 10 million; since each vehicle needs 20 m ^ 2 on average for parking, the total surface area for parking areas should be over 200 million square meters.

A further consideration is that the distribution of the time between vehicle movement and parking is strongly unbalanced towards parking, on average the vehicle is used only for 2 hours a day, while the other 22 are still.

These considerations lead Egypt to a terrible situation where the streets are crowded and the spaces are insufficient for parking.

It is therefore necessary to drastically reduce the possibility of parking on public roads, so it is necessary to look for different solutions.

This project can be a help a proposal to improve the urban planning problem in Egypt.

Implementation:

To implement this project we use two main tools:

1- Maya for designing and texture

2- Unity for programming

Designing

In maya we started to design the garage by using some main functions, firstly we started to design the internal part by using some geometric shapes and functions such as 'Extrude'

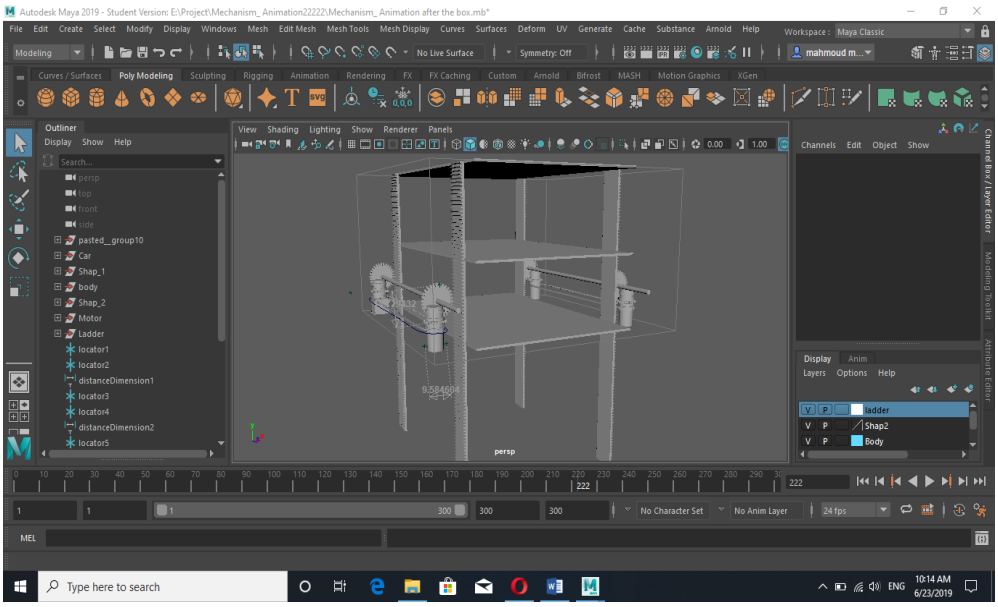


Fig3.1: Implementation of internal 3D underground Garage

Then with some other functions we started to design the external part with stairs to the technical team to maintain the mechanical part if necessary.

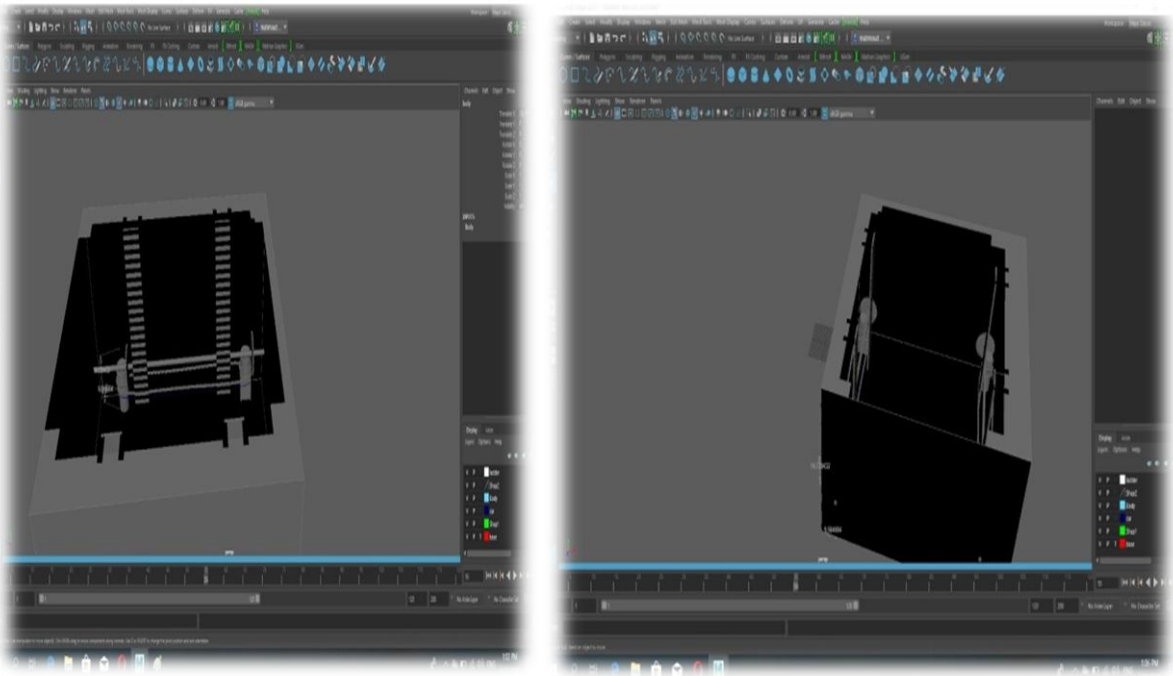


Fig3.2: Implementation of external 3D underground Garage

On the other wise we designed the city in which we will put this garage by using some other functions and geometric shapes and some models.

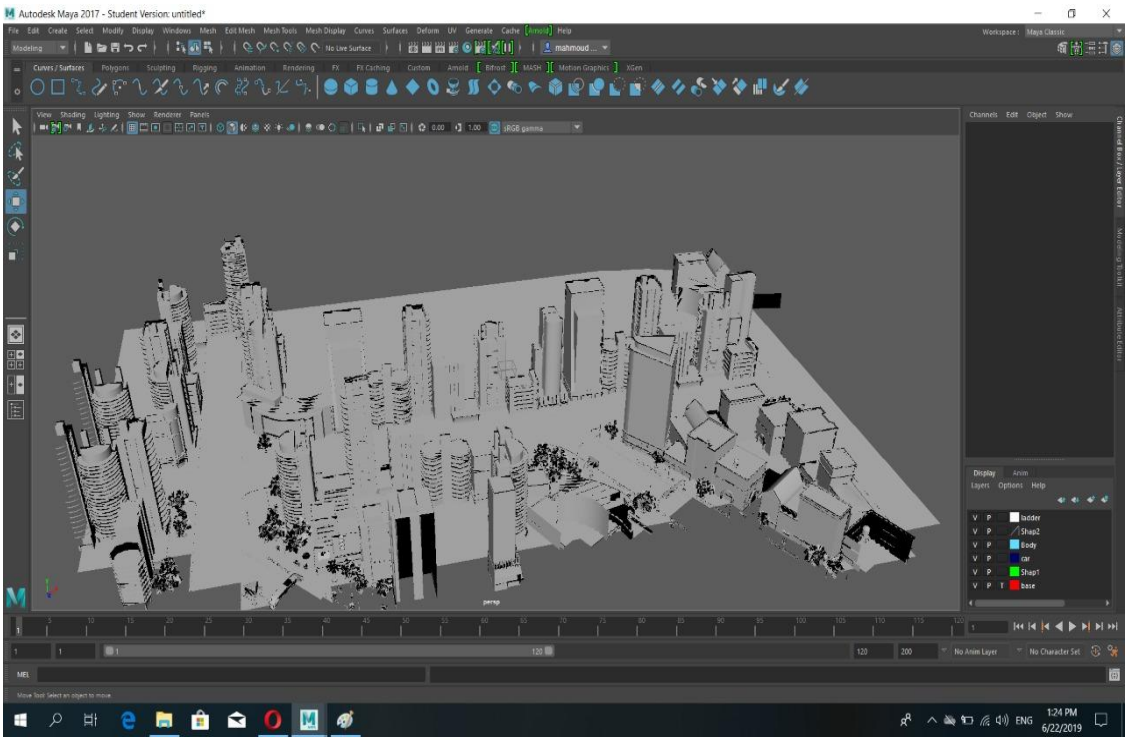


Fig3.3: Implementation of the 3D city

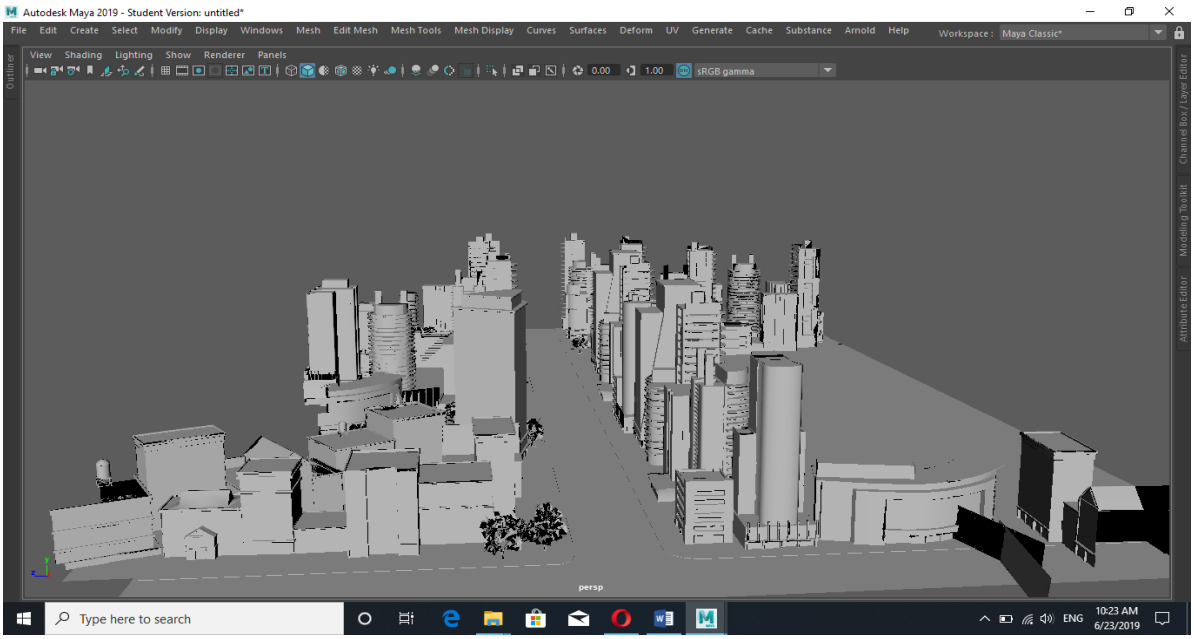


Fig3.4: City 3D

Through some other methods and functions such as “Mesh tools”, “Etrude” and some geometric shapes to design the Human.

For the animation we have used “Move Keys **Tool**”, “Region Keys **Tool”, “**Scale Keys **Tool”, “**Extend curves **Tool”, etc…….**

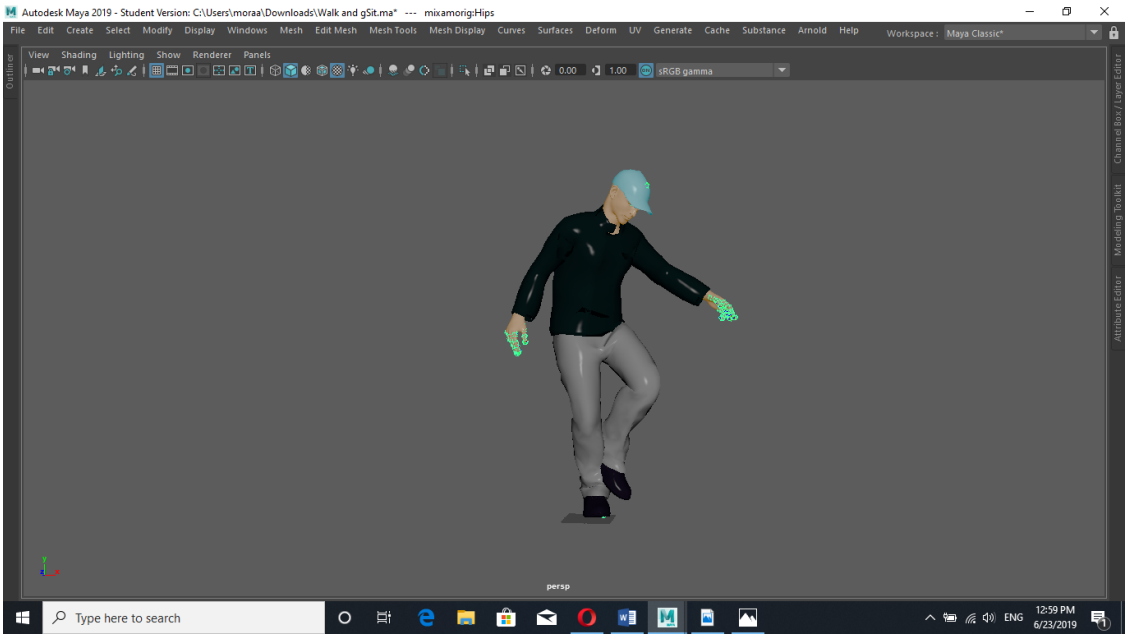


Fig3.5: Design of the Human

Texture

In this part we will describe how we can expend our shading networks and add flexibility using **"Maya's ramp texture node**".

So at this point we are going to work on a part of a model so we are going to use hybershade and going to isolate select the chosen part

that we are going to work on it by tapping ctrl+1.

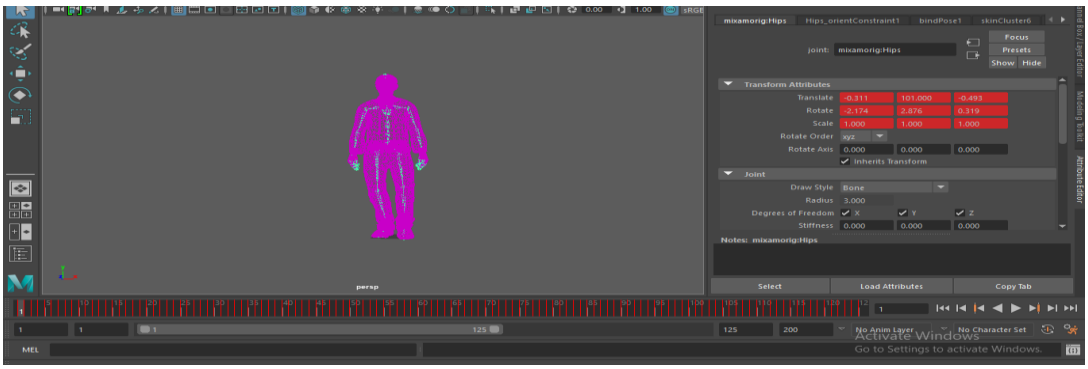


Fig3.6: Texture of the Human

So we jump to graph and hit tap key to type AIstandard surface so go up and give a material a name and we'll get assigned by middle clicking and dragging to our model now we are going to collected Aistandard surface to the ramp texture that consists from two nodes the first it's for ramp texture ,the second is responsible for placement of that 2D texture in zero to one and nw we going to collect ramp texture with AIstandard surface.

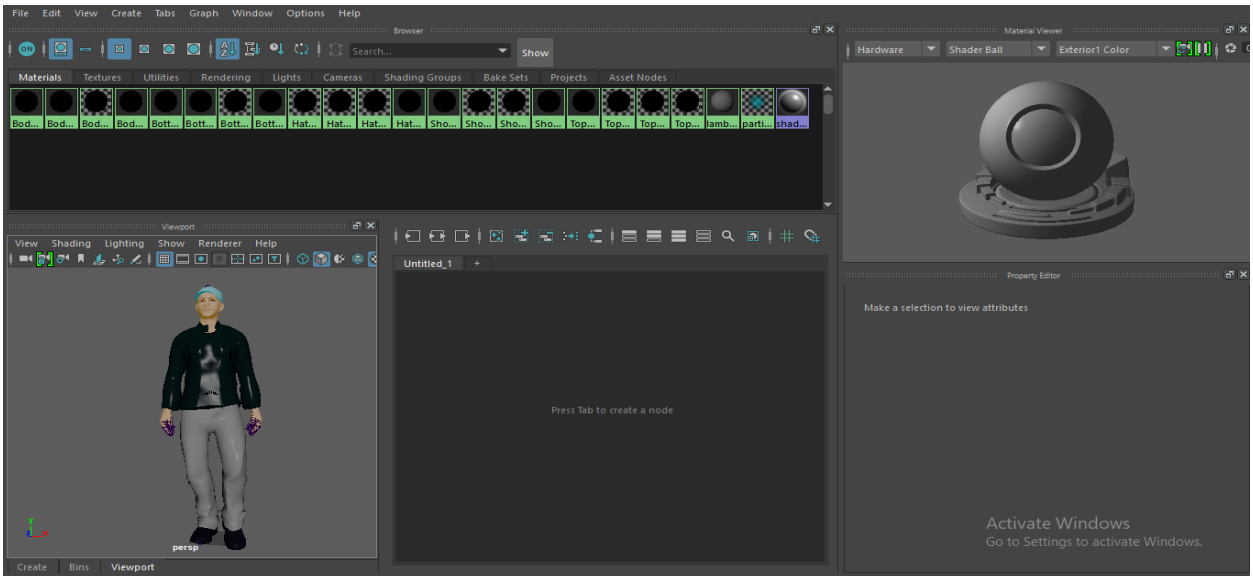


Fig3.7: Finish of the texture for the Human

In the part to texture with photos we are going to use surface shader ;surface shader is responsible to collect the chosen photo to the model

Before texture:-

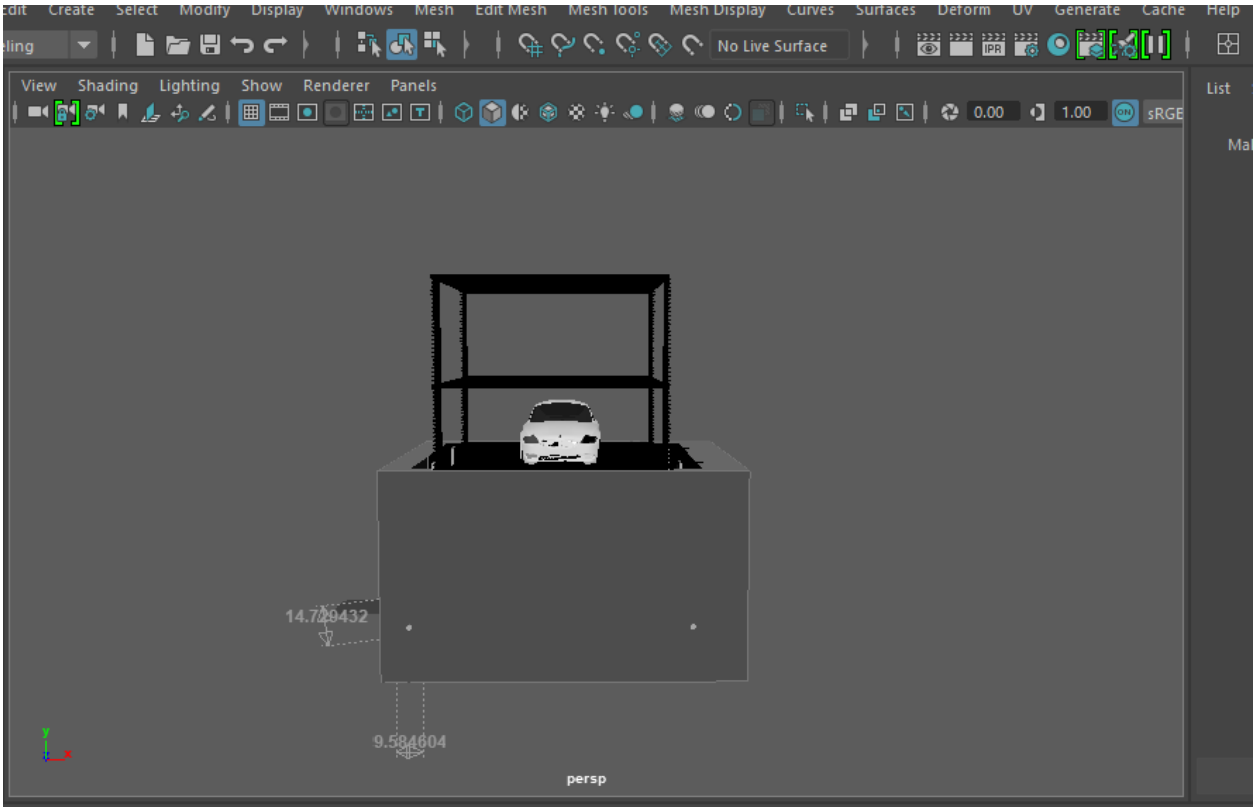


Fig3.8: Starting the texture of the Park

Making texture:-

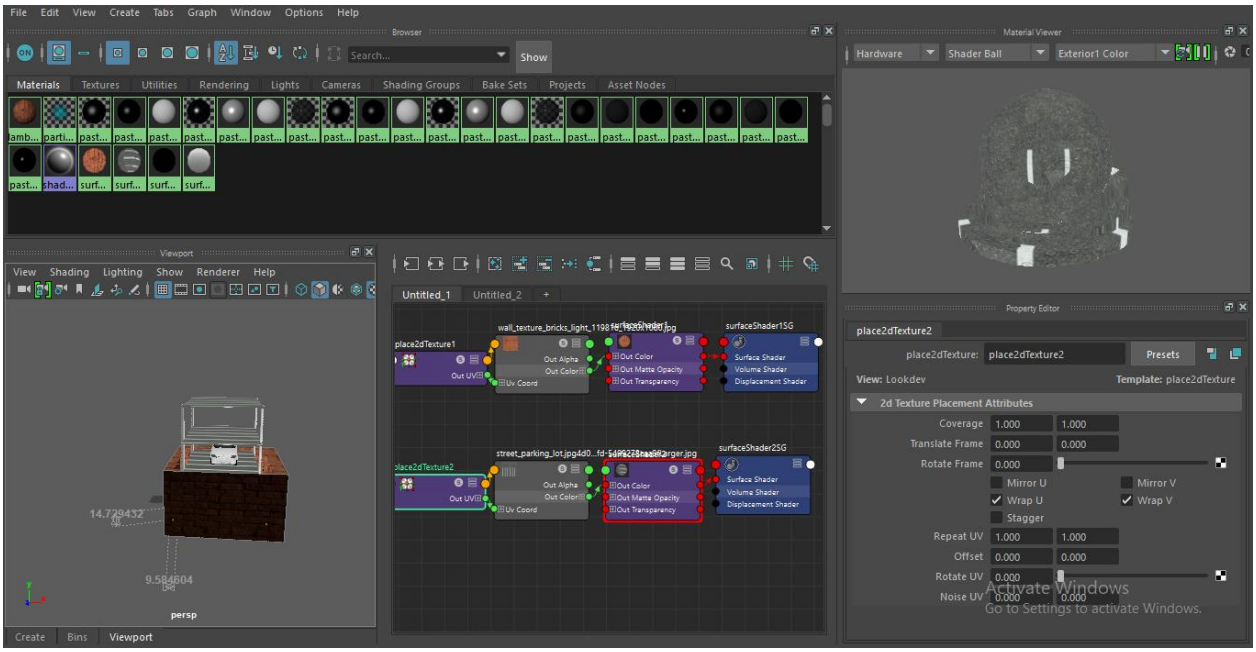


Fig3.8: Starting the texture of the Park

After texture:-

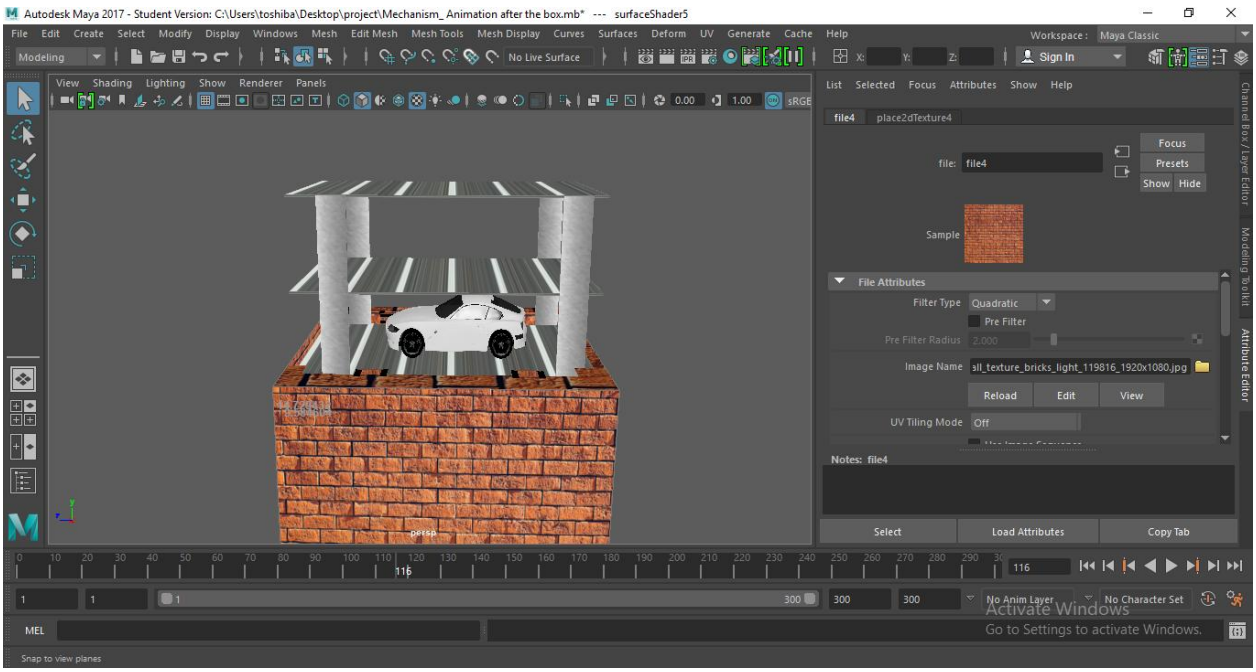
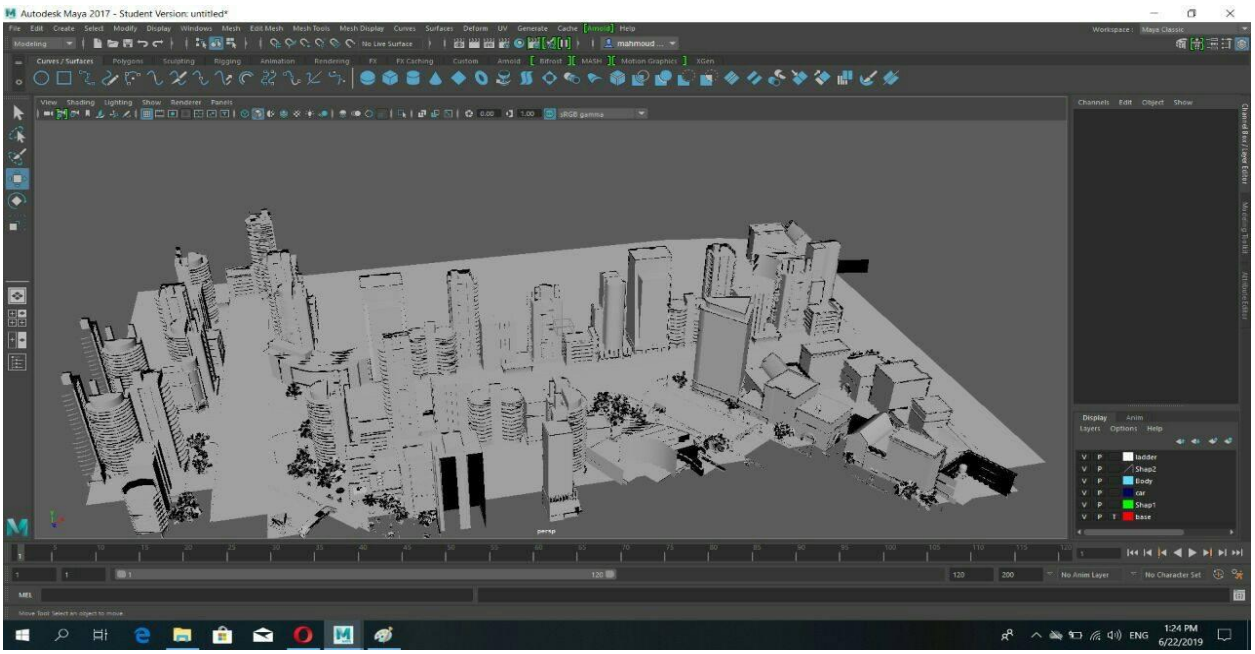


Fig3.8: After the texture of the Park

About the city's texture we use the same command that we had used before

- Isolate select the model
- Surface shader
- Going to create bar to chose photo from file command

Before texture



After texture

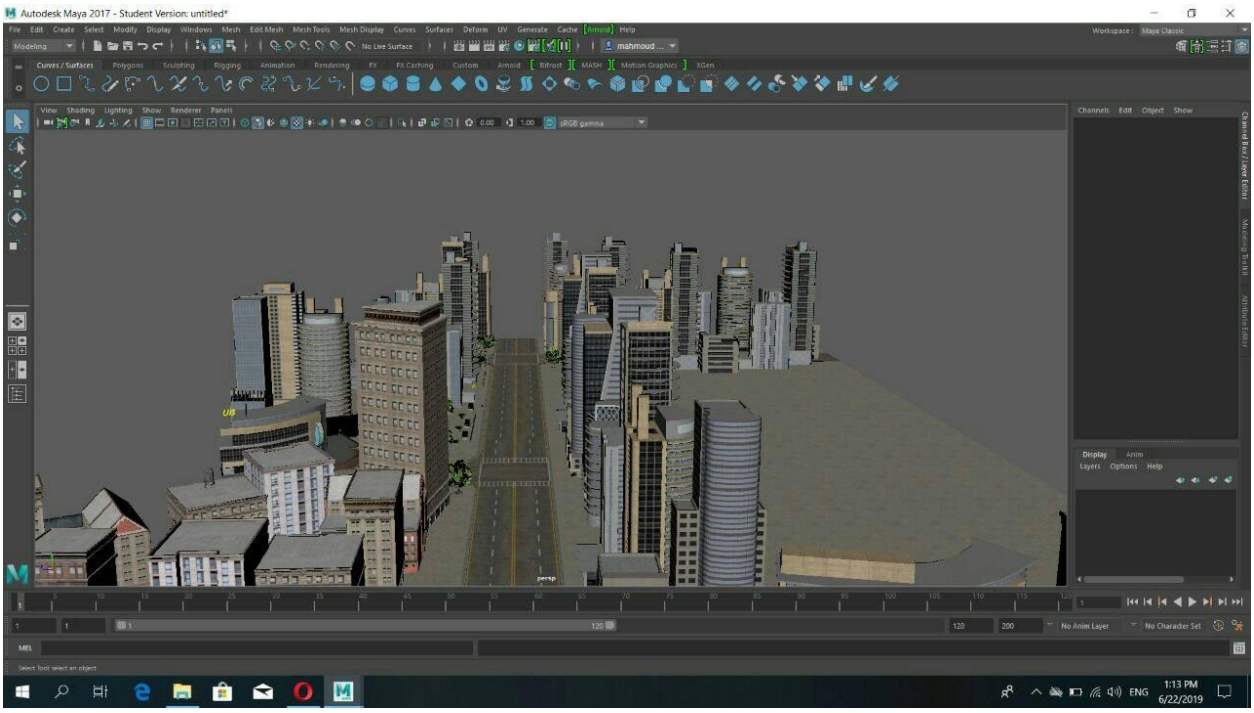


Fig3.10: The city after the texture

Migrating from Maya to Unity

The first step in the implementation process is importing the animated-project's needed designs from Maya (animation and 3D design program) and put it in Unity engine to put the project into life.

Collecting Car's parts and adding functions

- The project components are imported to Unity in separated parts and not grouped together. To be more clearly; when the car is imported to Unity, the car body is separated from doors as well as the wheels.

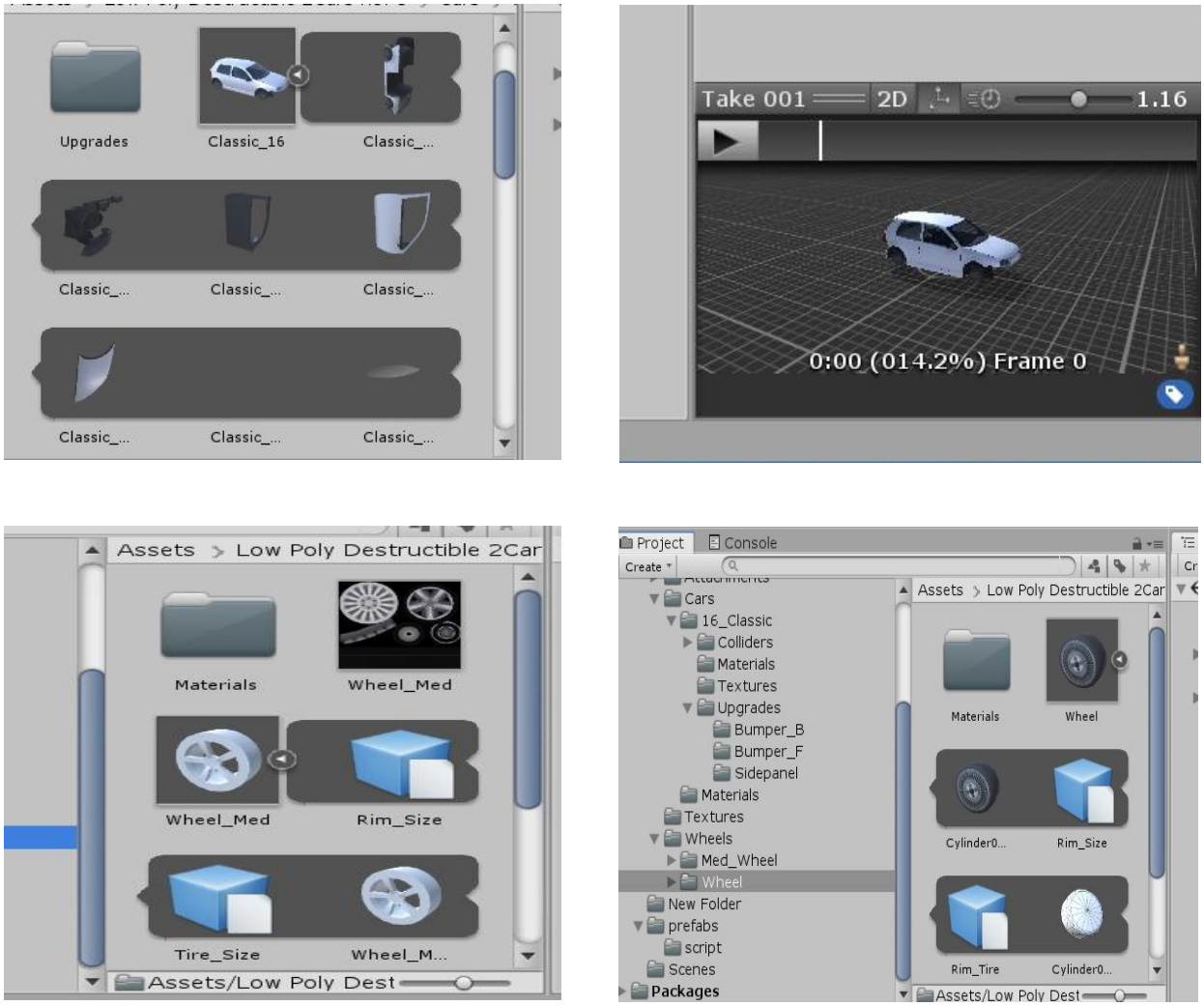


Fig3.11: Migrating the car from maya to unity

- To control the car movement Steer () and Accelerate () function is added.
- To control the wheels movement UpdateWheelPoses() and

UpdateWheelpose ()function is added.

```
private void Steer()
{
    m_steeringAngle = maxSteerAngle * m_horizontalInput;
    frontDriverW.steerAngle = m_steeringAngle;
    frontPassengerW.steerAngle = m_steeringAngle;
}

private void Accelerate()
{
    frontDriverW.motorTorque = m_verticalInput * motorForce;
    frontPassengerW.motorTorque = m_verticalInput * motorForce;
}

private void UpdateWheelPoses()
{
    UpdateWheelpose(frontDriverW, frontDriverT);
    UpdateWheelpose(frontPassengerW, frontPassengerT);
    UpdateWheelpose(rearDriverW, rearDriverT);
    UpdateWheelpose(rearPassengerW, rearPassengerT);
}

private void UpdateWheelpose(WheelCollider _collider, Transform _transform)
{
    Vector3 _pos = _transform.position;
    Quaternion _quat = _transform.rotation;

    _collider.GetWorldPose(out _pos, out _quat);

    _transform.position = _pos;
    _transform.rotation = _quat;
}
```

Fig3.12: Code of movement of the car

- Regarding the camera view, there are many views systems to show the car movement, but here it's preferred to make the camera focus at the back of the car back to make it easy for the user to follow the car and see its movement wherever it goes.

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

public class camera : MonoBehaviour
{
    public void LookAtTarget()
    {
        Vector3 _lookDirection = objectToFollow.position - transform.position;
        Quaternion _rot = Quaternion.LookRotation(_lookDirection, Vector3.up);
        transform.rotation = Quaternion.Lerp(transform.rotation, _rot, lookSpeed * Time.deltaTime);
    }

    public void MoveToTarget()
    {
        Vector3 _targetpos = objectToFollow.position +
                             objectToFollow.forward * offset.z +
                             objectToFollow.right * offset.x +
                             objectToFollow.up * offset.y;
        transform.position = Vector3.Lerp(transform.position, _targetpos, followSpeed * Time.deltaTime);

    }

    private void FixedUpdate()
    {
        LookAtTarget();
        MoveToTarget();
    }

    public Transform objectToFollow;
    public Vector3 offset;
    public float followSpeed = 10;
    public float lookSpeed = 10;


}
```

Fig3.12: Code of movement of the car

- To add more reality to the car movement we add some components like
  a) *Rigidbody*: to give the car mass with *Mass* property and gravity with *Gravity* property to make the car stable on ground and prevent it from floating in the air.
  b) *Box Collider:*to make the core more roughly and when hits a wall it stops going forward or change its direction and stability, so it appears more real.

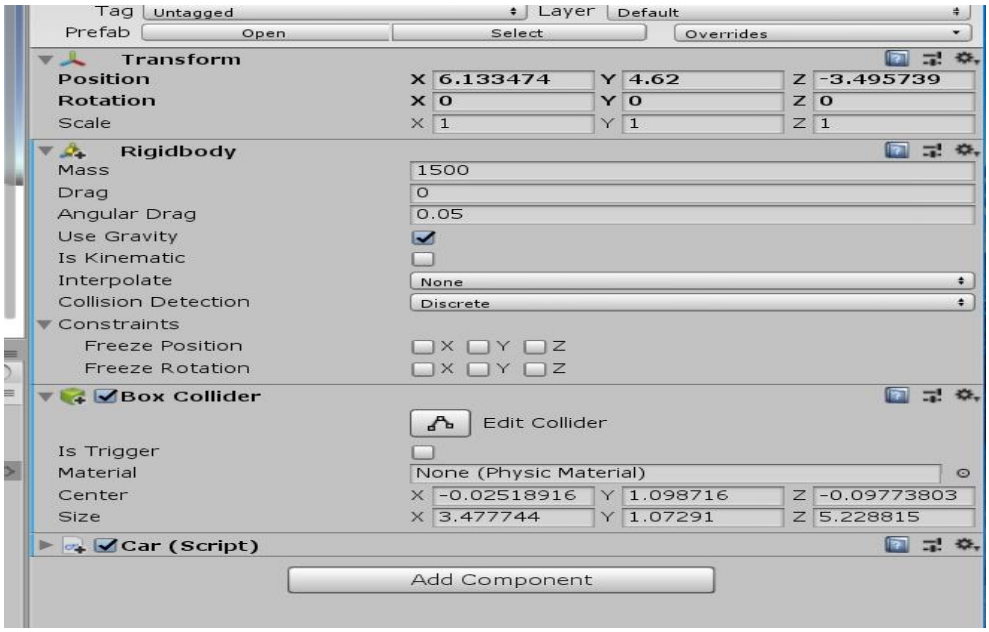
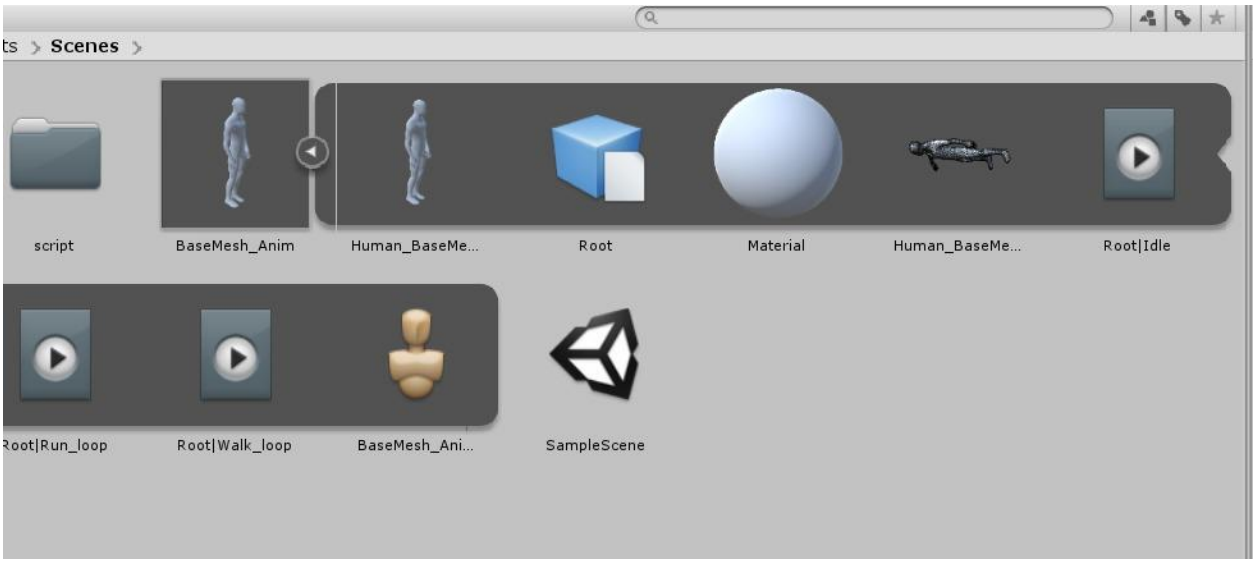


Fig3.13: Collecting character and adding movement functions

Collecting character and adding movement functions

The design is developed by Maya, both modelling and animation.



To control the character movement, we make a code written in C# programming language. But this as internal structure only.

We use to functions :

a) Start(): This function is to call the animator component to the character.

b) Update(): The function is to update the position of the character respect to the x-axis and y-axis as well as its rotation.

We add if condition to put the character in moving state if the speed is not equal to zero. Otherwise if the speed equals to zero the character stops moving.

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

public class controll : MonoBehaviour
{
    private float translation;
    public float speed = 3f;
    public float rotationspeed = 100f;
    private Animator anim;
    void Start()
    {
        anim = GetComponentInChildren<Animator>();
    }


    void Update()
    {
        translation = Input.GetAxis("Vertical") * speed;
        float rotation = Input.GetAxis("Horizontal") * rotationspeed;
        translation *= Time.deltaTime;
        rotation *= Time.deltaTime;
        transform.Translate(0, 0, translation);
        transform.Rotate(0, rotation, 0);
        if (translation != 0)
            anim.SetFloat("speed", 1);
        else
            anim.SetFloat("speed", 0);
    }
}
```

Fig3.14: Code of movement of the character

Regarding the animation, the character is composed of 3 animations:

- Root|Idle
- Root|Walk
- Entry

1. Idle: in this state the character is standing up as a normal person with soul and normal movements like human being.
2. Walk: in this stage the character is moving around using predefined controls.
3. Entry: in this stage the character is entering the car.

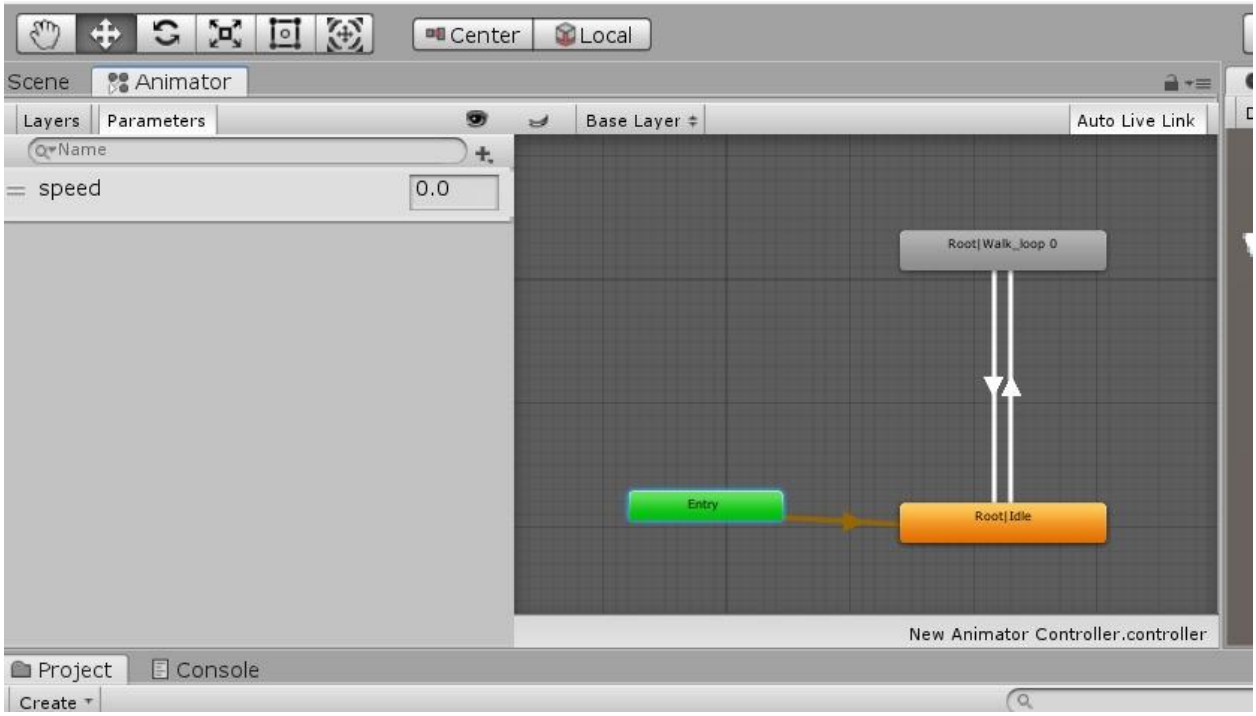


Fig3.15: Using animator components

- We use animator component to connect between the animations and the movement control and a parameter *speed* is used to connect between the code and the animator to move the character using the specified buttons.
-

- We make condition called Speed so we can control the character movement and speed
- We add the animator to the character so the Unity can show the character being moved.
- The arrows between animation states are used to make transactions, more specifically to transform the character from an animation state to another to make a complete loop and the character movement without stopping.
- And in each arrow we add the *speed* parameter to implement the movement respect to the if condition.

Merging the character movement with the car movement

To make things happen we merge between the car movement and the character movement.

When the character get into the car the control state change from character to car and the character control stops as well as the animation.

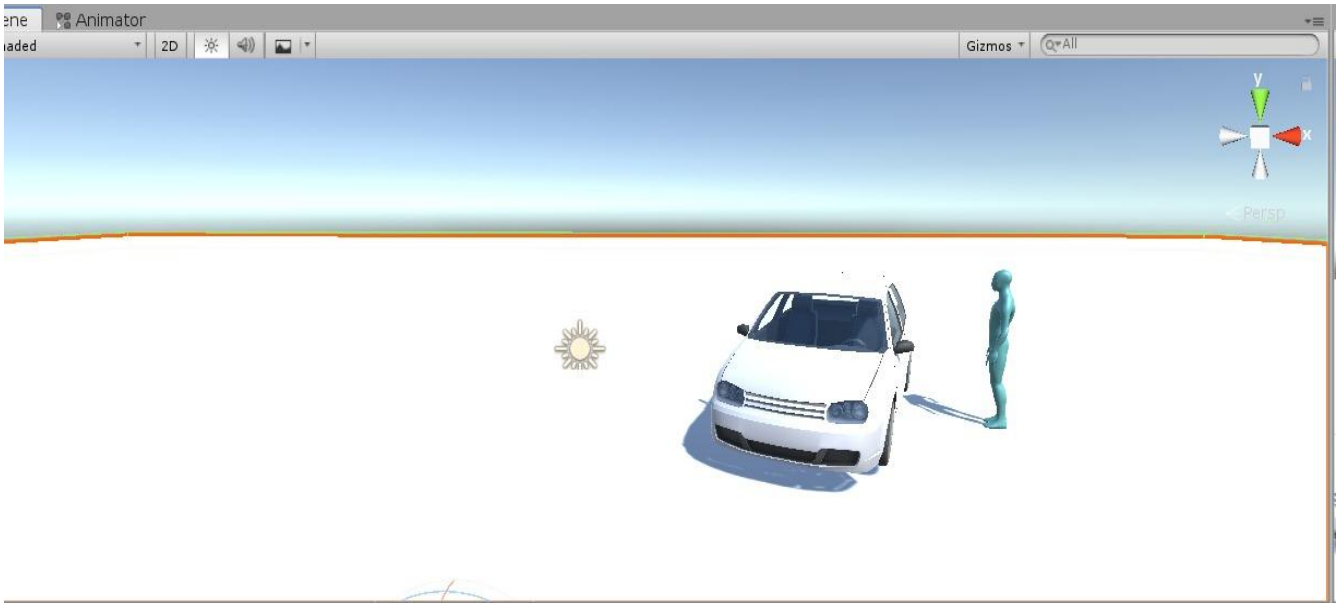


Fig3.16: Migrating the car movement with the character movement

Interface and Database

- The Database is made by *MySQL* and *phpMyAdmin*.

```
--

DROP TABLE IF EXISTS `card`;
CREATE TABLE IF NOT EXISTS `card` (
  `id` int(10) NOT NULL AUTO_INCREMENT,
  `type` text NOT NULL,
  `start_date` timestamp NOT NULL DEFAULT current_timestamp() ON UPDATE current_timestamp(),
  `end_date` timestamp NOT NULL DEFAULT '0000-00-00 00:00:00',
  `description` text NOT NULL,
  `client_id` int(11) NOT NULL,
  `user_id` int(11) NOT NULL,
  PRIMARY KEY (`id`),
  UNIQUE KEY `client_id` (`client_id`),
  UNIQUE KEY `user_id` (`user_id`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8;

-- --------------------------------------------------------

--

DROP TABLE IF EXISTS `client`;
CREATE TABLE IF NOT EXISTS `client` (
  `id` int(10) NOT NULL AUTO_INCREMENT,
  `ssn` text NOT NULL,
  `full_name` text NOT NULL,
  `create_date` timestamp NOT NULL DEFAULT current_timestamp() ON UPDATE current_timestamp(),
  `user_id` int(11) NOT NULL,
  PRIMARY KEY (`id`),
  UNIQUE KEY `user_id` (`user_id`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8;

-- --------------------------------------------------------

--

DROP TABLE IF EXISTS `park`;
CREATE TABLE IF NOT EXISTS `park` (
  `id` int(10) NOT NULL AUTO_INCREMENT,
  `name` text NOT NULL,
  `description` text NOT NULL,
  `creade_date` timestamp NOT NULL DEFAULT current_timestamp() ON UPDATE current_timestamp(),
  `user_id` int(11) NOT NULL,
  PRIMARY KEY (`id`),
  UNIQUE KEY `user_id` (`user_id`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8;

-- --------------------------------------------------------
```

Fig3.17: Interface and Database

We create tables with phpMyAdmin and import it to Unity using a script written in C# programming language.

- We use UI elements in Unity like Buttons to show data.

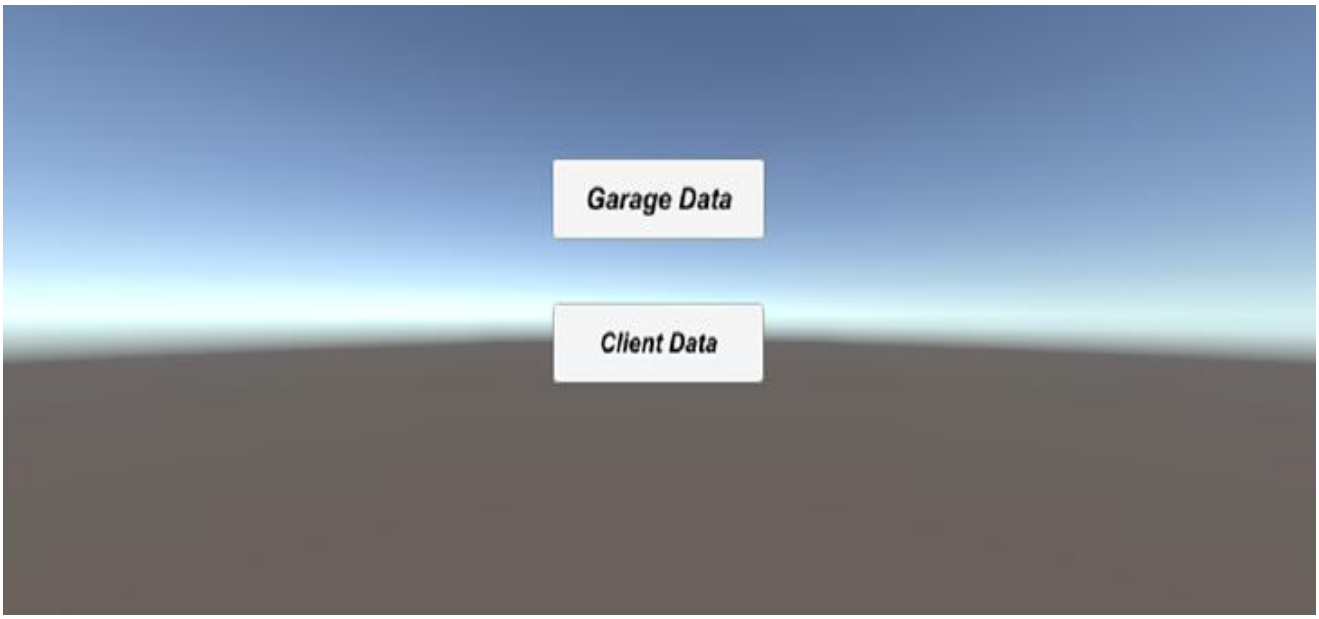


Fig3.18: using UI elements in unity

- Data that is necessary to be showed is Client Data, Garage Data and Card Data.
- When the Button Client Data is clicked it shows the data concerned to the client who park his car in the garage. It has the following elements:
    - id
    - ssn
    - full name
    - create date

- The Button Garage Data shows the data concerned to the garage itself. It has the following elements:
    - id
    - name
    - description
    - create date

- The Button Card Data shows the data concerned to the card that the client put in the garage. It has the following elements:
    - id
    - type
    - start date
    - end date
    - description

Chapter 4

Conclusion

Moreover, for several years, the average standard has been moving towards 2 vehicles per family unit.

The second or third car that you leave on the street, creates a degradation of the urban place, the slowdown in traffic and the inability to freely use the public place for other activities (walking, shopping, etc .....).

the purpose of this research is therefore the design of a car parked in a semi automatic way and where particular attention is paid to the space used.

The semiautomatic parking system consists off a container / warehouse of cars with more floors, equipped with a system of movement and storage of cars totally computerized, the only operation that requires the user is to deposit the car in special room

This Garage was designed by using Maya, designing all its components and collect all of them in a model and animate it.

On the otherwise we have used Unity in programming, controlling the garage by using access card for every floor, making the client choose if he will use this garage monthly or daily for detecting the cost of the single hour (LE/hour).

ملخص المشروع باللغه العربيه

الغرض من هذا البحث هو تصميم سيارة متوقفة بطريقة شبه آلية وحيث يتم إيلاء اهتمام خاص للمساحة المستخدمة.

يتكون نظام وقوف السيارات شبه التلقائي من حاوية / مستودع للسيارات مع مزيد من الطوابق ، ومجهزة بنظام حركة وتخزين السيارات المحوسبة بالكامل ، والعملية الوحيدة التي تتطلب من المستخدم هي إيداع السيارة في غرف خاصة.

نطاق المشروع

يحتوي موقف السيارات هذا ، بالمقارنة مع مواقف السيارات التقليدية ، على الصور التالية:

زيادة استغلال الأسطح والأحجام ، مع ما يترتب على ذلك من زيادة في عدد الأماكن التي يمكن بناؤها.

يسمح للأشخاص باستغلال المكان العام في أنشطة أخرى.

قبل كل شيء ، والحد من حركة المرور.

أتمتة كاملة دون وجود "بعض اللص".

السلامة للسيارة من الحوادث.

كما يتم حفظ المساحة الخاصة بك ، لا يمكن لأحد أن يأخذها.

تم تصميم هذا المرآب باستخدام مايا ، وتصميم جميع مكوناته وجمع كل منهم في نموذج وتحريكه.

على خلاف ذلك استخدمنا الوحدة في البرمجة ، والتحكم في المرآب باستخدام بطاقة الوصول لكل طابق ، مما يجعل العميل يختار ما إذا كان سيستخدم هذا المرآب شهريًا أو يوميًا للكشف عن تكلفة الساعة الواحدة (جنيه / ساعة).

References

Photos and problems of the traffic in egypt

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Courses of maya and unity

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https://bit.ly/2X28g8Z

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https://bit.ly/2iAmeYB

https://bit.ly/2IBYZM1

https://bit.ly/2LbCoro

Car model

https://bit.ly/2RvkaCm