

CV/Resume Analysis System

FYP Report



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Certificate

It is certified that this final year project report/thesis for the project titled as "CV/Resume analysis System", which is a cross platform mobile app for HR department to shortlist job seeking candidates for interview is authored by Muhammad Sohail and Muhammad Ibrahim under the supervision of Dr. Moazzam Ali. This work is original and recorded according to the defined and required standards. Any contribution made by others, is explicitly acknowledged in this thesis.

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Abstract

CV/resume analysis System is a cross-platform mobile app to shortlist the most suitable candidate for specific job announced by the organization.

The main purpose to develop a such kind of app is to provide a platform that facilitate the HR department for better decision-making process in hiring the candidate for job. it does not help HR department only, but it is also useful for candidates in term of quick decision and meritocracy that is the major problem in the world and specially in Pakistan.

Among the fast progress of business domain, all enterprises are undergoing a dramatic shift to help themselves improve their performance. thousands of resumes. In general, some key points or specific information found in a specific resume may help accomplishing this mission. For this reason, finding a reliable way to search for some data through the resumes is a perfect solution that saves time Decision making in any organization should firstly rely on choosing the perfect candidates for any job opportunity they have, therefore linking a perfect employer to the job is a hard mission when having to search between, effort and complexity.

There are two modules in application, first the candidate submits their CV or resume and second is to shortlist the candidates for interview call. The backend module runs on complex algorithms and Natural languages techniques. The application gets multiple CVs and run it core process to analyze the CVs. Since there are different format of CVs, that is the main problem. After completion of process, the system will generate a list of most qualified and suitable candidates for announced job.

The whole process takes a little time as compare to manual reading and reviewing each Resume leaf by leaf, because it is traditional way to hiring and tedious task that requires a lot of time This application provides a platform to the jobless people who are capable and suitable candidate for specific job. It resolves many problems related to applicant satisfaction, fast selection process, quick and fair decision-making process. This application helps both candidate and HR department. The candidate just sends their CV and leaves the rest of work to the HR department. Due to quick and fair process, the HR department contact with applicant early as possible.

Acknowledgements

We would like to express our special thanks and sincere gratitude to our project supervisor Dr. Moazzam Ali (Assistant Professor, department of Computer Science, Bahria University, Islamabad), for providing us with the golden opportunity to work on this wonderful project “CV/Resume analysis system”. We are grateful to him for helping us throughout this project. Their involvement in this project, with their guidelines and advices, gave us the motivation and courage to complete this project with limited framework resources and time. Their sincerity with project, vision and motivation have deeply inspired us. It was a great honor for us to work under their supervision. Despite of their busy routine, their valuable and different ideas are sure to make this project unique in nature. Also, we would like to thank our fellow seniors for sharing their experiences and for their valuable help.

Dated: 1st December 2020

Bahria University Islamabad, Pakistan

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1. Introduction

1.1 Background

The increase in technology provides more opportunities in job seeking in a faster and easy way. Now a day's Internet holds the market attention [7]. For business perspective, it is necessary to launch a quick and fair process to hire the employees instead of traditional way. The candidates want quick and fair systems that help them in job seeking queries. No doubt, technology has made our daily life more convenient. The use technology in business, help to grow faster than competitors. This project attempt to provide advantages in term of effort-less and time saving with minimum latency to the candidates.

Among the fast progress of business domain, all enterprises are undergoing a dramatic shift to help themselves improve their performance. thousands of resumes. In general, some key points or specific information found in a specific resume may help accomplishing this mission. For this reason, finding a reliable way to search for some data through the resumes is a perfect solution that saves time Decision making in any organization should firstly rely on choosing the perfect candidates for any job opportunity they have, therefore linking a perfect employer to the job is a hard mission when having to search between, effort and complexity. Crossed-platform app helps an organization to enlist CVs for a specific job, even if the resume of the candidate is written with some fuzzy mistakes. Also, there are several currently active websites which claim to perform the analysis but have provided disappointing results so far [3]. This fact also provided for the main motivation behind the mentioned project. The necessity of such service application may or may not be considered now given the provided results, this project has a high potential and will have a great demand once the employers get to know about the true convenience for the process.

1.2 Problem Description

In traditional way, people must go to the HR departments and submit their CVs. In traditional way of seeking jobs, both time and manual work is required. It is the biggest problem for HR department to review manually each CV. This is very time-consuming task.

[1] According PTA statistics of 2020, 78+ million internet users and [1]168+ million mobile users. This project also helps in elimination of gender discrimination. Therefore, we are developing such a platform that suits all section of society.

Crossed-platform app will help organization to shortlist the resume related to specific job. candidates send their resume (in the form of PDF) to the HR department's email address. Admin uses app analyst system shortlist CVs for interview. It helps the organization in term of effort and time saving. It also helps in decision making process. The main issue is that there are different sorts of CV parsers [2] on the market (keyword-based, grammar-based and statistical-based), but to gain the most accuracy we need a mix of all these methods.

1.3 Objective

To design and develop a cross-platform software application that will.

- Collect job-specific requirements and criteria from employers.
- Collect CVs and Resumes of willing applicants.
- Analyse the provided CVs and Resumes and categorize the applicants as Overly qualified, qualified or under qualified for their desired job.
- Provide the applicant with other job options they might be interested in

This system will provide ease and convenience to those who are jobless and HR department. This application allows to submit CVs and as a result gives list of selected candidates for interview call. Thanks to fast technology, the process is quick and fast. It boosts the satisfaction of the users.

[4] According to the most recent studies rate of unemployment in Pakistan is 5.50. Our system has capable of fast selection and right employee for job, it gives opportunity to earn money that reduce unemployment.

1.4 Methodology

The project development will follow Agile Method (as shown in figure 1). In which a project is break down into several stages involving constant collaboration with stakeholders and continuous improvement and iteration at every stage. The agile methodology begins with describing how the product will be used and what problem it will solve. When the development initiates, teams' cycle through a process of planning, executing, and evaluating which might just change the final deliverable to solve a problem in a better way.

The phases in the Agile Model [5] [9] are as follows.

- Requirements gathering
- Design
- Construction/ iteration
- Testing/ QA
- Deployment
- Feedback

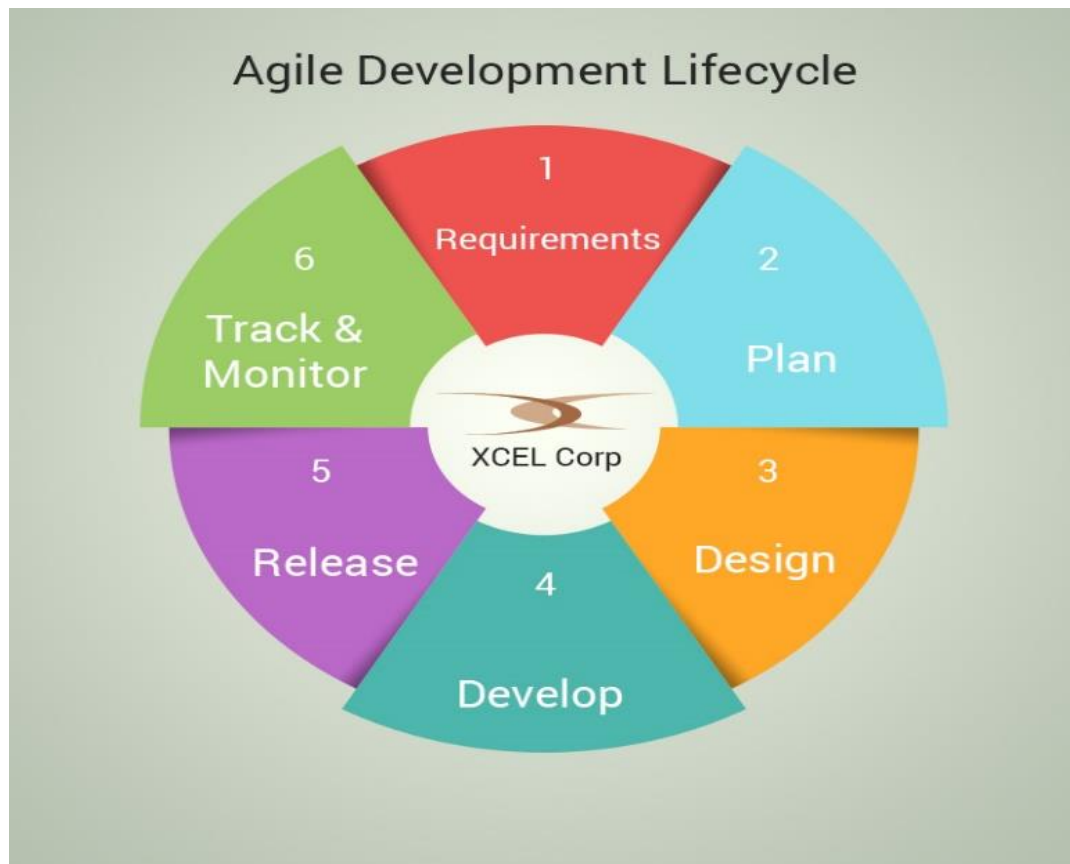


Figure 1 - Agile Model

Requirements

Define the requirements for the iteration based on the product backlog, sprint backlog, customer, and stakeholder feedback.

1.4.1 Design

Design software based on defined requirements.

1.4.2 Development

Develop software based on defined requirements.

1.4.3 Testing

QA (Quality Assurance) testing, internal and external training, documentation development

1.4.4 Delivery

Integrate and deliver the working iteration into production.

1.4.5 Feedback

Accept customer and stakeholder feedback and work it into the requirements of the next iteration.

1.5 Project Scope

The project affects all the participant employers and employees, easing the complex process of candidate and job selection respectively. This project will have a large impact on candidate selection process within large organizations as well as small organizations and especially home-based offices with less opportunities of hiring specialized HR managers or teams. The common man will also have greater opportunities of finding a job as they will be provided with other options in case they do not qualify for their desired job.

This project will facilitate and help both HR department and candidate. It will simplify selection process and increase convenience. Now a days, mostly people interested in saving money, time, and effort. This system provides these basic elements. Tremendous use of smart phones [1] also enhances the scope of this project. This system is easy to use, easy to maintain, cost effective and more reliable as compare to manual work. It is secure and fair process.

1.6 Feasibility Study

With the project scope defined above, following analytical data is critical for the completion of this project in time successfully.

1.6.1 Risks Involved

Following is a detailed view of the possible risks and how we are prepared to cater them.

- The employee is qualified for a certain job, but relevant information is not properly provided.
- The employee is qualified but has not used the specific keywords as specified by the employer for that job.
- The employee is qualified or overqualified in some requirements for the job but lacks qualification in some minor requirement.

1.6.2 Resource Requirement

Following is a detailed view of the possible computing or any other resource this project would need.

- Required knowledge of Python (language used in project)
- Required knowledge of web and app development.
- Enough knowledge of React (Native)
- A computing device meeting the requirements to run the required software(s)
- Required knowledge of Artificial Intelligence and Data Mining

2. Literature Review

2.1 Literature Review Introduction

This chapter will be going to discuss about the existing systems related to our project and how they differ from our project, will be going to discuss the literature review of our proposed system. In this we will also discuss about the research done for the implementation of our project. This chapter also provides a vivid and understandable perception of the standards and technologies that are being used in the past and the present in online job selection process in Pakistan and globally. It gives us an overview of the HR department models that currently exist and changes with the passage of time. Due to the evolution of the candidate selection process within different organizations, the HR department have faced many challenges and difficulties. There is no restriction for user to submit their CVs with the given time frame without visiting the organization physically.

2.2 Previous Work

If we talk about previously done work on CV/Resume Analysis technology, there are currently quite a few working websites which try to perform the same operation. After extensive research on previous work of CV analysis system, 'Resume Parser System' [11] is the project of China-HR which is the recruitment website. This system works on data extraction base upon regular expression and text automatic classification.

Another previous work is about online course selection system in Kurdistan region Government [12]. it will help the students to choose between the reasonable institute between private and public universities. The system is based upon many attributes.

Personality Prediction System through CV Analysis [13] is the proposed system which is based on aptitude test, online personality test and CV analysis to produce higher decision ranking.

2.3 Proposed System

As we are all aware of the fact that, even statistically, the most used and convenient method nowadays is to access the web and applications using a smart phone. And from the previous statements, it is obvious that there are only websites trying to perform similar operations. So, our first objective is to move the complete system from the internet to personal smart devices, as an application rather than or in addition to an online interface, making it more convenient. One of the key features that the proposed system has above from the previous system is that our application simplifies the whole procedure for every employer, unlike currently present websites which only focus on the employee side, providing the modern-day convenience of managing the complete system from any smart device.

2.4 Conclusion

The main objective is to satisfy the users of this application with its simplicity and convenience. The idea may be already in the working and we will use that foundation and upon it we will build

a more accurate and user-friendly system that will provide the users with their desired results with minimum effort while having maximum usability convenience.

3. Requirements & Specification

3.1 Existing Systems

After a thorough research on the previous work done in this regard, we came to know that the existing systems do not offer much of the functionality. Some systems just give information about the CV/Resume or get expert feedback for CV enter by the user for free and some services are paid [19]. Some system just adds up the help section where user can discuss their issues/queries with the expert. Our system is different in a regard that it has a functionality that no other system has offered before. The core function of the system will be that it will help the HR department to shortlist the job seekers for interview.

One example of such website is Jobee.pk There are some other national and international websites that try to perform similar operations but most of them for the user to manually input some information as well which goes against the whole purpose of such website or application.

CASE 1 [6]

Jobee.pk, Job.com and other online job search websites

The internet is filled with job searching websites, which help people look for available jobs. Some of these websites offer more variation and the flexibility to apply for jobs that are close to a person's choice. But whether that is true or not, with the passage of time, many of these websites have upgraded as well. For instance, many of these sites only ask the user to create their profile and then upload their Resumes/CVs and then the websites try to extract the data and fill it in their own Resume/CV format. But as far as concerned, they do not perform an excellent job. And if a person wants to increase his/her chance to get a job, he/she must fill their format of the CV in the end regardless. Also, these websites only work for the ease of the people looking for jobs, and not for people providing them.

CASE 2

National Online application system DHERST (Papua New Guinea) [8][10]

This system was launched by department of higher education, research, science, and technology (DHERST) Papua New Guinea. The system takes student grades and select the student for higher education according to their previous performance in academic. This system facilitates the admission process.

3.2 Proposed System and Scope

Our system "CV/Resume analysis system" is a cross-platform mobile app that based upon data mining techniques to analyse the Resume against job's requirements set by an organization. It provides convenience and ease of access to job related queries. In today's busy routine and schedule, everyone wants to work remotely.

Through this system we are providing an opportunity to both HR department and candidate to minimize their effort and save their time during routine task. This system will eliminate the

nepotism and biased element from selection process. It enhances the reputation of the organization due to high meritocracy and fair policy. This system will be easy to use, efficient to use, safe and reliable. The system will design according to design rule, principles, and standards.

The proposed system will provide assist the HR department in Organization. The main function of the system will be that it will shortlist the job seeker candidates for interview. Now a days there are lot of people who are finding jobs, deliver CVs to the organization. For single post there are hundreds of CVs. There is problem to shortlist the right candidate for human being. Our system will scan all CVs and analyse the best one. It will be time worth.

Our system will bring ease to the Candidate and HR department in their manpower selection. Our aim is to provide people with the simple interface so, they can use the system with very little knowledge and to help people with their financial issue in a better way.

3.3 Requirements Specifications

Requirement specification is the first core step before developing a system. This step with the help of software quality assurance (SQA) lead toward better system with little bugs and issues. There is leading role of SQA in requirement specification process [14]. It provides pathway to the developers to kickstart their project. There are functional and non-functional requirements of the proposed system as described below.

3.3.1 Functional Requirements

3.3.1.1 Scanning

When all CV are entered, system start its scanning process to shortlist the most suitable job seekers for the interview.

3.3.1.2 Notification

The system will display the notification about progress of application/CV about job. It will also provide date for interview.

3.3.1.3 Database

The information about the user and his CV will be stored in the database. The information stored will be on the device of the current user and on remote server.

3.3.2 Non-Functional Requirements

3.3.2.1 Reliability

The project must reliable as we are dealing with financial matters of public and even a little mistake can affect the user satisfaction badly.

3.3.2.2 Accessibility

The accessibility will be maintained in the system as the users can use it using their smartphone anywhere in Pakistan.

3.3.2.3 Privacy

The privacy of the respected user will be kept and there will be no disclosure to anyone by any means.

3.3.2.4 Usability

The system interface will be very user friendly so, it can be used by anyone without any kind of proper training.

3.3.2.5 Security

The system should follow the security protocols and standards. The admin validation should be done by means of strong password or authentication process. The system should ensure the confidentiality of user information.

3.3.2.6 Modifiable

The system should be flexible in nature and modifiable. So, the later, some changes may propose by stakeholders.

3.4 Use Cases

After going through the process of requirements specification, we will propose the use cases of the system under discussion. These use cases provide us with visual aid in determining the requirements, whether functional or non-functional and other specifications [15]. The Use Cases diagrams also helps us, as project developer, to understand the development process from both ends the developer end as well as the user end. The use cases of the system design after requirement specification phase. These use cases are very helpful to understand the usage of the system in visual way. The use case diagrams are best to identify different functions.

Different roles, actors, provide high-level view of the system and identify external and internal factors.

Based upon main system use case diagram, we further divided the use case into two categories which includes applicant use case diagram and HR department use case diagram. These use cases describe all applicant and HR department functions and operations. The applicant uses case diagram show how the applicant will use and interact with system. The main actor is HR department because it is the main user of the system.

3.4.1 Main System Use Case Diagram

In our system, there are two major actors, which are applicant and HR department of the organization. The Main use case diagram includes the overall system operations and functions of the system as shown in below figure 1.

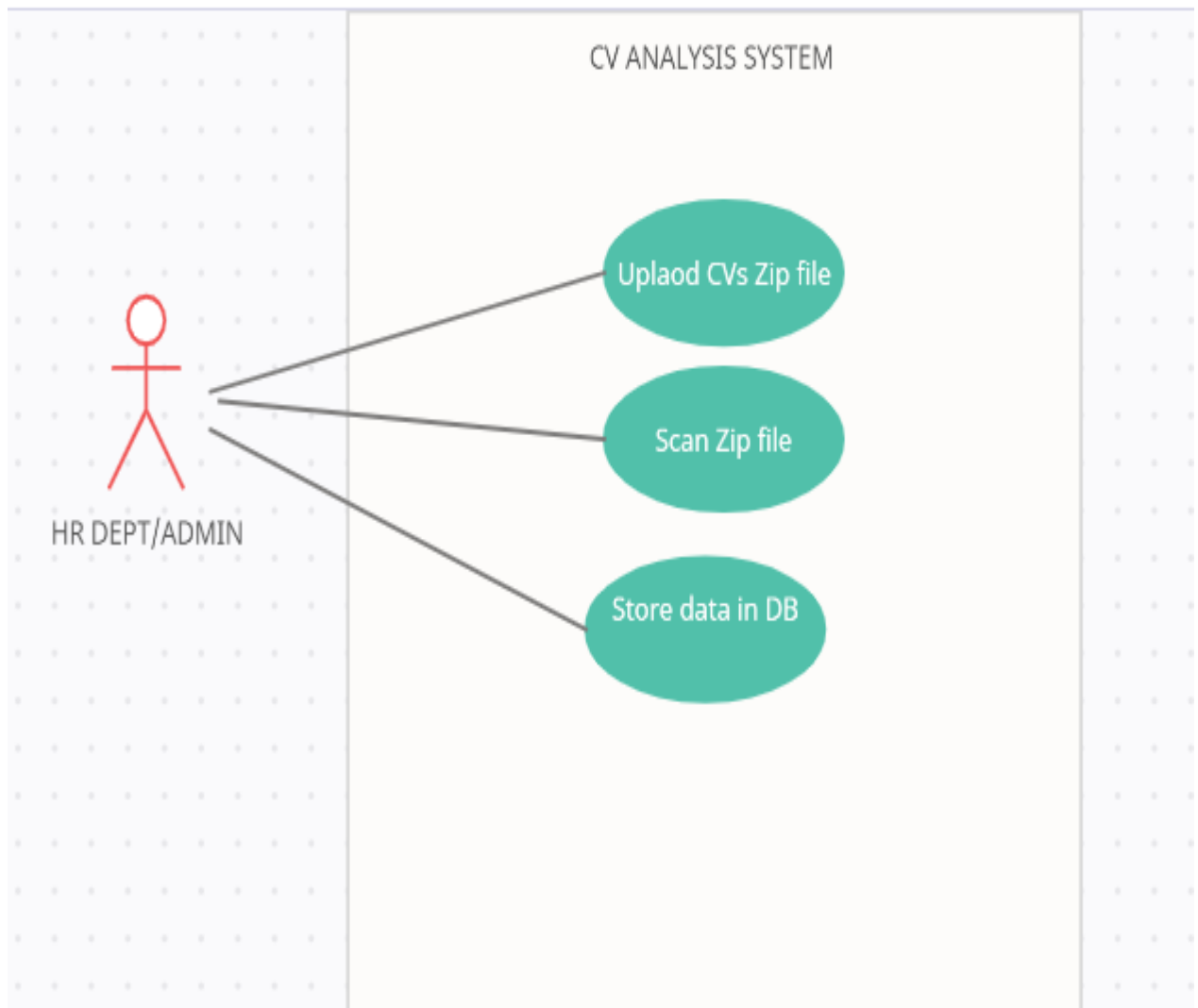


Figure 2 - Main Use Case Diagram

Use-Case Name	Upload_files
Use-case ID	01
Priority	High
Primary Actor	HR department
Description	This use case describes how the HR department upload multiple CVs to the system via application interface.
Basic row	The HR department receives CVs related to specific job. By using application GUI, the HR department upload CVs for further process
Alternative row	An alternative is available to upload CVs manually. Which is given in user manual
Pre-condition	There is vacancy of specific job, system is in working condition. HR department must login.
Pre-condition	Actor action
	Step1: the HR department must be logged in.
	Step2: Multiple CVs are existed.
	Step 4: The HR department must upload zip file of CVs.
	the customer information.
	Step 6: the system will save this into
	Database for further processing
Post condition	If nothing happens, the zip file is uploaded successfully.

Table 1 - Communication Use Case Description Table

4 System Design

In this chapter we will discuss about the basic architecture of the system and the design constraints. The main of our system is to assist the HR department to shortlist the candidates of job.

4.1 System Architecture [16]

It helps in getting the overview of the whole project. It shows how the system will work in a brief manner. Our will have three basic layer which are presentation, business, and database layer.

4.1.1 Presentation Layer

This will include the front end of the application. It will be presented to the user and user will interact with the system using this layer.

4.1.2 Business Layer

The functionalities of the system will be included in this layer. It will be directly connected with the presentation layer and the database layer. The functionalities behind the buttons are added in this layer which do the actual work.

4.1.3 Database Layer

As the name suggests, this layer will store the data and upon calling will show it to the user.

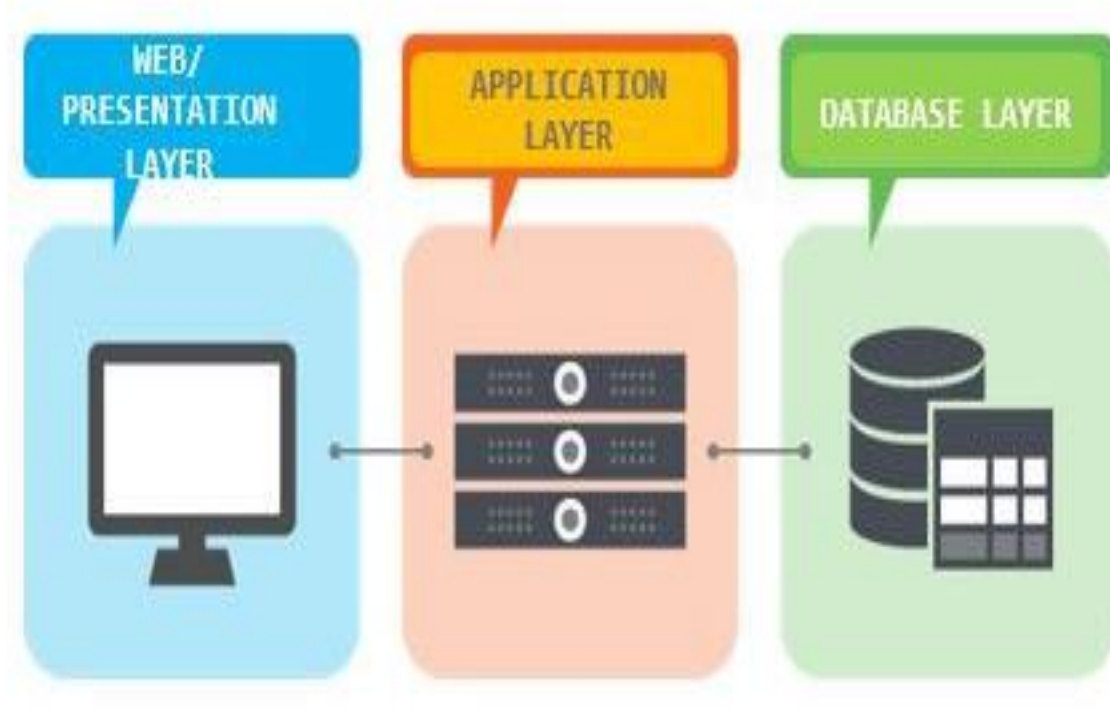


Figure 3 - Database Layer

4.2 Design Methodology

We will use agile development method as our system will be developed in an iterative manner. We will develop a mobile application.

4.3 High Level Design

High Level Design includes the major functionalities offered by the system. It covers the architecture of the system as well as the database design. It describes the relation between different modules and functionalities of the system. The main modules of the high-level design are input, processing, and output. In the input module the user entered about the medicine. In processing that entered data is stored in the database and in the output the data is displayed after scanning the name of the medicine.

4.4 Data Flow Diagram [17]

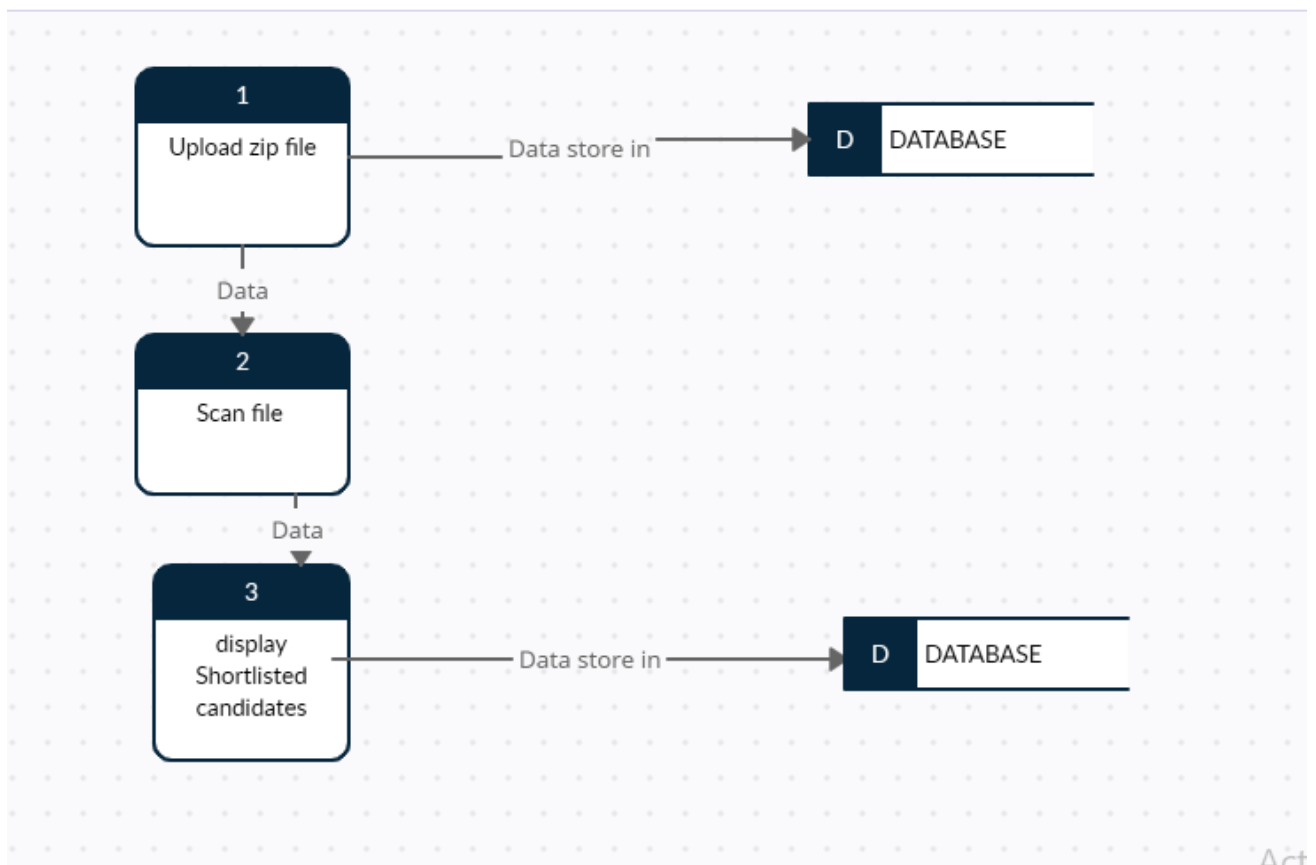


Figure 4 - Data Flow Diagram

4.5 Sequence Diagram [18]

Sequence diagrams show a sequence of modules carried in running of the application. Figure x shows the sequence of the tasks performed in the application.

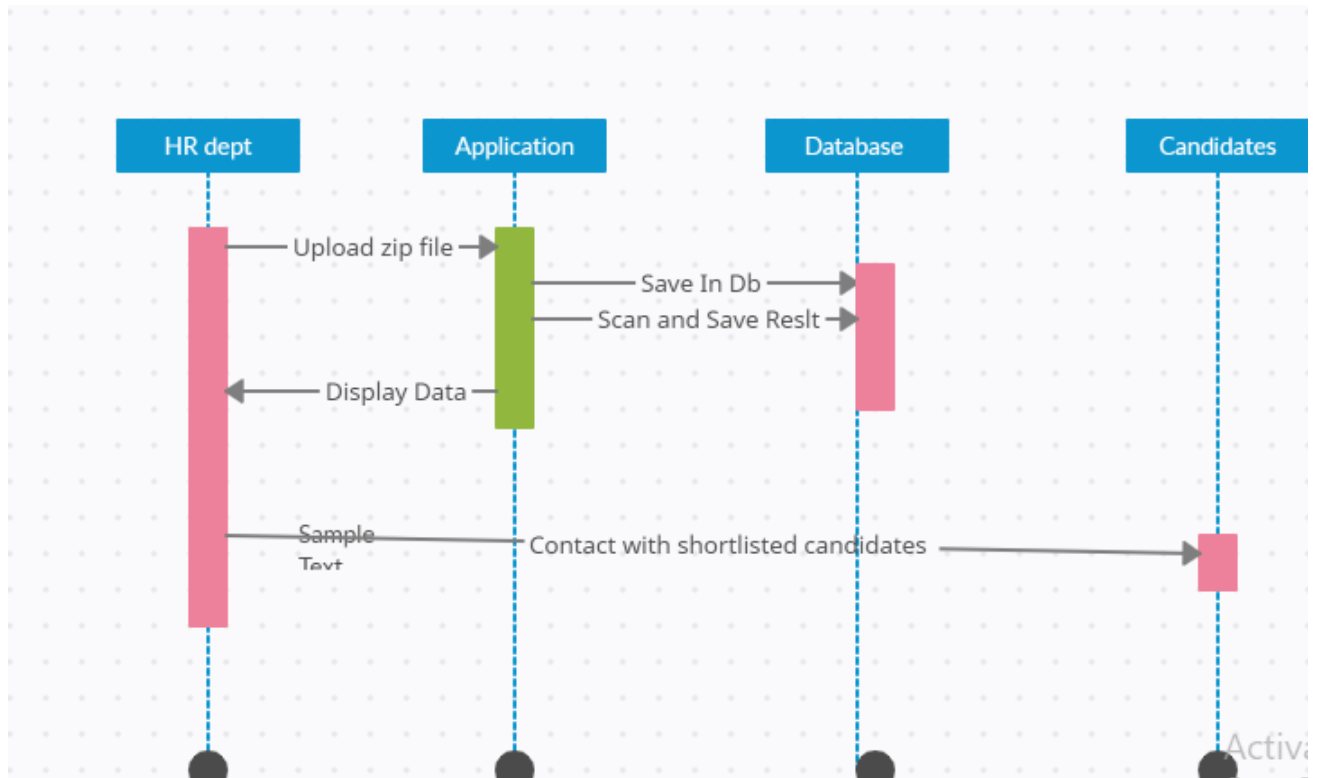


Figure 5 - Sequence Diagram

4.6 Low-Level Design

Low-level design is like explaining the high-level design. It shows the complete logic and processing behind each component of the system. In our system the input will be user entering the medicine by scanning and storing its information in the data base. Then the output will be the information presented by the system from its database after scanning the medicine.

4.7 GUI Design

The GUI design will represent the interface of the system, its inputs, and outputs.

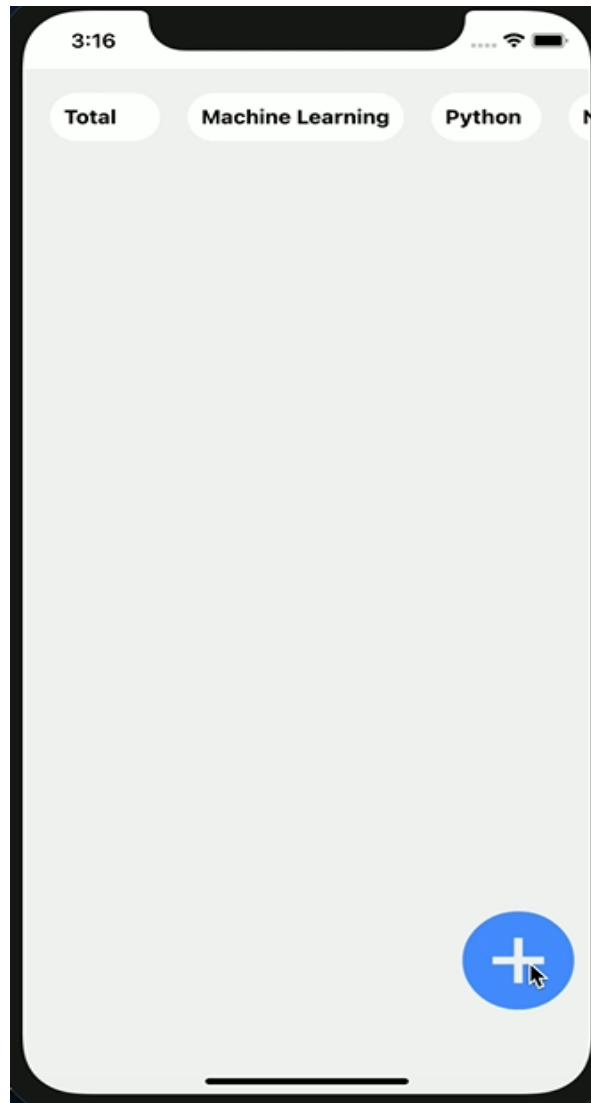


Figure 6 - GUI Main Screen

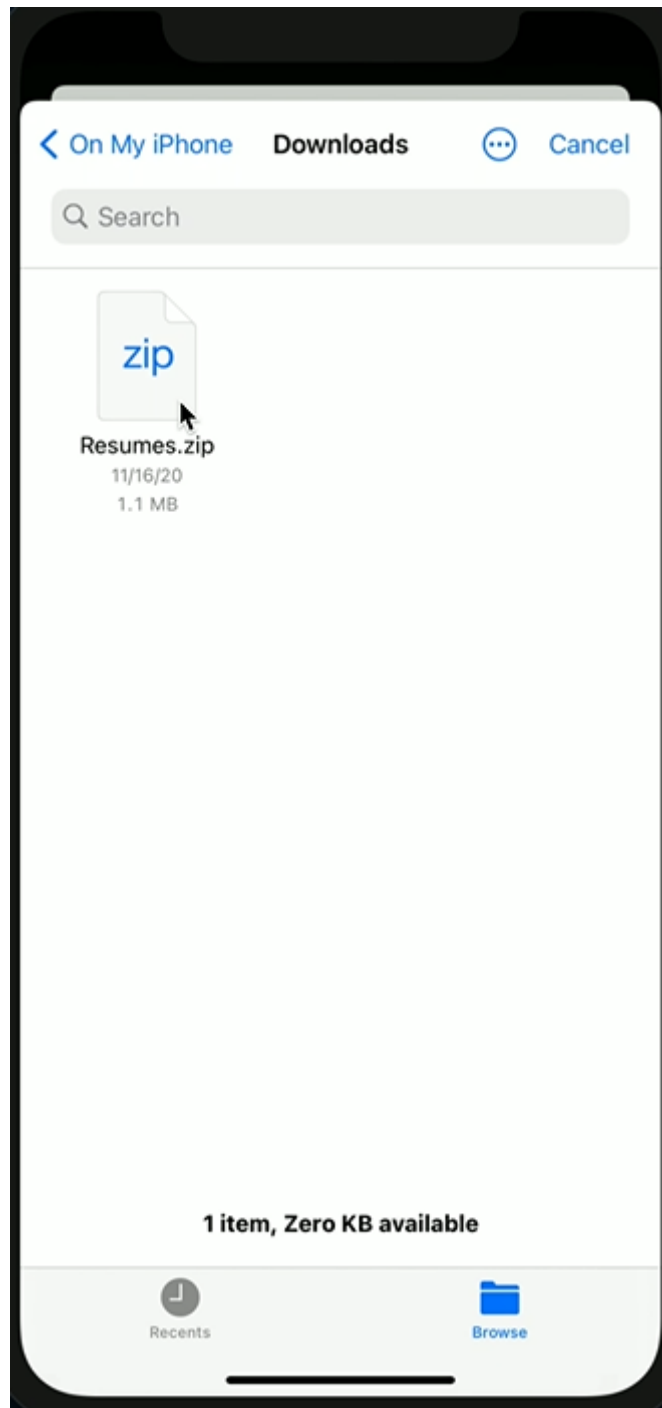


Figure 7 - GUI Upload Files Screen

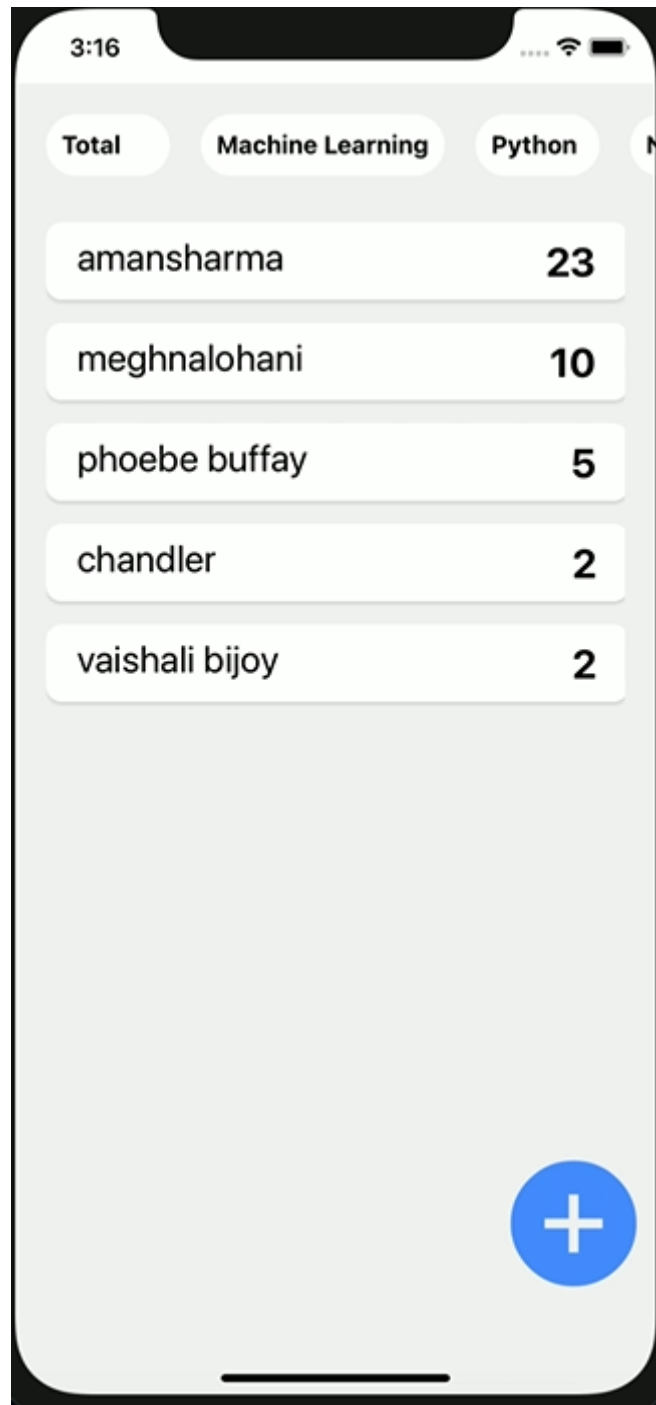


Figure 8 - GUI Output (Total Scores)

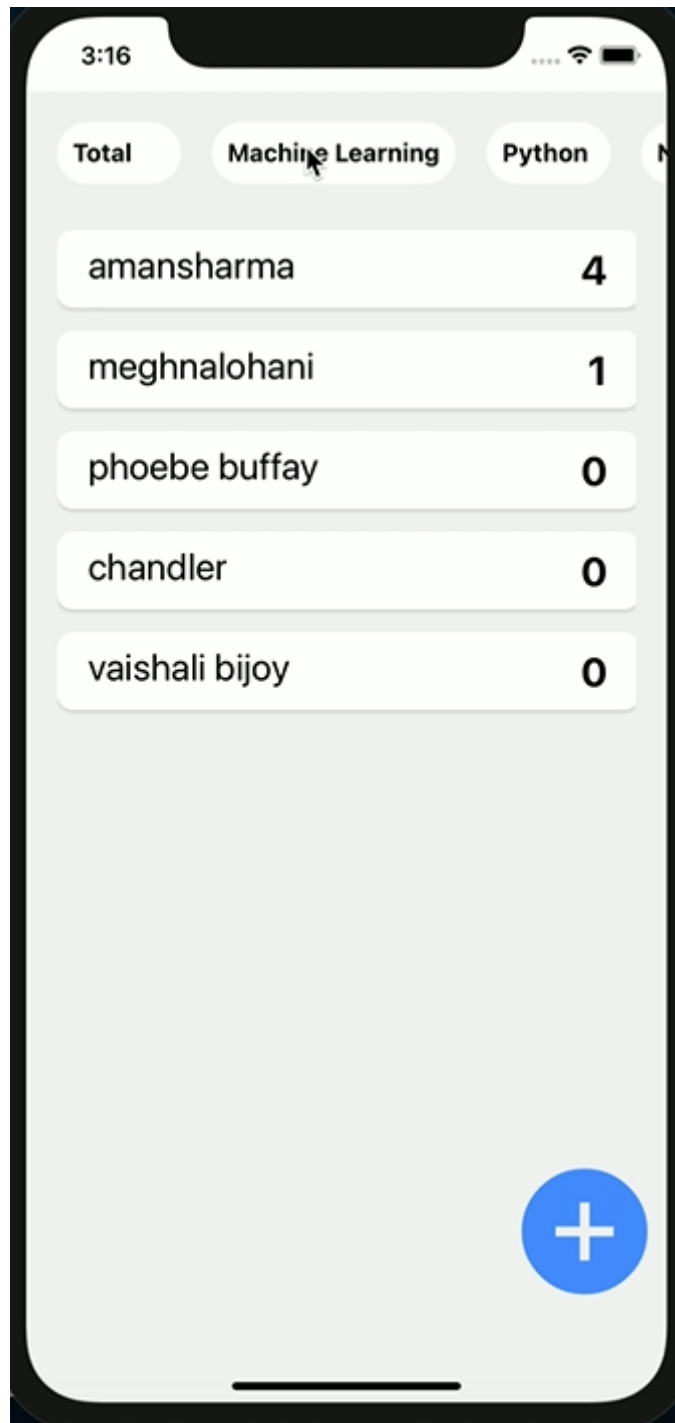


Figure 9 - GUI Output (ML Scores)

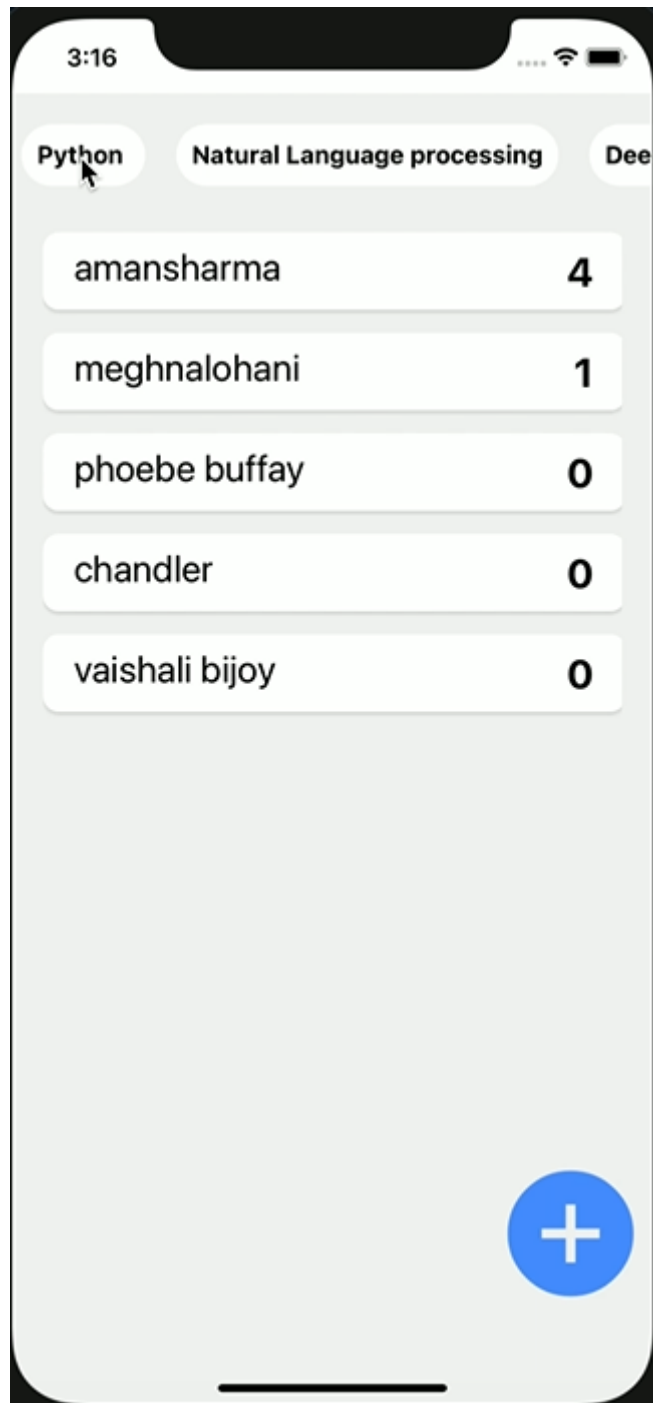


Figure 10 - GUI Output (Python Scores)

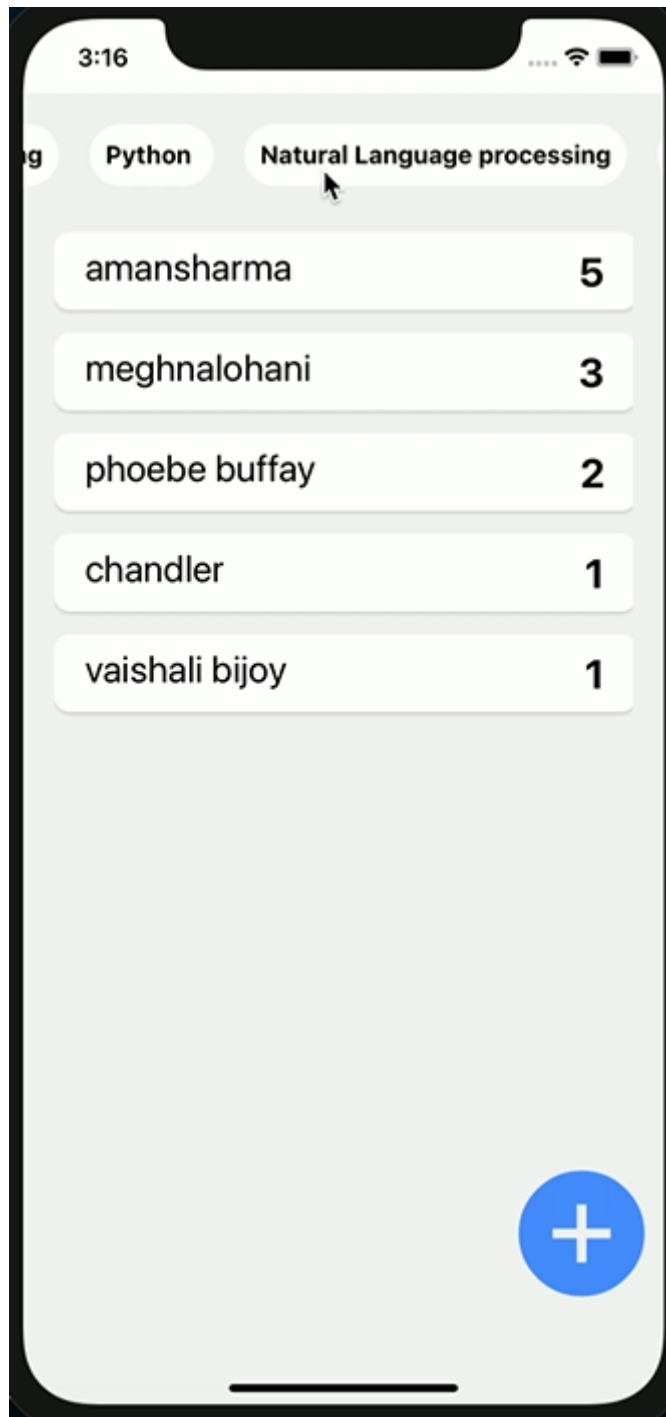


Figure 11 - GUI Output (NLP Scores)

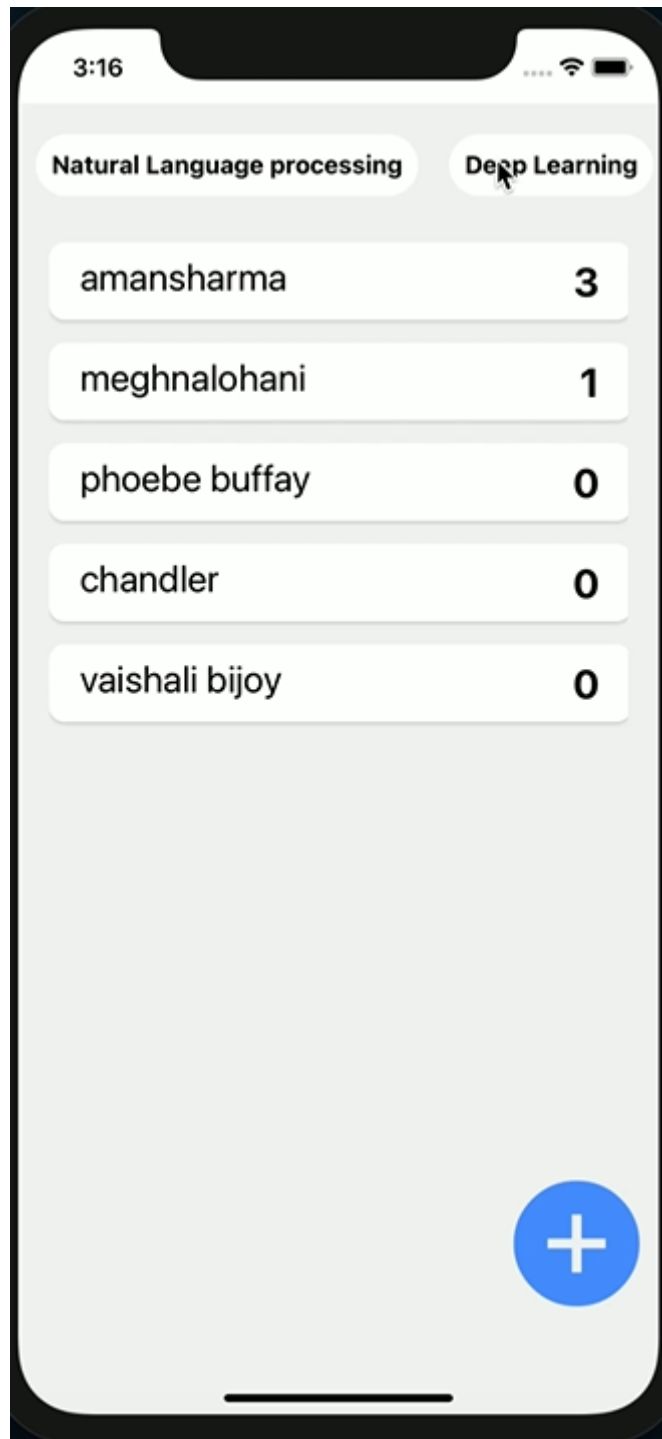


Figure 12 - GUI Output (Deep Learning Scores)

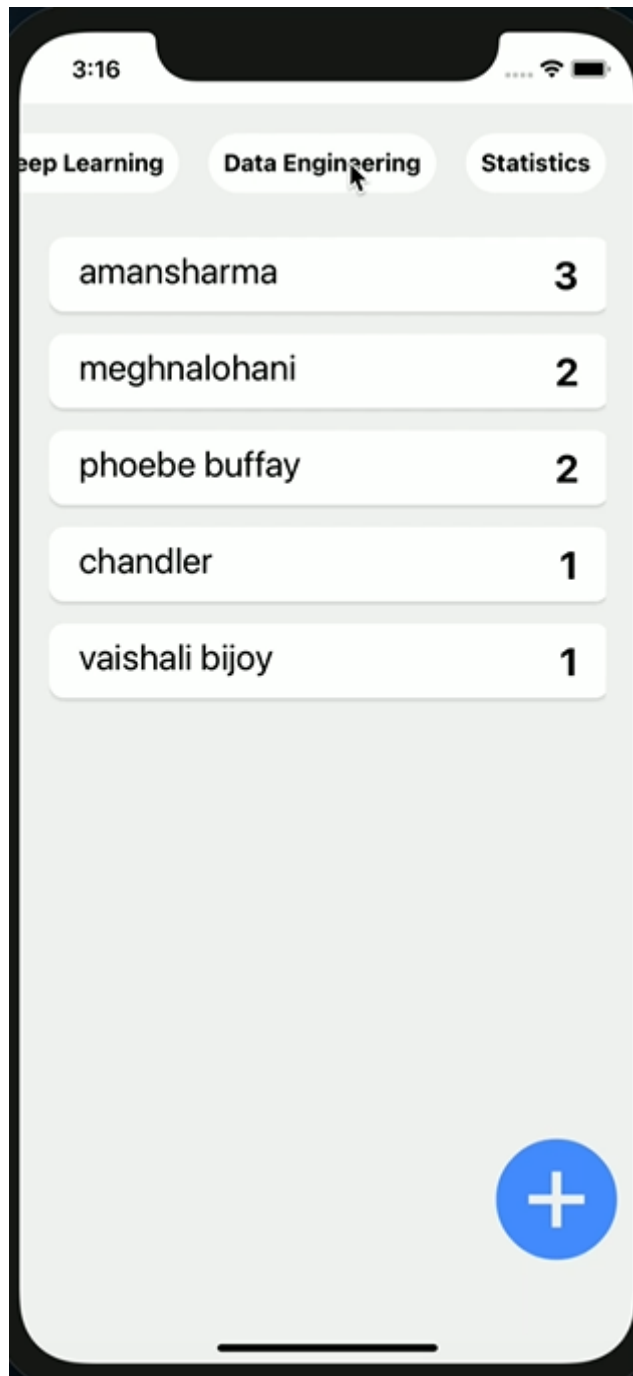


Figure 13 - GUI Output (Data Engineering Scores)

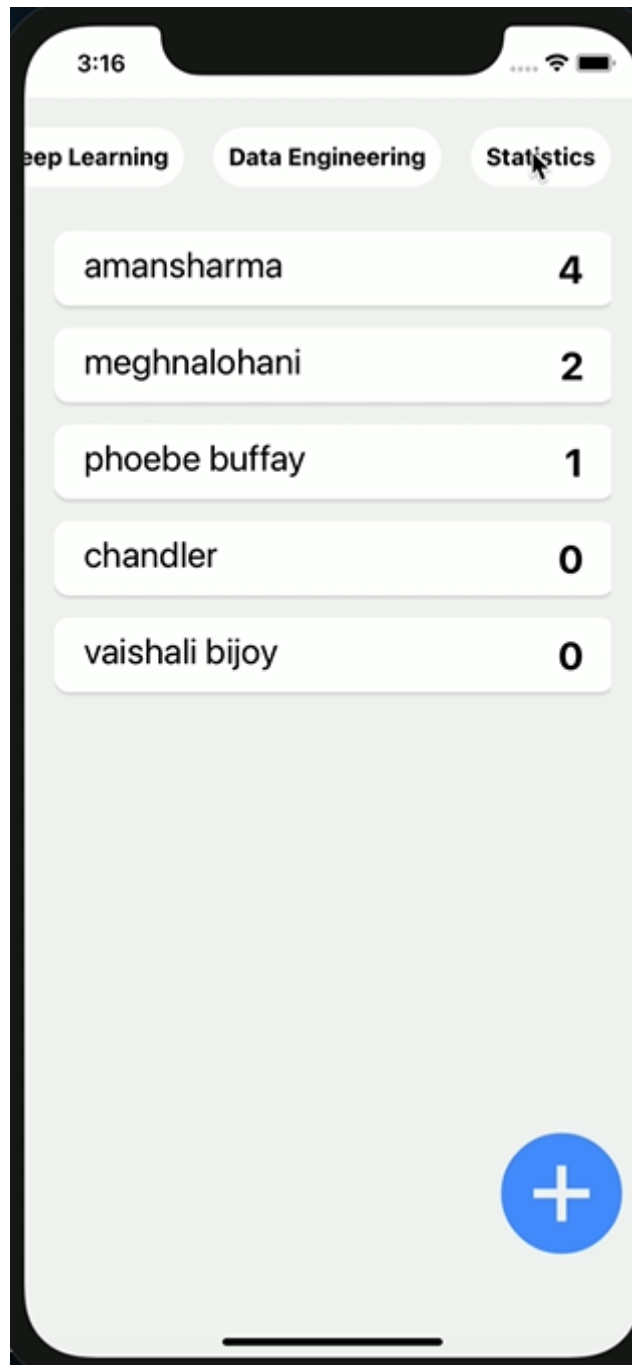


Figure 14 - GUI Output (Statistics Scores)

5 System Implementation

5.1 What is System Implementation [20]

In this chapter, we try to explain how the project will be implemented and made available to the users. The working and performance are then analysed according to the mode of implementation. Other standards are also applied according to the projects system implementation as stated in this chapter.

This is an important part of the process as is it is the main building block of the entire project. In this section, the objective is to make sure that our system is operational as required, with its core functions working correctly and all desired quality standards are met during the process of its implementation.

5.2 Application and Interface Outline

The Resume/CV Analysis System is implemented as a smart phone application, supporting the most common smart devices operating systems Android and iOS both. The application is available and can be installed on any smart device of choice. For its interface, the target to achieve was convenience for its any user, regardless being a technology expert or someone with only basic knowledge of smart devices. The interface is made as clear and understandable as possible. Although, we tried to design it to have as less complexity as possible, the application tries to provide knowledge for every step that may be seem a bit complex in the beginning.

5.3 Application Working Outline

There are different components/working ends of application that define the outline of its working capabilities and objectives.

5.4 Tools Used

- PostMan (For RestFull Service Testing)
- Pycharm
- Android studio
- Xcode
- Visual Studio (Optional)

5.5 Technologies Used

- React Native
- Django
- Java Development Kit (JDK)
- SQL Server

5.6 Development Environments Used [28] [29]

- Pycharm (For Backend Development)
- Android Studio (For Android Front-End Implementation)
- XCode (For iOS Front-End Implementation)

5.7 Computer Languages Used

- RXJS
- Python

5.8 Programming Algorithms Used

- Word2Vec
- JSON Serializer
- JSON De-serializer

6 System Testing & Evaluation

6.1 Introduction

Testing is a core of software quality assurance in organization [21][22]. The system testing is performed in three categories: one is unit testing, second is integral testing and third is overall system testing. All testing process are performed base upon test cases. it comes to security testing for mobile applications it is also some-thing that needs to be taken seriously. The more effective ways and more efficient testing is the major challenge in testing process. There are lot testing techniques and tools are available. But best and efficient practice ensure better quality and reduce cost. [21]

6.2 Approaches for Testing [22][26]

In this section, the test cases are defined for different functionalities. the approaches to testing have been specified through which the system have been evaluated. There are different approaches are described in this section. These test cases are defined into two major categories.

- Functional test case
- Non-functional test cases

6.2.1 Functional Testing [24]

- Unit testing
- Integration testing
- System testing
- Interface testing

6.2.2 Non-Functional Testing [23]

- Performance testing
- Load testing
- Reliable testing
- Usability testing
- Compatibility testing
- Volume testing
- Stress testing

6.3 Unit Testing [25]

In this testing, functions and basic components are tested. Unit testing is performed during system implementation process. Unit testing is a white box technique that is review by developers. If Unit testing is carried out properly it saves time and effort because it helps to fix bugs at early stage.

Test Case ID	TC01
Description	Tests the component, methods, functions
Applicable For	Functions. Methods,
Initial Conditions	Components are test during developing process.
steps	Task and expected Result
1	Code Review each component. PASS
2	Run each component: pass
3	Zip file is acceptable to upload. PASS
4	Check each GUI component. PASS
5	Parsing is of File. PASS

Table 2 - Unit Testing Test

6.4 Integration Testing

It is carried out to verify the behaviour of the system. This test is performed to check module interaction and integrity of the components. Integration testing is carried out after unit testing.

Test Case ID	TC02
Description	Test the integrity of the components
Applicable For	Similar Functions. Methods.
Initial Conditions	Component are tested with Unit testing
steps	Task and expected Result
1	GUI component integrity check. PASS
2	Backend algorithm integrity check: pass
3	Integrity between Front and backend. PASS
5	

Table 3 - Integration Testing Test Case

6.5 System Testing

In this kind of testing, the whole system is tested. This is done after integration testing. The main purpose of this testing to deliver a high-quality product.

Test Case ID	TC03
Description	Tests the whole system/app
Applicable For	Applicable for entire app
Initial Conditions	Integrity of component is tested
steps	Task and expected Result
1	Run the App. PASS
2	Upload zip File: pass
3	Check desire result. PASS
5	Parsing is of File. PASS

Table 4 - System Testing

6.6 Interface Testing

In GUI testing the application user interface is tested that either the application is working properly or not. This is done by carrying out a few tasks and comparing the obtained result with the expected result. GUI includes how different interface components like menu bar, dialogs, buttons, images etc. react to user interactions.

Test Case ID	TC04
Description	Tests the graphical user interface
Applicable For	android (5.0+), iOS (10+)
Initial Conditions	Equipment is set up as per requirements.
steps	Task and expected Result
1	Open the application. PASS
2	Verify that all button, interfaces are working properly. PASS
3	Check for the internal links are working properly. PASS
4	Verify that all the categories are working properly. PASS

Table 5- Interface Testing Test Case

6.7 Usability Testing [27]

The usability testing ensures that how much design is easy for users .it helps to identify design flaws and issues.

In this test, we aim to check for:

- that the users can complete tasks successfully
- the time to complete as task.
- that the user is satisfied by the working
- if any changes to improve the UI are needed
- if the app is easy enough to use
- further learnability

Case ID	TC05
Description	Usability testing of the system
Applicable For	android (5.0+), iOS (10+)
Initial Conditions	App in working condition.
steps	Task and expected Result
1	Open the application.
2	Verify that the button icons/texts are relatable by the user. PASS
3	Simple interface . PASS
4	Easy navigation. PASS
5	Verify that the user can easily complete all asks. PASS
Table 6.3: Usability Test Case	

Table 6 - Usability Testing Test Case

6.8 Performance Testing

In performance testing, the whole performance is measured. It identifies system speed, scalability, stability check system errors and so on. It is useful in some scenarios where quality and performance are mandatory in software. It highlights the failure points of the system.

Case ID	TC06
Description	Tests the performance of the application.
Applicable For	android (5.0+), iOS (10+)
Initial Conditions	Equipment is realistic base on requirements.
steps	Task and expected Result
1	Open the application.
2	Verify that the load time of the application Is Average. PASS
3	Verify that the response time of application to user input is small. PASS
4	Verify that the application can handle expected number of CVs. PASS
5	Verify that the application works well under slow connections. Fail

Table 7 - Performance Testing Test Case

6.9 Compatibility Testing

Compatibility testing is the type of software testing which is used to test whether the software can run on other hardware, operating systems, and mobile devices (android, iOS) etc.

Test Case ID	TC07
Description	Check compatibility of application with android and IOS on different devices
	.
Applicable For	android (5.0+), iOS (10+)
Initial Conditions	Set up Virtual environment.
Steps	Task and expected Result
1	.
2	Verify that the application can run on android. PASS
3	Verify that the application can run on ios 10 and later versions. FAIL
4	Verify that the application can run on windows phone. Fail
5	Verify that the application works on android different devices- . PASS

Table 8 - Compatibility Testing Test Case

Conclusion

6.1 Solution Application Areas

The main target of this project are individuals as well as organizations which are willing to offer jobs and hire employees. This project helps both parties, the employers, and the employees. The employer sets a specific criterion and finds the perfect person for the job. The employee on the other hand provides all their data and are informed if they are qualified enough and if there are other jobs that they should apply for.

6.2 Expertise of the Team Members

The team members are well equipped with basic to intermediate knowledge of all relevant courses as well as the programming languages and the software to be used throughout the project. All members are equally interested in the procedure as well as the final product of the discussed project.

6.3 Conclusion

The main objective is to satisfy the users of this application with its simplicity and convenience. The idea may be already in the working and we will use that foundation and upon it we will build a more accurate and user-friendly system that will provide the users with their desired results with minimum effort while having maximum usability convenience.

6.4 Limitations

As of currently, our application has the following limitations:

- The app has to be trained for each individual skill, so if a company wishes to add a skill after the initial set-up, the whole model will have to be trained for all the old skills plus the new skill(s).
- Currently, our app only supports CVs and Resumes in the PDF file format, since we have applied different programming methods which extract data and work best on pdf files. Also, to upload the CVs and Resumes, they have to be first compressed into ZIP format.
- Given that we are using NLP (Natural Language Processing), the process behind our project relies heavily on textual information. One drawback of NLP and such dependence is that, in case of higher keyword density, the app may fail to produce viable results and most probably halt.
- The application is not a complete system. It was intended to be a complete system in a sense that it allows the users, both employers and employees to have their personal management dashboards which could be accessed by their credentials through registration and login processes. This system would allow the employees to upload their CV/Resume by themselves, while giving them the ability to view their own scores and connect with employees using a chat service. Hence, this app was intended to be a personal portal as well as a management system for its users.

6.5 Future Enhancements

Our focus throughout the project has been to provide maximum convenience to the users of this application, regardless of their background being technical or non-technical. For this purpose, we aim to make this app much easier to use. Due to the whole pandemic situation, the collaboration of ideas as well as communication was disturbed, and we were faced with many problems, which lead to the limitations stated above. Our main priority now is to get rid of these limitations.

- We plan to automate the training process, making it easier for every company to customize the app as per different selection criterion among the same organizations. This will make it very easy to set up the application by different organizations for different purposes. We plan to add further customization options during the set-up process as well as after the process. This will make the application more personalized for different organization's needs.
- The application was intended to be a complete system of Human Resource Management among different employers and employees. So, we will keep working on adding many beneficial features, such as:
 - The ability to have personal dashboards/ control panels for both the employers and employees
 - This panel should be accessible using personal credentials, which will be provided after going through registration process by everyone. These credentials will then be used to log in to personal accounts. These accounts will show information regarding job applications and allow the employers to select the best applicant for their job. It will allow the employees to view the status of their submitted applications and the score of their CVs/ Resumes. This will help them improve their CVs/ Resumes accordingly.
 - The ability to communicate with each other shall also be added, which will let employees communicate with each other as well as with different employers (if allowed by those employers). This chat system will allow for better communication among both sides.
- We applied several different techniques, noticing the output accuracy and how they affected the overall working of the system. But as of now, most of these techniques are commonly used for (and hence, work best for) PDF file formats. We plan to configure this app to support many other file formats, which will require much more effort and the use of new techniques, but we are willing to make this product as better as it can be.
- We believe that by giving in a lot of effort, the error handling and management system can be further improved. We also aim at improving the overall process of the application, by trying new and suitable combinations of different programming methodologies and techniques.

References

- [1] Haamiz Ahmed (Jan 2020), [Online]. Available: propakistani.pk/people-in-pakistan-own-a-mobile-phone-report
- [2] cn.daxtra.com, Types of parser and how they work [Online]. Available: <http://cn.daxtra.com/what-is-cv-resume-parsing/types-of-parser-and-how-they-work.html>
- [3] resumeworded.com, Score-My-Resume [Online]. Available: (“<https://resumeworded.com/score>”)
- [4] tradingeconomics.com (2019), Pakistan unemployment rate, <https://tradingeconomics.com/pakistan/unemployment-rate>
- [5] Ihor Feoktistov, Agile Software Development Lifecycle Phases Explained [Online]. Available: <https://relevant.software/blog/agile-software-development-lifecycle-phases-explained/>
- [6] Jobs in Pakistan, Free CV Builder [Online]. Available: <https://jobee.pk/>
- [7] Vijay Sharma (), Importance of Internet in Business [Online]. Available: <https://www.klientsolutech.com/importance-of-internet-in-business/>
- [8] apply.dherst.gov.pg, Department of higher Education, Research, science, and technology [Online]. Available: <https://apply.dherst.gov.pg/Apply/Account/Login>
- [9] Educba.com (Dec 2019), Agile Methodology Useful in Project Management (Accessed on 24th Feb 2020) [Online]. Available: <https://www.educba.com/agile-methodology-in-project-management/> (Accessed24-Feb-2020)
- [10] <https://edu.pngfacts.com/> National Online Application System for School Leavers Through DHERST-2020 [Online]. Available: <https://apply.dherst.gov.pg/Apply>
- [11] Zhang Chuang, Wu Ming, Li Chun Guang, Xiao Bo, Lin Zhi-qing (31 March-2 April 2009), Resume Parser: Semi-structured Chinese Document Analysis [Online]. Available: <https://ieeexplore.ieee.org/document/5170487>
- [12] Zanyar Ali Ahmed, Mazen Ismaeel Ghareb (Aug 2018), An Online Course Selection System: A Proposed System for Higher Education In Kurdistan Region Government [Online] (Accessed on 5th May 2020). Available: <https://www.ijstr.org/final-print/aug2018/An-Online-Course-Selection-System-A-Proposed-System-For-Higher-Education-In-Kurdistan-Region-Government-.pdf>
- [13] Allan Robey, Kaushik Shukla, Kashish Agarwal, Keval Joshi, Professor Shalmali Joshi (2nd Feb 2019), Personality Prediction System through CV Analysis [Online] (Accessed on 5th May 2020). Available: <https://www.irjet.net/archives/V6/i2/IRJET-V6I2343.pdf>
- [14] IEEE Xplore (13th June 2014) 730-2014 - IEEE Standard for Software Quality Assurance Processes [Online] (Accessed on 28th May 2020). Available: <https://ieeexplore.ieee.org/document/6894541>
- [15] www.cs.hmc.edu/, Donald G. Firesmith, Use Cases: The Pros and Cons [Online]. Available: <https://www.cs.hmc.edu/~mike/courses/mike121/readings/reqsModeling/firesmith.htm>
- [16] www.techopedia.com , Juliano Rabelo, August 14, 2020 , Three-Tier Architecture [Online]. Available: (“<https://www.techopedia.com/definition/24649/three-tier-architecture>”)
- [17] www.visual-paradigm.com, What is Data Flow Diagram (DFD)? How to Draw DFD? [Online]. Available: <https://www.visual-paradigm.com/tutorials/data-flow-diagram-dfd.jsp>” (January 27, 2012).
- [18] Creately, Tools, Templates and Resources to Draw Sequence Diagrams [Online]. Available: <https://creately.com/diagram-type/sequence-diagram>

- [19] Career Consultants, Free CV Analysis Tool [Online]. Available: <https://careerconsultants.co.uk/free-cv-analysis-tool/>
- [20] SDLC Activity 8 – Implementation [Online]. Available: <https://sdlc.uconn.edu/activity-8-implementation>
- [21] IEEE Xplore, A walk through of software testing techniques [Online]. Available: <https://ieeexplore.ieee.org/document/7894499>
- [22] IEEE Xplore, Software Testing Techniques: A Literature Review [Online]. Available: <https://ieeexplore.ieee.org/document/7814898>
- [23] IEEE Xplore, A Framework for Non-Functional Testing Process of Mobile Applications [Online]. Available: <https://ieeexplore.ieee.org/document/8853813>
- [24] IEEE Xplore, Improving Coverage in Functional Testing [Online]. Available: <https://ieeexplore.ieee.org/document/4032274>
- [25] IEEE Xplore, Unit testing in practice [Online]. Available: <https://ieeexplore.ieee.org/document/1383101>
- [26] IEEE Xplore, An approach to software testing: methodology and tools [Online]. Available: <https://ieeexplore.ieee.org/document/810468>
- [27] IEEE Xplore, Usability testing and research [Online]. Available: <https://ieeexplore.ieee.org/document/1003706>
- [28] React Native Documentation, Setting up the development environment [Online]. Available: <https://reactnative.dev/docs/environment-setup>
- [29] Python Documentation, Using Python on Windows [Online]. Available: <https://docs.python.org/3/using/windows.html>