 

**T.C. MARMARA UNIVERSITY**

**FACULTY of ENGINEERING COMPUTER ENGINEERING DEPARTMENT**

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Title of the Project

**FaceApp**

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**1. Problem Statement**

The aim of this project is to address the privacy concerns related to group photographs shared within applications like WhatsApp and Telegram. The problem arises when users share group photographs that may not include every participant, leading to discomfort and privacy issues. This project aims to develop a solution that ensures individuals only see group photos they are part of and prevent unauthorized access to these photos.

**2. Problem Description and Motivation**

In a world where digital privacy is a growing concern, ensuring the protection and security of personal photographs shared in group chats is essential. This project aims to provide a solution that not only addresses this issue but also respects the privacy of individuals, particularly in school groups where parents can be sensitive to the subject. The motivation for this project is to offer a practical and user-friendly solution to these concerns.

**3. Main Goal and Objectives**

* **Main Goal:** To develop a privacy-focused group photograph sharing application.
* **Objectives:**
  + Create a user-friendly chat application.
  + Implement facial recognition to classify people in photos.
  + Develop a system to share photos only with individuals present in the photo.

**4. Related Work**

In this section, we review and compare existing research and solutions related to privacy issues in group photograph sharing applications. A thorough understanding of related work is crucial for identifying gaps and novelties in our project.

4.1 Existing Solutions

Several existing solutions and applications address privacy issues in group photograph sharing, with a focus on user privacy and data security. Notable examples include:

*4.1.1 WhatsApp and Telegram*

* **Privacy Features:** Both WhatsApp and Telegram have implemented privacy features like end-to-end encryption and group-specific settings.
* **Limitations:** While these applications provide some level of privacy, they may not address the issue of sharing photographs only with individuals present in the photo.

*4.1.2 Facial Recognition Applications*

* **Applications:** Some facial recognition applications enable users to tag individuals in photos, offering a level of personalization.
* **Limitations:** These applications often require manual tagging and do not address privacy concerns related to photo sharing with unauthorized users.

4.2 Research in Privacy Protection

Several research studies have delved into privacy protection in photo sharing, particularly in social media settings:

*4.2.1 Privacy-Preserving Photo Sharing*

* **Research:** Studies in privacy-preserving photo sharing have explored cryptographic techniques to protect images from unauthorized access.
* **Limitations:** These solutions may not always offer seamless user experiences and can be complex for non-technical users.

*4.2.2 Facial Recognition in Photo Tagging*

* **Research:** Facial recognition research has advanced in the context of photo tagging on social media platforms.
* **Limitations:** These solutions are often oriented towards improving user experiences but may not address concerns specific to group photograph sharing privacy.

4.3 Project Novelties

Compared to the related work, our project introduces several novelties and differentiators:

* **Automated Facial Recognition:** Our project focuses on automating facial recognition to classify individuals in group photographs, reducing the need for manual tagging.
* **Privacy-Centric Approach:** We prioritize user privacy and security by ensuring that photographs are shared only with individuals present in the photo, addressing concerns related to unauthorized access.
* **Integration of Chat and Facial Recognition:** The combination of chat functionality with facial recognition sets our project apart, offering a holistic solution for privacy-focused group photograph sharing.

Our project aims to build on the strengths of existing solutions while addressing the limitations and providing a more comprehensive approach to privacy protection in group photograph sharing.

**5. Scope**

The scope of this project encompasses the development of a privacy-focused group photograph sharing application with a multifaceted approach. It includes the following components:

5.1 Chat Application

* Creation of a user-friendly chat application for the mobile platform using Flutter and Dart technologies.
* Integration of chat functionalities, including text messaging, multimedia sharing, and group creation.

5.2 Facial Recognition System

* Implementation of a facial recognition system using the OpenCV library in Python.
* Accurate classification of individuals present in group photographs.
* Detection of unique facial features and characteristics to identify individuals.

5.3 Data Sharing Features

* Development of a system that enables users to share photographs securely.
* Ensuring that photos are shared only with individuals who are part of the image.
* Protection of personal data and prevention of unauthorized access to shared photos.

5.4 Constraints

The project operates within defined constraints and assumptions, including:

* **Economic Constraints:** Limitation of messaging feature since we are planning to use free version of FireBase.

5.5 Assumptions

The project is based on several key assumptions, including, but not limited to:

* Assumption that access to necessary data is available for facial recognition training.
* Assumption of a manageable number of simultaneous users for optimal system performance.
* Assumption of compatible network infrastructure to handle bandwidth requirements.
* Assumption that the project design will be suitable for its intended purpose.

**6. Methodology and Technical Approach**

The methodology and technical approach for this project encompass a comprehensive plan to achieve the specified objectives and deliver a privacy-focused group photograph sharing application. This section provides a detailed breakdown of our approach, including the technologies, tools, and methods we intend to employ.

6.1 High-Level Solution Approach

Our high-level solution approach involves several key phases:

*6.1.1 Chat Application Development*

* **Technology Stack:** We will develop the chat application for the mobile platform using Flutter and Dart. These technologies offer cross-platform compatibility and an efficient development process.
* **User Profiles:** Upon entering the application, users will be expected to take and upload several photos of themselves to facial recognition feature to work. Later on, they will be able to add, edit or delete those photos.

*6.1.2 Facial Recognition*

* **Technology Stack:** For the main feature of the project, which is facial recognition, we will utilize the OpenCV library in conjunction with Python.
* **Face Classification:** The primary objective is to accurately classify individuals in group photographs. This will involve detecting and distinguishing facial features to identify and differentiate users.

*6.1.3 Secure Data Sharing*

* **Security Protocols:** To ensure privacy, we will implement secure data sharing mechanisms. Photographs will only be shared with individuals who are present in the photo, and personal data will be protected.

6.2 Theory and Algorithms

Our technical approach involves the utilization of established theory and algorithms in the following areas:

*6.2.1 Facial Recognition Algorithms*

* We will employ well-established facial recognition algorithms and techniques to accurately detect and classify individuals in photographs. These may include methods like Eigenfaces, Fisherfaces, or deep learning-based approaches.

*6.2.2 Secure Data Transfer*

* The project will implement encryption and secure data transfer protocols to protect the privacy of users. Standard encryption methods, such as AES or RSA, will be used to ensure data security.

6.3 Performance Evaluation

Performance evaluation is a critical aspect of this project, and we will employ the following measures:

* **Accuracy:** We will assess the accuracy of the facial recognition system in correctly identifying individuals.
* **Response Time:** Measurement of the system's response time when handling image recognition and data sharing.
* **Resource Utilization:** Monitoring the efficient use of system resources, including memory and processing power.
* **User Experience:** Evaluation of the user experience, including ease of use and overall satisfaction with the application.

6.4 Resource Requirements

To successfully complete the project, we will require various resources, including:

* **Hardware:** Mobile devices for testing and development.
* **Software:** Development tools such as IDEs and libraries.
* **Data:** Training data for the facial recognition system.
* **Human Resources:** A skilled development team for coding and testing.

6.5 Performance Testing

The project will undergo rigorous performance testing to ensure the application's reliability and efficiency. This will involve testing under various network conditions, assessing system responsiveness, and evaluating the accuracy of facial recognition.

**7. Professional Considerations**

In this section, we address various professional considerations and standards that will guide the project's development, collaboration, and overall management.

7.1 Methodological Considerations and Engineering Standards

*7.1.1 Version Control with Git/GitHub*

* **Version Control:** We will utilize Git as our version control system and host our code repositories on GitHub. This practice ensures code integrity, collaboration, and easy tracking of project changes.
* **Commit Conventions:** Our team will adhere to clear and descriptive commit messages, following a consistent convention (e.g., Semantic Versioning) for effective code review and history tracking.

*7.1.2 Gantt Charts*

* **Project Management:** Gantt charts will be employed to visualize project timelines, task dependencies, and milestones. This aids in effective project management and allows for the tracking of progress against established deadlines.

*7.1.3 Object-Oriented Programming (OOP)*

* **Code Structure:** We will follow the principles of Object-Oriented Programming to create modular and maintainable code. Classes, objects, inheritance, and encapsulation will be employed to enhance code organization and reusability.
* **Design Patterns:** We will explore design patterns like Singleton, Factory, and Observer to solve recurring design problems and promote code flexibility and scalability.

7.2 Realistic Constraints

*7.2.1 Economic Constraints*

* **Cost-Benefit Analysis:** Throughout the project, we will assess the expected costs and benefits to ensure alignment with project objectives.
* **Budget Adherence:** We will manage project finances prudently and control expenditure to remain within budgetary limits.

*7.2.2 Environmental Constraints*

* **Environmental Impact Assessment:** We will evaluate the project's potential environmental impact, considering factors such as energy consumption and resource usage.
* **Mitigation Strategies:** Strategies to reduce any negative environmental effects, such as optimizing energy-efficient algorithms, will be implemented.

*7.2.3 Ethical Constraints*

* **Intellectual Property:** We will respect intellectual property rights and avoid using patented designs and concepts without proper permissions.
* **Privacy and Security:** Protecting the privacy and security of users and their data is of utmost importance. We will adhere to ethical guidelines in data handling and access control.

*7.2.4 Health and Safety Constraints*

* **User Safety:** We will consider the health and safety of users and the public when designing the application, particularly in scenarios involving potential stress factors or sensitive information.

*7.2.5 Sustainability Constraints*

* **Product Reliability:** Ensuring that the application is reliable and durable under normal operation conditions to support its long-term sustainability.
* **Lifecycle Planning:** The project will include a well-defined product lifecycle plan to address sustainability, including updates and maintenance.

*7.2.6 Social Constraints*

* **Public Funding Compliance:** We will adhere to public funding regulations if applicable, ensuring that the project aligns with the goals of any funding sources.
* **Respectful Design:** We will avoid designing products that may negatively profile specific races, genders, or any group of individuals.

7.3 Legal Considerations

*7.3.1 Permissions and Licensing*

* **Compliance:** We will ensure compliance with all necessary legal permissions and licenses, especially if the developed product is intended for market release.
* **Data Protection:** Legal considerations will extend to data protection and privacy regulations to safeguard user information.

**8. Management Plan**

* **Task Phases and Durations:** Detailed descriptions of all task phases with their durations.
* **Division of Responsibilities:** Responsibilities and duties among team members.
* **Timeline with Milestones:** Gantt chart illustrating project timeline with well-defined milestones.

**9. Success Factors and Risk Management**

* **Measurability/Measuring Success:** Key performance indicators for project objectives.
* **Risk Management:** List of potential risks with corresponding resolution plans.

**10. Benefits and Impact of the Project**

* **Benefits/Implications:** Discuss potential benefits and beneficiaries of the project.
* **Scientific, Economic, Commercial, Social Impact:** Address the expected impacts in these areas.
* **Potential Impact on New Projects:** Assess if the project will have a pioneering effect.
* **Impact on National Security:** Address any security considerations.

**11. References**

Include a list of references used in the project.

**12. Appendix (Realistic Constraints)**

Detail the realistic constraints related to economic, environmental, ethical, health and safety, sustainability, and social aspects.