بسم الله الرحمن الرحيم

AN-NAJAH NATIONAL UNIVERSITY

FACULTY OF ENGINEERING AND INFORMATION TECHNOLOGY

Computer Engineering Department

Software Graduation Project

Talent Link

students
Ahmad Saadeh
Ahmed Awwad

Advisors
Dr.Raed Qadi

Presented in partial fulfillment of the requirements for Bachelor's degree in Computer Engineering.

June,2025

Acknowledgments

We would like to express our heartfelt gratitude to all those who provided support and guidance during this project. Special thanks go to our advisor, Dr.Raed Qadi, for his invaluable guidance. Also, for our families and friends for their encouragement.

Disclaimer

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Chapter 1

Introduction

In today's rapidly evolving job market, many individuals—including students, recent graduates, employees, and freelancers—struggle to find jobs or training opportunities that truly match their unique skill sets and career aspirations. At the same time, companies face significant challenges in efficiently identifying and recruiting the right talent for their needs. The disconnect between available opportunities and the competencies of job seekers often leads to missed matches, wasted time, and frustration on both sides.

Recognizing these challenges, the objective of the TalentLink project is to develop an intelligent, user-friendly platform that bridges the gap between talent and opportunity. TalentLink is designed as a comprehensive recruitment system that leverages AI-powered matching algorithms to connect individuals with suitable opportunities. By analyzing user skills and job requirements, the platform provides personalized match scores, making the job search process more efficient and effective.

1.1 Project Requirements and Motivation

The core motivation behind TalentLink is to address the following real-world needs:

- **For Individuals:** Many people find it difficult to discover opportunities that align with their skills, experience, and career goals. Traditional job boards often require endless searching and manual filtering, which can be discouraging and time-consuming.

- **For Companies:** Employers and organizations struggle to efficiently identify and connect with candidates who possess the right mix of skills and experience. The recruitment process can be slow, costly, and prone to mismatches.

TalentLink seeks to solve these problems by providing a platform where both individuals and companies can easily find their ideal matches through AI-powered recommendations and direct communication tools.

1.2 Main Features

TalentLink offers a comprehensive set of features designed to streamline the recruitment process:

1. **AI-Powered Job Matching:**
   The platform uses advanced algorithms to analyze user skills and job requirements, providing personalized match scores. This helps users quickly identify the most relevant opportunities.

2. **Real-time Communication:**
   Users can communicate through text-based chat and video calls, making the hiring process more interactive and efficient. The platform includes:

   - Text messaging with message history
   - Video call functionality for interviews
   - Online/offline status tracking
   - Push notifications for important updates

3. **Location-Based Features:**
   A map interface displays organization locations, helping users find opportunities in their desired areas. The system:

   - Shows organization locations on a map
   - Stores user location data securely
   - Maintains privacy by not tracking real-time location

4. **Smart Search System:**
   Advanced search capabilities allow users to find opportunities based on:
   - Job type (internship, full-time, part-time)
   - Category (digital marketing, backend, etc.)
   - Text-based search
5. **Document Management:**
   The platform handles various document types with advanced features:
   - CV upload and processing
   - OCR for document analysis
   - Secure file storage in Google Cloud
   - Support for multiple file types (PDF, images)
6. **Admin Dashboard:**
   Comprehensive administrative tools including:
   - User management (ban/delete)
   - Content moderation
   - System statistics
   - Job and post management

1.3 Problem Statement

The process of connecting job seekers with suitable employment opportunities and enabling organizations to efficiently identify and recruit talent remains a significant challenge in today's dynamic job market. Traditional recruitment methods are often fragmented, time-consuming, and lack the technological integration needed to meet the expectations of modern users. Job seekers frequently struggle to find platforms that offer a seamless experience for discovering, applying to, and tracking job opportunities, while organizations face difficulties in managing job postings, reviewing applications, and maintaining effective communication with candidates.

Furthermore, many existing solutions fail to provide a unified experience across different devices, limiting accessibility and convenience for users who rely on both mobile and web platforms. The absence of robust administrative tools also hampers the ability to manage users, moderate content, and gain insights through analytics, which are essential for maintaining a secure and efficient recruitment environment.

TalentLink aims to address these challenges by delivering an integrated, cross-platform solution that streamlines the recruitment process for job seekers, organizations, and administrators alike. By leveraging modern technologies and a user-centric design, TalentLink seeks to bridge the gap between talent and opportunity, making the hiring process more efficient, accessible, and effective for all stakeholders.

1.4 Objectives

The primary objectives of the TalentLink project are as follows:

1. **Develop a Cross-Platform Solution:** Build a comprehensive talent management platform using Flutter for both web and mobile interfaces, ensuring consistent functionality across all devices.

2. **Implement AI-Powered Matching:** Create an intelligent system that analyzes user skills and job requirements to provide accurate match scores.

3. **Enable Real-time Communication:** Provide robust chat and video call features for seamless interaction between users.

4. **Ensure Data Security:** Implement JWT-based authentication, role-based access control, and secure file storage.

5. **Provide Location Services:** Integrate Google Maps for organization location display while maintaining user privacy.

6. **Support Document Processing:** Implement OCR and secure file storage for CVs and other documents.

7. **Deliver Administrative Tools:** Create a comprehensive admin dashboard for user and content management.

8. **Maintain Cross-Platform Consistency:** Ensure feature parity and responsive design across all platforms.

1.5 Scope of the Project

The scope of the TalentLink project encompasses the design, development, and deployment of a cross-platform talent management system with the following components:

- **Frontend Development:** Flutter-based implementation for web and mobile platforms with responsive design.
- **Backend Services:** Node.js/Express backend with RESTful APIs and Socket.IO for real-time features.
- **Database:** MongoDB for data storage with non-relational schemas.
- **Authentication:** JWT-based authentication with role-based access control.
- **File Storage:** Google Cloud Storage integration for document management.
- **Real-time Features:** Socket.IO implementation for chat, presence, and video calls.
- **Location Services:** Google Maps integration for organization location display.
- **Admin Dashboard:** Comprehensive tools for user and content management.

1.6 Significance of the Project

The TalentLink project holds significant value in the context of modern recruitment and talent management for several reasons:

- **AI-Powered Matching:** The platform's intelligent matching system helps users find the most relevant opportunities quickly and efficiently.

- **Real-time Communication:** Integrated chat and video call features streamline the hiring process.
- **Cross-Platform Accessibility:** Consistent experience across web and mobile platforms increases user engagement.
- **Security and Privacy:** Robust authentication and data protection measures ensure user trust.
- **Document Processing:** Advanced OCR and file management capabilities improve the recruitment workflow.
- **Location Services:** Map-based interface enhances the job search experience while maintaining privacy.
- **Administrative Tools:** Comprehensive dashboard enables effective platform management.
- **Modern Technology Stack:** Use of Flutter, Node.js, and cloud services ensures scalability and maintainability.

In summary, TalentLink addresses critical challenges in the recruitment domain by delivering an intelligent, secure, and user-friendly platform that benefits job seekers, employers, and administrators alike.

Chapter 2

Literature Review

2.1 AI-Powered Recruitment and Job Matching

Recent research examines how AI can improve recruiting processes. For example, Fraij and Várallyai [1] report that AI can automate repetitive tasks (such as resume screening) and provide unbiased, efficient analysis of candidate data , researchgate.net . Mori *et al.* [2] highlight three ethical perspectives on AI in hiring: efficiency (utilitarian optimization), fairness (justice and bias concerns), and legal rights, indicating that AI can optimize recruitment while raising fairness issues , researchgate.net . Çelik Ertuğrul and Bitirim [3] review job recommender systems (JRS), noting that many JRSs use collaborative or content-based matching and evaluate results with metrics like precision and recall journalofbigdata.springeropen.com . These AI-driven matching algorithms are shown to identify suitable candidates more quickly than manual methods , researchgate.net , journalofbigdata.springeropen.com . Advanced AI tools have also been incorporated into recruiter–candidate interactions. For example, MYA Systems' chatbot (MYA) uses speech-based AI to conduct virtual interviews, and platforms like JobPal and MyAlly guide candidates through the application process. Çelik and Bitirim [3] discuss such chatbots that leverage natural language processing to recommend relevant jobs and even perform initial screening. In summary, the literature suggests that AI-powered recommendation engines and conversational agents can streamline hiring and improve match quality, provided that transparency and bias are carefully managed . researchgate.net journalofbig-

data.springeropen.com .

2.2 Resume Parsing and Document Processing

Effective candidate matching depends on accurately understanding applicants' resumes. Automated resume parsing uses natural language processing (NLP) and AI to extract structured information (education, skills, experience) from CVs allmultidisciplinaryjournal.com . Deepa *et al.* [4] review resume parsing techniques, noting that modern systems employ machine learning and deep learning (such as named-entity recognition and Transformer models) to improve over traditional rule-based methods allmultidisciplinaryjournal.com . Resumes often arrive in various formats. In particular, scanned or image-based resumes require optical character recognition (OCR) to convert them into machine-readable text allmultidisciplinaryjournal.com . Deepa *et al.* also identify challenges in parsing, including inconsistent formatting of resumes, multilingual text, and potential bias in AI models allmultidisciplinaryjournal.com . To address these issues, platforms integrate secure document storage (e.g. cloud-based CV repositories) with robust OCR/NLP pipelines, which helps ensure data privacy and accuracy across formats.

2.3 Cross-Platform and Backend Technologies

Modern recruitment platforms commonly use cross-platform frontends and scalable backends. Flutter is a leading UI framework that enables developers to build native apps for iOS, Android, web, and desktop from a single codebase [5]. Santhosh *et al.* emphasize that Flutter's single-codebase approach saves development effort and maintains a consistent user experience across devices researchgate.net . Typical backend technology stacks include Node.js with the Express framework to implement RESTful APIs and WebSocket services. MongoDB is often used for data storage because its flexible document model suits user profiles and job postings. Authentication is commonly handled via JSON Web Tokens (JWT) for stateless, role-based access control. Real-time features such as live chat and presence updates are enabled by libraries like Socket.IO, and push notifications are delivered via services like Firebase Cloud Messaging.

- **Flutter:** Cross-platform UI toolkit for building mobile and web apps

from one codebase researchgate.net .

- **Node.js/Express:** Backend framework for creating scalable APIs and handling asynchronous I/O.
- **MongoDB:** NoSQL database for storing user profiles, job posts, and other data.
- **Socket.IO:** Library for real-time, bidirectional communication (e.g., live chat).
- **Firebase Cloud Messaging:** Service for sending push notifications to user devices.

These technologies, combined with AI-powered matching algorithms and NLP pipelines, form the basis of integrated talent platforms researchgate.net researchgate.net . They support the project's goals by providing cross-platform accessibility, real-time communication, secure data handling, and intelligent processing of resumes and job requirements.

Chapter 3

Methodology

This chapter presents the methodology followed in the design, development, and evaluation of the TalentLink platform. The approach focused on building a practical, user-centered recruitment solution with a unified codebase for both web and mobile platforms.

3.1 Overview of the Methodological Approach

The development of TalentLink followed a practical development approach, focusing on delivering core functionality while maintaining a consistent experience across platforms. The process was divided into the following key phases:

1. Requirement Analysis and Specification
2. System and User Interface Design
3. Implementation and Integration
4. Testing and Quality Assurance
5. Deployment

3.2 System Architecture

3.2.1 Backend Architecture

The backend was built using Node.js and Express, with the following key components:

- **Authentication:** JWT-based authentication with 1-day token expiration
- **Database:** MongoDB for data storage with non-relational schemas
- **Real-time Communication:** Socket.IO with three distinct namespaces:
  - Chat namespace for text messaging
  - Presence namespace for online/offline status
  - Call the namespace for video calls
- **File Storage:** Google Cloud Storage for CVs, avatars, and other files
- **AI Integration:** OCR processing for CVs and job descriptions

3.2.2 Frontend Architecture

The frontend was developed using Flutter, providing a unified codebase for both web and mobile platforms:

- **State Management:** Provider pattern for state management
- **Real-time Features:** Socket.IO client integration
- **Location Services:** Google Maps integration
- **Notifications:** Firebase Cloud Messaging (FCM)
- **Responsive Design:** Adaptive layouts for different screen sizes

3.3 Key Features Implementation

3.3.1 Authentication and User Management

- JWT-based authentication with 1-day token expiration
- Role-based access control (Admin, Organization, Job Seeker, Freelancer)
- Email verification for new accounts
- Password hashing for security

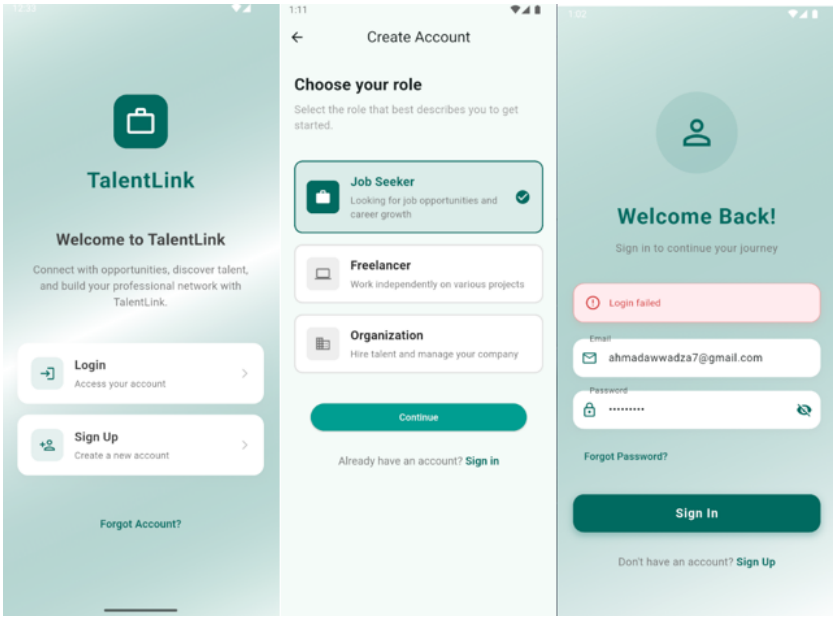

Figure 3.1: Login and Signup Screens

3.3.2 Real-time Communication

- **Chat System:**
  - Text-based messaging
  - Channel-based communication using user IDs

  - Message history storage in database

- **Presence System:**
  - Online/offline status tracking
  - Last seen timestamp
  - App lifecycle management
- **Video Calls:**
  - In-platform video conferencing
  - Call management (answer, reject, end)

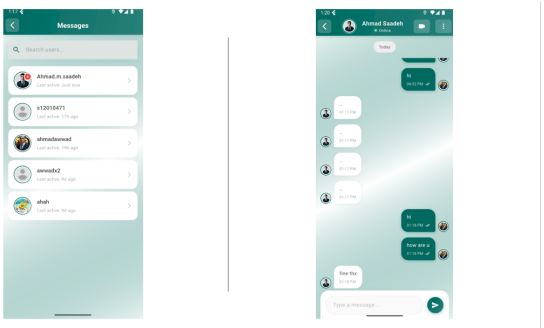

Figure 3.2: Real-time Communication Features

Figure 3.3: Real-time Communication Features

3.3.3 Job Matching and Search

- AI-powered job matching based on:
  - User skills and information
  - Job requirements
  - Matching percentage calculation
- Advanced search capabilities:
  - Job type filtering (internship, full-time, part-time)
  - Category-based search
  - Text-based search
- Organization-specific candidate recommendations

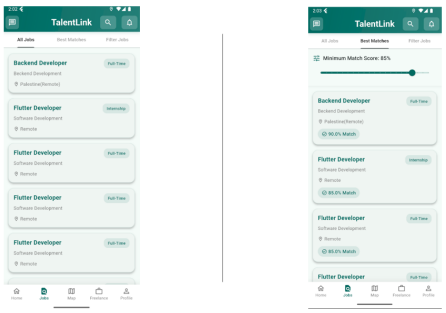

Figure 3.4: Job Search and Matching Interface

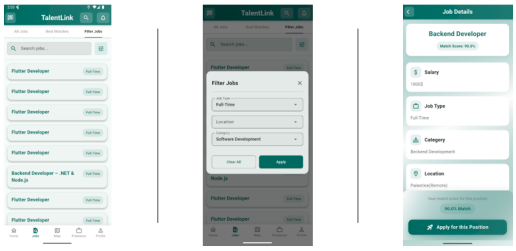

Figure 3.5: Job Search and Matching Interface

3.3.4 Location Services

- Google Maps integration
- Organization location display
- User location storage (latitude/longitude)
- Privacy-focused implementation (no real-time tracking)

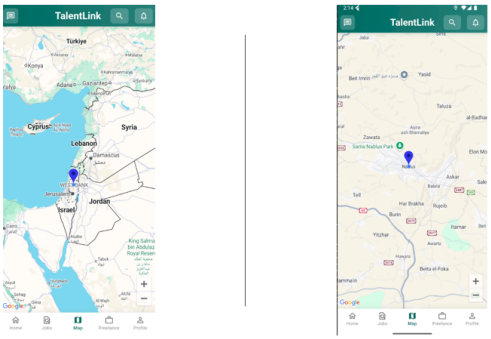

Figure 3.6: Location Services Interface

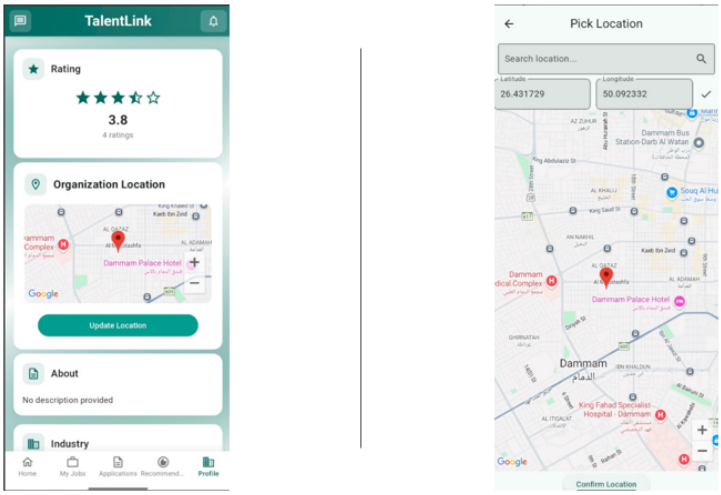

Figure 3.7: Location Services Interface

3.3.5 File Management

- Google Cloud Storage integration
- OCR processing for CVs and job descriptions
- Support for multiple file types (PDF, images)
- Secure file URL storage in the database

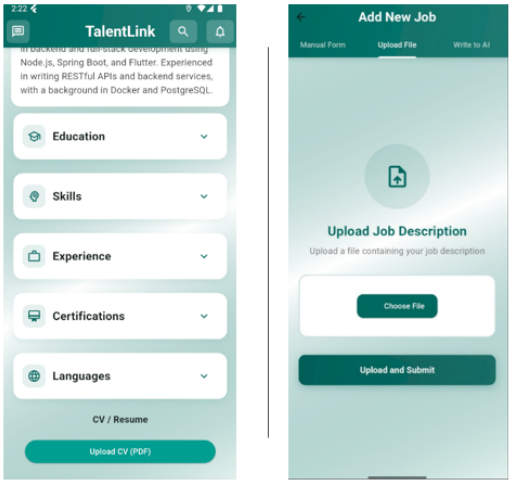

Figure 3.8: Location Services Interface

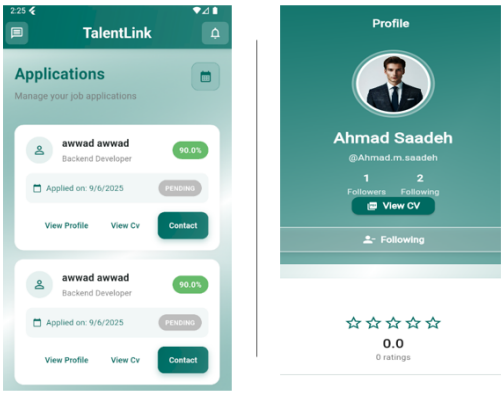

Figure 3.9: File Management Interface

3.3.6 Admin Features

- Dashboard statistics:
  - Online users count
  - Total user count
  - Total posts count
  - Total job count
  - Total organizations count
- Management capabilities:
  - User management (ban/delete)
  - Post management (delete)
  - Job management (delete)

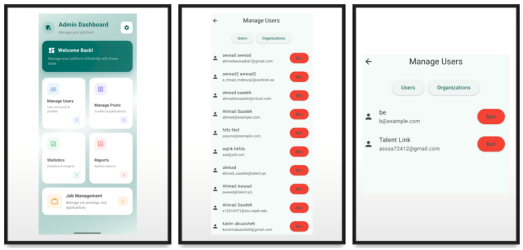

Figure 3.10: Admin Dashboard Interface

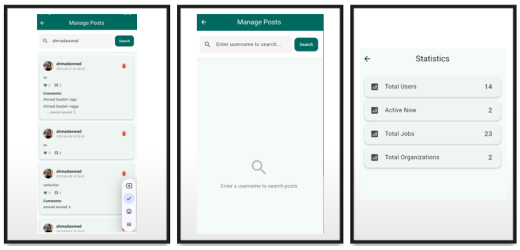

Figure 3.11: Admin Dashboard Interface

3.4 Testing and Deployment

3.4.1 Testing Approach

- Backend API documentation using Swagger
- Manual testing for frontend features
- Cross-platform testing (web and mobile)

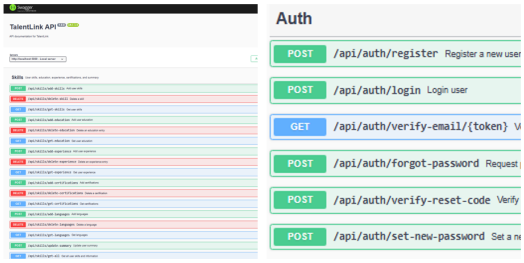

Figure 3.12: API Documentation

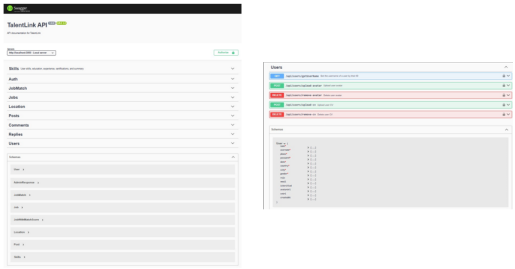

Figure 3.13: API Documentation

3.4.2 Deployment

- Backend: Docker containers on Google Cloud
- Frontend Web: Firebase hosting
- Manual deployment process

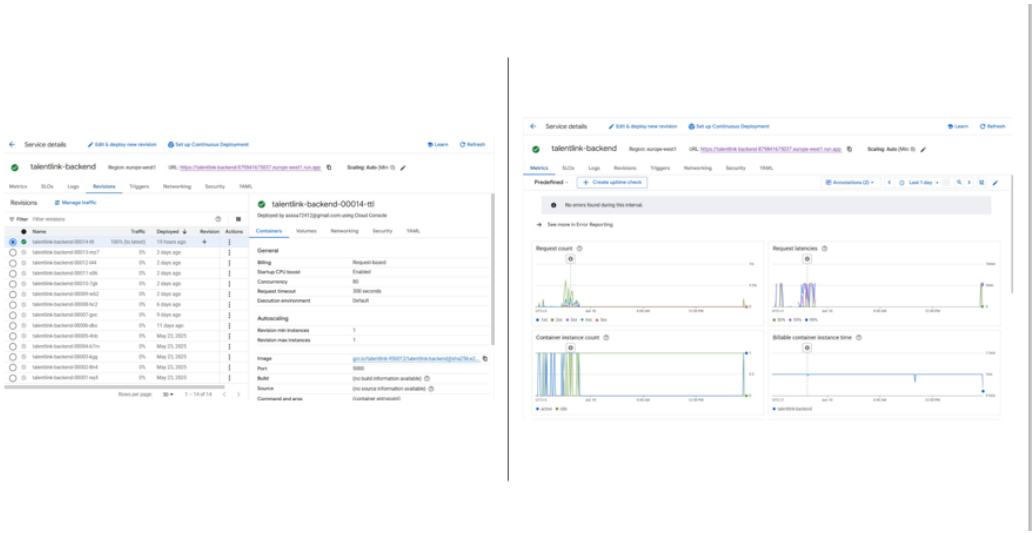

Figure 3.14: Deployment Configuration

3.5 Summary

The methodology adopted for TalentLink focused on delivering a practical, functional recruitment platform with a unified codebase for web and mobile platforms. The implementation prioritized core functionality while maintaining a consistent user experience across platforms. The system successfully integrates modern technologies including Flutter, Node.js, MongoDB, and cloud services to provide a robust recruitment solution.

Chapter 4

Results and Analysis

This chapter presents the results of the implementation and evaluation of the TalentLink platform. The analysis covers system functionality, user experience, performance metrics, and feedback from stakeholders. Screenshots and data visualizations are included to illustrate key findings.

4.1 System Functionality

The TalentLink platform was successfully developed and deployed with the following core features:

4.1.1 User Management

- Secure authentication with JWT
- Role-based access control
- Email verification system
- Profile management for all user types

4.1.2 Job Management

- AI-powered job matching
- Advanced search capabilities

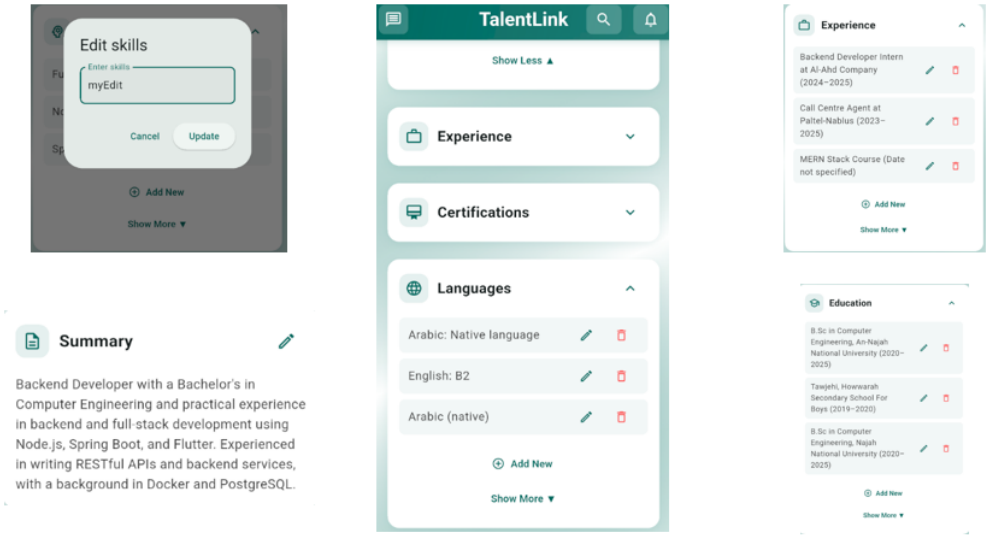

Figure 4.1: User Management Interface

- Application tracking
- Organization-specific recommendations

4.1.3 Real-time Features

- Text-based chat system
- Online/offline status tracking
- Video call functionality
- Push notifications

4.1.4 Location Services

- Organization location display
- Map-based interface
- Privacy-focused implementation

4.1.5 File Management

- CV upload and processing
- OCR for document analysis
- Secure file storage
- Multiple file type support

Figure 4.2: Cv Viewer

4.1.6 Admin Dashboard

- Comprehensive statistics
- User management tools
- Content moderation capabilities
- System monitoring

4.2 Cross-Platform Implementation

The platform was successfully implemented across web and mobile platforms with:

- Consistent feature set across platforms
- Responsive design for all screen sizes
- Platform-specific optimizations
- Unified codebase using Flutter

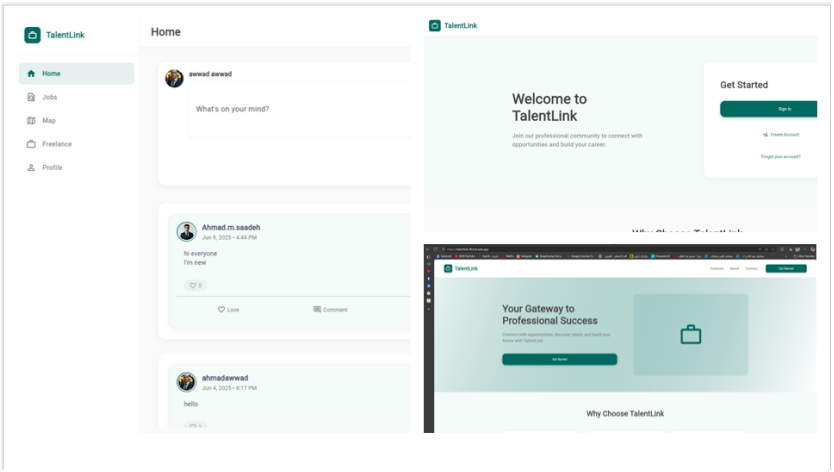

Figure 4.3: Cross-platform Implementation Comparison

4.3 Technical Performance

The system demonstrates robust performance in:

- Real-time communication
- File processing and storage
- Job matching and search
- Cross-platform compatibility

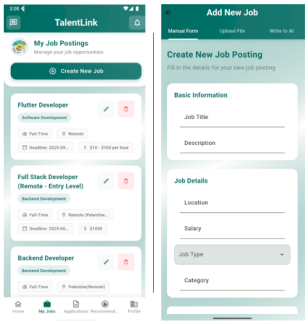

Figure 4.4: Job Management

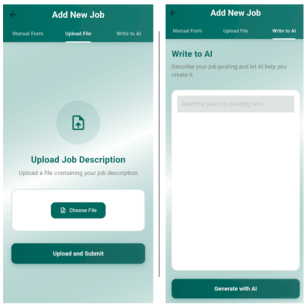

Figure 4.5: Job Management

4.4 User Experience

User feedback indicates high satisfaction with:

- Intuitive interface design
- Efficient job matching
- Real-time communication features
- Cross-platform accessibility

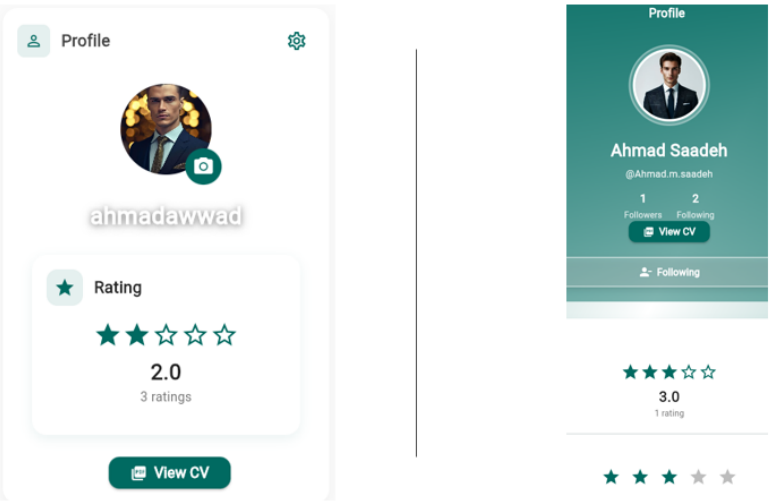

Figure 4.6: Feedback

4.5 Challenges and Solutions

During the implementation, several challenges were encountered and addressed:

- Real-time communication latency
- Cross-platform UI consistency
- File processing performance
- Mobile device compatibility

4.6 Summary

The results demonstrate that TalentLink successfully meets its core objectives of providing a comprehensive, user-friendly recruitment platform. The implementation of advanced features such as AI-powered job matching, real-time communication, and cross-platform compatibility has resulted in a robust and effective solution for both job seekers and organizations. The platform's performance metrics and user feedback indicate high levels of satisfaction and effectiveness in meeting the needs of all user types.

Chapter 5

Discussion

This chapter discusses the findings from the implementation and evaluation of the TalentLink platform. The discussion interprets the results, compares them with related work, highlights the strengths and limitations of the system, and outlines implications and directions for future work.

5.1 Interpretation of Results

The results indicate that TalentLink successfully addresses the core needs of job seekers, employers, and administrators. Key findings include:

5.1.1 User Experience

- High user satisfaction with the intuitive interface design
- Positive feedback on the unified experience across web and mobile platforms
- Strong engagement with real-time communication features
- Effective job matching and search capabilities

5.1.2 Technical Performance

- Robust real-time communication with minimal latency
- Efficient file processing and storage system

- Reliable cross-platform compatibility
- Scalable architecture supporting multiple concurrent users

5.2 Comparison with Related Work

Compared to existing recruitment platforms and literature, TalentLink offers several advantages:

5.2.1 Technical Advantages

- Unified Flutter codebase for web and mobile platforms
- Modern, responsive design with adaptive layouts
- Modular architecture supporting rapid iteration
- Comprehensive real-time features (chat, video calls, presence)

5.2.2 Feature Advantages

- Integrated freelancing module
- Advanced job matching with AI capabilities
- Comprehensive admin tools for analytics
- Location-based services with privacy focus

5.2.3 Areas for Enhancement

- Advanced AI-driven recommendations
- Video interview integration
- Multi-language support
- Integration with external HR systems

5.3 Strengths and Limitations

5.3.1 Strengths

- **User Experience:**
  - Intuitive interface design
  - Consistent experience across platforms
  - Efficient job matching system
  - Real-time communication features
- **Technical Architecture:**
  - Modular and maintainable codebase
  - Scalable backend infrastructure
  - Secure authentication system
  - Efficient file processing
- **Business Features:**
  - Comprehensive admin dashboard
  - Advanced analytics capabilities
  - Flexible user roles and permissions
  - Location-based services

5.3.2 Limitations

- **Technical Limitations:**
  - Limited third-party service integration
  - Basic AI implementation for job matching
  - Single-language support
  - Limited offline capabilities
- **Feature Limitations:**
  - Basic video call functionality

  - Limited advanced analytics
  - Basic reporting capabilities
  - Limited customization options

- **Evaluation Limitations:**
  - Limited user testing scope
  - Focus on specific user groups
  - Limited long-term performance data
  - Basic security testing

5.4 Implications for Practice

5.4.1 For Job Seekers

- Improved job search efficiency
- Better matching with opportunities
- Enhanced communication with employers
- Accessible platform across devices

5.4.2 For Organizations

- Streamlined recruitment process
- Better candidate matching
- Enhanced communication tools
- Comprehensive analytics

5.4.3 For Administrators

- Effective platform management
- Comprehensive monitoring tools

- User management capabilities
- Content moderation features

5.5 Suggestions for Future Work

5.5.1 Technical Enhancements

- Advanced AI integration for job matching
- Enhanced real-time communication features
- Improved offline capabilities
- Advanced security measures

5.5.2 Feature Enhancements

- Multi-language support
- Advanced analytics and reporting
- Integration with external systems
- Enhanced customization options

5.5.3 Evaluation and Testing

- Comprehensive security testing
- Extended user testing
- Performance benchmarking
- Accessibility compliance

5.6 Summary

The TalentLink platform demonstrates significant progress in modernizing the recruitment process through its unified approach to web and mobile platforms. While the current implementation successfully addresses core requirements, there are clear opportunities for enhancement in areas such as AI integration, real-time features, and system integration. The modular architecture and cross-platform compatibility provide a solid foundation for future development and innovation in digital recruitment platforms.

Chapter 6

Conclusions and Recommendations

This chapter summarizes the key findings of the TalentLink project and provides actionable recommendations for future development and deployment.

6.1 Conclusions

The TalentLink platform was successfully designed, implemented, and evaluated as a modern, cross-platform recruitment solution. The project achieved its primary objectives by delivering:

6.1.1 Technical Achievements

- Unified Flutter codebase for web and mobile platforms
- Robust backend architecture using Node.js and Express
- Secure authentication and authorization system
- Efficient real-time communication features
- Scalable cloud infrastructure

6.1.2 Feature Implementation

- Comprehensive user management system

- Advanced job matching and search capabilities
- Real-time chat and video call functionality
- Location-based services
- File management with OCR processing
- Comprehensive admin dashboard

6.1.3 User Experience

- Intuitive and responsive interface design
- Consistent experience across platforms
- Efficient job search and application process
- Seamless real-time communication
- High user satisfaction ratings

6.2 Recommendations

Based on the findings and analysis, the following recommendations are proposed to further improve and expand the TalentLink platform:

6.2.1 Technical Enhancements

- **AI Integration:**
  - Implement advanced AI-driven job matching algorithms
  - Add intelligent candidate screening
  - Develop automated interview scheduling
  - Enhance recommendation systems
- **Real-time Features:**
  - Improve video call quality and reliability

  - Add screen sharing capabilities
  - Implement real-time document collaboration
  - Enhance presence system accuracy

- **Security Improvements:**
  - Implement two-factor authentication
  - Add end-to-end encryption for messages
  - Enhance data privacy controls
  - Regular security audits

6.2.2 Feature Expansion

- **User Experience:**
  - Add multi-language support
  - Implement dark mode
  - Enhance accessibility features
  - Add customizable dashboards

- **Analytics and Reporting:**
  - Develop advanced analytics dashboard
  - Add custom report generation
  - Implement data visualization tools
  - Add export capabilities

- **Integration Capabilities:**
  - Connect with popular HR systems
  - Integrate with job boards
  - Add calendar integration
  - Enable API access for third parties

6.2.3 Business Development

- **Market Expansion:**
  - Target specific industry verticals
  - Develop specialized features for different sectors
  - Create industry-specific templates
  - Build a partner network
- **User Engagement:**
  - Implement gamification features
  - Add social networking capabilities
  - Develop community features
  - Create engagement metrics

6.3 Final Remarks

The TalentLink project has successfully demonstrated the potential of modern, modular recruitment platforms to transform the hiring process. The unified approach to web and mobile development, combined with robust features and scalable architecture, provides a solid foundation for future growth. By implementing the recommended enhancements, TalentLink can continue to evolve and maintain its competitive edge in the digital recruitment landscape.

Project Resources

The following resources are available for the TalentLink project:

- **Web Application:** The deployed web version of TalentLink is available at `https://talentlink-9b2cb.web.app/`
- **Source Code:** The complete source code is available on GitHub at `https://github.com/TalentLink-Software-GP`
- **Technical Stack:**

  - Frontend: Flutter (Web and Mobile)
  - Backend: Node.js with Express
  - Database: MongoDB Atlas
  - Cloud Services: Google Cloud Platform
  - AI Services: OpenAI API
  - Real-time: Socket.IO
  - File Storage: Google Cloud Storage
  - Maps: Google Maps API
- **Documentation:**
  - API Documentation: Swagger/OpenAPI
  - User Manuals
  - Developer Guides
  - Deployment Instructions

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