

Software Requirements Specification

Predictive Analytics on the Academic Record of NUCES

Version: 1.0

Supervisor	Dr Jawwad Ahmed Shamsi	
Project Team	Obaid ur Rehman	(17k-3848)
	Areeka Aijaz	(17k-3913)
	Tooba Shahid	(17k-3731)
Submission Date	14 th December 2020	

Document History

Version	Name of Person	Date	Description of change
1.0	Tooba Shahid	29th Nov 2020	Document Created
1.0	Tooba Shahid	30th Nov 2020	Added Overall description.
1.0	Obaid Ur Rehman	30th Nov 2020	External Interface requirements
1.0	Areeka Aijaz	6th Dec 2020	Added Non functional requirements
1.0	Obaid Ur Rehman	7th Dec 2020	Added Functional hierarchy
1.0	Tooba Shahid/ Areeka Aijaz	8th Dec 2020	Added Use cases

Distribution List

Name	Role
Dr Jawwad Shamsi	Supervisor
Mr Zeshan Khan Alvi	FYP Coordinator
Mr Abdullah Zarshaid	FYP Coordinator

Document Sign-Off

Version	Sign-off Authority	Sign-off Date
1.0	Supervisor	14 Dec 2020

Table of Contents

Introduction	5
1.1 Purpose	5
1.2 Document convention	5
1.3 Abbreviations	6
1.4 Intended Audience and Reading Suggestions	6
Overall System Description	6
2.1 Project Background	6
2.2 Project Scope	7
2.3 Project Objectives	7
2.4 StakeHolders	7
2.5 Operating Environment	7
2.6 System Constraints	8
2.7 Assumptions and Dependencies	8
External Interface Requirements	9
3.1 Hardware Interface	9
3.2 Software Interface	9
3.3 Communication Interface	9
Functional Requirements	10
4.1 Functional Hierarchy	10
4.2 Use Cases	10
Nonfunctional Requirements	14
5.1 Performance Requirements	14
5.2 Safety Requirements	14
5.3 Security Requirements	15
5.4 User Documentation	15
References	15
Appendices	15

Introduction

1.1 Purpose

The purpose of this document is to perform predictive analytics on the Academic record of FAST Nuces and integrate with the system, developing a web portal. The document will provide a detailed description of requirements and functionalities.

1.2 Document convention

? Main headings

Font: Calibri (Body)
Face: Bold, underline
Size: 24

? Text Subheadings

Font: Calibri (Body)
Face: Bold
Size: 22

? Description

Font: Calibri (Body)
Face: None
Size: 14

? Tables and images

Font: Calibri (Body)
Face: None
Size: 22

1.3 Abbreviations

NUCES	National University Of Computer and Emerging Sciences
FYP	Final Year Project
MERN	MongoDB , ExpressJs , ReactJs , NodeJs

1.4 Intended Audience and Reading Suggestions

- User

The user of this project will get an idea of the functionalities of the system.
The users of this project may be different academic institutions.

- Project Team

Project team will have a clear understanding of the user requirements, functionalities, functional and non functional requirements.

- Project Instructor

The instructor will be able to easily identify the proposed system together with the scope, requirements and functionalities that will help the instructor to grade the project.

Overall System Description

2.1 Project Background

Predictive analytics has become an influencing factor in improving educational experiences for students. The result of predictive analytics on academic record plays a big role in a way to achieve the highest level of quality of education. This analytics can not only be used to better understand student performance but also to boost graduation rates. Moreover , the predictive model may also help to identify the students who are subject to low performance at an early stage and do

the necessary intervention. Hence , early student performance prediction can help universities to take appropriate actions on time to improve the success rates of students .

2.2 Project Scope

Predictive Analytics is the process of using past data to make future predictions . The past data is used to capture important trends with the help of a mathematical model and the model is then used to make predictions on current data . We aim to perform predictive analytics on the academic record of NUCES . Our project will use the past academic record of NUCES to make insights and find out correlations between different attributes and then build a predictive model , based on the statistical inference , to make predictions on the current data. Finally we aim to integrate our analytics with a system , developing a fully functional web portal . The web portal will support the features such as importing data , query processing on data , visualizing data and predicting results .

2.3 Project Objectives

Our project aims to perform predictive analytics on the academic record of NUCES. Our project will use the past academic record of NUCES to make insights and then build a predictive model, based on the statistical inference, to make predictions on the current data. Finally integrate our analytics with a system, developing a fully functional web portal. The web portal will support the features such as importing data , query processing on data , visualizing data and predicting results.

2.4 StakeHolders

The primary stakeholder of this predictive analytics is the academic institution which in our case is FAST NUCES.

2.5 Operating Environment

- Operating System

It will work with any operating system.

- Processor
Pentium IV and above.
- Database
MongoDB.
- Platforms
Expressjs, Reactjs, Node.js.

2.6 System Constraints

- Hardware constraints:
System should be compatible with all the system architectures
- Cultural constraints:
System isn't compatible for all languages except English language.
- User constraints:
The software is being developed for FAST NUCES and can only be used by authorized personnel who will have the login credentials.

2.7 Assumptions and Dependencies

- While making predictions , the system assumes that the future will continue to be like the past. Therefore the system is dependent on the data being fed into the system , and assumes that important attributes for prediction are not missing , false or vague.
- The design is dependent on the format (template) of the academic data .

External Interface Requirements

3.1 Hardware Interface

- Main Server:
All server-side components must execute on server-class computers. All client-side components must execute on workstation-class and personal-class computers.
- External connections:
External connection is provided by means of Internet and/or private dialup access.

3.2 Software Interface

- Data Analytics
Data Analytics will be performed using R and Python.
- Frontend
For frontend, it will use “VS Code” for Reactjs.
- Backend
Backend will be developed using Node Js framework, Expressjs for Server and MongoDB will be used as a database.

3.3 Communication Interface

ExpressJS is used as the communication interface between database and web portal, internet browser.

Functional Requirements

4.1 Functional Hierarchy

- **Admin account sign up**

Academic institutions need to create an admin account and login in order to access the functionalities on the portal.

- **Import academic record**

Admin will import their student's data for processing , performing data analytics and prediction.

- **Data Visualization**

Data can be visualised in the form of bar graphs, box plots etc.

- **Query on the academic data**

Admin or user can view the desired subset of the data using filters.

- **Data Analytics**

Users can perform data analytics on past academic data to make useful insights.

- **Predict Student Performance**

The visual output will neatly show you the predictions on your data. Users can view the calculations and performance metrics of different models.

4.2 Use Cases

1.Sign up

Sign Up		
Use case Id:	01	
Actors: Admin of an institute		
Feature: Admin account sign up		
Pre Condition:	Admin must be an employee of an institute	
Scenarios		
	Action	Software Reaction
	1. Open portal	2. Portal displays sign up page
	3. Enter sign up Id	4. Validate Id

	5. Enter password	6. Authenticate password
	7. Press "Sign Up" button	8. The portal is refreshed & displays a dashboard.
Alternate Scenarios:		
2a: Server is not responding.		
3a: User types sign up id in invalid format.		
5a: User doesn't follow password constraints.		
Post Conditions:		
	Description	
	Users have a login id and can access the functionalities of the web portal.	

2. Import academic record

Import Academic Record		
Use case Id:		02
Actors: Admin of an institute / Manager Academics		
Feature: Importing Data		
Pre Condition:		Users must be Logged In. The dataset should be in required format.
Scenarios		
	Action	Software Reaction
	1. Go to the dashboard	
	2. Click on the “Import Data” option.	3. A page will be displayed showing the “Upload/Insert Data” button with Instructions.
	4. Insert Data	5. Asks confirmation before performing the action.
	6. Confirm The Action	7. Dataset is successfully uploaded.
Alternate Scenarios:		
4a: The dataset file is not in correct format (for eg jpeg , mp4 etc)		
Post Conditions		
	Description	
	Dataset is uploaded.	

3. Visualize your Data

Visualize your Data	
Use case Id:	03

Actors: Admin of an institute / Manager Academics		
Feature: Data visualization		
Pre Conditions:		User must logged in Data must be uploaded for further processing.
Scenarios		
	Action	Software Reaction
	1. Go to Dashboard	
	2. Click on “Data Visualization” option	3. System asks to select the data for further processing.
	4. Select the Data	5. System displays the graphical representation of the attributes in the form of bar graphs, box plots , charts etc.
Alternate Scenarios:		
2a: Server isn’t responding		
2b: Shows a warning message if data is not uploaded.		
Post Conditions		
	Description	
	System summarizes the dataset and shows graphs, charts representing different attributes of data.	

4.View Data

View Data		
Use case Id:		04
Actors: Admin of an institute / Manager Academics		
Feature: Query on the Academic data		
Pre conditions:		User must logged in Data must be uploaded for further processing.
Scenarios		
	Action	Software Reaction
	1. Go to Dashboard	
	2. Click on the “View Data” option	3. System will display the data tables along with the filters options
	4. Apply filters (If want to see the subset of data)	5. Query will be processed and displays the desired data.
Alternate Scenarios:		
2a: Server is not responding		
Post Conditions		
	Description	
	Data is displayed on the page.	

	Desired subset is displayed if filters are applied.
--	---

5. Analyze your Data

Analyze your Data		
Use case Id:	05	
Actors:	Admin of an institute / Manager Academics	
Feature:	Data Analytics	
Pre Conditions	User must logged in Data must be uploaded for further processing.	
Scenarios		
	Action	Software Reaction
	1. Go to Dashboard	
	2. Click on the “Data Analysis” option	3. System will display detailed summary of every attribute 4. Asks to select attributes to find correlation between them
	5. Select attributes.	6. Displays the graphs and relation between the attributes.
Alternate Scenarios:		
2a: Server is not responding.		
5a: Same attribute is selected to find relation.		
Post Conditions		
	Description	
	System will display detailed summary of every attribute	
	Displays the graphs and relation between the attributes.	

6. View predictions/ calculations of model

View predictions/ calculations of models		
Use case Id:	06	
Actors:	Admin of an institute / Manager Academics	
Feature:	Predict Student Performance	
Pre-condition:	User must logged in Data must be uploaded for further processing.	
Scenarios		
	Action	Software Reaction
	1. Go to Dashboard	

	2. Click on "Predict performance" option	3. Displays the Prediction results and performance metrics of the model with the best accuracy. 4. Option to select different models to see their Prediction calculations.
	5. Select the model.	6. Displays the Prediction results and performance metrics of the model.
Alternate Scenarios:		
1a: Server is not responding.		
Post Conditions		
	Description	
	Displays the Prediction results and performance metrics of the model.	

Nonfunctional Requirements

5.1 Performance Requirements

- Speed:
Depends on the bandwidth and service available to the user.
- Precision:
The data delivered is accurate with no variations.
- Capacity:
Records of various medicines can be maintained as there is no overlapping of records.

5.2 Safety Requirements

Backup is maintained for safety purposes. The damage to the data and the server is provided by regular surveillance of the system. This is to save the system from any malicious activities that can be carried out.

5.3 Security Requirements

For security reasons not every user is allowed to access all the data. Each user is provided with a login user id and password to protect the data. By providing login and password, unauthorized access to data cannot be made.

5.4 User Documentation

A complete document will be provided to an institute about the proper functioning of the system. It will include the conditions and constraints. The technologies such as the frontend and the backend will also be defined.

References

1. Hajra Waheed , Saeed-UI Hassan , Julie Hardman , Salem Alelyani , Raheel Nawaz , “Predicting academic performance of students from VLE big data using deep learning models” , Volume 104, March 2020
2. Eyman Alyahyan , Dilek , “Predicting academic success in higher education: literature review and best practices” , International Journal of Educational Technology in Higher Education , 10 February 2020
3. Muhammad Yunus Iqbal Basheer, Sofianita Mutalib, Nurzeatul Hamimah Abdul Hamid, Shuzlina Abdul-Rahman, Ariff Md Ab Malik , “Predictive analytics of university student intake using supervised methods” , IAES International Journal of Artificial Intelligence , Vol. 8, No. 4, December 2019, pp. 367~374
4. Sonali Rawat , “Predictive Analytics for Placement of Student- A Comparative Study” , International Research Journal of Engineering and Technology (IRJET) , Volume: 06 Issue: 06 , June 2019
5. Ashish Dutt , Maizatul Akmar Ismail , Tutut Herawan , “A Systematic Review on Educational Data Mining” , IEEE Access , Volume: 5 , January 2017

Appendix A

Development Tools & Technologies

A.1 MongoDB

MongoDB is a cross-platform document-oriented database program. Classified as a NoSQL database program, MongoDB uses JSON-like documents with optional schemas. MongoDB is developed by MongoDB Inc. and licensed under the Server Side Public License.

A.2 Express

Express.js, or simply Express, is a back end web application framework for Node.js, released as free and open-source software under the MIT License. It is designed for building web applications and APIs. It has been called the de facto standard server framework for Node.js.

A.3 React

React is an open-source, front end, JavaScript library for building user interfaces or UI components. It is maintained by Facebook and a community of individual developers and companies. React can be used as a base in the development.

A.4 Node

Node.js is an open-source, cross-platform, back-end, JavaScript runtime environment that executes JavaScript code outside a web browser.

Appendix B

Data Analytics Tools & Technologies

B.1 R studio

RStudio is an integrated development environment for R, a programming language for statistical computing and graphics. It is available in two formats: RStudio Desktop is a regular desktop application while RStudio Server runs on a remote server and allows accessing RStudio using a web browser.

B.2 PyCharm

PyCharm is an integrated development environment used in computer programming, specifically for the Python language. It is developed by the Czech company JetBrains.

B.3 R

R is a programming language and free software environment for statistical computing and graphics supported by the R Foundation for Statistical Computing. The R language is widely used among statisticians and data miners for developing statistical software and data analysis.

B.4 Python

Python is an interpreted, high-level and general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace.