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Usage of IoT in automation routine processes

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Internet of Things or IoT is a representation of the automatic processes by integrating processors, sensors and data collections through a huge amount of processing techniques. The contribution of IoT in technology is significant, offering revolutionary changes in a big amount of industries. [1]

Actually, these devices became so powerful that they can work with data in real-time, doing ***machine learning*** *and* ***artificial intelligence****. In big words, a single processor got the frequency up to 2.4 GHz, with integrated Wi-Fi and many connectors, for the connection with sensors, being capable of simultaneously working with all of them, depending of the back-end efficiency programming.*

Initially, the IoT devices were programmable only by the Arduino IDE, which is based on C++. After some time, languages like Python and C# opened their support by creating or opening open-source projects for libraries to work with them, processors being recognized as a programmable mini PC. USB was the only solution for code upload, the IDE doing the compilation and the transfer, then the project could just work with a source of electricity (for smaller projects, a powerbank could be enough). The programming language Python evolved and they released, through a open-source project, OTA (Over The Air) upload, which means the project will need just the usual electricity source and Wi-Fi, no more physical connection to the PC.

Keywords: *iot, big data, database, programming, protocol, sensor, module, upload.*

1 Introduction

Arduino is a brand which is formed with hardware (processors) and software (IDE) components, where anyone can build automation projects. Most libraries from the IDE are open-source, so the users are able to copy and alter the code as they like. Besides the platform, Arduino got a lot of processors and modules, at low-moderate cost, for every type of project needed. Almost all processors got attachments, for a small fee, which can extend their capabilities, like: Wi-Fi, GSM, storage shields.

Speaking of the power of a single processor, the Arduino can stand as a server with ease, being even able to work with the data received from the client. The sensors will complete the board, meaning there will be data received from the IoT device; they can also be analogical or digital, Arduino being able to handle both with specific ports, controlling the voltage it drives through the sensors, careful enough not to burn them.

Some analogical sensors will need physical intervention, because they usually have buttons.

Fig. 1 Arduino UNO Board

2. Software application for routine processes

The project have the following components:

- Application in the Arduino IDE: for decision control for every sensor and module, offering analysis data by inserting it into the SQL Server database. Arduino hardware is meant to give LOW and HIGH signals to the output modules and to read data measured by the input sensors.

When the data comes in critical values, the C# client will be instantly contacting the user via e-mail, showing a page with the values. For this to be done, a SMTP server will be contacted, in our case, Google. Speaking of network, the processor will be the kernel of the effective processes upon the plants, having the highest priority and access at the point of taking decisions. In this platform, we will use TCP model for transmission of data, where we can create a 2-way communication between the server (Arduino) and the client (C# app). The client app will be uploaded on the processor, being ready for execution, even when there is no physical access to the PC. It will only need a power supply and Wi-Fi connection.

In the Arduino IDE, the graphical user interface will be 0, because it will be only used to transmit data to the client. C# will take all the variable passed through the TCP model and will start working with the available data. The speed will be slightly higher without a user interface on the server, just command line.

- C# application as client, having technologies like: ASP .NET for server-side controllers, JavaScript for client-side scripts, SQL Server for the database storage and data processing, CSS for adding a friendly interface.

This application will be quite useful at monitoring data and taking manual actions, where the interface is simple and friendly, where relevant data is shown into the interface, especially on the Chart control. Speaking of network, the web application will be the client, where the user can request data at any moment or by an interval created by the user. The WebForm will be hosted via IIS on a local computer. For a fresh-looking website, Dark Mode has been also added.

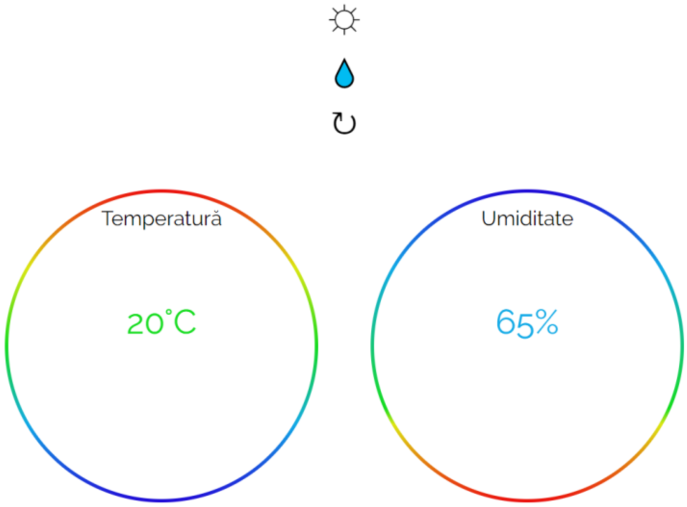


Fig. 2. Light Mode client interface

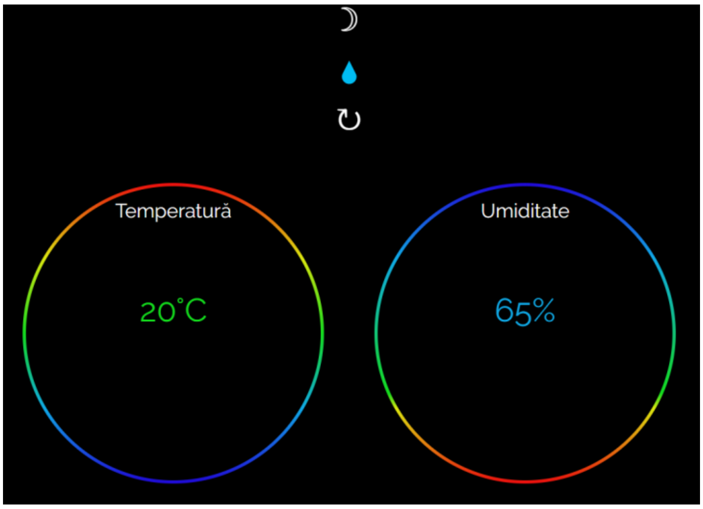
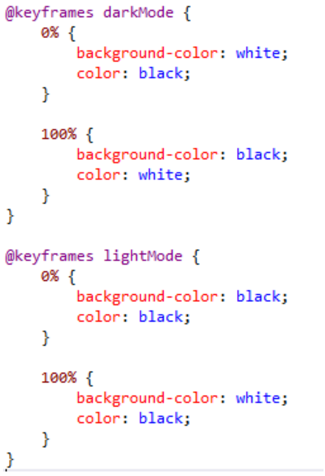


Fig. 3. Dark Mode client interface

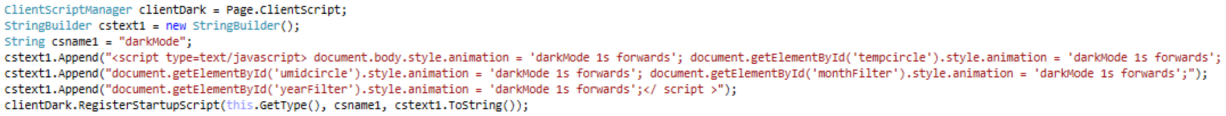
To get the Dark Mode working, JavaScript and CSS keyframes are making the work easier, creating a smooth animation for the background change.



```
@keyframes darkMode {
    0% {
        background-color: white;
        color: black;
    }

    100% {
        background-color: black;
        color: white;
    }
}

@keyframes lightMode {
    0% {
        background-color: black;
        color: black;
    }

    100% {
        background-color: white;
        color: black;
    }
}
```

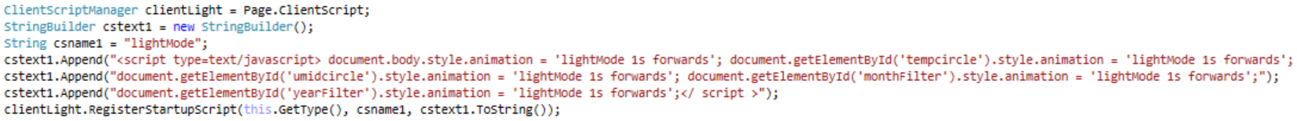
Fig. 4. CSS Dark/Light mode

In order to get this working in C#, we need to use a server-side script, like JavaScript.



```
ClientScriptManager clientDark = Page.ClientScript;
StringBuilder cstext1 = new StringBuilder();
String csname1 = "darkMode";
cstext1.Append("<script type=text/javascript> document.body.style.animation = 'darkMode 1s forwards'; document.getElementById('tempcircle').style.animation = 'darkMode 1s forwards';
cstext1.Append("document.getElementById('umidcircle').style.animation = 'darkMode 1s forwards'; document.getElementById('monthFilter').style.animation = 'darkMode 1s forwards';");
cstext1.Append("document.getElementById('yearFilter').style.animation = 'darkMode 1s forwards';</ script >");
clientDark.RegisterStartupScript(this.GetType(), csname1, cstext1.ToString());
```

Fig. 5. JavaScript Dark Mode integration C#



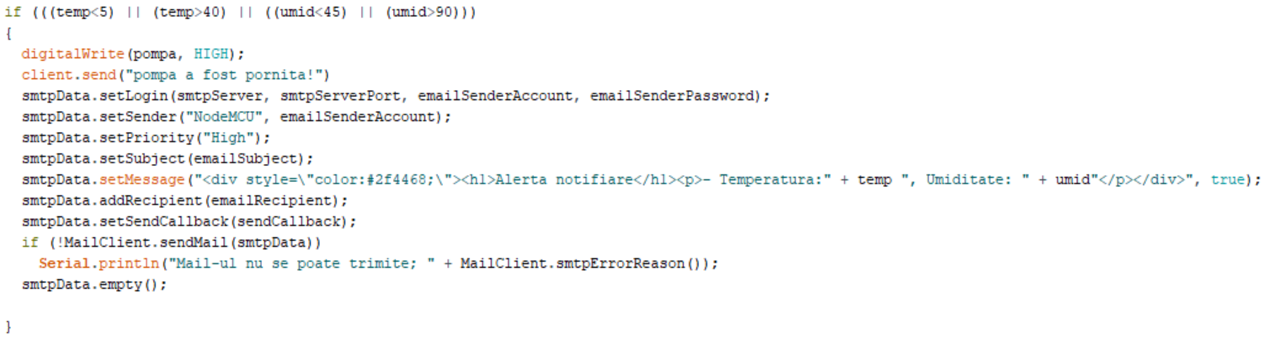
```
ClientScriptManager clientLight = Page.ClientScript;
StringBuilder cstext1 = new StringBuilder();
String csname1 = "lightMode";
cstext1.Append("<script type=text/javascript> document.body.style.animation = 'lightMode 1s forwards'; document.getElementById('tempcircle').style.animation = 'lightMode 1s forwards';
cstext1.Append("document.getElementById('umidcircle').style.animation = 'lightMode 1s forwards'; document.getElementById('monthFilter').style.animation = 'lightMode 1s forwards';");
cstext1.Append("document.getElementById('yearFilter').style.animation = 'lightMode 1s forwards';</ script >");
clientLight.RegisterStartupScript(this.GetType(), csname1, cstext1.ToString());
```

Fig. 6. JavaScript Light Mode integration C#

In the client application, buttons with custom text are used (unicode characters) for a more self-explanatory functionality, being recognized by both ASP HTML and C#, but with different characters.

As we can see in the above example, the Web client interface is created with centered unicode characters and 2 variables in the interior of a gradient circle.

Firstly, the Sun and the Moon unicode characters are used as symbols for Dark/Light mode. The action is working client-side with JavaScript, so the server will not interpret any design. The drop of water, as the second unicode character is meant to sent a signal to the Arduino to immediately water the plants running under this system for approximately 5 seconds. Furthermore, the client is sending a request to the server with a signal sent via the TCP model. When the server finish the job, it will send a confirmation of success to the client, the data being processed and, finally, inserted into the specific database. The 3rd element, the unicode character of refresh is created to force a request to the server, so it can return newer data, anytime the user wants to. Anytime when a value exceeds or goes under the critical low value, the C# will instantly create a mail and send it to the recipients.



```
if (((temp<5) || (temp>40) || ((umid<45) || (umid>90)))
{
  digitalWrite(pompa, HIGH);
  client.send("pompa a fost pornita!")
  smtpData.setLogin(smtpServer, smtpServerPort, emailSenderAccount, emailSenderPassword);
  smtpData.setSender("NodeMCU", emailSenderAccount);
  smtpData.setPriority("High");
  smtpData.setSubject(emailSubject);
  smtpData.setMessage("<div style=\"color:#2f4468;\"><h1>Alerta notifiare</h1><p>- Temperatura:" + temp ", Umiditate: " + umid"</p></div>", true);
  smtpData.addRecipient(emailRecipient);
  smtpData.setSendCallback(sendCallback);
  if (!MailClient.sendMail(smtpData))
    Serial.println("Mail-ul nu se poate trimite; " + MailClient.smtpErrorReason());
  smtpData.empty();

}
```

Fig. 4. Automatic mail creation and transmission

3. Hardware application for routine processes

For this project to be done, the following components were needed:

- Processor NodeMCU 12E – low-cost, efficient, open-source, integrated Wi-Fi, powerful processor – 2.4 GHz.

Arduino IDE compatible, the NodeMCU is the ideal module for small-medium projects in IoT, being able to work with many Arduino libraries. It has 9 digital pins, meaning that we can attach maximum 9 digital sensors or less (depending of the number of pins the sensors use). [2]

As example, a sensor of humidity and temperature needs only a pin for transmitting data, while an OLED display will use 2 pins for showing data. Thanks to the Wi-Fi integrated module, the microprocessor will be able to communicate data to the client Web with the TCP model of data transmission.

Fig. 5. NodeMCU 12E

- Temperature and humidity sensor Adafruit DHT22: digital, efficient, accurate.

The DHT22 is a modern sensor which can take accurate values of temperature and humidity, with a 2 seconds minimum interval between measurements. [3]

These values will be sent to the Web client for immediate availability in the recalculation of statistic analysis.

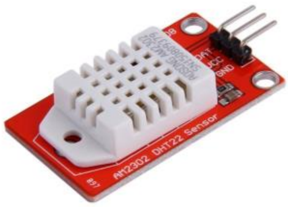


Fig. 6. Adafruit DHT22

- Breadboard – fast connection, no soldering, useful for prototyping.
  The breadboard is a fundamental piece for IoT, making the work easier, because of the electrical conductors integrated on every pin. This connectivity board is a friendly welcome to everyone who is

new in Internet of Things, because of the simplicity of it. The processor links with sensors and modules via soldering or breadboard. For example, with the help of jumper cables, we can insert one into the GND (”-” polarity) pin of the processor, and the other side into the GND pin of the sensor/module, and analog to the VCC (”+” polarity), depending on the power the sensor needs (3.3V or 5V). At this point, we created a connection of power, but we will need a pin to take or to send data to a sensor/module. In the same manner, we will just insert the jumper cable into the DAT pin of the sensor and the other side to any pin from D1-9 of the processor, depending of the preferences of the user.

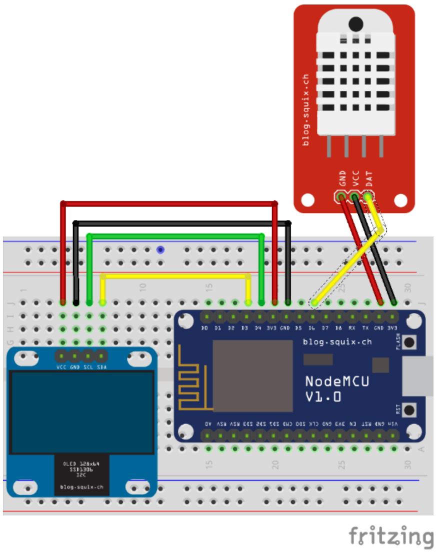


Fig. 7. Breadboard connectivity

As we can see in the above example, the DHT22 sensor is conected to the NodeMCU via 3 pins – 3.3V, GND and D6, meaning that it will have power from the microprocessor and data transmission. The OLED screen will need one more additional data pin for slave-master connection. [4]

- Water pump.

The water pump was connected as a ”Do It Yourself” project, because it is a traditional one and it has normal connectors, not the one we need to connect to the board. But thanks to IoT relays, we can connect the water pump to it and the relay to the NodeMCU, where will get 0 or 1 signals, meaning that the pump is on or off.

This action can be triggered automatic or manual, depending on the stats of the DHT22 sensor and the user intervention.

Fig. 8. Water pump

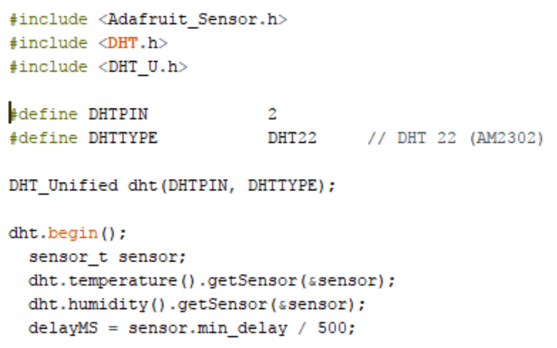
- Switch button.

This type of module will be used to water the plants manually, with physical intervention, without any need of access to the Web application. For additional functionality, the button have an embedded led to announce the user that the press changed its state. As long as the button is pressed, the water pump will transfer water to the plants.

Fig. 9. Water switch

4. Functionalities and implementation methods

In the Arduino IDE, we must declare every sensor with the number of pin assigned earlier, because from there the data stream will start. In our case, we will declare the library, the pin and the type of the temperature and humidity sensor, as follows:



```
#include <Adafruit_Sensor.h>
#include <DHT.h>
#include <DHT_U.h>

#define DHTPIN            2
#define DHTTYPE           DHT22     // DHT 22  (AM2302)

DHT_Unified dht(DHTPIN, DHTTYPE);

dht.begin();
  sensor_t sensor;
  dht.temperature().getSensor(&sensor);
  dht.humidity().getSensor(&sensor);
  delayMS = sensor.min_delay / 500;
```

Fig. 9. DHT22 declaration

For a better view of the data stated into the database, I created a Chart control, which will show the temperature and humidity on days/years. The data is directly queried from the SQL Server.

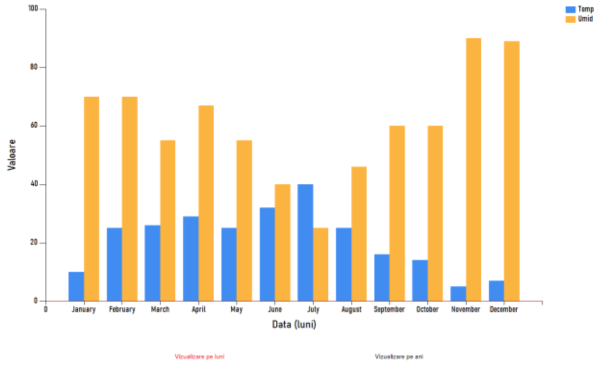


Fig. 10. Temperature/humidity Chart (Light)

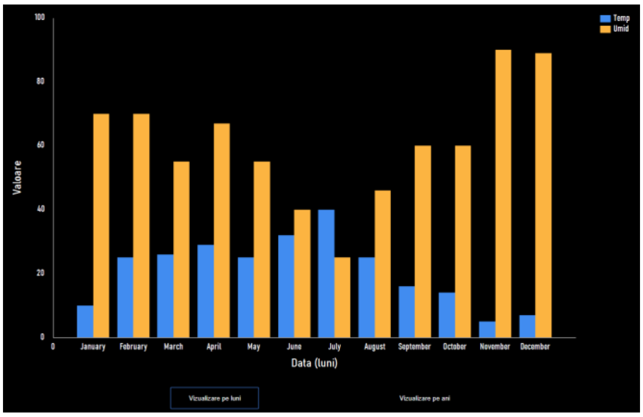
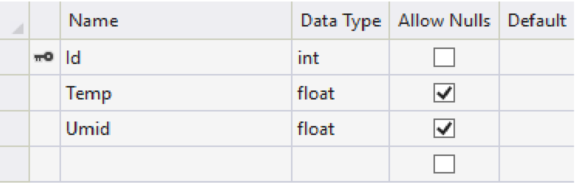


Fig. 11. Temperature/humidity Chart (Light)

4.1. Database structure and management

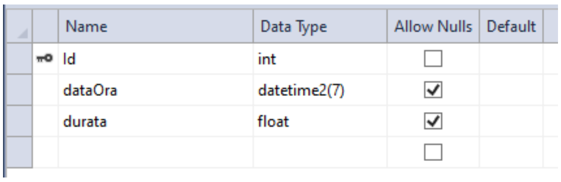
The creation of database is essential here for long or permanent time interval storage. Moreover, a database was created with 2 tables, one for the temperature and humidity and one for the watering management.



Name	Data Type	Allow Nulls	Default
Id	int	□	
Temp	float	☑	
Umid	float	☑	
		□	

Fig. 12. Temperature/humidity table

I used the **ID** attribute as primary key, with auto-incrementation for easier management of data collection. The attributes **Temp** and **Umid** are floats, there is where the C# will place the values from the DHT22.

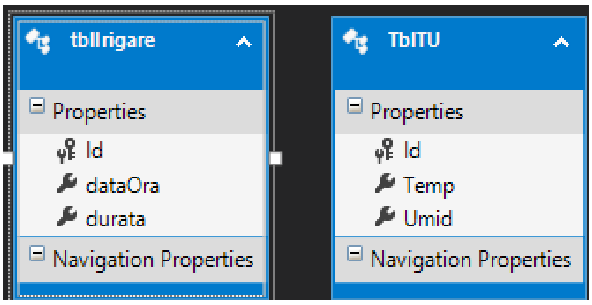


Name	Data Type	Allow Nulls	Default
Id	int	□	
dataOra	datetime2(7)	☑	
durata	float	☑	
		□	

Fig. 13. Watering management table

In the same manner, I used ID for better management, **dataOra** attribute will be created as a time stamp when the watering will be done, plus the duration, marked with the attribute **durata**.

Both tables will accept null values, because the temperature can be 0, for example, and we can manage to see when it begun to show errors in data.

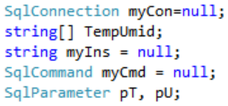


tblIrigare
Properties
Id
dataOra
durata
Navigation Properties

TbITU
Properties
Id
Temp
Umid
Navigation Properties

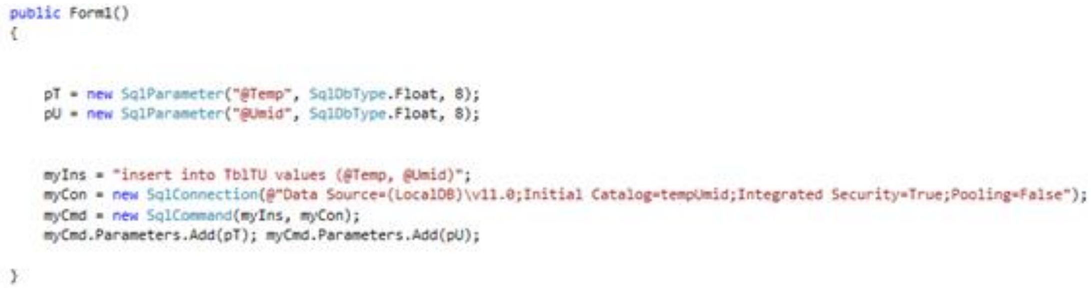
Fig. 14. Database tables

In order to be working with the database, we will need to declare variables to create a variable which will store data received, the connection to the database, the query string, the command and the parameter.



```
SqlConnection myCon=null;
string[] TempUmid;
string myIns = null;
SqlCommand myCmd = null;
SqlParameter pT, pU;
```

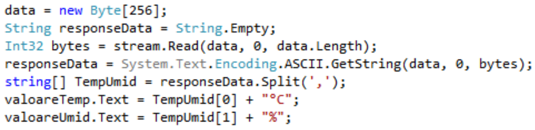
Fig. 14. Variables for database interaction



```
public Form1()
{


    pT = new SqlParameter("@Temp", SqlDbType.Float, 8);
    pU = new SqlParameter("@Umid", SqlDbType.Float, 8);


    myIns = "insert into TblTU values (@Temp, @Umid)";
    myCon = new SqlConnection(@"Data Source=(LocalDB)\v11.0;Initial Catalog=tempUmid;Integrated Security=True;Pooling=False");
    myCmd = new SqlCommand(myIns, myCon);
    myCmd.Parameters.Add(pT); myCmd.Parameters.Add(pU);

}
```

Fig. 15. Values for database interaction

In order to take the data from Arduino, we need to use some variables for data received and classification. To work with the data easier, I made the Arduino server to put comma between temperature and humidity so I can manipulate the variable with separator.

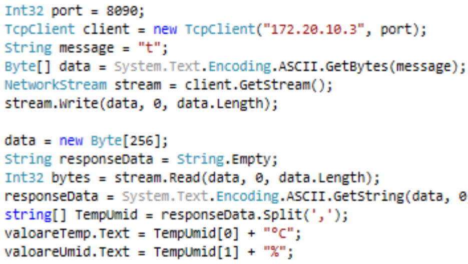


```
data = new Byte[256];
String responseData = String.Empty;
Int32 bytes = stream.Read(data, 0, data.Length);
responseData = System.Text.Encoding.ASCII.GetString(data, 0, bytes);
string[] TempUmid = responseData.Split(',');
valoareTemp.Text = TempUmid[0] + "°C";
valoareUmid.Text = TempUmid[1] + "%";
```

Fig. 16. Variables for data reception

4.2. Connectivity between the server and client

Because a keep-alive session between Arduino and the web can cause damage to the board due to overheating, a network stream can be opened any time the data is requested. Newer data can be requested: manually, when the refresh control is pressed or automatically, when the page is loaded or when the C# timer interval control is reached. The entire application is meant to work with short sessions.



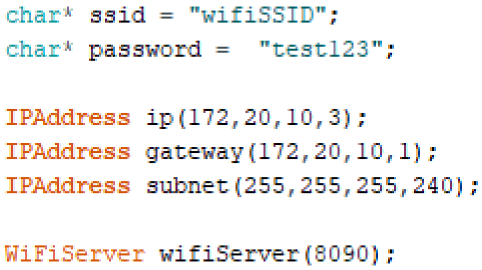
```
Int32 port = 8090;
TcpClient client = new TcpClient("172.20.10.3", port);
String message = "t";
Byte[] data = System.Text.Encoding.ASCII.GetBytes(message);
NetworkStream stream = client.GetStream();
stream.Write(data, 0, data.Length);

data = new Byte[256];
String responseData = String.Empty;
Int32 bytes = stream.Read(data, 0, data.Length);
responseData = System.Text.Encoding.ASCII.GetString(data, 0, bytes);
string[] TempUmid = responseData.Split(',');
valoareTemp.Text = TempUmid[0] + "°C";
valoareUmid.Text = TempUmid[1] + "%";
```

Fig. 17. Creating network stream for fresh data

As we can see in the earlier image, a port was opened both on the Arduino and C# for the 2-way communication. The control TcpClient is a good tool to communicate via internal network. Once the client started, the client will go to the specified IP address (fixed from the Arduino IDE), taking the message “t” and sending it through the network stream to the specified IP.

To receive what NodeMCU wrote on the network, we created a byte variable named data and a string named ResponseData, so we can take both the bytes received and the string received from the IoT processor. The string is then split into 2 pieces with the comma separator, followed by validating the data and proceeding to the insert query to the database.

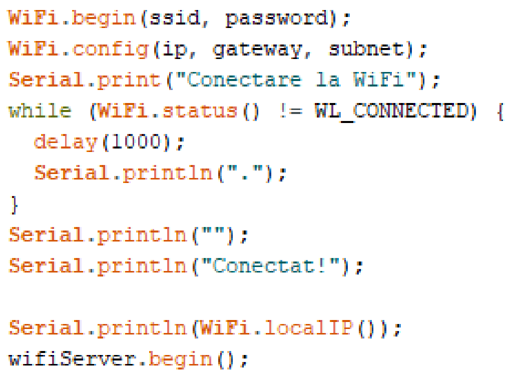
Speaking of server, Arduino IDE has some features which enables manual configuration of the Wi-Fi server, as follows:



```
char* ssid = "wifiSSID";
char* password =  "test123";

IPAddress ip(172,20,10,3);
IPAddress gateway(172,20,10,1);
IPAddress subnet(255,255,255,240);

WiFiServer wifiServer(8090);
```

Fig. 18. (Creating manual connection)

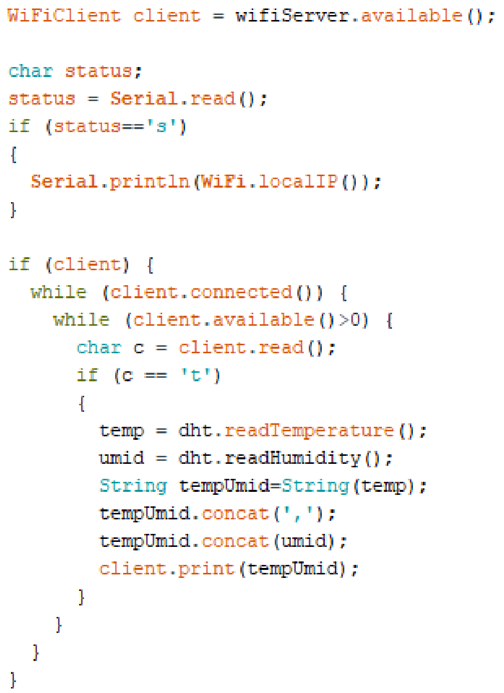
As we can see, we must provide the SSID of the Wi-Fi network and the password in plain text, which can be a security threat. Because the IDE is not supporting only the fixed IP, we must set the gateway (local router) and the subnet, then we config the port we want by creating an object WiFiServer with int parameter.



```
WiFi.begin(ssid, password);
WiFi.config(ip, gateway, subnet);
Serial.print("Conectare la WiFi");
while (WiFi.status() != WL_CONNECTED) {
  delay(1000);
  Serial.println(".");
}
Serial.println("");
Serial.println("Conectat!");

Serial.println(WiFi.localIP());
wifiServer.begin();
```

Fig. 19. (Connecting to the Wi-Fi)

The Wi-Fi library is working very well with NodeMCU, so we can setup all the data before we turn on the connection.



```
WiFiClient client = wifiServer.available();

char status;
status = Serial.read();
if (status=='s')
{
  Serial.println(WiFi.localIP());
}

if (client) {
  while (client.connected()) {
    while (client.available()>0) {
      char c = client.read();
      if (c == 't')
      {
        temp = dht.readTemperature();
        umid = dht.readHumidity();
        String tempUmid=String(temp);
        tempUmid.concat(',');
        tempUmid.concat(umid);
        client.print(tempUmid);
      }
    }
  }
}
```

Fig. 20. (Sending data to the client)

Firstly, we need to make the server available via the loop function in the Arduino IDE. For debugging reasons, I created a variable named **status**, which will show me the IP address of the NodeMCU everytime I press the letter ‘s’.

The nested if statements if will validate the connection and will send data only when the client is ready to receive.

5. Conclusions

In this model, a project can be easily created and upgraded with better processors, multiple sensors, and, probably, a permanent solution by soldering the pins and creating a box to look like a commercial product. I used the TCP model because I wanted a good support from both Arduino and C#, plus getting confirmation on every packet sent into the network. This small project is capable of showing relevant data about the plant under observation, doing the routine tasks, the user being alerted only when the plant’s quality of life will be under or above the critical values.

As an improvement at the moment, Arduino Over The Air upload can be done with the Python scripts.

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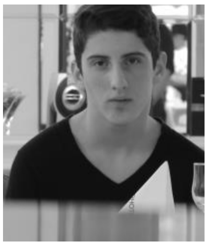

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Multi-user event planning web-application

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Given the fact that we live in a time when everything is surrounded by technology and most of the people are looking for faster and more efficient alternatives regarding their problems, developers must adapt and provide modern solutions. By doing a research, we discovered that event planning is a domain which has not registered any standing out improvements in terms of technology yet. Therefore, in this paper, we propose a web application for making event planning a more efficient process.

Keywords: *event planning, efficient, multi-user web application*

1 Introduction

Event planning is a relatively new industry in Romania, in 2018 being on the 26th place of 35 European countries [1]. This domain is in a continuous development process, new technologies, equipment and even services have started to appear. There have been developed new tools so that people could organize their tasks, manage the seating plan for the guests or even personalizing their own invitation cards.

Romanian people are very popular for their excitement when it comes to parties, even if we speak about weddings, anniversaries or even corporate parties, but organising an event could be a long term process, involving a lot of time and energy. As we live in a time when nobody has as much free time as they desire, people are prioritizing their tasks and are trying to find efficient solutions that do not take much time.

Organizing a party could be exhausting, because there are multiple elements that should be taken into consideration. First of all, event organizers must do a brief research in order to get acquainted with the latest offers and services in this domain. Additionally, they should take into account the number of guests and the budget so that they book appropriate services regarding their wishes and financials. It is also necessarily to verify if those companies are available on the day of the event and to ensure that they could offer the services you expect to.

Taking into consideration these aspects, we have decided to develop a web application that on the one hand, supports people in order to organise their party and on the other hand, provides a marketing platform for companies which activate in events planning field. This app is called “Plan it your style” and aims to optimize the steps of planning a party by automatically creating packages of service types offers. These packages will contain all the services needed in order to organize an event. They could include event locations, live music, decorations, candy bar, photo corner, fireworks, DJs and MCs, but restricted by the user’s budget.

Plan it your style also has a specialized interface for companies that provide services in event planning domain. This interface allows users to update their page with new information in any moment, without depending on people who are working for the app support and additionally, service providers could mention the dates that are no longer available.

2 Comparison with other software products

In event planning domain there has been developed a large variety of tools in order to help people when organizing a party. Most of them aim to inform users about the steps they need to follow in this process and are extremely useful especially for those who haven't any experience in this field. This kind of applications may seem like a guide which contains all the information and the tasks that should be done in order to get a successful result.

The first similarity between the presented app and the others is that they are free of charge. Therefore, the only taxes that a user must pay are those charged by the service providers.

One example of this type of application is Epic Plan (https://epicplan.ro/). Epic Plan offers users the possibility to create a personalized to do list which includes all the details that should be taken into account. It also provides a functionality that keeps track of expenditures where people can save the total price, the advance payed and also the remaining value that should be payed. In addition, Epic Plan has two more functionalities regarding the guests. The first one refers to a list where there are saved details about the guests. The list holds information about the name, the number of persons that he is accompanied of, the number of the table, the menu (standard/vegetarian), the relationship (friends/family), the email and also a checkbox that displays if the guest has accepted the invitation or not. The second functionality allows the user to manage the perfect seating plan by simply drag and drop the guests from a list.

Another type of software product is the one which is based on the concept of online full-service agency. This type of application offers the opportunity to preview companies that provide a variety of services in only one web page. In this way, users will easily find all the services that are interested in, without consuming much time. The application offers information regarding the starting prices, a description of the company, reviews from other clients, contact details and also images that promote the products. An example of this kind of application is Fiestador (https://fiestador.ro/). Fiestador also has an interface for companies which provide services like photography, events location, candy bar, photo corner and many others.

There are multiple similarities between the presented software products and the one described in this paper. Plan it your style comes up with solutions for organizing the budget like Epic Plan does and it could also be named as an online full-service agency because in a single page users will find all the services they wish for.

3 Innovative functionalities

The presented application provides some innovative solutions apart from the ones described in section 2. One of them is that it focuses on the concept of personalization for both types of users: event organizers and service providers. For an event organizer, the process of personalization starts by completing a form, which contains three sets of images. Each image has associated a style and depending on the number of images selected from each style, the one with the maximum number is the result. When it comes to a service provider, they must choose their style in the registration form. The form contains a section where all the predefined styles will be listed along with their descriptions. In this way, a service provider will select the style which considers that suits the best their company's image.

Another new concept is the opportunity of automatically generating packages for the event planners. In order to create a package, a user must complete a form which contains three parts. The first one consists of event details like event type, number of guests, budget, the event date and the city, while the second part is represented by the style defining which has been described by the personalization process. Last but not least, the third part of the form contains a checklist of service types. Each user must select a service type that wants to be included in the package. After filling in all the parts, the application applies an algorithm in order to display the resulted style and a set of packages of offers whose value fit in the budget. The offers belong to service providers that match the event's style and are also available on the event date.

For those who do not want to generate packages automatically, Plan it your style offers the opportunity of customising packages. The application contains a section named "My packages" where users can manage their sets of offers. They can add new offers to existing packages by surfing on service provider's personal pages. After the insertion, the value of the package will be automatically calculated by the program.

Another innovative functionality for event planners is a page that will display all sort of statistics regarding the latest trends in terms of parties. The page consists of four bar charts that present the most popular service categories for every event type, the medium budget for all event types, the most popular styles and also the party types distribution on months. In this way, people who do not know much about events will be well informed.

In terms of service providers' interface, the innovative functionality is that they have the opportunity to personalize their page at any time and that they can manage their already booked dates.

4 Designing the application

In order to benefit of the application functionalities a user must log in. If he has not an account yet, he will complete a registration form. After logging in, the user will be redirected to the start page which contains a menu where the user can access the main functionalities. These functionalities are displayed in **Fig. 1.** through the general use case diagram.

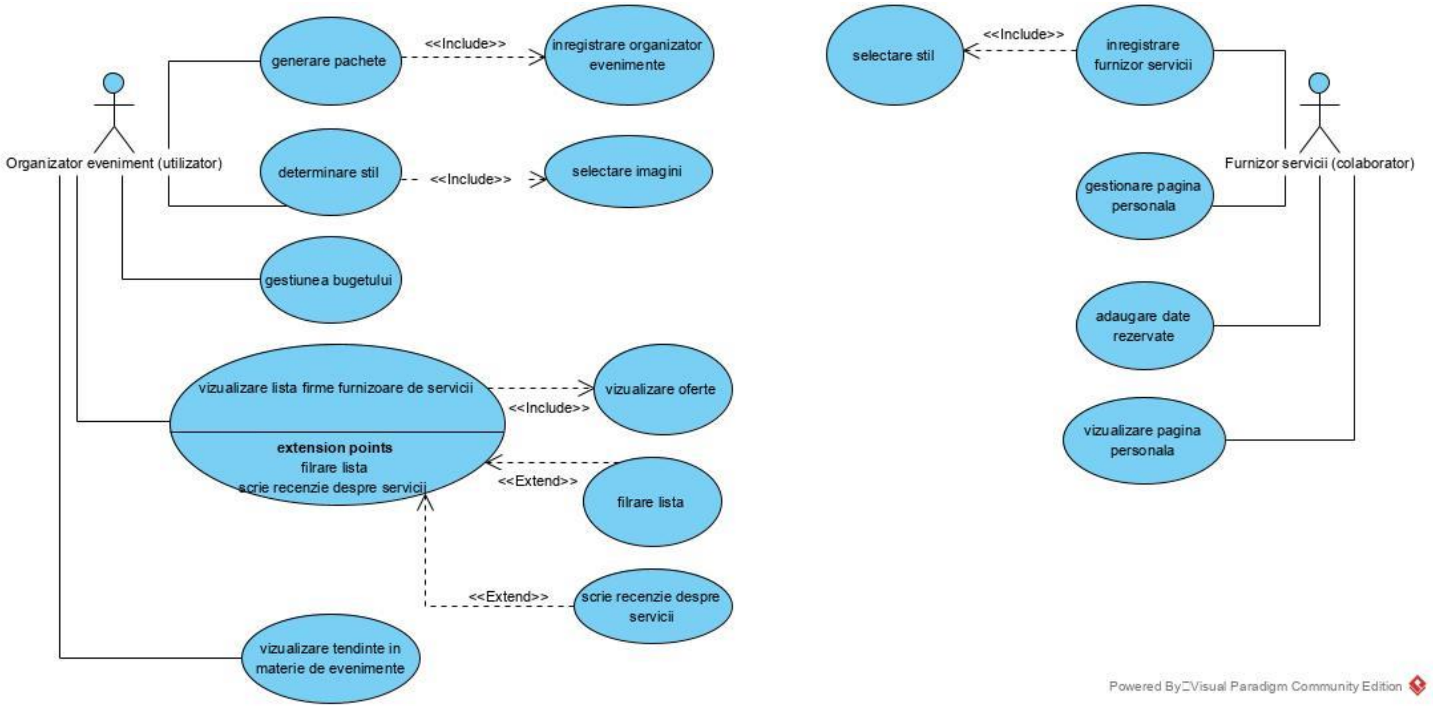
generare pachete
<<Include>>
inregistrare organizator evenimente
Organizator eveniment (utilizator)
determinare stil
<<Include>>
selectare imagini
gestiunea bugetului
vizualizare lista firme furnizoare de servicii
extension points
filrare lista
scrie recenzie despre servicii
<<Include>>
vizualizare oferte
<<Extend>>
filrare lista
<<Extend>>
scrie recenzie despre servicii
vizualizare tendinte in materie de evenimente
selectare stil
<<Include>>
inregistrare furnizor servicii
Furnizor servicii (colaborator)
gestionare pagina personala
adaugare date rezervate
vizualizare pagina personala
Powered By Visual Paradigm Community Edition

Fig. 1. General use case diagram

The use cases that need to be detailed are: the budget organizer, the management of the service provider's page and also the package generator. **Fig. 2.** depicts the actions that a user can do through the budget organizer page (insert, update or delete an expenditure, view the general situation regarding the expenditures).

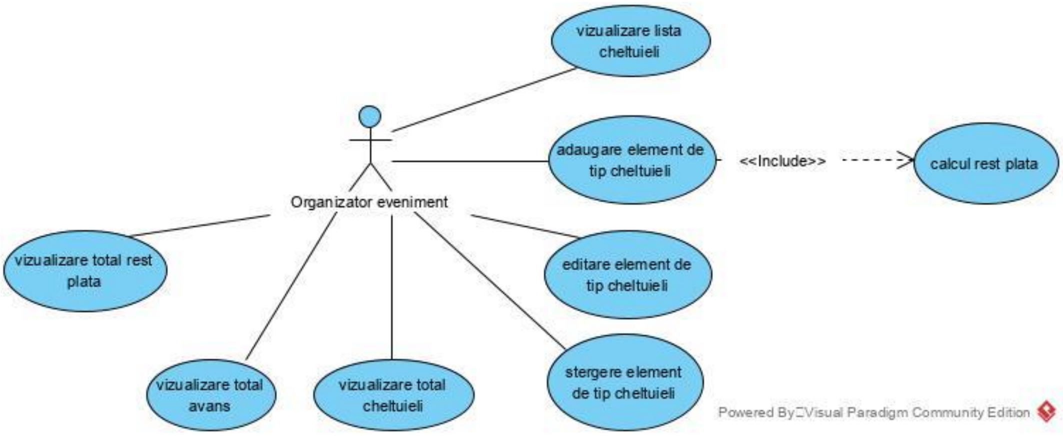
vizualizare lista cheltuieli
Organizator eveniment
adaugare element de tip cheltuieli
<<Include>>
calcul rest plata
vizualizare total rest plata
editare element de tip cheltuieli
vizualizare total avans
vizualizare total cheltuieli
stergere element de tip cheltuieli
Powered By Visual Paradigm Community Edition

Fig. 2. Budget organizer use case diagram

Fig. 3. describes the functionality of managing the personal page associated to the service providers' interface. A service provider can update the company's description, the profile picture and the contact information. This kind of user can also add, update or delete offers and presentation images.

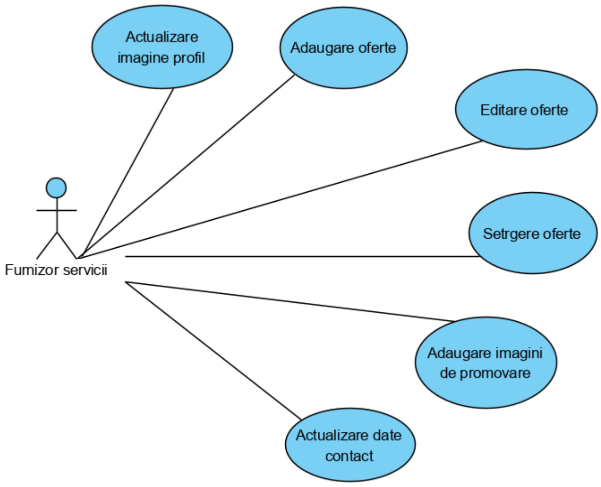

Fig. 3. Personal page management use case diagram

In **Fig. 4.** there is described the detailed use case diagram for generating packages. It can be observed that an event organizer can generate a package automatically by filling in a form or he can customize one by selecting service providers' offers.

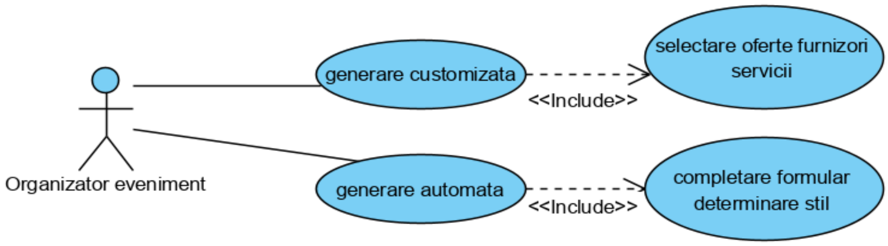

Fig. 4. Package generator use case diagram

When starting to complete the form in order to generate packages, the user should respect some rules so that he can successfully finish this action. For example, in the first part of the form all fields must be completed, where as in the second part, the user should select three images from each presented set. Regarding the last part, the event planner must choose at least one service type that he wants to include in the package. If the user does not respect any of the presented conditions, the access to the following parts will be restricted. The diagram displayed in **Fig. 5.** describes the whole process of filling in the form and displaying the result through an activity diagram.

The algorithm of automatically generating packages is based on a successive data filtering. First of all, using an SQL interrogation it will be retrieved from the database a list of service providers' offers. These offers belong to service providers that match with the resulted style of the event and that are also available on the day of the event. The next step refers to building a dictionary, which is defined as a collection of keys and values. Therefore, the service types will represent the keys and the list of offers corresponding to each service type will represent the values. In this way, the collection is easily manipulated. In order to make this whole process more efficient, the program will calculate the minimum, maximum and the average value of the packages based on the offers from the dictionary. After that, the user's budget will be compared with the

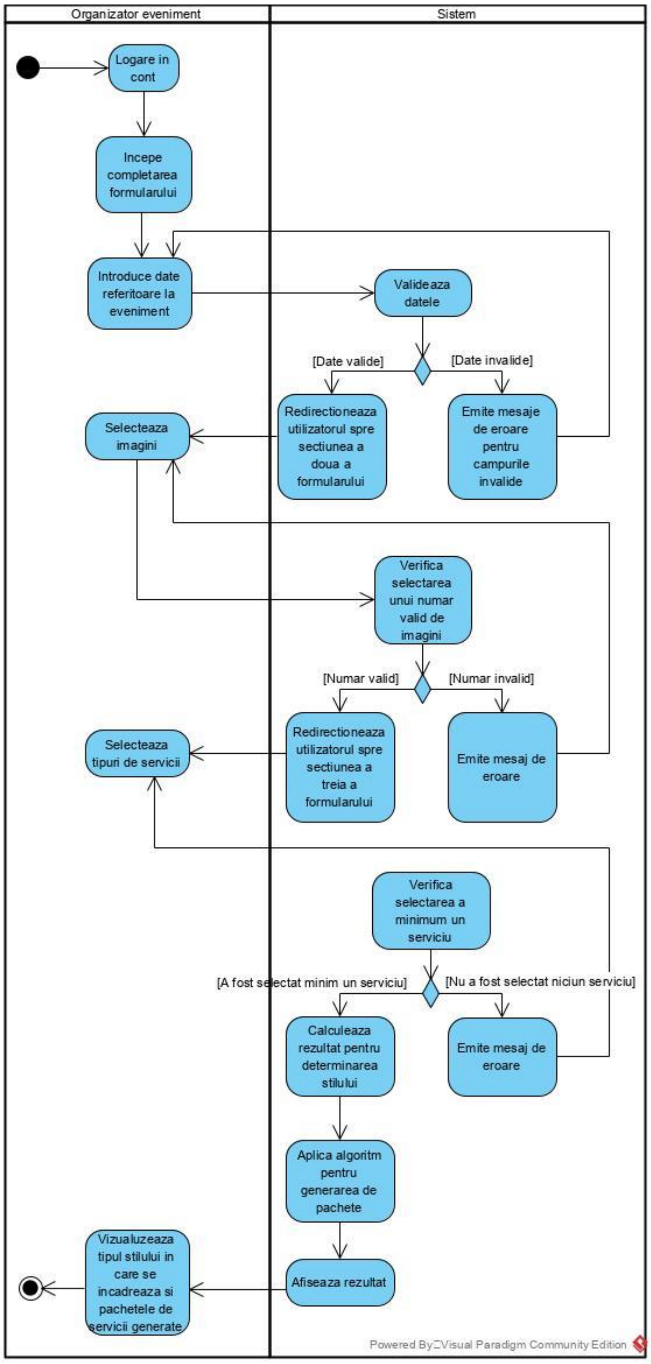
Organizator eveniment
Sistem
Logare in cont
Incepe completarea formularului
Introduce date referitoare la eveniment
Valideaza datele
[Date valide]
[Date invalide]
Redirectioneaza utilizatorul spre sectiunea a doua a formularului
Emite mesaje de eroare pentru campurile invalide
Selecteaza imagini
Verifica selectarea unui numar valid de imagini
[Numar valid]
[Numar invalid]
Redirectioneaza utilizatorul spre sectiunea a treia a formularului
Emite mesaj de eroare
Selecteaza tipuri de servicii
Verifica selectarea a minimum un serviciu
[A fost selectat minim un serviciu]
[Nu a fost selectat niciun serviciu]
Calculeaza rezultat pentru determinarea stilului
Emite mesaj de eroare
Aplica algoritm pentru generarea de pachete
Afiseaza rezultat
Vizualuzeaza tipul stilului in care se incadreaza si pachetele de servicii generate
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Fig. 5. Automatically generating packages activity diagram

earlier calculated values and it will be determined in which interval fits. The possible intervals are the following: [0, minimum_value), [minimum_value, average_value], (average_value, maximum_value] or grater than the maximum value. When the budget fits in the second or the third interval, the dictionary will be filtered by keeping just those offers which have a price between the lowest priced offer and the medium priced offer in that category, respectively between the medium priced and the most expensive offer. After the filtering, all the remaining offers are suitable candidates for being included in the generated packages, because the price belongs to the same category as the budget, the service providers match the event's style and all of them are available on the event day.

The database schema is presented in **Fig. 6.**

Therefore, it will be created a set of packages by randomly selecting offers from the filtered map, one offer for each type of service, but with the condition that the total value of the offers will not go over the budget.

On the other hand, if the user's budget is lower than the minimum possible value, the initial dictionary of offers will be filtered and will store just those offers that have the minimum value for each category. Each service type has a priority form 1 to 3, priority 1 being the most important. Therefore, the dictionary will be sorted by priority and by price and then the last offer will be removed in order to verify if the value is still over the budget. The action of removing offers will be done until the value will fit the budget.

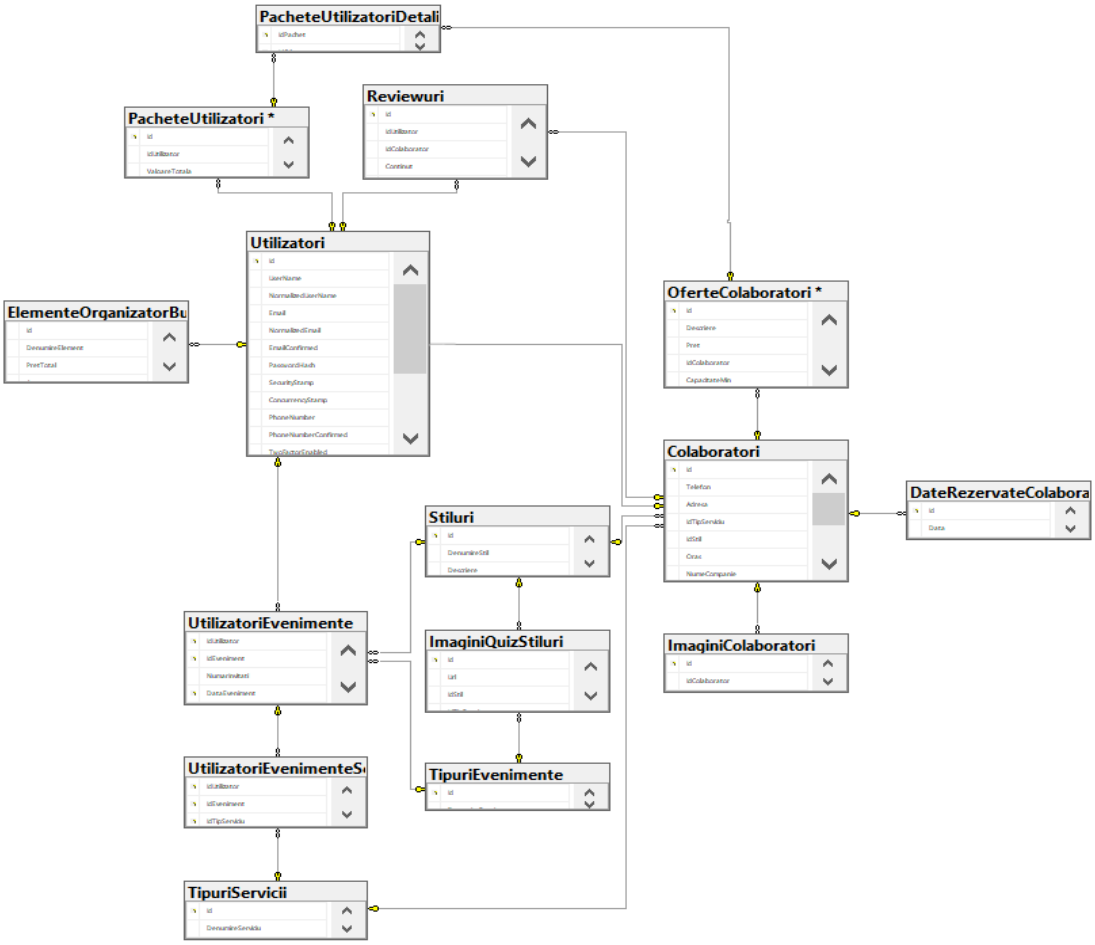


Fig. 6. Database schema

5 Software technologies

Plan it your style is an app with a REST Api architecture. REST stands for Representational State Transfer and it represents an architectural style being often used in the development of web services. REST does not enforce any rule regarding how it should be implemented at lower level, it just imposes high level design guidelines and gives you freedom in choosing your own implementation [2]. In addition, both the client and the server components can be build independently, without each knowing about the other. This means that the code on the client side can be changed at any time without affecting the operation of the server, and the code on the server side can be changed without affecting the operation of the client. Although, the messages format should be respected during the communication between the two components, otherwise the system will no longer work correctly.

The communication between the client and the server starts with a request of a client to the server in order to retrieve information or to modify data on the server. A request has a standard format and must contain a HTTP verb (GET, PUT, POST or DELETE), which will define what type of operation to perform, a header that allows the client to pass along information about the request, the path to the source and an optional message called body message that contains all the data a client sends to a server [3].

Methods defined by the HTTP verbs are in close connection with the CRUD concept. CRUD is an acronym for CREATE, READ, UPDATE, DELETE. These form the standard database commands that are the foundation of CRUD. When an Api is build, we want to create a model that has the ability to perform at most these four functions so that it can be considered complete. Therefore, in order to create new resources, in a REST Api architecture, most of the times we will use HTTP POST method. Also, for reading data it will be used HTTP GET, for updates HTTP PUT and for delete actions we will use HTTP DELETE method.

In order to make the communication between the client and the server more efficient and more secure, it has been used a JSON Web Token (JWT) mechanism. JWT is an open standard (RFC 7519) that defines a compact and self-contained way for securely transmitting information between parties as a JSON object. This information can be verified and trusted because it is digitally signed [4]. Therefore, when a user loges in, the application will generate a unique token that will be valid until the user loges out. This token will be passed along with every request to the server, in this way, the profile of the user who sent the request being kept privately. The token has a standard format and consists of three parts separated by a dot (General format: xxxxx.yyyyy.zzzzz).

Plan it your style is an application that was implemented using ASP .Net Core and Angular technologies. ASP .Net Core is a framework developed by Microsoft which is usually used for creating modern web applications. It has a modular architecture and more advanced features can be added as NuGet packages, depending on the application’s requirements. Therefore, ASP .Net Core provides benefits like high performance, less memory required, less deployment size and easy maintenance. [5]

In terms of server-database communication, we utilized a technology named Entity Framework Core. This framework is used as an object-relational mapper (ORM), enabling developers to work with a database using .Net objects, this way reducing the amount of code they needed to write in order to access the data.

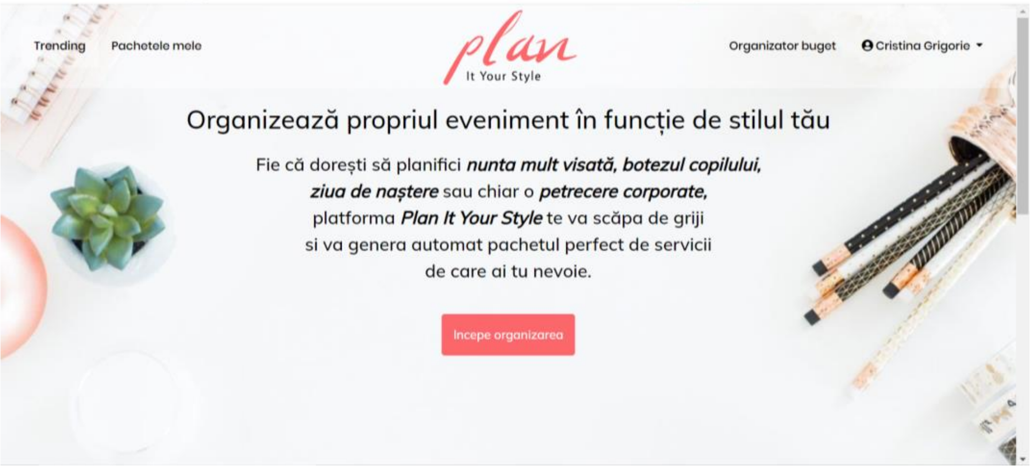
Regarding the client implementation, it has been utilized Angular technology. Angular is an open-source front-end web framework that uses HTML and TypeScript. An angular application is defined by a set of NgModels, which provide a compilation context for components. Components define views which are sets of screen elements from the application and use services in order to provide specific functionalities, but are not directly related to views [6].

In terms of the database administration, it has been used SQL Server Express along with Microsoft SQL Server Management Studio, which provides a user-friendly interface in order to manage the data. SQL Server Express is a database management system that can be used to store and access the information held in many different databases. It uses SQL, which is a domain-specific language utilized in programming for maintaining data stored in a relational database system.

6 Application's Interface

The presented application has a user-friendly interface for both kind of users (**Fig. 7.**). All the actions that can be done are very intuitive, being suggested by suitable pictograms. For instance, the action of deleting an item will be presented as a trash can icon.

In addition, the main functionalities will be presented in the application menu, so that they can be easily accessed.

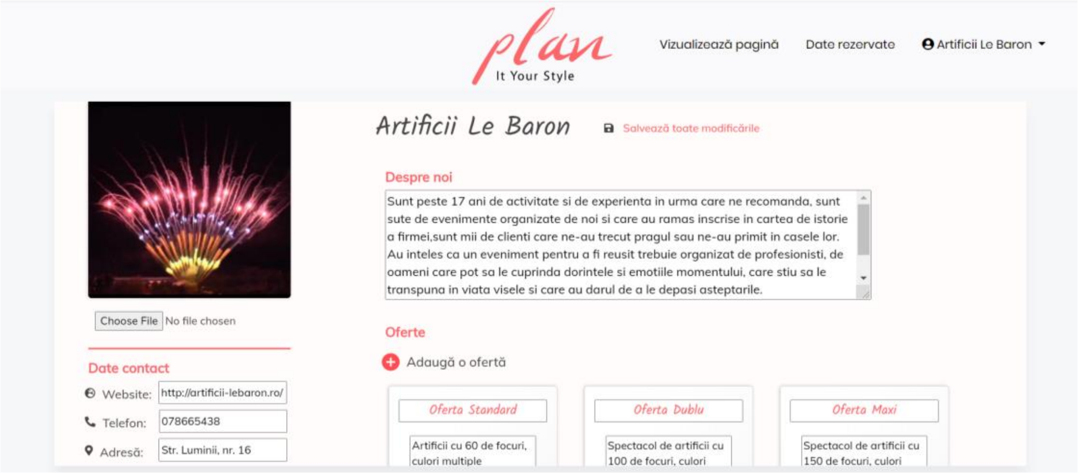


Organizează propriul eveniment în funcție de stilul tău

Fie că dorești să planifici ***nunta mult visată, botezul copilului, ziua de naștere*** sau chiar o ***petrecere corporate,*** platforma ***Plan It Your Style*** te va scăpa de griji si va genera automat pachetul perfect de servicii de care ai tu nevoie.

Fig. 7. Event planner interface main page

When it comes to the service providers' interface (**Fig. 8.**), the main page is represented by the management of their personal page. Here, service providers are able to update offers, to add or delete presentation images or even to change their profile picture.



Artificii Le Baron

Despre noi

Sunt peste 17 ani de activitate si de experienta in urma care ne recomanda, sunt sute de evenimente organizate de noi si care au ramas inscrise in cartea de istorie a firmei,sunt mii de clienti care ne-au trecut pragul sau ne-au primit in casele lor. Au inteles ca un eveniment pentru a fi reusit trebuie organizat de profesionisti, de oameni care pot sa le cuprinda dorintele si emotiile momentului, care stiu sa le transpuna in viata visele si care au darul de a le depasi asteptarile.

No file chosen

Date contact

Website: http://artificii-lebaron.ro/
Telefon: 078665438
Adresă: Str. Luminii, nr. 16

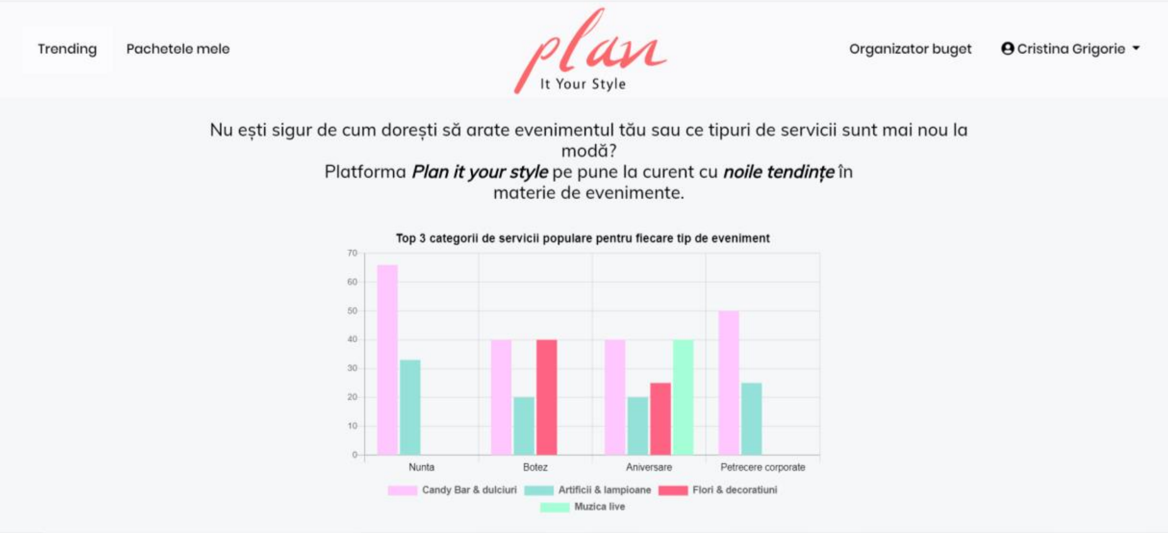
Oferte

Oferta Standard	Oferta Dublu	Oferta Maxi
Artificii cu 60 de focuri, culori multiple	Spectacol de artificii cu 100 de focuri, culori	Spectacol de artificii cu 150 de focuri, culori

Fig. 8. Service provider interface main page

Through their specific interface, event planners can automatically generate packages, as there has been presented in the previous sections, they can also customize packages, visualise the service providers list, organize their budget and last, but not least, they can inform about the latest trends in terms of events.

In **Fig. 9.** there is depicted a bar chart that displays the most popular service types for each event category. It can be observed that for an anniversary the top 3 service types are candy bars, live music and decorations, whereas for a corporate party the most popular are fireworks and candy bars.

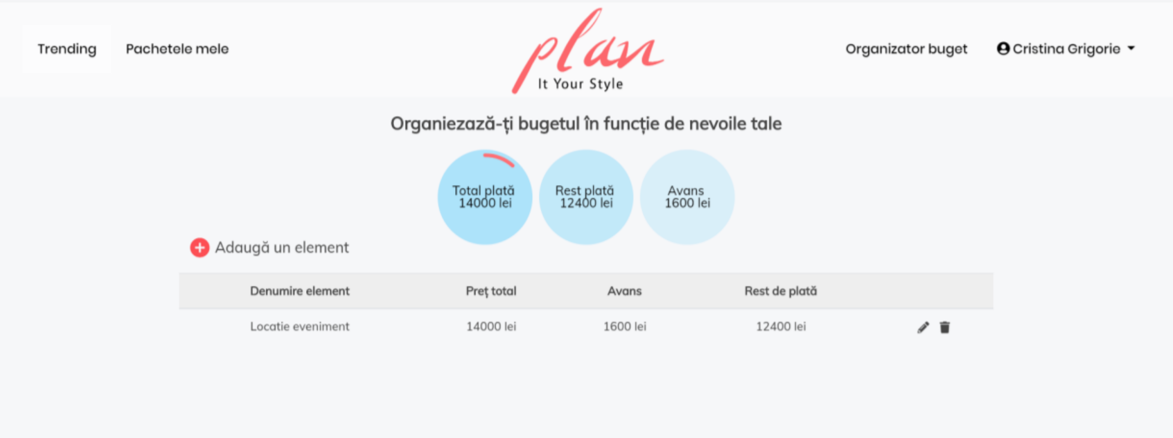


Nu ești sigur de cum dorești să arate evenimentul tău sau ce tipuri de servicii sunt mai nou la modă?
Platforma ***Plan it your style*** pe pune la curent cu ***noile tendințe*** în materie de evenimente.

Top 3 categorii de servicii populare pentru fiecare tip de eveniment

Fig. 9. Most popular service categories for each event type chart

Regarding the budget organizer (**Fig. 10.**), the page consists of two sections. The first section presents the general situation of the expenditures, containing details about total value of the expenditures, the total advance that was payed and the total remaining payment. Also, in order to highlight the percentage that has already been payed from the total sum, it has been used a progress bar. The second part of the page is represented by a table where there are stored the expenditures along with their details: name, total value, advance payment and remaining payment. In addition, the user can edit or delete any of the existing elements from the table. After every action on these items, the values from the first section will be automatically updated by the program.



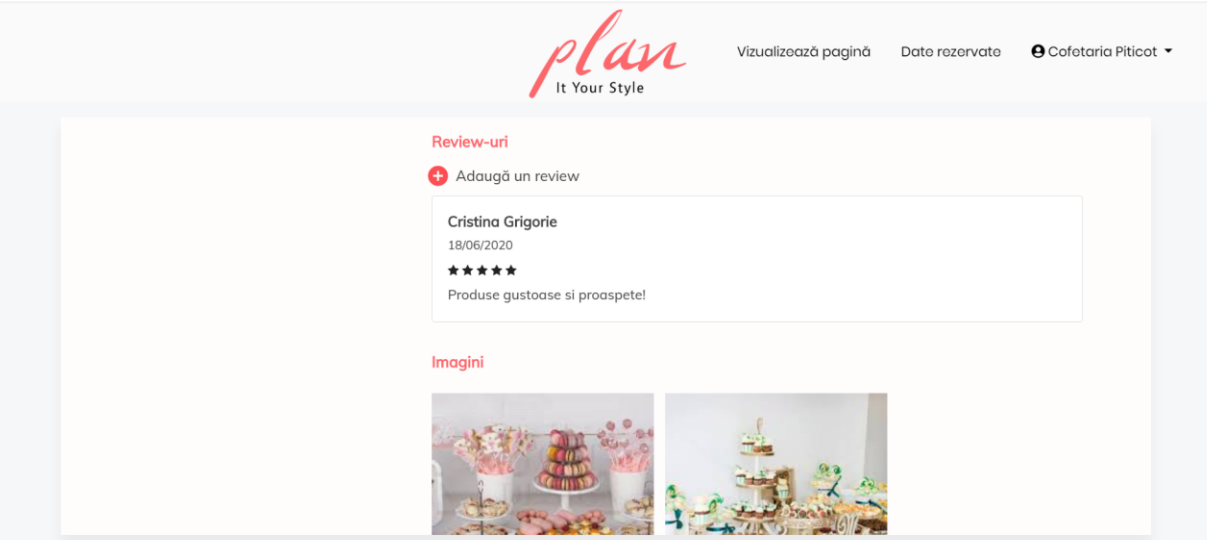
Organizează-ți bugetul în funcție de nevoile tale

Denumire element	Preț total	Avans	Rest de plată	
Locatie eveniment	14000 lei	1600 lei	12400 lei	✎ 🗑

Fig. 10. Budget organizer page

In terms of a service provider interface, the functionalities that he can benefit of are managing the personal page, viewing his page as an event planner user and also manage the already booked dates.

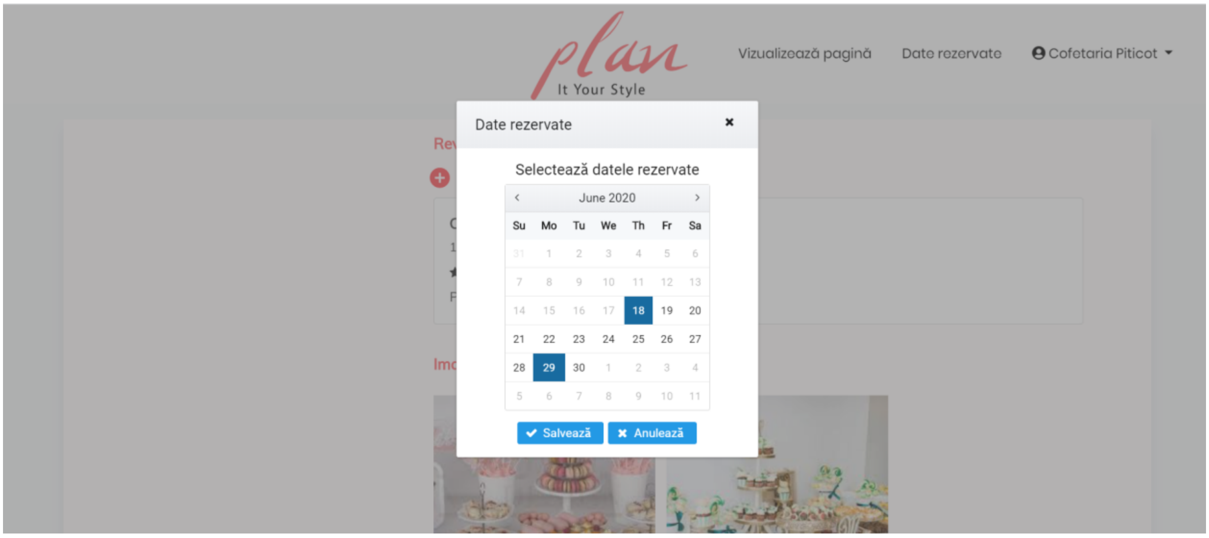
Because we consider that feedback is an important aspect, we have offered the possibility to the service providers to view their page as they were an event planner user. Apart from the elements they have added through the management section, they will be able to see the reviews from other clients (**Fig. 11.**). This way, service providers can improve the quality of their services and will be informed about whether the event planners enjoyed the experience of working with them or not.



Cristina Grigorie
18/06/2020
★★★★★
Produse gustoase si proaspete!

Fig. 11. Review section from view page option

Regarding the booked dates management, a service provider can acces the option form the main menu. This way, it will be displayed a pop-up with a clendar where the already booked dates are highlighted (**Fig. 12.**). In case an event was cancelled, a user can make that date available again. In order to save the changes, the service provider must press the save changes button.



Su	Mo	Tu	We	Th	Fr	Sa
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4
5	6	7	8	9	10	11

Fig. 12. Reserved dates functionality

7 Conclusions

In conclusion, Plan it your style is an application that aims to make the event planning process more efficient by automatically generating packages of offers. In addition, the presented application focuses on both types of users, trying to make their experience a pleasant one by providing a user-friendly interface and multiple functionalities. Plan it your style is an app that concentrates on people's needs and because every person has a different personality, this solution is based on personalization. In this way, event planners will see offers that they are interested in and that match with their style, whereas the service providers will benefit of the opportunity of being included in event planners' packages that have the same vision as they do in terms of planning a party.

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Application assisting tourists with integrated information from certain areas of interest

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Travelling often involves the contact with a wide range of information from many sources. Organizing a vacation in a city like Bucharest, relatively chaotic and quite unfriendly to those who are not familiar with its rhythm and characteristics, especially if they are not Romanian speakers, can be an unpleasant process. Thus, this paper aims to develop an application that will serve as a tool in conducting a vacation in Bucharest in accordance with the needs, desires and preferences indicated by the user. The knowledge and activities of a local tourist guide, the promptness of a personal advisor, the availability of an expert and reliable friend are the activities that will represent the core of the application.

1 Introduction

Bucharest, the city of all possibilities, the one that never sleeps, impossible to know entirety and that can offer anyone the most diverse experiences, has started to become more and more attractive. Its contrasts, diversity, picturesqueness, fun, culture have made it more and more attractive for tourists in recent years.

Intense economic life and low prices are other reasons why tourists choose to come to Bucharest.

Official statistics show that Bucharest is the most visited city in Romania, in recent years the annual number of tourists is around 2 million people, with an average length of stay of 2 days. Only a third out of them come for relaxation, most arriving here for business, congresses and conferences. Most foreigners arrive in the capital from Israel (almost 170,000). 104,000 tourists come from the USA, from Italy - 92,000, from Germany - 82,000, from Great Britain - 80,000 and from France - 72,000. [1] [3]

In addition to being the capital of the country, Bucharest is also the "capital" of Romanian IT, with the largest number of companies and employees in the field and a dynamic growth trend.

In addition, we can boast about a very good internet speed and the first steps towards testing 5G technology, a technology that will increase the speed of the current 4G technology. A well-known company, Vodafone Romania, activated in the spring of 2019, in several areas of Bucharest (Unirii and Pipera), its own 5G network, a network that will be extended to other areas in Bucharest and other cities in Romania. [2]

The motivation for designing an IT application in the field of tourism for Bucharest, designed according to the type of tourist arriving in Bucharest, taking into account the characteristics of this segment and its potential needs, arose due to the non-existence of an application to focus on the end user, on his wishes, needs and interests as a visitor.

The "BucharEST" application is therefore designed taking into consideration certain characteristics of tourists, paying attention especially to the middle class, for which time and price are two of the most important reasons to buy. The application will interact with the user and will provide information on the various ways of spending free time in the city, depending on the interests he will indicate and ordered in descending order according to the time the tourist intends to spend in Bucharest.

2.Presentation of functionalities

The purpose of the application is to maximize the satisfaction generated by the trip and in order to do this, it will provide the most appropriate suggestions to positively influence the user's choices, based on his needs and personality.

The application will focus on the user's statements related to his wishes during his stay and his likely needs and will provide a series of information about the most beautiful places in Bucharest and the activities that can be done here, grouped into two categories: " Recommended for you ”and“ Good to know ”.

The "Good to know" section contains useful information that responds to needs that exist or have arisen during the visit, needs related to:

- health (112, emergency hospitals, pharmacies)
- beauty salons
- childcare services
- pet services
- weather information, including the most appropriate time for travel
- safety
- traffic
- local customs
- ATM
- free or almost free activities

GPS location services are used to improve the experience, in order to highlight the user's location and the objectives of interest.

In addition, the user who declares that he is coming to Bucharest for business purposes will also have information on certain useful services for business (consulting or various services for expats).

In the "Recommended for you" section, the application will respond to the user's wishes and will generally suggest the most suitable 6 locations for:

- food & drinks
- outdoor walks
- museums
- coffee & bars
- sports & spa
- shopping
- casino
- nightlife
- transport
- local guide

The information and implicitly the personalized tourist offer will be calibrated based on the user's answers to a questionnaire with a number of 11 questions, addressed in the form of a questionaire. After completing the test, the information can be viewed at any subsequent access to the application. If the user changes his mind about the answers initially provided, the test will be able to be repeated to provide other answers and to benefit from other suggestions.

Each question will allow the user to choose one of the approximately 4 answer options and will indicate the tourist's preferences regarding the following areas of interest: dining places, outdoor activities, cafes, museums, sports & spa, casino, shopping, nightlife, local guides and transport services. Each area of interest will bring to the tourist's attention about 6 offers, ordered in descending order, either according to the assessments obtained on the Trip Advisor application, or according to the developer's assessment, so that the tourist can make the right choice, taking into account the time available and their own inspiration.

Regarding the field of dining places, the tourist will be able to choose one of the 4 categories: Romanian cuisine, fine international cuisine (fine dinning), fast food or home delivery services.

The offer related to cafes and bars will bring to the user's attention luxury cafes, cafes with a good quality/price ratio or that offer "coffee to go" services, and if he answered that he is not a coffee lover he will be tempted with 6 of the the most beautiful teahouses in town.

In terms of outdoor activities, you the user will be able to choose from the parks in Bucharest, impressive streets and facades, bike trails or a City Tour, if his option indicates the desire to walk less.

Bucharest museums will be presented taking into account their variety and specificity - art for the art-loving respondent, those with

Romanian specifics for the curious interested in the uniqueness of the place, various for the declared lover of museum visits and virtual tours for the skeptic who does not think a visit to a museum might be a good idea for him.

Visitors interested in sports and spa will have a choice between locations where they can find both services or just some of them and those who declare that they are not interested in sports or spa will be able to view locations where they can play bowling, darts, billiards or other such games.

The transport options will allow the user to choose between public transport, taxis, rental cars or a simple City Tour, and shopping options between traditional gift shops, malls or shops with elegant outfits.

Regarding the nightlife, the visitor of Bucharest will be able to choose between clubs with a lively atmosphere, clubs more suitable for socializing and drinking a cocktail or bars where he can have dinner or participate in karaoke. If the user's statement is that he is used to falling asleep early and then he will still be curious to see what he could do later in the night, the Old City Center will be the offer that will be presented to him, as the most suitable location from the perspective of diversity, for an undecided person. Gambling lovers will have a choice between the most attractive casinos in Bucharest.

In addition, the visitor will be able to choose if he wants a personal guide for the period in which he visits Bucharest or if he will be his own guide using the application "BucharEST", Google Maps and a tourist guide in pdf format.

3.Analysis and design

The use case diagram will be used as a tool for identifying and modelling the functional requirements provided by the application.

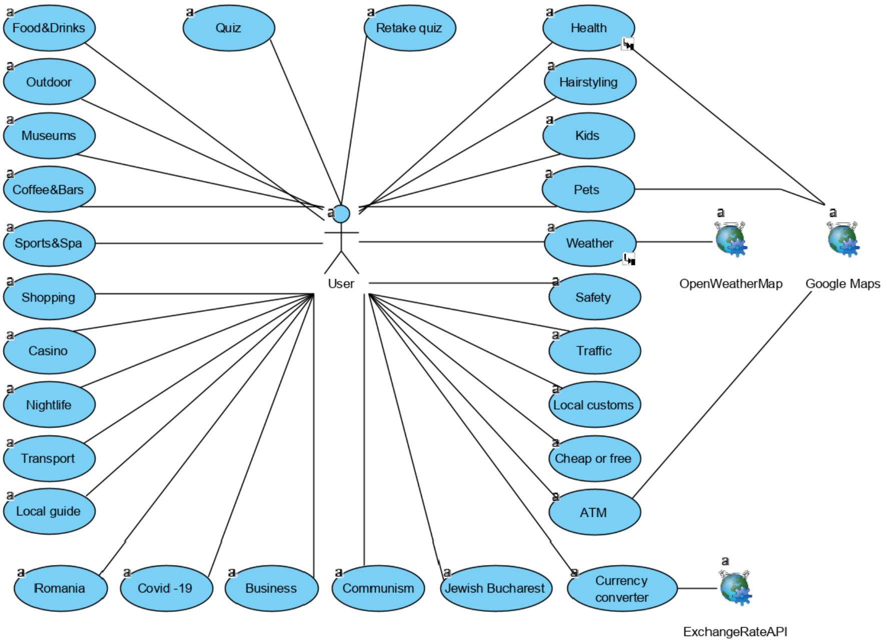


Fig. 1 – Use case diagram

According to the general use case diagram, we can identify a single actor, the user of the application, who after completing the quiz will have a wide range of information available for consultation.

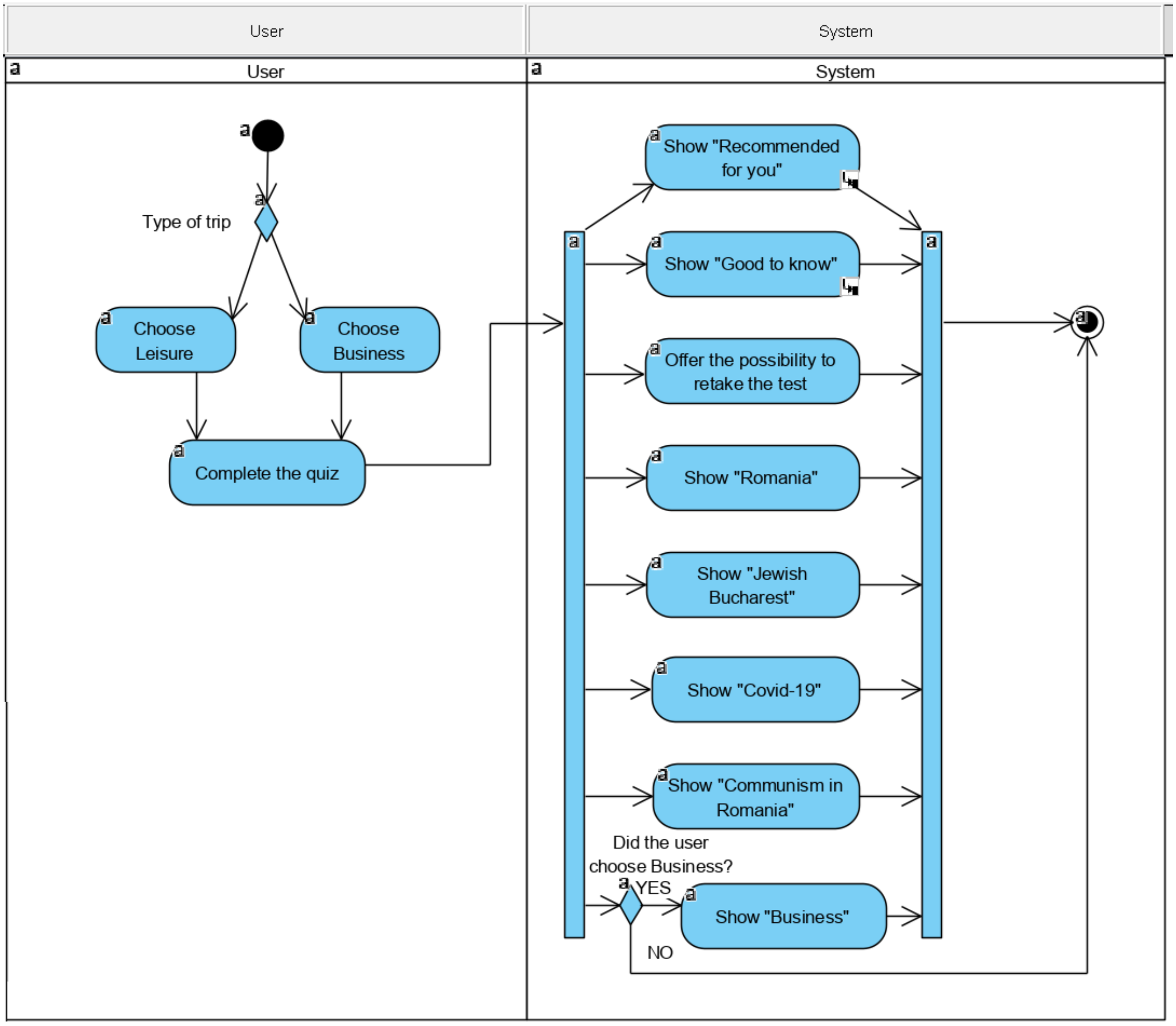


Fig. 2 – Activity diagram

This diagram highlights the course of a user's actions.

The user indicates the type of vacation he will spend in Bucharest, respectively Leisure or Business. He then completes a personality test, at the end of which he is brought in front of a menu from which he can view the "Recommended for you" section, the "Good to know" section, a section with information on activities that can be done outside Bucharest, a page with information on the situation of Covid-19, a page containing information about the story of communism in Romania.

In addition, the application provides the user a link to a website that contains information about the Jewish culture in Bucharest.

If the user has chosen Business trip, the menu will display an additional section with options of interest to him. Also, the user has the option to retake the personality test.

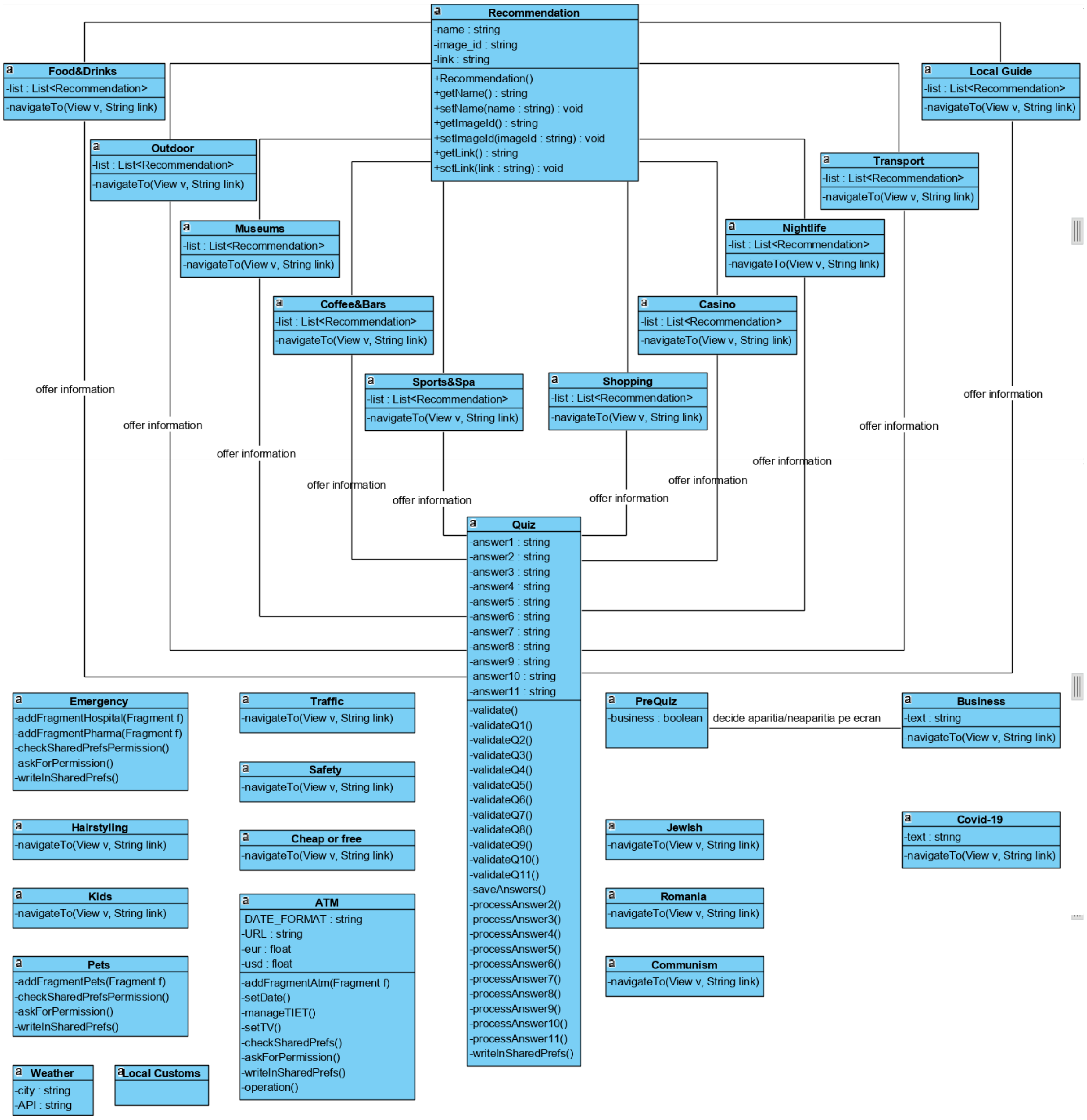


Fig. 3 – Class diagram

The class diagram presents the structure of the system, by including the classes and the relationships between them.
The purpose of this diagram is to highlight the attributes, operations, and associations between classes.

4.Implementation

After the user has answered the questions in the personality test, his answers are persisted in a preferences file. At the same time, a query is made to the firebase database and the data is brought in a map structure in which the key is of String type and represents the possible answers to the questions in the questionnaire, and the value is of List type parameterized on objects of type Recommendation and represents the list of recommendations for each response variant.
When the user selects a specific topic (for example Food & Drinks), a topic that is technically transposed into the application as an activity, this activity contains a list retrieved based on his answer from the preferences file, which is the key in the map data structure, which simulates a data caching mechanism. This list is displayed

to the user.

When the application is closed, the user's responses remain in the preferences file. This ensures that the user is not required to complete the questionnaire on subsequent access to the application. However, if the user wants to change his answers in the personality test, he will be able to do so through an additional functionality ("Do the test again"), through which, from a technical point of view, certain entries in the preferences file are overwritten.

5.Database design

The application uses as persistence level a non-relational database, implemented using Google technology - Firebase. It uses a multi-level hierarchical JSON file. Thus, there is one node for each category of activities. These nodes contain four other nodes that correspond to the interpretation of the user's answers in the personality test. Each of these nodes generally contains six elements, which include information relevant to the front-end pages. The information is based on the location name, as well as two additional fields: the image id and the URL to the official website.

6.Technologies

Android SDK – Android Studio

Android SDK (Software Development Kit) is the essential tool for developing Android applications. It contains useful libraries for programming mobile applications and the means necessary to run applications on different emulators, to perform the debugging process, to monitor the logs of running applications (LogCat console) and others. In addition, the kit contains the Gradle plugin, a system that deals with satisfying project dependencies by purchasing external libraries.

Android Studio is a standard integrated development environment (IDE) that provides the functionality needed to implement applications for the Android operating system. It is based on the IntelliJ development environment and offers the possibility to write applications in Java, Kotlin or C++. The development environment provides a user-friendly interface with an easy-to-follow directory structure. Thus, the files are organized as follows: the AndroidManisfest.xml file (application configuration file) is included in the “manifest” directory and the .java files are integrated in the “java” directory. In addition, for all resource elements, the development environment has a "res" directory in which various images and icons will be included in "drawable", fonts in "font", menus in "menu" and other files needed for the application in the "values" directory. There is also a directory called "layout" which will include all xml files, files disconnected from Java code, which define the interface objects such as buttons, textviews and the like. [4]

Java

Java continues to be one of the most widely used programming languages even 24 years after its release. One of the main advantages it brings is the independence of the platform, being able to run on almost any platform.

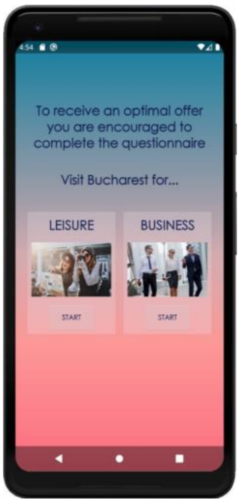
This programming language has 3 editions: Standard Edition, Enterprise Edition and Mobile Edition. It is mostly an object-oriented language, in which the general conventions for naming packages, classes, constants, methods, and variables are used. [5]

Firebase

Firebase is a service created by the Google team and is intended for both web and mobile platforms. Its capabilities are vast and involve the persistence of data in non-relational databases, real-time notifications regarding the updating of tables or the structure of the database. In addition, the service provides cloud storage for binary files, the most common being images. In order to ensure an extra security, but also a communication flow free from threats, the authentication of the application to the service is done through an encrypted token. [6]

In this project, the capabilities of the Firebase service were exploited only in terms of authentication between application and service, persistence of data in the non-relational database and real-time notifications. An important aspect from the point of view of the communication flow between Firebase and BucharEST app is the data format, structured in JSON files, characteristic of REST services.

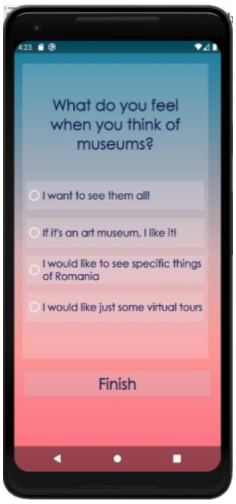
7.Visual presentation of the application


To receive an optimal offer you are encouraged to complete the questionnaire

Visit Bucharest for...

Fig. 1 - Possible user choices

Upon entering the application, the user indicates the purpose of his trip: relaxation or in the interest of business.


What do you feel when you think of museums?

○ I want to see them all!

○ If it's an art museum, I like it!

○ I would like to see specific things of Romania

○ I would like just some virtual tours

Fig. 2 – Example of a question in the quiz

He then receives a set of questions with a single answer. To move on, the user is required to answer all questions. After completing the test, the user reaches the main page.

For each category of interest, the user will receive results according to his answers in the personality test.

The results are materialized by a location name, an image and the possibility to navigate by clicking on the image, to the official website of the location, if it exists, or to another relevant website (for parks for example, Google Maps).

The application has a navigation drawer menu with which the user can navigate through the application.

The "Good to know" section contains information of an informative nature, some of general interest, others relevant to certain, specific situations.

For example, the “Emergency” section informs the user of the questions that a caller will need to answer when dialling 112, so that he can get help as quickly as possible. A map of emergency hospitals and a map of pharmacies is also included. Because Google Maps requires the location of the user's device to provide complete information, the user is required to be allow the app to access his location. If he offers it, his device will be able to be located on the map in a visible way, the user being able to see the hospitals or pharmacies and his current location. Otherwise, the locations of hospitals and pharmacies will be displayed without positioning on the map the location of the device. Thus, although the user does not allow access to his location, he will still be able to use an important part of the functionality of this section.

The “Pets” section similarly displays the locations on the map for veterinary emergency hospitals and pet shops.

In the “Weather” section, the user can see the current location, current temperature, minimum and maximum temperatures, weather description, sunrise and sunset times, wind, pressure and humidity data. Also, by clicking on the “Best time to travel” button, he will be able to discover short descriptions related to the weather in Bucharest over the course of a year.

The “Safety” section expresses some general tips to avoid possible problems in Bucharest and presents a map that illustrates the perception of the inhabitants regarding the degree of safety depending on the area.

The “Traffic” section describes the situation of Bucharest in relation to daily traffic and provides the link to 2 useful websites in case the user wants to see the traffic situation in real time or if he wants to find a parking space.

The “Local Customs” section describes some of the customs and holidays celebrated by Romanians.

The "ATM" section displays a map on which the ATMs are highlighted and contains a currency converter which, when it receives input from the user, calculates the value entered by him for other currencies. Specifically, if the user enters an amount in RON, the equivalent of that amount will be displayed for EUR and USD.

The “Cheap or Free” section presents some activities that can be done in Bucharest cheap or even for free.

The "Communism in Romania" section briefly presents the story of communism and provides a link to the "Ferestroika" website, which includes the possibility of purchasing a tour of a preserved apartment from the communist era.

When selecting the "Jewish Bucharest" option from the navigation drawer menu, the application will redirect the user to a website with information relevant to Jewish culture in Bucharest.

When selecting the "Romania" option from the navigation drawer menu, the application will display some places of interest for tourists who want to spend some time outside Bucharest.

When selecting the “Covid-19” option from the navigation drawer menu, the application will display information regarding the situation generated by this virus in Romania.

By selecting the "Do the test again" option from the navigation drawer menu, the user will be able to retake the personality test if he wants to provide other answers.

8.Further developments

The future development of the application could take into account other functionalities that could be useful in the field of tourism, including business. It could add some features for photography, accessible itineraries for people with disabilities, a link to Google Translate, social and professional interaction or games. A further development that allows feedback and sharing experiences with other users can contribute to the success of the application, increasing the number of downloads or comments. The feedback could be rewarded in a certain way (a frame or a suggestive filter for the most memorable photo taken in Bucharest, perfect for sharing on social media).

9. Similar applications

Booking is the most used and well-known application, with offices in 70 countries, which assures users that it will offer them stress-free travel experiences, to help everyone know any corner of the world. Mainly, Booking is an intermediate between accommodation providers and users, the providers being the ones who provide all the information about properties, availabilities, prices and other information. The properties offered for rent can be filtered according to several criteria: price, scores resulting from comments and price, only scores resulting from reviews, number of stars, distances from the center or favorites Booking, the latter being a filter based on a algorithm that takes into account the interests of the application related to the percentage of commission received as a result of listing the property, prompt payment of commissions, other data related to reservations. In addition to accommodation, Booking also offers information on flights, car rentals, taxis to and from the airport, or tours and activities and attractions near the accommodation. [7]

Foursquare is an application launched in 2009 that uses GPS technology to provide search results and promises users to discover places that their friends and experts love. Users can connect with Facebook accounts and searches can be done according to the criteria: Food, Breakfast, Coffee, Shopping, Nightlife, Trending and Top Picks. Search recommended locations take into account other users' ratings and price levels, and certain comments about these locations are also displayed. [8]

Tripadvisor is the most complex tourism application in the world that offers travelers the opportunity to discover a wide variety of information about the place visited. The basic information is supplemented by millions of user opinions and reviews, the application becoming a kind of collective wisdom. Searches are made from the sections Hotels, Vacation Rentals, Restaurants, Things to do, Shopping, Tour & tickets, Location, Airlines. Search results are displayed based on ratings. [9]

For a busy traveler who does not have much time to read and make comparisons, the large amount of information managed by the application becomes a weak point.

10.Conclusion

Nowadays, when planning a trip, tourists are increasingly relying on their smartphones and travel applications have become extremely useful for everything related to travel management. For any tourist, smartphones have become real travel partners, ways to access a huge amount of practical information, useful addresses, locations, opinions and tips. In addition, the desire of tourists to get as well informed as possible before leaving for a destination, to move easily or to optimize their consumption at the destination has increased. Also, the access to the Internet has progressed. Tourists are attentive to the existence of Wi-Fi networks, they want to be able to connect permanently and have the services they perceives as useful at a fair price. The use of mobile applications has become widespread, becoming a habit in all areas, including in the tourism industry.

However, most applications focus mainly on managing an impressive amount of information from which the user has to make his own choice, even though his knowledge of the local offer is limited. When the time available is limited to a few days, exploring any destination, and Bucharest in particular, can make choosing the most suitable locations and activities difficult, without detailed documentation or without the knowledgeable advice of connoisseurs. For these situations, the idea of "**B**uchar**est**" was developed - an application that offers the best that the city has to offer to users meet through the answers they provide in a questionnaire.

The purpose of the project was to create an application dedicated to the tourists visiting Bucharest, to improve their travel experience, a free application, easy to use, to respond quickly to the personalized needs and desires, through truly relevant information and offers, gathered in a single application.

Knowing that the application name and description are key factors for a successful application, a suggestive wordplay was chosen for the name to suggest to the user as clearly as possible that using this application will give him destinations for memorable experiences.

Before starting the project, a short documentation was made about tourism and tourists in Bucharest in order to identify and provide offers for the most common or for possible needs and desires that may arise during a visit to Bucharest.

In conclusion, the purpose of the application has been achieved, the application allows users to discover, at their choice, the best face of Bucharest. The application brings together useful functions, under a friendly interface, easy to use by a wide and diverse segment of users, deserving to be downloaded by every type of traveler. "**B**uchar**EST**" is an inspired application that can be the heart of a memorable tourist experience and that could stand out even in a competitive market.

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