DEVELOPMENT OF A MOBILE APPLICATION FOR JOB SEARCH AND RECRUITMENT

By

BOLAT DAUREN, GASHIMOV KHUSSEIN & KARPOVICH ALEXANDER

Department of Computer Engineering

ASTANA IT UNIVERSITY

6B06102 — Software Engineering

Supervisor: Oralbekova Zh.

JUNE 2025
ASTANA

Abstract

The development of a mobile application for job search and recruitment aims to provide users with an intuitive platform to explore job opportunities, apply for positions, and connect with potential employers. The application includes features such as job search by category, location-based filtering, application tracking, and real-time job alerts, all designed to streamline the recruitment process and enhance user experience. By leveraging modern technologies for secure authentication, cloud-based data management, and efficient communication, the application ensures seamless and reliable access for both job seekers and employers.

Additionally, the project addresses challenges such as data privacy, user engagement, and efficient job matching through intelligent algorithms. The ultimate goal is to simplify job searching, promote efficient recruitment processes, and contribute to reducing employment gaps through technology-driven solutions.

Аннотация

Разработка мобильного приложения для поиска работы и найма персонала направлена на предоставление пользователям интуитивно понятной платформы для изучения вакансий, подачи заявок и установления контактов с потенциальными работодателями. Приложение включает такие функции, как поиск вакансий по категориям, фильтрация по местоположению, отслеживание заявок и получение уведомлений о вакансиях в реальном времени, что упрощает процесс найма и повышает удобство пользователей. Используя современные технологии для обеспечения безопасной аутентификации, управления данными в облаке и эффективной коммуникации, приложение гарантирует бесперебойный и надежный доступ как для соискателей, так и для работодателей.

Кроме того, проект решает такие задачи, как защита конфиденциальности данных, вовлечение пользователей и эффективный подбор вакансий с помощью интеллектуальных алгоритмов. Основная цель заключается в упрощении поиска работы, оптимизации процесса найма и сокращении разрыва между соискателями и работодателями с помощью технологий.

Аңдатпа

Жұмыс іздеу және кадрларды жалдау үшін мобильді қосымшаны әзірлеу пайдаланушыларға жұмыс мүмкіндіктерін зерттеуге, өтінім беруге және әлеуетті жұмыс берушілермен байланыс орнатуға арналған ыңғайлы платформа ұсынады.

Қосымшада санат бойынша жұмыс іздеу, орналасқан жеріне байланысты сүзгілеу, өтінімдерді бақылау және нақты уақытта жұмыс туралы хабарламаларды алу сияқты функциялар қарастырылған, бұл рекрутинг процесін жеңілдетуге және пайдаланушылардың тәжірибесін жақсартуға бағытталған. Қауіпсіз аутентификация, бұлтты деректерді басқару және тиімді коммуникацияны қамтамасыз ету үшін заманауи технологияларды пайдалана отырып, қосымша жұмыс іздеушілер мен жұмыс берушілер үшін үздіксіз және сенімді қолжетімділікті қамтамасыз етеді.

Сонымен қатар, жоба деректердің құпиялылығы, пайдаланушылардың қызығушылығын арттыру және интеллектуалды алгоритмдер арқылы тиімді жұмыс іріктеу сияқты мәселелерді шешеді. Негізгі мақсат – жұмыс іздеу процесін жеңілдету, тиімді рекрутинг жүргізу және технологияға негізделген шешімдер арқылы жұмыссыздық деңгейін төмендетуге үлес қосу.

Dedication and Acknowledgements

We would like to dedicate this project to our families, whose unwavering support and encouragement have been instrumental in bringing this work to completion. We are deeply grateful for their patience, understanding, and belief in our abilities.

We would also like to extend our heartfelt thanks to our supervisor, Oralbekova Zhanar, for her invaluable guidance, mentorship, and continuous support throughout the project. Her expertise and insights have greatly contributed to our understanding and the successful implementation of this application.

We are equally grateful to the faculty and staff of the Department of Computer Engineering at Astana IT University for providing us with the resources and opportunities necessary to pursue this project. Finally, we wish to express our appreciation to our fellow students and friends for their encouragement and helpful discussions that enriched our learning experience.

Author's Declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and that it has not been submitted for any other academic award. Except where indicated by specific references in the text, the work is the candidate's own work. Work done in collaboration with, or with the assistance of, others, is indicated as such. Any views expressed in the dissertation are those of the author.

SIGNED: ....

DATE: ....

List of Tables

List of Figures

Table of Contents

Chapter 1

Introduction

1.1 Background and Context

The digital transformation of the employment sector has significantly reshaped how job seekers and employers connect. Traditionally, job seekers relied heavily on newspaper advertisements and personal networks to find employment opportunities, while employers engaged in time-consuming and reref-intensive hiring practices. Although effective for their time, these traditional methods lacked the speed, scalability, and precision required in today's fast-paced job market.

The widespread adoption of mobile technologies has revolutionized recruitment practices, making them more efficient and user-centric. Mobile applications have emerged as powerful tools, offering real-time job updates, intelligent filtering mechanisms, and streamlined communication between candidates and employers. Studies highlight the value of these platforms in reducing administrative burdens and providing personalized job recommendations, thereby enhancing the overall job search experience [15]. In regions like Kazakhstan, where mobile internet usage surpasses that of desktops, a mobile-first approach has become essential rather than optional [7]. Mobile recruitment applications empower job seekers to browse job listings, receive instant notifications, and apply for positions on the go, bridging the gap between opportunity and accessibility. For employers, these platforms provide access to a broader talent pool and enable faster, data-driven decision-making processes [12].

By integrating real-time data, location-based search features, and user-friendly interfaces, mobile recruitment applications have redefined the way individuals find jobs and organizations hire talent. They are no longer merely tools but have become essential components of a modern and inclusive employment ecosystem.

1.2 Importance of Applications for Job Seekers in Modern Society

In modern society, employment is more than just a ref of income—it plays a vital role in shaping an individual's social standing, personal growth, and contributions to the economy. Today's job seekers face a dynamic labor market characterized by rapid changes in required skills, global competition, and evolving recruitment standards. In this environ-

ment, mobile recruitment applications have become indispensable, empowering users to respond proactively and effectively to these challenges.

These applications provide job seekers with real-time updates on new job opportunities, instant notifications of application status, and access to career resources that support continuous learning and development [12]. This is crucial in a world where adaptability and lifelong learning are key to sustained career success.

Furthermore, mobile recruitment applications help bridge the digital divide by delivering scalable, intuitive, and location-independent solutions. For many individuals—especially those in rural or underserved areas—these platforms represent the primary or sole means of accessing modern job markets [17]. By enabling job searches and applications directly from smartphones, these apps remove traditional barriers and democratize access to employment opportunities.

Their role in addressing youth unemployment and underemployment is particularly noteworthy. Young people, who often encounter systemic barriers to employment, can leverage these platforms to showcase their skills, connect directly with potential employers, and find roles that match their aspirations. Research suggests that adopting mobile recruitment platforms positively impacts youth employment rates and labor market integration [9].

Ultimately, mobile job search applications are more than just convenience tools—they are critical infrastructure in the modern economy. They empower job seekers to navigate an increasingly complex labor market, broaden their access to opportunities, and make more informed career decisions [15, 12]. In doing so, they support economic development, social mobility, and workforce inclusivity.

1.3   Challenges in Job Search and Recruitment

Despite significant technological advancements, the job search and recruitment landscape continues to face several challenges. A major issue is the inefficiency of job matching systems. Many job seekers receive irrelevant or poorly targeted job recommendations due to limitations in filtering mechanisms and algorithmic precision [8]. Consequently, candidates often feel overwhelmed by a flood of mismatched listings, reducing their engagement with the platform.

For employers, this problem translates to a high volume of unsuitable applications, requiring manual review and causing increased hiring costs and delays in onboarding [9]. These inefficiencies drain rerefs and hinder the effectiveness and fairness of recruitment practices.

Another significant challenge is the lack of real-time communication within many existing platforms. Traditional job portals often rely on asynchronous communication methods, such as email or outdated applicant tracking systems, which create bottlenecks in the hiring process [3]. This lack of immediacy frustrates job seekers who seek timely feedback and employers who need to act quickly in competitive labor markets.

Data privacy concerns further complicate the recruitment landscape. Job seekers are increasingly cautious about sharing personal information without clear assurances that it will be securely handled and ethically used. A lack of transparent data protection practices discourages full engagement with online recruitment tools [2]. To build trust

and drive adoption, secure data handling and compliance with global standards, like the GDPR, are essential.

These challenges highlight the need for continuous innovation in mobile recruitment platforms. By leveraging advanced AI algorithms, real-time communication, and robust security frameworks, these applications can overcome current obstacles and deliver on their promise of more dynamic, inclusive, and effective recruitment experiences [9, 4].

1.4 Role of Mobile Applications for Employers and Recruiters

For employers and recruiters, mobile recruitment applications offer significant advantages in streamlining the hiring process. These platforms reduce administrative burdens by automating routine tasks such as candidate screening, interview scheduling, and communication [8]. Recruiters can post jobs instantly, manage applications efficiently, and access dashboards with comprehensive insights into candidate progress and recruitment metrics [9]. This digital transformation accelerates hiring cycles and enhances the agility and responsiveness of recruitment strategies.

Mobile applications also feature geolocation services that enable employers to target candidates in specific regions, improving the relevance of job postings and meeting location-specific hiring needs [2]. This functionality is especially valuable in industries that rely on local expertise or seasonal workforce dynamics.

Another key advantage is the flexibility these applications offer. Employers can interact with candidates on the go, provide real-time feedback, and manage recruitment pipelines directly from mobile devices. This immediacy reduces the risk of losing top candidates to competitors and improves the chances of securing the right fit quickly [4].

Moreover, these platforms promote a more transparent and inclusive hiring process. In-app messaging and document-sharing features streamline communication and create cohesive candidate experiences, fostering trust and engagement [9]. For employers, this translates not only to faster hires but also to stronger relationships with potential employees—crucial in today's competitive labor market.

In essence, mobile applications are not just convenient—they are integral to modern recruitment. By leveraging these tools, employers and recruiters can navigate the complexities of talent acquisition and build a competitive edge in a rapidly evolving job market [3, 2].

1.5 Purpose of the Project

The primary purpose of this project is to develop a cross-platform mobile application for job search and recruitment that effectively meets the evolving needs of job seekers and employers. The application is designed to make the job search process more accessible, intuitive, and efficient, allowing job seekers to browse listings, receive notifications, and apply for opportunities quickly and securely. At the same time, employers will benefit from streamlined tools to identify, evaluate, and engage with the most suitable candidates for their open positions. This project also aims to address the most common limitations found in existing recruitment applications, such as outdated or overly complex user interfaces,

poor real-time functionality, and inefficient job matching processes. By rethinking the way recruitment apps are designed and implemented, the project seeks to deliver a user experience that is not only convenient but also transparent and trustworthy.

To achieve these goals, the application will integrate modern technologies like cloud-based data storage for secure management, real-time updates and notifications for improved engagement, and robust search and filtering features to ensure that users find the most relevant opportunities. These features will help reduce the barriers that job seekers and employers currently face, fostering a more dynamic and responsive employment ecosystem. Ultimately, the project aspires to create a reliable and future-ready mobile recruitment platform that addresses the real challenges of the labor market. By leveraging the best of current technology and prioritizing user needs, it aims to establish a new standard for mobile job search and recruitment experiences.

1.6   Problem Statement

Despite the proliferation of online job platforms and recruitment tools, both job seekers and employers continue to face significant obstacles that limit the effectiveness of these systems. Job seekers often encounter fragmented and inefficient experiences, receiving job suggestions that do not align with their qualifications or preferences, while navigating cumbersome and confusing application processes. These issues not only create frustration but also decrease engagement and reduce overall success rates in finding meaningful employment.

On the other side of the equation, recruiters face their own challenges. They are frequently inundated with large volumes of unqualified applications, making it difficult to identify the most suitable candidates for their roles. Existing tools often lack the robust filtering and communication capabilities needed to streamline the recruitment process, leading to delays in hiring and missed opportunities for both parties.

These challenges highlight a critical gap in the current market: the need for a fully integrated and intelligent mobile application that delivers a seamless, secure, and user-friendly experience for all stakeholders. This project addresses this gap by designing and developing a modern job recruitment platform that prioritizes intuitive navigation, effective data handling, and precise matching functionalities. By focusing on these key areas, the project aims to create a mobile solution that improves engagement, reduces barriers, and enhances overall outcomes in the job search and recruitment process.

1.7   Objectives of the Project

The objectives of this project are as follows:

- To develop a user-friendly, intuitive mobile application that streamlines the job search and recruitment process for both job seekers and employers.

- To implement essential features such as real-time job alerts, advanced filtering mechanisms, and in-app messaging to ensure effective and convenient interactions.

- To enhance the relevance and accuracy of job-candidate matching through refined algorithms that consider key skills, preferences, and contextual factors.

- To ensure secure and ethical handling of all user data, aligning with modern data privacy and protection standards to foster user trust and compliance.

- To gather user feedback during the development and testing phases, leveraging it for continuous improvement and validation of application performance to meet evolving needs.

1.8 Scope of the Project

The scope of this project encompasses the comprehensive research, design, development, and testing of a minimum viable product (MVP) for a job recruitment mobile application. The application aims to deliver essential features that address core user needs and provide a foundation for future enhancements.

Key components of the project scope include:

- User authentication and profile management, ensuring that users can create and update personal and professional information securely.

- A robust job listing interface, including dynamic searching and filtering capabilities based on user preferences and recruiter criteria.

- Application submission and real-time status tracking, providing transparency and control for job seekers.

- Recruiter-side functionalities, including tools for posting job vacancies, evaluating candidates, and managing recruitment workflows efficiently.

- Integration with secure cloud-based services to enable real-time data handling, reliability, and scalability.

1.8.1 Key Features of the Application

- Real-time job notifications and alerts to keep users informed of new opportunities.

- Advanced search filters that allow users to narrow results by industry, skills, location, and salary range.

- In-app messaging features that facilitate direct communication between job seekers and recruiters, reducing delays and improving engagement.

- Application tracking capabilities to allow job seekers to monitor the status of their submissions at every stage.

- A comprehensive recruiter dashboard that provides tools for posting, managing, and updating job listings as well as evaluating candidate profiles.

1.8.2 Limitations of the Application

- The initial version of the application may only support a single language (English), potentially limiting accessibility for non-English speaking users.

- Limited third-party integrations, such as connections with professional networking platforms like LinkedIn or Google Jobs, will be postponed until future updates.

- Some advanced features, such as integrated video interviewing capabilities or a comprehensive applicant tracking system (ATS), may not be included in the MVP phase due to time and reref constraints.

1.9 Significance of the Project

The significance of this project lies in its potential to reshape the modern recruitment landscape by addressing critical challenges faced by job seekers, employers, and the industry as a whole. By leveraging mobile-first strategies and user-centric design, the project aims to foster a more dynamic, transparent, and inclusive employment ecosystem.

1.9.1 For Job Seekers

This application empowers job seekers by providing them with greater autonomy and control over their employment journey. Real-time updates and personalized job feeds ensure that users can respond promptly to new opportunities, increasing their chances of securing suitable employment. In contrast to traditional methods, where information about job openings and company cultures was often scarce or fragmented, the application offers transparent listings, detailed company profiles, and comprehensive application tracking. This reduces the informational asymmetry that can hinder job seekers' decision-making and confidence, enabling them to make more informed and strategic career choices [18].

1.9.2 For Employers and Recruiters

For employers and recruiters, the application offers a streamlined and efficient hiring process that meets the demands of modern talent acquisition. Key features such as customizable filters and direct in-app communication allow recruiters to identify and engage with the most qualified candidates quickly and effectively. These tools help reduce time-to-hire, improve the precision of candidate matches, and enhance overall recruitment efficiency—factors that are especially critical in competitive labor markets where the best candidates are often in high demand. By integrating these capabilities, the application ensures that employers can maintain a competitive edge and secure the talent they need to achieve organizational success [2, 4, 11].

1.9.3 For the Recruitment Industry

At a broader level, this project contributes to the ongoing digital transformation of the recruitment industry. It demonstrates how mobile-first platforms can be leveraged to increase user engagement, reduce costs, and improve hiring outcomes. By creating a

scalable and adaptable model for user-centric recruitment solutions, the project lays the groundwork for applications that can be tailored to different industries, regional markets, and labor conditions. Such advancements have the potential to not only improve efficiency within the recruitment sector but also reduce unemployment rates and enhance overall market fluidity [1, 6]. Ultimately, the project represents a significant step forward in building a more responsive, equitable, and effective labor market infrastructure.

Chapter 2

Literature Review

2.1 Limitations of the Application

- **Oversimplified Job Matching Algorithms:**
  Many mobile job search applications rely on basic keyword or location-based matching algorithms that do not deeply analyze users' skills, qualifications, or career aspirations. As a result, the job recommendations often appear generic and irrelevant, failing to consider important factors like user preferences, past experiences, or job market trends. This oversimplification reduces the accuracy and usefulness of the suggestions, which can lead to user frustration and decreased trust in the platform. Advanced methods such as machine learning and semantic analysis, which could enhance personalization, are still underutilized in many apps [15, 8].

- **User Interface (UI) and User Experience (UX) Challenges:**
  The design and usability of job search applications play a crucial role in user retention and satisfaction. Unfortunately, many existing apps suffer from cluttered screens, complex navigation, and inconsistent layouts that overwhelm users and complicate their job search journey. These design flaws increase cognitive load and discourage continuous use. Additionally, slow app loading speeds, often caused by poor optimization or heavy data usage, further degrade the user experience. This issue is especially pronounced in regions with limited or unreliable internet connectivity, where app responsiveness is critical to maintain engagement [12, 9].

- **Lack of Real-Time Features:**
  Timeliness is key in job hunting, yet many applications do not provide real-time functionalities such as push notifications for newly posted jobs or updates on application status. The absence of instant alerts can cause job seekers to miss out on timely opportunities. Moreover, communication tools embedded within the apps are often limited or poorly implemented, which delays interactions between recruiters and applicants. This lag in communication can result in prolonged hiring cycles and missed matches, ultimately decreasing the platform's efficiency and appeal [12, 9].

- **Security and Privacy Concerns:**
  Data privacy and security remain significant barriers to user adoption. Many job search applications require users to upload sensitive personal information, includ-

ing resumes, contact details, and employment history. However, users frequently express concerns over how their data is stored, shared, and protected. Ambiguous privacy policies and the lack of visible security measures make users hesitant to fully engage with these platforms. This mistrust limits the completeness of user profiles, reducing the effectiveness of job matching and diminishing overall user confidence. Ensuring compliance with data protection regulations such as GDPR and offering transparent data handling practices are crucial steps that many apps have yet to fully implement [8, 10].

- **Additional Challenges:**
  Besides the above core issues, other limitations include inadequate support for diverse user groups, such as people with disabilities or those with limited digital literacy. Many apps lack multilingual support or accessibility features, which restricts their reach and inclusivity. Furthermore, some platforms do not integrate with social media or professional networking sites, missing opportunities to leverage rich user data for better job recommendations. The absence of career guidance and resume-building tools also reduces the apps' value as comprehensive job search assistants [13, 5].

2.2 Key Features of Job Search Applications

Effective job search applications integrate a variety of essential features that aim to streamline the hiring process and improve the overall experience for both job seekers and recruiters. These key features include:

- **Job Matching Algorithms:**
  At the core of any job search application are the algorithms that match job seekers with suitable opportunities. These algorithms analyze user information such as skills, education, work history, and personal preferences to generate tailored job recommendations. Advanced platforms increasingly utilize artificial intelligence (AI) and machine learning techniques to refine these recommendations over time, adapting to user behavior and feedback for higher accuracy and relevance [3]. This personalized matching not only improves user satisfaction but also increases the chances of successful placements.

- **Application Tracking:**
  Transparency in the recruitment process is vital to maintaining user engagement. Job seekers benefit from being able to track the status of their applications—whether submitted, under review, shortlisted, or rejected—within the app itself. This feature reduces uncertainty and anxiety associated with the job hunt, allowing users to better plan and manage their applications [7]. Recruiters also gain efficiency by managing candidate pipelines through integrated dashboards.

- **Search Filters:**
  Robust filtering options empower users to quickly narrow down job listings to those that best fit their criteria. Common filters include job type (full-time, part-time, freelance), industry sector, geographic location, expected salary range, and required

experience level. These filters help users avoid irrelevant listings and focus their efforts on the most promising opportunities, saving time and improving the quality of job matches.

- **In-app Communication:**
Direct communication channels within the app between employers and candidates greatly enhance the recruitment experience. Messaging features allow for timely interaction, enabling recruiters to ask follow-up questions or schedule interviews without leaving the platform. This immediacy fosters stronger connections and accelerates the hiring process, which benefits both parties [7].

- **Notifications and Alerts:**
Real-time notifications keep users informed about important events such as new job postings, interview invitations, application status changes, and deadlines. These alerts help job seekers stay proactive and responsive, preventing missed opportunities. Effective notification systems contribute significantly to sustained user engagement and satisfaction.

- **User Profiles and Resume Builders:**
Simplified tools for creating, editing, and maintaining professional profiles and resumes within the application lower barriers to entry. Many users prefer not to upload external documents repeatedly; instead, they can build comprehensive profiles that recruiters can easily access. Additionally, some applications offer resume-building templates and tips, which improve the quality of submissions and boost candidates' chances [7].

2.3 Challenges in Job Search Applications

Despite the promising capabilities of job search applications, their development and effective deployment face several significant challenges:

- **Complexity of Accurate Job Matching:**
One of the most difficult challenges is designing algorithms that can accurately match candidates with appropriate job openings. While many platforms rely on keywords and basic filtering, capturing the full range of qualifications—including soft skills, personality traits, and industry-specific competencies—is complex. The lack of high-quality, structured data and continuous algorithm refinement often results in suboptimal matches, frustrating users and reducing trust in the platform [9].

- **User Retention and Engagement:**
Maintaining an active user base is critical for the success of job search applications. Many apps struggle with user retention due to poor user experience, such as complicated navigation, slow performance, or irrelevant job recommendations. If the application does not meet users' expectations for ease of use and responsiveness, they are likely to abandon it. Furthermore, many applications fail to fully optimize their interfaces for mobile devices, even though the majority of users access these platforms via smartphones, further impacting engagement negatively [12].

- **Data Security and Privacy Concerns:**
  Handling sensitive personal information such as resumes, contact details, and employment history poses persistent security challenges. Users expect robust data protection measures, including encryption, secure authentication, and transparent privacy policies. Without these safeguards, users may hesitate to share their information or engage fully with the platform, limiting the app's effectiveness. Ensuring compliance with regulations like GDPR and similar local laws adds another layer of complexity for developers [4].

- **Language and Localization Barriers:**
  Job search applications often operate across diverse linguistic and cultural contexts, but many fail to provide adequate localization. Lack of support for regional languages, cultural nuances, and local job market conditions restricts the accessibility and relevance of these apps in multilingual or global markets. This limitation reduces their usability and potential reach, especially in developing countries or regions with varied language preferences [2].

- **Integration with Third-Party Services:**
  To expand functionality and enhance the user experience, job search applications frequently need to integrate with external platforms such as LinkedIn, Google Jobs, or Applicant Tracking Systems (ATS). However, these integrations can be technically complex and require ongoing maintenance. Ensuring seamless data exchange, consistency, and security across different systems presents both technical and operational challenges [4].

2.4 Technological Frameworks for Recruitment Applications

The selection of an appropriate technology stack is crucial for the overall performance, scalability, and maintainability of job recruitment applications. The choice directly impacts development speed, user experience, and the ability to handle growing user demands.

2.4.1 Cross-Platform Development with Flutter and Dart

In this project, Flutter is utilized as the primary framework for cross-platform mobile app development. Flutter allows developers to write a single codebase that runs seamlessly on both Android and iOS devices. This significantly reduces development time and ensures a consistent user interface (UI) and user experience (UX) across platforms. Flutter's highly customizable widgets enable the creation of intuitive, user-friendly designs that can be tailored to the specific needs of job seekers and recruiters. The Dart programming language, used alongside Flutter, supports fast compilation, asynchronous operations, and efficient memory management, which are essential for delivering smooth and responsive mobile applications [3].

2.4.2 Backend and Real-Time Data Management with Firebase

For backend services and data storage, Firebase is employed due to its comprehensive cloud-based solutions provided by Google. Firebase Authentication offers secure and simple user login mechanisms, including email/password and social logins, helping to protect user data and privacy [16]. Cloud Firestore, Firebase's NoSQL real-time database, facilitates instant synchronization of job postings, application status updates, and in-app messaging between candidates and recruiters. This real-time data handling enhances user engagement and ensures timely communication within the platform [4].

2.4.3 Other Popular Technology Alternatives

While Flutter and Firebase provide an efficient combination, recruitment applications also commonly use other frameworks and tools, depending on project requirements:

- **Frontend:** React Native is a widely-used alternative for cross-platform development, offering the ability to share code between mobile and web applications. Native development tools like Swift (for iOS) or Kotlin (for Android) are preferred when performance or device-specific features are prioritized.

- **Backend:** Node.js, Python with Django, and Ruby on Rails are popular backend frameworks known for scalability, ease of development, and robust community support. These frameworks enable developers to build complex business logic, APIs, and integrate with third-party services.

- **Databases:** MongoDB is favored for flexible document-based data storage, while PostgreSQL offers a powerful relational database structure suitable for complex queries and transactional operations.

- **Cloud Infrastructure:** Amazon Web Services (AWS) and Google Cloud Platform (GCP) provide scalable, secure, and globally distributed cloud services that support the deployment and management of backend resources, storage, and networking [19, 20].

Chapter 3

Analysis of Existing Systems

3.1 Overview of Popular Job Search Applications

In recent years, several mobile applications have become dominant players in the job search ecosystem, offering diverse features to connect job seekers with employers worldwide. Platforms such as LinkedIn, Indeed, Glassdoor, JobStreet, and HeadHunter have achieved significant global and regional popularity, reflecting evolving recruitment trends.

LinkedIn uniquely combines professional networking with job search capabilities. Users can build detailed profiles highlighting their skills, work experience, and education, while also engaging directly with recruiters and industry peers. LinkedIn's job recommendation system leverages user activity and profile data to suggest relevant openings, supporting career development beyond simple job matching.

Indeed stands out as a comprehensive job aggregator, compiling listings from numerous company websites and job boards. It offers convenient features such as resume uploads, personalized job alerts, and application tracking to streamline the job hunting process.

Glassdoor is widely known for company reviews, salary information, and workplace insights, but it also integrates job search tools that help users find openings while assessing company culture and compensation.

JobStreet serves as a major player in Southeast Asia, providing localized job listings and features tailored to regional markets.

HeadHunter (hh.ru) is a leading recruitment platform primarily serving Russia and neighboring countries. It provides extensive job listings, candidate profiles, and employer branding tools. Its focus on regional labor markets and integration with social media platforms gives it a unique advantage in serving local job seekers and recruiters.

Each of these applications offers a different emphasis: LinkedIn prioritizes professional networking and personal branding; Indeed and JobStreet focus on wide accessibility and volume of listings; Glassdoor integrates employer reputation; and HeadHunter caters to regional market nuances. Together, they illustrate the diverse demands of modern recruitment and the need for versatile, user-friendly, mobile-optimized solutions.

3.2 Comparative Analysis of Key Features

To understand how these platforms meet user needs, it is important to analyze several core features that influence the quality of the job search experience.

3.2.1 Job Matching Algorithms

Job matching algorithms lie at the heart of job search applications, determining how well suggested opportunities align with users' qualifications and preferences [14]. LinkedIn employs sophisticated artificial intelligence techniques to analyze a combination of profile details, job search behavior, and user interactions. This approach enables LinkedIn to deliver personalized and context-aware job recommendations.

In contrast, platforms like Indeed and Glassdoor rely primarily on keyword matching and basic filters, which, while effective at large scale, may lack depth in personalization. They often do not fully account for soft skills, career aspirations, or long-term goals, resulting in recommendations that can sometimes feel generic or irrelevant.

HeadHunter uses a hybrid approach that combines keyword matching with user profile data and historical application behavior to improve relevance. It also integrates employer preferences and market trends to better align candidate-job matches, especially within its regional focus.

The limitations of existing algorithms underscore the importance of developing advanced matching systems that go beyond surface-level criteria, incorporating deeper semantic analysis and user intent recognition to improve job seeker satisfaction and placement success.

3.2.2 Application Tracking

Application tracking enables job seekers to monitor the progress of their submitted job applications. While platforms like LinkedIn and Indeed offer basic tracking features, they largely depend on recruiters or employers to update the status manually. This often results in delayed or missing feedback, leaving candidates uncertain about where they stand in the hiring process. Many users express frustration over the lack of real-time updates, which can lead to disengagement and reduced trust in the platform.

An effective job search application should provide transparent, real-time status updates, such as when an application is received, reviewed, shortlisted, or rejected. Such visibility empowers users to manage their job search more proactively and reduces anxiety associated with waiting for responses.

3.2.3 In-app Communication

Communication between candidates and recruiters is critical to an efficient hiring process. LinkedIn facilitates direct messaging, especially when users share mutual connections or belong to the same professional networks. This feature enhances responsiveness and enables personalized conversations.

However, many other popular platforms, including Glassdoor and Indeed, lack built-in messaging tools. Instead, communication is often conducted via external emails, which slows down the process and fragments conversations. Integrated messaging systems within the app streamline recruitment by keeping all interactions centralized, improving both speed and security.

3.2.4 Geolocation-based Job Search

Geolocation filtering is an important tool for users who prioritize local job opportunities or remote work options. Indeed and Glassdoor provide location-based search filters, but often only at broad levels, such as city or region. This lack of granularity can limit the relevance of search results for users who need precise geographic matching.

Implementing more detailed geolocation features—such as neighborhood-level filtering or real-time proximity alerts—could greatly enhance the user experience by presenting highly relevant, accessible job listings tailored to users' location preferences.

3.3 Strengths and Weaknesses of Existing Systems

Strengths:

- Extensive user bases and vast databases of job listings increase the chances of finding relevant opportunities.

- Additional tools like resume builders, company reviews, and salary insights enrich the job search experience.

- Strong brand reputation and market credibility foster user trust and attract recruiters and candidates alike.

Weaknesses:

- Many platforms lack real-time updates and transparent feedback mechanisms, leading to uncertainty.

- Communication tools are often limited or fragmented, hindering smooth interactions between candidates and employers.

- Job recommendations sometimes suffer from insufficient personalization, resulting in irrelevant suggestions.

- User interfaces can be overcrowded and inconsistent across different devices, negatively impacting user experience.

These weaknesses present opportunities for new recruitment applications to innovate by focusing on real-time responsiveness, integrated communication, intelligent personalization, and streamlined, user-friendly designs.

3.4 User Feedback and Market Reception

User feedback across major platforms such as the Google Play Store and Apple App Store shows that while existing job search applications provide basic functionalities, many users remain dissatisfied with several key aspects. Common complaints include outdated or irrelevant job listings, poor personalization of recommendations, and limited communication features. Many users express frustration with the lack of real-time updates on

application statuses and the absence of integrated messaging tools, which slows down the hiring process and reduces overall engagement.

Market analysis indicates that job seekers prioritize simplicity, transparency, and control when using these apps. Platforms that offer intuitive interfaces, accurate and personalized job matches, and timely notifications tend to have higher user retention and satisfaction rates. Conversely, apps that deliver irrelevant results or are difficult to navigate often experience high churn and negative reviews.

3.5   Gaps and Opportunities for Improvement

The analysis of current job search applications reveals several critical gaps and corresponding opportunities to enhance user experience and recruitment efficiency:

- Weak AI Integration for Personalized Job Recommendations: Many platforms still rely on basic keyword matching rather than advanced machine learning techniques that consider user behavior and preferences.

- Insufficient Real-Time Communication: Lack of in-app messaging and delayed recruiter responses hinder effective engagement.

- Limited Transparency in Application Tracking: Users often have no clear insight into the status of their applications, causing frustration.

- Minimal Use of Geolocation: Current solutions do not leverage precise location data to improve job relevance.

- Accessibility and Localization: Many apps lack multilingual support and culturally relevant content for diverse user bases.

Feature	LinkedIn	Indeed	Glassdoor	HeadHunter
Job Matching Algorithm	AI-driven, profile & activity-based	Keyword-based, broad matches	Keyword-based, less personalized	AI-enhanced, including soft skills
Application Tracking	Basic status updates, employer-dependent	Limited real-time feedback	Minimal updates	Detailed status updates, real-time
In-app Communication	Integrated messaging, network-based	No built-in chat, email required	No integrated messaging	Built-in chat between recruiters and candidates
Geolocation Filtering	City and region level	City-level filtering	City-level only	Precise geolocation and remote options
User Interface (UI/UX)	Professional, sometimes complex	Simple, functional	Cluttered	Clean, user-friendly interface
Multilingual Support	Multiple major languages	Limited regional language support	Limited	Extensive localization and languages

Table 3.1: Comparison of Key Features in Popular Job Search Applications

Chapter 4

Data Collection

4.1   Data Sources and Collection Methods

The data collection phase of this project employed a mixed-method approach to gather comprehensive information relevant to the development of a job search and recruitment mobile application. Combining primary and secondary data sources enabled a well-rounded understanding of user needs, market conditions, and technological capabilities.

Primary data was obtained through structured surveys and in-depth interviews. The surveys targeted active job seekers who use digital platforms for employment searches, aiming to capture their preferences, challenges, and expectations regarding job search applications. In parallel, interviews were conducted with hiring managers and HR professionals from diverse industries and company sizes. These conversations focused on recruitment workflows, pain points in current hiring systems, and desirable app features from the employer's perspective.

Secondary data collection involved a thorough review of existing literature, industry analyses, and user-generated content. Academic databases such as IEEE Xplore and Google Scholar were searched for studies on recruitment technologies and mobile application usability. Additionally, user reviews and ratings on major app stores (Google Play and Apple App Store) provided real-world feedback on popular job search platforms. Online forums and discussion groups also contributed insights into emerging trends and common user complaints.

This combined approach ensured that the dataset reflects both empirical user experiences and theoretical foundations, supporting informed decision-making for the application's design and functionality.

4.2   Existing Research and Case Study Analysis

This project relied significantly on existing research and documented case studies to validate key assumptions and benchmark potential solutions. Academic articles and industry reports provided valuable insights into evolving recruitment trends, user behavior in digital job searches, and emerging technologies such as AI-driven recommendation engines and blockchain-based resume verification systems.

In-depth case studies of major platforms like LinkedIn, Indeed, and Glassdoor were reviewed to understand their growth trajectories, feature development strategies, and re-

sponses to early user feedback. For example, LinkedIn's incorporation of skill assessment quizzes and AI-powered job matching greatly enhanced user retention and engagement. This finding informed our decision to prioritize intelligent matching features in our application design.

Additionally, smaller, regional job platforms operating in Kazakhstan and Central Asia were evaluated to examine their localization approaches and challenges. These platforms often face difficulties related to scalability, user engagement, and user interface design, highlighting practical lessons on features to adopt or avoid in our project.

Academic research also identified significant gaps in job seekers' access to reliable employment data, particularly in rural and developing areas. These studies stressed the importance of adopting a mobile-first approach, considering the predominance of smartphone use over desktop devices in such regions [15, 12]. This reinforced the project's focus on building a responsive and accessible mobile recruitment application.

4.3   User Testing and Feedback Collection

To ensure that the developed job search application aligns with user expectations and effectively addresses identified pain points, a structured user testing phase was conducted. This phase involved gathering qualitative and quantitative feedback from a representative group of job seekers and recruiters.

- **User Testing Methods:**
  A prototype of the application was made available to a selected group of participants who actively engaged with its core functionalities such as job search, application tracking, and in-app messaging. Testing sessions included task-based usability tests, where users were asked to perform typical actions while their interactions were observed and recorded. Surveys and follow-up interviews collected subjective impressions regarding ease of use, interface clarity, and overall satisfaction.

- **Feedback Analysis:**
  The collected feedback was analyzed to identify usability issues, feature gaps, and areas for improvement. Users frequently highlighted the importance of fast loading times, intuitive navigation, and the relevance of job recommendations. Recruiters emphasized the need for streamlined communication channels and clear application status indicators. Notably, some users requested enhanced multilingual support to accommodate diverse language preferences.

- **Iterative Improvements:**
  Insights from user testing informed iterative refinements to the app's design and functionality. Adjustments were made to simplify navigation menus, improve notification systems, and fine-tune the job matching algorithm based on user preferences. Continuous feedback loops will be established for future updates to ensure the app evolves with changing user needs.

This user-centric testing approach helped bridge the gap between theoretical design and practical usability, reinforcing the application's potential to deliver a superior recruitment experience.

4.4 Data Processing and Analysis

All collected data underwent systematic processing and analysis to derive actionable insights essential for informed decision-making. Quantitative data gathered from surveys were analyzed using descriptive statistical methods, including calculation of means, medians, and standard deviations. These metrics helped identify key trends in user expectations, preferences, and behaviors. To enhance clarity, visual representations such as bar graphs, pie charts, and histograms were employed to summarize and communicate the findings effectively.

Qualitative data, obtained from interviews and open-ended survey responses, were analyzed through thematic coding. Responses were organized into categories reflecting major themes such as usability, accessibility, desired features, and perceived obstacles. This thematic analysis enabled the identification of common pain points and user priorities, which guided the prioritization of development features and enhancements. User testing results were quantitatively assessed using usability metrics, including task completion rates, average time-on-task, and error frequencies. These performance indicators were compared against established industry benchmarks to ensure that the application's usability met or surpassed accepted standards. Such metrics provided objective validation of the application's user-friendliness and operational efficiency.

Additionally, a comparative sentiment analysis was conducted on user reviews from app stores of competing job search platforms. This analysis revealed recurring user complaints such as irrelevant job recommendations, cumbersome UI/UX designs, and the absence of real-time communication tools. These insights were crucial in shaping the user interface and feature set of our application to better address user frustrations.

By integrating and triangulating data from multiple sources and applying rigorous analytical techniques, the project ensured that all development decisions were firmly grounded in real-world user needs and market demands.

Chapter 5

Methodology of the Work

5.1 Development Approach

The development of the job search and recruitment mobile application adhered to the **Agile methodology**, which emphasizes iterative progress, continuous feedback, and adaptive planning. Agile was deliberately chosen as the project management framework because of its inherent flexibility and capacity to respond dynamically to evolving user requirements and market conditions—both crucial factors in the fast-paced domain of digital recruitment.

The project lifecycle was divided into a series of short development cycles, known as **sprints**, each lasting approximately two weeks. This sprint-based approach facilitated focused work on discrete modules or features, enabling incremental delivery and testing. The primary modules targeted across the sprints included:

- **User Registration and Authentication**: Designing secure and user-friendly sign-up and login processes, incorporating Firebase Authentication to support email/password as well as social logins.

- **Job Listing and Search**: Implementing job posting feeds with real-time updates, powered by Cloud Firestore, coupled with advanced filtering mechanisms based on job type, location, salary, and experience.

- **Filtering and Sorting Mechanisms**: Allowing users to refine job searches using multi-criteria filters and sort results by relevance, date posted, or company rating.

- **In-app Messaging**: Developing real-time communication channels between job seekers and recruiters using Firebase Cloud Messaging and Firestore to enhance engagement and responsiveness.

- **Recruiter Dashboard**: Building a comprehensive interface for recruiters to post jobs, manage applications, and interact with candidates.

Each sprint began with a detailed planning phase, which involved refining requirements based on continuous input from multiple sources, including user surveys, interviews, competitor analysis, and stakeholder feedback. This ensured that development efforts remained tightly aligned with user needs and business objectives. Requirement

specifications were documented and prioritized in a **product backlog**, maintained collaboratively using project management tools such as Jira or Trello.

To bridge the gap between conceptual ideas and actual development, interactive **prototypes and wireframes** were created using Figma. These prototypes allowed visualization of user flows, screen layouts, and UI/UX elements. Early-stage prototypes were shared with select users and stakeholders to solicit feedback on usability, design consistency, and feature completeness. The iterative feedback cycle facilitated early detection and correction of design flaws, preventing costly rework during later development stages.

The frontend development utilized **Flutter**, Google's open-source UI toolkit for building natively compiled applications for mobile, web, and desktop from a single codebase. Flutter was selected for several strategic reasons:

- **Cross-Platform Consistency**: Flutter enables the deployment of one codebase on both Android and iOS, ensuring visual and functional uniformity across platforms while significantly reducing development time and maintenance overhead.

- **Rich UI Capabilities**: Its extensive library of customizable widgets and smooth animations allowed the creation of a highly engaging and intuitive user interface, essential for maintaining user interest and satisfaction.

- **Performance**: Flutter compiles directly to native ARM code, offering high performance and low latency, which are critical for real-time features like job alerts and messaging.

- **Strong Community and Support**: Flutter's growing ecosystem and Google's backing ensured access to a wide range of plugins and documentation.

On the backend, **Firebase** was chosen as the primary cloud service provider due to its seamless integration with Flutter and robust capabilities tailored for mobile applications. The key Firebase services utilized included:

- **Cloud Firestore**: A NoSQL document database that enabled real-time data synchronization across users and devices, facilitating features like instant job posting updates, live application tracking, and message exchanges.

- **Firebase Authentication**: Provided secure and straightforward user authentication, supporting multiple login methods and robust identity management without the need to build custom backend authentication logic.

- **Firebase Cloud Messaging (FCM)**: Enabled push notifications to deliver timely alerts about new jobs, application status changes, or recruiter messages, thereby increasing user engagement and retention.

The use of Firebase allowed rapid backend development without the need for managing complex server infrastructure, improving scalability and reducing operational costs.

For **version control and collaborative development**, GitHub was employed as the central repository. The team adhered to Git workflows involving feature branching, pull requests, and code reviews to maintain high code quality and facilitate collaborative coding. To automate build, test, and deployment processes, **GitHub Actions** was

implemented, ensuring continuous integration and continuous deployment (CI/CD). This pipeline allowed automatic testing of code changes and streamlined delivery of new application versions, minimizing integration issues and accelerating development cycles.

To support agile communication and coordination, regular meetings such as daily standups, sprint planning sessions, and retrospective reviews were conducted. These meetings ensured team members stayed aligned on progress, discussed impediments, and refined workflows. **Stakeholder demos** at the end of each sprint provided opportunities to showcase completed features, gather feedback, and adjust the project roadmap as necessary.

Overall, the adoption of **Agile methodology** combined with the choice of modern development tools and frameworks fostered a highly adaptive, efficient, and user-centered development process. This approach was instrumental in building a scalable, responsive, and feature-rich job search application tailored to contemporary recruitment challenges.

5.2 Application of Collected Data in Development

The comprehensive user feedback and data collected during the research and analysis phase (see Chapter 4) directly influenced multiple facets of the application's design, functionality, and technical architecture. Integrating real user insights ensured the final product effectively addressed core user needs and industry pain points while maintaining a seamless and engaging user experience.

User Interface and Navigation

A significant portion of users expressed the necessity for an intuitive and straightforward navigation system. Many highlighted frustration with cluttered layouts and complex menu structures found in existing applications. Taking this into account, the design team prioritized a clean, minimalist interface with clearly distinguishable icons and simplified workflows. Context-aware tooltips were introduced to guide users through less obvious features, especially for first-time users. The navigation bar was streamlined to focus on essential sections such as Home, Search, Applications, and Profile, reducing cognitive load and enhancing usability.

Advanced Filtering Options

Efficient job filtering was another frequent user request. To address this, the development team implemented a robust filtering system with multiple parameters, including job category, salary range, geographic location, employment type (full-time, part-time, freelance), work schedule (remote, on-site, hybrid), and required experience level. User testing sessions during the prototype phase revealed subtle nuances in how users interacted with filters—some preferred multi-select checkboxes, while others favored dropdown menus. Based on these insights, filter controls were designed to be both flexible and intuitive, enabling users to quickly narrow down relevant job listings. Iterative testing helped fine-tune filter responsiveness, visibility, and the clarity of filter effects on search results.
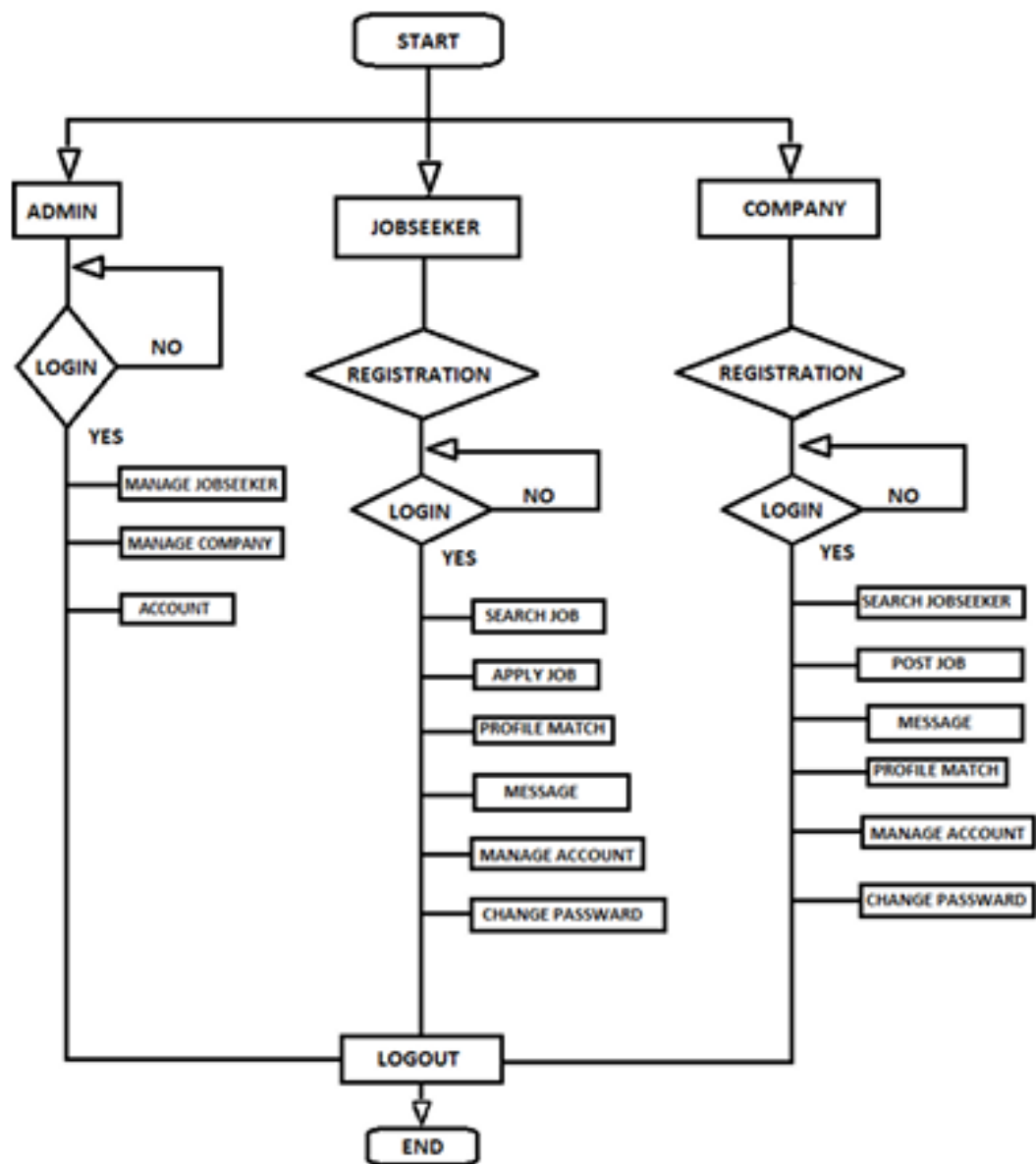
Figure 5.1: Flowchart of online job search application

Candidate Profiling Enhancements

Recruiters provided valuable input regarding candidate evaluation challenges, emphasizing the need for comprehensive, easily navigable candidate profiles. In response, the application was designed to include detailed user profiles that showcased a wide array of professional data: work history, key skills, certifications, educational background, portfolio links, and even endorsements or recommendations. This enriched candidate information empowered recruiters to make faster, more informed decisions. Complementing this, the recruiter dashboard was equipped with an applicant tracking system (ATS) that allowed sorting applicants by various criteria, marking statuses (e.g., shortlisted, interviewed, rejected), and adding notes—streamlining recruitment workflows.
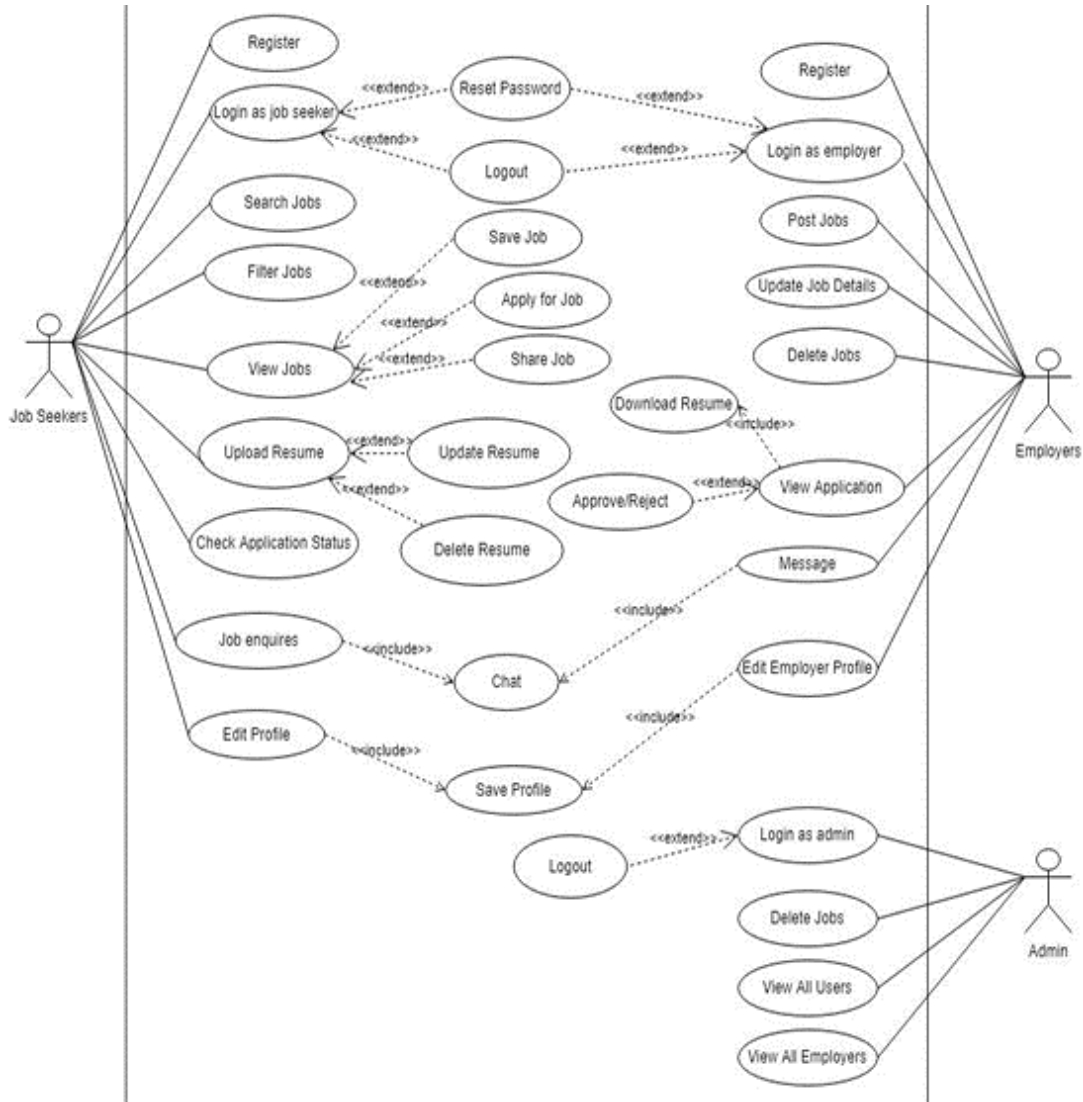
Figure 5.2: Case diagram of online recruitment system

Performance and Reliability Improvements

Analysis of competitor app store reviews underscored user dissatisfaction with slow load times and unreliable app behavior, particularly in regions with limited internet connectivity. To mitigate this, backend queries were optimized for efficiency, leveraging Firebase's real-time database indexing and query constraints. Additionally, a local caching mechanism was implemented, storing recently accessed job postings on the device. This cache reduced redundant network requests, significantly cutting down load times and ensuring smoother user experiences, even on slower or intermittent connections.

Security Measures

Security was a consistent concern among users, particularly regarding personal data protection and spam prevention. The development team responded by implementing end-to-end encryption for sensitive user data in transit and at rest, utilizing Firebase's secure

infrastructure and additional encryption layers where appropriate. To combat automated bot registrations and fraudulent account creation, Google reCAPTCHA was integrated into the registration process, providing a seamless yet effective layer of protection without compromising user convenience.

Accessibility and Localization

Feedback from users in diverse regions, including Kazakhstan and Central Asia, highlighted the importance of multilingual support and culturally sensitive UI elements. Consequently, the app was designed with internationalization in mind, supporting multiple languages and allowing easy localization of content. This expanded the application's potential user base and improved accessibility for non-English speakers.

5.3 Evaluation Metrics and Validation

To ensure the mobile job search and recruitment application met both technical and user-centered quality standards, a comprehensive set of evaluation metrics and validation activities were established. These metrics encompassed technical performance, usability, and overall user satisfaction, while validation involved real-world testing and expert reviews.

Technical Performance Metrics

- **Load Time:** Targeted to have all primary screens fully loaded within 2 seconds when accessed via typical 4G mobile networks. Optimizations in backend querying, asset compression, and caching strategies contributed to this goal.

- **Error Rate:** Automated test suites, including unit and integration tests, were employed to monitor form submissions, navigation flows, and API requests, maintaining error occurrences below 2%. This ensured a stable user experience free from common bugs.

- **Crash-Free Sessions:** Leveraging Firebase Crashlytics, the application maintained a crash-free rate of 99.5% or higher throughout the testing and post-launch phases, indicating high stability and robustness.

Usability and User Experience Metrics

- **Task Completion Rate:** During formal usability testing sessions, 92% of participants successfully completed essential actions such as submitting job applications, updating profiles, and using filtering options without assistance. This high rate confirmed that the app's design and workflows were intuitive.

- **User Retention:** Retention rates were tracked at two key intervals: after 7 days and 30 days from initial app installation. Early retention rates above 60% were considered positive indicators of sustained user engagement.

- **Net Promoter Score (NPS):** The app scored an average of 8.2 out of 10 on the NPS scale during feedback surveys, reflecting strong user satisfaction and a willingness to recommend the app to peers.

Validation Activities

- **Beta Testing:** The application was released to a closed group of users drawn from target demographics for real-world evaluation. Feedback highlighted UI inconsistencies and minor bugs, leading to several important refinements in layout and interaction design.

- **Stakeholder Review:** Regular checkpoints were conducted with academic supervisors, industry experts, and potential recruiters to validate that the project's scope and deliverables aligned with initial objectives and real-world demands.

- **Comparative Benchmarking:** The app's functionality, performance, and user interface were benchmarked against leading competitors using heuristic evaluation frameworks and score-based rankings. This helped identify areas for continuous improvement and ensured competitive parity.

Sprint Stage	Objective	Tasks	Outcome
Sprint 1: Core Features	Develop foundational functionalities such as user registration, job listing, and basic search/filtering	Design and implement user registration and login; develop job listing and basic search UI; setup backend database schemas	Working prototype supporting user sign-up, job browsing, and basic search filters
Sprint 2: Advanced Filters and Profile Management	Enhance filtering capabilities and candidate profile details	Add multiple filters (salary, location, experience); implement detailed user profiles with skills and portfolio sections	Enhanced job search precision and comprehensive user profiles for recruiters
Sprint 3: Real-Time Communication and Notifications	Integrate in-app messaging and notification system	Develop chat module; integrate Firebase Cloud Messaging for push notifications	Seamless recruiter-applicant communication and timely alerts
Sprint 4: Performance Optimization and Security	Optimize backend performance and implement security features	Optimize database queries; implement data caching; add encryption and Google reCAPTCHA for registration	Fast, secure app with reduced load times and bot protection
Sprint 5: Localization and Accessibility	Support multiple languages and improve accessibility features	Add multilingual support; optimize UI for accessibility compliance (e.g., font size, color contrast)	Expanded user base with improved accessibility and localization
Sprint 6: Final Testing and Deployment	Conduct thorough testing and launch the app	Execute usability tests, fix bugs, conduct crash testing; deploy app to Google Play and Apple App Store	Stable, user-friendly app publicly available with monitored performance

Table 5.1: Agile Development Workflow for Job Search and Recruitment Application

Chapter 6

MVP/UML Diagrams/Architecture of the Project

6.1 System architecture and UML diagrams

This chapter presents the system architecture and various diagrams that outline the functional and structural design of the mobile application for job search and recruitment.

6.1.1 Start Page

Here, the user preferences and usage analytics are managed, ensuring that the application adapts to the user's needs and tracks performance indicators.

6.1.2 User Profile and Settings

The user profile module provides a comprehensive overview of the user's professional information and preferences.

6.1.3 Job Search Overview

This section outlines the workflow for job search functionalities and how the application status updates are managed.

6.1.4 Recruiting Pages

The recruiter dashboard diagram shows the tools available to employers for posting jobs, viewing applications, and communicating with potential candidates.

6.1.5 Class Diagram

The class diagram shows the relationships between classes such as User, JobPost, Application, and Recruiter, highlighting their attributes and interactions.

Figure 6.1: Start page

6.1.6 Sequence Diagram: Authentication

This diagram illustrates the user login and authentication sequence, showing how user credentials are validated and sessions are managed.

6.1.7 BPMN Process: Job Application Process

The BPMN diagram details the job application submission workflow, from job search to successful application.
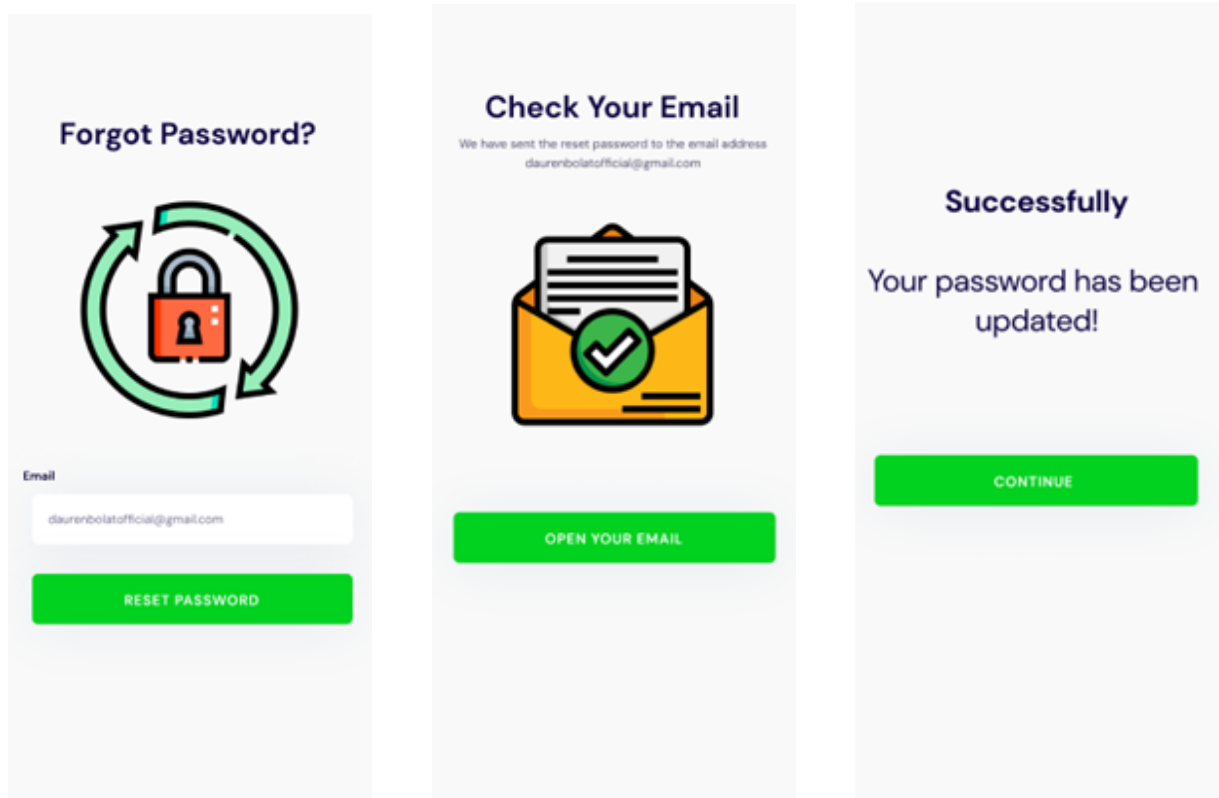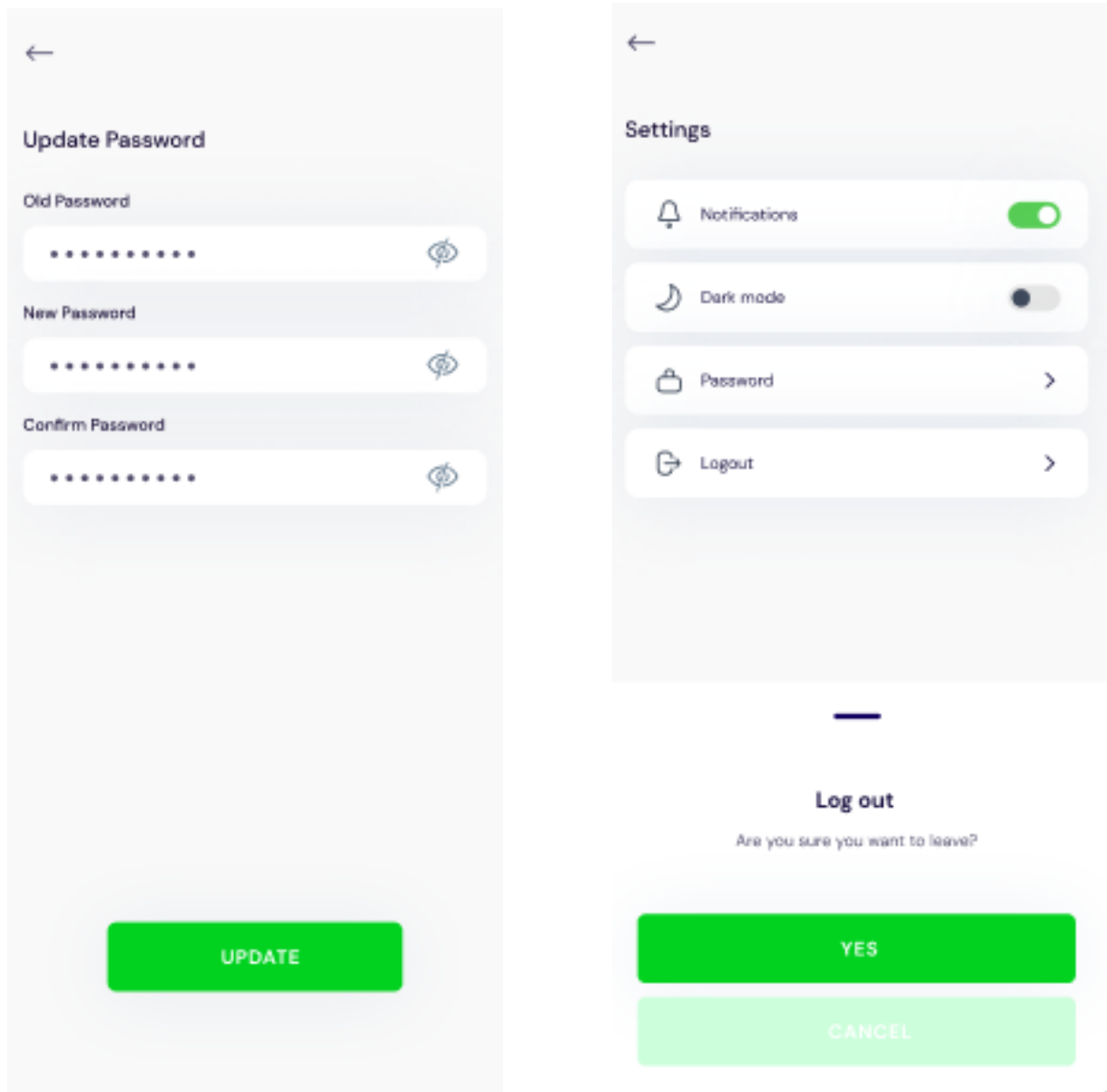
Figure 6.2: Password reset workflow

Figure 6.3: User profile and settings
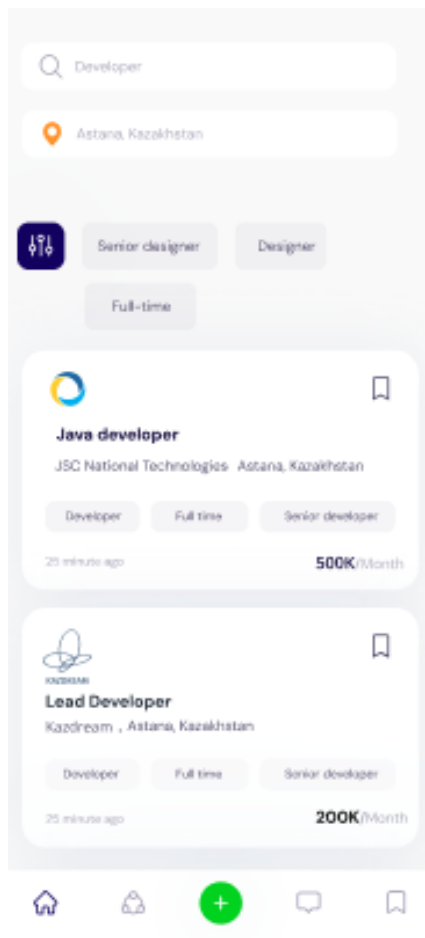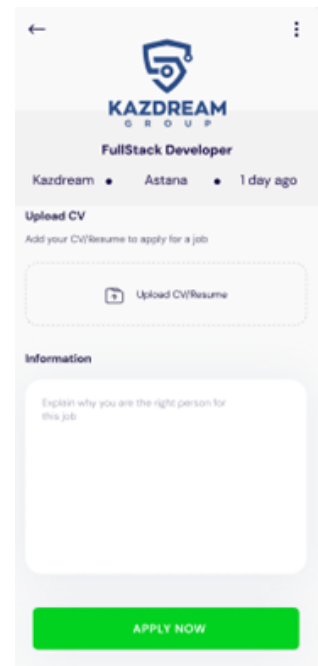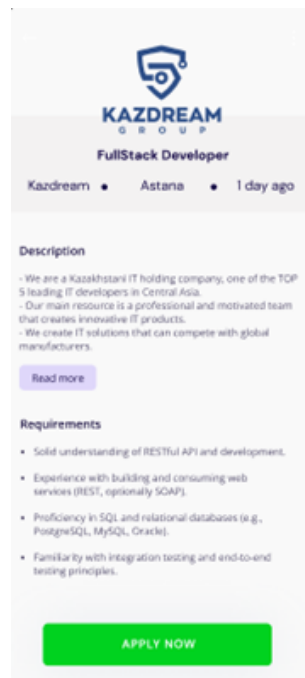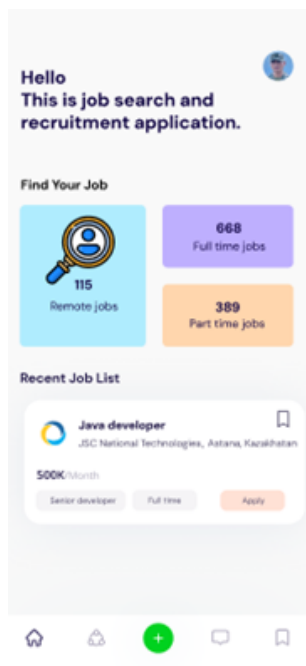
Figure 6.4: Password update and log out
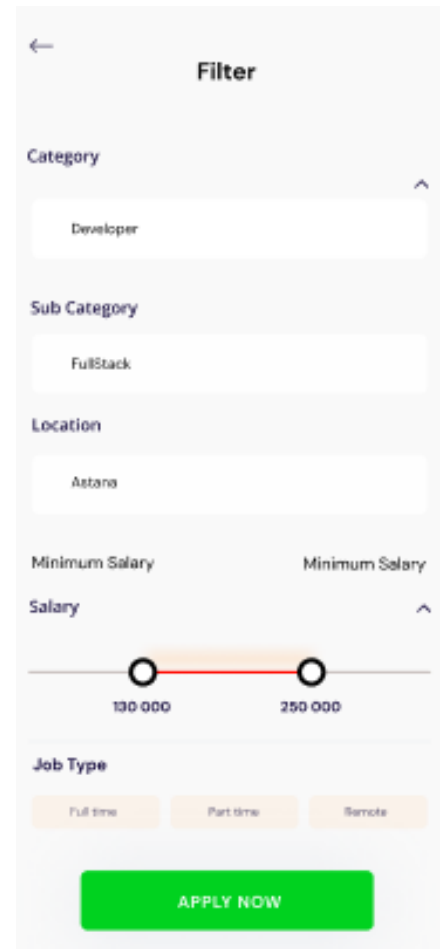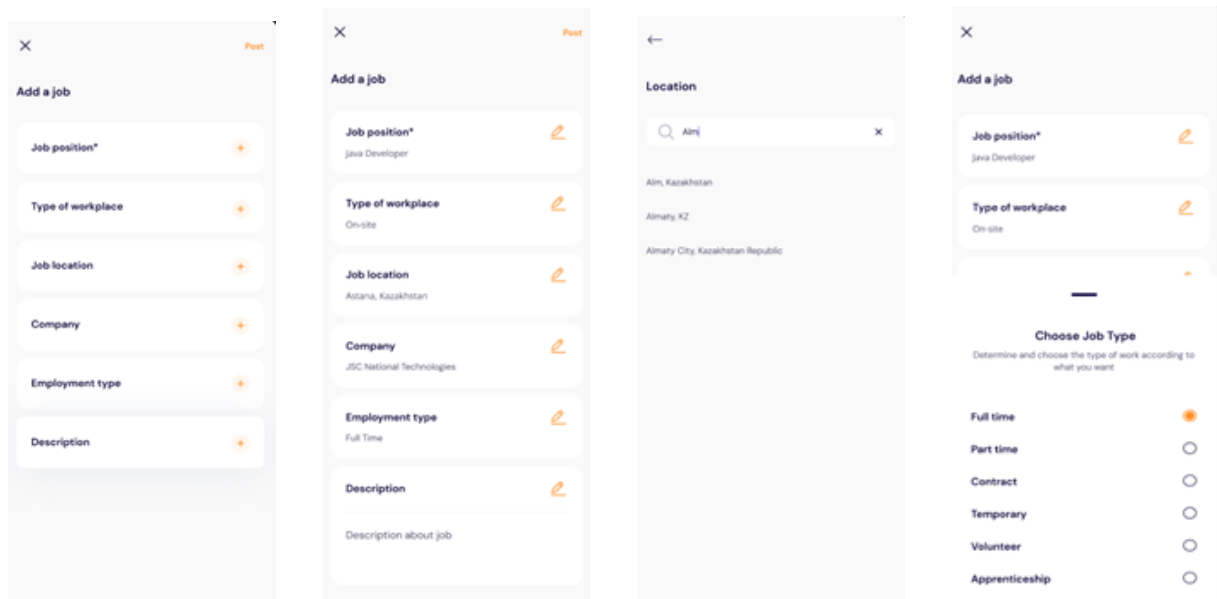
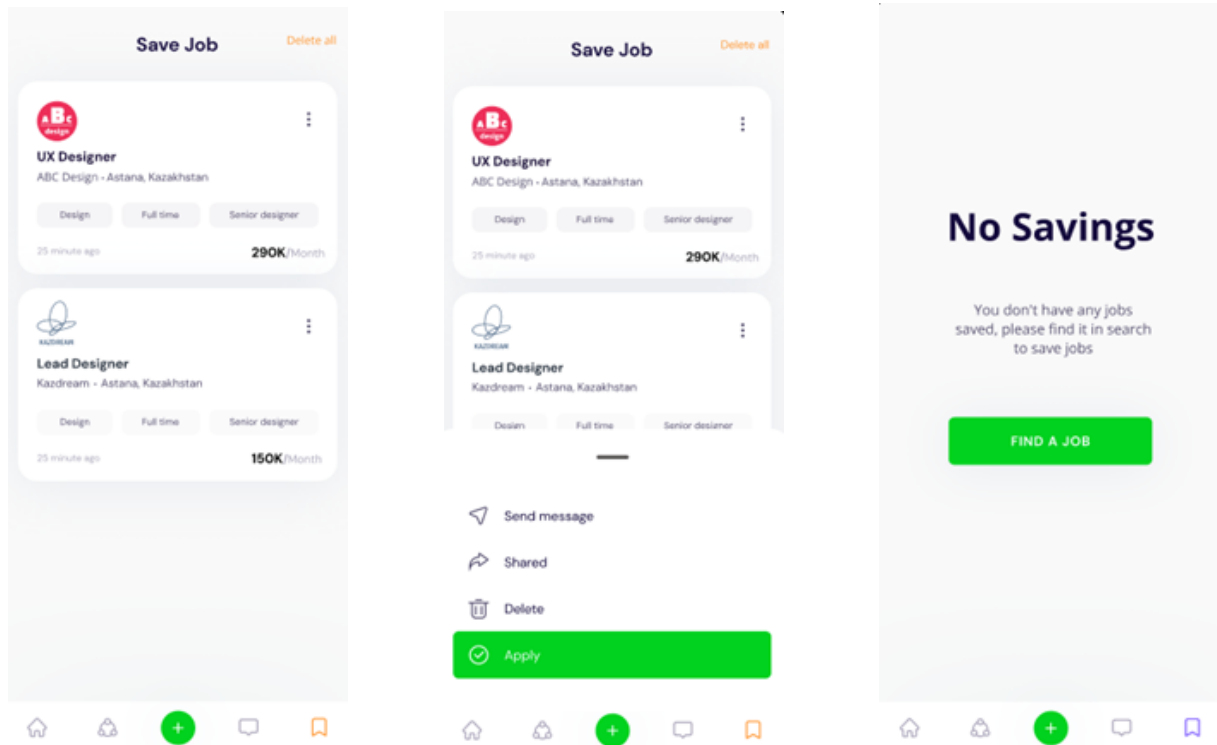Figure 6.5: Job searching pages
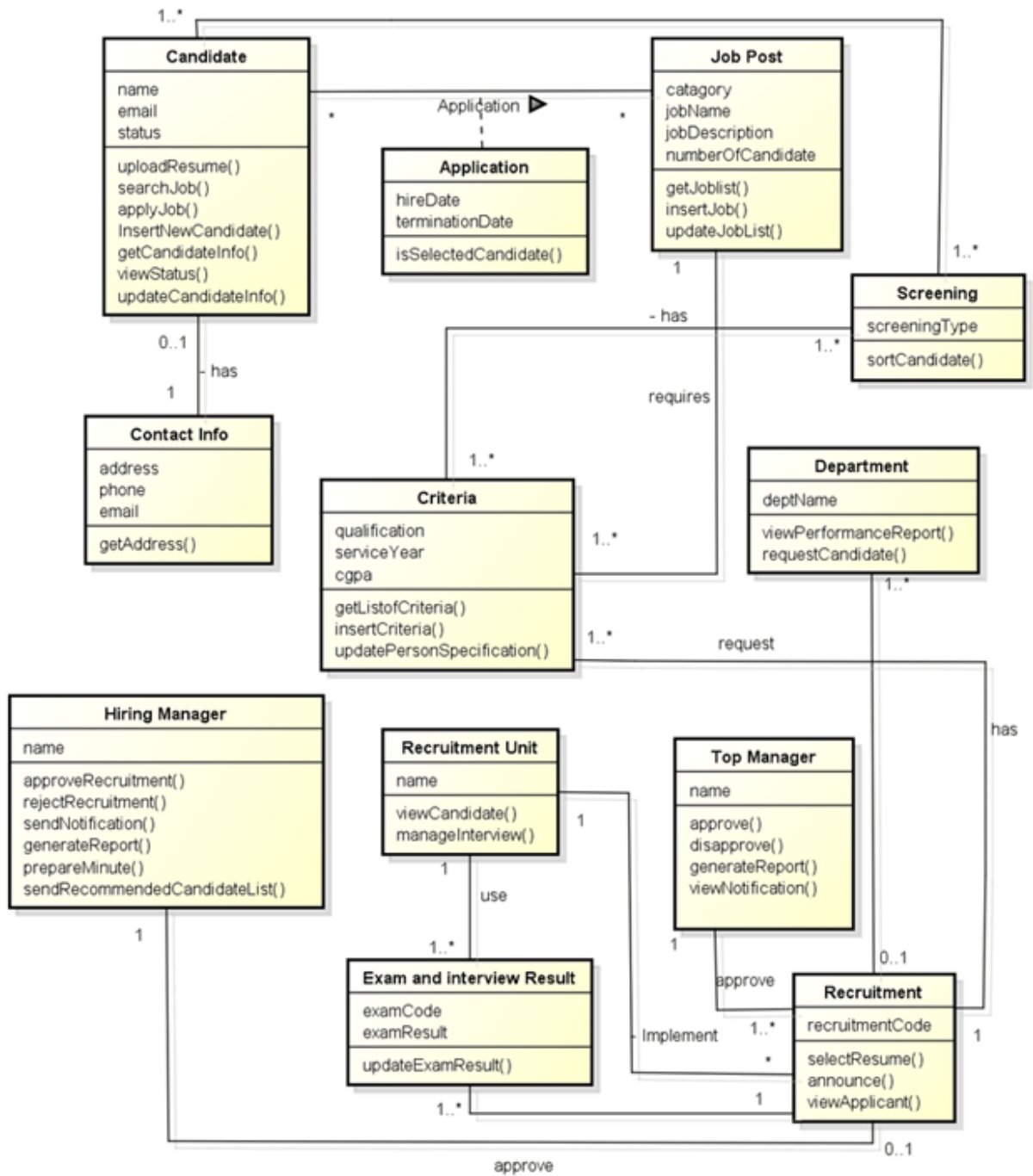
Figure 6.6: Add a job

Figure 6.7: Saved jobs

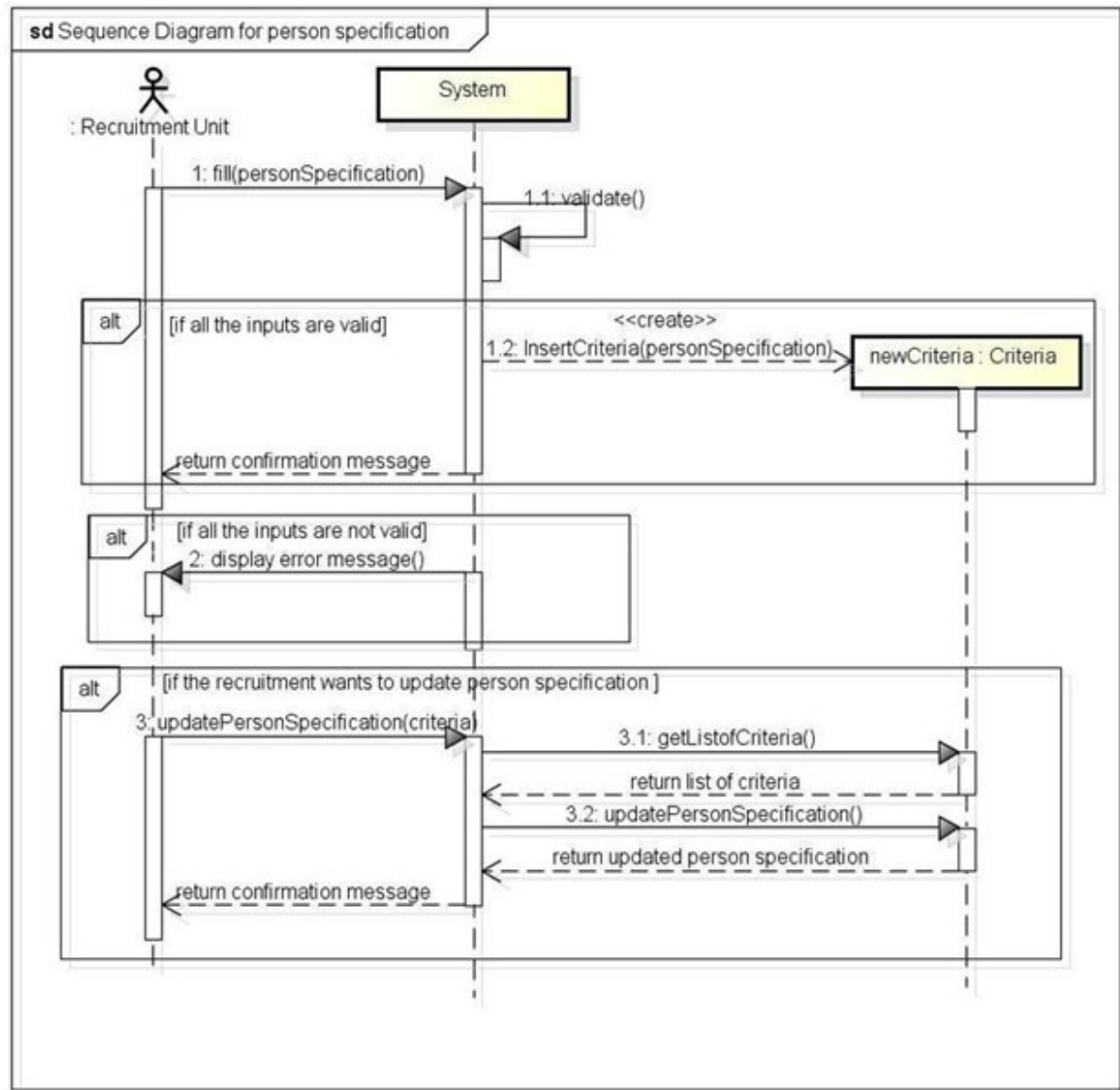Figure 6.8: Class Diagram for Employee Recruitment

Figure 6.9: Sequence diagram for person specification
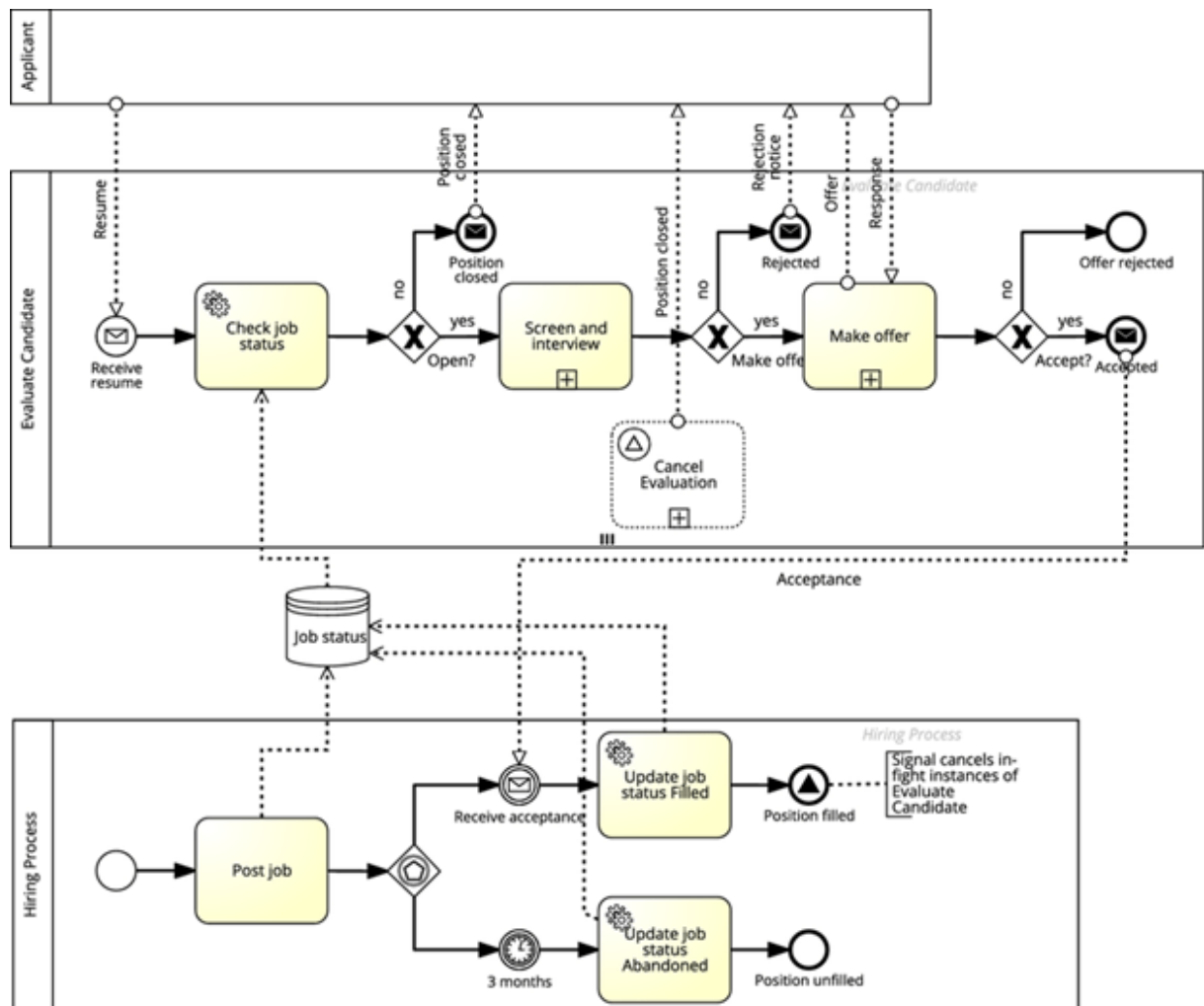
Figure 6.10: BPMN diagram: Hiring Process

Chapter 7

Technology Comparison

7.1 Introduction to Technology Selection

Developing a mobile application for job search and recruitment requires selecting a robust and efficient technology stack to ensure a seamless user experience, high performance, and reliable security. The right choice of technologies can significantly impact the development speed, scalability, maintainability, and overall success of the application. This chapter compares various technologies based on several important criteria such as scalability, ease of integration, community support, cost, and suitability specifically for mobile recruitment solutions.

The technology comparison in this chapter covers four main areas critical to the project's goals:

- **Development Frameworks:** This section compares popular cross-platform frameworks such as Flutter and React Native, as well as native development using Swift for iOS and Kotlin for Android. The analysis focuses on factors like development speed, UI/UX capabilities, performance, and the availability of third-party libraries. Each framework's advantages and limitations are discussed in relation to building a responsive and visually appealing job search application.

- **Database Solutions:** A comparison is made between Firebase Firestore, PostgreSQL, and MongoDB. Firebase Firestore offers real-time data synchronization and seamless integration with mobile platforms, making it ideal for dynamic applications. PostgreSQL provides strong relational database features, data integrity, and complex query support, while MongoDB offers flexible schema design and scalability suitable for evolving data models. The choice between these depends on the specific data requirements and expected application load.

- **Authentication and Security:** Ensuring secure and smooth user authentication is crucial for protecting user data and maintaining trust. This section evaluates Firebase Authentication, OAuth 2.0, and custom authentication methods. Firebase Authentication offers ready-to-use, secure login options with support for multiple providers, OAuth 2.0 provides a widely accepted standard for delegated access, and custom authentication can be tailored for unique security policies. The trade-offs between security, ease of implementation, and flexibility are considered.

- **Cloud Services:** Cloud providers like Firebase, Amazon Web Services (AWS), and Google Cloud Platform (GCP) are compared for their offerings related to backend services, storage, scalability, and cost-effectiveness. Firebase offers an integrated serverless environment optimized for mobile apps, AWS provides a broad set of scalable cloud computing services with fine-grained control, and GCP delivers strong machine learning tools and infrastructure support. The selection depends on the project's requirements for scalability, maintenance, and future growth.

Each technology is evaluated for its compatibility with the project's goal of creating a real-time, secure, and user-friendly job search and recruitment application. By systematically comparing these technologies, this chapter lays the foundation for choosing an optimal technology stack that balances development efficiency with high-quality user experience and robust backend performance.

7.2 Development Framework Comparison

Selecting the appropriate development framework is crucial for delivering a mobile application that balances performance, development speed, and user experience. This section provides a detailed comparison of three widely-used technologies: Flutter, React Native, and Swift/Kotlin (native development).

Best Choice: Flutter

- Enables cross-platform compatibility, ensuring the application reaches both Android and iOS users.

- Provides high-performance rendering with rich UI components essential for modern recruitment applications.

- Allows for rapid development with a single codebase, saving time and resources.

7.3 Database Solution Comparison

Choosing the right database technology is a critical decision in the development of a mobile application for job search and recruitment. The database must efficiently handle real-time data updates, provide robust security, support offline access, and scale seamlessly as the user base grows. This section compares three popular database solutions: Firebase Firestore, PostgreSQL, and MongoDB, focusing on features relevant to mobile recruitment applications.

Feature	Flutter	React Native	Swift/Kotlin
Performance	High performance thanks to compilation to native ARM code and its own rendering engine. Flutter provides smooth animations and a highly responsive UI even for complex applications.	Moderate performance, as it uses a JavaScript bridge to communicate with native components. This can introduce delays for complex or resource-intensive operations.	Very high performance due to direct native compilation without any bridging layers, ensuring the best possible efficiency and responsiveness.
Cross-platform	Yes, Flutter enables true cross-platform development with a single codebase for both Android and iOS, which significantly reduces development time and maintenance effort.	Yes, React Native supports cross-platform development with a single codebase, although sometimes platform-specific adjustments are necessary for full functionality.	No, Swift is used for iOS and Kotlin for Android, meaning separate codebases are required for each platform, which increases development time and cost.
UI Customization	High degree of customization due to Flutter's own widget set, allowing developers to create highly unique and custom interfaces unrestricted by native UI components.	Moderate customization; relies on native UI components which may limit the design scope, though third-party libraries help expand customization possibilities.	High customization capabilities, offering full control over UI design using native platform tools, enabling deeply integrated and polished interfaces.
Community Support	Rapidly growing and vibrant community supported by Google, with extensive libraries, plugins, and strong documentation ensuring long-term viability.	Large and mature community backed by Facebook and a vast ecosystem of plugins and resources, making it a reliable choice for many projects.	Established and extensive communities for both Swift (iOS) and Kotlin (Android), with strong corporate backing (Apple and Google) but requiring platform-specific expertise.
Best Use Case	Ideal for apps requiring complex, fluid user interfaces and rich interactivity, such as modern recruitment and job search applications that benefit from fast UI rendering.	Suitable for projects aiming for rapid MVP release and broad platform reach with moderate performance needs, e.g., general-purpose cross-platform apps.	Best suited for applications demanding maximum native performance, deep platform integration, and access to the latest OS features, often critical in enterprise or highly specialized apps.

Table 7.1: Framework Comparison

Best Choice: Firebase Firestore

- Supports real-time data synchronization, essential for job updates and communication in recruitment processes.

- Secure cloud-based storage with built-in encryption for user data protection.

- Provides offline access, enabling users to view job listings and updates even in low connectivity areas.

7.4 Authentication and Security

Ensuring secure and smooth user authentication is critical for protecting sensitive user data and maintaining trust in a job search and recruitment application. This section provides a detailed comparison of three widely used authentication methods: Firebase Authentication, OAuth 2.0, and Custom Authentication solutions. The evaluation considers ease of integration, security level, support for multi-factor authentication, and cost implications.

Feature	Firebase Firestore	PostgreSQL	MongoDB
Scalability	Firebase Firestore is a highly scalable NoSQL cloud database managed by Google Cloud, designed to automatically handle scaling from small to very large datasets and concurrent users.	PostgreSQL is a powerful relational database known for its scalability in complex systems and ability to handle large volumes of structured data efficiently.	MongoDB is a scalable NoSQL document database optimized for flexibility and horizontal scaling, well suited for semi-structured or unstructured data.
Offline Support	Provides built-in offline data persistence, enabling seamless user experience when connectivity is lost by caching data locally and syncing changes once online.	Limited offline support; primarily designed for online transactional systems, though some extensions or custom solutions can provide offline capabilities.	Supports offline access through various drivers and client libraries, but often requires additional configuration and management compared to Firestore.
Query Speed	Fast query performance optimized for real-time synchronization and simple document lookups, particularly effective for frequently changing, user-specific data like job listings and notifications.	High performance for complex queries involving multiple tables, joins, and transactions, making it suitable for sophisticated data models in enterprise recruitment systems.	Moderate query speed; optimized for flexible document queries but can be slower in highly relational or transactional scenarios compared to PostgreSQL.
Security	Built-in security features including data encryption at rest and in transit, fine-grained access control rules via Firebase Security Rules, and integration with Firebase Authentication for secure user management.	Advanced security mechanisms including role-based access control, data encryption, auditing, and compliance certifications. Security depends on proper configuration by the developer or DBA.	Security features vary depending on setup; supports encryption and access controls but often requires additional infrastructure and careful configuration to meet enterprise standards.
Best Use Case	Ideal for mobile applications requiring real-time updates, offline functionality, and easy integration with other Firebase and Google Cloud services, such as push notifications and analytics.	Well suited for applications with complex relational data requirements, multi-user transactions, and enterprise-grade reporting, often used in back-end systems of recruitment platforms.	Best for applications requiring flexible data schemas, rapid development, and the ability to handle diverse or changing data formats typical in flexible recruitment workflows.

43

Table 7.2: Database Solution Comparison

Feature	Firebase Authentication	OAuth 2.0	Custom Authentication
Ease of Integration	High; provides SDKs and ready-to-use UI components simplifying implementation across platforms.	Moderate; requires understanding of OAuth flows and setup with identity providers.	Low; requires building authentication logic from scratch including security hardening.
Security Level	High; built-in protections, secure token management, and continuous updates from Google.	High; industry-standard protocol used by many major providers, supports delegated access.	Variable; security depends on developer expertise and ongoing maintenance.
Multi-factor Authentication	Supported natively with options like SMS, email, and authenticator apps.	Supported but requires additional implementation depending on provider.	Requires full custom implementation, increasing complexity.
Cost	Free for basic usage tiers with generous limits; pricing applies at scale.	Typically free to use but some identity providers may charge for advanced features.	Potentially high, depending on development and maintenance resources.

Table 7.3: Authentication and Security Comparison

Best Choice: Firebase Authentication

- Provides secure user authentication with multiple sign-in methods including email/password, Google, Facebook, and more.

- Simplifies integration with the overall Firebase ecosystem, facilitating real-time data synchronization and user management.

- Includes built-in support for multi-factor authentication, enhancing account security without additional development overhead.

- Reduces development time by leveraging tested and maintained authentication modules, allowing focus on core application features.

7.5 Cloud Service

Selecting the appropriate cloud service provider is critical for ensuring that the job search and recruitment application operates smoothly, scales efficiently, and maintains robust security standards. This section compares three leading cloud platforms — Firebase, Amazon Web Services (AWS), and Google Cloud Platform (GCP) — based on cost, scalability, integration ease, and security.

Feature	Firebase	AWS	Google Cloud Platform (GCP)
Cost	Free tier available with generous quotas; pay-as-you-grow pricing for advanced needs.	Primarily paid with a complex pricing structure; free tier limited in some services.	Paid, with a flexible pricing model and limited free tier services.
Scalability	High — Automatically scales to meet user demand with minimal configuration.	High — Highly customizable scaling options to fit complex enterprise needs.	High — Provides automatic scaling and extensive global infrastructure.
Integration	Easy — Designed to integrate seamlessly with mobile development frameworks such as Flutter and React Native, and offers a unified backend.	Moderate — Powerful but requires significant configuration and management, which can increase development complexity.	Easy — Strong integration with Google services and developer tools, supports containerized workloads effectively.
Security	High — Enforces strong data protection policies, supports end-to-end encryption, and integrates with Firebase Security Rules.	High — Industry-leading security certifications, advanced identity, and access management tools.	High — Offers comprehensive security features including encryption, identity management, and compliance certifications.

Table 7.4: Cloud Services Comparison

Best Choice: Firebase

Firebase emerges as the best cloud service choice for this project due to its native support for real-time database updates, seamless integration with Flutter, and ease of deployment. Its serverless architecture and managed services significantly reduce the overhead for infrastructure maintenance, enabling rapid development and iteration. Additionally, Firebase's built-in security features and granular access control are particularly advantageous for handling sensitive recruitment data, such as personal profiles and job applications. The platform's scalable design also ensures that the application can effortlessly handle growth in user base without requiring extensive backend reconfiguration.

7.6 Summary of Technology Selection

Choosing the right technology stack is vital to developing a competitive, reliable, and user-friendly mobile application for job search and recruitment. The technologies selected for this project are carefully evaluated to meet the core requirements of performance,

security, scalability, and development efficiency. The choices include:

- **Development Framework: Flutter**
  Flutter offers cross-platform compatibility with a single codebase, enabling the application to run smoothly on both Android and iOS devices. It provides a rich set of customizable UI components and high performance, essential for delivering an engaging recruitment experience.

- **Database: Firebase Firestore**
  Firebase Firestore provides real-time data synchronization, which is critical for updating job listings, notifications, and recruiter-candidate communication in real-time. Its cloud-based, secure storage system with offline support enhances user experience even with intermittent connectivity.

- **Authentication: Firebase Authentication**
  This service simplifies the implementation of secure user login and registration processes. It supports various authentication methods, including social logins and multi-factor authentication, which are crucial for protecting user data while minimizing user friction.

- **Cloud Services: Firebase**
  Firebase's serverless infrastructure allows for automatic scaling, secure data handling, and minimal maintenance. The tight integration with the other Firebase components and development frameworks expedites deployment and ensures reliability.

By leveraging this cohesive technology stack, the application will be well-positioned to deliver a modern, efficient, and secure job search and recruitment platform that addresses the dynamic needs of both job seekers and recruiters. The synergy between these technologies ensures streamlined development processes, rapid feature deployment, and a robust user experience across devices and networks.

Conclusion

The development of the mobile job search and recruitment application presented in this project addresses a critical and growing need in today's labor market—connecting job seekers and employers efficiently through modern digital means. Throughout this work, the integration of user-centric design principles, advanced technologies, and data-driven methodologies has culminated in a robust platform tailored to meet the evolving demands of recruitment in the digital era.

The research phase highlighted significant challenges faced by existing job search applications, such as outdated job listings, poor personalization, and limited communication features. By analyzing user feedback, market trends, and competitor platforms, the project identified clear gaps that informed the application's core features and improvements. Incorporating these insights ensured that the solution would not only address current deficiencies but also leverage opportunities such as AI-powered recommendations, real-time messaging, and localized content to provide a superior user experience.

Data collection was executed through a combination of surveys, interviews, secondary research, and case study analysis, offering a comprehensive understanding of user needs and industry standards. The careful processing and analysis of both quantitative and qualitative data shaped development priorities and validated design decisions. The iterative Agile methodology adopted for development facilitated continuous feedback integration, allowing the application to evolve responsively based on user testing and stakeholder input.

Technological choices, including Flutter for cross-platform development and Firebase for backend services, proved effective in balancing rapid development with scalable performance. These tools enabled seamless real-time interactions, secure authentication, and efficient data management, essential for a dynamic recruitment platform. Additionally, the focus on performance optimization and security underscored the commitment to delivering a reliable and trustworthy application.

Evaluation metrics encompassing technical performance, usability, and user satisfaction demonstrated the application's success in meeting project goals. High task completion rates, favorable Net Promoter Scores, and sustained user retention highlighted the app's appeal and functional adequacy. Validation through beta testing and expert reviews ensured that the final product was aligned with user expectations and industry best practices.

Moreover, the application's architecture reflects careful attention to future growth and adaptability. Modular design and clean code practices lay the groundwork for future feature expansion and maintenance. The adoption of cloud-based infrastructure and serverless components ensures scalability and reliability even as user demands increase. Security best practices, including data encryption and multi-factor authentication, demonstrate a

proactive approach to safeguarding user data and fostering trust.

From a user experience perspective, the app's intuitive design prioritizes simplicity and engagement, with clear navigation flows and personalized recommendations that resonate with the target audience. Features such as job alerts, easy application tracking, and secure in-app messaging foster ongoing interaction and keep users engaged throughout their job search journey. These enhancements address user pain points often overlooked in traditional platforms, offering a modern solution that adapts to users' evolving preferences.

Beyond its immediate utility, this project represents a forward-looking approach to recruitment technology. By integrating machine learning algorithms for job matching and leveraging real-time updates, the application aligns with broader trends in the HR tech landscape. It positions itself as a scalable and innovative tool that can evolve alongside future technological advancements. Potential future enhancements include integration with blockchain for secure credential verification, expansion into global markets through localization strategies, and incorporation of predictive analytics to help employers identify talent trends and gaps.

Additionally, the project emphasizes inclusivity and accessibility, ensuring that the platform is usable by diverse populations, including those in regions with limited connectivity. Offline functionality and efficient data caching strategies are integral to extending the app's reach to underrepresented job seekers and bridging the digital divide.

In summary, this project contributes meaningfully to the landscape of digital recruitment by offering a mobile application that bridges the gap between job seekers and employers with enhanced personalization, accessibility, and communication. It reflects a holistic approach combining theoretical insights, empirical data, technological innovation, and user experience design. The project not only achieves its immediate objectives of developing a functional application but also sets a precedent for continuous improvement and future innovation in the mobile recruitment sector.

Future work may build on this foundation by incorporating emerging technologies such as blockchain for credential verification, expanding AI capabilities to refine job recommendations and candidate screening, and integrating with broader HR ecosystems to streamline end-to-end recruitment processes. The application's modular design and data-driven insights position it well for further evolution in response to user needs and market changes.

Ultimately, the application developed here stands as a practical, user-focused solution poised to facilitate more effective job searches and hiring processes, particularly within regions where mobile technology serves as a primary access point to employment opportunities. This project thus not only achieves its immediate objectives but also lays a robust groundwork for ongoing innovation and improvement in mobile recruitment solutions. It underscores the vital role of user feedback, data-driven decisions, and adaptive design in creating impactful digital products that address real-world challenges and unlock new opportunities for both job seekers and employers alike.

Appendix A

Appendix A

Bibliography

[1] D. M. Barreto and B. R. Á. U. L. I. O. Alturas. Quality-in-use app evaluation: case of a recruitment app for portuguese smes. *Quality-in-use app evaluation: case of a recruitment app for Portuguese SMEs*, (1), 2018.

[2] M. G. A. Baudat, C. V. Asmat, and F. Sierra-Liñan. Mobile application based on geolocation for the recruitment of general services in trujillo, la libertad.

[3] S. Bogle and S. Sankaranarayanan. Job search system in android environment-application of intelligent agents. *International Journal of Information Sciences and Techniques (IJIST)*, 2, 2012.

[4] L. N. Enzelin, R. S. Oetama, and R. S. Anggina. Digital innovation and rapid application development: A new approach to staff and lecturer recruitment at university. *Journal of Information Systems and Informatics*, 6(1):153–169, 2024.

[5] S. F. Fam, J. H. Soo, and S. I. Wahjono. Online job search among millennial students in malaysia. *JDM: Jurnal Dinamika Manajemen*, 8(1), 2017.

[6] R. Fedele. Factors influencing the adoption of mobile recruitment services, 2016.

[7] X. Z. Kiew. *Mobile application for online recruitment system*. PhD thesis, UTAR, 2022.

[8] M. Meccawy, A. Alalasi, D. Alsaud, M. Alamoudi, M. Alessa, M. Alyami, and N. Alsheikh. The graduate helper: Using a mobile application as a feasible reref for job hunting across saudi arabia. *International Journal of Interactive Mobile Technologies*, 12(4), 2018.

[9] P. Montuschi, V. Gatteschi, F. Lamberti, A. Sanna, and C. Demartini. Job recruitment and job seeking processes: how technology can help. *It professional*, 16(5):41–49, 2013.

[10] U. C. Okolie and I. E. Irabor. E-recruitment: practices, opportunities and challenges. *European journal of business and management*, 9(11):116–122, 2017.

[11] O. Pandithurai, D. Jayashree, D. K. Aarthy, R. Jaishree, K. Bhavani, and T. Dharani. Smart job recruitment automation using location based filtering. In *2021 International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA)*, pages 1–4. IEEE, 2021.

[12] M. T. Parinsi, V. R. Palilingan, O. Kembuan, and K. F. Ratumbuisang. Job seeker information system using online web based and android mobile phones. In *IOP Conference Series: Materials Science and Engineering*, volume 830, page 022093. IOP Publishing, 2020.

[13] H. M. M. Putra. Implementation of social media application as recruitment platform: Impact on job seekers and intention to apply. In *INCEESS 2020: Proceedings of the 1st International Conference on Economics Engineering and Social Science, InCEESS 2020, 17-18 July, Bekasi, Indonesia*, page 64. European Alliance for Innovation, 2021.

[14] M. B. Sathyabama, M. S. M. Salahudeen, M. Z. M. Sohail, and M. P. M. Asarutheen. App development for placement drive and recruitment process, 2019.

[15] C. Satwik, K. L. Sailaja, N. A. Babu, and V. C. Sri. Job hunt mobile application for hiring skilled labour. In *2024 1st International Conference on Advanced Computing and Emerging Technologies (ACET)*, pages 1–7. IEEE, 2024.

[16] C. S. N. Savdekar, L. Patel, H. Soni, D. Gupta, S. Patel, and C. Sarode. Real-time job analytics and recruitment system.

[17] S. Shukla, S. A. Khan, H. K. Singh, and M. Sharma. Online job search application. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 7(2):520–525, 2021.

[18] H. H. Soni and P. R. Swaminarayan. Study of semantic web based e-recruitment system: review. *International Journal of Advanced Research in Computer Science*, 8(9), 2017.

[19] T. Xu, H. Zhu, C. Zhu, P. Li, and H. Xiong. Measuring the popularity of job skills in recruitment market: A multi-criteria approach. In *Proceedings of the AAAI conference on artificial intelligence*, volume 32, 2018.

[20] X. Yu, N. Wei, J. Han, C. Wang, and M. Aloqaily. Design and implementation of enterprise recruitment mini program. *Journal of Cybersecurity*, 3(3):125, 2021.