CREATING A WEB GIS APPLICATION WHICH PRESENTS A TOURISTIC MAP OF TIMISOARA

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Abstract

This paper presents a digitized map of the city of Timisoara based on the exposure of the main locations by adding them to the map with a geographical position (latitude, longitude), a name and a symbol that differentiates them from each other. In addition to the attributes listed above, each point of interest also includes a description that helps platform users find out more. Spatial analysis is the process of examining, modelling and interpreting the results. After spatial analyses, information about a set of geographic data can be extracted or created. Spatial data processing is performed on the basis of algorithms using the special operations of these data categories. In GIS there are four main types of spatial analysis: spatial overlay and continuity analysis, linear analysis and raster analysis. With this spatial analysis feature, GIS software is different from CAD software. Thus, the interactive map created through the ArcGIS Online program is very useful for the city of Timisoara both for residents and tourists, especially as Timisoara was designated the European Capital of Culture in 2021.

Key words: ArcGIS Online, analysis, GIS, raster, vector, Timisoara.

INTRODUCTION

The city of Timisoara is situated at the intersection of the parallel of 45 ° 47 ' north latitude, with the 21 ° 17' east longitude meridian, being in the northern hemisphere as a mathematical position at nearly equal distances from the north pole and the equator. The local time of the city (considered by the meridian) is in advance 1h 25' 8" to the meridian time 0, Greenwich, but is late with 34'52" than the time Romania's official time (Eastern Europe Time). Timisoara is located at an average distance of about 550 km to the capital of Romania - Bucharest and about 170 km to Belgrade and 300 km to Budapest, the capitals of the two neighbouring countries Serbia and Hungary.

The purpose of the paper is to create a mobile web map of the city of Timisoara with various points of interest (eg hotels, monuments, etc.) on the basis of which can be realized and various useful spatial analyses for the tourists who will visit the city of Timisoara as well as for local users. Also, this map will be especially important in the context in which the multiculturalism of Timisoara and the fact it was designated as European cultural capital in 2021 and thus the number of tourists will be steadily increasing.

MATERIALS AND METHODS

GIS is an information system that is capable of owning and using data describing locations on the Earth's surface (geographic data). A GIS is a powerful set of tools which collect, record, transform, and visualize space data of the world (Moscovici et al., 2015).

A GIS must perform the following functions or operations: capture and input of geographic data, geographic data processing, geographic data management (Grecea et al., 2013).

In this paper, to achieve the proposed objectives, were used the GIS solutions offered by ESRI Romania, namely:

- For data organization and preliminary processing was used the Desktop solution - ArcGIS v. 10.5

- ArcGIS Online cloud platform was used to build the GIS Web app (Herbei et al., 2010).

The workflow to accomplish this application is described in the following figure:

Figure 1. Workflow

The most important feature of a GIS and a GIS application is its ability to perform spatial analysis, to process spatial (geographic) data in order to obtain information about the studied area (Barliba et al., 2017).

Spatial analysis is the process of the examination and interpretation of model results. After spatial analyses, information about a set of geographic data can be extracted or created.

Spatial data processing is performed on the basis of special algorithms using the operations of these data categories. (Grecea and Moscovici, 2015)

In GIS there are four main types of spatial analysis: spatial overlay and continuity analysis, linear analysis and raster analysis. With this spatial analysis feature, GIS software differentiates from CAD software (Mason, 2015).

Vector spatial analyses can also be grouped into 4 categories (Herbei, 2015) such as:
- vector analysis based on extraction;

- vector analyses based on overlapping;
- vector analyses based on proximity analyses;
- vector analyses based on statistics.

The ArcGIS Online application is an ESRI-based GIS mapping platform that is stored on the cloud and allows the use and creation of a map, a GIS web application that contain spatial data and layer analysis. Creating the GIS web application is make using dedicated software such as JavaScript and HTML5 that are directly implemented on the ArcGis Online, platform without which the program can't work (Herban et al., 2012).

RESULTS AND DISCUSSIONS

This paper presents a web map of Timisoara based on the exposure of the main locations by adding them to the map with a geographic position (latitude, longitude), a name and a symbol that differentiates them from each other. In addition to the attributes listed above, each point of interest also includes a

description that helps platform users find out more.

In order to achieve the interactive map proposed by ESRI's ArcMap application, the following steps were taken:

Step 1

The first step is to acquire on the ground the geographical coordinates of the targeted objectives using specific devices and create a spatial database containing several Microsoft excel files, each file having as attributes name, description, latitude, longitude, website . As shown in the figures below is presented a list of databases containing xlxs (Figure 2). As an example, we presented the contents of the GIS database for transport in Timisoara (Figure 3) and the GIS database for accommodation (Figure 4).
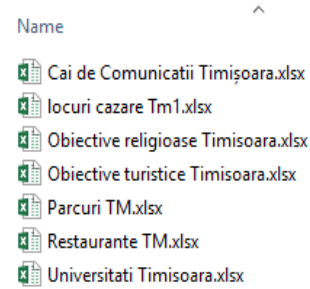
Figure 2. Excel files list

Figure 3. GIS Transport Database in Timisoara

Figure 4. GIS Database Accommodation in Timisoara

Later was performed the conversion of Excel files with XLSX extension into files with the CSV extension (Comma delimited).

The CSV file was created in Microsoft Excel and had the following structure:

name (for name is used name, title, name-short, name-long). Name of the points that are on the map (eg.: Polytechnic University of Timisoara);

description (for description is used description, caption, snippet, comment) - Description of points on the map (eg 5-storey building and attic);

longitude (for longitude is used lon, long, longitude, x, xcenter)

latitude (for latitude is used lat, latitude, y, ycenter)

Website (A hyperlink can be entered for the website) (Herbei and Sala, 2014).

After the file has been reopened, the xlxs file has been saved (Save as ...) with the CSV (Comma delimited) extension.

Then we stored all csv files in a new folder (Figure 5).

After authenticating on the ArcGIS online platform and opening a new map, were created CSV files as a theme layer (Figure 6). In the main menu of this platform we find a variety of options available for data editing, such as creating labels (Figure 7) or changing the symbols (Figure 8).

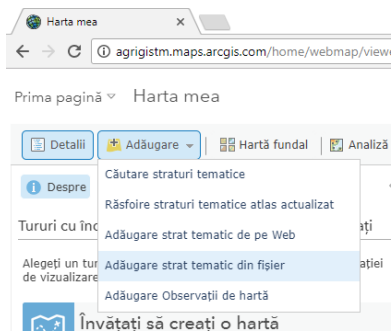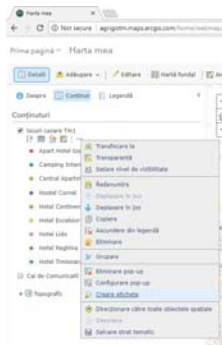Figure 5. CSV files list

Figure 6. Insert CSV file

Figure 7. EsriArcMap options

Figure 8. Highlight symbols on the map

In order to a better highlight of the points of interest on the map, the ArcGis online application allows us to enter symbols for each point of interest (Figure 8). For example, for transport locations, you can individually enter a symbol based on its type, namely a plane for the airport and a train for the train station. All of this leads to better mapping for future users (Gridan, 2016).

In the beginning we introduced the specific symbols for the points of interest that includes the terrestrial communication routes, namely, the airport was symbolized by an airplane, a railway station with a train and, respectively, bus stations with a bus (Figure 9). This makes it easy to differentiate between them and helps many users to recognize those points at first sight without reading their name or description (Herbei and Nemes, 2012).
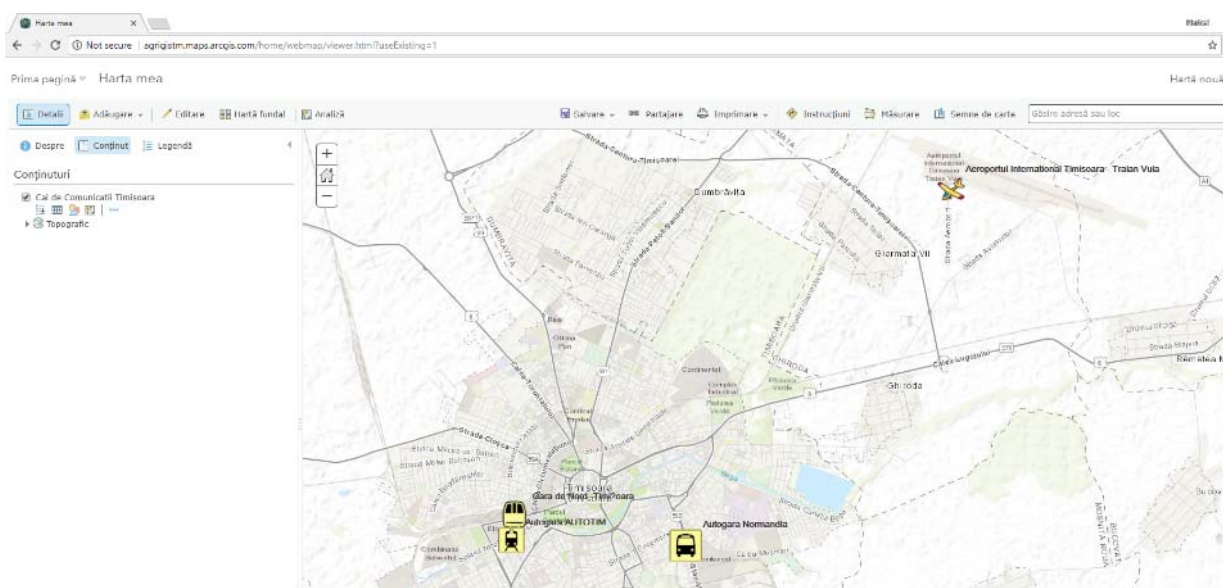

Figure 9. Examples of transport related symbols

Afterwards, an overall view of the city was achieved by zooming in on all the important points (universities, restaurants, terrestrial communications, religious objectives, landmarks) on the map created in ArcGIS Online (Figure 10).
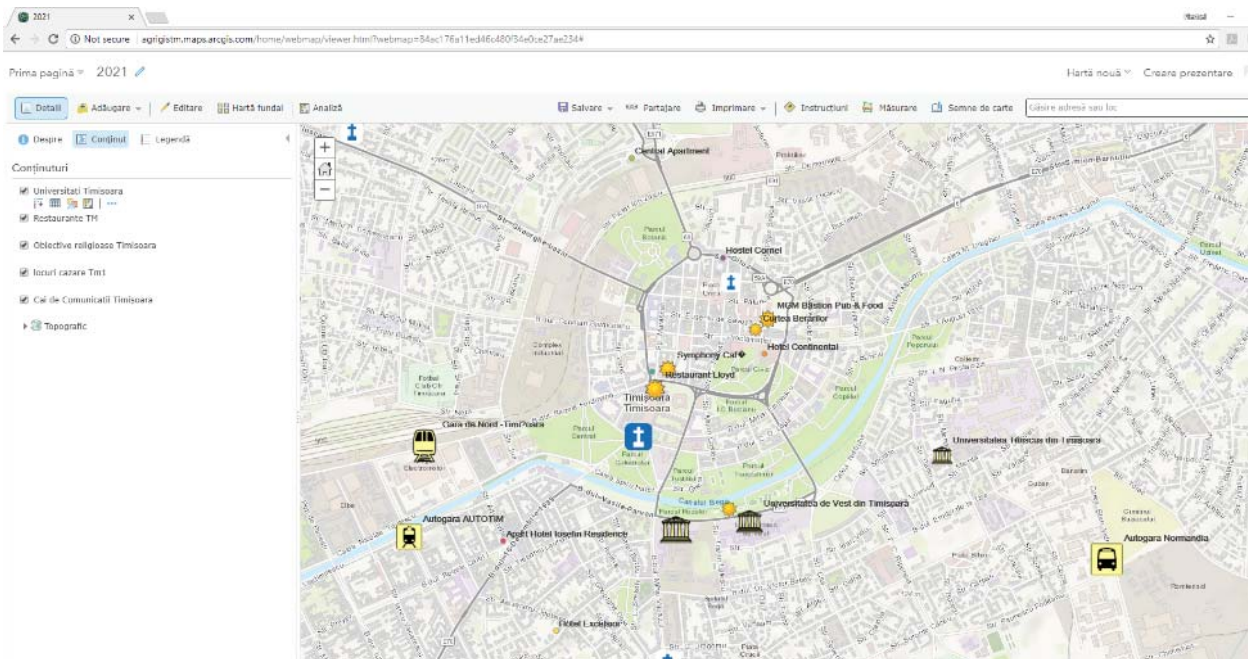

Figure 10.General map of Timisoara

The images below show how the app allows us to display only a category of points of interest such as universities (Figure 12) or restaurants (Figure 11).
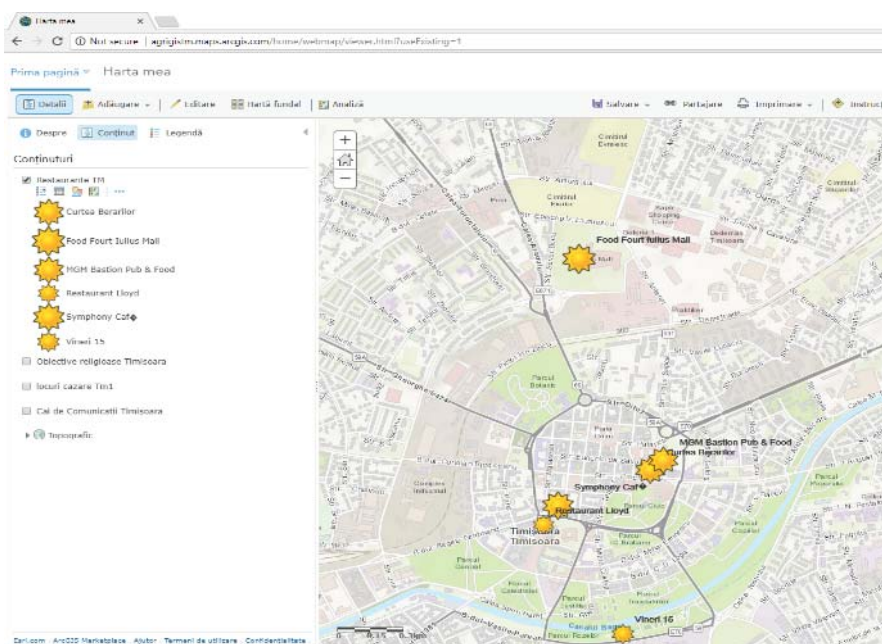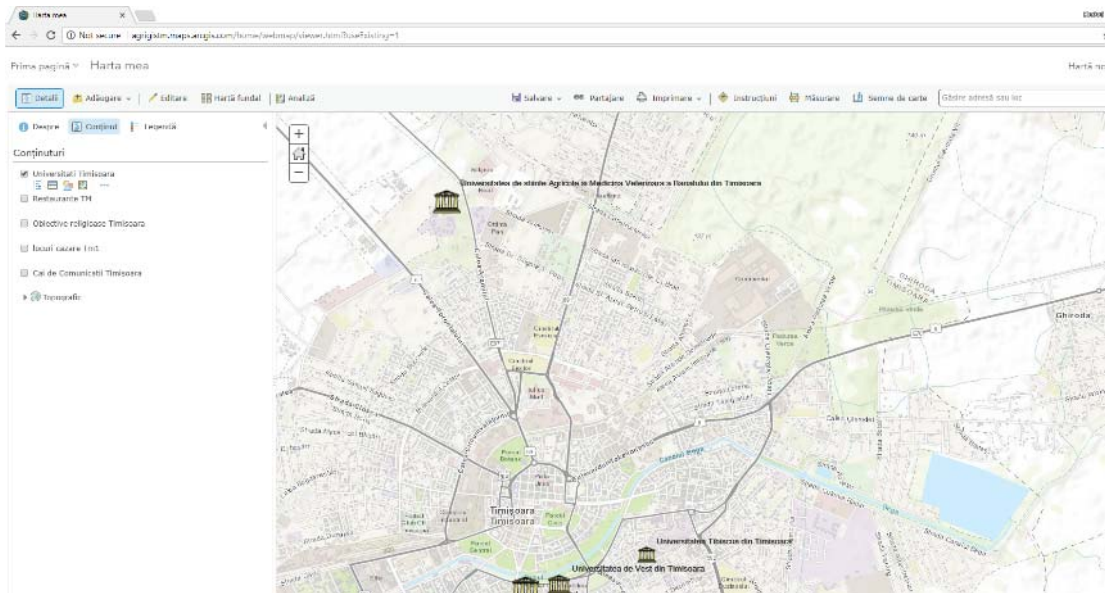

Figure 11.Highlights Restaurants & Pubs

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Figure 12.Highlights Universities

Each point of interest is based on multiple attributes and can be accessed by users by clicking on the icon. Thus the app opens a new window where information is presented including the description of the object and the geographical coordinates. (Figure 13).
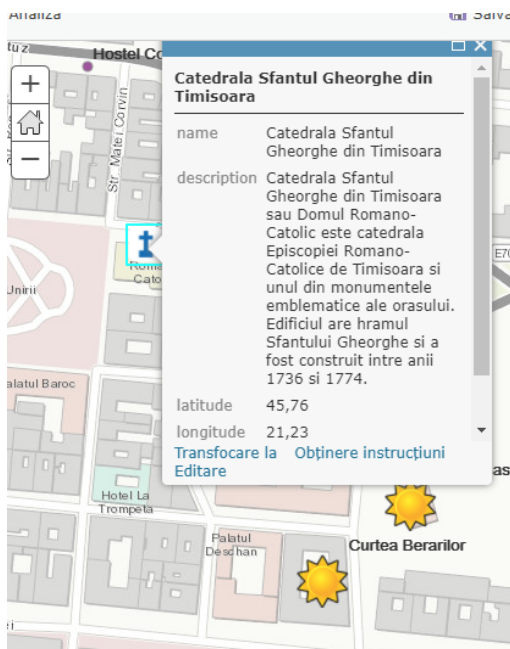

Figure 13. Point of Interest Information

Step 2
The second step presented in this paper is exemplified by spatial analysis. It is possible to highlight routes between 2 points of interest (on foot and by car with time display) as well as buffer analyses by which the locations near a target point can be determined having a distance entered by the user (Figure 14).
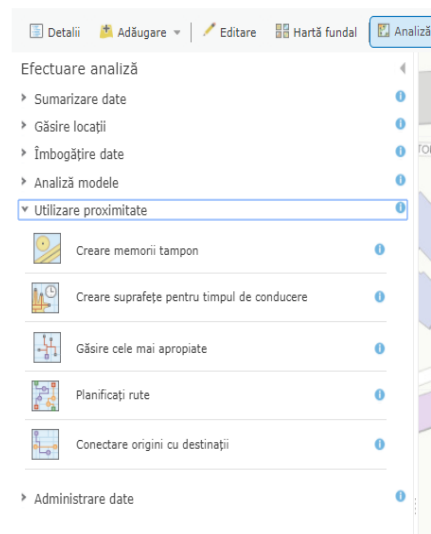

Figure 14. Spatial analysis menu

To begin with, we showed a spatial buffer analysis by looking for other points of interest within 0.5 km of the Metropolitan Cathedral (Figure 15). All these analyses can be of great help to the public institutions, including to the city hall, and so they can locate and verify the legality of the location of these points of interest. In this case, there is a about the symbolic cathedral in the city and are some restrictions for neighbouring buildings (such as high volume music in nearby pubs, so the city hall can easily verify these aspects with this application.)
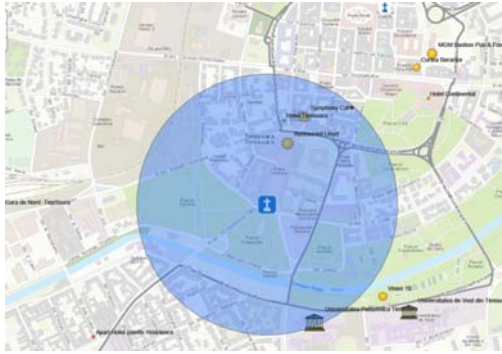
Figure 15. BUFFER analysis to the Metropolitan Cathedral

to reach the places of accommodation and I took as an example North Train Station, Autotim Bus Station and Normandia Bus Station. Thus, the closest accommodation places for Normandia Bus Station are Hotel Lido and Hotel Reghina; to the North Train Station being Hostel Cornel, Hotel Timisoara and Hotel Continental; to the Autotim Bus Station is ApartHotelIosefin Residence and Hotel Excelsior (Figure 16).We have also created some routes created by us through the "Plan Route" interface in the ArcGIS Online (Figure 17).

Another example is the proximity analysis that we have highlighted through the closest ways
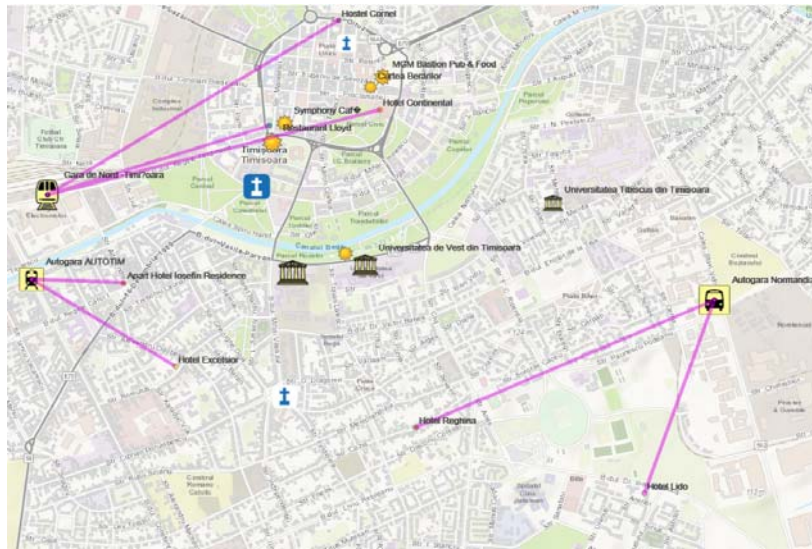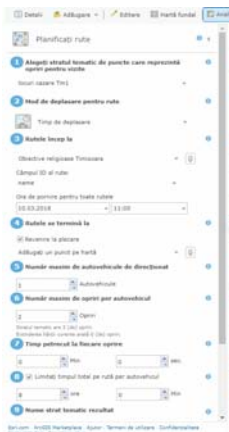

Figure 16. Proximity analyses- Closest locations

Figure17. Route Planning Menu

route that is planned through a pedestrian zone and the route from Timisoara Hotel to Unirii Square (Figure 19).

Among these routes are two types of walking routes such as the route from Metropilitan Cathedral to the Timisoara Hotel (Figure 18), a
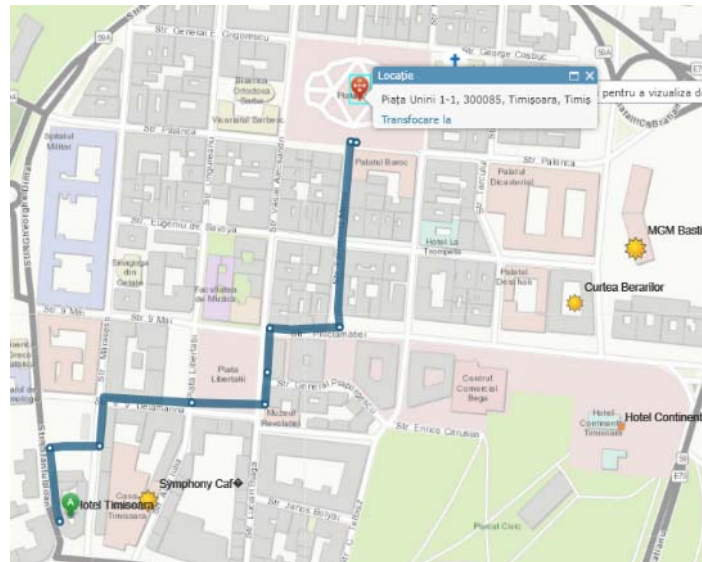

Figure 18. Pedestrian route

Figure 19. Pedestrian route

Also, there were several routes that can be traveled by the car, among which we mention the route from Timisoara Hotel to the Autotim Bus Station (Figure 20) which is the shortest and includes the same the list of turns that it has to make the driver of the car.
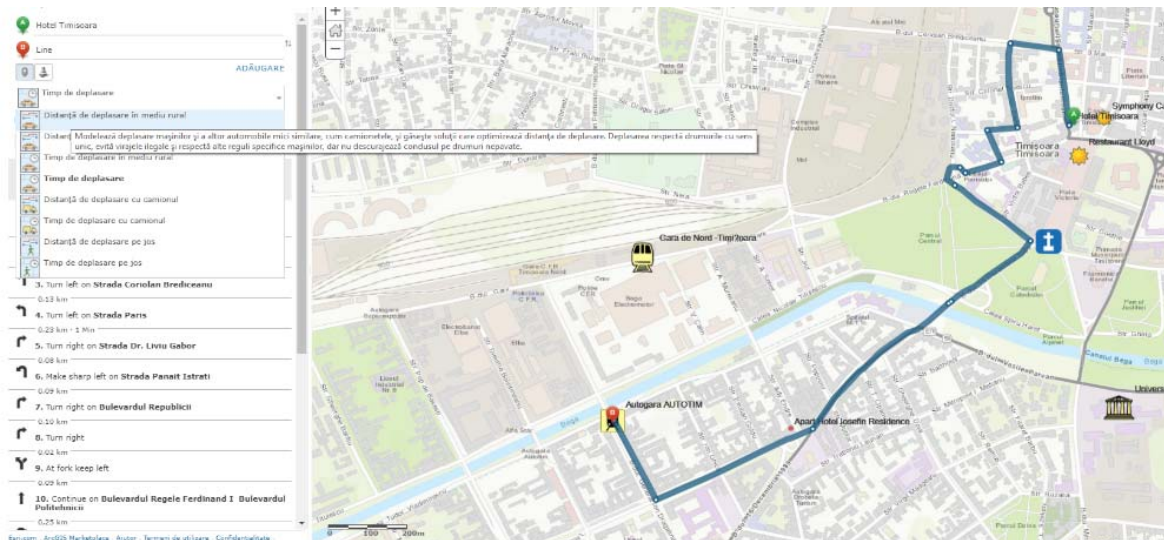

Figure 20. Car routes

The final step of this paper is to create a web GIS application by uploading the map online and making it available to users (tourists, public institutions, etc.) to help them in their activities (Figure 21) (Mason et al., 2015).

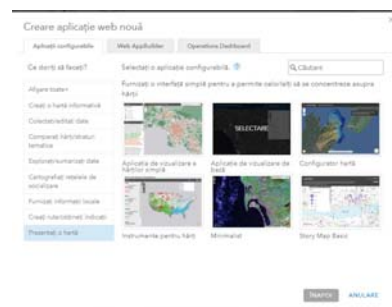Here is the final form of the map uploaded in the online environment (Figure22).

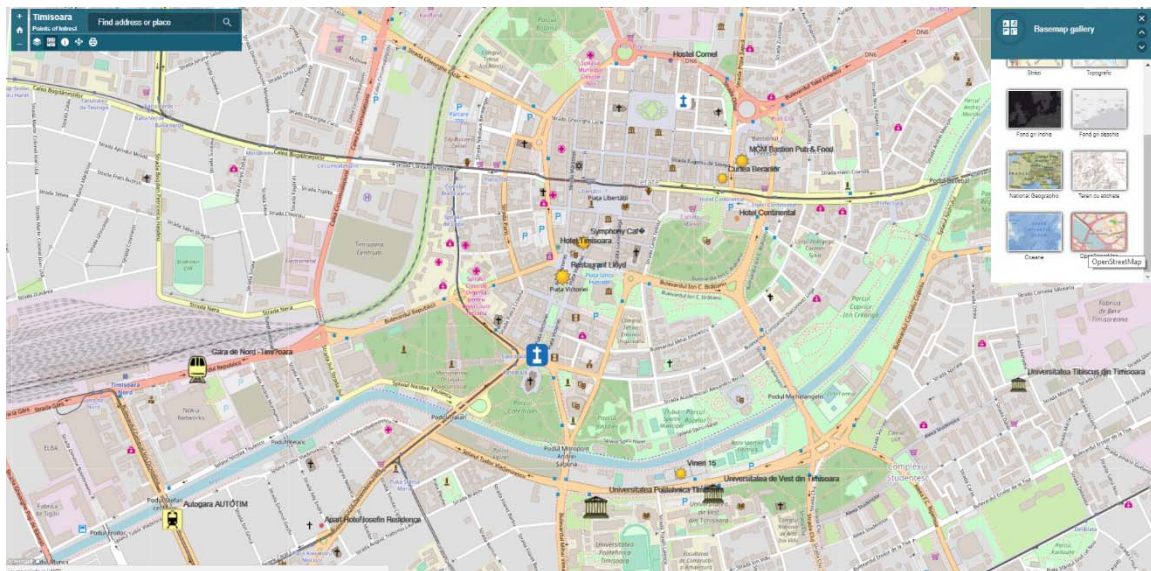Figure 21. Web application creation

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Figure 22. Web GIS Map

CONCLUSIONS

Through this paper, it was created an interactive map using the ArcGIS Online program that presents a mobile and advanced solution of how to use a map. Thus this map is very useful for the city of Timisoara both for residents and for tourists, especially as Timisoara was designated the European Capital of Culture in 2021.

Also points of interest from all the areas of interest for tourists such as transport means (railway stations, airports, bus stations), accommodation for all budgets (hotels, hostels, apartments and camps), universities, important tourist attractions in the city (museums, central markets), restaurants and cafes. Also are included the spatial analyses by which the routes from point A to point B are created, as well as the search for the range of interest of the neighbouring objectives. All this leads to a better management of the activities that can take place in the city, as well as a simple overview of the city for tourists. This map may be updated whenever necessary because there may be changes in the field, some points of interest may have temporarily changed location and so the application allows us to improve the map without recreating it from scratch.

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