Tribhuvan University

Faculty of Humanities and Social Sciences

A PROJECT REPORT

ON

PicTok (Social Media)

Submitted to

Department of Computer Application

Swastik College

In partial fulfillment of the requirements for the Bachelors in Computer Application

Submitted by

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SUPERVISOR'S RECOMMENDATION

I hereby recommend that this project prepared under my supervision by **APIL BASNET and KUNJAN DHUNGANA** entitled **"PICTOK"** in partial fulfillment of the requirements for the degree of Bachelor of Computer Application is recommended for the final evaluation.

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LETTER OF APPROVAL

This is to certify that this project prepared by **APIL BASNET** and **KUNJAN DHUNGANA** entitled **"PICTOK"** in partial fulfillment of the requirements for the degree of Bachelor in Computer Application has been evaluated. In our opinion it is satisfactory in the scope and quality as a project for the required degree.

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ABSTRACT

PicTok is a social photo-sharing application designed to enable users to express themselves through images. Inspired by the engagement model of TikTok, PicTok replaces short-form videos with photos, creating a platform where visual storytelling takes center stage. Users can upload, browse, like, and comment on photos, while features like dynamic feeds, trending posts, follows, and real-time notifications drive interaction and discovery.

The mobile frontend is built with React Native, ensuring a responsive and native-like user experience across platforms. The backend architecture leverages NestJS, PostgreSQL, and Redis, optimized for scalability, performance, and real-time responsiveness.

PicTok bridges the gap between traditional static photo feeds and the viral, fast-paced nature of modern content platforms. The project aims to promote creative expression through photography, while maintaining a high-performance, scalable infrastructure designed for growth and user engagement.

Keywords: Photo-sharing, Social media, React Native, NestJS, Redis, PostgreSQL, Mobile app, Cross-platform development, JWT Authentication, Image-centric Design.

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Lastly, a huge thanks and appreciation to our colleagues and everyone who has directly or indirectly supported us in completing this project.

Thanking you,

Apil Basnet

Kunjan Dhungana

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LIST OF ABBREVIATIONS

API = Application Programming Interface

CSS = Cascading Style Sheet

DFD = Data Flow Diagram

ER = Entity Relationship

HTML = Hypertext Markup Language

IDE = Integrated Development Environment

JS = JavaScript

ORM = Object Relational Mapping

Postgres = PostgreSQL

SQL = Structured Query Language

UI = User Interface

CHAPTER 1: INTRODUCTION

1.1 Introduction

PicTok is a mobile-first social media platform designed exclusively for sharing photos. Inspired by TikTok's vertical swipe interaction, PicTok replaces short videos with high-quality still images, allowing users to scroll through content quickly and immersively. The platform emphasizes minimalism and visual expression, enabling users to upload, browse, like, and comment on photos in a clean, distraction-free environment.

In contrast to platforms like Instagram and TikTok—which focus heavily on mixed media and video—PicTok is built around the simplicity of still photography. It caters to users who prefer visual storytelling through images without the noise of autoplay videos or complex content algorithms. This focus makes PicTok particularly appealing to photographers, artists, travelers, and visual enthusiasts.

The app is built using **React Native** for a smooth, cross-platform mobile experience. Its backend is powered by **NestJS**, with **PostgreSQL** handling persistent data and **Redis** managing caching and real-time interactions. The entire stack uses **TypeScript**, ensuring strong type safety and maintainable code across the system.

Core features include real-time photo feeds, user authentication, photo uploads, interactive likes and comments, and customizable user profiles. Each interaction is optimized for performance and responsiveness, aiming to deliver a seamless user experience.

By prioritizing photos over video and simplicity over complexity, PicTok reimagines photo sharing for the modern user—fast, expressive, and focused on the art of still imagery.

1.2 Problem Statement

While existing platforms like Instagram offer mixed media content and TikTok focuses exclusively on video, there is a clear gap in the market for a platform dedicated solely to still photography with lightweight, intuitive interaction. Users who prefer photo-based content often find themselves overwhelmed by features tailored to video creation and consumption.

For individuals and communities who value simple, focused visual storytelling, current solutions fall short. There is a lack of platforms that provide a minimalist, distraction-free environment for sharing and enjoying static images—without competing against autoplay videos, algorithm-heavy recommendations, or unrelated media formats. PicTok addresses this gap by creating a platform where photos take center stage, enabling users to connect through the art of still imagery.

1.3 Objective

Here are some objectives of this system:

General objectives:

- To develop a mobile-first social media application that enables users to share and interact with photo-based content in a fast, engaging, and user-friendly way.
- To provide a dedicated platform for creators and users who prefer still images over videos, ensuring visibility, simplicity, and meaningful engagement around photographic content.

Specific objectives:

- To allow users to upload, like, comment, and browse images.
- To provide a smooth and interactive mobile experience with React Native.
- To ensure real-time feed updates and caching using Redis.
- To build a scalable backend using NestJS and PostgreSQL.
- To implement user authentication for secure access to the system.

1.4 Scope and Limitation

Scope:

This system also has some scope unlike others that allow users to login, signup and provide access for the system. The scopes of this system are outlined below:

- Picture sharing feed.
- User authentication and profile.
- Real-time like/comment updates.
- Redis-based performance caching.
- Responsive design for Android and IOS.

Limitation:

While this system has good scope, it also has some limitations.

- No video content support.
- There are only basic image filters.
- Push notifications not supported.
- The system requires internet access to function properly.

1.5 Development Methodology

To develop the PicTok application, we adopted the **Waterfall Model**, a traditional and linear software development methodology. This model is suitable for projects with well-defined requirements and minimal changes expected during the development cycle.

Why Waterfall?

We selected the Waterfall model because:

- Requirements were clear and unlikely to change frequently.
- Each stage could be completed and reviewed before the next began.
- It matched our academic schedule with fixed deliverables.

Phases Followed:

1. **Requirement Analysis:** We gathered all functional and non-functional requirements from expected user scenarios.
2. **System Design:** Based on the requirements, we created ER diagrams, DFDs, and architectural designs.

3. **Implementation:** Frontend (React Native), Backend (NestJS), and Database (PostgreSQL + Redis) were developed module-wise.
4. **Testing:** Unit testing and system testing ensured correctness and performance.
5. **Deployment:** The system was tested on both emulators and physical mobile devices.

Waterfall Model Diagram:

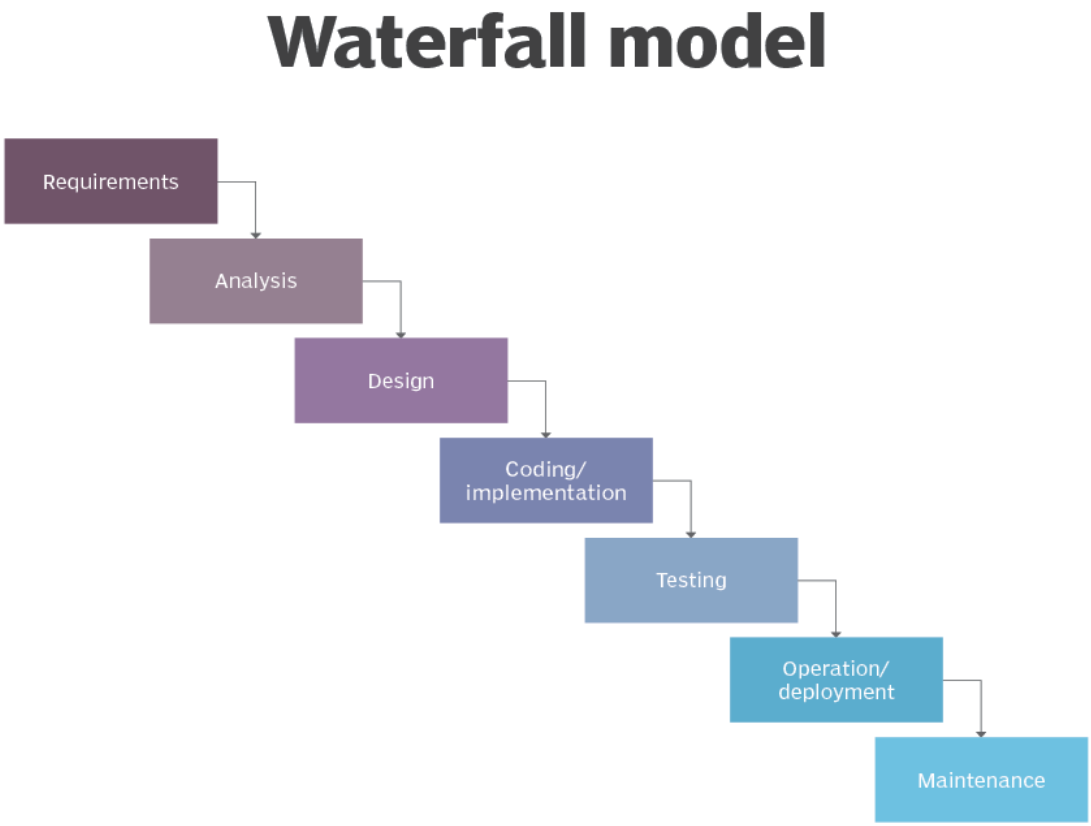

Figure 1: Waterfall Model

1.6 Report Organization

This report is organized in systematic pattern where each chapter includes the sub-topics to support the main title of the chapter. The report is organized as follows:

- **Chapter 1:** First chapter is about the introduction of the whole report. It includes short introduction of the project, problem statement, objectives, scope and limitations.
- **Chapter 2:** Second chapter is about the background study and literature review that includes explanation of existing systems and their reviews.
- **Chapter 3:** The third chapter includes the system analysis. The topics of this chapter include about requirement analysis (functional and non-functional requirements), feasibility study, data model, process model and system design.
- **Chapter 4:** The fourth chapter is about the implementation and testing. It contains detail information about the tools that are used to develop the system and includes different testing processes.
- **Chapter 5:** The last chapter includes the conclusion of the whole project. It also provides the information about what further can be achieved from this project.

CHAPTER 2: BACKGROUND STUDY AND LITERATURE REVIEW

2.1 Background Study

Short-form video has taken center stage in recent years, largely due to TikTok's innovative vertical-scroll user interface and its emphasis on rapid, bite-sized content consumption. However, this growing dominance of video has unintentionally sidelined the importance and appeal of still imagery. Originally, platforms such as Instagram were built primarily for photo sharing, giving creators and users a simple and elegant interface to showcase their pictures. Over time, these platforms have become increasingly cluttered with multiple content formats (Reels, Stories, Lives, Shops, etc.), making it difficult for users who prefer still images to enjoy a focused and uninterrupted experience.

Photographers, artists, designers, and casual users looking to share their visual work often struggle with discoverability and engagement on these multi-format platforms. Algorithms tend to prioritize videos, resulting in less visibility for photo posts. Additionally, for users who enjoy consuming visual content but are not interested in videos or reels, current platforms no longer offer a straightforward, image-first environment.

2.2 Literature Review

During the development of PicTok, we reviewed and analyzed existing image-based social media platforms and academic studies to better understand user behavior, engagement strategies, and design principles of visual communication platforms.

Image-based social media platforms such as Instagram and Pinterest have gained immense popularity over the past decade. According to Ma and Fan [1], these platforms allow users to express identity and emotion through images, which are more visually engaging and culturally resonant than text alone. Instagram, launched in 2010, became one of the largest photo-sharing platforms, with over 1 billion users and more than 500 million images shared daily by 2020 [2].

Rogers [3] explored how users on Instagram and similar platforms engage in "visibility labor"-frequently uploading curated content such as selfies, travel photography, and lifestyle imagery to build social presence and gain followers. This behavior is particularly common among micro-influencers and content creators seeking to cultivate a personal brand.

Oliveira [4] conducted an empirical study on 7,500 Instagram influencer profiles and found that posts with visually rich content—especially those with faces, high color saturation, and novelty-received significantly more likes and comments. The use of specific and trending hashtags was also shown to boost content discoverability on feeds like "For You", increasing post reach and engagement.

User interface design plays a critical role in sustaining user interest. Wei and Zhang [5] emphasized that simple, intuitive, and mobile-optimized UI components such as like buttons, image filters, and follower counters encourage repeated use and interaction. The visibility of metrics like likes and shares also acts as instant feedback, motivating users to engage more frequently.

Another important aspect is content strategy. Research indicates that users who space out promotional content, write longer captions, and use niche-specific hashtags tend to maintain stronger engagement levels over time [4]. However, studies also warn about artificial engagement metrics caused by bots or automated liking systems, which can distort authentic user interaction [3].

These insights from prior research and platform studies have informed the design and feature implementation of PicTok, focusing on visual impact, ease of use, and real-time social interaction to enhance user engagement.

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CHAPTER 3: SYSTEM ANALYSIS AND DESIGN

3.1 System Analysis

As described in **Section 1.5**, we have used the waterfall model for developing our system because it is a flexible and adaptive approach that allows for continuous development. Waterfall model divides the project into smaller, incremental pieces that have been developed and tested individually.

3.1.1 Requirements Analysis

To make this project successful, we have considered both functional and non-functional requirements.

I. Functional Requirements:

This section includes the functions and core operations of our system which let the users interact with our site.

a) **User Authentication**:
   Users can register and log in using valid email.

b) **User Management:**
   New users can register through a sign-up form.

c) **Image Management:**
   Users can upload photos along with captions and hashtags and can delete their own posts.

d) **Search Functionality:**
   Users can search for posts using hashtags or keywords from captions.

e) **Interaction Features:**
   Users can like or unlike posts, add, view, and delete their own comments on posts.

f) **Feed Generation:**
   The system displays two types of feeds:

   - **Following Feed:** Displays posts exclusively from users the current user follows.
   - **For You Feed:** Displays a personalized feed generated based on trending content, user interactions (likes, views), and hashtag relevance.

Use Case:

The use case diagram provides a high-level overview of the interactions between users (actors) and the core functionalities (use cases) of the PicTok system. It helps visualize how external users engage with the application through actions such as login, uploading photos, liking posts, and commenting. The use case diagram is shown below:

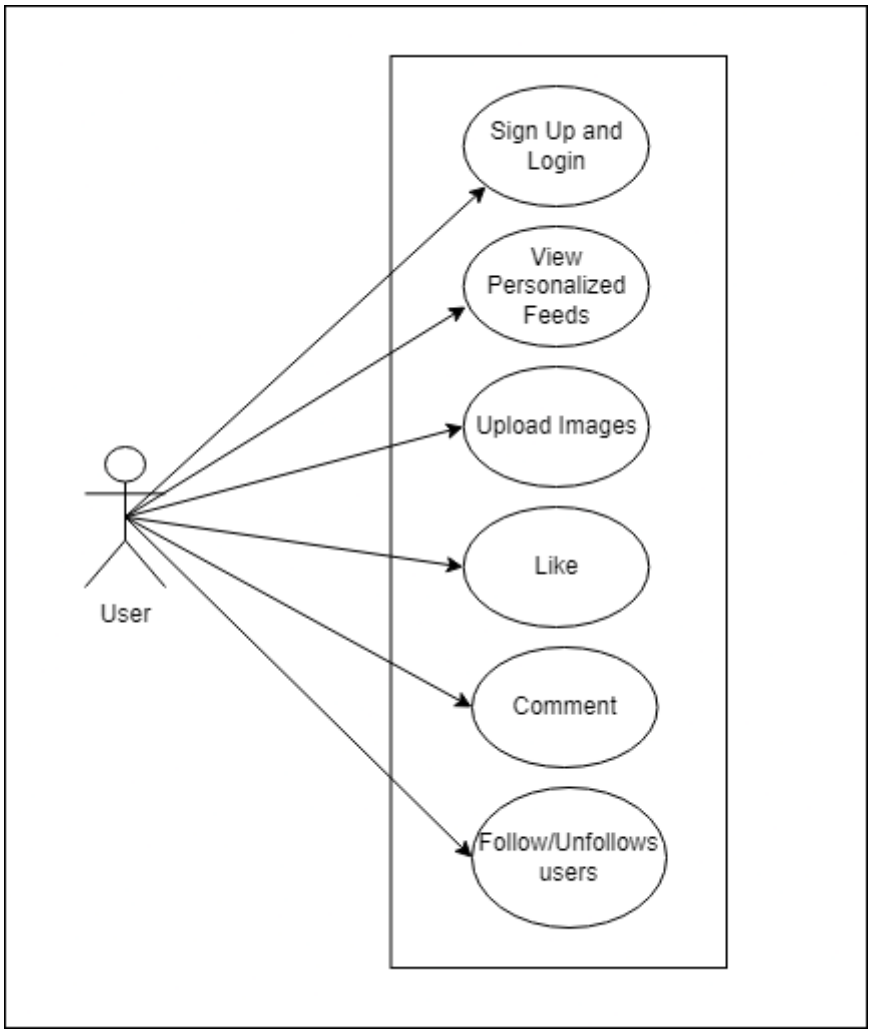


Figure 2: Use Case Diagram

II. Non-Functional Requirements:

These requirements describe how well our system operates and include aspects like security, reliability and so on.

a) Security:

The system ensures secure access to user accounts through token-based authentication (JWT). Only registered users can log in using valid email address.

b) Usability:

This system has been developed considering both technical and non-technical users. So the user interface is simple and easy to use.

c) Compatibility:

The mobile application is built with React Native and is compatible across both Android and iOS devices. Backend APIs follow RESTful standards and work seamlessly across various client platforms.

d) Performance:

To ensure high performance and low latency, Redis is used for caching frequently accessed data such as user feeds and top posts. The system supports concurrent requests from multiple users without lag or performance degradation.

3.1.2. Feasibility Analysis

Feasibility study helps to determine whether the system is sufficiently feasible to carry out. This study involves evaluating various factors to determine whether our proposed system is feasible from technical, economic, operational, and scheduling perspectives. We have considered different feasibility study to develop our system:

i. Technical feasibility:

In order to develop this system, we use the available resources thus there has been no need of external equipment. The system runs on mobile devices. The system has been built using simple technologies which have been given below:

a) Hardware specification:

- **Client Side (Mobile Device for Users):**
  i. Device Type: Android / iOS Smartphone
  ii. Processor: Quad-core (1.8 GHz or higher)
  iii. RAM: Minimum 2 GB
  iv. Storage: Minimum 100 MB free space
  v. Internet: Required (Wi-Fi or Mobile Data)
  vi. OS: Android 8+ / iOS 12+
- **Development Machine (For Developers):**
  i. Processor: Intel i5 (8th Gen) or AMD Ryzen 5 and above
  ii. RAM: Minimum 8 GB
  iii. Storage: SSD with at least 256 GB free space
  iv. GPU (optional): Integrated or entry-level dedicated GPU
  v. Internet: Stable broadband connection
  vi. OS: Windows 10 / macOS 12+ / Linux (Ubuntu 20.04+)

b) Software Specification:

- Platform: Android & IOS
- IDE: Visual Studio Code
- Diagram: Draw.io
- Database: Postgres
- Server: Nodejs (Express)
- Caching: Redis

ii. Operational feasibility:

The system is simple and easy to use due to its simple user interface. Users don't require any special training for accessing the system.

iii. Economic feasibility:

Our system is highly economically feasible as we don't spend assets for the hardware and software. We use resources that are free of cost so there is no recurring cost.

iv. Schedule feasibility:

We have planned to complete our project within 3 months. Hence, Gantt chart is used to schedule our project as it is very effective way to schedule our time. Through its use we easily track the status of task as our work progress. The following Gantt chart shows

the timeline required for completion of the project. However, we try to complete our project on specified timeline.

Figure 3: Gantt Chart

3.1.3. Data Modeling (ER Diagram)

There are different data modeling technique used to represent data with diagrams. Among them we have used ER model. This ER model shows how our data is connected to each other and how they are processed and stored in a system.

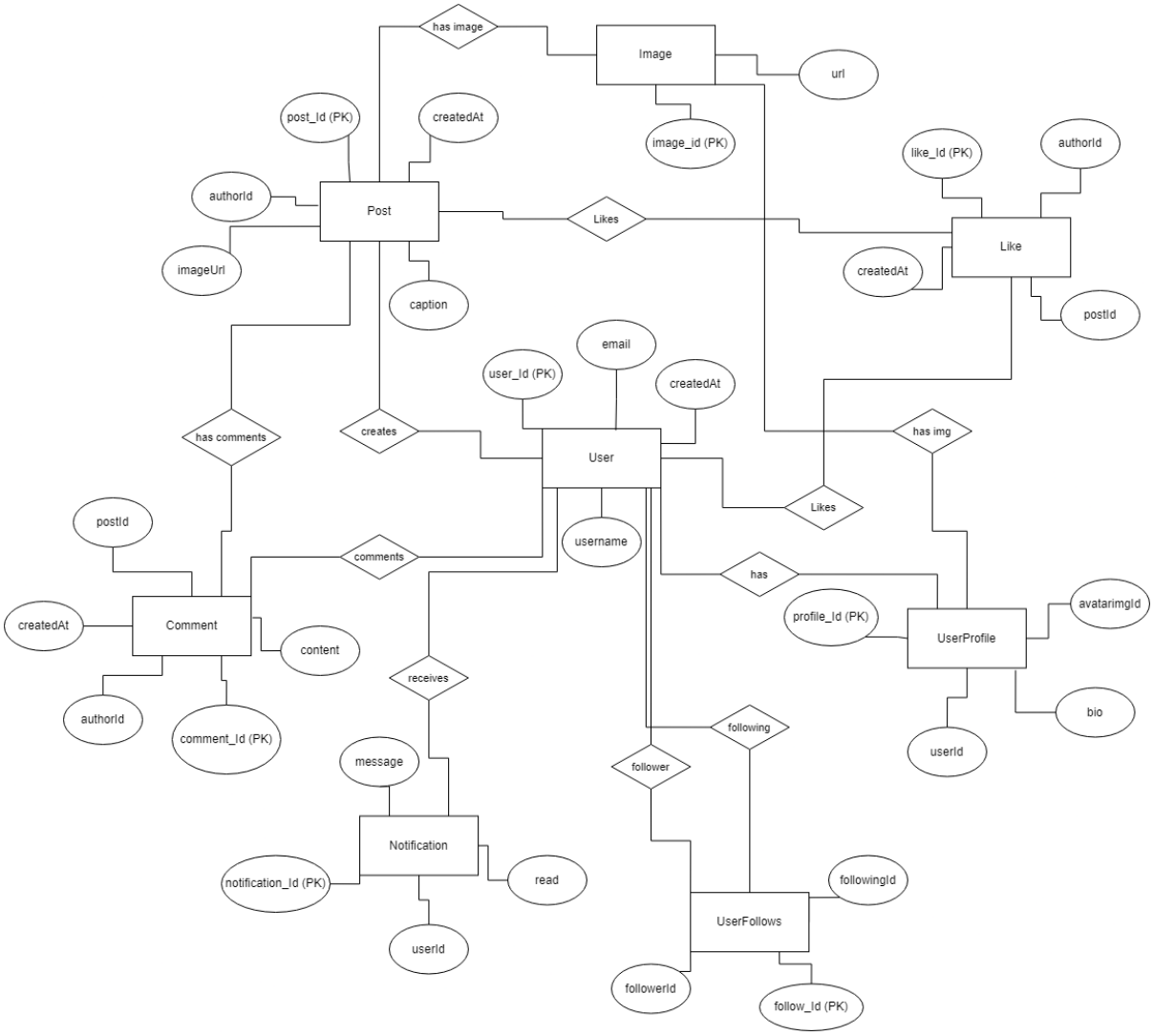


Figure 4: ER Diagram

3.1.4. Process Modeling (DFD)

Initially, a context diagram also known as DFD level 0, is drawn, which is a simple representation of our entire system. Then it is followed by a level 1 DFD diagram, which provides an overview of the major functional areas. Level 2 diagram shows the detailed analysis of our system. These all diagram are shown below:

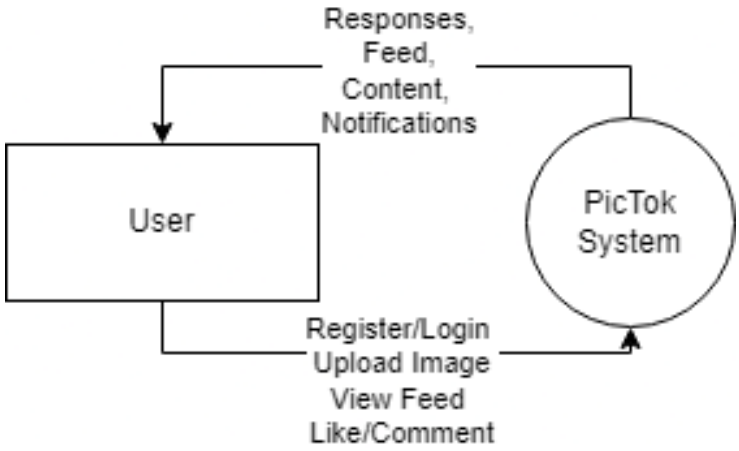


Figure 5: DFD Level 0

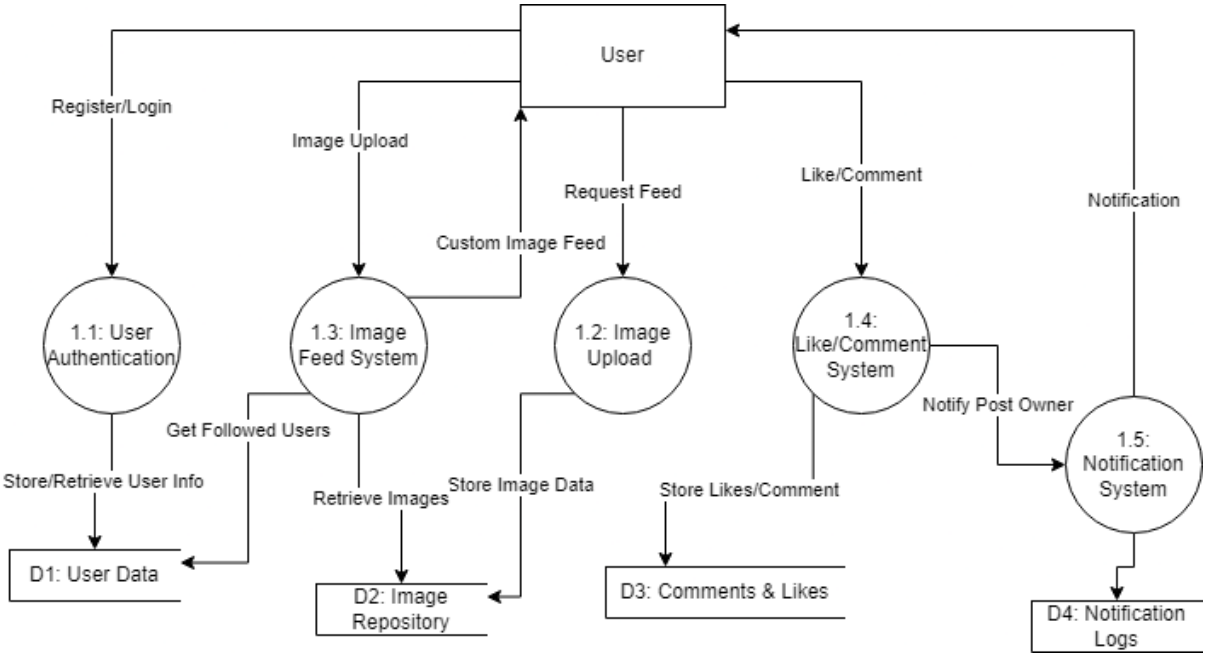


Figure 6: DFD Level 1

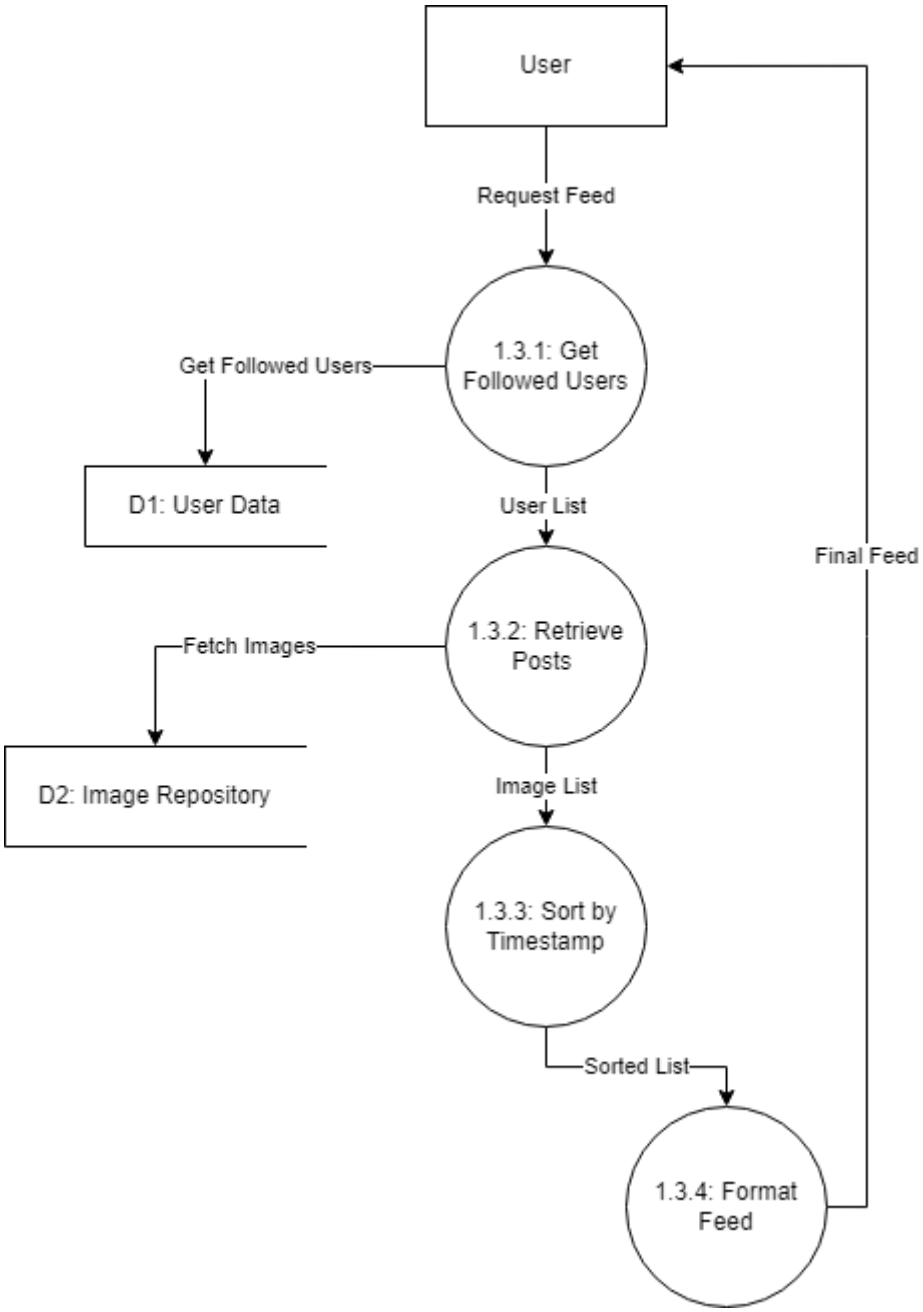


Figure 7: DFD Level 2

3.2. System Design

3.2.1. Architectural Design

Here is the architectural design of our system.

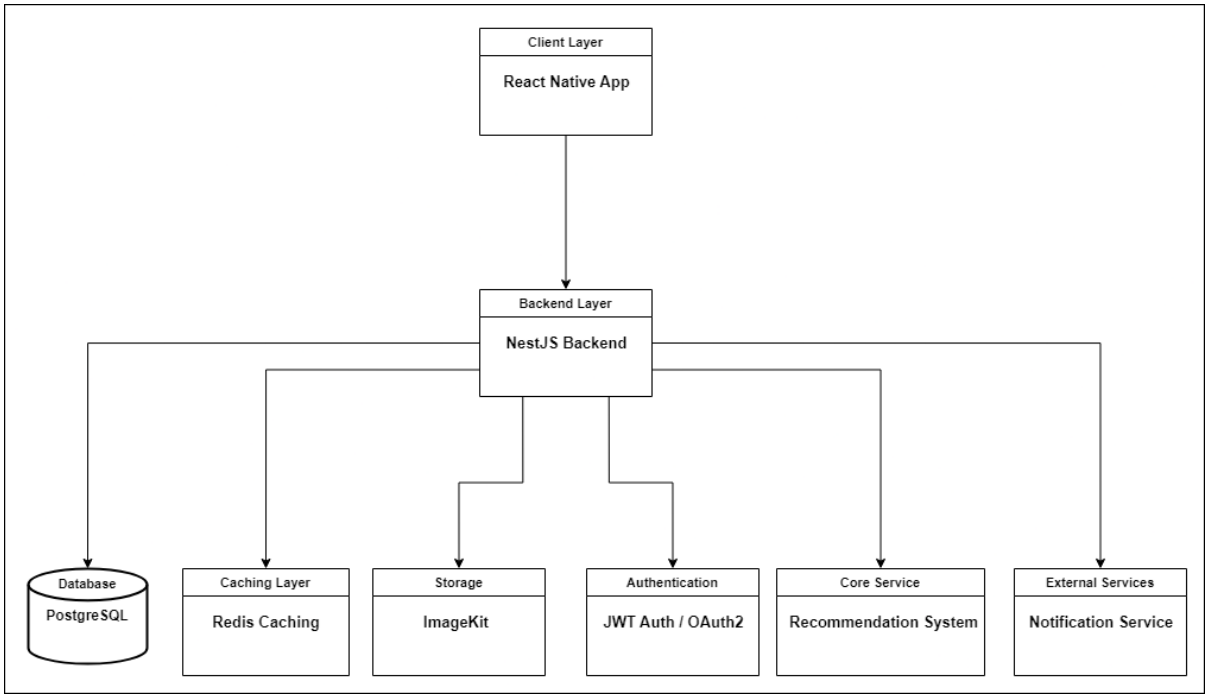


Figure 8: Architectural Design

3.2.2. Database Schema Design

A database schema design of our system has created which show how the relationships between different data elements are managed.

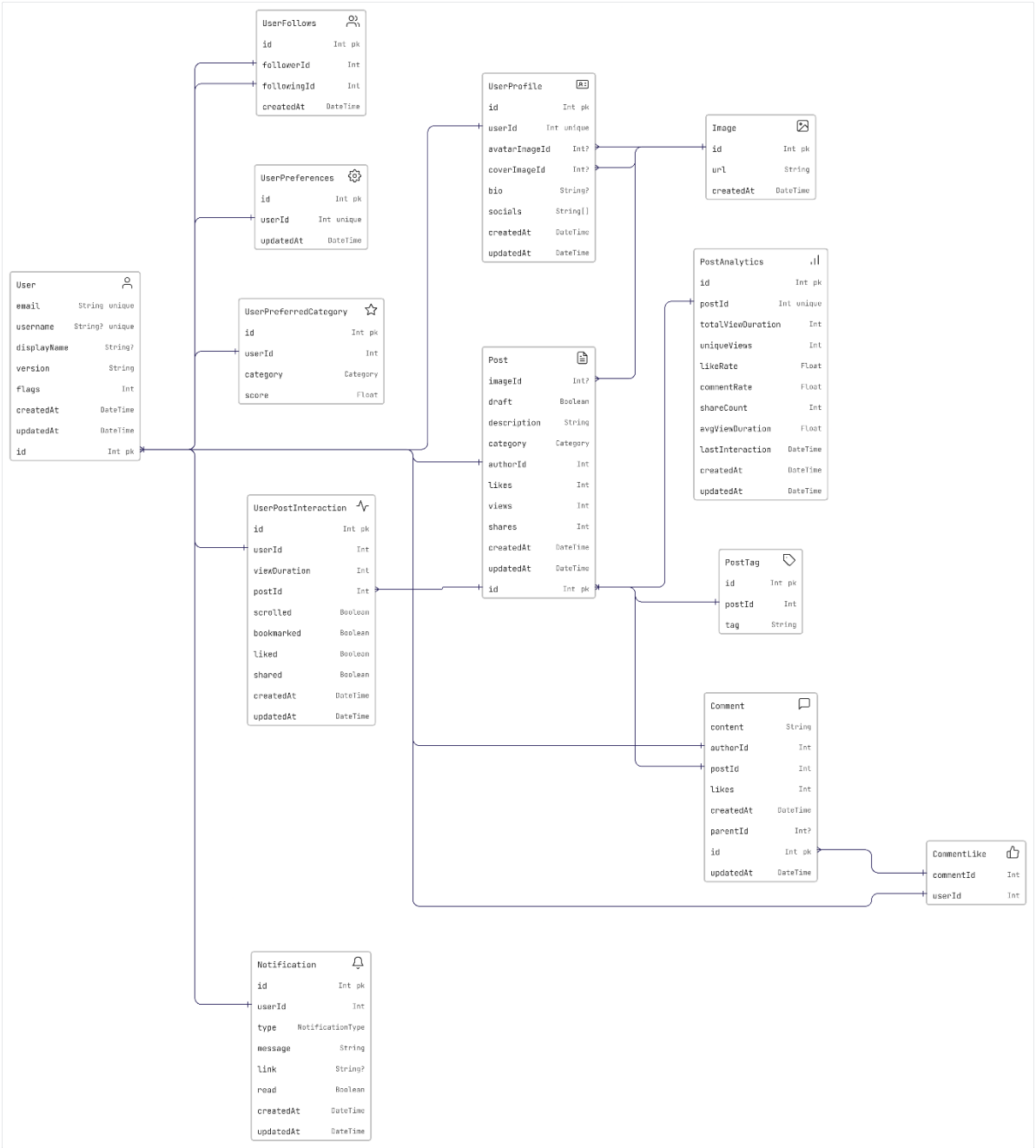


Figure 9: Database Schema Diagram

3.2.3. Interface Design

The user interface of our application has been designed using Figma. It is an open-source software which is used to build the user interface design and prototype. Through the design we can visualize the final look of our system what it will look like after completion. We have created some wireframes of our system and include these designs as shown below.

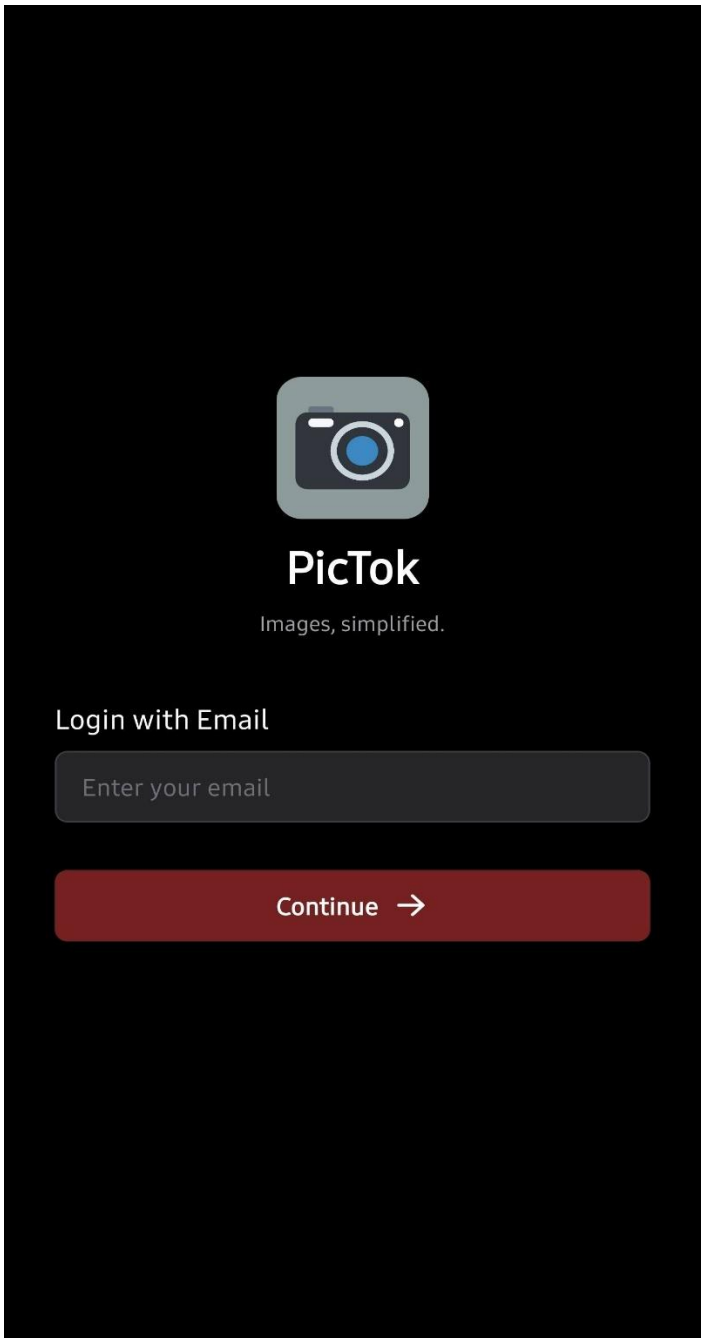
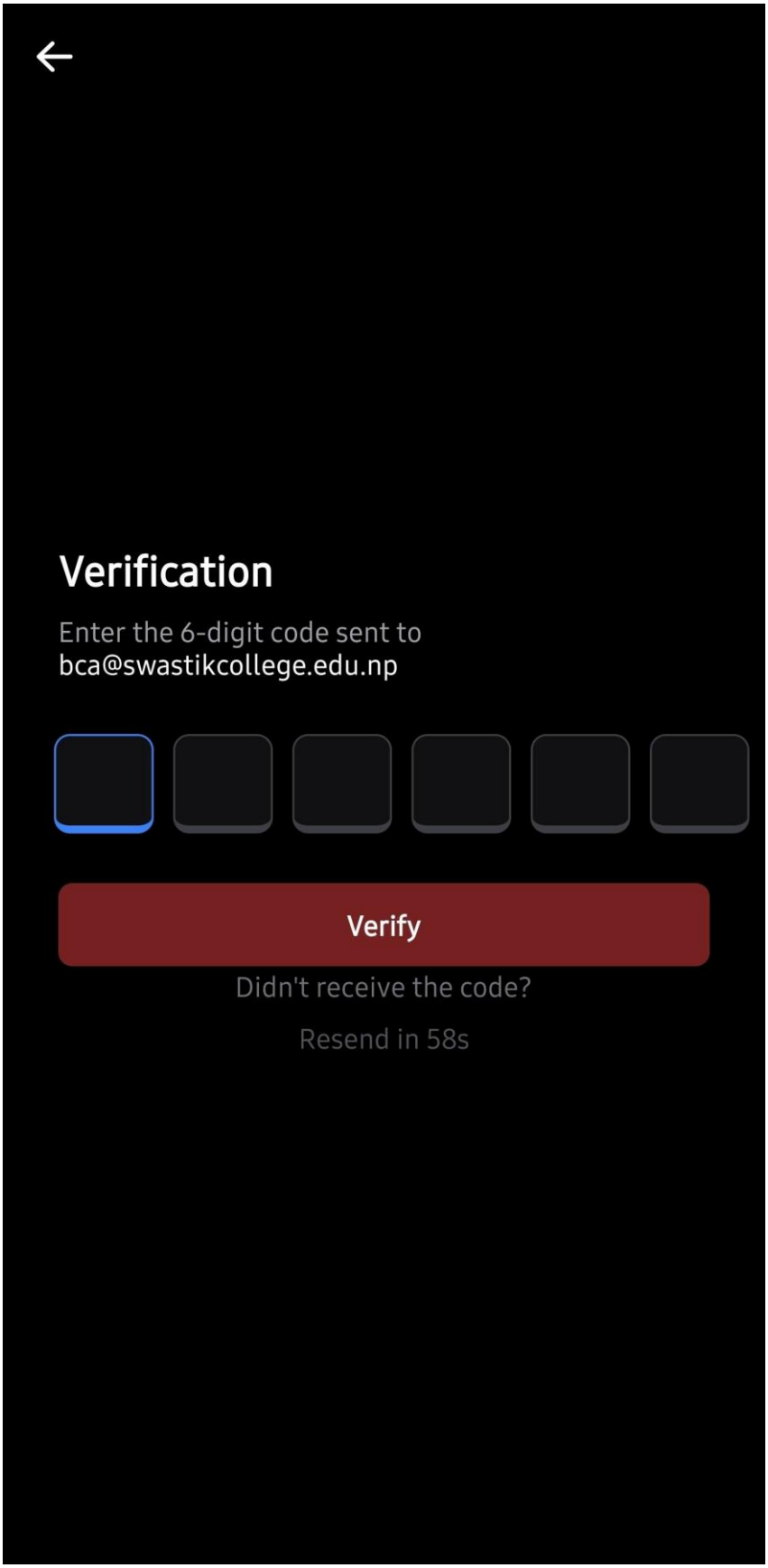


Figure 10: Login Page Interface


Verification
Enter the 6-digit code sent to
bca@swastikcollege.edu.np
Verify
Didn't receive the code?
Resend in 58s

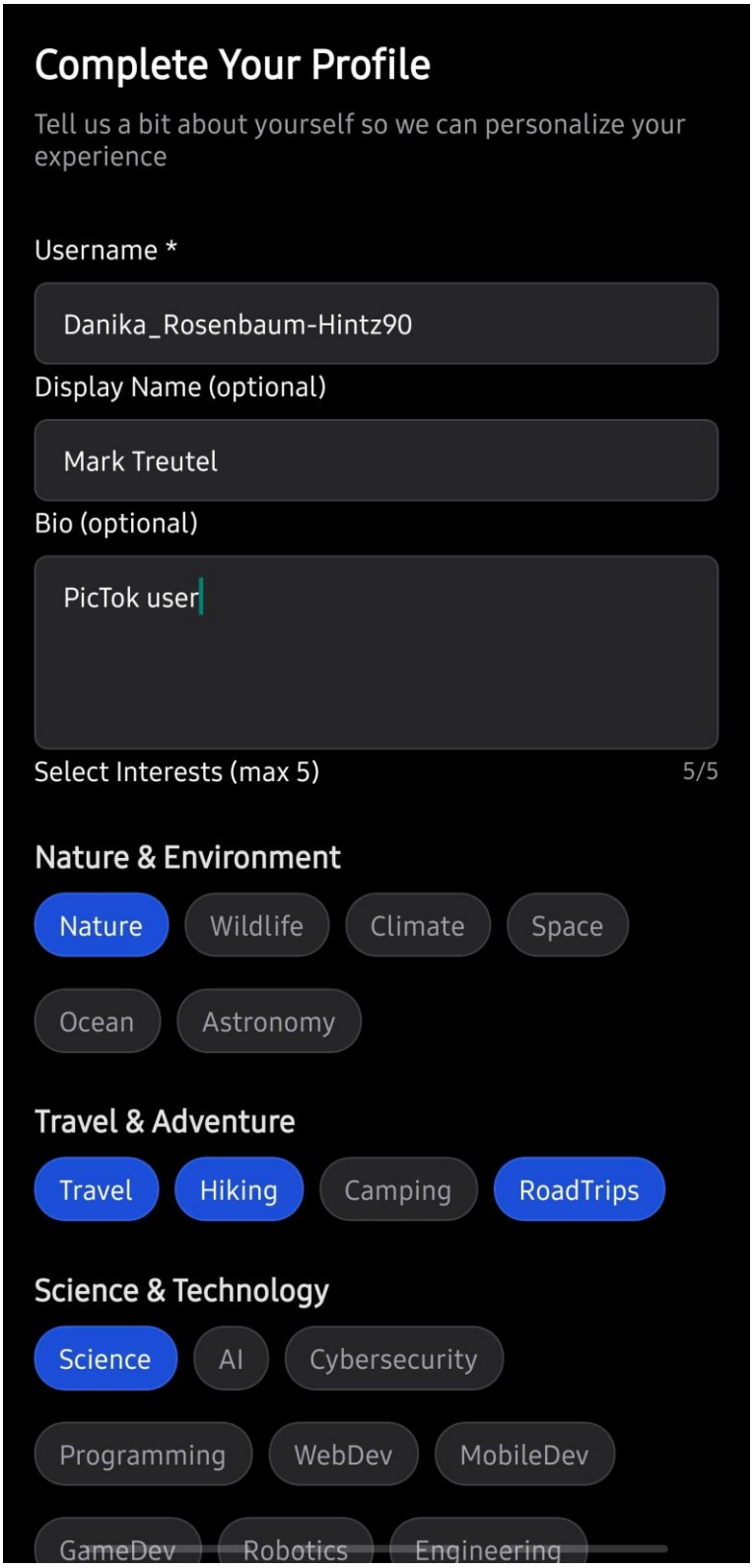


Figure 11: Signup Page Interface

3.2.4. Physical DFD

The physical DFD represents the actual implementation of data flow in the PicTok system. It includes the real-world technologies, components, and communication methods used during system operation.

The user interacts with the mobile app built using React Native. When a user registers or logs in, authentication is managed using JWT. All user requests, such as uploading photos, liking posts, or viewing feeds, are handled by the NestJS API server.

The server stores data such as user information, posts, and comments in a PostgreSQL database. Frequently accessed data such as trending posts and feeds are cached using Redis to enhance performance.

The diagram below illustrates how these components interact at the physical level.

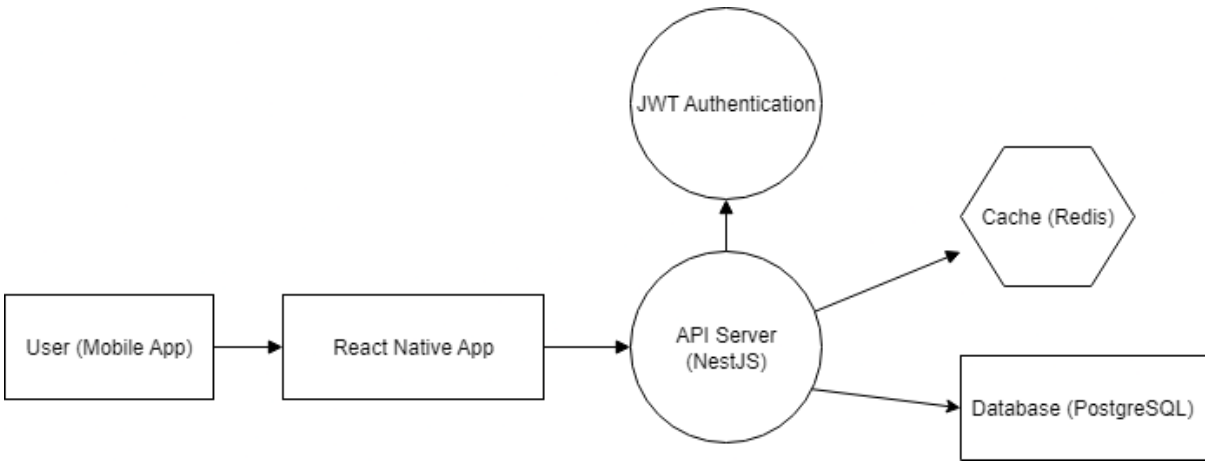


Figure 12: Physical DFD

3.3. Algorithm details

Assume we have:

- A set of users $U = \{u_1, u_2, ..., u_m\}$
- A set of items (posts on Pictok) $I = \{i_1, i_2, ..., i_n\}$
- A user-item interaction matrix $R \in \mathbb{R}^{m \times n}$, where $R_{u,i}$ is the rating (or engagement) user u gives to item i

---

User-based CF:

To predict how much user u will like item i:

$$\hat{R}_{u,i} = \bar{R}_u + \frac{\sum_{v \in N(u)} \text{sim}(u, v) \cdot (R_{v,i} - \bar{R}_v)}{\sum_{v \in N(u)} |\text{sim}(u, v)|}$$

Where:

- $\bar{R}_u$ is the average rating by user u
- $\text{sim}(u, v)$ is similarity between user u and user v (e.g., cosine similarity)
- $N(u)$ is the set of top-k users similar to u

Item-based CF:

To predict how much user u will like item i:

$$\hat{R}_{u,i} = \frac{\sum_{j \in N(i)} \text{sim}(i, j) \cdot R_{u,j}}{\sum_{j \in N(i)} |\text{sim}(i, j)|}$$

Where:

- $N(i)$ is the set of top-k items similar to i that user u has rated

Figure 13: Algorithm Details

CHAPTER 4: IMPLEMENTATION AND TESTING

4.1. Implementation

In this phase the actual design is converted into practice using different tools. The system can be implemented only after through testing is done. It is one of the most important phases of system development.

4.1.1. Tools Used

In this project we have used the following tools for implementation:

Front-end:

For developing the frontend, we used React Native, Expo and Typescript.

React Native:

We used React Native to build a cross-platform mobile application for both Android and iOS. It allows us to write a single codebase in JavaScript/TypeScript and render it natively, which provides better performance and native-like user experience compared to web views.

TypeScript:

TypeScript is a statically typed superset of JavaScript. It helps us catch errors early during development and maintain a more structured and scalable codebase. We used TypeScript throughout the frontend for better tooling and type safety.

Expo (React Native CLI):

Expo was used to streamline the development and testing process. It allows for fast refresh, device previews, and easy builds, which improved our productivity significantly.

Back-end:

For backend, we utilized the following technologies:

NestJS:

We used NestJS as the primary backend framework. It is a modern Node.js framework that supports TypeScript and follows modular architecture principles.

PostgreSQL:

It is a powerful and reliable relational database system that supports advanced indexing and query optimization, which was crucial for handling large volumes of post and user data.

Prisma ORM:

Prisma was used as the Object-Relational Mapping tool to communicate with PostgreSQL.

Redis:

Redis was used for caching frequently accessed data such as the user feed and trending posts. It significantly improved the response time and reduced database load by storing pre-processed responses.

4.1.2. Implementation details of modules

According to the requirements, the system has been divided into several modules.
Following are the modules designed for our system.

- **Auth Module:**

The authentication module manages user login and registration. It ensures that only authorized users can access the application by verifying credentials and generating secure session tokens using JWT. It also handles authentication-related errors, and redirects users to the appropriate parts of the app after successful login.

- **Comment Module:**

This module manages the full lifecycle of comments on posts. Users can add, read, update, and delete comments. It also supports threaded replies, allowing users to engage in conversations. Additionally, this module handles the comment-like functionality and generates notifications for post owners when new comments are added.

- **Post Module:**

The post module is responsible for creating, retrieving, updating, and deleting photo posts. It interacts with the upload module for attaching images, the recommendation system for categorization, and the analytics module for tracking engagement. This module forms the core content engine of the application.

- **Recommendation Module:**

The recommendation module analyzes user preferences and behaviors to suggest relevant posts and categories. It utilizes interaction history and user-selected categories to deliver a personalized feed. This module helps increase user engagement by tailoring content to individual interests.

- **User Module:**

The user module manages user profile operations including editing display names, bios, profile pictures, and social links. It also handles features like user preferences, following/followers, and displays user-specific content such as their posts or bookmarked items.

4.2. Testing

Testing has been done to ensure that the system is working properly on integrated environment. In order to accomplish testing of our system, two different categories of test case have been carried out.

4.2.1. Test Cases for Unit Testing

Unit testing has done to make sure that individual units are working properly or not. It focuses on individual unit of code.

Table 1 User Register Page Test Cases

Id	Test Case Description	Test Data	Expected Result	Actual Result	Pass / Fail
U_REG_1	User enters email address and goes to OTP page.	Email: apilbasnet@gmail.com OTP: 056867	User was redirected to complete profile page	User was redirected to complete profile page	Pass
U_REG_3	User enters the profile details.	Email: apilbasnet@gmail.com Username: apilbasnet Display Name: Apil Basnet Bio: HI! I am Apil. Interests: Nature, Travel, Music	Successful	Successful	Pass

Table 2 Post Creation and Edit Profile Test Cases

Id	Test Case Description	Test Data	Expected Result	Actual Result	Pass/ Fail
POST _1	User uploads a valid image with caption and category.	Image: travel.jpg Caption: "My trip to the hills" Category: Nature	**Success** Your post has been created!	**Success** Your post has been created!	Pass
POST _2	User uploads post with empty caption and category.	Image: sunset.png Caption: (empty) Category: (empty)	**Success** Your post has been created!	**Success** Your post has been created!	Pass
EDIT_ 1	User updates display name and username with valid input.	Username: Angie. Display Name: Angel Sanford Jr.	Profile updated successfully.	Profile updated successfully.	Pass
EDIT_ 2	User clears the bio and leaves it empty.	Bio: (empty)	Bio saved as empty (optional field).	Bio saved as empty (optional field).	Pass
EDIT_ 3	User leaves the required field: Username empty.	Username: (empty)	Save button disabled (no actual changes).	Save button disabled (no actual changes).	Pass

4.2.2. Test Cases for System Testing

System testing has done to ensure that entire system, including all integrated components is working properly. We make sure that:

- Successful photo upload.
- Profile editing.
- Post like/unlike actions.
- Redis caching efficiency.

CHAPTER 5: CONCLUSION AND FUTURE RECOMMENDATION

5.1. Conclusion

PicTok successfully demonstrates a functional, scalable image-sharing platform tailored for mobile devices. The modularity and stack choices support future expansion.

5.2. Lesson Learnt/Outcome

We explored the full stack development pipeline from mobile app design to backend API integration, caching strategies, and system deployment.

5.3 Future Recommendation

This system has been developed in such a way that it can accept modification and can be enhanced further by adding new features allowing users to increase usability, gaining trust and effectivity. Here are some future scopes of our system.

- Add stories feature (similar to Instagram)
- Direct messaging
- Push notifications

By focusing on these aspects, we can enhance the use of PicTok to address the issue faced by users.

APPENDIX

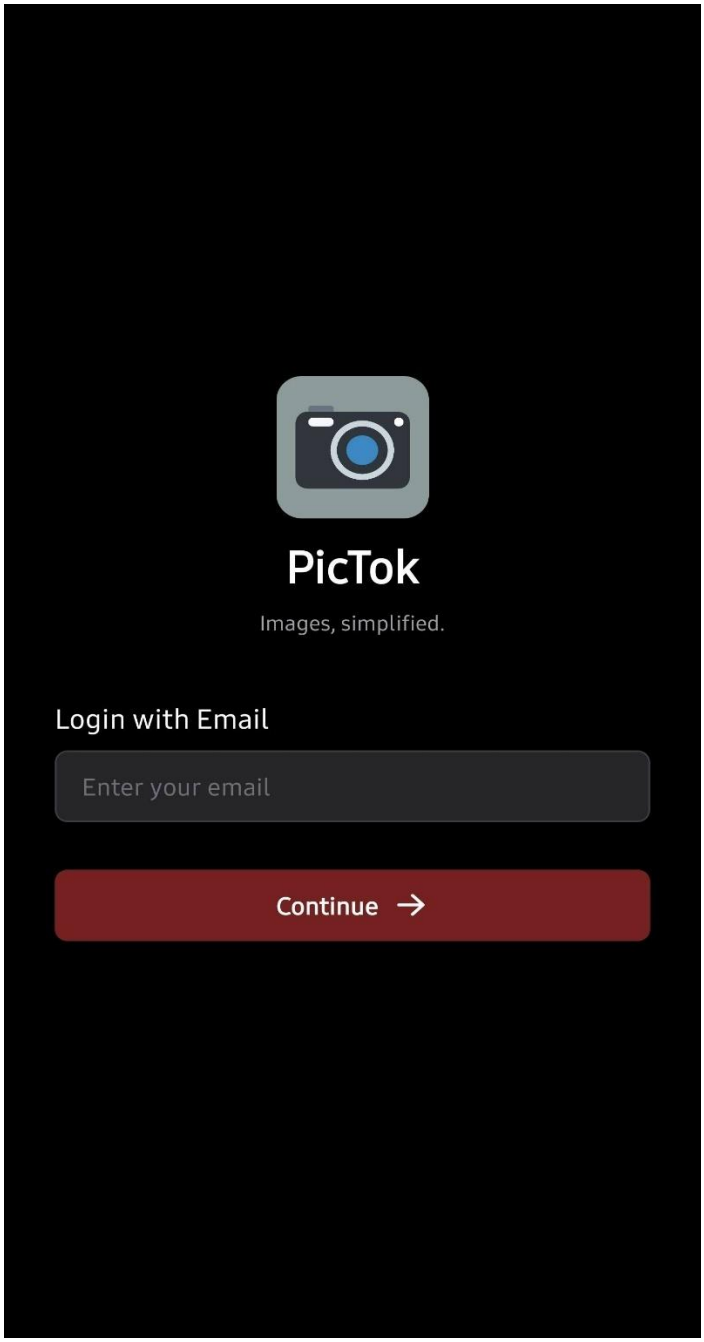


Figure 14: Login Page

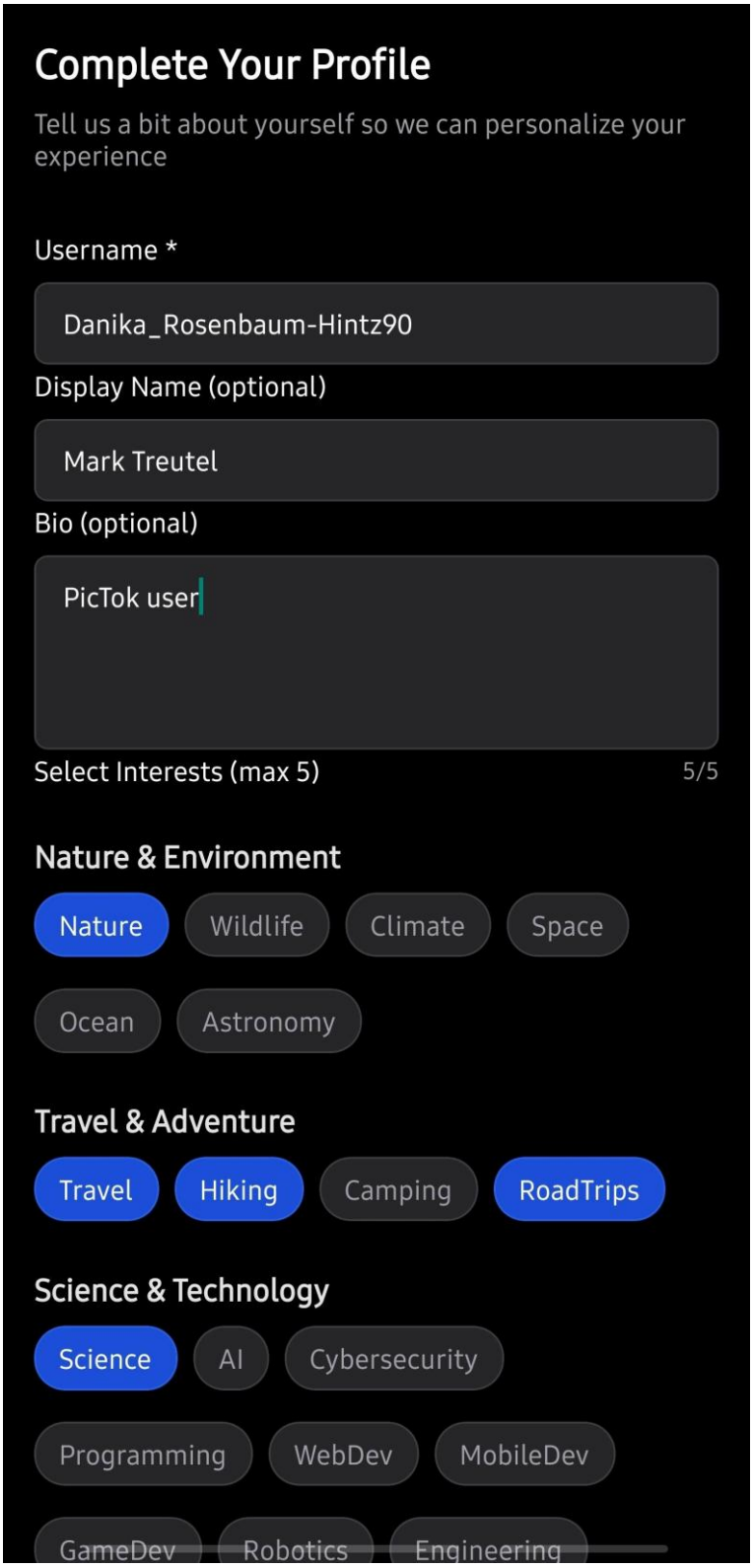


Figure 15: Signup Page

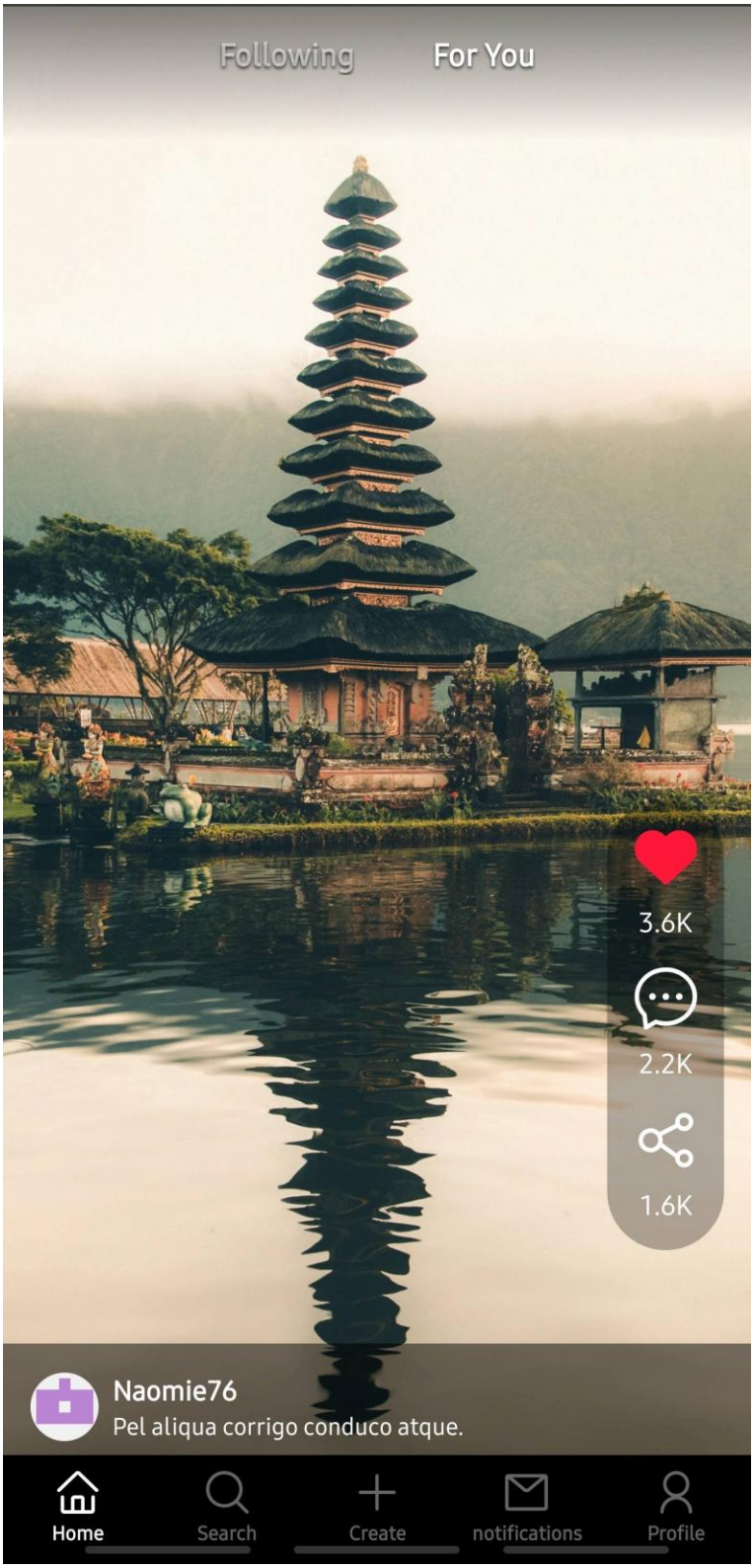


Figure 16: Home Page

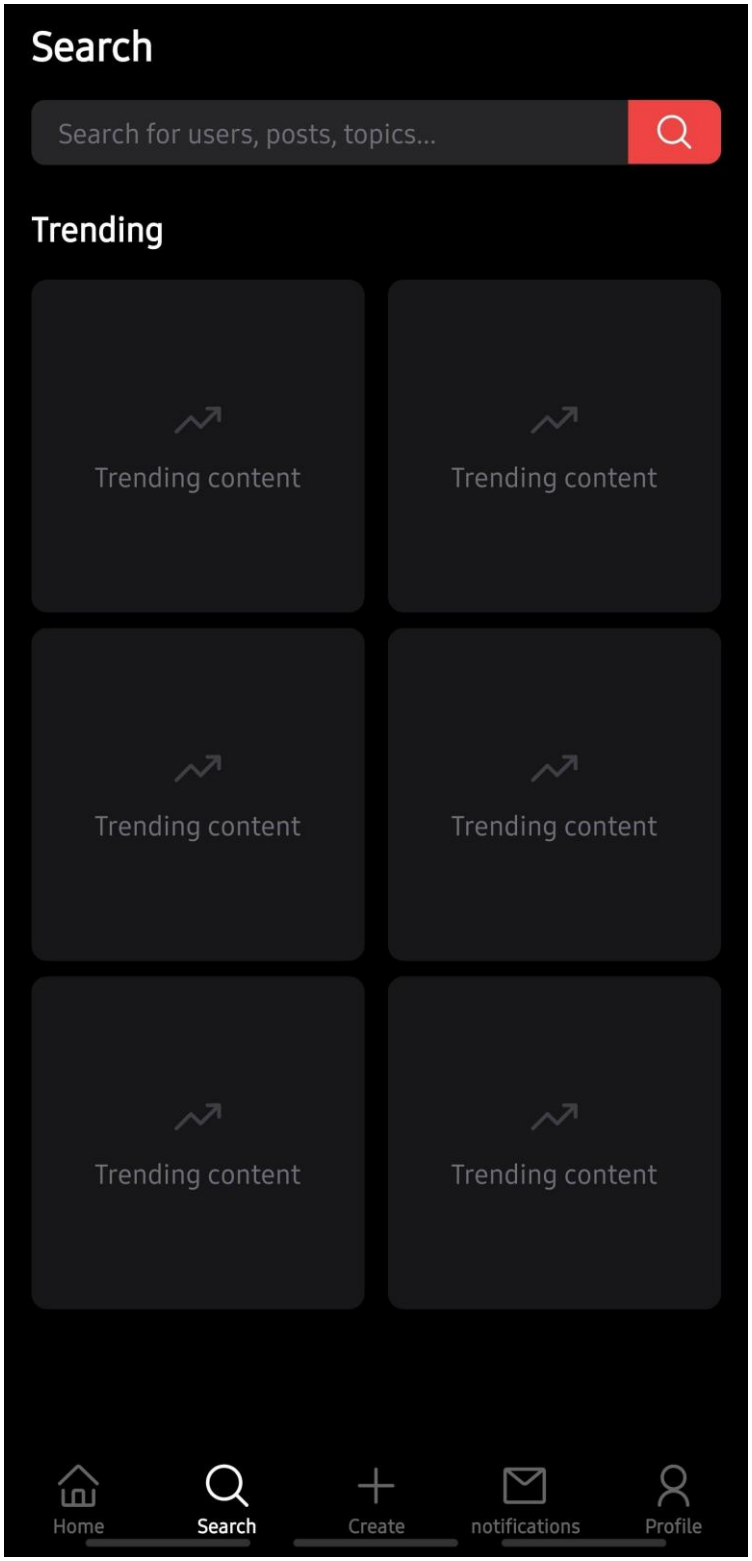


Figure 17: Search Page

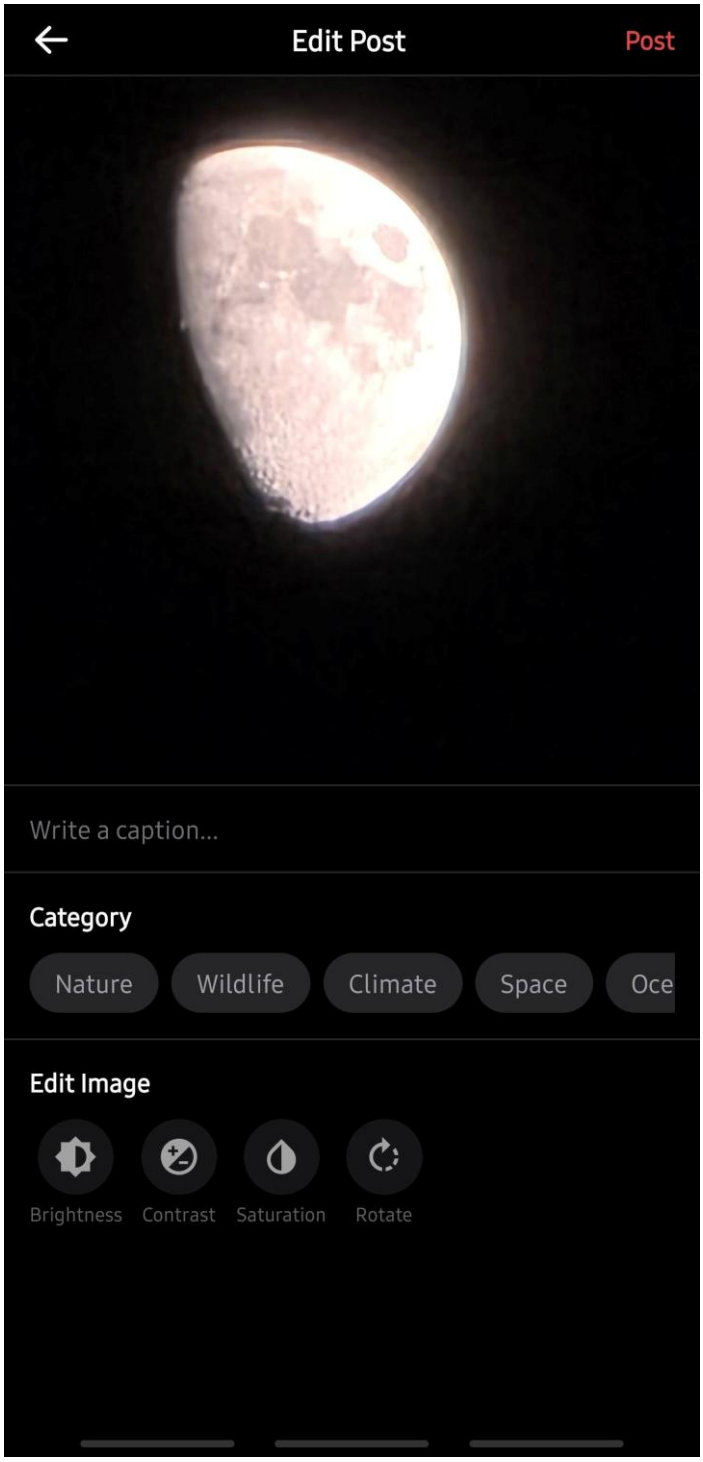


Figure 18: Create Page

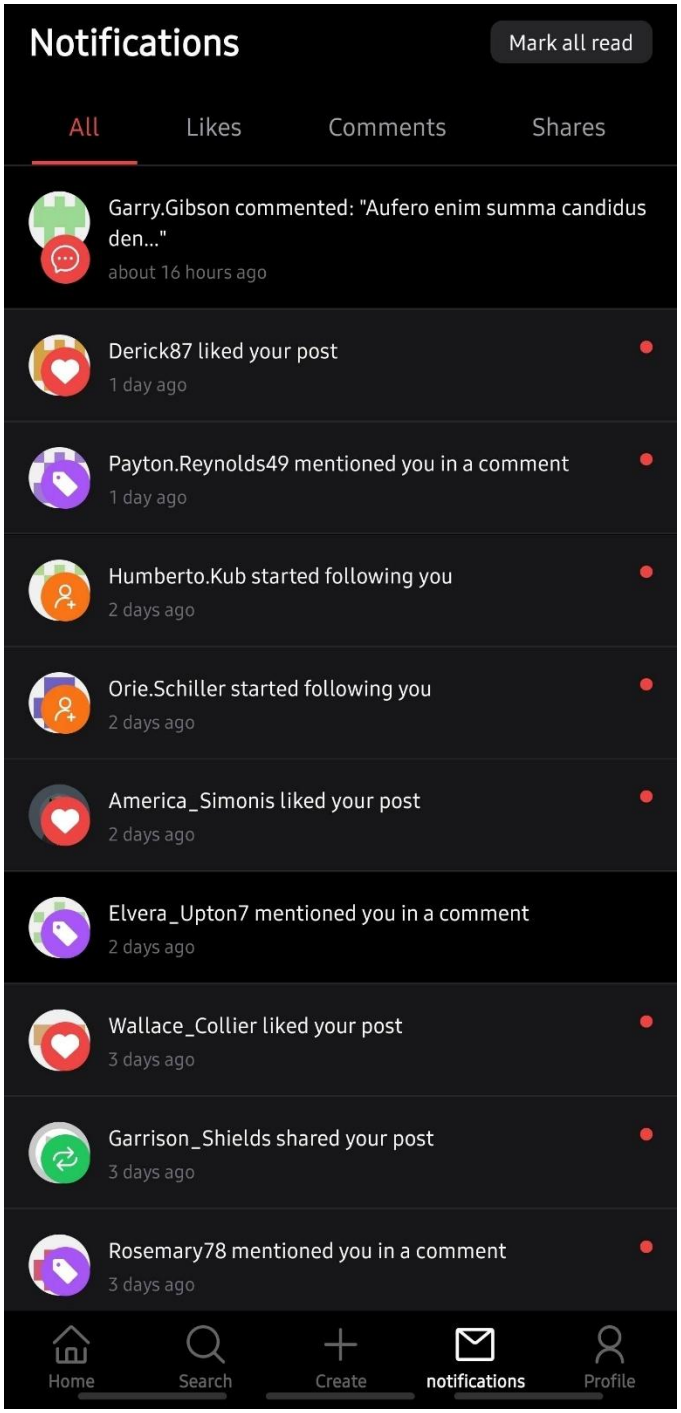


Figure 19: Notifications Page

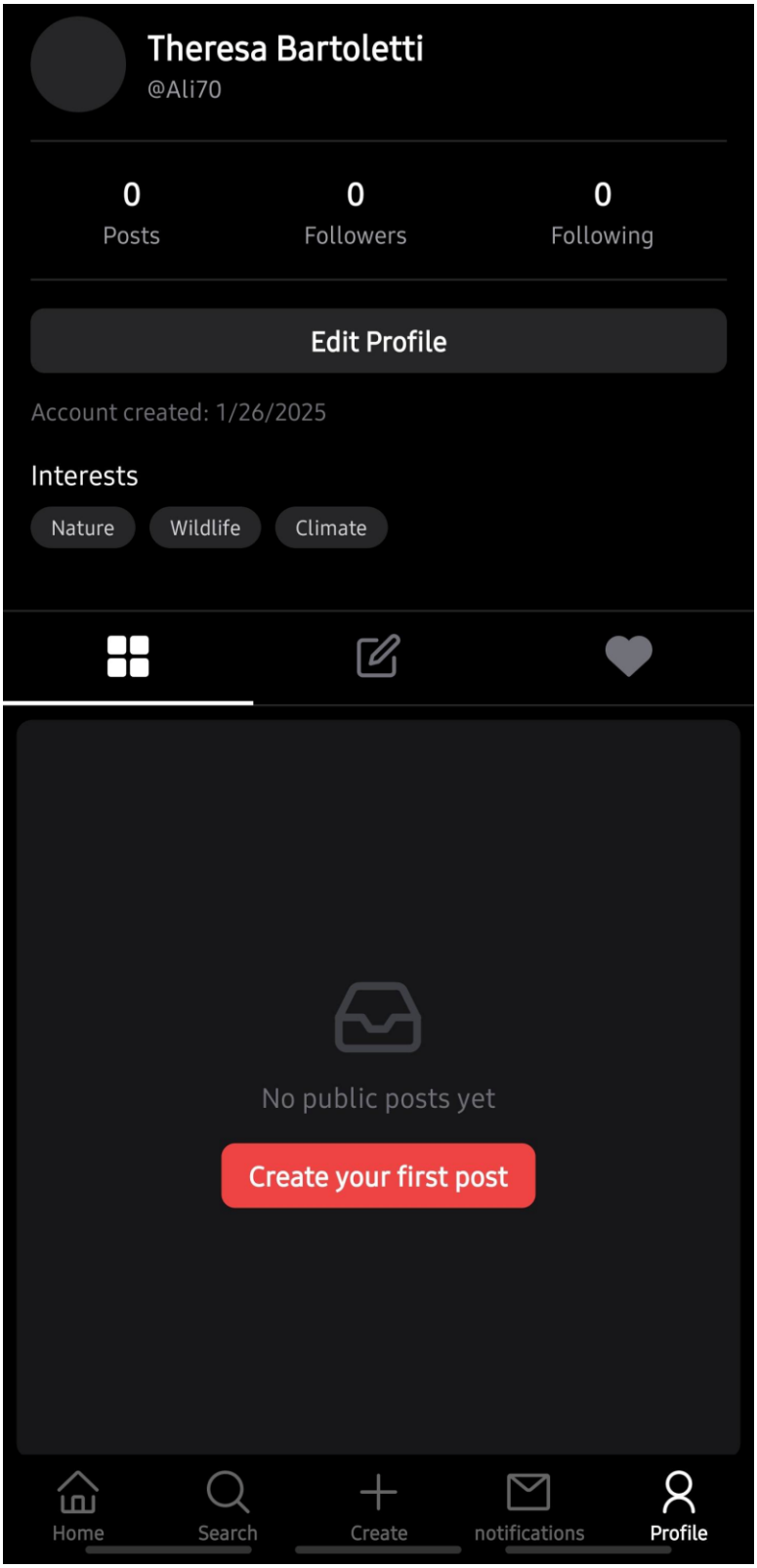


Figure 20: Profile Page

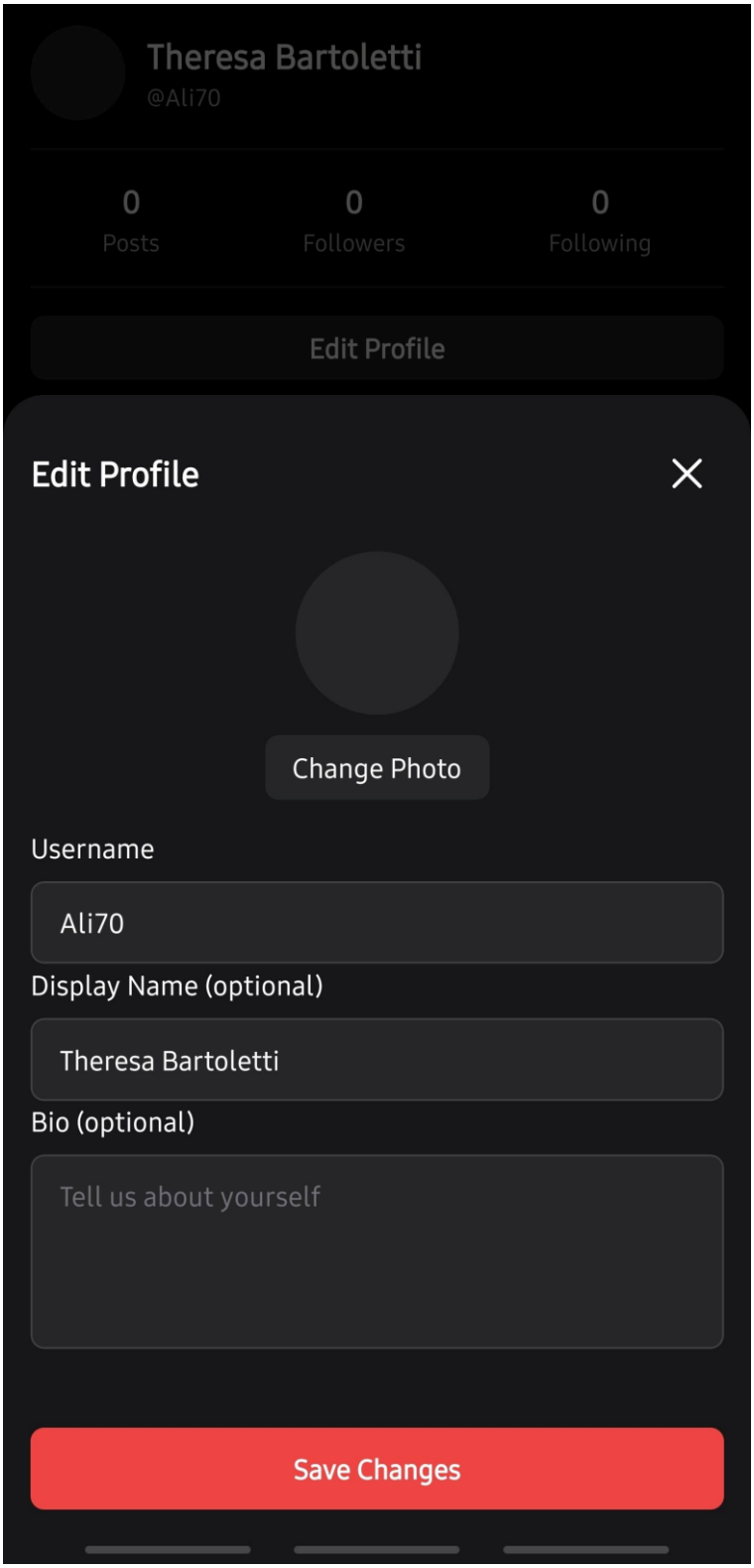


Figure 21: Edit Profile Page

Figure 22: Comments Page

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