

RIGA TECHNICAL UNIVERSITY FACULTY OF

COMPUTER SCIENCE AND INFORMATION TECHNOLOGY OF

**INSTITUTE APPLIED COMPUTER SYSTEMS**

**FACIAL EXPRESSION ANALYZER SYSTEM**

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1. Introduction

1.1. Definitions of the abbreviations

|  |  |
| --- | --- |
| Abbreviation | Description |
| FEA | Facial Expression Analyzer – the name of the developed system |
| CV | Computer Vision – image processing using artificial intelligence |
| FER | Facial Emotion Recognition – classification of emotions based on facial input |
| CNN | Convolutional Neural Network – deep learning model used for emotion detection |
| ONNX | Open Neural Network Exchange – format for machine learning model portability |
| HTML | HyperText Markup Language – standard language for web user interfaces |
| DB | Database – structured storage of user and analysis data |

1.2. Purpose of the document

This document describes the detailed software requirements of the study project Facial Expression Analyzer, a web-based application that performs facial emotion recognition using computer vision and deep learning techniques.

The document is intended for the parties involved in the development, implementation, and maintenance of the software developed within the study project:

* Supervising lecturers of the course, who are responsible for reviewing, accepting, and evaluating the project outcomes,
* Technical specialists of the development team, who are responsible for the design, implementation, and functionality of the system.

1.3. Related documents

This specification has been developed on the basis of the following documents:

[1] TASK FOR THE STUDY PROJECT of the subject “System Design”

[2] Software Requirements Specification of the project “Facial Expression Analyzer”

1.4. Overview of the document

The document consists of three sections:

* The first section – Introduction, contains information on the general structure of the document, its purpose, and the definitions used;
* The second section – Detailed design of the Client's interface, which describes the pages and interactions provided to the end user;
* The third section – Description of the decomposition, which includes the database ER model and a description of the database tables used to store user and analysis data;
* The fourth section – Examples of reports, such as analysis logs and emotion recognition summaries.

1.5. Traceability table

|  |  |
| --- | --- |
| PPS IDENTIFIER AND NAME | PPA |
| SCORING-1 Access rights to user data | 2.5 |
| SCORING-2 User registration and authentication | 2.2, 2.3 |
| SCORING-3 Access rights to uploaded images | 2.4, 2.11 |
| SCORING-4 Emotion analysis request management | 2.6, 2.7 |
| SCORING-5 Emotion prediction and result display | 2.6, 2.9 |
| SCORING-6 Query history and detail view | 2.5, 2.6 |
| SCORING-7 Query deletion with image cleanup | 2.7 |

2. Detailed design of the client interface

2.1. Authorization form

2.1.1. Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Field Type | Oblıgatory | Description |
| Username | Text input field | Yes | User authorization username |
| Password | Text input field | Yes | User authorization password |

2.1.2. Function description

By pressing the "Login" button, the user authorization data is checked with the data stored in the database. In case of incorrect input data, a corresponding error message is displayed. If the input data is correct, the user is redirected to the Main Menu of the system.

2.1.3. Screen prototype

metin, ekran görüntüsü, yazı tipi, çizgi içeren bir resim

Yapay zeka tarafından oluşturulan içerik yanlış olabilir.

2.2. Registration form

2.2.1. Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Field Type | Oblıgatory | Description |
| Username | Text input field | Yes | Chosen username for new account |
| Email | Text input field | Yes | Valid email address of the user |
| Password | Text input field | Yes | Password for the new user account |
| Confirm Password | Text input field | Yes | Password confirmation for security |

2.2.2. Function description

1. When the user fills in all fields and presses the "Sign Up" button, the system verifies the validity of the input (e.g., matching passwords, unique username).
2. If the input is valid, the user account is created and the system redirects the user to the login form.
3. In case of incorrect or incomplete data, a corresponding error message is shown (e.g., "Username already exists", "Passwords do not match").

2.2.3. Screen prototype

metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Yapay zeka tarafından oluşturulan içerik yanlış olabilir.

2.3. Main Menu (Dashboard)

2.3.1. Function description

1. After successful login, the system redirects the user to the Main Menu page.
2. The interface displays a welcome message and a brief description of the system.
3. Users are provided with three main actions:

* Start New Analysis – begins a new emotion recognition process.
* View My Queries – navigates to the user's history of past analyses.
* Create New Query – shortcut to begin uploading a new image.

2.3.2. Interface preview

metin, ekran görüntüsü, yazılım, web sayfası içeren bir resim

Yapay zeka tarafından oluşturulan içerik yanlış olabilir.

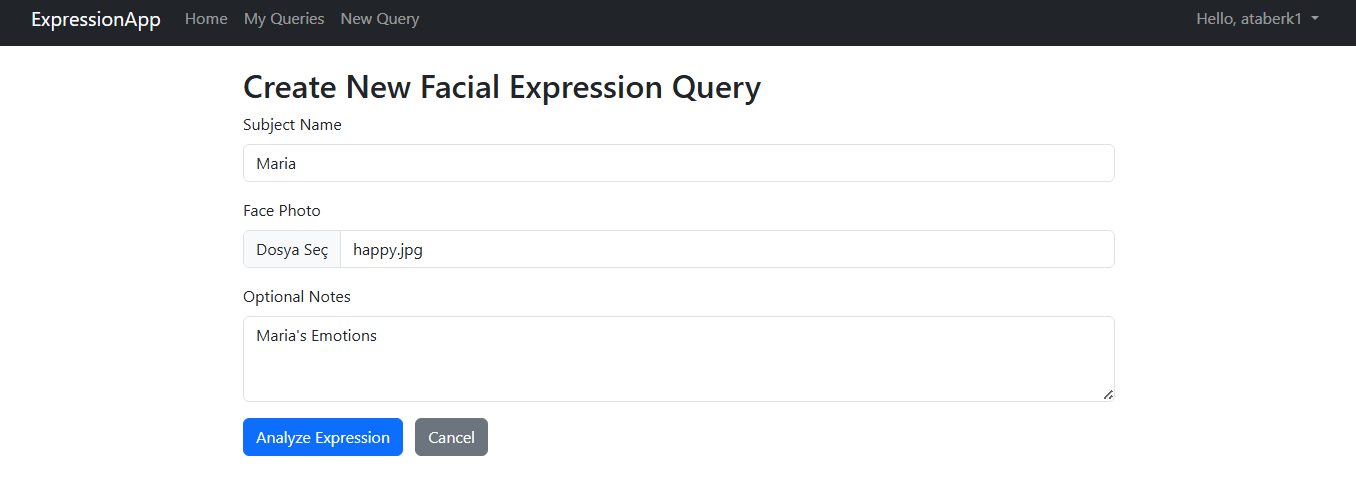
2.4. New Query Form

2.4.1. Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Field Type | Oblıgatory | Description |
| Subject Name | Text input field | Yes | Name or identifier of the person in the image |
| Notes | Text area | No | Optional description about the uploaded image |
| Upload Photo | File input (image) | Yes | Image to be analyzed (JPG or PNG format supported) |

2.4.2. Function description

1. The user provides the subject name and optionally enters a note.
2. A face photo is uploaded through the file input field.
3. After pressing the Submit button, the image is sent to the server and analyzed using the trained emotion recognition model.
4. Once processed, the result (detected emotion and confidence score) is stored and displayed to the user.

2.4.3. Screen prototype

1. After filling in the form and uploading a face image, the user presses the **“Analyze Expression”** button.
2. The system runs emotion detection using a deep learning model and classifies the image.
3. The following results are shown to the user on the detail screen:

* **Subject Name**
* **Date & Time of Analysis**
* **Detected Expression** (e.g., *surprise*)
* **Confidence Score**
* **Notes** (if provided)

1. A success message confirms that the query was created and analyzed successfully.
2. Users can **delete** or **go back** to the query list from this screen.

metin, insan yüzü, ekran görüntüsü, gülümsemek, gülüş içeren bir resim

Yapay zeka tarafından oluşturulan içerik yanlış olabilir.

2.5. Query List / History

2.5.1. Function description

1. This page displays a gallery of past emotion recognition queries for the logged-in user.
2. Each card includes:

* Subject name
* Date and time of analysis
* Recognized emotion
* Preview image of the uploaded photo

1. Available actions:

* Details: Opens a detailed result view
* Delete: Removes the query and associated image from the database

2.5.2. Screen prototype

metin, insan yüzü, ekran görüntüsü, web sitesi içeren bir resim

Yapay zeka tarafından oluşturulan içerik yanlış olabilir.

2.6. Query Detail Page

2.6.1. Function description

1. This page displays full details of a selected facial expression analysis query.
2. It includes:

* Original image uploaded by the user
* Subject name
* Date and time of analysis
* Detected expression (emotion)
* Confidence score of the prediction
* Any additional notes added by the user

1. **A Back to List** button allows returning to the query list.
2. **A Delete Query** button enables permanent deletion of the analysis record.

2.6.2. Screen prototype

metin, insan yüzü, ekran görüntüsü, gülümsemek, gülüş içeren bir resim

Yapay zeka tarafından oluşturulan içerik yanlış olabilir.

2.7. Deletion Confirmation Dialog

2.7.1. Function description

1. When the user chooses to delete a query, a confirmation dialog appears.
2. This screen shows the subject’s name, associated photo, and timestamp of the original analysis.
3. The user is prompted with two options:

* Confirm Delete – permanently deletes the query and the image from the system.
* Cancel – returns to the query detail page without deleting anything.

2.7.2. Screen prototype

metin, ekran görüntüsü, web sitesi, web sayfası içeren bir resim

Yapay zeka tarafından oluşturulan içerik yanlış olabilir.

3.Description of the decomposition

3.1. Database ER model

ekran görüntüsü, metin, tasarım içeren bir resim

Yapay zeka tarafından oluşturulan içerik yanlış olabilir.

3.2. Description of the database

3.2.1. Users

|  |  |  |  |
| --- | --- | --- | --- |
| IDENTIFICATOR | | Users | |
| Description | | | |
| The table that stores user data | | | |
| Field Name | Field Type | Obligatory | Description |
| id | int (10) | Yes | Table identifier |
| username | varchar (150) | Yes | User login name |
| email | varchar (255) | Yes | User email address |
| password | varchar (255) | Yes | Hashed user password |
| date\_joined | datetime | Yes | Registration date |

3.2.2. FacialExpressionQuery

|  |  |  |  |
| --- | --- | --- | --- |
| IDENTIFICATOR | | FacialExpressionQuery | |
| Description | | | |
| Stores facial expression analysis records for uploaded images | | | |
| Field Name | Field Type | Obligatory | Description |
| user\_id | int (10) | Yes | Foreign key to Users |
| subject\_name | varchar (100) | Yes | Name of the person in the image |
| image\_path | varchar (255) | Yes | Path to uploaded image file |
| detected\_emotion | varchar (50) | Yes | Emotion result from model |
| confidence | float | Yes | Prediction confidence score |
| notes | text | No | Optional user-provided description |
| created\_at | datetime | Yes | Date of submission |

3.2.3. PasswordReset

|  |  |  |  |
| --- | --- | --- | --- |
| IDENTIFICATOR | | PasswordReset | |
| Description | | | |
| Table that stores user password reset tokens and timestamps | | | |
| Field Name | Field Type | Obligatory | Description |
| email | varchar (255) | Yes | User's email address |
| token | varchar (255) | Yes | One-time password reset token |
| created\_at | datetime | Yes | Timestamp of token creation |
| email | varchar (255) | Yes | User's email address |

3.2.4. AnalysisResultHistory

|  |  |  |  |
| --- | --- | --- | --- |
| IDENTIFICATOR | | AnalysisResultHistory | |
| Description | | | |
| Stores archived analysis results for user queries over time | | | |
| Field Name | Field Type | Obligatory | Description |
| id | int (10) | Yes | Table identifier |
| query\_id | int (10) | Yes | Foreign key to FacialExpressionQuery |
| emotion\_detected | varchar (50) | Yes | Archived emotion result |
| confidence\_score | float | Yes | Archived confidence level |

4. Reports

4.1. Student assessment report for individual test

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Surname | Certificate number | Group | Detected Expression |
| Ataberk | AKCIN | 211AIB121 | Group-27 | Surprise |
| Renas | ALP | 211ADB112 | Group-27 | Neutral |
| Efehan | ARAS | 211ADB079 | Group-27 | Happy |
| Babak | GASIMIZADE | 211ADB125 | Group-27 | Surprise |

4.2. Student evaluation report for all tests

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Surname | Certificate number | Group | Rating  1 | Rating  2 | Rating  3 | Rating  4 | Average  Confidence |
| Ataberk | AKCIN | 211AIB121 | Group-27 | 0.96 | 0.93 | 0.95 | 0.94 | 0.95 |
| Renas | ALP | 211ADB112 | Group-27 | 0.89 | 0.87 | 0.88 | 0.90 | 0.88 |
| Efehan | ARAS | 211ADB079 | Group-27 | 0.91 | 0.92 | 0.89 | 0.90 | 0.91 |
| Babak | GASIMIZADE | 211ADB125 | Group-27 | 0.95 | 0.96 | 0.94 | 0.95 | 0.95 |