ÇANKAYA UNIVERSITY
FACULTY OF ENGINEERING
COMPUTER ENGINEERING DEPARTMENT

Project Report
Version 1

CENG 407
Innovative System Design and Development I

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<What Will My GPA Be? >

Efnan Gülkanat
201311021
Meltem Daşdemir
201311014
Sergen İspir
201311026

Advisor: *Prof. Dr. Erdoğan DOĞDU*

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Abstract

Today with Machine Learning and other statistical methods, we can understand and find patterns from big data. In this case, we are going to discuss that how student data would be useful for academic success and result of other related works. In detail, early intervention in academic life helps students to change their course of education and graduate early with better grades. In this project, we used to help universities to understand their students and teaching efficiency in their institutions by learning from data and also administrators to cope with advising students efficiently. We will develop a software tool which is analyzing and visualizing data from past student enrollments in classes and their grades. For this purpose, we are going to use different kind of machine learning algorithms for classification and regression problems in python environment and Kibana for visualizing data. Furthermore, we are going to try to improve and analysis past works accuracies.

Key Words:

Machine Learning, Kibana, Visualization, Python, Analyses, Classifications, Regression, University Information System

Özet

Makine Öğrenimi ve diğer istatistiksel yöntemlerle, büyük verilere ait kalıpları anlayabilir ve bulabiliriz. Bu durumda, öğrenci verilerinin akademik başarı ve diğer ilgili çalışmaların sonuçları için nasıl faydalı olacağını tartışacağız. Ayrıntılı olarak, akademik hayatta erken değişiklikler yapılması, öğrencilerin eğitimlerine yön vermelerine yardımcı olur. Bu projede öğrencilerin verimli bir şekilde bilgilendirilmesine yardımcı olmak için üniversitenin verilerden ve yönetici bilgilerinden verileri öğrenerek, öğrencilerin akademik etkinliklerini öğrenmelerinde yardımcı olduk. Mezun ve mezun olmamış öğrenci kayıtlarından gelen veriyi analiz eden ve görselleştiren bir yazılım aracı geliştireceğiz. Bu amaçla Python ortamında sınıflandırma ve gerileme problemleri için farklı türde makine öğrenme algoritmaları kullanacağız ve veriyi görselleştirmek için Kibana kullanacağız. Ayrıca, geçmişteki çalışma doğruluklarını iyileştirmeye ve analiz etmeye çalışacağız.

Anahtar Kelimeler:

Makine öğrenimi, Kibana, Görselleştirme, Analizleme, Python, Sınıflandırma, Regresyon, Üniversite Bilgilendirme Sistemi

1. Introduction

1.1 Motivation

We are a group of senior students in computer engineering department who are interested in machine learning and big data. Our purpose is combining machine learning with our department information such as course grades, students' success, fail rates and etc. We try to enhance student success to show us their future GPAs or course grades. Some of the project members have taken the course of data mining. Besides machine learning, our project includes Database Structure and Web development. We use the Python programming language because it is useful, understandable and very suitable for our project. In order to do our project well, we tried to study various materials, research about the design and to strengthen the programming language.

1.2. Related Work

As listed below there are three applications for the prediction student success.

1. Georgia State University (GSU)
2. Maryland University College (PASS)
3. An Application in the University of Dartmouth

These all three projects aimed to able to predict the success of students. The first GSU project is about the graduation rates. They aimed to increasing of the university graduation rates. The second PASS project aimed to monitor academic progress identifies success factors, and implements interventions that encourage student success and the last project aimed to discover what influences students' grades. We explained these projects in the Literature Search section.

2. Literature Search

2.1 Big Data Analyses and Big Data to Improve Graduation Rates

Educational software development has become important for students' academic and social life. One of the aims of academic evaluation is to determine which student needs to help. For this purpose, the ability to collect unique data using technology has become more accurate and less burdensome.

2.1.1 Three ways to Collecting and Analyzing Data

Academic research suggests that technological tools can predict results by collecting or analyzing data according to three different categories. One way to estimate the results is to measure how much the students use the curriculum materials; For example, a study conducted by Reynol Junco of the State of Iowa investigated whether working with online textbooks would predict class

outcomes. Using data from more than 200 students in 11 college classes [1] he found that students could predict the performance of the number of days they used the course book, which was actually a better predictor than previous lecture notes. Another recent research led by Nynke Bos from the University of Amsterdam [2] also suggests that the time spent watching online lessons can also predict course outcomes when combined with participation in classes. These two studies show that a student's prior knowledge of the class can provide a warning.

A second way to predict student outcomes is to focus on student involvement. This survey, which includes data from learning management systems (LMS), shows that regardless of whether someone has opened a book or not and that certain behaviors (such as sending a message) may be indicative of future learner performance. Another example came from a group of researchers led by Andrew Krumm; one step further, LMS data was used to design early warning systems for university students in the STEM program. In their assessment [3] they found evidence that using LMS data to place students in different need categories improved the cohort average GPA over a period of three years.

The most difficult technological (and computational) success is actually estimating the results of the students by evaluating the knowledge of the students. In a new study led by Stanford's Paulo Blikstein, they investigated whether machine learning algorithms could predict computer science course grades based on the progress of a student's code at a single assignment. Algorithms - usually a cluster analysis algorithm - are simply grouped according to how the students change their codes to one another without trial. After examining how the computer grouped the students, the researchers found that a group contained a code that gradually improved, while another group could easily determine that it contained codes that always entered the barricade. The link between these group classifications and the final lecture notes was not overwhelming, but researchers have found evidence that the information provided by the machine learning algorithm predicts course outcomes. In particular, students [4] with better codes (separated by categorization by algorithm in one assignment) performed 7.9% better on average in classroom midterms for students with weak class codes. These surveys enable teachers to better understand their students without making additional assessments.

2.1.2 Many Factors of effecting GPA

Paul Gore, who presided at the University of Utah with a predicted analytical issue, joined to webinar in prestigious mid-west university. This webinar's topic is related to how university to use data to predict student success. According to the webinar made, it is possible to reach the information of the student, the average of the high school, the information about the preparation scores. The Student Management System [5] is one of these sources . It controls the degeneracy of the student. Controls the interaction of the learner with his classmates, the assignments he/she has submitted, and the homework assignments he/she has not visited. The information system has developed in detail to reach the knowledge of the learners. Where the studies were willing to share, the fitness measures of the predictive models look pretty good, achieving classification

success rates in the 70% to 80% range. Interpretations in the social media affect the success of the student. These interpretations are thought to be related to factors affecting the school life and affect the graduation. The goal of each study is different. There are common elements when looking towards a goal. In the first semester the area is equipped with elements such as GPA look, specific courses offered. Paul, who heads the University of Utah, said that there are some categories that are effective in the success of the student. The researcher noted that the academic interests and responsibilities of the learners, academic effectiveness, educational commitment, and participation in school activities affect GPA and its success. It was understood that measuring the success of a student would be easier if these elements were noted. In a study conducted at a seminar, the GPA and read achievement were influenced by the fact that there were many factors affecting the student in the research and by showing the way to success, increasing the motivation of the students.

2.2 Models of Predictive Students Success

In this part of the literature we will mention that how universities use big data and what applications to prediction student success.

Table1. List of projects

University	Project	Data	Results	Purpose
Georgia State University	GPS(Graduation and Progression Success)	Analyzed 2.5 million grades earned by students in more than 10 years of courses	The University graduation rates have increased by 6 points since 2013 and Graduates take lessons half a semester ago and also they are limited to spending about $ 12 million.	To better utilize the time of advisers in college and to get more students from the finish line and create a list of factors that affect the chance of graduation
Maryland University Collage	PASS (Predictive Analytics for Student Success)	All students who enrolled in Spring 2015 and Spring 2012	Tool can correctly classify 76.8% of students as having a first class GPA success.	Following academic progress and completion of community transfer students, identifying success factors, and implementing interventions that encourage student

				success.
University of Dartmouth	SmartGPA	Thirty of the University students collected behavioral data	The results are GPA can be affected by where and how students spend their time and also the predicted GPA strongly correlates with the facts obtained from students' transcripts ($r = 0.81$ and $p < 0.001$) and estimates the grade average within ± 0.179 of the reported grades.	They show that with smartphone information, there are a number of important behavioral factors that are significantly related to the term and collective GPA, including time series analysis such as activity, speech interaction, mobility, class participation, learning and party.

The projects are explained in detail below.

2.2.1 Georgia State University (GSU) Project

In another research on large data research, it was investigated how university graduation rates could be increased. The Georgia State University (GSU), who conducted this research, analyzed 2.5 million grades earned by students in more than 10 years of courses in order to establish a list of factors affecting their chances of graduation by working with Education Advisory Board (EAB), an external consulting firm. EAB then developed an early warning system for Graduation and Progression Success (GPS). The system is updated daily and includes a number of alerts that help advisors keep students on the road before graduation. For example, if a student does not receive a satisfactory grade that he needs, the advisor will be alerted. Timothy M. Renick, a GSU vice-president who leads the project, gives this example [6]: In the first political science class, A or B's area graduates 75% in political science. If you get a C, your chances are down to 25 percent. With this practice, students have begun to plan together with their advisors to get additional teacher help, get a summer class, or perhaps change the main branches. As a result of this research, school graduation rates have increased by 6 points since 2013. Low-income, first-generation and minority students have closed their graduation rate recognition.

2.2.2 Predictive Analytics for Student Success(PASS) Project

The Predictive Analytics for Student Success(PASS) project is one of the models for predicting students' success. While researching and completing the Pass Project, University of Maryland University College (UMUC) partnered with two colleges. These are Montgomery College (MC) and Prince George's Community College (PGCC). The aim of the PASS project [7] is to: monitor the academic progress and completion of community transfer students, identify success factors,

and implement interventions that encourage student success. The project consists of three phases. Each phase is built on the results of the previous phase so that research development and comprehensive analyzes are maintained. Within this project, the Success Calculator was developed as a consulting tool based on an estimated model of student achievement. The First Term Success Calculator uses students' demographic data and course-taking behaviors to predict the probability of gaining a GPA of 2.0 or higher during the first semester of the UMUC. Within the project, predictive modeling was used to create models related to significant milestones in students' academic orbit; including a successful first-term GPA, re-enrollment, continuity and graduation.

2.2.3 An Application in the University of Dartmouth

Andrew Campbell, a computer research professor, found in his research that there was no relationship between students' class continuity and their grades. Thus, Campbell agreed with the University of Darthmouth to discover what influences students' grades. He has developed an application where thirty of the university students collect behavioral data. Thanks to this application, students can learn GPA based on where and how they spend their time. Campbell says [8] "Students who spend more time without distraction will fare better at school.". It was created to think of how a practitioner who predicts GPA will create a competitive environment in universities where and how the learners spend their time. GPA was created to think that a practitioner would create a competitive environment in universities about where and how students spend their time. Campbell is planning to test in a larger group of students at the University of Texas in Austin next semester. This application exemplifies a project in which data analysis is used to increase student success and graduation rates. Finally, Campbell says companies can do such data analysis to see if employees are productive.

2.3 Methods for Using Predictive Analytics for Student Success

The application rate in higher education increased, business intelligence techniques were applied. Predictive analytics is used in higher education to manage finance, operations, tools and equipment. Predictive analytics is focused on student success in higher education. For higher learning and success in schools, it is necessary to identify specific students and determine their performance. Reliable results are obtained when asking the right research results when performing predictive analysis because it contains certain rules. Predictive analytics [9] is used to push students with predicted skill levels based on test results rather than personal passions and interest. In order to keep students engaged, you must accelerate, automate and optimize your student retention strategies to support them. Maximize your student recruitment with a range of specialist services from QS Enrolment Solutions (formerly Hobsons Solutions). Hobsons is working on student-focused work to encourage many students to succeed. The student has been following regularly since the first year. Even if the students are technically ready, they see themselves at the middle school level. Hobsons aims to change this solution by presenting career advancement solutions to the second-year students until graduation. The students are expected to graduate with regard to the student. The students must make sure that they have achieved their student's success and permanence through strategic record management when applying. This has helped to increase student achievement and make predictions by controlling the student. Hobsons

has determined the GPA ratio by increasing the motivation of students with various applications, especially graduate students.

2.3.1 Considerable Five Methods for Using Predictive Analytics for Student Success

There are many important considerations that we need to look into and investigate when starting the journey of using predictive analytics to support student achievement. In one study, it was emphasized that analytics based on guessing are some important points that need to be carefully considered in order to be based on morality. They are explaining more detail five guiding practices into report.

First one is that have a vision and plan. Developing a vision and plan for data use will help guide an estimated analytical effort. Without such planning, intelligent analysis can be used to do more harm than good harm to students.

Second one is that Build a Supportive Infrastructure. A supportive infrastructure [10] ensures that the analytical benefits of the project are understood and welcomed by the university stakeholders and that processes and other support are performed to assist the data effort.

The third guiding practice is that work to ensure proper use of data. Data is required for estimating models and algorithms. Consider the quality of privacy and security issues as well as the interpretation of your data and data in order to ethically create and use the results of these models and applications.

The fourth guiding practice is that design predictive analytics models and algorithms that avoid bias. It is important that predictive models and algorithms are built to reduce prejudice and test for correctness. Also, be sure to match the vendor with the vendor who can promise to design it so that it does not intentionally code the bias and can be tested for accuracy and the final guiding practice is that Meet Institutional Goals and Improve Student Outcomes by Intervening with Care. Develop the institution’s goal by ending the product and intervening in a positive sense of these objectives with the results of the students.

In the meantime, the personnel involved in the intervention in the institution should be trained in how to respond appropriately and test the effectiveness of the interventions once deployed. Another resource to consideration before the predictive analytic success is that IPASS-Predicitive Analytics Checklist. This list [11] is a checklist of these matters. It is one of the applications in EDUCAUSE. As a result of these ethics and methods, it is very important to careful about predictive student success.

2.4 Predicting Student Success with Machine Learning

Machine learning is one of the most popular approach today that understand patterns from data and there are lots of different areas that working with machine learning. Machine Learning algorithms are powerful tools which can obtain remarkable results from big data. In this section, firstly, we are going to mention about data which can usable for predict student success and secondly, some related works about machine learning and results of them.

2.4.1 Data for Predicting Student Success

For this project, our data contains graduated students transcripts but other researches and related works in this area shows that students grades are not only determinant to estimate. Many different factors or attributes would useful to increase correctness, make a prediction or support original data. In addition, any attribute can be the most significant one.

Reynol [1] hypothesized that digital textbook usage data can predict students' course grades with using linear regression analyses and more than 200 students' data. Moreover, he found that usage of digital textbooks data was better predictor than students' previous course grades. Also, factor of time spent reading was better predictive for course grades. Nynke [2] suggests that data of time spent on watching online courses, can also predict outcomes of students' exam performances. Leah [3] examined students' online activities to predict academic success and researchers found 15 variables such as number of mails sent and number of discussion messages posted that correlation with students' final grades using regression modeling. Further, model identified 81% of students' who fails on course.

Table2. Different factors on success

Study	Attribute/Feature	Result
Reynol [1]	Digital textbook usage, time spent on reading	Found that digital textbook usage and time spent is better predictor than previous grades
Nynke [2]	Time spent on watching online course	Time spent can be usable on exam performances
Leah [3]	Student online activity	Found 15 variables that related with final grades and identified 81% of failed students on certain course

2.4.2 Machine Learning in Practice

In this part, some related works explained in detail.

A study from Stanford University, Martin, Sharon and Chinmay [12] attempted to construct a value-predictor that predicting grade of a student for a given course using Support Vector Machines (SVM) and Collaborative Filtering (CF) techniques on Matlab environment and taken data from CourseRank recommendation system which is contains information of anonymized students' transcripts and courses. In general, there were four key features; Previous course history, recent grades by department, students' major and concurrent courses. Also, while students' major was a most significant predictor for a particular course, students' previous course grades was the predictor for another course. Results of this study that neither SVM and CF provide better grade predictions than an estimate of the average grade of each student.

Another research from Information Technology University (ITU), Lahore, Pakistan evaluated students' academic performances in Electrical Engineering Department. Researchers [13] says that machine learning techniques would help to students' for improve their performance in different courses and predict students' GPA in registered courses. They analyzed 225 undergraduate student data on different techniques; Restricted Boltzmann Machine (RBM), Collaborative Filtering and Matrix Factorization (MF) which is very popular approach in recommendation systems to systematically analyzing. The dataset contains features such as high school percentage, entry test scores, course credits and so on. Additionally, they have mentioned some limitations of this study. Limited dataset used for study and root mean squared error (RMSE) can predict more clear if there are more information of students' GPAs. They found that RBM was better technique to estimate students' performances in courses.

University Sains Malaysia has provided an overview to predict students performances using data mining techniques and they also focused on that how this techniques can use for identifying the most significant attributes in data. In Malaysia, usually final grades which is based on course structure, final exam score, assessment mark and extracurricular activities have used for evaluate to student performance. They [14] proposed a systematical review to support main objective of study which contains identifying the gaps in existing prediction methods and the variables used in analyzing students performance, to study the existing prediction methods for student performance. In study, they shows a list of attributes and list of methods used in prediction students' performance. Neural networks are used for high school background, internal and external assessments and student demographics. K-Nearest Neighbor, Naive Bayes and Support Vector Machines are used for internal assessments, cumulative grade point average(CGPA), extra-curricular activities and Decision trees for many attributes such as scholarship, social network interaction, assessments which has been used the most often and psychometric factors that is identified as student interests, study behavior, engage time and family support. At the end of the study, they found that the most effective method was neural networks. Accuracies of methods are 98% with Neural Networks followed by Decision Trees by 91%, Naive Bayes gave lower prediction accuracy with 78%. Lastly, K-Nearest Neighbor and Support Vector Machines with 83% accuracy obtained. They also mentioned that result of this work depending on features or attributes that were used. Neural Networks gave highest prediction because of internal and external assessments. With only one attribute, NN's accuracy was decreased by 1%.

In another project about this topic, three different machine learning algorithms have used to measure student performance. These are Linear regression, Decision trees, Naive Bayes classifier. In the linear regression method, there is a scoring system for the age of the student and whether they passed the exam[15]. One (1) for past students, zero(0) for past students. The regression algorithm can find approximate values and graph the results. In the regression algorithm, the acceptable value can be between 0 and 1. Decision trees, the age of a student, and GPA, are measured. The value of the test is based on the age and the group. The success of the student is estimated by reaching the result by defining independent variables from each other in the decision tree. The success of the student is estimated by reaching the result by defining independent variables from each other in the decision tree. It uses the P (A \ B) formula to find out the probability. It calculates the achievements of people using age and GPA. It compares the likelihood of transition from 0 to 1 using the same data. Different algorithms have used in the result finding section.

Table3. List of studies in detail

Study	Purpose	Data	Method(Success Rate)
Hunt, Lin & Kulkarni [12]	Predict student grades using transcripts and courses	CourseRank recommendation system data	Support Vector Machines, Collaborative Filtering
Iqbal, Qadir, Mian, Kamiran [13]	Evaluate student performance and predicting GPA for a certain course	A real-world data contains 225 undergraduate student from Information Technology University	Restricted Boltzmann Machine, Collaborative Filtering, Matrix Factorization
Shahiri, Husain, Rashid [14]	Overview for predicting student performance and trying to find most significant attribute	Unknown Data	Neural Networks (98%), Decision Tree (91%), Naive Bayes (78%), K-Nearest Neighbor (83%), Support Vector Machines (83%)
Pojon [15]	Predict students' GPA	Unknown Data	Linear regression, Decision trees, Naive Bayes classifier
Blikstein, Worsley, Piech, Sahami, Cooper, Koller [4]	Estimates for identifying successful students	Unknown Data	Clustering analysis
Vorhies [5]	Using data to predict the success of students	The Student Management System Data	Classification model

2.5 Applications

The table below shows the purposes of the applications, what data they are doing with it, and which machine language method they are using.

Table4. List of applications in detail

Goal	Works	Data	Method	Success Rate
Predict Gpa	1.Pass project	All students who enrolled in Spring 2015 and Spring 2012	using data mining, predictive modeling, including cluster analyses and logistic regression	Tool can correctly classify 76.8% of students as having a first class GPA success.
	2.SmartGPA	The dataset is collected from 30 undergrads and 18 graduate students over a 10-week term in spring 2013	Data mining	The predicted GPA strongly correlates with the ground truth with $r = 0.81$ and $p < 0.001$.
	3.GPS Project	Analyzed 2.5 million grades earned by students in more than 10 years of courses	Unknown	In addition, during the 2012-2013 academic year, the total number of undergraduate students increased by 9% for a 4-year graduation.
Monitor and model student progress in institutions	1.Pass Project	First-year university students were randomly assigned to the control group (n =	predictive models and data mining techniques	Test-Control GPA 2.70 2.66 Successful Course Completion 78% 69% Re-Enrollment 74% 75%

		33) and the test group (n = 90), transferred from MC and PGCC.		
	2.SmartGPA	The dataset is collected from 30 undergrads and 18 graduate students over a 10-week term in spring 2013.	Web usage mining	r = −0.398, p = 0.029
Predict Graduation	1.Pass Project	first semester of transfer to UMUC was between Spring 2005 to Spring 2012	using data mining, predictive modeling, including cluster analyses and logistic regression	Effect size measures suggest that between 20.0%, according to Cox and Snell's R2, and 26.7%, according to Nagelkerke's R2

3. Software Requirements Specification

3.1 Introduction

3.1.1 Purpose

This document describes a system capable of estimating the objective GPA Prediction. There are different conditions for teachers and students in GPA prediction.

In this system, students have the option of calculating future GPA through old lessons' grades and also the system allows students to choosing only one lesson and calculating new final score through just this choosen lesson. On the other hand, the system does not always calculate GPA or

notes, it can give advice through these calculations and it warns students who cannot graduate because of fail lessons and students who are below a certain grade average.

In terms of teachers, the system aimed to inform about previous lessons information including who passes, fails, lesson grades or students' informations with graphs. Especially department head,faculty head or rector can be used our system. They can do what the teachers can do. This document contains information on the following topics. The identified headings specify the specified functions and details of the work to be performed. Otherwise, the SRS document describes the functions and activities of persons using the GPA system. This document describes how stakeholders' needs are addressed.

3.1.2 Scope of Project

Students often want to have future knowledge of the notes. In addition, teachers may want to be informed about GPA or previous lessons' letter grades and also in universities, there are worries caused by student grades and uncertainty. In the system, teachers can have knowledge about GPA estimation. A system for estimating GPA was developed to remove the problems for teachers and students.

The goal of the GPA estimation system is to create a guide that can be answered by the questions, which may be information for teachers, students and students. Teachers and students use this system by making different entries. Students need to find e-mails and passwords in order to access the system. It is possible for teachers to input by e-mail to the stakeholder. Teachers have detailed information about the lessons of students from past years after they have been logged in.

The GPA system has two user entrances, teachers and students. After entering the user, there are different options for teachers and students. When they enter, teachers can reach all informations about past years. They can reach all of students' grades, lessons' informations and they can access the graphs based on years of students' GPAs. Students can calculate their average from next year, or choose a course and system calculates final score through just this chosen lesson. Also, they can be warned by system to working hard more through graduation or their GPA's. Each section going to provide an advice after make prediction. In other words, the fact that students know their future is important to them. For example, if the system calculates a low GPA, the student may be aware of his / her situation and then he / she can fix it and work more. So knowing GPA in advance affects how they will perform in lessons in the future. On the other hand teachers reach the informations about the previous lessons' with students' success or failures and also they can reach statistical data with graphics or lists of lessons' informations.

3.1.3 Glosarry

Term	Definition
Participant	The user who interacts with the web address of GPA Prediction. Generally departmenthead,facultyhead, rector or students of the Cankaya University
Stakeholders	Any person who has contribution in the project
Web Site Environment	The environment that allows students learn new GPAs or allows to other important persons to show old lessons' informations and graphics
Data of students	Students' personal informations and also their grades in lessons
Data of previous lessons	All informations about previous lessons. For example, letter grades, how many people passed or failed, graphics of the success rate or failure rate and etc.

3.1.4 Overview of the Document

The second part of the document describes functionalities of our project. Informal requirements are described and it is a context for technical requirement specification in the Requirement Specification chapter. Requirement Specification chapter is written for software developers and details of the functionality of the project are described in technical terms.

3.2 Overall Description

3.2.1 Product Perspective

GPA Prediction: It is a web-based program that allows students to learn future GPAs and also allows teachers or other workers learn previous lessons' all informations with graphics or lists. The project divided into two parts: student mode and teacher mode. Student mode allows student learn future GPAs. Students enter previous lessons' letter grades then the system calculates new GPA or student choose a lesson and the system calculate new final score through just this choosen lesson. After each calculation the system provide an advice to students or alert students. Teacher mode allows teachers to learn previous lessons' informations with graphics and lists and also they can learn all informations about choosen students. On the other hand, they do everything that students can do.

3.2.1.1 Development Methodology

For developing the project, we have planned to use Scrum which is an agile software development methodology. Agile development is opened to change and also ıt allows high level of team communication, fast and continuous product delivery, test-driven understanding and simple and realistic planning. It is incremental and iterative development. Scrum is based on short cycle output generation and feedback thought. It is aimed primarily at developing important requirements for the project. It can easily apply the changes needed throughout the project time. One of Scrum's innovations [16] is the graph of the remaining features / number of days past, showing the progress of the project clearly and continuously. All activities inside the Scrum take place in Sprint. Every Sprint includes tasks which has own story points and risk points. Development team should have a daily meeting every morning which should be maximum 15 minutes. Product owner is the person who delivers the requirements. Development team is the group of developers who work on the project according to schedule. Thanks to constant feedbacks, it is easier to cope with changes. Sprint is very important feature for Scrum methodology. At the end of each sprint, a part of project has been completed and it has been presented to customer for validation. Thanks to all advantages, Scrum methodology is more proper to our project.

3.2.2 User Characteristic

3.2.2.1 Participants

3.2.2.1.1

Participant must be a student, teacher, dean, warden of the Cankaya University.

3.2.2.1.2

Participant must read and understand Turkish language due to simulation language is Turkish.

3.2.2.1.3

If participant is a student, he or she must enter at least the first term letter grades.

3.3 Requirements Specification

3.3.1 External Interface Requirements

3.3.1.1 User interfaces

The user interface will be worked on web application.

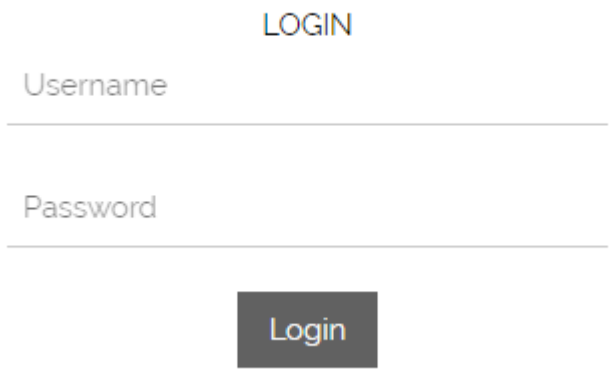

Figure 1 Login Panel

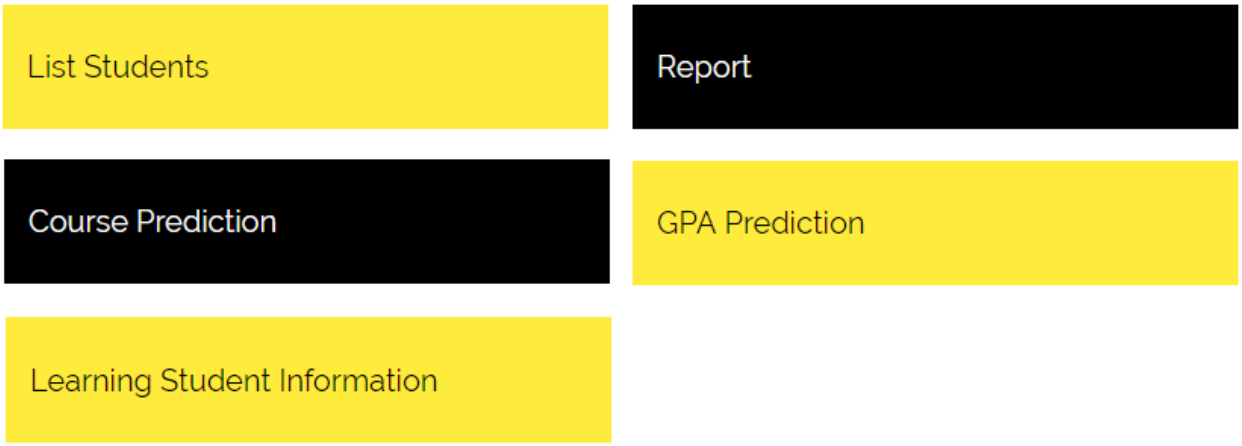

Figure 2 Admin Control Panel

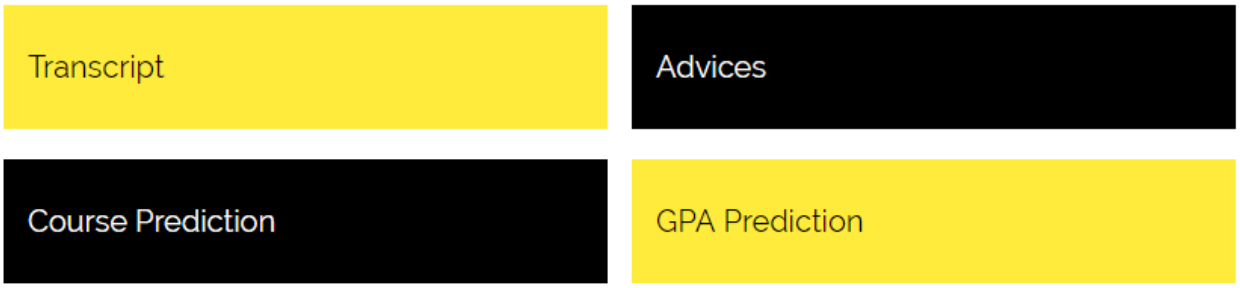

Figure 3 Student Panel

COURSES	CREDIT
CENG290	2 2 3
ENG222	2 0 2

Predict

Figure 4 Course Prediction Panel

COURSE	CREDIT	GRADE
CENG 191	2 2 3	AA
PHYS 131	3 2 4	CB
TURK 101	2 0 2	BB
CENG 111	3 2 4	DC

Predict

Figure 5 GPA Prediction Panel

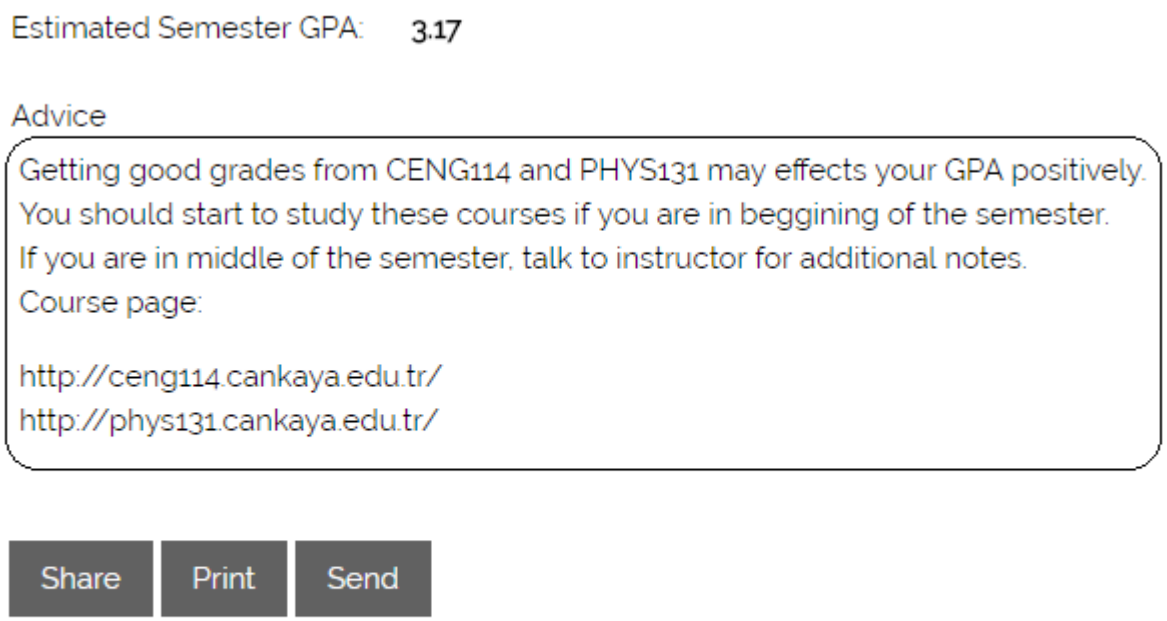

Figure 6 Result and Advice Panel

3.3.1.2 Hardware interfaces

There is no external hardware interface requirement.

3.3.1.3 Software interfaces

There is no external software interface requirement.

3.3.1.4 Communications interfaces

There is no external communication interface requirement.

3.3.2 Functional Requirements

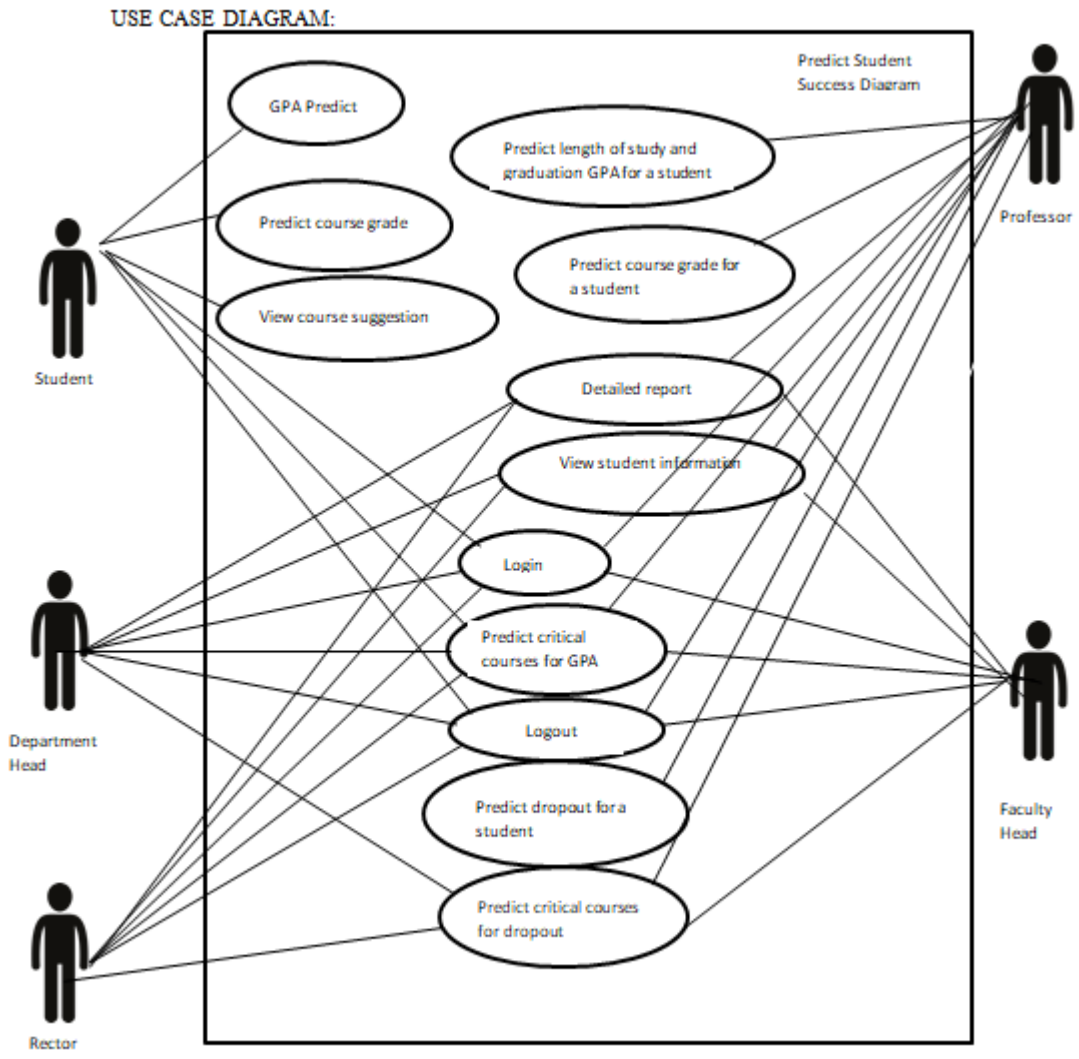

Figure 7 Predic Student Success Diagram

3.3.2.1 Profile Management Use Case

Use Case

1. Start
2. Login
3. Exit

Diagram

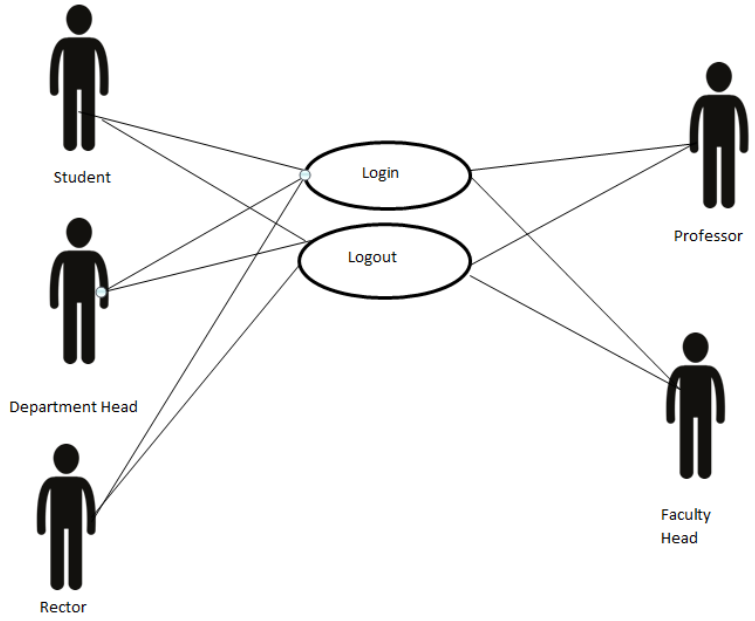

Figure 8 Profile Management Use Case

Brief Description:

Login Use Case describes related actions that all users (admin) can perform. The user of the system should login before starting to use our system. Students must login using student mail as username and password. Professors, Rector, Faculty Head,Department Head must login using uviversity mail as username and password.

Initial Step by Step Description:

1. Students and professors should start system with login.
2. Students must login using student mail as username and password.
3. Professors must login using university mail username and password.
4. Students and professors can exit from system.

3.3.2.2 GPA Predict Use Case

Brief Description:

Students easily learn new future GPA through old lessons grades. The system access old lesson grades and predicts new GPA.

Initial Step by Step Description:

1. Student clicks ‘GPA Predict’ button.

2. The system opens GPA Predict Panel and access student's old lessons grades.
3. The system calculates new future GPA and shows this number into the GPA Predict panel.

Diagram

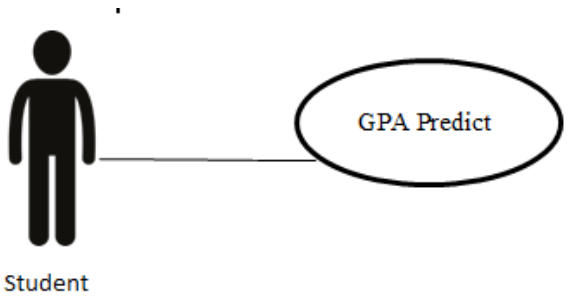

Figure 9 GPA Predict Use Case

3.3.2.3 Predict Course Grade Use Case

Brief Description:

When student login to the system, he/she be able to see own transcript. Student can selects course whatever they want and the system calculates future final grade of this choosen lesson.

Initial Step by Step Description:

1. Student click 'Predict Course Grade' button.
2. The system opens Predict Course Grade Panel.
3. Student chooses any lesson which includes students department.
4. The system predicts new final score and appears into the Predict Course Grade panel.

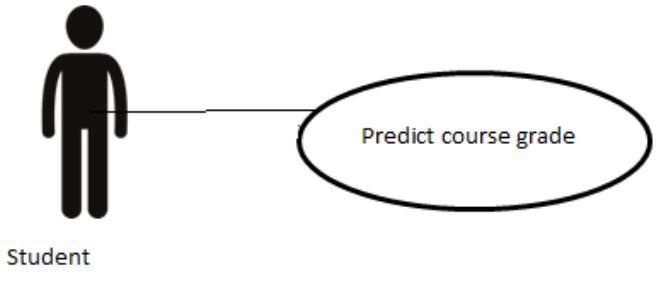

Figure 10 Predict Course Grade Use Case

3.3.2.4 View Course Suggestion Use Case

Brief Description:

Students can view course suggestions which are given by the system. This suggestions include what courses should a student take in a semester that will likely boost gpa, and these courses' websites and instructor emails.

Initial Step by Step Description:

1. Student clicks 'View Course Suggestion' button.
2. System opens course suggestion panel.
3. System creates a list which includes course suggestion, their websites and lecturer mails.
4. List appears into the course suggestion panel.

Diagram

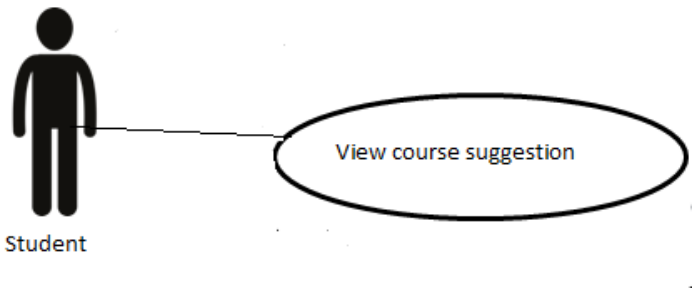

Figure 11 View Course Suggestion Use Case

3.3.2.5 Predict course grade for a student Use Case

Brief Description:

Professor calculates lesson final grade of any student. Professor enter student's ıd number and the lesson code, system automatically calculate final grade of the choosen lesson.

Initial Step by Step Description:

1. Professor clicks 'Predict course grade for a student' button.
2. System opens Predict course grade for a student panel.
3. Professor enter student ıd and course code.
4. The system takes student ıd and course code and calculates final score.
5. The system shows this number into the Predict course grade for a student panel.

Diagram

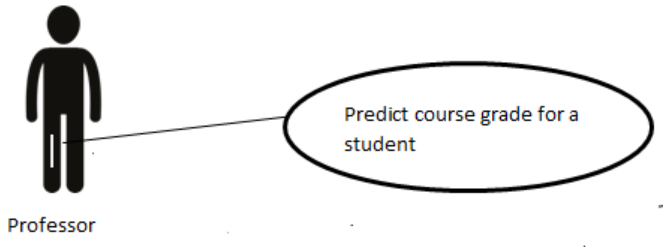

Figure 12 Predict course grade for a student Use Case

3.3.2.6 Predict critical courses for GPA Use Case

Brief Description:

All users can learn which courses determine the success at GPA.

Initial Step by Step Description:

1. The user clicks 'Predict critical courses for GPA' button.
2. System opens critical courses for GPA panel.
3. System access all courses' credits and finds courses which determine the success at GPA.
4. The system shows courses' information with list into the Predict critical courses for GPA panel.

Diagram

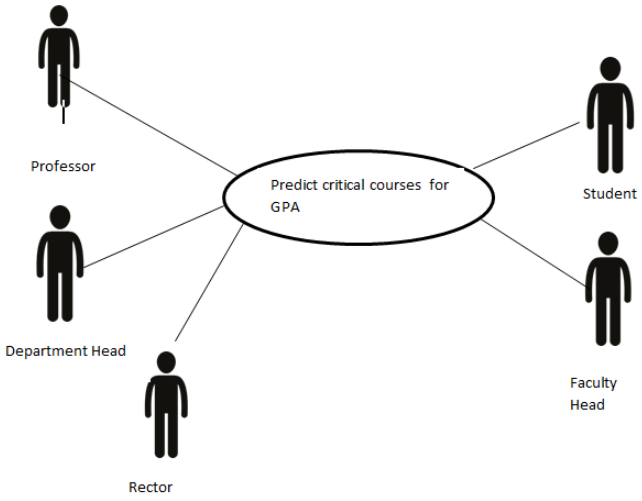

Figure 13 Predict critical courses for GPA Use Case

3.3.2.7 Predict critical courses for dropout Use Case

Brief Description:

The user(excluding Students) can learn failing which courses cause dropout.

Initial Step by Step Description:

1. The user clicks 'Predict critical courses for dropout' button.
2. System opens Predict critical courses for dropout panel.
3. System access all dropout information which course causes.
4. The system shows courses' information with list into the Predict critical courses for dropout panel.

Diagram

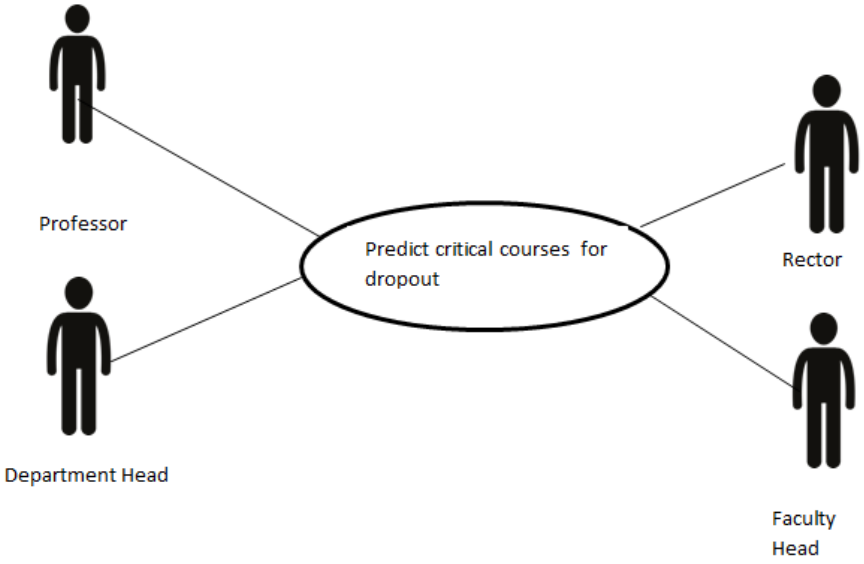

Figure 14 Predict critical courses for GPA Use Case

3.3.2.8 View student information Use Case

Brief Description:

The user (excluding student) learns all information for the student he/she wants with graphs or lists. Graphs show the comparison of other students' success with chosen student's success rate of the each lesson. Lists show the success rate of each spring terms or fall terms and also they can access students' transcripts.

Initial Step by Step Description:

1. The user clicks ‘View Student Information’ button.
2. System opens Learn Student Information panel.
3. The user enter student’s ıd number and choose what they want to learn about this student.
4. If the user want to learn success rate, they enter course grade and the system creates graph of comparison informations.
5. If the user want to learn just student transcript, the system access just that chosen student’s transcript.
6. If the user want to learn terms’ success rate, the system creates lists of success rate of spring and fall terms.
7. The system shows related informations about this student with graphs or list into the Learn Student Information panel.

Diagram

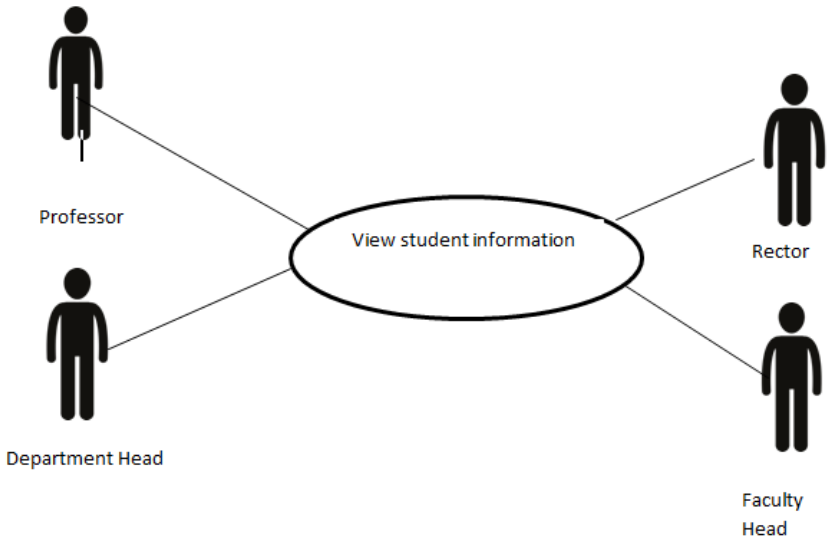

Figure 15 View student information Use Case

3.3.2.9 Detailed Report Use Case

Brief Description:

The user(excluding Student) get detailed report with graphs or lists about:

-Grade distributions: by course/year, course/program/year, department/year, faculty/year, university/year, professor/year, gender/year

-Graduation distributions: by length/dept/year, length/faculty/year, length/univ/year

-Course success distributions: fail/pass rates by professor/year

-Professor success distributions: fail/pass rates by course/year

-Dropout distributions: by department/year, faculty/year, university/year

-Average GPA distributions: by dept/year, faculty/year, university/year

Initial Step by Step Description:

1. The user clicks ‘Detailed Report’ button.
2. System opens Detailed Report panel.
3. The user choose which informations’ report want to see.
4. System access all informations about this chosen report.
5. System creates graphs or lists with these informations.
6. System shows this lists or graphs into the Detailed Report panel.

Diagram

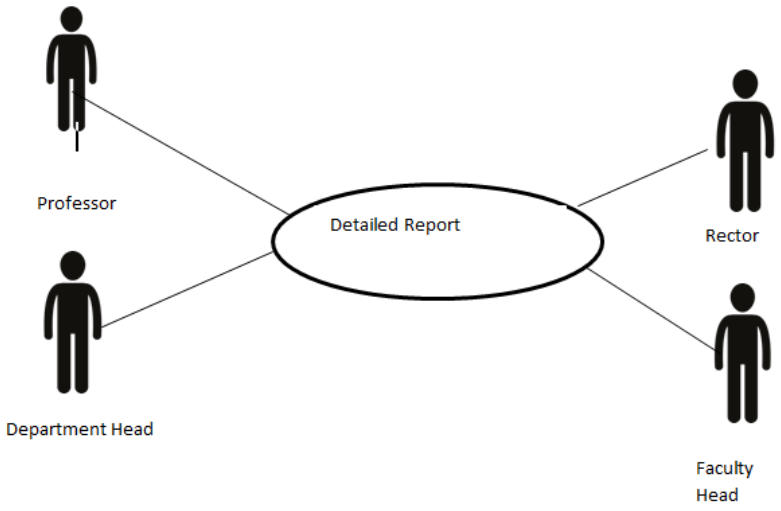

Figure 16 Detailed Report Use Case

3.3.2.10 Predict length of study and graduation GPA for a student Use Case

Brief Description:

Professors can learn prediction of students graduation GPA and their length of study.

Initial Step by Step Description:

1. The user clicks ‘Predict length of study’ and graduation GPA for a student’ button.

2. System opens Predict length and graduation GPA for a student of study panel.
3. User enter student's ıd number and the system access all previous course grades.
4. System predicts length of the study and graduation GPA for a chosen student.
5. System shows this predictions into a Predict length and graduation GPA for a student of study panel.

Diagram

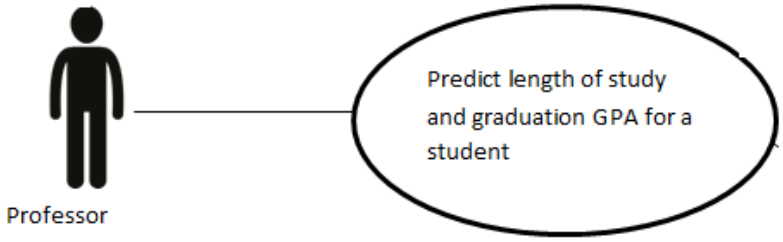

Figure 17 Predict length of study and graduation GPA for a student Use Case

3.3.2.11 Predict dropout for a student Use Case

Brief Description:

Professors can learn prediction of dropout of students. System control student's previous course grade and calculate a prediction of dropout.

Initial Step by Step Description:

1. The user clicks 'Predict dropout for a student' button.
2. System opens Predict dropout for a student panel.
3. User enter student's ıd number and the system access all previous course grades.
4. System predicts chosen student dropout possibility.
5. System shows this predictions into a Predict dropout for a student panel.

Diagram

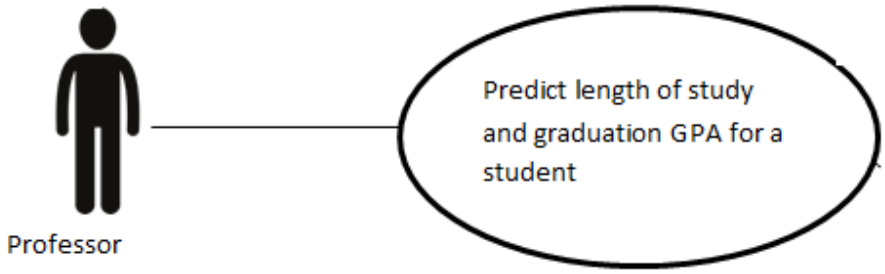

Figure 18 Predict dropout for a student Use Case

3.3.3 Nonfunctional Requirements

3.3.3.1 Adaptability

Web application can work on different web browsers, therefore user's PC be able to run web browsers.

3.3.3.2 Security

The system keeps all students' informations with high security.

3.3.3.3 Performance

The system gives advice or alerts user immediately.

3.3.3.4 Usability

The system is easy to operate and the design of the system is very clear.

4. Software Requirements Specification

4.1 Introduction

4.1.1 Purpose

The purpose of this Software Design Document is "What will my GPA be?" to give detailed information about the project.

The target audience is primarily the students, teachers, rector, department head, and faculty head. When GPA is calculated, students can get clearer results about their education life. The teacher, rector, department chair, faculty president may have knowledge about the information, graphics

and various documents belonging to the student. Students are expected to take GPA calculations in the future by taking past course grades. The other users are aimed to get information about the students, graphics, and course contents.

The aim of the GPA estimating project is to create an easy-to-use system that is both realistic and user-friendly. The GPA estimate is available in two different modes. If you are a student, you will be logged in via email and password. Other users can only login with their username. The student logs in to the system with e-mail and password. GPA predict, Predict course grade, view course suggestion. After doing the teacher user login, predict length of study and graduation GPA for a student, predict course grade for a student, detailed report, view student information, predict critical courses for GPA, predict dropout for a student, predict critical courses for dropout.Once the department head user enters the system, he / she performs detailed report, view student information, predict critical courses for GPA, predict dropout for a student, predict critical courses for dropout. After login to the faculty head user login, you can perform detailed reports, view student information, predict critical courses for GPA, predict critical courses for dropout. After logging in, the Rector can view student information, predict critical courses for GPA, and predict critical courses for dropout, detailed report. Users in the system can perform many operations. They exit the system after their processes are finished.

All the elements that can help the user from the system are in the category when they are entered into the system. Our GPA estimate can be in the form of an application site that will be easy to reach by everyone. SDD, Block Diagram, and UML Diagram are available for better and detailed introduction to the system.

4.1.2 Scope

This document should read “What will my GPA be?” provides details and information about the design of the project.

Python is an object-oriented, interactive, modular, handy high-level programming language. Python graphical faces are very convenient to use in intermediate design, web site construction, database access, software and games. It has a dynamic structure and can be integrated very quickly and easily into languages. Python is a programming language that can perform operations quickly and dynamically with the system. Pyhton works on Linux /Unix, Windows and Mac-OS, and Java is integrated with .NET. We chose the Python programming language because of its easy and fast access, dynamic structure and types, open source, easy to read and write, and a variety of interface and web interface transitions.

Kibana provides diversity and ease of visualization. We can make a transition by clicking on the overview part in the system by naming the cluster part in Kibana. There are various graphics on this page. It is possible to reach the index number, node number, document pages. Elasticsearch it allows us to easily visualize the indices found. Once visualization has been enabled, it is possible to do so without reaching various tables. Using Elasticsearch summaries, you can create charts that show the trends, increments, and diversions you need.

Phyton was rich in visuality, easy to understand by people, and we preferred the programming language because it had a lot of features in its structure. We have enriched our project with

visualization using Kibana visualization. The designed user interface is made more dynamic. Thus, people entering the system can easily exit the system after using the system and performing the necessary operations.

4.1.3 Glossary

Term	Definition
BLOCK DIAGRAM	This is a schema that which comprise of blocks to show compononents of the system.
SDD	Software Design Document.
WEB SITE ENVIRONMENT	The environment that allows users learn predictions or informations about lessons, students and exc.
PARTICIPANT	The user who interact with the what wiill my gpa be? web site.
UML DIAGRAM	It is a modelling language of visualizing a software program using a collection of diagrams.

4.1.4 Overview of Document

The remaining chapters and their contents are listed below.

Section 2, discusses the Architectural Design of the project. In this section, users and their actions, pre-conditions and post conditions. The software development method used is mentioned.

Section 3 is Use Case Realization. In this section which is designed according to use cases in SRS document, a block diagram of the system, visuals and explanations.

4.2. Architecture Design

4.2.1 System Design Approach

For developing the project, we have planned to use Scrum which is an agile software development methodology. Agile development is opened to change and also ıt allows high level of team communication, fast and continuous product delivery, test-driven understanding and simple and realistic planning. It is incremental and iterative development. Scrum is based on short cycle output generation and feedback thought. It is aimed primarily at developing important requirements for the project. It can easily apply the changes needed throughout the project time.

One of Scrum's innovations [1] is the graph of the remaining features / number of days past, showing the progress of the project clearly and continuously. All activities inside the Scrum take place in Sprint. Every Sprint includes tasks which has own story points and risk points. Development team should have a daily meeting every morning which should be maximum 15 minutes. Product owner is the person who delivers the requirements. Development team is the group of developers who work on the project according to schedule. Thanks to constant feedbacks, it is easier to cope with changes. Sprint is very important feature for Scrum methodology. At the end of each sprint, a part of project has been completed and it has been presented to customer for validation. Thanks to all advantages, Scrum methodology is more proper to our project.

4.2.1.1 Class Diagram

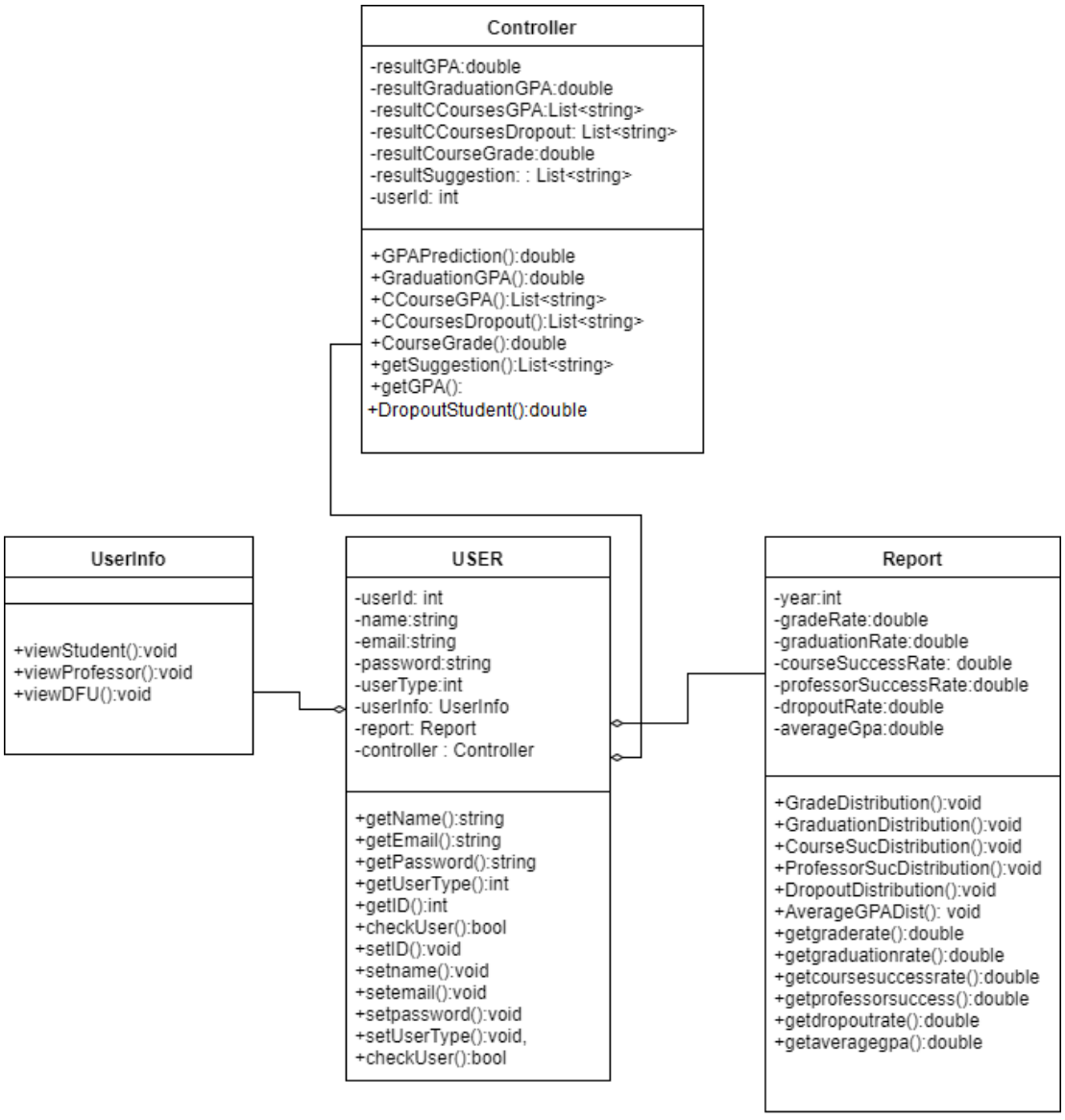

Figure 19 Class Diagram

The class diagram consists of four tables. User, Controller, Report, UserInfo tables. The User table contains UserInfo, Controller, and Report tables. There are five user types in the User table. Users can login to the system using email and passwords. The UserInfo table holds information for students, professor, department head, faculty head, and university head. In the controller table there are functions such as GPA estimation, GPA estimation of those who can graduate list of classroom drop-outs, lecture notes, which courses should be taken for high GPA. In the reporting table; the distribution of grades, the proportion of graduates, course success rates, the success rate of teachers, the average distribution of GPA estimates, and the distribution of classroom attendants by years.

4.2.1.2 Database Tables

4.2.1.2.1 Student Table

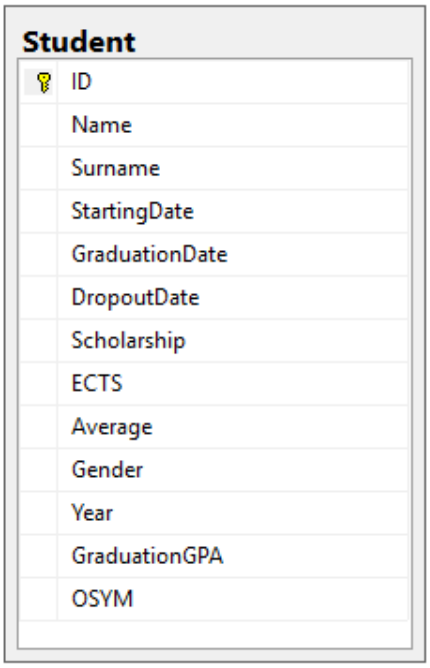

Figure 20 Student Table

Description:

Student table holds graduated and non-graduated students information such as gpa, class, start date, dropout date, graduated date and so on. When related function called by user, related information uses by system.

4.2.1.2.2 Grades Table

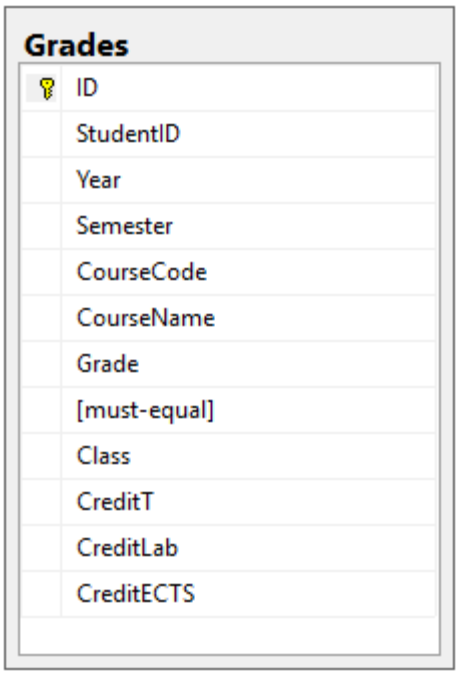

Figure 21 Grades Table

Description:

Grades table holds information such as student number, course, grade, course name and code, credit of course, year and so on. This values are necessary for making a model using machine learning algorithms. When user call a prediction function, trained data is obtained after system takes this information and processing it. Therefore, for any prediction function, system should use this data.

4.2.1.2.3 Lecturer/Course Table

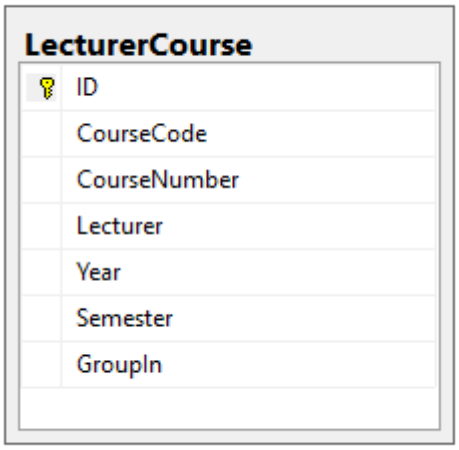

Figure 22 Lecturer/Course Table

Description:

Lecturer/Course table holds course code and number, group, lecturer, year and semester. System takes information when related function called by user.

4.2.1.2.4 Function Trained Data Table

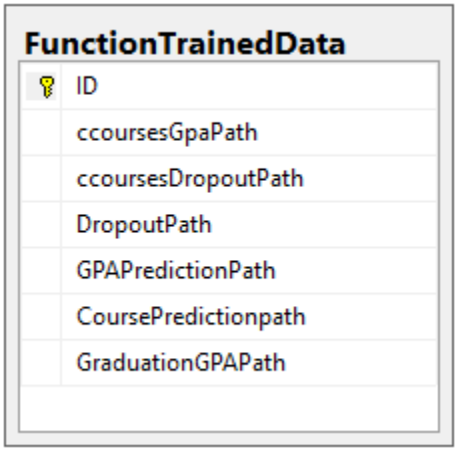

Figure 23 Function Trained Data Table

Description:

FunctionTrainedData table contains path of trained data files. Trained data can obtain after finding pattern from machine learning algorithms. When user want to use any prediction

function, these trained data uses or updates. After analyzing or retrain data, related files should update.

4.2.1.3 Sequence Diagram

4.2.1.3.1 Login Web Application

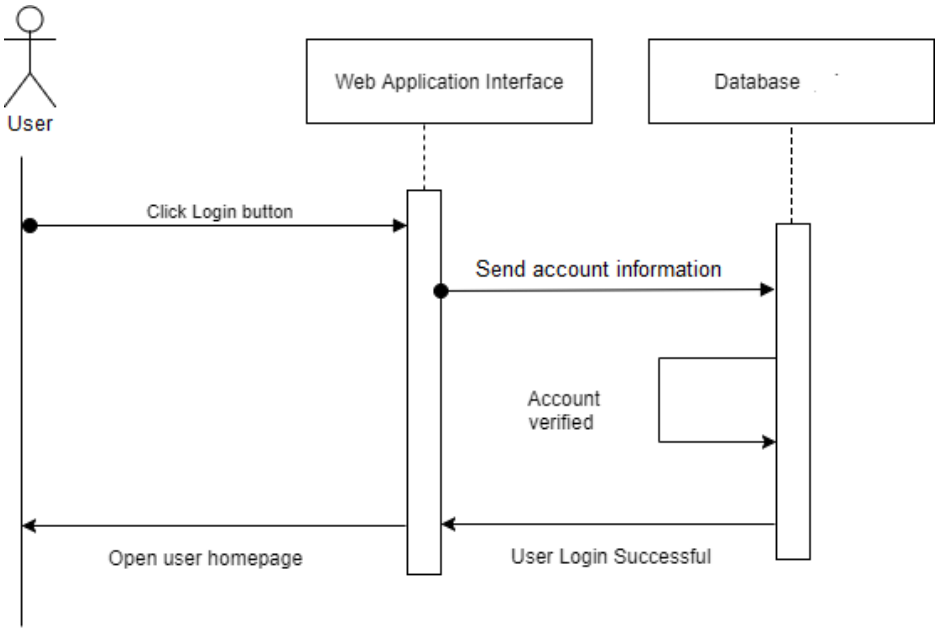

Figure 24 Login Web Application

In figure 6, All participants enter their emails and passwords then the system sends this information to the database system and if the informations about people is true, they can login to the web page successfully and access their homepages.

4.2.1.3.2 View Student Information

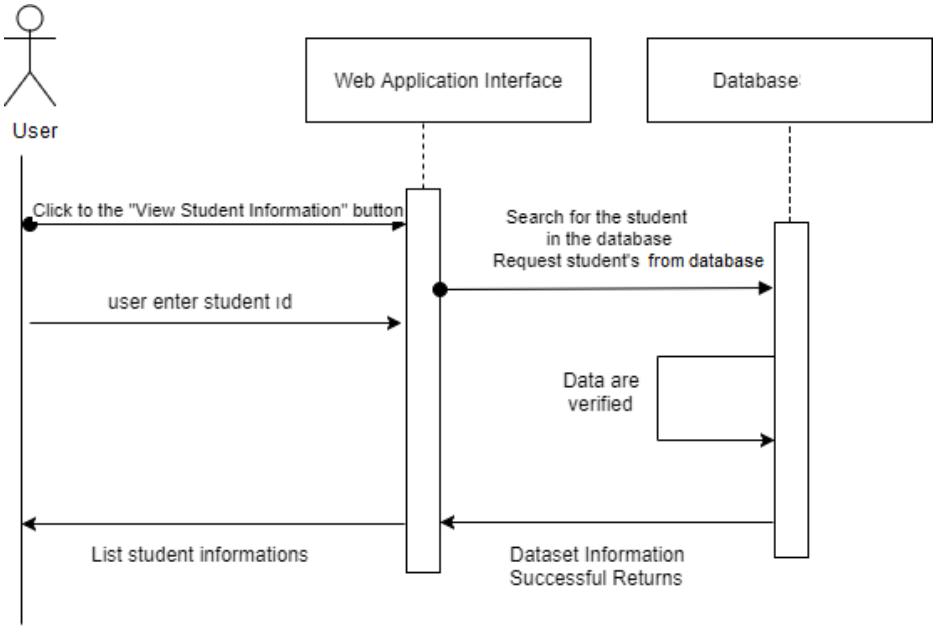

Figure 25 View Student Information Diagram

The user clicks the “View Student Information” button and necessary informations are showed by the system.

4.2.1.3.3 Get Course Suggestion

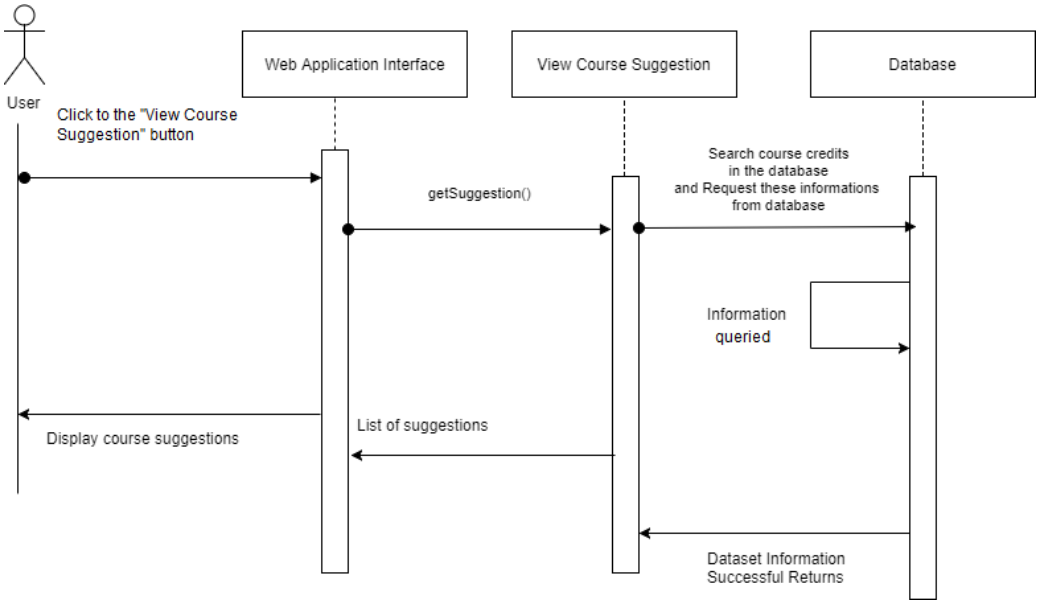

Figure 26 Get Course Suggestion Diagram

The user clicks the “Get Course Suggestion” button and courses are showed by the system.

4.2.1.3.4 Detailed Report

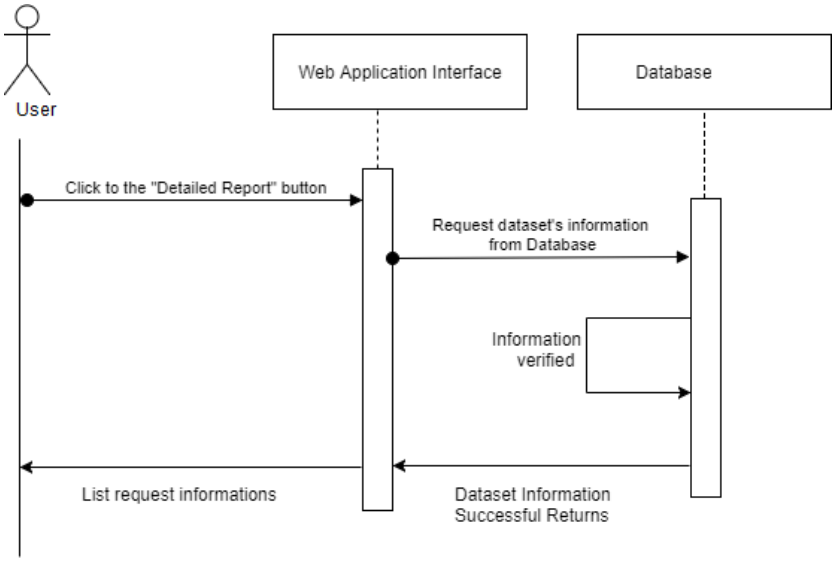

Figure 27 Detailed Report

The user clicks the “Detailed Report” button and reports are showed by the system.

4.2.1.3.5 Prediction of dropout for a student

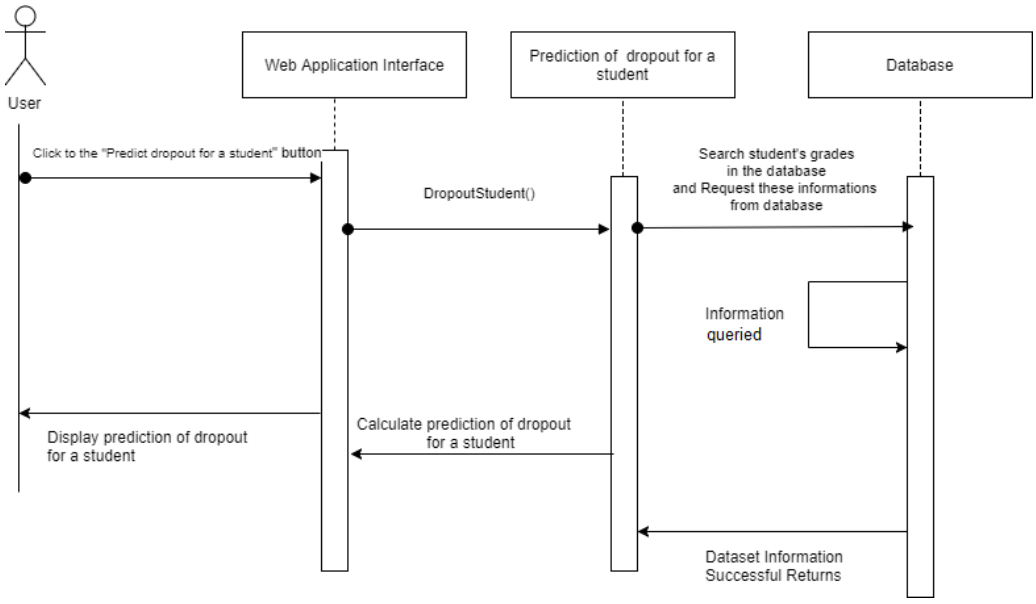

Figure 28 Prediction of dropout for a student Diagram

The user clicks the “Predict of dropout for a student” button and the dropout rate are showed by the system.

4.2.1.3.6 Prediction of GPA

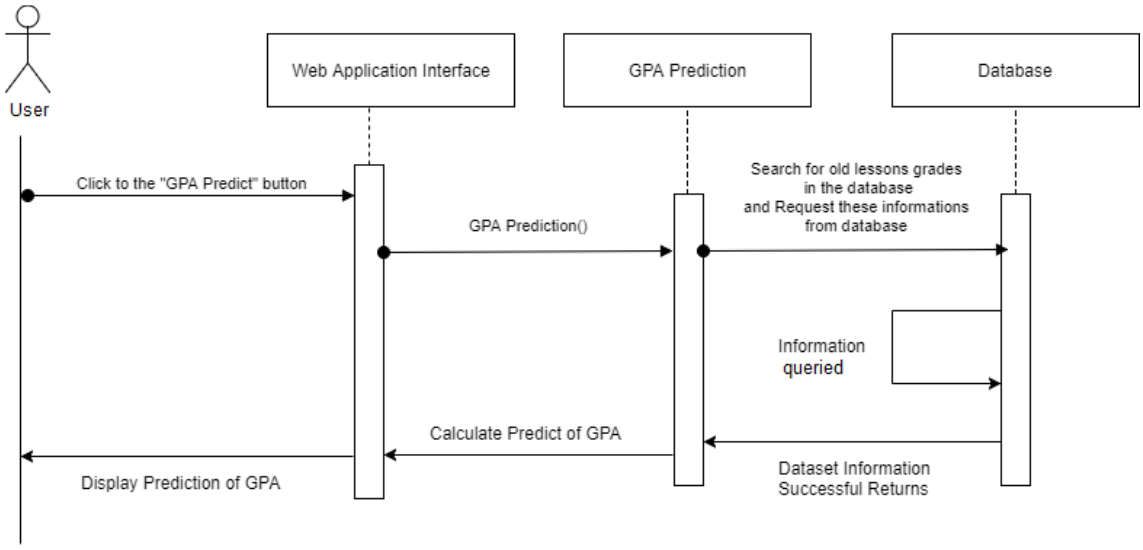

Figure 29 Prediction of GPA Diagram

The user click the “Detailed Report” button and GPA value are showed by the system.

4.2.1.3.7 Prediction of length of study and Graduation GPA for a student

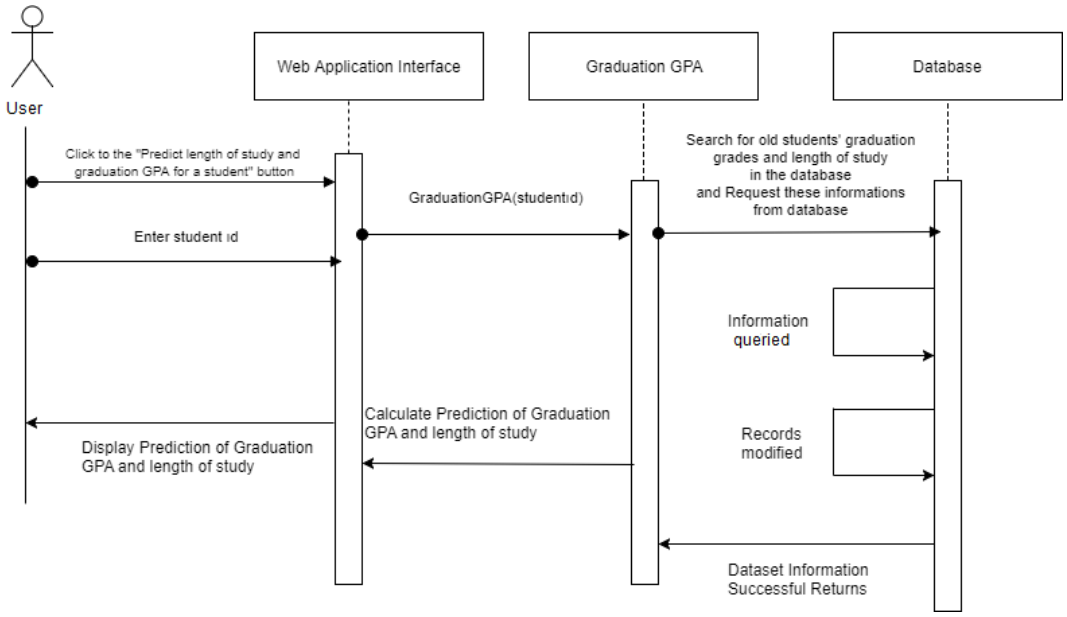

Figure 30 Prediction of length of study and Graduation GPA for a student Diagram

The user click the “Predict of length of study and Graduation GPA for a student” button and graduation GPA value and length of study are showed by the system.

4.2.1.3.8 Prediction of critical courses for dropout

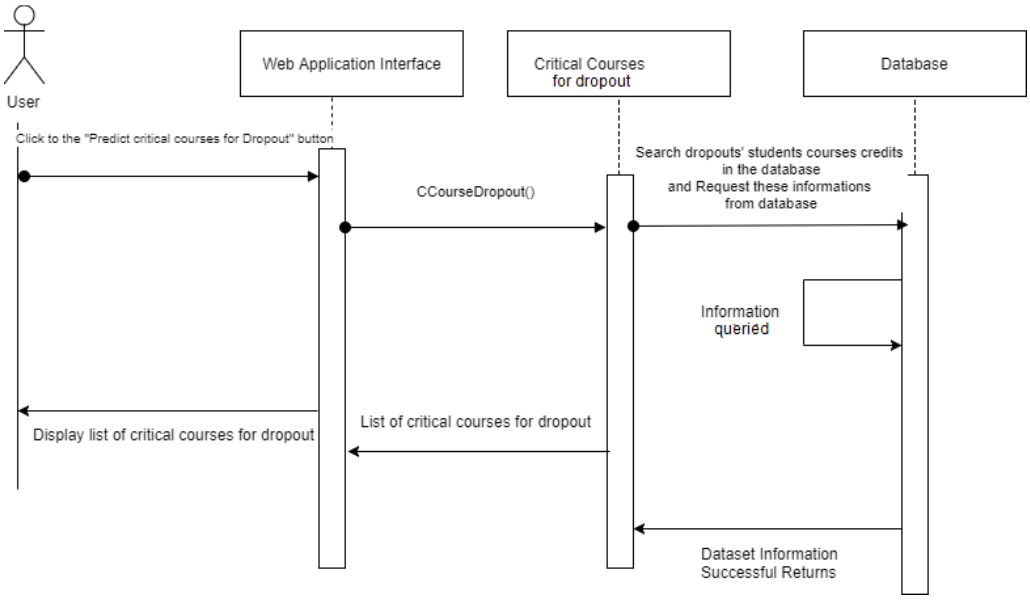

Figure 31 Prediction of critical courses for dropout Diagram

The user click the “Predict of critical courses for dropout” button and list of critical courses are showed by the system.

4.2.1.3.9 Prediction of course grade

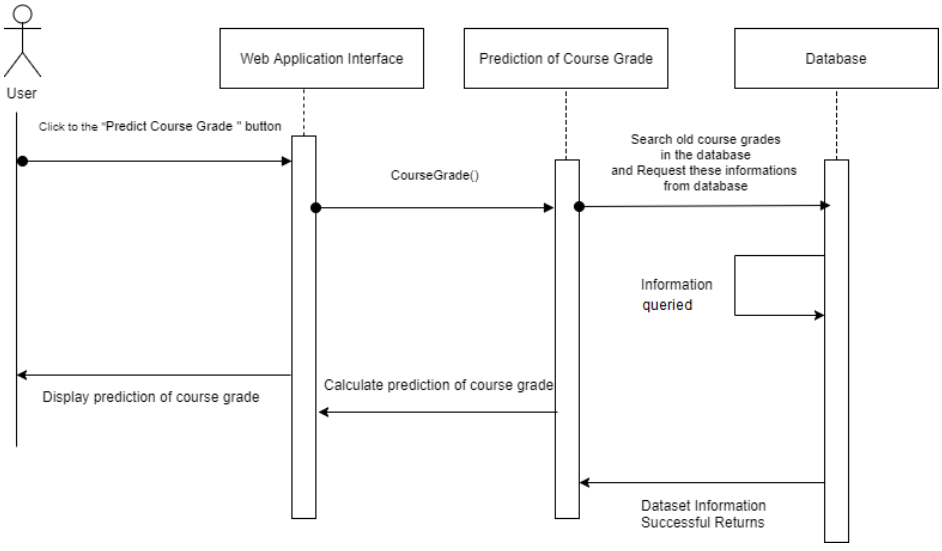

Figure 32 Prediction of course grade Diagram

The user click the “Predict of course grade” button and course grade are showed by the system.

4.2.1.3.10 Prediction of critical courses for GPA

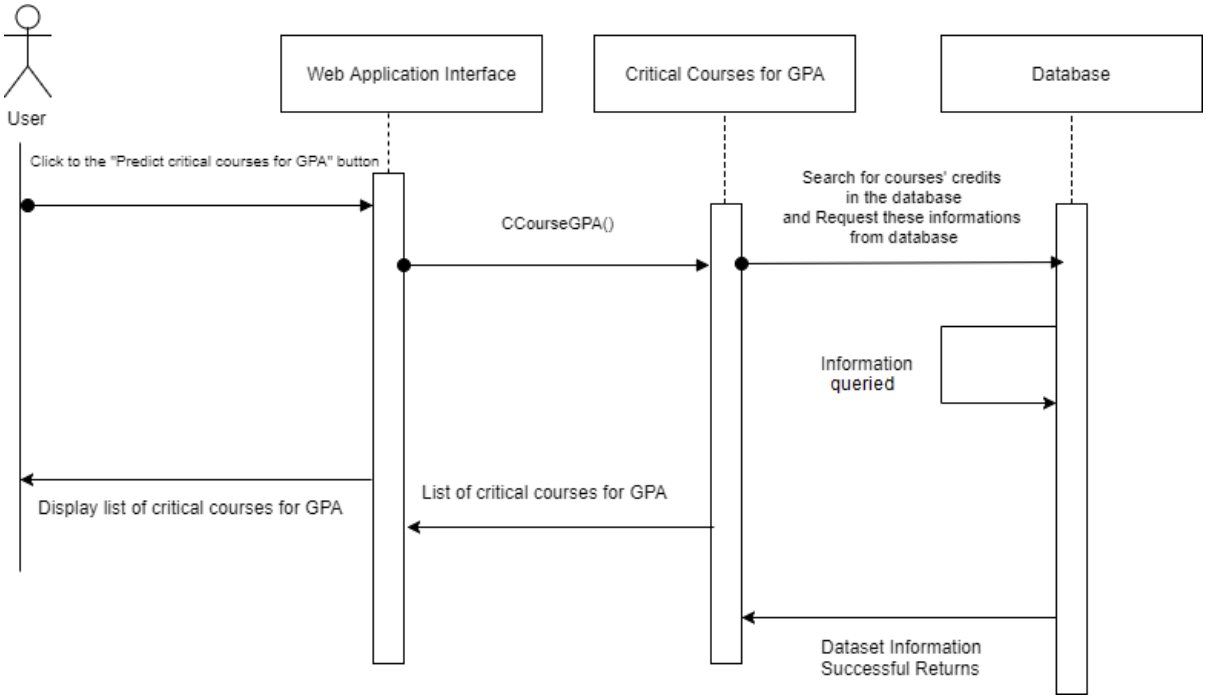

Figure 33 Prediction of critical courses for GPA Diagram

The user click the “Predict of critical courses for GPA” button and list of critical courses are showed by the system.

4.2.2 Architecture Design of System

4.2.2.1 Profile Management

Summary: This system is used by all user and admin. Users can login and exit from the system. In addition to this, admin can delete an account, approve participant accounts and add a new admin.

Actor: Professors, Rector, Faculty Head,Department Head, Admin

Precondition: User must enter the website.

Basic Sequence:

1. All participants should start system with login.
2. All participant login using university mail as username and password.
3. All users can exit from system by selecting logout button.

Exception: Database connection can be failed.

Post Conditions: Participant should be enrolled in Cankaya University system.

Priority: Low

4.2.2.2 Mutual Home Page Menu

Summary: This page is used by all users. They can predict of critical courses that directly affect the GPA.

Actor: Student, Professor, Rector, Faculty Head, Department Head

Prediction: All users must be logged in the system.

Basic Sequence:

1. Users can learn critical courses for GPA that determines the high GPA by selecting predict of critical courses for GPA button from Prediction of critical courses for GPA page.
2. Users can exit from the system by selection exit button.

Exception: None

Post Conditions: All users should be enrolled in Cankaya University system.

Priority: High

4.2.2.3 Reporting and learning student success page

Summary: This page is used by all users excepting student. They can learn prediction of critical courses which causes of dropout of students. They can learn students' transcript, students' lessons informations with graphs or lists. Graphs show the comparison of other students' success with chosen student's success rate of the each lesson. Lists show the success rate of each spring terms or fall terms and also they can access students' transcripts. On the other hand, users get detailed report about:

-Grade distributions: by course/year, course/program/year, department/year, faculty/year, university/year, professor/year, gender/year

-Graduation distributions: by length/dept/year, length/faculty/year, length/univ/year

-Course success distributions: fail/pass rates by professor/year

-Professor success distributions: fail/pass rates by course/year

-Dropout distributions: by department/year, faculty/year, university/year

-Average GPA distributions: by dept/year, faculty/year, university/year

Actor: Professor, Rector, Faculty Head, Department Head

Prediction: All users must be logged in the system.

Basic Sequence:

1. Users can learn critical courses for dropout by selecting critical courses for dropout button from mutual home Page menu.
2. Users can get detailed report by selection the desired report type. For this, they can select detailed report button and select report's type from mutual home Page menu.
3. Users can continue the system by selecting detailed report button from mutual home page menu.
4. Users can exit from the system by selection exit button.

Exception: None

Post Conditions: All users should be enrolled in Cankaya University system.

Priority: High

4.2.2.4 Student Home Page Menu

Summary: Student can learn prediction of GPA, prediction of course final grade and and also they can view course suggestion.

Actor: Student

Precondition: Student must be logged in the system.

Basic Sequence:

1. Student can learn GPA prediction by selecting predict GPA button from Student Home Page menu.
2. Student can display course suggestion for boost GPA.
3. Student can learn critical courses for GPA prediction by selecting predict critical courses for GPA button from Student Home Page menu.
4. Student can continue the system by selecting predict course final grade button from Student Home Page menu.
5. Student can exit from the system by selection exit button.

Exception: None

Post Conditions: Student should be enrolled in Cankaya University system.

Priority: High

4.2.2.5 Professor Home Page Menu

Summary: Professor can learn length of study and graduation GPA for student, prediction of course final grade for a student and prediction of dropout for a student.

Actor: Professor

Precondition: Professor must be logged in the system.

Basic Sequence:

1. Professor can learn length of study and graduation GPA for any student with selecting prediction of length of study and graduation GPA for student button from Professor Home Page menu.
2. Professor can continue the system by selecting predict course final grade button for any student from Professor Home Page menu.
3. Professor can learn prediction of students' dropouts with selecting predict of dropout for a student button from Professor Home Page menu.
4. Professor can exit from the system by selection exit button.

Exception: None

Post Conditions: Professor should be enrolled in Cankaya University system.

Priority: High

4.2.3 Activity Diagram

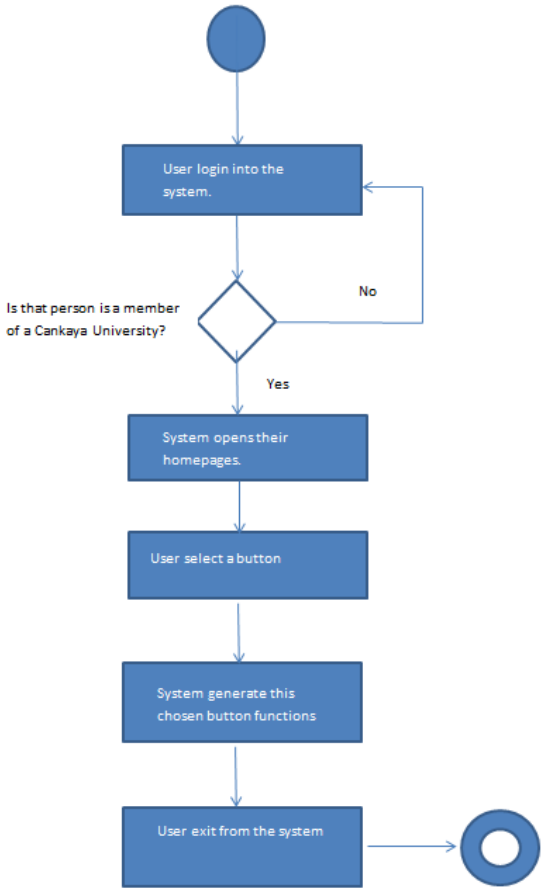

Figure 34 Activity Diagram

Figure 16 shows that how the scenario generation works as an activity diagram. When the user login to the system, it controls whether the user is a member of Cankaya University or not. If the user is a member, system opens user's home page with all buttons. User selects a button which he/she wants and then system generate this buttons functions. When he/she finished their request to the system, they can exit from the system.

4.3. Use Case Realizations

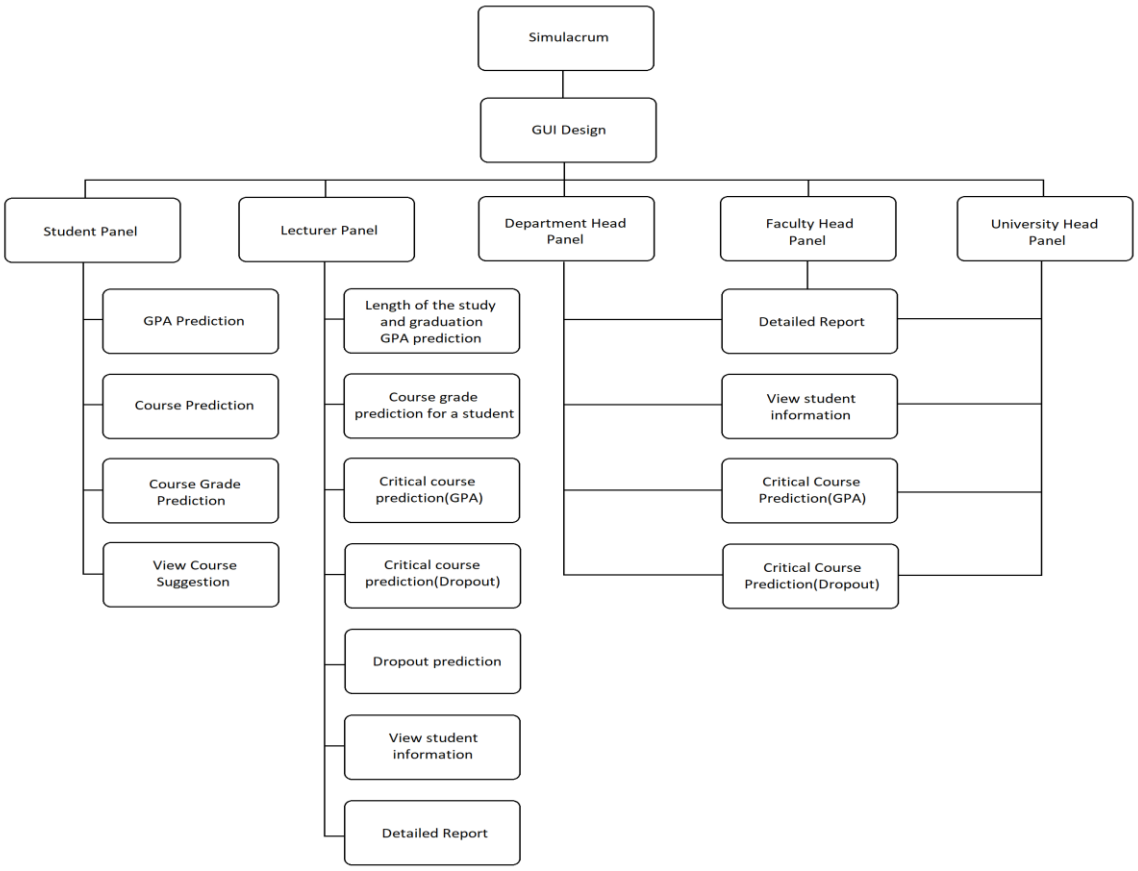

Figure 35 Block Diagram

4.3.1 Brief Description of Figure 17

In figure 17, all designed system is displayed in block diagram. Diagram includes five main component and their sub-systems.

4.3.1.1 Student Panel Design

In student panel, student be able to interact with system. System has own student main page and it contains three sub-system; GPA prediction, course prediction, prediction of critical courses for GPA and view course suggestion. GPA prediction is responsible for making a prediction of a semester GPA. Student must enter his/her available past semester grades and GPA. Course prediction makes an estimate for a certain course. To do so, student must fill all required fields and enter his/her available past grades. After GPA and course prediction, system is responsible to give a suggest that includes critical course names, lecturer name and websites for student. Student page can be accessible after login to the system. In student page, personal information and three function are located in the middle of the page. Student will be directed to responsible page after clicking one of the functions. Prediction of critical courses page has a predict button and list of

courses that student has been enrolled. After click predict button, name of critical courses can be seen in result section where at the bottom of the page.

4.3.1.2 Professor/Lecturer Panel Design

In lecturer panel, professor/lecturer can interact with system. User main page includes seven sub-system which are predict length of study and graduation GPA, predict course grade for a student, predict critical courses for GPA and dropout, predict dropout for a student, view student information and detailed report. Also, user's personal information displays in the main page. There are seven button in main page that shows each sub-system. Every button directs lecturer to related page. GPA and course grade prediction works the same way in student panel. Professor selects a student from student list and system makes a prediction after clicking predict button. Result displays on the same page in the result section which shows predicted GPA or course grade. Predict critical courses for GPA and dropout pages have two separated field. Left field for course and right field for dropout prediction. User should select a student from student list in both fields. After click to predict button, critical course names that effects student GPA or cause dropout displays in result section at the bottom of the page. Predict dropout page contains same elements; list of students, prediction button and result section. After click event, system shows that whether student dropout or not. User be able to learn student information in view student information page. There are several choices takes part in here. User can access to students transcripts, graph of comparison student success rate for certain course and lists show that success rate of semester. Student list displays at top of the page. There are graph, list and comparison buttons at the left side of the page. User can see whatever he/she wants after click one of buttons. Additionally, there is a Detailed report page as well. Many different reports will be available in detailed report page such as failure rates by course, grade distributions by course. User can access this page by clicking Detailed Report section button. Left side of the page includes list of reports. User should click to name of the report to see content of the related report. Rest of the page displays related report information, graphs and lists.

4.3.1.3 Department Head Panel Design

In department head panel, department head be able to interact with system. There will be four sub-system in page; View student information, predict critical courses for GPA and dropout and detailed report. Main page contains personal information and four button placed bottom of the page. Department head can access to related pages using these buttons. Each button indicates sub-system. View student information and detailed report pages have same structure with other page structures that has mentioned. Critical course prediction page finds out name of the significant courses for GPA and dropout. In page, there will be two side with prediction button for GPA and dropout. Click button makes a prediction and displays results(course names) under the page in result section.

4.3.1.4 Faculty Head Panel Design

In faculty head panel, department head be able to interact with system. Faculty head panel has four sub-system. These are critical course prediction for GPA and dropouts, view student information and detailed report. Similar to other pages, faculty head page includes personal information and sub-system buttons. Each button related to sub-systems. Predict critical course

for GPA and dropout, view student information and detailed report pages have same structure with other page structures that has mentioned.

4.3.1.5 University Head Panel Design

In university head panel, university head be able to interact with system. Main page includes four sub-system which are critical course prediction for GPA and dropouts, view student information and detailed report. At the top of the page personal information can be seen. Four sub-system buttons placed under the personal information. Every sub-system page have same structure with other page structures that has mentioned.

Conclusion

In this project our goal was to make a web application to help and increase student success using machine learning methods and student/lecturer/course data. System is responsible to make a prediction for related functions. Output of the functions indicates how student improve oneself according to results, what critical situation should handle or warn to student for bad results for his/her academic life. In addition, these functions not only usable for students but academic staff as well. Most academic staff be able to access and use these functions. Also, some of the academic staff has different type of prediction function. Furthermore, every academic staff can have detailed report according to their duties.

To begin with, we have made a literature research to find related projects and figured out how they have been made. Thus, we've gained different perspective for our project and have learned how can we use this knowledge to perform project. We found what kind of tools we should use such as python as programming language, Kibana for visualize the data or Tensorflow to use powerful deep learning methods. Our next step was to prepare software requirement specification (SRS) to determine the requirements of the project. Documentation contains a general structure of project, use cases and development methodologies. Finally, software design document has prepared to create a generic design for application and given guidance of software architecture.

As a result, we obtained big detailed documentations for make an application to help and enhance student success and indirectly university success. Both student and academic staff have big advantage through using this application. Of course system has a disadvantage which is about updating prediction functions. Machine learning algorithms uses big data and this data needs preprocess and maintenance. System should update machine learning models after each semester.

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