

Summary of sub-project 4 activities: "Experimental development of augmented reality tools at the level of online social networks and study of their impact at the level of users" (AR Media)"

-Summary 2019-

Activity 4-2-1: Developing an experimental model (prototype) of the AR Media online social network using augmented reality of registered users using mobile cameras

In studying the design process of the computer system, the starting point was the concept of the system. The proposed system is a set of interdependent elements (components) between which a dynamic interaction is established, based on predetermined rules, with the aim of achieving the objective. System decomposition is very useful in simpler subsystems, the structure of which can be analysed and understood one at a time, without taking into account interference between subsystems.

The main functions and functionalities pursued at this stage are:

- the possibility of adding an unlimited number of members;
- the possibility of adding members' personal data;
- possibility of sending personal messages between members;
- possibility of posting public messages with text and images to all members of the social network;
- possibility to evaluate posts with LIKE;
- possibility to track a member's activity;
- the possibility of creating a group of friends to manage your personal profile, friends, incoming messages, etc.;
- identification of persons based on the information contained in the database with members of the social network.

For this purposes an open-source DNN platform was used, based on a Web content management system and Microsoft .NET web application framework.

As a social media platform, it made possible to create an unlimited number of user accounts characterized by a series of personal information, entered by each

individual, such as name, first name, username, address, contact details, profile photo. This profile photo plays a very important role, being used in the learning of figures of members of the social network. Basically, based on this photo, facial recognition algorithms learn each person's characteristic traits, then identify the person's face with an accuracy of about 95%.

Deliverable: Study 1

Activity 4.2.2.: Achieving the methodology for testing and evaluating the functions and modules of the online social network with facial recognition using AR Media augmented reality

For the testing and evaluation of the functions and modules of the online social network with facial recognition using augmented reality, the team of specialists of the project opted for qualitative research (exploratory), namely research based on the focus group method and the in-depth interview method.

From the multitude of techniques specific to qualitative research, it was chosen to design and conduct 8 interviews, among specialists from various fields of activity, users of social networks, in order to know their opinions on augmented reality applications integrated into social networks.

In order to achieve the above-mentioned objectives, it was considered appropriate to choose the method of semi-structured in-depth interviewing so as to allow the most detailed knowledge of the views of the interviewees on the key issues pursued in this research approach.

Deliverable: Study 2

Activity 4.2.3.: Determination of functionality, usability and design problems of the online social network with facial recognition using AR Media augmented reality

In accordance with the selected methodology, a marketing study was carried out based on group interviews, which consisted in organizing and conducting three focus groups among users of social networks plus a qualitative research based on the method of in-depth interview.

A. Qualitative research based on group interview

Focus group 1 - 8 participants, young people aged 20 to 24.

Four women and four men participated voluntarily. The criterion of choice was one with a strong subjective character, based on the willingness of students to participate in research. The participants in the focus group were students in the third year or masters at the Faculty of Economic Sciences (specialization in Marketing, Accounting and Management Informatics, Business Administration in Tourism) and the Faculty of Mathematics and Informatics, at the Transylvania University in Brasov. The Focus group was held in October 2019, with a duration of 140 minutes.

Focus Group 2 - 10 participants, young people aged 21 to 23. A number of 7 women and 3 men participated voluntarily, thus ensuring the heterogeneity of the participating groups. Participants in this study are third year students in Economic Sciences, specializing in The Economy of Trade, Tourism. This specialization was chosen due to the large number of AR applications present in their field of study. The Focus group was held in October 2019, with a duration of 120 minutes.

Focus Group 3 - 7 participants, aged between 30 and 45, from among the teachers of Transylvania University in Brasov. The heterogeneity of the group was ensured by the fact that 6 women and 1 male participated voluntarily, as well as by the fact that the participants are teachers from different fields with different research interests. The criterion of choice was one of strong subjective character, based on the willingness of teachers to participate in research. The participants in the focus group were teachers of Transylvania University in Brasov, with a teaching degree of Lecturer and Associate Professor, having as various research interests. Focus group was held in October 2019, with a duration of 95 minutes.

These focus groups were moderated by a marketing specialist (Associate Professor Dr. Alina Tecău), who led the discussions impartially using the semi-structured interview guide as a tool to guide discussions.

The research endeavour aimed at finding out the opinion of the subjects on the following matters:

1. Reasons, criteria and options for choosing social networks.
2. Knowledge of AR applications.
3. Opportunity to integrate new AR technologies into social networks.

4. Problems with functionality, usability and design of the online social network with facial recognition using the augmented reality application -AR Media, developed as part of the FUTUREWEB project.

5. Proposals to improve the augmented reality application -AR Media, developed as part of the FUTUREWEB project. These have also become the main objectives of the proposed interview guide for the realization of focus groups.

At the same time, the research highlights a number of proposals and recommendations made by interview subjects on the functionality, usability and design issues of the online social network with facial recognition using the augmented reality app - AR Media, developed within the futureWEB project as well as ideas generated, which could improve this application.

The interview guide used envisaged the transposition of each objective into relevant aspects of research. The aim was to provide the beneficiaries of this study with the opportunity to provide complete and detailed information in order to respond to the objectives of the research.

In order to benefit from the group's emergence of ideas, during the discussions the moderator intervened only to guide the discussions so as to obtain the information concerned, without expressing personal value judgments that could have influenced the views of the participants.

Deliverable: *Study 3*

Activity 4.2.4. : Making specifications to improve the AR Media online social network and implementing the necessary changes

Having as a starting point the results obtained under of the 4-2-1 activity, respectively from the prototype of the online social network AR Media, and adding the suggestions for improvement generated by the qualitative research outputs (3 focus groups and 8 in-depth interviews among specialists from different fields) it was possible to effectively create the functional model of the social network with facial recognition.

As the main functionalities, the following were to be achieved:

1. the possibility of adding an unlimited number of members;
2. the possibility of adding members' personal data;
3. the possibility of sending personal messages between members;

4. the possibility of posting public messages with text and images to all members of the social network;
5. possibility to evaluate posts with LIKE;
6. possibility to track a member's activity;
7. the possibility of creating a group of friends;
8. the ability to manage personal profile, friends, incoming messages, etc.
9. Identification of persons on the basis of the information contained in the database with members of the social network.

For this purpose an open-source DNN platform was used, a web content management system and Microsoft .NET web application framework.

As one of the main focus of the research carried out, special attention was paid to the facial recognition process. It is important to note that before the facial recognition process, it is necessary to create an image gallery. Basically, the image gallery is the set of biometric models on the basis of which the characteristics of individuals are identified during the data comparison process.

How the facial recognition process works involves the following steps:

1. *Image Capturing phase*

The first step is data collection (physical traits). Image capture is done with a camera, which can save information in digital format.

2. *Face recognition*

The identification process begins with identifying the face in the entire image, that usually contains other objects, buildings, backgrounds or in some situations, other faces. If it's very easy for a man to distinguish between the face of an individual in a picture, the computer system decides which pixels belong to the face and which don't. The facial recognition system will standardize - as far as possible - the image so that it has the same dimensions, rotation, brightness with the images contained in the image gallery. This standardized image is processed by the facial recognition system.

3. ***Extracting traits*** to create a model based on collected data assumes that a mathematical representation, called a model (or biometric reference), is generated in the process of extracting traits. This model is saved in the database, forming the basis of recognition. The biometric model is a facial recognition algorithm that transforms the face image (in the form of pixels) into a simplified mathematical representation.

At the heart of facial recognition algorithms are geometry and photometry (measuring the intensity of light sources). The basic algorithms used in facial recognition use only geometry, identifying only the relationships between the main features (positioning of the eyes, nose and mouth). This method is dependent on the detection of all features, which in some cases can be very difficult due to the variations in brightness present in the image and especially of shadows and dark areas.

4. *Comparison of models*

The next step is to compare the data collected with the image of the individual. The identification app compares the score obtained for the analyzed image with those of the images in the gallery.

5. *Identity declaration*

The last step determines whether the compared data corresponds to the data in the database. The proximity between the two scores is high enough to show the match of the two images. The declaration of identification is sometimes determined with 100% certainty by the human factor (computer systems however efficient they are, at present have an error rate).

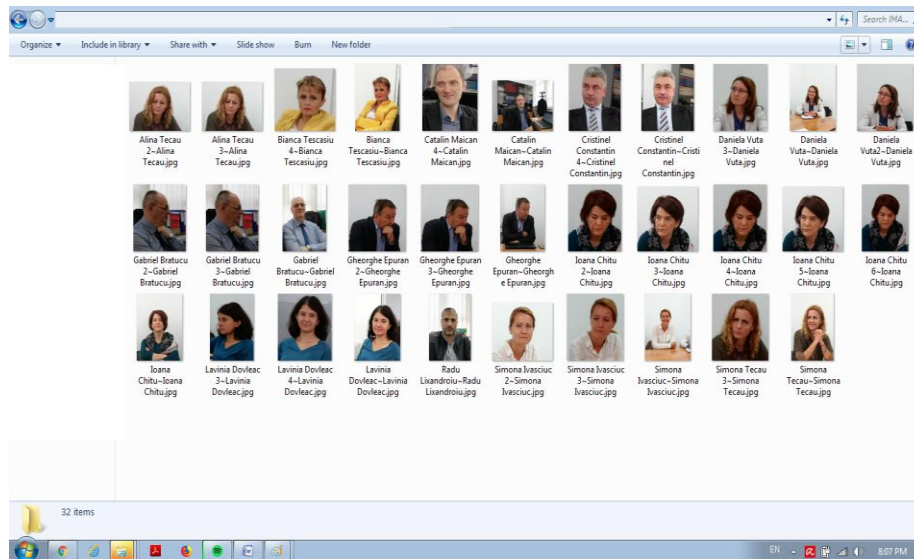
The performance of the facial recognition system depends primarily on the quality of the image. For high accuracy, the image must capture the individual in front and must have the right brightness and contrast. At the same time, the eyes must be open and the image show as few shadows as possible. The system is sensitive even to facial expression. Thus, a broad smile can lead to less effective recognition results.

Within the facial recognition application we have the following categories of functions:

1. Basic functions required in training and recognition processes.
2. Secondary functions necessary for integration and operation within the IT system

1. The basic functions are the following:

- Create a database of images used to recognize people.



Database of images used in recognition

- The training function by which images in the database are assigned to a person. For training, it is used the Open-source OpenCV module, which specializes in real-time computer vision.

Deliverable: Study 4

Activity 4-3-1: Developing the emotional state viewing service based on the latest posts and photos of online social network users with facial recognition using AR Medi augmented reality

The emotional state view function comes as a complement to the facial recognition function. Basically, after the person in an image is recognized and associated with a person in the database, the facial features are analyzed. Feelings of joy, sadness, neutrality and nervousness are recognized based on mathematical algorithms that analyze more than 180 points of the face. For each face it calculates percentages for these fundamental feelings that are then displayed.



Displaying feelings: Joy 55%, Sadness 15%, Neutrality 3%

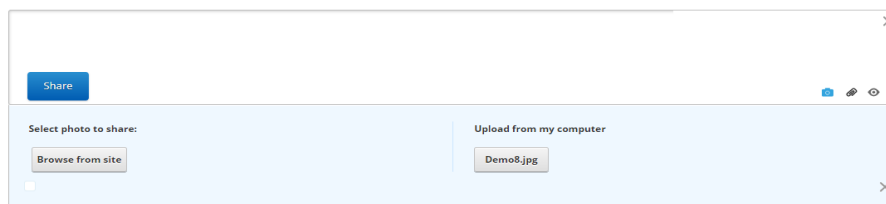
The sentiment identification algorithm works for absolutely all faces identified in a photo.

Deliverable: Study 5

Activity 4-3-2: Developing the view and sharing service for preferred photos and media clips of users registered on the AR Media social network using augmented reality techniques and visual effects

The app improvement process was complemented by *the development of the view and sharing service for preferred photos and media clips of users registered on the AR Media social network, using augmented reality techniques and visual effects.*

To view and share photos on the social network, a posting module has been created that allows you to add image files and distribute them to other members of the network.



Possibility of uploading and distributing image files to other members of the social network

Photo information, once uploaded, goes into the process of identifying known figures (which are learned by the system based on profile photos) as well as identifying the state of feelings.

The author of the post who uploaded the photo or photos has the right to delete the post if he believes it is inappropriate. Other members cannot delete its post, except for the social network administrator.

Deliverable: Study 6