A Project Mid term defense for the Degree of Bachelor of Science in Computer and Information Technology

Hire-Hawk

Submitted for the partial fulfillment of the requirement for the degree of Bachelor of Science in Computer and Information Technology

Mandip Kunwar (5-2-1131-18-2019)

Saurabh Subedi(5-2-1131-30-2019)

Shiwam Paudel (5-2-1131-32-2019)

Swastik College

Department of Computer Science and Information Technology

Institute of Science and Technology

Tribhuvan University

December, 2023

DECLARATION

This project entitled "Hire-Hawk" is based on our own research.Other researchers related work on this issue has been recognized. We are responsible for all liabilities pertaining to the data corrections and validity,as well as any other material contained herein

.....

Mandip Kunwar

.....

Saurabh Subedi

.....

Shiwam Paudel

RECOMMENDATION

I hereby certify that, this project entitled "Hire-Hawk" submitted by MANDIP KUNWAR, SAURABH SUBEDI and SHIWAM PAUDEL was prepared under my supervision in partial fullfilment of the requirements for the degree of Bachelor of Science in Computer Science and Information Technology.

.....

Mr.Sagar Rana Magar

Supervisor

CERTIFICATE

This is to certify that, this project entitled "Hire-Hawk" submitted by MANDIP KUNWAR (5-2-1131-18-2019), SAURABH SUBEDI (5-2-1131-30-2019) and SHIWAM PAUDEL (5-2-1131-32-2019) is partial fullfilment of the requirements for the degree of Bachelor of Science in Computer Science and Information Technology has been Studied. In our opinion, it is satisafactory in scope and quality as a project for the required degree.

.....
Mr.Sagar Rana Magar
Supervisor

.....
External Examiner

.....
Mrs, Sristi Khatiwaida
Co-Ordinator

ACKNOWLEDGEMENT

A project entitled "Hire-Hawk" has been prepared to fulfill the requirement of the undergraduate project. The report is deeply indebted to Tribhuvan University and Swastik COllege for incorporating a project report in the bachelor program which provides a wonderful opportunity to carry out pratical knowledge on any topic. Our forthnight gratefulness goes to the supervisor MR.Sagar Rana Magar,program coordinator MRS. Sristi Khatiwada, Department of Computer Science and Information technology(Bsc.CsIT) for your coordinating and supporting this project.And lastly, we are also thankful to teacher and all the people who put valuable effort to help us with this project.

Thanking you,
Mandip kunwar
Saurabh Subedi
Shiwam Paudel

ABSTRACT

Recruiting the right people for your team is essential for any business, but it can be a time-consuming and challenging process.Especially for small businesses, it can be difficult to find the time and resources to review a large number of resumes.So the prime intention of the 'Hire-Hawk' is to assist system to pinpoint the eligible applicant swiftly and effortlessly without any time consuming and challenging process. This web application analyzes applied applicant resumes and assists HR in recruiting the perfect candidates for the given vacancy.By automating the initial screening of resumes and providing recruiters with a more comprehensive view of each candidate's skills and experience, a web application that analyzes resumes and assists in recruitment can help businesses save time and hire the best possible candidates.

Contents

List of Figures

Chapter 1: Introduction

1.1 Introduction

The prime intention of the ‘Hire-Hawk’ is to assist system to pinpoint the eligible applicant swiftly and effortlessly without any time consuming and challenging process. This web application analyzes applied applicant resumes and assists HR in recruiting the perfect candidates for the given vacancy.This application provides the score to each applied applicant according to their knowledge and experience based on certain criteria mentioned by the companies and the candidate with the highest score is automatically displayed to the HR for the further selection of the applicant.

The “Hire-Hawk” system project is a web application that works well with maximum handheld devices. UI/UX will be pleasing to the eyes and simple to use of Google for the application user interface and Django framework using python for the Backend to keep records of the system users, store data, read and analyze the Resumes. Both help in the flexibility, simplicity, reliability, and scalability of the application. Thus,"Hire-Hawk" application analyzes and assists in enlisting the accurate and principled applicant in a rapid time without facing any burdensome and challenging process.

1.2 Problem Statement

When the vacancies are opened by the business and company the number of enthusiastic candidates applying for the post will be high and the company will face a hard time analyzing and recruiting the perfect and correct applicant by a given deadline, especially for small companies with limited manpower and resources.Assembling the resumes of the applied candidates and recruiting the pinpoint applicants based on their knowledge and experience manually in the given field will be difficult, burdensome, and time-consuming. Most of the

resume analyzing applications and websites aren't free and require payment and subscriptions to use.

It will be very appreciative and pleasant if a web application analyzes and assists in enlisting the accurate and principled applicant in a rapid time without facing any burdensome and challenging process.

1.3 Objectives

The project 'Hire-Hawk' has several big goals and objectives and the main objectives of this application are to analyze applied applicant resumes and assist HR in the recruitment of the perfect candidates for the given vacancy.Other objectives of this project are:

- To identify qualified candidates quickly and easily
- To save time by automating the initial screening of resumes

1.4 Scope and Limitation

In today's world internet is obtainable and accessible at one's fingertips. "Hire-Hawk" is a web application that can be run on web browser like chrome,Mozilla Firefox,opera etc. with the support of internet. So,we are making an web application that provides the score to each applied applicant according to their knowledge and experience based on certain criteria mentioned by the companies and the candidate with the highest score is automatically displayed to the HR for the further selection of the applicant.

Despite its various scope, the 'HireHawk' application has certain limitations:

- The accuracy of the application heavily relies on the completeness and accuracy of the resumes submitted by applicants. Incomplete or misleading resumes may impact the effectiveness of the analysis.
- The application's scoring system is based on the Cosine Similarity Algorithm, which may not capture certain subjective aspects of a candidate's suitability
- The application cannot replace the need for human judgment.

1.5 Development Methodology

In building the "Hire-Hawk" app, we use Scrum Agile approach because this project requirements are dynamic, and the project is innovative and research-oriented so we used the Scrum approach to software development. Scrum is an Agile project management framework that helps teams structure and manage their work in a short iterative cycle called Sprints. This approach allows us to be flexible, responding to feedback and adjusting priorities as needed throughout the development journey

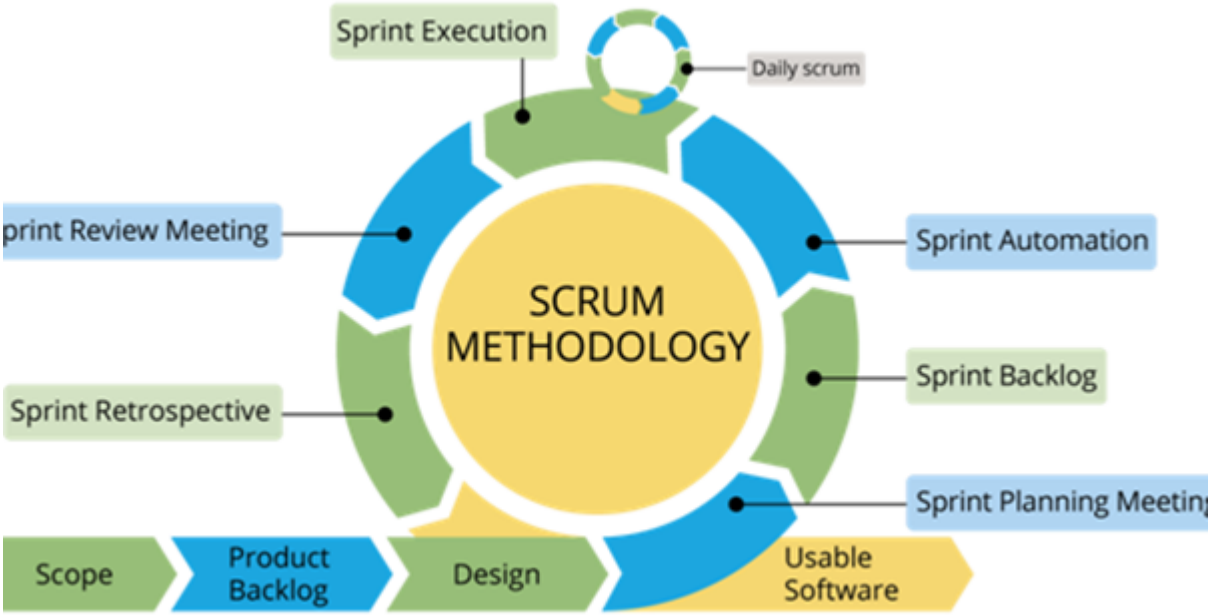

Figure 1.1: Visual Representation of Scrum Methodology

1.6 Report Organization

This Report has been organized into the following six chapters. They are listed below:

- Chapter 1: Chapter 1 is all about the Introduction of the project, the Problem statement, its objectives, scope, and limitations as well as the development methodology.
- Chapter 2: Discusses about the generation of project idea, description of fundamental theories, general concepts and terminologies related to the project as well as review of the similar/relevant projects, theories and results by other researchers

- Chapter 3: Chapter 3 focuses on System Analysis. We first look at what the system needs to do (Functional Requirements) and the other important aspects like how it should work (Non-Functional Requirements). We also check if the project is doable by considering technical stuff, if it makes economic sense, and if it can stick to a schedule. We then decide on the best way to understand and plan the system.

- Chapter 4: In Chapter 4, we discuss about system design and algorithm details along with Class diagrams, Object diagram, Activity diagram etc.

- Chapter 5: Chapter 5 discusses about the implementation and testing process. In this chapter we also discuss about tools such as CASE tools, Programming languages, and Database platforms. Details of Modules are also discussed.

- Chapter 6: Chapter 6 discusses the conclusion of the project and future enhancement and recommendations.

Chapter 2: Background Study and Literature Review

2.1 Background Study

2.1.1 cosine similarity algorithm

A cosine similarity[1] measure is a metric that determines how much the two objects are alike. Cosine similarity (Sidorov, Grigori, et al., 2014) is a measure to find how similar the two documents are regardless of their size. It represents the orientation of the documents when plotted on an Ndimensional space, where each dimension depicts the features of the object. It's a symmetrical algorithm, which implies that the results from computing the similarity of item X to item Y is equal to computing the similarity of item Y to item X. Mathematically, we can represent it as shown below (Sidorov, Grigori, et al., 2014) in equation (4).

$$\cos(\theta) = \frac{\vec{a} \cdot \vec{b}}{\|\vec{a}\|\|\vec{b}\| \mid} = \frac{\sum_{i=1}^{n} a_i b_i}{\sqrt{\sum_{i=1}^{n} a_i^2}\sqrt{\sum_{i=1}^{n} b_i^2}}$$

Here, $\overrightarrow{\mathrm{a}} \cdot \overrightarrow{\mathrm{b}} = \sum_1^n a_i b_i = a_1 b_1 + a_2 b_2 + \ldots + a_n b_n$ is the dot product of the two vectors. Using this formula, we calculate the cosine similarity between all pairs of elements. It can then be used to rank the resume documents with respect to a given vector of query words. However, cosine similarity focuses on features that are related to the text's words only and will give less accurate results. The efficiency of similarity measures can be improved by the inclusion of semantic information. This will constitute the future scope for our automated resume screening system.

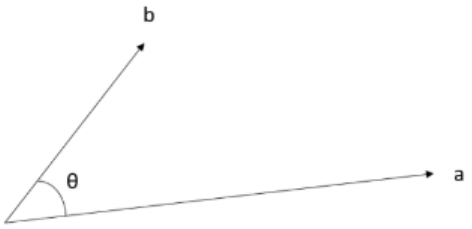

Figure 2.1: Cosine Similarity

2.1.2 NLP pattern recognition

Natural Language Processing (NLP) pattern recognition refers to the task of identifying and understanding patterns, structures, and regularities within natural language data. NLP is a subfield of artificial intelligence that focuses on the interaction between computers and human language. Pattern recognition in NLP involves the use of algorithms and models to extract meaningful information, relationships, and trends from large sets of textual data. It involves tasks like tokenization, where text is dissected into smaller units, and part-of-speech tagging, which assigns grammatical categories to each unit.[2]

2.2 Literature Review

There is a growing body of research on the effectiveness of resume analysis apps. A 2002 study by Carlson, Kevin D and Connerley, Mary L and MECHAM III, ROSS L found that a resume analysis app based on the BERT language model was able to achieve an accuracy of 95 percent in identifying the skills and experience listed on a resume. The study also found that the app was able to accurately match candidates to job descriptions.[3],

Another study, published in 2023 by (Daryani, Chirag and Chhabra, Gurneet Singh and Patel, Harsh and Chhabra, Indrajeet Kaur and Patel, Ruchi), found that a resume analysis app was able to reduce the time spent by recruiters on screening resumes by 50 percent. The study also found that the app was able to help recruiters identify qualified candidates who might not have been found through traditional screening methods. While the research on resume analysis apps is still in its early stages, the results so far are promising. Resume analysis apps have the potential to revolutionize the hiring process by making it more efficient and effective.[4] The work presented as EXPERT (Daryani, Chirag and Chhabra,

Gurneet Singh and Patel, Harsh and Chhabra, Indrajeet Kaur and Patel, Ruchi) proposed the use of ontology mapping for screening candidates for the given job description. It included three phases of operation which were the creation of candidate ontology, construction of job criteria ontology document and then finally mapping of both of these to evaluate which candidates are eligible for the job.[5] In 2017, an automated job screening system was proposed (H.Braun). It discusses different machine learning algorithms and uses Support Vector Regression to create a list of ranked candidates for the given job[6]. Another work presented (Weathington and Bechtel, 2012) that described how social media (e.g. LinkedIn, Facebook, etc.) information of the applicants can be used for recruitment decisions[7].

Chapter 3: System Analysis

3.1 System Analysis

System analysis is the performance management and documentation of activities related to the life cycle phases of any software.This section describes what a system does and include requirements that specify all the fundamentals action of the system.The requirements are the major part in the system development.Once the requirements are collected they determine the structure,functionalities and operational constraints of the system.

3.1.1 Requirements Analysis

In the development of a system, the requirements play a critical role. After the requirements are gathered, the structure, functionality, and operational restrictions of the system are determined. Because of their dynamic and contingent nature, the needs are difficult to predict. The requirements of the system user may vary during development.

1. **Functional Requirements**

   Functional requirements are those that are used to demonstrate the system's internal working nature, as well as the system's description and explanation of each subsystem.They are the specific functions or tasks of the system that must be able to perform to meet the needs of its users. It includes determining what task the system should accomplish, the processes involved, the data the system should keep, and the user interfaces.The functional requirements of the Hire-Hawk are:

   - **Authentication System:**

     The system should authenticate the valid admin and user along with registration with the new users.

- **Vacancy Announcement Platform:** The Admin must be able to create new vacancies as well as update and delete those vacancies.
- **Job Application with Resume Submission:**
  Applicants should be able to apply for the vacancies/jobs with their valid resume.
- **Score Generator and Hiring Assistance:**
  The applicants can get their score based on their resume and job they applied for.Meanwhile, the admin is able to rank those applicants based on their respective scores.

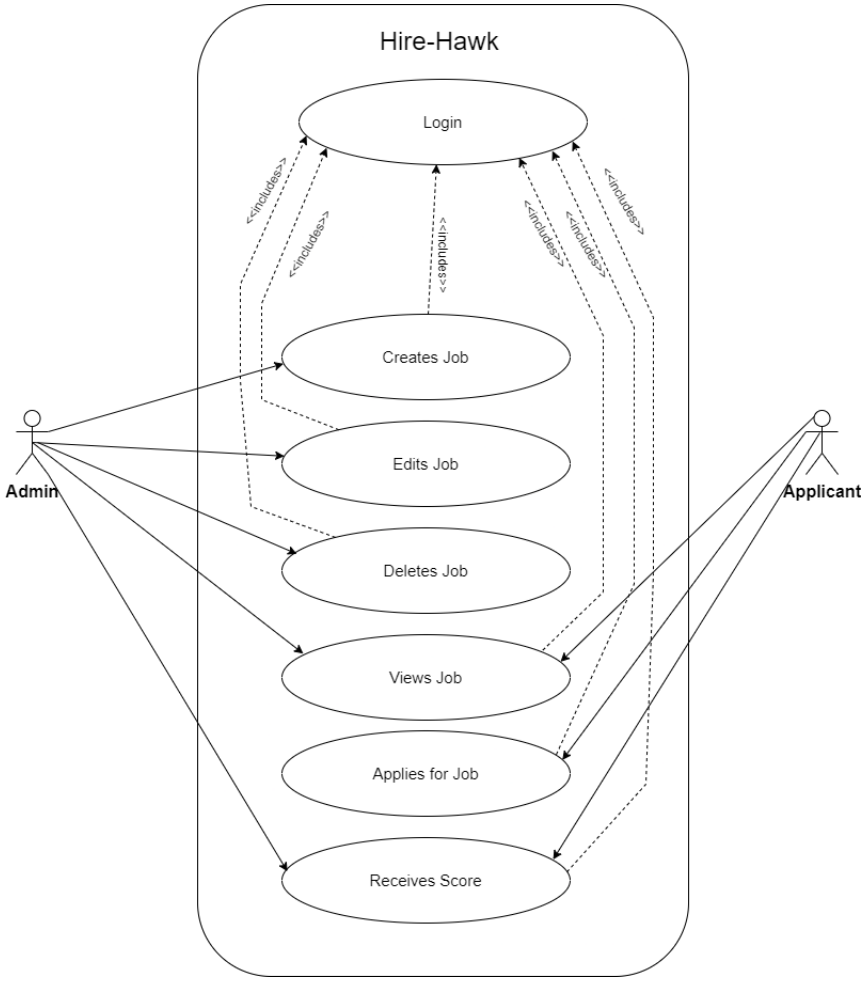

Figure 3.1: Use Case Diagram of Hire-Hawk

Above Use case Diagram displays two actors admin and applicant where admin creates the job,edits job,views job and deletes job .In other hand, applicant view job,applies for the job and receive score based on the resume and job description.

2. **Non Functional Requirements**

   Non Functional Requirements are the attributes or qualities of a system that are directly not related to the functional capabilities but essential for its effectiveness.some of the non functional requirements of the Hire-Hawk are:

   - **Simple UI:**

     The User Interface of the web application is simple,user friendly and device responsiveness.

   - **Security:**

     The access to the system is done only via the valid username and password.

   - **Accuracy:**

     System should able to generate the accurate score based on the resume and job description.

3.2 Feasibility Analysis

After doing the system study and analyzing all the existing or required functionalities of the system, the next task is to do the feasibility study for the project. All projects are feasible - given unlimited resources and infinite time. Feasibility study includes consideration of all the possible ways to provide a solution to the given problem. The proposed solution should satisfy all the user requirements and should be flexible enough so that future changes can be easily done based on the future upcoming requirement.

3.2.1 Technical Feasibility

This Hire-Hawk web application fully works on the system which supports the internet connectivity.It require the virtual environment to execute and database management system to operate which provides score based on the resume and job description. The system configuration consists of Hardware configuration(any hardware configuration including mobile phones and tables which supports browser) and software configuration(operating system on any platform windows ,MacOs with internet browsing functionality).

3.2.2 Operational Feasibility

All the functions of the system are possible to create.Job vacancy is uploaded along with the description via admin and applicant apply for the given job by submitting the resume and system provides the score based on the resume and job description through score generator.

3.2.3 Schedule Feasibility

For each activity of the project, proper estimation of the time is done.Overall the calculated time is sufficient to complete the project without any difficulty.The gantt chart shown below shows the different phases and time required for the development of the Hire-Hawk. We have allocated maximum time for analysis,development and documentation of the project.

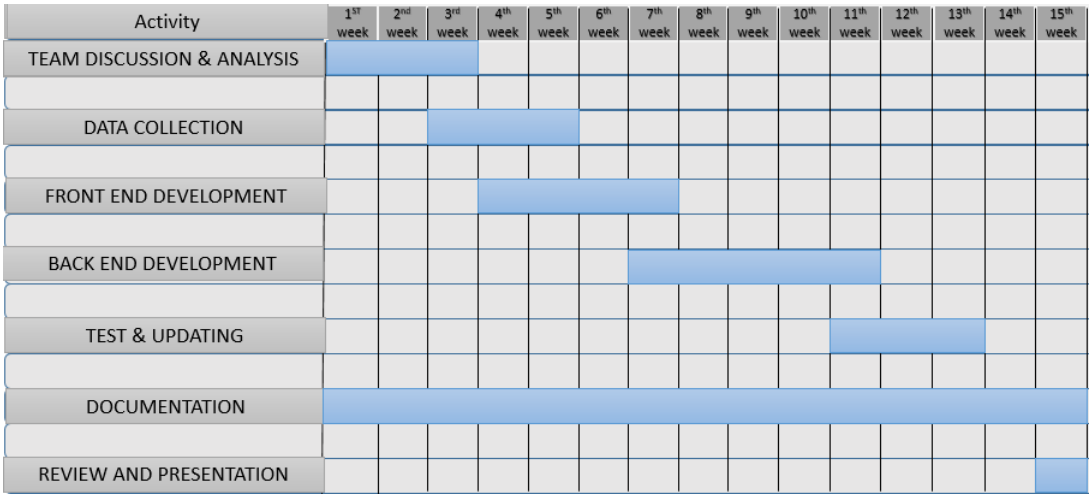

Figure 3.2: Timeline chart for the completion of Project(Gantt chart

3.3 Analysis

Hire-Hawk is structured approach:

1. Data Modelling using ER Diagram
2. Process Modelling Using DFD

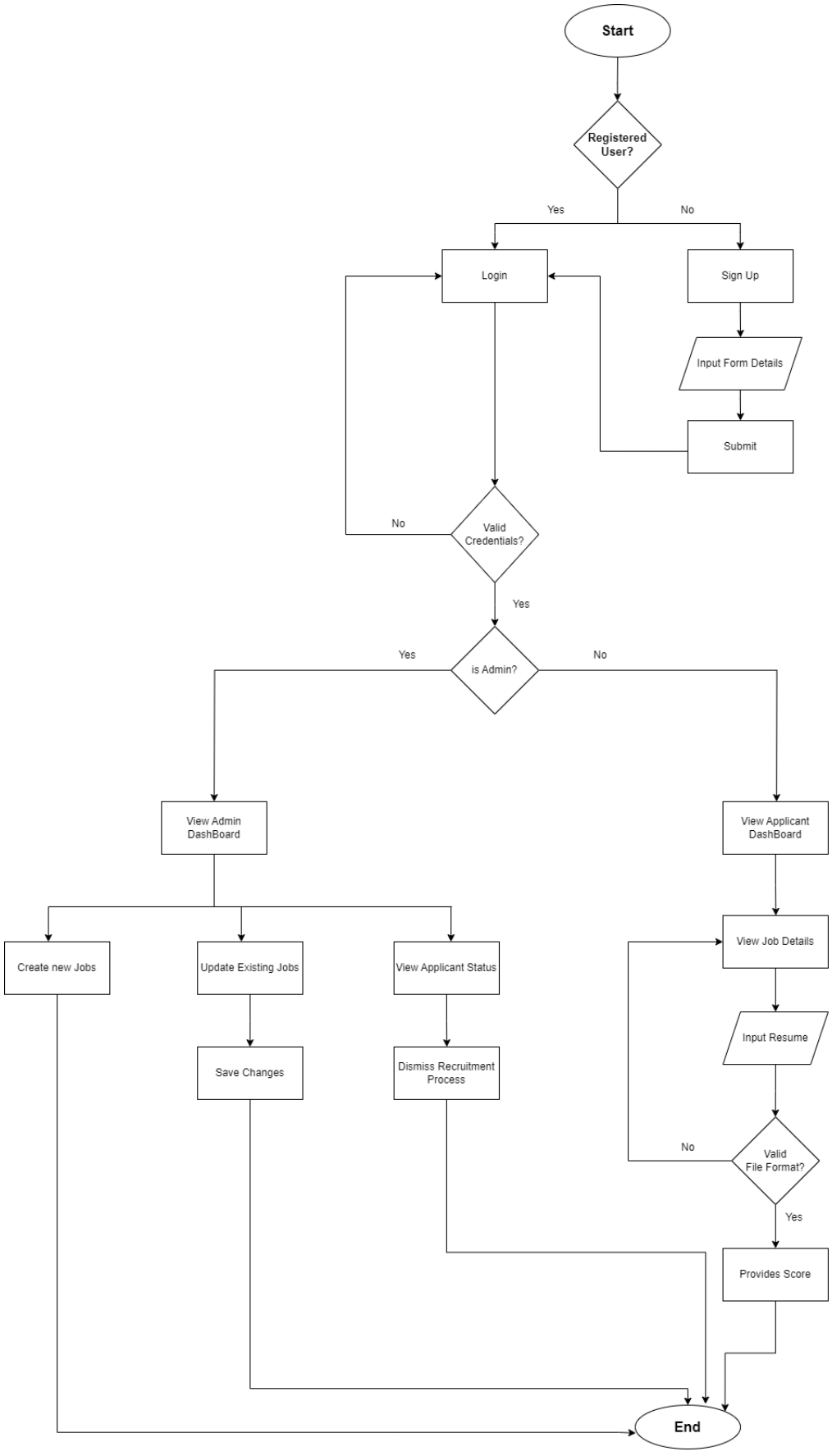

Figure 3.3: flowchart of Hire-Hawk Application

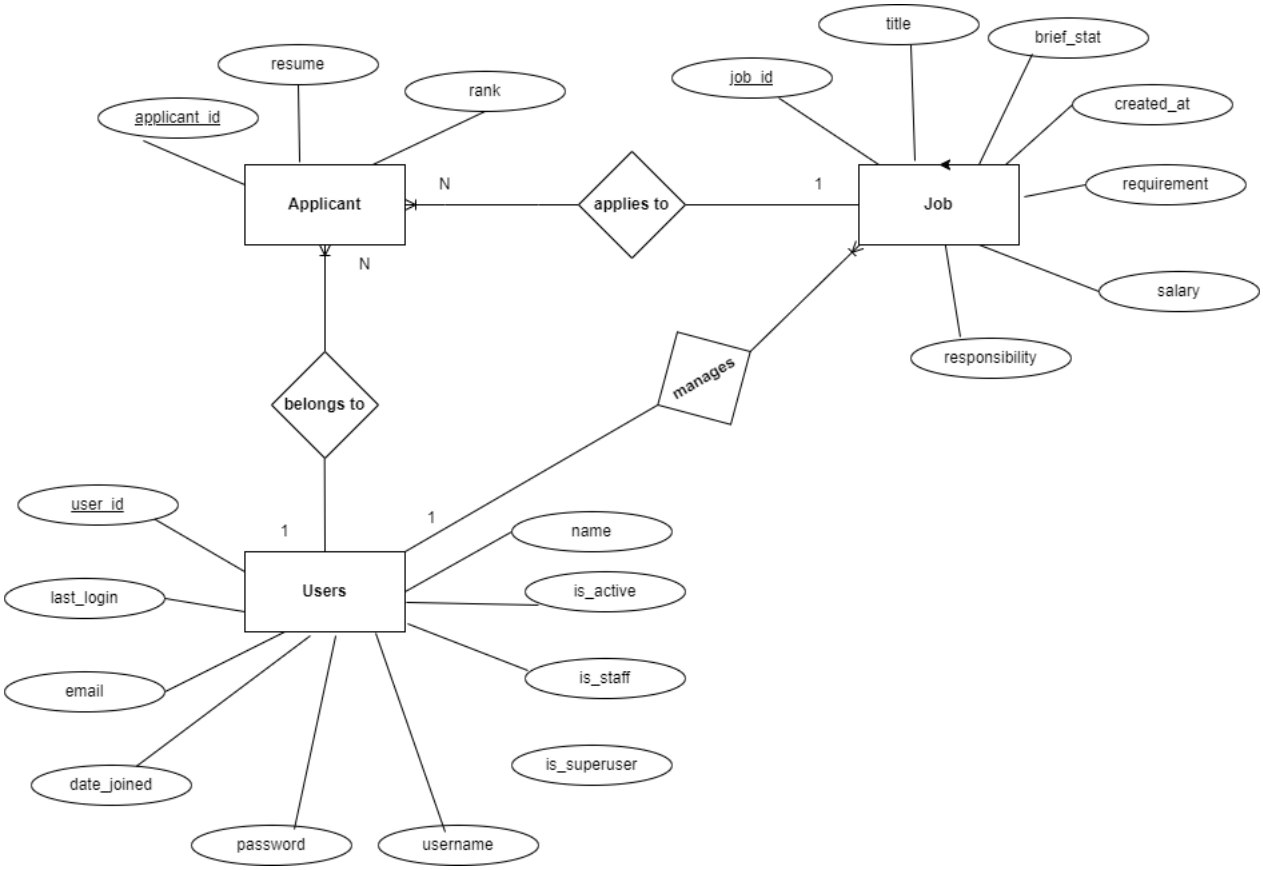

Figure 3.4: ER Diagram of Hire-Hawk Application

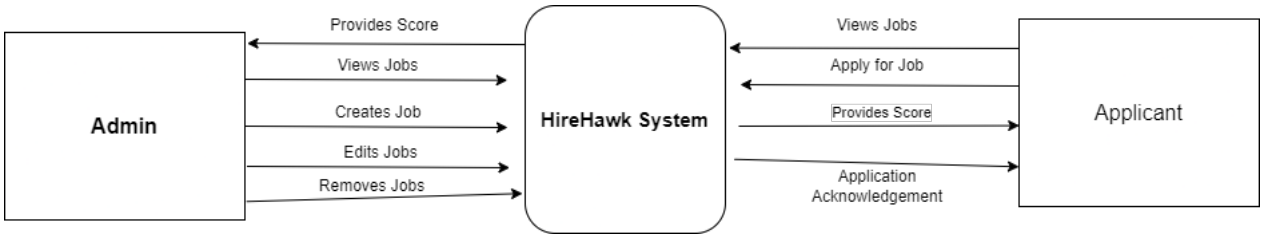

Figure 3.5: Level 0 DFD of Hire-Hawk Application

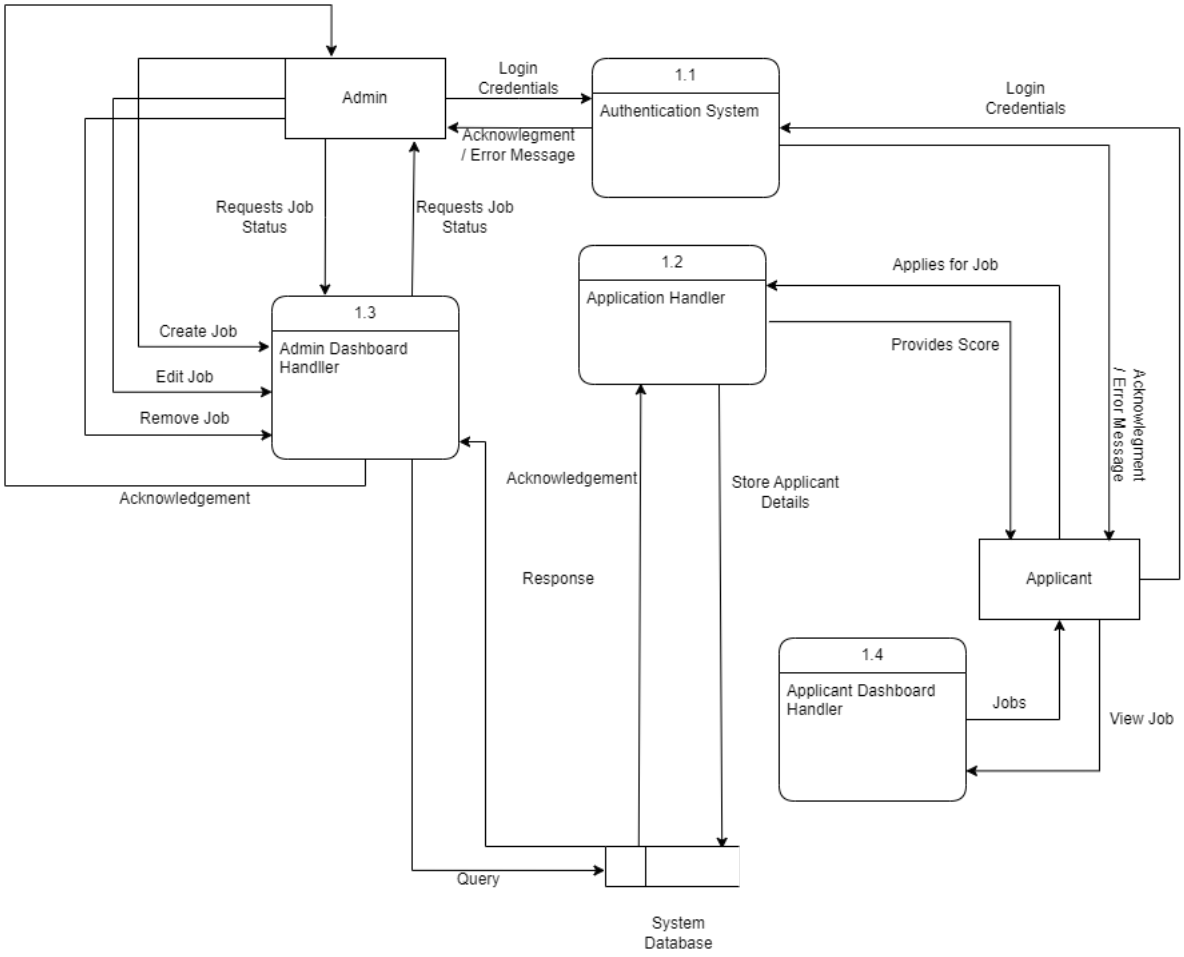

Figure 3.6: level 1 DFD of Hire-Hawk Application

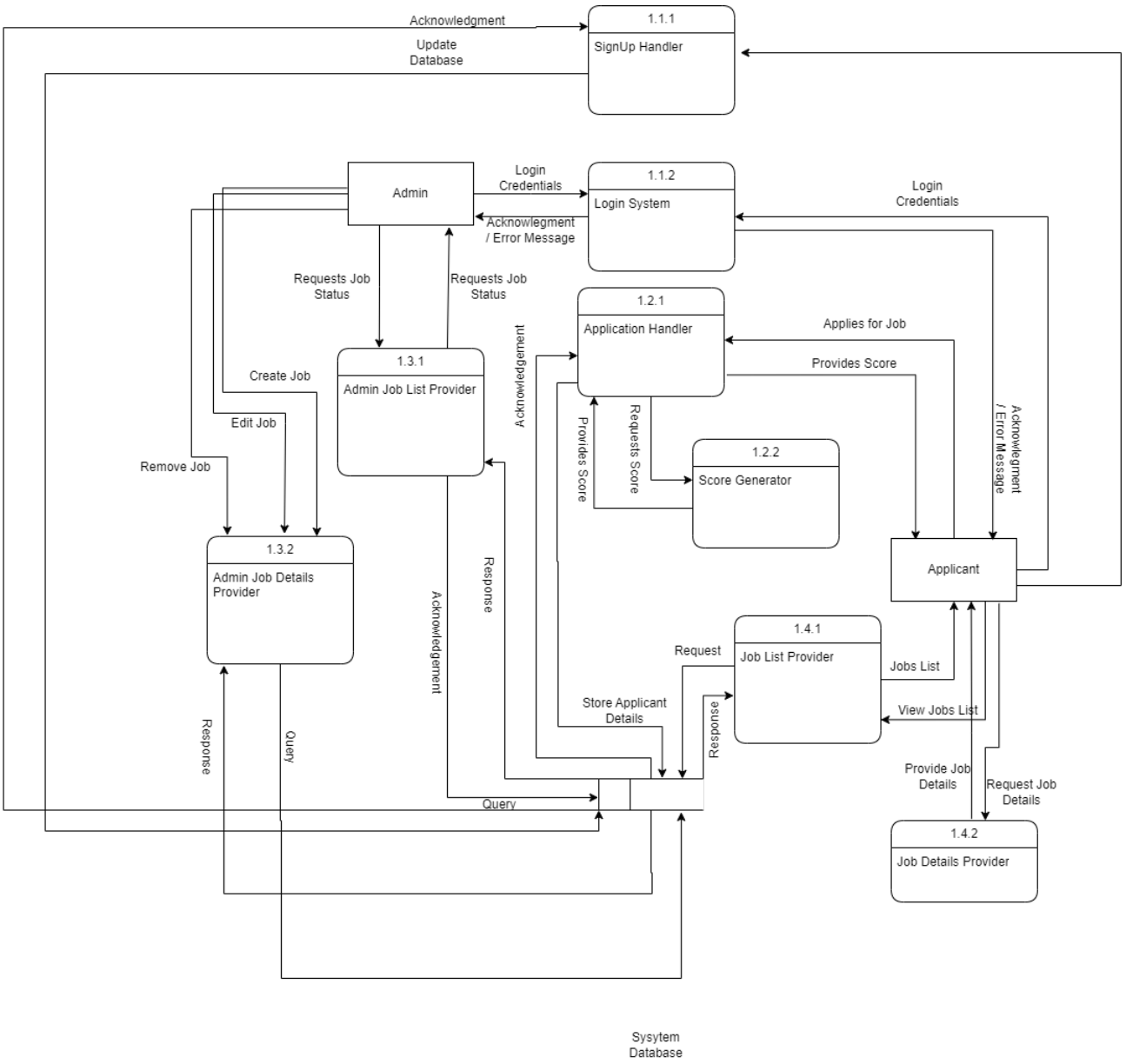

Figure 3.7: level 2 DFD of Hire-Hawk Application

Chapter 4: System Design

4.1 Design

System design is the process of designing the elements of a system such as the architecture, modules, and components, the different interfaces of those components, and the data that goes through that system. form , Interface and report design of Hire-Hawk are

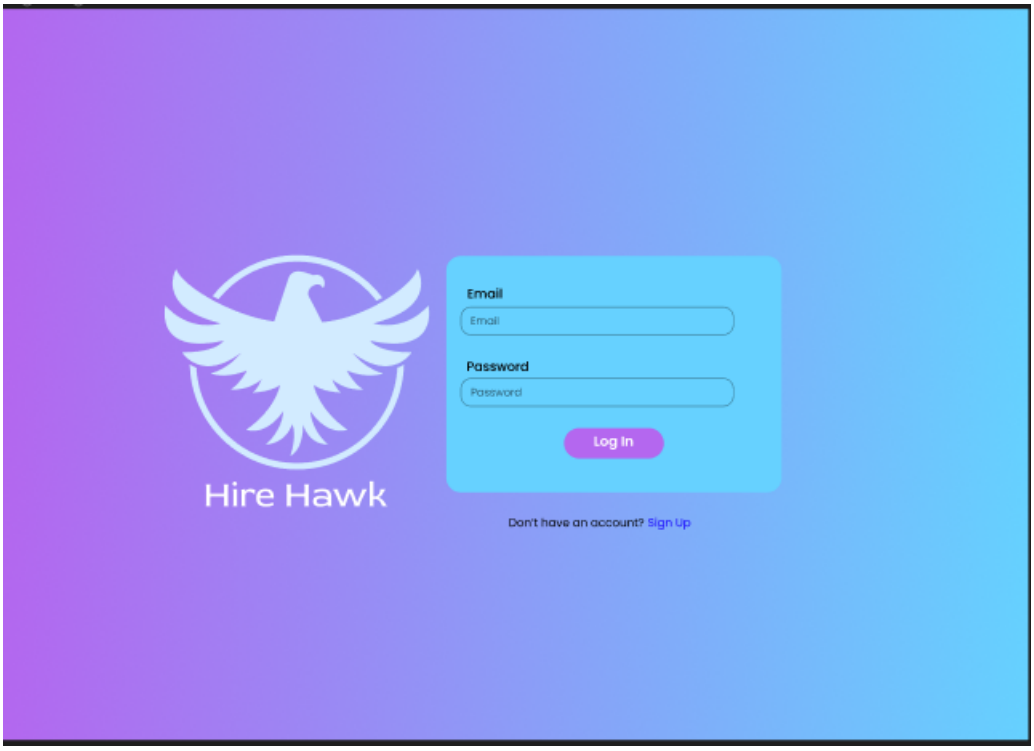

Figure 4.1: Login Page of Hire-Hawk Application

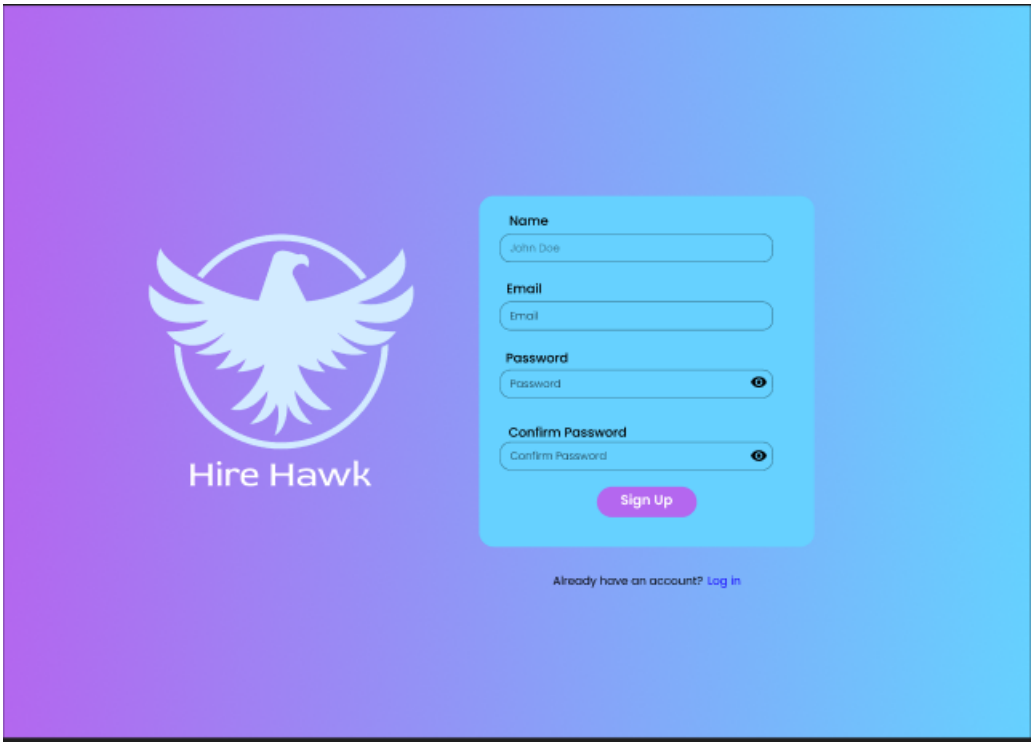

Figure 4.2: Signup page of Hire-Hawk Application

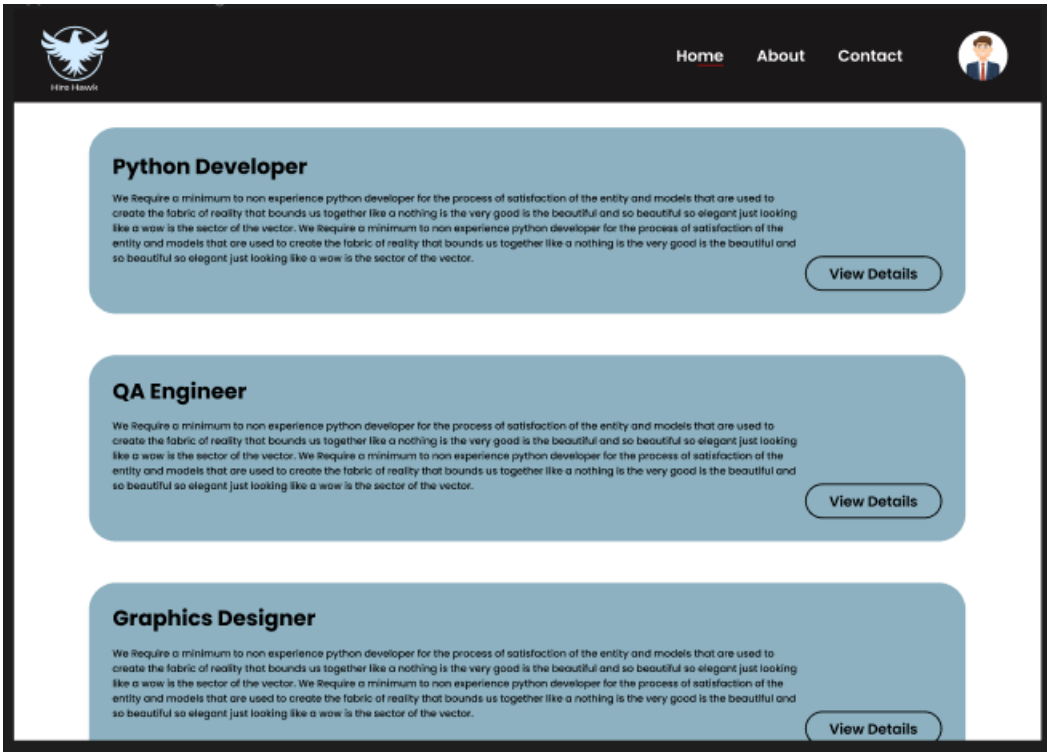

Figure 4.3: Applicant dashboard page of Hire-Hawk Application

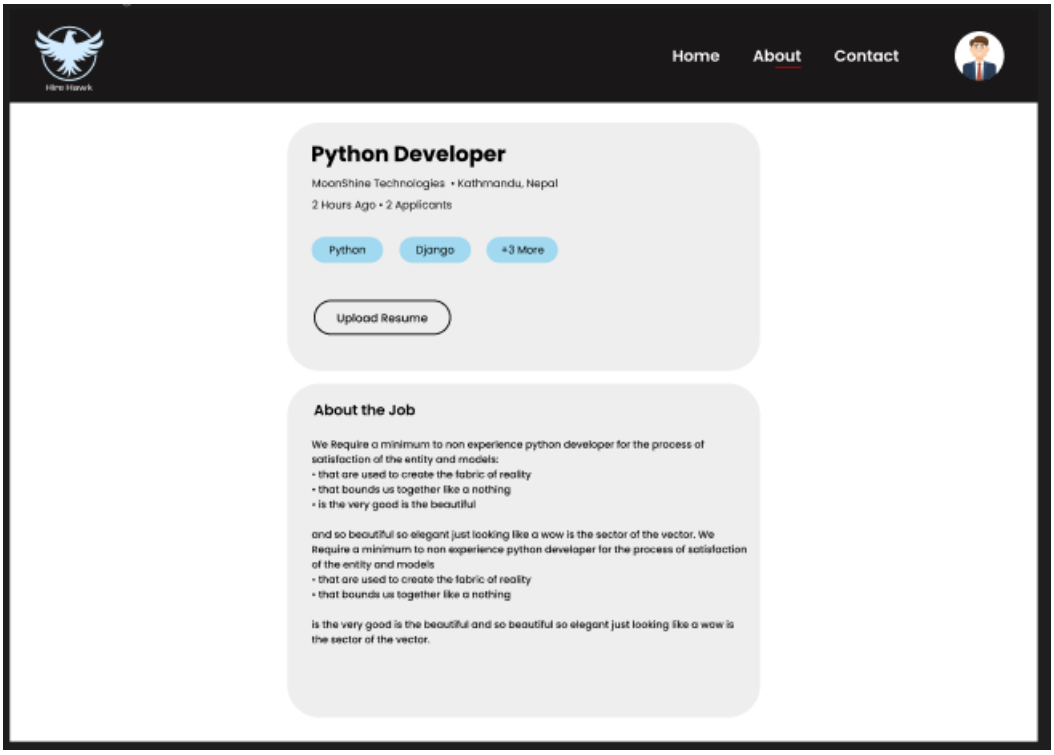

Figure 4.4: About Job page of Hire-Hawk Application

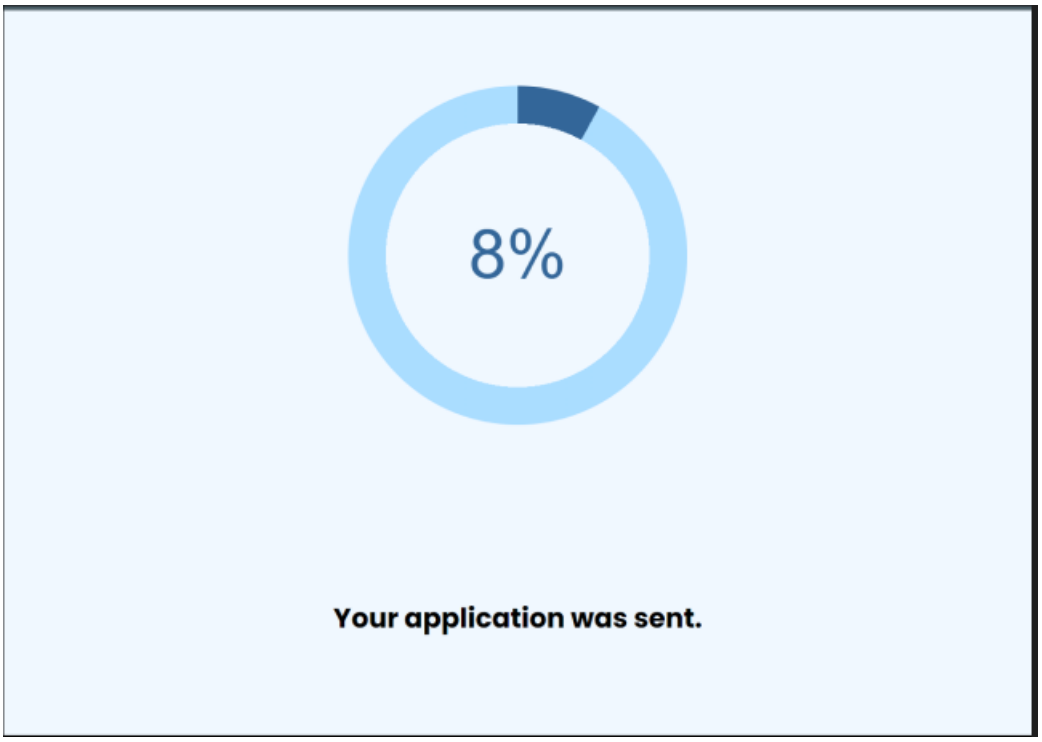

Figure 4.5: Score guage page of Hire-Hawk Application

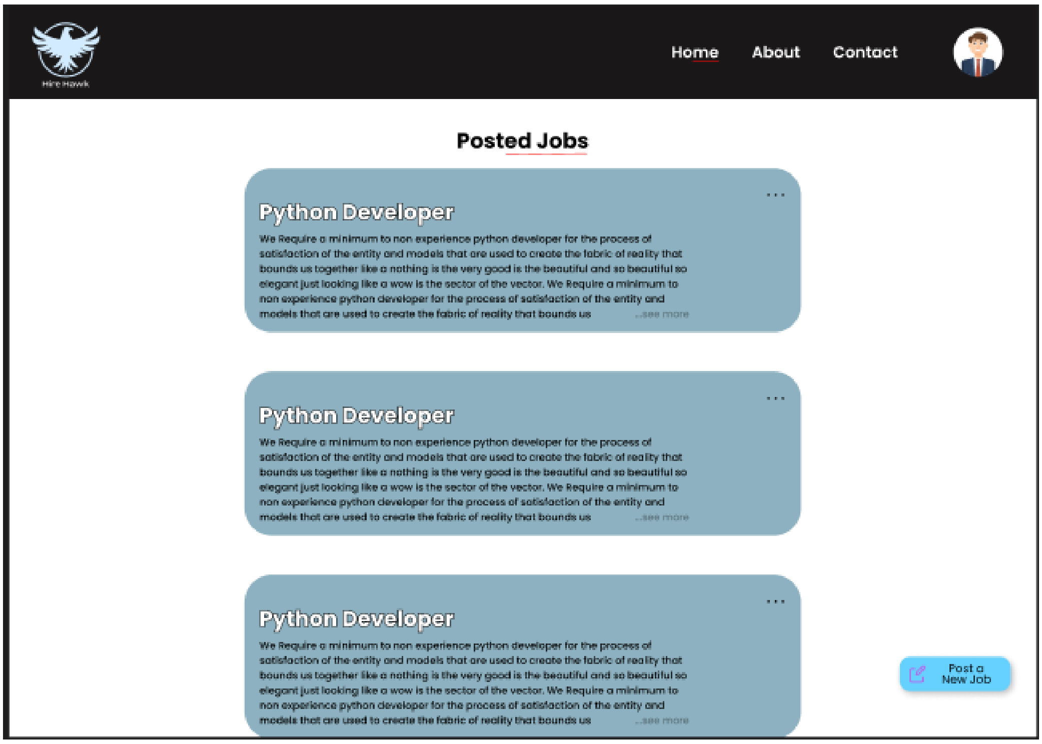

Figure 4.6: Recruiter Dashboard page of Hire-Hawk Application

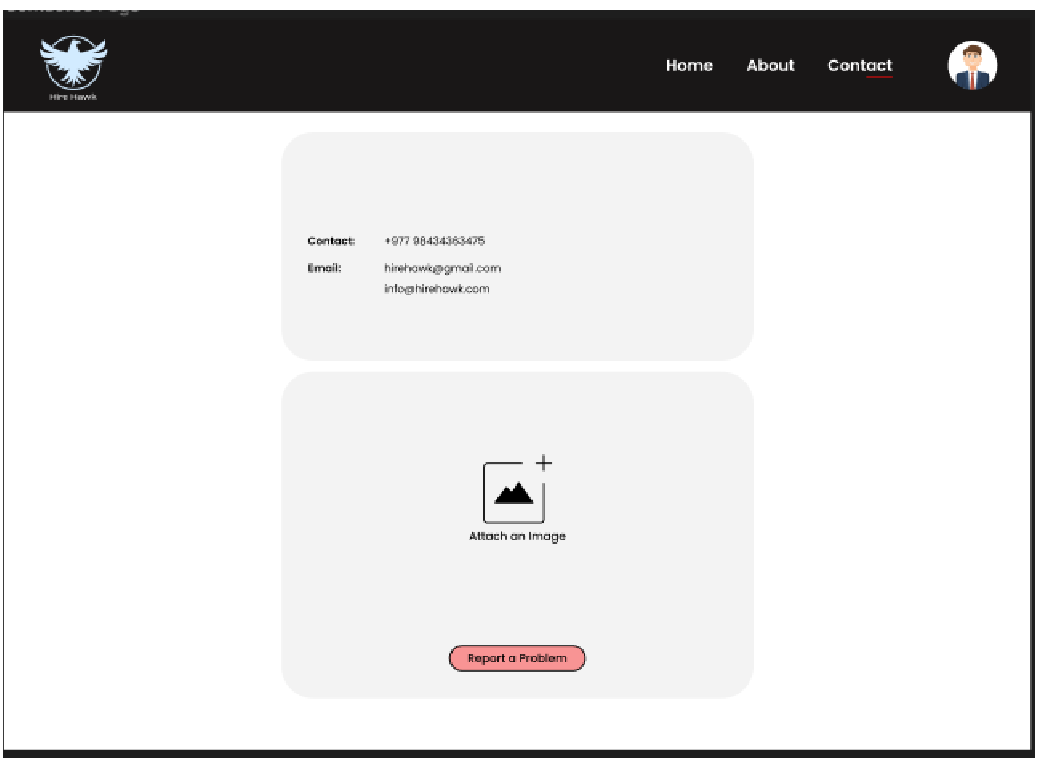

Figure 4.7: Contact us page of Hire-Hawk Application

References

[1] C. Daryani, G. S. Chhabra, H. Patel, I. K. Chhabra, and R. Patel, "An automated resume screening system using natural language processing and similarity," *ETHICS AND INFORMATION TECHNOLOGY [Internet]. VOLKSON PRESS*, pp. 99–103, 2020.

[2] M. Kocaleva, D. Stojanov, I. Stojanovic, and Z. Zdravev, "Pattern recognition and natural language processing: State of the art," *Tem Journal*, vol. 5, no. 2, pp. 236–240, 2016.

[3] K. D. Carlson, M. L. Connerley, and R. L. MECHAM III, "Recruitment evaluation: The case for assessing the quality of applicants attracted," *Personnel Psychology*, vol. 55, no. 2, pp. 461–490, 2002.

[4] C. Daryani, G. S. Chhabra, H. Patel, I. K. Chhabra, and R. Patel, "An automated resume screening system using natural language processing and similarity," *ETHICS AND INFORMATION TECHNOLOGY [Internet]. VOLKSON PRESS*, pp. 99–103, 2020.

[5] C. M. Ross and S. J. Young, "Resume preferences: Is it really "business as usual"?" *Journal of Career Development*, vol. 32, no. 2, pp. 153–164, 2005.

[6] H. Braun, "Applying learning-to-rank to human resourcing's job-candidate matching problem: A case study." 2017.

[7] A. Zaroor, M. Maree, and M. Sabha, "Jrc: a job post and resume classification system for online recruitment," in *2017 IEEE 29th International Conference on Tools with Artificial Intelligence (ICTAI)*. IEEE, 2017, pp. 780–787.