**Study Compass**

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**Abstract**

Course selection has been a major issue for students at the undergraduate level due to its significant impact on the overall academic achievement.

Moving to distance, blended, and online learning beside lack of effective academic advising has put more pressure and responsibility on students towards fulfilling their academic demands and goals.

**Study Compass** is a reliable interactive educational tool for assisting students in choosing the right courses based on their own performance in the freshman year of computer science. Study source is a complete guidance database web system developed over machine learning classification techniques.

According to **ABET** (Accreditation Board for Engineering and Technology), each course in the curriculum of computer science program should have specific learning outcomes to be met by students. We used these outcomes to build a questionnaire. This questionnaire was filled by hundreds of students from different universities in Jordan to train a machine learning classifier. In the prediction phase, the classifier selects the track, in which student obtained the best performance.

The tracks are Math and Science, Theory, and Programming. Based on this selection, a full curriculum tree is shown demonstrating the courses to be taken in the following year while ranking them from “strongly recommend” to “weakly recommend”, in addition to helpful resources and links that cover the material of courses.

# ABBREVIATIONS

* **UML:** The Unified Modeling Language is a general-purpose, developmental, modeling language in the field of software engineering that is intended to provide a standard way to visualize the design of a system.
* **ER**: An Entity relationship model (ER model) describes the structure of a database with the help of a diagram, which is known as the Entity-Relationship Diagram (ER Diagram).
* **Database:** is an organized collection of data, generally stored and accessed electronically from a computer system. Where databases are more complex, they are often developed using formal design and modeling techniques.
* **Use case diagram:** a graphical depiction of a user's possible interactions with a system. A use case diagram shows various use cases and different types of users the system has and will often be accompanied by other types of diagrams as well.
* **Stakeholder**: is a party that has an interest in a company and can either affect or be affected by the business.
* **Nonfunctional Requirements** **(NFRs):** define system attributes such as security, reliability, performance, maintainability, scalability, and usability. They serve as constraints or restrictions on the design of the system across the different backlogs.
* **Modifiability:** is the degree of ease at which changes can be made to a system, and the flexibility with which the system adapts to such changes.
* **Accessibility**:is strongly related to universal design which is the process of creating products that are usable by people with the widest possible range of abilities, operating within the widest possible range of situations.
* **Machine learning:** an application of artificial intelligence that provides the system the ability to automatically learn and improve from experience without being explicitly programmed.
* **Frameworks:** they are often built, tested, and optimized by several experienced software engineers and programmers, software frameworks are versatile, robust, and efficient.

**Chapter1: INTRODUCTION**

Education is the foundation of the future; it can lead to our shining or our demise this is what we always fear when we see the student’s moral during the first years of college.

This has led us to think of solutions to ensure that we will have a bright future filled with innovators and inventors rather than students who got used to just receive the information without really knowing what depends on it and what we can create with the information that we received, and most of the time, they didn’t even receive the information.

**Study Compass** is a reliable interactive educational tool for assisting students in choosing the right courses based on their own performance in the freshman year of computer science.

**Concept**

The concept is we do a questionnaire so we can check the level of the user in his previous classes. We can place the users in different classes based on their test results.

**Project Motivation**

We were motivated to help students to keep up with their studies and stay motivated to keep progressing and evolving in their studies, in the hopes of becoming unique.

The idea of **Study Compass** is determining what is the level the student in each track if he can the best in it and give it a green color while the medium and weak tracks take the orange and red colors respectively so the student can focus more on them.

**Project Aim and Objectives**

There are three objectives to this project:

* **Ease of access:** this project should be easy to access by all students all the time.
* **Availability:** it must include all the needed sources for the student.
* **Ease of use:** The project must be easy to use by everyone.

**Chapter2: Requirement Analysis**

This chapter should include the analysis of the functionalities and data used in the project.

**Stakeholders**

A Stakeholder is A Party That has an interest in project and can either affect or be affected by this project in our project there are two primary stakeholders and one as secondary:

Primary Stakeholders**:**

1. The student: the student is the main user of the application as they well use it to progress faster in their studies
2. Admin: the admin can add courses delete courses create new progress trees and change them at well, he can also monitor the progress of the students and the analytics of the application.

Secondary Stakeholders

1. The courses’ creators: The benefit that Study Source gives the courses’ creators, is that the users (students) get to know the tutor and they get free publicity.

**Use Case Diagram**

This is the use case diagram of our project; it shows that there’s 2 main users and a machine. It shows the available functions that every user can do and what functionalities the program has.

Diagram

Description automatically generated

**Functional User Requirements**

A functional requirement specifies something that a user needs to perform their work.

* **Registration:** this page is for registering new users.
* **Log in:** this page is for users to sign in and use the website.
* **Fill Form:** this page is a questionnaire to support the machine learning.
* **Update Courses:** this page is for admins to add or remove courses.
* **Delete My Account:** a page where the user can delete his account.
* **Update Tree:**  a page where the admin can edit the tree path.
* **Change Password:** a page where the user can change his password.

**Non-Functional User Requirements**

The non-functional requirement (NFR) is Simply said, a non-functional requirement is a specification that describes the system’s operational capabilities and constraints that enhance its functionality. These may be speed, security, reliability, etc. We’ve already covered different types of software requirements, but this time we’ll focus on non-functional ones, and how to approach and document them.

The non-functional user requirements in this project as the following:

1. **Privacy**: The User information and access data must be protected on this application by preventing unauthorized access to happen, each username and password should be protected.
2. **Security**: to assure that all data inside the system or its part will be protected against malware attacks or unauthorized access.
3. **Modifiability**: when the system must be implemented so that it is easy to add new functions. In our application administrators can modify the trusted parts that the student can request courses from.
4. **Availability**: availability describes how likely the system is accessible for a user at a given point in time. Our application should be available 24/7 for each online – user.
5. **Accessibility**: it is to evaluate how accessible/usable the application to people who are interested in this kind of application. At our application, the admin and students should have full access while using the internet at any time and location.
6. **Accuracy**: In our application, the function and results should be accurate as possible.

**Chapter3: Requirement Analysis**

**3.1 Decision Tree Classifier**

This is how the Decision Tree Classifier decides which is the best track for the student. The fig below shows it.

Timeline

Description automatically generated

**3.2 Classification**

Classification is a two-step process, where the first is to train a classifier (training phase) while the second is to use the trained classifier for classifying unknown instances (prediction phase). The table below shows the precision, recall, and accuracy of the Decision Tree Classifier machine learning model.

**Classification results using Decision Tree classifier algorithm.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Algorithm** | **Precision** | **Recall** | **Accuracy** |
| Decision Tree | 0.984 | 0.98402 | 98.4% |

**3.3 Why Classification**

The Classification algorithm is a Supervised Learning technique that is used to identify the category of new observations based on training data. In Classification, a program learns from the given dataset or observations and then classifies new observation into several classes or groups.

We used the Classification algorithm because we have 3 identified categories. We already talked about them, but we’re going to mention them another time. The first category is Math and Science (it means the student is the best at math and science), the second category is Theory (it means the student is the best at Theory), the third category is Programming (it means the student is the best at Programming).

So, in the matter that we have three identified categories, we’re going to provide the machine learning algorithm with a training set with identified observations.

**Chapter4: Conclusion**

Our application is an ambitious one we decided on it and worked hard to develop the idea to what it has become this came with a lot of difficulties and after a lot of hard work.

We hope this application would help more students and, in the future, we can add more majors to be more effective and more inclusive.

**4.1 Summary**

In this document we’ve talked about all the steps of creating our project (Study Compass), also we’ve shown a lot of diagrams like the use case diagram.

**4.2 Future Work**

Based on feedback from users we will see how to enhance the mechanism application.

We're going to make this web application for all universities around the world and make it not only for Computer Science students but for all majors.