

## Development of a web application to carry out academic advising in a virtual environment

MCIE. Juan Carlos Huerta Mendoza

*PhD student / Da Vinci University, Mexico*

**Abstract:** The use of web technology currently plays a very important role in the optimization of processes, the fact that educational institutions implement them to improve their service will bring many benefits. The academic advising service within higher education universities gives the student the opportunity to acquire skills, which for some reason they could not acquire during class. In addition to preventing the student from dropping out. Some important points for the student to have a successful counseling is that he has a follow-up in his teaching-learning process and that this follow-up is always available for consultation and it is of the utmost importance that the advising teacher has technological tools that allow him to administer consulting and being able to provide this monitoring synchronously and asynchronously.

**Keywords:** Web application, Academic Advising, Virtual Environment, processing

### 1. INTRODUCTION

The use of technology in educational institutions has been increasing and has brought many benefits for solving problems, optimizing times and generating better results. One of these technologies is the development of applications based on the cloud (Internet), currently most educational institutions make use of them in the optimization of their processes, whether academic or administrative. Using this type of application has different benefits, among some we can mention saving time, money, security and information management, scalability and availability.

This research work emphasizes the optimization of the academic advisory process of the Reynosa Rodhe Multidisciplinary Academic Unit (UAMRR), belonging to the Autonomous University of Tamaulipas (UAT). This research work is a continuity of "Implementation of genetic algorithm for the assignment of academic advisory" in which the final result that the genetic algorithm yields is only the most optimal advisory teacher to provide the academic advising to the student who requested it. In this research work, a web application is developed and implemented (assuming that the student has already assigned the adviser teacher) to follow up on the entire teaching-learning process that is carried out in the advisory. Generating with this that the academic advising is carried out in a virtual environment.

For the development of the application, 3 different roles are considered, whose specific characteristics are reflected in the platform. Student role: it has a list of the requested academic consultancies and in each one you will be able to view the pending activities that the adviser teacher has assigned you, you will also view the evaluated activities. In addition, you will have a calendar with links (ZOOM or Microsoft Teams) for synchronous sessions (real-time connection with the advisor teacher). You can send a message to the teacher advisor where you can continue to have asynchronous communication. Advisory teaching role: view the list of academic advisors assigned to them, can generate activities and evaluate them, have their calendar for synchronous connections (by ZOOM or Microsoft Teams), send and receive messages. You can also view the kardex according to the evaluated activities. Administrator role: view the list of all academic advisory services for all advisory teachers, you can view all the characteristics of the teacher except the messages.

This research work contributes to the solution of a great deficiency that universities have in the process of monitoring academic advising, with this contribution the area of academic advising will have the process in a virtual environment and always available to the student and the teacher adviser.

### 2. WEB APPLICATIONS

A web application is a type of client / server application where the client and the server exchange information through the hypertext transfer protocol (HTTP) [1]. A web client is a program with which the user can access an internet page, for example: Google Chrome, Internet Explorer, Firefox. A web server is a program that is constantly waiting for requests from the HTTP protocol to transfer the information from the web application to the client [1]. In most educational institutions they use this type of applications because they help to optimize their processes, allowing them to always be digitally available to users.

This type of application can be configured in 3 different types of computing environments: Internet, Intranet and Extranet. Internet, It has a decentralized design, that is, each computer or device connected to the internet is independent, the user has the ability to choose the internet service to use and which local services to provide to the rest of the internet [1]. When the web application is in this environment, all users with an internet connection could have access to it, in many cases the applications place boxes to enter username and password to authenticate. Intranet: it is a set of computers connected to each other, they belong to an organization and that can be accessible by the members of the organization [1]. Extranet: it is an intranet that can be partially accessed by authorized persons outside the organization or company that owns the intranet [1]. That is why it is of the utmost importance that the UAMRR academic advising area has a web application that allows optimizing the process and that each person involved can have the necessary tools to carry it out.

### 3. IMPLEMENTATION OF THE WEB APPLICATION

The UAMRR makes available different technologies at the service of the different areas that make it up, among them is the academic advisory area of the tutoring department, among the technologies we can mention the following: Microsoft Teams, although these technologies are of great benefit in particular It is difficult for the academic advising department to follow up on how the academic advising is being carried out, and how the student is progressing, this because the department has to adapt to the structure of the platforms and many of the times You have to wait for the advisor teacher to notify you of the student's progress.

The characteristics for the development of the web application are based on the different roles:

- a) Student:
  - a. Access according to a specific role..
  - b. Calendar of your academic advising.
  - c. Direct link for synchronous classes through ZOOM platform or Microsoft Teams.
  - d. List of activities requested by the advising teacher.
  - e. Sending and receiving direct messages with the advising teacher.
- b) Advisory teacher
  - a. Access according to your specific role.
  - b. Calendar of your academic advising.
  - c. Direct link for synchronous classes using the ZOOM platform or Microsoft Teams.
  - d. Interface for generating activities.
  - e. Interface for the evaluation and feedback of the activities.
  - f. Student progress Kardex according to the activities carried out in the advisory.
  - g. Record student attendance.
  - h. Sending and receiving direct messages with the advising teacher.
- c) Administrator of academic advising
  - a. Access according to your specific role.
  - b. List of all academic advisors.
  - c. Direct link to connect to synchronous classes using the ZOOM platform or Microsoft Teams.
  - d. Student progress Kardex according to the activities carried out in the advisory.
  - e. Student attendance list.

#### 3.1 Framework

It is usually defined as a “reusable design of all or part of a system, represented by a set of abstract classes and the way in which these instances interact”. It can include program support, libraries among other programs to help develop and unite different components of a project [2].

For the development of the web application it is necessary to implement different frameworks oriented to the web environment, which are mentioned below.

**NET Framework:**One of the main elements for the development of the web application is .NET Framework, since it provides all the necessary libraries to code each of the interfaces that the user will have, all the libraries that it provides are functional for be executed through the internet.

The .NET Framework consists of a Virtual Runtime System (VES) called the Common Language Runtime (CLR) and a unified set of base class libraries. The CLR is a commercial implementation of Microsoft's Common Language Infrastructure (CLI) [3].

In the development of the web application, it will allow the development of back-end code to carry out the characteristics mentioned in point 3.

**JQuery:** Open source JavaScript-based. It allows the programmer to simplify the way of interacting with JavaScript elements and interacting with the web. Creating animations and effects very easily. In addition, it is capable of modifying CSS style sheets and adding interaction with AJAX technology [4]. The implementation of JQuery in the development of the web application will allow the use of libraries for communication between different technologies such as AJAX, JavaScript, JSON, CSS. Resulting in an interactive and dynamic application.

**Bootstrap:** Designed by the Twitter company and contains several libraries for the development of user interfaces. It is fully customizable and allows the programmer to add an adjustable grid system to all types of screen sizes. In addition, it incorporates the basic elements of a website (forms, buttons, pop-ups, alert messages) without the need to design them. The implementation of the framework will save a lot of time in the design of the styles for each of the elements that make up the user interfaces. Since most of the design will be based on the libraries included in [4].

### 3.2 Client-side programming

An important element in the development of the application is the interaction it will have with the user. The client-side programming allows the application to have the necessary options so that the user in an interactive and dynamic way can develop their activities in an efficient way. Another important characteristic is that in this type of programming the execution is carried out in the client's browser, this allows the response to the requests to be faster. Some examples, when the student needs to register an academic advising session, it can be validated that all the fields are correct before sending the information to the server. Another example, when registering a new academic advisory instead of updating the entire page to see that it was registered, we can only update the section of the academic advisory list by displaying a successful registration message. These types of actions impact the user experience with the use of the web application. The following technologies pertaining to client-side programming are used for the development of the web application.

**Hypertext Markup Language (HTML 5):** It is a tag management language which allows to give the structure of web pages, also performs the primary function of distributing information through the web. As technology has evolved, HTML has also advanced, currently it is in version 5. This new version provides mechanisms to simplify the work and facilitate the inclusion of multimedia elements [4]. HTML 5 is an important element for the development of the web application, since it allows the structure of the application to be well ordered and each element (images, buttons, labels, forms, reports) is in its correct position for the different roles (student, professor and those in charge of the academic advising area).

**Cascading Style Sheets (CSS 3):** CSS aims to separate the structure of the page (HTML) from the layout and formatting of the page itself. It allows to define and create the presentation of the HTML structure, that is, to generate the visual part of each of the user interfaces. It is currently in version 3 in which 2 improvements stand out, first in the regrouping of the properties in independent functional modules that evolve at their own pace, allowing web browsers to implement them progressively. As the second improvement is that it includes new properties and redefines some that already existed [5]. The implementation of CSS 3 in the development of the web application will have an impact on the appearance and way of being viewed by users, since regardless of the device with which they access, the application must be displayed correctly and functionally.

**JavaScript:** It is a programming language used mainly to create dynamic web pages. This programming language, similar to Java, allows you to perform simple tasks in the browser without the need to make requests to the server [4]. JavaScript will allow users of the web application to have a better usability experience in each of the actions they perform. In addition, the implementation in the development of the web application will be carried out in conjunction with other technologies to improve communication management with the server

**Asynchronous JavaScript and XML (AJAX):** It is a tag that refers to a repertoire of techniques based on browsers to implement Web applications in which the elements and content of the pages are retrieved asynchronously. It allows to load content from a web page and display it without having to reload it [4]. For the development of this web application, this technology will be implemented in conjunction with JavaScript technology, for when the user performs actions that have a response from the server, only the corresponding section of the page is updated, in this way the performance of the web application.

### 3.2 Server-side programming

Every time the user performs an action in a web application that, for security or integrity of the information, is not convenient for it to be executed or processed on the client's machine, it is when it is necessary to use technologies designed to be executed on the server. These technologies are known as server-

side programming or back-end programming. For the development of the web application the following technologies are necessary.

**C #:** It is one of the high-level programming languages that belong to the .NET Framework. With it they can write conventional applications for the internet. One of the important characteristics is to be an object-oriented programming language, which allows having an orderly development structure and allowing code reuse [6]. The C # language will allow to generate the algorithms necessary to process the information of the web application. In addition, it will carry out transactions with the database.

**MYSQL:** It is a relational database management system. It is a client / server system that consists of a multi-threaded SQL server, which works with different client programs and libraries, administrative tools and a wide range of application interfaces (APIs) [7]. This technology will allow to store all the information that is processed in the web application in an orderly way. In addition, all the information that is stored will always be available to users according to the role assigned through the web application.

#### 4. WEB APPLICATION DEVELOPMENT

One of the advantages of the web application is that both the student and the teacher advisor can access it from any device connected to the internet. This allows the academic advising process to be always available virtually. Next, the development of the different modules that make up the web application is mentioned.

##### 4.1 Access module

One of the important characteristics of the web application is the access module, this module allows to show the interface corresponding to the role that has been authenticated. For the development of this module, different programming technologies were implemented on the client side such as HTML (fig. 1) which allows the user to show the fields to enter their access data (user and password) other programming technologies on the side of the client implemented in this module is JavaScript, AJAX and JQuery (fig. 2), the implementation of these technologies in this module allows to manage communication with the server in a more efficient way, in the coding you can see the implementation of the technology AJAX that at the moment to validate that the data is correct, this is done without the need to refresh the entire page, having the same behavior if an error occurs in communication with the server, it will show a notification message without the need to refresh the page again, thus improving the response speed for the user and providing a more interactive action. We can also appreciate the implementation of server-side technologies. The C # programming language (fig. 3) is an important part of the information processing in this module since it is in charge of receiving the data (username, password) and validate them by means of a stored procedure of the MYSQL database (fig. 3), in the coding a call is made to a method "Roles" to which the access data is sent and, if it exists, the role of the user and returns it so that the module can determine which interface to show the user.

```

<form class="login100-form validate-form p-b-33 p-t-5">
  <div class="wrap-input100 validate-input" data-validate="Enter username">
    <input id="User" class="input100" type="text" name="username" placeholder="Usuario">
    <span class="focus-input100" data-placeholder="&#xe82a;"></span>
  </div>
  <div class="wrap-input100 validate-input" data-validate="Enter password">
    <input id="Password" class="input100" type="password" name="pass" placeholder="Contraseña">
    <span class="focus-input100" data-placeholder="&#xe80f;"></span>
  </div>
  <div class="container-login100-form-btn m-t-32">
    <button type="button" class="login100-form-btn" id="BtnLogin">
      Entrar
    </button>
  </div>
</form>

```

Fig.1. HTML language access module

```

function Roles() {
    usu = $('#User').val();
    pass = $('#Password').val();

    if (usu != '') {
        if (pass != '') {

            var datos = '{"usu":"' + usu + ',';
            datos += "pass":"' + pass + '"}';

            $.ajax({
                type: 'POST',
                url: urlResources(0) + 'Roles',
                data: datos,
                async: false,
                contentType: 'application/json',
                error: function (xhr) {
                    //overlay('Desbloquear');
                    swal("Ocurrió un error!, Verifique su conexion a internet.");
                },
                success: function (data) {
                    var json = JSON.parse(data.d)

                    if (json.length != 0) {
                        var str = json[0].Rol;
                        var lon = str.length;
                    }
                }
            });
        }
    }
}

$(document).ready(function () {
    $('#BtnLogin').on('click', function () {
        general();
        Roles();
    });
});

```

Fig. 2. JavaScript module function

```

public List<Usuarios> Roles(string usuario, string contraseña)
{
    [WebMethod]
    [ScriptMethod(ResponseFormat = ResponseFormat.Json)]
    public string Roles(string usu, string pass)
    {
        List<Usuarios> lista = new List<Usuarios>();
        lista = conn.Roles(usu, pass).ToList();

        JavaScriptSerializer Js = new JavaScriptSerializer();
        return Js.Serialize(lista);
    }

    MySqlCommand cmd = new MySqlCommand();
    MySqlDataReader reader;
    List<Usuarios> list = new List<Usuarios>();

    if (conectar() == true)
    {
        try
        {
            cmd.CommandText = "GetRoles";
            cmd.Parameters.Add("@User", SqlDbType.VarChar).Value = usuario;
            cmd.Parameters.Add("@Pass", SqlDbType.VarChar).Value = contraseña;
            cmd.CommandType = System.Data.CommandType.StoredProcedure;
            cmd.Connection = conn;
            reader = cmd.ExecuteReader();
        }
    }
}

```

Fig. 3. C # programming language

#### 4.2 Student module

The role of the student is very important since it is the reason why the academic consultancies are developed, for this module different characteristics have been developed implementing the technologies of client-side programming and server-side programming which we have mentioned in chapters previous. One of the essential codifications of this module is for the student to visualize the list of consultancies, as well as the activities assigned to him (fig. 4) and (fig. 5).

The student will be able to visualize the calendar of synchronous sessions and the link to connect in a virtual way with the advisor teacher, (fig. 6) and (fig. 7) show this coding in conjunction with Bootstrap.

```

<div class="container">
    <div class="row">
        <div class="col-md-4 col-12 contenedor-central">
            <div class="row padding10">
                <div class="col-md-12">
                    <span class="texto">Lista de Asesorías
                </span>
                </div>
                <div class="col-md-12" id="table_lista_clases">
                </div>
            </div>
        </div>
    </div>
</div>

function getAseorias(op) {
    var id = sessionStorage.ID;
    if (op == 1) {
        btn_Alumno(id);
    }
    sessionStorage["alu"] = id;
    var slt = document.getElementById('DDSelperiodo');
    var valor = slt.options[slt.selectedIndex].value;
    var data = '{"idp":"' + valor + '"}';
    $('#table_lista_clases').html(divAlert('success', 'cargando...', 'i'));
    $.ajax({
        type: 'POST',
        url: url + 'getAseorias',
    });
}

```

Fig. 4. Client-side programming to view the list of academic advisors.

```
public string getAseorias(string idp)
{
    string resp = "";
    DataTable dt = new DataTable();
    getMateriasCls mat;
    List<getMateriasCls> lista = new List<getMateriasCls>();
    try
    {
        string usuario = Session["idusuario"].ToString();
        string ciclo = Session["idciclo"].ToString();
        int idperiodo = Convert.ToInt16(idp);

        dt = db.sel("select * from Tbl_clases C inner join Tbl_alumnosClase ALC on C.id_clase = ALC.id_clase where usuario="

        for (int i = 0; i < dt.Rows.Count; i++)
        {
            mat = new getMateriasCls();
            int id_clase = Convert.ToInt32(dt.Rows[i]["id_clase"]);
            mat.id_materia = id_clase;
            mat.nombre = dt.Rows[i]["clase"].ToString();
        }
    }
}
```

Fig. 5. Server-side programming to view the list of academic advisors

```
<!--MODALES-->
<div id="modal_ClaseCalendario" class="modal fade bd-example-modal-md" role="dialog" aria-hidden="true">
  <div class="modal-dialog modal-lg">
    <div class="modal-content">
      <div class="modal-header">
        <h5 class="modal-title">Calendario de sesiones:</h5>
        <button type="button" class="close" data-dismiss="modal">&times;</button>
      </div>
      <div class="modal-body" id="body_ClaseCalendario">
      </div>
      <div class="modal-footer">
        <button class="btn btn-info" data-dismiss="modal">ok</button>
      </div>
    </div>
  </div>
</div>
```

Fig. 6. HTML and Bootstrap implementation in the session calendar

```
function getAseoriasCalendario() {
    $.ajax({
        type: 'POST',
        url: url + 'getAseoriasCalendario',
        data: null,
        dataType: 'json',
        contentType: 'application/json',
        timeout: 60000,
        error: function (xhr) {
            window.location.href = '../Acceso/login.html';
        },
        success: function (data) {
            var data = JSON.parse(data.d);
            var tabla = '';
            var cont = 1;
            if (data.length > 0) {
                dt = db.sel("select C.id_clase,C.clase,IFNULL(C.horario,'|') as horario,C.url from Tbl_clases C inner join Tbl_alumnos
                for (int i = 0; i < dt.Rows.Count; i++)
                {
                    string[] datos = dt.Rows[i]["horario"].ToString().Split('|');
                    int cantidad = datos.Count();
                    idReunion = datos[0];
                    for (int y = 1; y < cantidad; y++)
                    {
                        if (datos[y].Contains(hora) == true)
                        {
                            switch (y)
                            {
                                case 1:
                                    lun = "<a href=" + dt.Rows[i]["url"].ToString() + " target=Blank" + dt.Rows[i]["clase"].ToString()
                                    break;
                                case 2:
                                    mar = "<a href=" + dt.Rows[i]["url"].ToString() + " target=Blank" + dt.Rows[i]["clase"].ToString()
                                    break;
                                case 3:
                                    mier = "<a href=" + dt.Rows[i]["url"].ToString() + " target=Blank" + dt.Rows[i]["clase"].ToString()
                                    break;
                                case 4:
                                    jue = "<a href=" + dt.Rows[i]["url"].ToString() + " target=Blank" + dt.Rows[i]["clase"].ToString()
                                    break;
                                case 5:
                                    vie = "<a href=" + dt.Rows[i]["url"].ToString() + " target=Blank" + dt.Rows[i]["clase"].ToString()
                                    break;
                                case 6:
                                    sab = "<a href=" + dt.Rows[i]["url"].ToString() + " target=Blank" + dt.Rows[i]["clase"].ToString()
                                    break;
                                case 7:
                                    dom = "<a href=" + dt.Rows[i]["url"].ToString() + " target=Blank" + dt.Rows[i]["clase"].ToString()
                                    break;
                            }
                            tabla += "<tr><td>";
                            if (cont % 7 == 0)
                                tabla += "</tr><tr><td>";
                            else
                                tabla += "<td>";
                            tabla += "</td></tr>";
                            cont++;
                        }
                    }
                }
            }
        }
    });
}
```

Fig. 7 Client-side and server-side scheduling session schedule

In case the student has any questions or comments, they can send a messagedirect to the consultant teacher asynchronously, you can also receive direct messages from the consultant teacher (fig. 8).

```
[WebMethod(EnableSession = true)]
[ScriptMethod(ResponseFormat = ResponseFormat.Json)]
public string getMsg(string id)
{
    string resp = "";
    DataTable dt = new DataTable();
    getMsg msg;
    List<getMsg> lista = new List<getMsg>();
    try
    {
        string usuario = Session["idusuario"].ToString();
        string ciclo = Session["idciclo"].ToString();
        string idperiodo = Session["idperiodo"].ToString();

        if (id == "1")
        {
            dt = db.sel("SELECT distinct(M.id_mensaje), CONCAT(U.Nombre, ' ',U.Apellido1,' ',U.Apellido2) AS de ,(
            inner join Tbl_usuarios U2 ON U2.Id_usuario = M.Para " +
            "left join(select id_mensajeResp, deResp from Tbl_mensajesRespuesta ME inner join Tbl_mensajes
            where(U2.Id_usuario = " + usuario + ") or(M.id_mensaje in (select id_mensajeResp from Tbl_m
        }
    }
}
```

Fig. 8 Receiving messages from the student



**4.4 Administrator module**

The administrator of the academic advising area has access to all the characteristics of the advising teacher except for personal messages. The development of these characteristics is described in the previous chapters.

**5. TESTS OF IMPLEMENTATION AND IMPLEMENTATION**

The detailed results of the implementation and execution tests of the web application are shown below.



**5.1 Access module**

Fig. 13 Access interface.

**5.1Módulo de Estudiante**

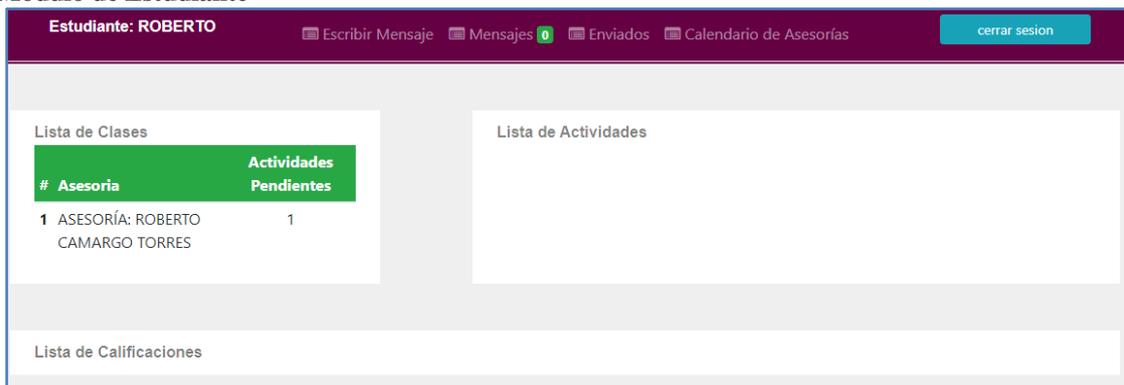


Fig. 14 Student module interface.



Fig. 15 List of academic consultancies and activities.

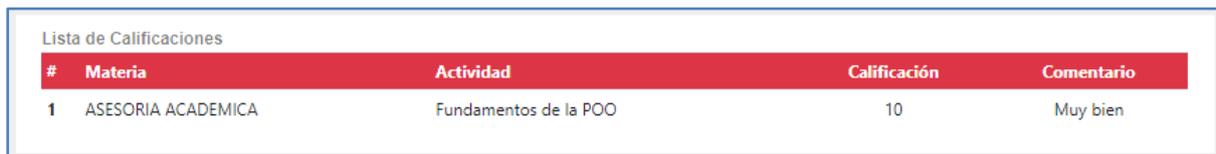


Fig. 16 List of evaluated activities.

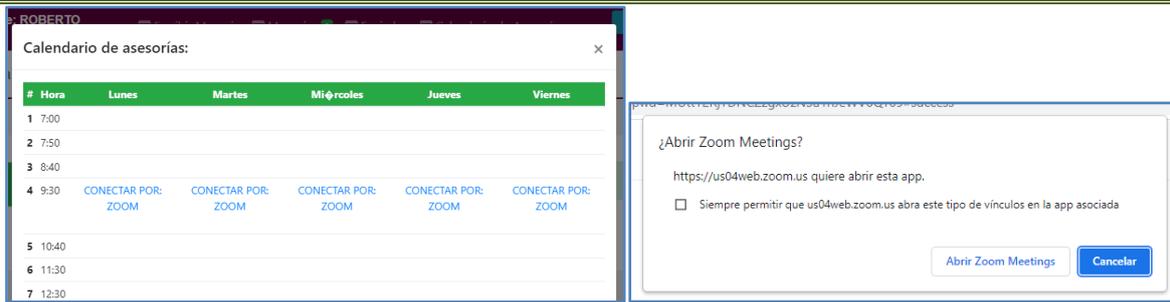


Fig. 17 Calendar of synchronous academic advisory sessions

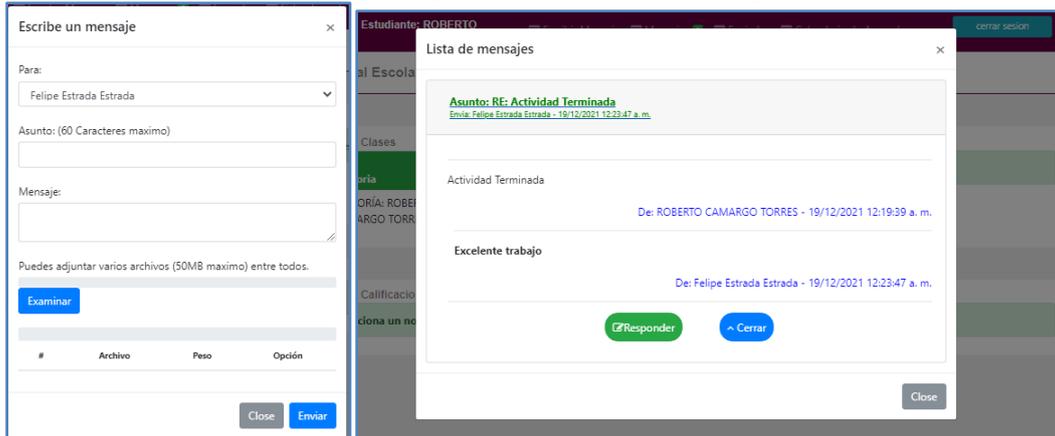


Fig. 18 Sending and receiving messages

### 5.1 Advisor Teacher Module



Fig. 19 Advisor teacher interface

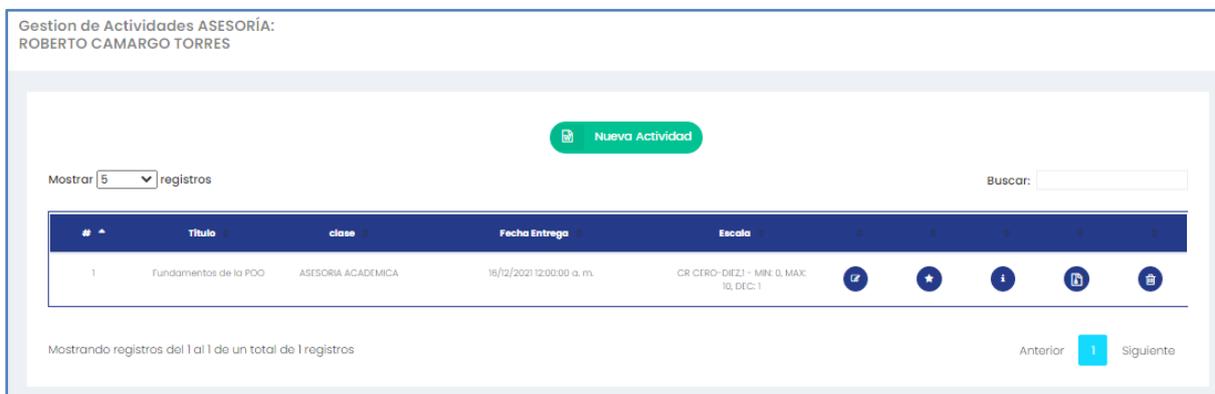


Fig. 20 List of academic advising activities.

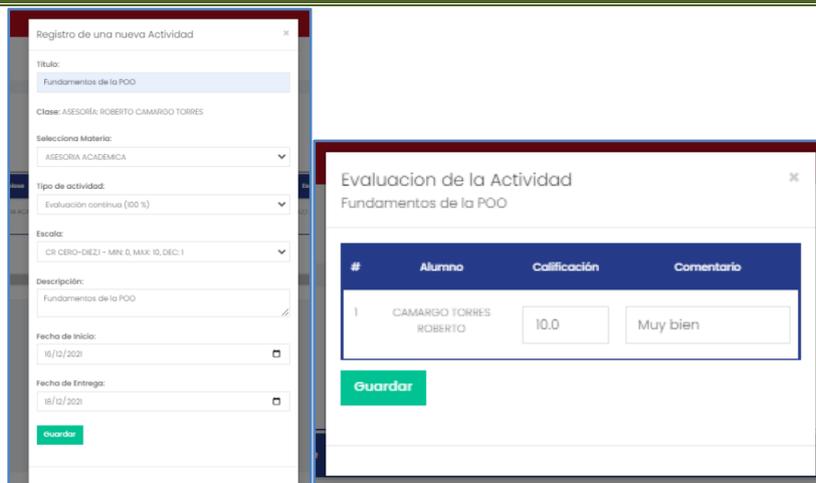


Fig. 21 Assignment and evaluation of academic advising activities.

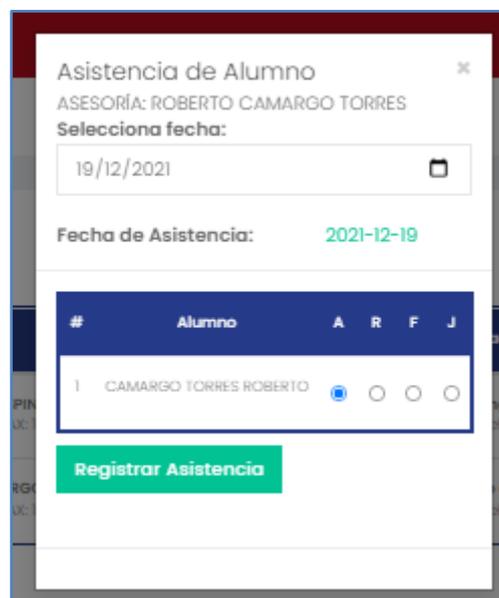


Fig. 22 Student attendance to academic advising

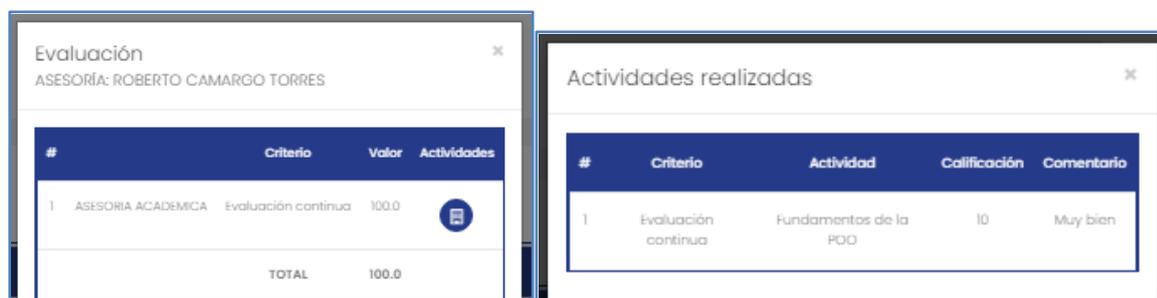


Fig. 23 Student activities Kardex



#	Asesoría	grado/grupo					
1	ASESORÍA ACADÉMICA: ISABEL ESTRADA CR CERD-DREZJ - MIN: 0, MAX: 10, DEC: 1	1º- Semestre Ingeniero en Electronica B Maria Guadalupe					
2	ASESORÍA: RICARDO MATA CR CERD-DREZJ - MIN: 0, MAX: 10, DEC: 1	1º- Semestre Ingeniero en Electronica A Juan Perez					
3	ASESORÍA: ROBERTA ESPINOZA CR CERD-DREZJ - MIN: 0, MAX: 10, DEC: 1	1º- Semestre Ingeniero en Electronica A Felipa Estrada					
4	ASESORÍA ACADÉMICA: MARIA ESCAMILLA CR CERD-DREZJ - MIN: 0, MAX: 10, DEC: 1	2º- Semestre Ingeniero en Electronica B Felipa Estrada					
5	ASESORÍA: ROBERTO CAMARGO TORRES CR CERD-DREZJ - MIN: 0, MAX: 10, DEC: 1	2º- Semestre Ingeniero en Sistemas Computacionales A Felipa Estrada					
6	ASESORÍA ACADÉMICA: SOFIA PUNTE CR CERD-DREZJ - MIN: 0, MAX: 10, DEC: 1	3º- Semestre Ingeniero en Electronica B Juan Perez					
7	ASESORÍA ACADÉMICA: ERNESTO TORRES CR CERD-DREZJ - MIN: 0, MAX: 10, DEC: 1	3º- Semestre Ingeniero en Sistemas Computacionales A Iñiran Castro					
8	ASESORÍA ACADÉMICA: JOSE ORTIZ CR CERD-DREZJ - MIN: 0, MAX: 10, DEC: 1	4º- Semestre Ingeniero en Electronica B Maria Guadalupe					
9	ASESORÍA ACADÉMICA: EDUARDO CASTANON CR CERD-DREZJ - MIN: 0, MAX: 10, DEC: 1	5º- Semestre Ingeniero en Electronica B Maria Guadalupe					
10	ASESORÍA ACADÉMICA: RUPERTO TOVIAS CR CERD-DREZJ - MIN: 0, MAX: 10, DEC: 1	6º- Semestre Ingeniero en Electronica B Iñiran Castro					

Fig. 27 List of academic advisors

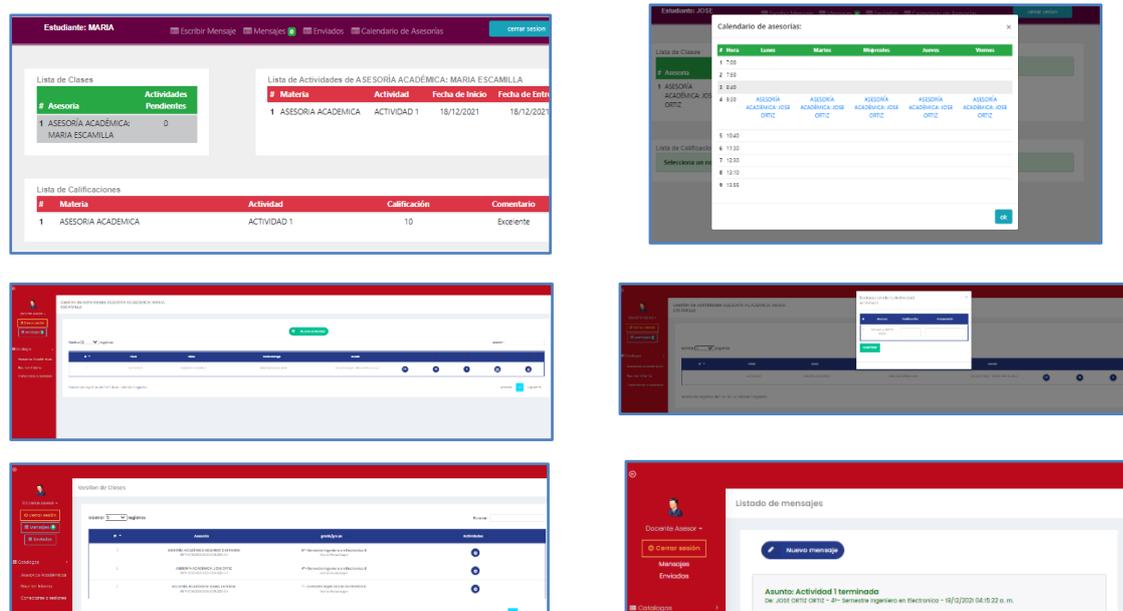


Fig. 28 Interfaces of random academic advisory processes

## 7. CONCLUSIONS

The development and implementation of the web application allows the academic advising area to offer its service in a virtual way, taking advantage of technology, allowing more flexibility and availability to the teaching-learning process. The development of this research work allows the following.

- The implementation of the web application allows the academic advising area to have a complete monitoring of the teaching-learning process in real time.
- The web application is a technology tool developed tailored to the academic advisory process, so it has the necessary characteristics to carry it out in a simple way.
- The academic advising service is always available from any electronic device that has an internet connection.

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