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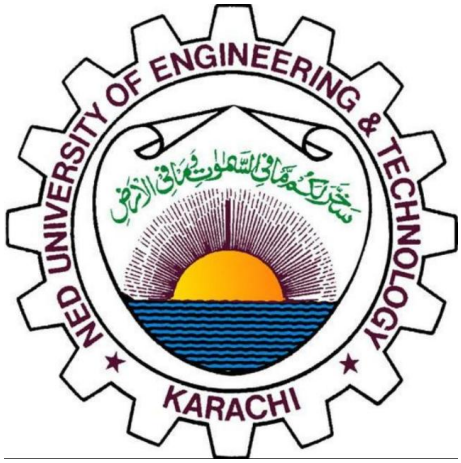

Department of Software Engineering

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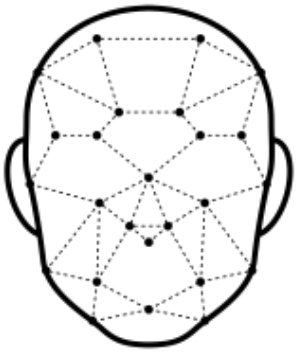

Software Requirements Specification

Facelog Attendance

Version 1.0

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1 Introduction

1.1 Purpose of requirement document

This Software Requirements Specification serves as a comprehensive guide to the functions and specifications of the FaceLog Attendance application. It provides a detailed account of the system's purpose, features, interfaces, and operational constraints.
The primary purpose of this software is to revolutionize the process of attendance-taking within organizations by using facial recognition technology. It addresses the inherent challenges of manual attendance tracking, such as time consumption and the potential for errors. The software is designed to automate the attendance recording process, ensuring efficiency, accuracy, and security.

1.2 Project Scope

1.2.1 Description

The FaceLog Attendance system utilizes advanced face recognition technology to identify individuals by recognizing their facial features, thereby facilitating efficient attendance collection. The process begins by capturing human faces through a webcam using the OpenCV framework. These captured faces are then resized to meet the required dimensions, and the Convolutional Neural Network (CNN) algorithm is applied for facial recognition. Once the recognition process is complete, the attendance data is promptly updated in the database, along with a timestamp for each entry, and comprehensive reports are generated.

1.2.2 Benefits

- The "Facelog Attendance" system eliminates manual attendance tracking, reducing the risk of errors and ensuring that attendance data is recorded with precision.
- The system can easily scale to accommodate the growing needs of organizations, making it an ideal solution for businesses of all sizes.
- The system's contactless attendance recording eliminates the need for physical contact unlike biometric scanners, reducing the risk of disease transmission. This promotes a hygienic and safe attendance recording process, enhancing overall health safety in the workplace.
- Admins can define attendance time intervals, rules for attendance statuses, and salary deduction policies, tailoring the system to their specific needs.
- All attendance data is stored in a secure cloud-based database, providing centralized access to authorized personnel.
- Admins have access to auto-generated monthly attendance reports for all employees and they can also utilize graphical representations to analyze attendance patterns, aiding in decision-making and employee management.

1.2.3 Corporate Goals

- The primary goal is to enhance overall operational efficiency by automating attendance tracking and reducing manual efforts.
- By using facial detection and recognition technology, the system enhances security and eliminates issues like buddy-punching, common in traditional attendance systems.
- Facelog aims to support the growth of organizations by providing a scalable solution that can adapt to their evolving needs and accommodate an increasing number of users.
- The system can support seamless integration with the organization's payroll system, allowing for the automatic transfer of attendance and related data reducing administrative overhead, minimizing errors, and ensuring accurate and timely payroll processing.
- Centralizing attendance data is a key goal, enabling easy access to attendance records while ensuring data security, compliance, and accessibility.
- The system aims to empower organizations with the tools to make data-driven decisions by providing detailed attendance analysis capabilities, which can inform business strategies and workforce management.

1.3 Definitions, acronyms, and abbreviations

1. **Front-end web application:**
   It is commonly referred to as "client-side" and serves as the user interface of the websites. It enables users to seamlessly engage with the system and presents the graphical user interface (GUI) of the system.
   Front-end web development involves using technologies like HTML5, CSS, JavaScript, and React to create user-appealing and responsive websites.
2. **Cloud-based database:**
   It is a type of database that is operated and hosted on a cloud computing environment, where data is stored and managed on servers provided by a cloud service provider rather than on local servers.
   This approach allows access, storage, and processing of data over the internet, offering benefits in terms of scalability and accessibility.
3. **ADMIN:**
   Admin stands for administrator.
   Administrative work within an organization involves overseeing employee information and ensuring that company operations align with the organization's policies.

4. **Timestamp:**
   A timestamp is a data record that indicates the date and time when a specific event or action occurred.
   In the case of an attendance system at the workplace, the timestamp is utilized to record the exact date and time when an individual's attendance is marked or registered. This helps in accurately tracking and documenting when someone arrives or leaves the workplace.

5. **Payroll System:**
   A payroll system is a comprehensive and organized approach to managing and processing employee compensation within an organization.

6. **OpenCv:**
   OpenCV stands for Open Source Computer Vision Library.
   It is an open-source computer vision and machine learning software library. OpenCV is written in C++ and also has Python and Java bindings.
   It is majorly used in computer vision tasks, which include image processing, object detection, facial recognition and more.

7. **CNN:**
   CNN stands for Convolutional Neural Network.
   It is a deep learning technique primarily utilized for the purpose of image processing. It is widely used in object detection in computer vision. It processes the input images and extracts feature maps that represent different aspects of the images.

8. **Visual studio Code:**
   Visual Studio is a free and open-source code editor developed by Microsoft. It is highly recommendable because of its lightweight, extensible, and highly customizable nature. It is available on Windows, macOS and Linux.

9. **Jupyter Notebook:**
   Jupyter Notebook, an open-source web application, is frequently employed for tasks related to machine learning, including model training and data visualization.
   Jupyter Notebook supports various programming languages, but it is most commonly used for Python programming language.

10. **Flask:**
    Flask is a popular Python web framework that allows users to build web applications and APIs.
    Flask provides tools and libraries for routing, handling requests and responses, and rendering templates, among other features.

11. **MongoDB:**
    MongoDB is one of the well-known NoSQL database management system. It is known for handling unstructured data, making it suitable for a wide range of applications.

MongoDB stores data in JSON-like document form. It's often used in web and mobile application development.

1.4 References

- Face Recognition Attendance System Using Python, AnalyticsVidya, https://www.analyticsvidhya.com/blog/2021/11/build-face-recognition-attendance-system-using-python/, April 26th, 2023
- Face Recognition Based Attendance System with GUI Using Opencv and Tkinter, Medium, https://meetsuvariya.medium.com/face-recognition-based-attendance-system-with-gui-using-opencv-and-tkinter-2d5ce7422aa5, Jan 12, 2022

1.5 Overview

The rest of SRS (Software Requirements Specification) is structured as follows:

- **Section 2** offers an overview of the system, presenting the product's functionality, and encompassing the various operations within the system. Furthermore, it outlines the user classes and the characteristics of both admins and employees.
- **Section 3** outlines the general constraints of the system, encompassing technology and hardware-related limitations.
- **Section 4** explores the assumptions and dependencies that are considered for the system.
- **Section 5** details the specific requirements of the system that must be integrated. This includes both functional and non-functional requirements, providing an in-depth description of the system's operations, and covering aspects of performance and safety. It also specifies software and hardware requirements.

2 General Description

2.1 Product Perspective

The "Facelog attendance" system is a web-based solution that employs facial detection and recognition technology for employee attendance tracking. It includes an end-user terminal - a front-end web application, and a cloud-based database for centralized data storage. Key features encompass efficient and secure attendance management, scalability, detailed attendance analysis tools, and automatic salary deduction. Additionally, the system prioritizes a hygienic, non-contact attendance approach, making it ideal for modern workplaces.

2.2 Product function

2.2.1 Attendance Recording and Management

- The system captures employee images for recognition.
- The system recognizes and verifies the employee by analyzing his/her facial features.
- Attendance data is stored securely in the database.

2.2.2 User Management

- Admins can add, edit, or remove employee accounts.
- There is only one admin account in the system however, the original administrator can add co-admins with the same privileges.
- User roles and privileges are defined for admins and employees.

2.2.3 Scheduling

- Admins can set attendance recording schedules and statuses, specifying days and times.

2.2.4 Report Generation

- The system generates detailed attendance reports, including information on late arrivals, absences, and deducted salary.

2.2.5 Graphical Representation

- Attendance data is also represented graphically, showing employees' punctuality and aiding in the visualization and analysis of attendance patterns.

2.3 User classes and characteristics

2.3.1 Admin

- Admin have the ability to configure the attendance system, set attendance schedules, and access detailed attendance reports.
- They are responsible for user management, including adding employees and co-admins.

2.3.2 Employees

- Employees use the system to mark their attendance by showing their faces to the camera during scheduled times.
- They can also view their own attendance history and statistics in tabular form.

3 General Constraints

3.1 Technology Constraints

- The system is compatible with modern web browsers for the user interface and relies on open-source face recognition libraries for face detection and recognition.
- An active internet connection must be available to mark the attendance.

3.2 Hardware Constraints

- The quality and placement of cameras impact system performance.
- The device must have the necessary hardware resources to connect to the internet.

4 Assumptions and Dependencies

4.1 Assumptions

- Employees have an access to a camera-enabled device with active internet connection for attendance marking.
- The organization's hardware, including cameras, is in working order and compatible with the system.
- There is an active internet facility available for the user.
- It is assumed that a dedicated hardware device is available for marking attendance. Attendance can only be marked using this designated hardware device.

4.2 Dependencies

- The system depends on open-source face recognition libraries for accurate face detection and recognition.
- The system depends on consistent Internet access for smooth accessibility.
- The accuracy of attendance records relies on the camera and quality of facial images captured during registration and attendance marking.

5 Specific requirements

5.1 Functional Requirements

5.1.1 For Admin

- **Admin Registration**

  - The system should provide a onetime option for setting up the attendance system. This option asks for admin registration.
  - The system should allow admin to register himself, for once only.

- **Admin Login**
  - The system should allow the admin to log into the system.
  - Admin is required to log into the system in order to access admin features and also to set or modify system settings.

- **Employee Registration**
  - The admin should be able to register new employees into the system.
  - Registration of employees requires details such as employee name, employee ID, salary, and facial images (captured by system itself).

- **Attendance Time Management**
  - The admin should be able to define and modify attendance time interval.
  - During this interval, the system should be operational for recording attendance.
  - The admin should be able to define time interval to determine attendance statuses (Present, Late, Absent, Half Day).

- **Number of Late, Absent and Half Days**
  - The admin should be able to specify the permissible number of late, absent and half days for employees in a given year.

- **Salary Deduction Rules**
  - Admins should have the ability to define rules for salary deductions based on attendance status of employees during a month.

- **Employee Attendance Reports**
  - The admin should be able to access auto generated monthly attendance reports of all employees.
  - Employees attendance report should provide details including Employees IDs, Employees names, Present/Late/Absent/Half Days, and salary deductions.

- **Employee Attendance Graph**
  - Admins can view graphical representation of attendance record of each employee to help analyse attendance patterns.

- **Co-Admin Registration**
  - Existing admin should be able to register new admin.
  - Co-admin registration requires details such as Admin name, Admin email, and password.
- **Employee Management**
  - The admin should be able to manage employee information, including updating details, and removing employees from the system.

5.1.2 For Employee

- **Employee login**
  - The system should allow employees to log into the system.
  - To track the attendance and to change password, employees have to log into the system first.
- **Mark My Attendance**
  - The employees should be able to access mark my attendance feature during operational time interval as specified by admin, to record their attendance.
- **Track Attendance**
  - Employees should be able to track their attendance any time.
  - This feature displays individual employee attendance information including date, time, attendance status, and salary detection.
- **Change Password**
  - The system should allow employees to change their portal password.

5.1.3 For Facial Recognition Feature

- **Facial Registration**
  - The system should ask for facial images during employee registration.
  - The system should capture the real time facial images of employees through camera, during registration.
- **Facial Recognition**
  - The system should have the capability to record the attendance of registered employees by recognizing and verifying their faces.

- When an employee clicks on the "Mark My Attendance" button, the system should activate the camera to capture the employee's face.

- **Attendance Information**
  - The system should record attendance information, including employee name, employee ID, date, time, and attendance status (Present, Late, Half Day, Absent) for the recognized employee.

- **Attendance Status Determination**
  - The system should determine the attendance status based on recorded time as specified by the admin.

- **Salary deduction**
  - The system should calculate the amount to be deducted from employees salaries, based on the detection rules specified by admin.

- **Employee Reports**
  - The system should update and maintain the monthly employee reports, which is accessible by admin.
  - The system should update and maintain the individual employee reports, accessible by employees.

- **Graphical Attendance Representation**
  - The system should generate graphical representations of each employee's monthly attendance records in the form of graphs, charts, or visual plots.

5.2 Non-Functional Requirements

5.2.1 Product Requirements

- **Usability**
  - The system shall provide a user-friendly interface for both administrators and employees, ensuring ease of navigation and operation.
  - The system shall require minimal training for administrators and employees to effectively use all features.

- **Reliability**
  - The system shall maintain a high availability rate of at least 98%, ensuring that it is accessible to users at all times.

  - The system shall implement robust data integrity measures to prevent data corruption or loss, ensuring the accuracy of attendance records and reports.
  - The system shall recover itself within 3 seconds in case of failure.

- **Performance**
  - The system shall respond to user requests, including attendance recording and report generation, within 3 seconds under normal operational conditions.

- **Efficiency**
  - The system shall be optimized to utilize hardware resources efficiently, minimizing CPU and memory usage to ensure smooth operation.

- **Portability**
  - The system shall be compatible with commonly used web browsers and mobile devices to ensure accessibility from a variety of platforms.

5.2.2 External Requirements

- **Ethical**
  - Employees should be provided informed consent for the use of their facial data for attendance tracking, and this consent should be explicitly documented.
  - The use of facial recognition technology for attendance tracking should comply with ethical AI principles, including transparency, accountability, and fairness.

- **Safety**
  - The system must adhere to safety standards and guidelines applicable to facial recognition technology, ensuring that it does not pose any physical or psychological harm to individuals.

- **Security**
  - The system should adhere to data protection regulations and ensure the privacy of facial images and personal information stored in the system.
  - Access to the system, especially administrative functions, should be restricted to authorized personnel through robust user authentication mechanisms.

5.3 External Interface Requirements

5.3.1 Software Interfaces

- Visual Studio Code Version 1.83 and Jupyter Notebook Version 7.0.6 will be used for development.

- The software shall be developed using languages and frameworks suitable for web development, such as Python Version 3.10 and its popular framework Flask for back-end, and JavaScript for front-end.
- The user interface shall be developed using front-end frameworks and technologies, such as HTML, CSS, JavaScript, and React.
- The system shall rely on Python libraries i.e. OpenCV and CNN algorithm for face detection and recognition.
- The software shall be developed and integrated with a non-relational database management system i.e. MongoDB for data storage and retrieval.

5.3.2 Hardware Interfaces

- The system requires access to a camera or webcam to capture facial images. The camera or webcam should capture clear facial images.
- The system requires network connectivity to function. It shall support standard internet protocols and be accessible through HTTP or HTTPS.

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