Application for choosing disciplines for food and biotech industry students

Mariya Zhlekova1,* and Ivan Petleshkov1
1 University of Food Technology, 26 Maritza Blvd, Plovdiv 4002, Bulgaria

Abstract. Despite the multiple ways of communication between students and lecturers, the implementation of a course selection application contributes to the timely awareness of students about the subjects they will study in the curriculum, as well as facilitates lecturers in storing and managing the data obtained. The purpose of the research is to develop a web-based application that automates choosing disciplines from an elective block for the needs of students in the food and biotech industries. To achieve this goal, the logical processes in the choice of study disciplines by food industry students were investigated, the existing techniques and technologies for creating web apps were analyzed, tools were selected for the specific implementation, appropriate disciplines were selected related to the researched area, the database was built, the client interface was made (including responsive design), as well as the functionality of the system and numerous tests and experiments. The application has been tested with students studying biotechnology disciplines and the experiments performed demonstrate the main functionalities of the application and prove its reliability. Validations help to avoid misuse and limit the application to be used only by graduates of the University of Food Technology – students in the food and biotech industry.

1 Introduction

Nowadays, education is one of the most important things in human development. Universities offer a wide variety of specialities and disciplines for students to choose from. This is undoubtedly an extremely important choice for them, as their future development depends on it. For the convenience and awareness of the food and biotech industry students responsible for the successful completion of their education, it would be good to have an application where they would be able to choose disciplines that would be interesting for them to study during the educational process. It will facilitate the administration by the lecturers of the data for the selected disciplines.

The purpose of the research is to develop an application for choosing disciplines from an optional block proposed and accepted in the current curriculum. The application was created for the University of Food Technology (UFT) to automate the educational process of students and lecturers in food and biotechnology.

To achieve this goal the logical processes in the choice of study disciplines by food industry students were investigated, the existing techniques and technologies for creating web apps were analyzed, tools were selected for the specific implementation, and appropriate disciplines were selected related to the researched area. In the next stage, the database of the application, the client interface (incl. responsive) and the functionality were built and many experiments were done.

2 Related work

Typically, higher education institutions use different software applications for different purposes and spend money on periodic maintenance and servicing of the purchased systems. The factors that define an educational information system as good are related to an easy-to-navigate interface, data quality and management, impact of information on decision-making, availability of a web portal with academic information, etc. [1].

The use of information and communication technology (ICT) in education is an absolute necessity that must be undertaken and used by higher education institutions if they want to improve the quality of education [2]. It especially applies to content management systems, the so-called electronic and distance learning systems and work process management systems in educational institutions. The application of ICT at the curriculum level enables students to generate their own set of learning subjects. According to UNESCO’s International Bureau of Education [3] a curriculum model in which content is divided into individual disciplines is called "discipline-based" and covers the full range of individual disciplines, both the more traditional ones such as mathematics or physics, and newer areas of study such as media education, linguistics, etc. A discipline-based approach characterises teaching practice within one subject and encourages teachers to specialize, have a...
The curriculum of bachelor's and master's degrees according to the current legislation in Bulgaria includes mandatory, optional and facultative disciplines (courses); educational and production practices; internship; state exam or thesis. Mandatory courses provide the foundation (base) in the preparation for the speciality, and optional courses are supplemented with specific knowledge and competencies. Higher education institutions provide each student with the opportunity to choose disciplines within the established curriculum for the relevant speciality. The selection process is different for each Higher Education Institution (HEI). Enrollment for elective subjects is carried out based on the rules adopted at the university by submitting a corresponding application for the upcoming academic year. Again, according to the current legislation, every student has the right to choose at least one and at most two elective subjects per semester.

In his study [5], the author argues that a qualitative reform of higher education is achieved by replacing classroom teaching with more active forms of learning. It is through the optional disciplines that inclusive education is achieved, which adapts to the changing social conditions in which students are placed after completing their education.

This section examines leading universities in the country and their experience in creating and using such tools. At the University of National and World Economy (UNWE), students are ranked based on their wishes, arranged in descending order, and the average grade from the previous semester [https://www.unwe.bg]. The request is submitted online in the information system of the UNWE. Students are offered a list of possible elective courses by semester and a short annotation for each course.

At Sofia University (SU), students are informed about the optional and elective subjects of each semester from the curricula published on the SU website. Applications for elective courses are submitted in the Student Information Management System (SUSI). The enrollment campaign has a limited period, after the end of this period, the disciplines chosen by the student become mandatory [https://www.uni-sofia.bg]. Students must indicate in SUSI reserve disciplines to which they are directed in case of an insufficient number of students wishing to hold classes. For all elective subjects, SUSI includes a short annotation about the content of the course, the language of its implementation, the requirements of the teachers and the curriculum applied. In some of the disciplines, there is a limit to the number of enrolled students. Every lecturer who participates in a teaching team of an elective discipline can at any time during the elective course enrollment campaign see which students and with what status have enrolled for the course [https://www.uni-sofia.bg].

At Plovdiv University (PU), the selection of disciplines is carried out through a different approach in the different faculties. Some have built-in tools for submitting online requests for the choice of disciplines, in others – this is done by manually filling out an application in paper format. The order, conditions and deadline for choosing the disciplines are determined by a decision of the Faculty Council of the relevant department (faculty). The distribution of all applied students is done according to the order of submission. All others, including those who did not apply, are assigned ex officio and enrolled to study other elective subjects [https://uni-plovdiv.bg].

At the moment and at the University of Food Technology, the submission of applications for the selection of disciplines is carried out manually (on paper), but with the created web application part of the actions of submitting applications, selection of disciplines, ranking and preview of the candidates are also automated according to this in this way, the activities of the students and the administration by their teachers are facilitated.

3 Materials and methods for design a web application

This section discusses the selection of materials: local storage server and database management system, as well as methods and tools for building the web-based application. The technology chosen for the implementation of the logic of the web-based application is PHP.

3.1. Installing Xampp

The integration and management of the database are possible thanks to the cross-platform open-source web server developed by Apache – XAMPP. A standard version v3.3.0 is installed. It was used to run PHP and HTML scripts in this application. From the control panel, the individual components of the XAMPP package can be effectively controlled, monitored and managed. Individual modules can be started or stopped, all specific components can be configured, all active processes can be monitored, all active services can be displayed, and applications can be tested before they are hosted and published on an external server.

Fig. 1 shows the file structure of the discipline selection application. It is contained in a main folder htdocs. This directory contains all the folders and files of the project and in this case, the following folders and files have been created:

- Assets – the folder contains CSS files, images and JavaScript code,
- Pages – all files used to develop the project,
- Src – a folder with the library for exporting and printing the table with data on elective disciplines and students,
- Functions – file with functions in the web app,
- Index – main file for starting online session.
students and with what status have enrolled for the elective course enrollment campaign see which team of an elective discipline can at any time participate in the selection of elective courses. In some cases, an insufficient number of students wishing to complete their education is achieved by replacing the mandatory subjects with optional and facultative disciplines according to the conventions of their discipline [4].

3.2. Development environment

Programming is achieved with the integrated development environment (IDE) – Visual Studio Code and the platform-independent scripting language JavaScript. Visual Studio Code is a popular environment among programmers and offers great opportunities for transformations and visualization of results. It allows the maintenance of the life cycle of the developed application through a debugger. With this IDE, one can work with individual files or with a structured file system [6]. This is what makes Visual Studio Code one of the most used and desired environments by programmers for software and web application development.

3.3. Technologies used

**HTML** [7] (Hyper Text Markup Language) is a language for building the structure of web documents. The description of the document is done through special HTML elements. They shape the individual parts of a web page, such as titles, quotes, sections, forms, hypertext links, etc. HTML document is simply a text file that contains the information you want to publish and the appropriate markup instructions indicating how the browser should structure or present the document.

**CSS** (Cascading Style Sheets) is a language containing tools that can be used to influence the appearance of HTML pages [8]. CSS provides significant convenience in building and controlling the appearance of HTML documents by modifying a single CSS file, without the need to modify the HTML code of every page in the project. It is the most commonly used language for controlling the appearance of web pages.

**JavaScript** [9] JavaScript is an interpretive programming language introduced in 1995 as a means of adding programs to web pages. It is embedded in web pages, used to manage objects within them, and executed by a browser. It is suitable for preprocessing form data before it is sent to the server, thus saving server computation time. JavaScript serves the dynamics of a web application and its functionality. JavaScript code can be executed in several ways. This is possible thanks to the so-called events, the most commonly used of which are Onload (the corresponding function is executed when the file is loaded) and Onlick (the corresponding function is executed when a button is pressed).

**jQuery** [10] is one of the core libraries of the JavaScript language. This library accesses every element of a web page, thus allowing to building of dynamic functionality in pages and applications easily. jQuery is a free library and is used by almost everyone who has included JavaScript in their code. Thanks to jQuery’s features, developers can easily access all the elements on a page and also can make AJAX [11] requests to the server to load data faster and parse JSON data [12].

**PHP** (Hypertext Pre Processor) is a simple yet powerful open-source scripting language designed for creating web content. And as such it executes its programming instructions at runtime. What differentiates it from JavaScript is that the code is executed on the server by a PHP interpreter and the PHP scripts are processed on the server. PHP was originally designed to create dynamic web content. PHP can be used for generating XML documents, graphics, animations, PDF files, and so much more. PHP supports all major databases (MySQL, PostgreSQL, Oracle) [13].

3.4. Designing the database structure

**MySQL** [14] is an open-source relational database management system. SQL (Structured Query Language) is a structured query language designed for creating, processing, and reading databases, which are packages of related information stored in tables. MySQL organizes data into tables and allows quick access to it, which is why it is widely used in building web applications and websites, especially those with large volumes of information requiring fast reading and processing.

A MySQL relational database was used to record and store information about students, teachers and selected disciplines. The database of the application consists of two tables (users and user discipline) and the relationship between them is made by the faculty number of the students (faculty_id).

The table Users store data about the users (students and teachers) who have registered in the application. It contains the following fields (Fig. 2):

- id – primary key, not null field
- name – text field
- faculty_id – faculty number of a student
- speciality – speciality
- course – course
- semester – semester
- role_id – a role for a student or a teacher
- password – password
- email – email
- title – academic position/science degree
4 Development of an application for choosing disciplines

The web-based application is designed to contain the following modules:
- Registration and login form,
- Discipline selection panel,
- Admin panel for review, reports and administration.

HTML, CSS, JavaScript, jQuery, and PHP have been used for their development and have contributed to the vision, functionality and intuitiveness of the project.

The design of the modules is in line with modern trends and is modelled so that users have good visibility of all elements of the web pages. The registration checks are designed to benefit the users and ensure their security. Only users with institutional emails are allowed access. The disciplines selection form is convenient and pleasant to use, making it easy for students to select. The summary data view in the admin panel is convenient for viewing and managing student data. Print and export options are provided, as well as a filter to easily search and sort the table data.

Logically, the application consists of several interconnected pages, united in a common design. The project consists of a page for registration and logging in, a page for selecting the disciplines that students prefer to study and a page where teachers can administer the students’ data.

4.1. Registration and login page

The Login page is the first and base page of the application. It is where users (lecturers and students) create their profiles and can register and log in to the system (Fig. 4). A JavaScript file takes care of dynamically changing the registration and login panels of the application.

Users are given the option to register as students or lecturers, with their details recorded in table users. Student registration is possible with a valid university email address (Fig. 5).

```javascript
if (document.getElementById('email').value !== '') {
  if (document.getElementById('password').value !== '') {
    alert('The email and password must be filled out!');
  } else {
    alert('The password must be filled out!');
  }
} else {
  alert('The email must be filled out!');
}
```

Fig. 4. Registration in the system as a student and lecturer

4.2. Discipline selection page

Confirmation of a selected discipline is done with the "Save" button. After confirmation, the data with the selected discipline is saved in table user_discipline.

```javascript
if (document.getElementById('faculty_id').value !== '') {
  if (document.getElementById('name').value !== '') {
    alert('The faculty number and name must be filled out!');
  } else {
    alert('The name must be filled out!');
  }
} else {
  alert('The faculty number must be filled out!');
}
```

Fig. 5. A fragment of registration and login fields

Authentication is used to log in to the application to choose disciplines, which verifies that the data entered.
by users exists in the database. If a user attempts to reg-
ister again with the same credentials with which they
have already registered, the application displays an er-
or message. Using PHP, a check is made whether the
user who registered with the system is a student or a
teacher. The choice is made by clicking the check box
in the registration field. If the box is clicked the system
assumes that the registered user is a lecturer and re-
directs him to the admin panel, and if a student registers
the system redirects him to the discipline selection web
page (Fig. 6).

4.2. Discipline selection page

After logging in, users with the student role are
redirected to a discipline selection page. It contains the
fields for selecting courses and information about the
current user – name, course, and semester (Fig. 7).

Confirmation of a selected discipline is done with
the "Save" button. After confirmation, the data with the
student’s faculty number and the selected disciplines
are saved in the database in the table user_descipline.

At the end of each web page, there is a footer with
useful information about the university, such as links
and contacts of important departments for students.

4.3. Administration page

When a user with a teacher role logs into the system,
they are forwarded to the application’s admin panel. It
consists of a header including the university logo and
the caption "Welcome", followed by the academic
position, the science degree and the name of the
lecturer.

Fig. 8 shows a list of students and their selected
disciplines with student information such as name,
faculty number, speciality, course, semester, email
address and selected disciplines.

Users with teacher roles have the option to export
to .csv and .xls format and print the data from the table
(Fig. 9). For this purpose, the ready-made simple Excel
php library is used.

![Fig. 8. View the page with selected disciplines by students](image)

![Fig. 9. Initialization of the administration page](image)

![Fig. 10. Delete data from the Discipline table and database](image)

Thanks to a JavaScript framework, via jQuery, the
ability to sort the table by each of the columns,
respectively in descending and ascending order. A
search by keyword or part of a word has been added,
which is useful when there is a large amount of data in
the list.
4.4. Responsive design

The application has separate CSS files for the three main pages Admin, Login and Student_dashboard.css. Thanks to the capabilities of the CSS language, each page of the project is made of what is called responsive design. Through it, the discipline selection application works on different-sized displays no matter their resolution. Responsive design is enabled using the tag: `<meta name="viewport" content="width=device-width, initial-scale=1.0">`. It expands the window area and displays the web content of the page.

Responsive design is also functional on the discipline selection page, as it is required to look good and be easily readable on devices with a smaller resolution and a display width of 1024 pixels. To look good on small devices the table in the admin panel is vertically oriented without loss of content (Fig. 11).

Fig. 11. Responsive page design for administration

5 Results

This section shows experiments performed on test data by UFT students and lecturers. There are 10 students, 6 lecturers, and several elective blocks with optional disciplines included in them. In Fig. 12 and Fig. 13, the recorded data of registered lecturers, students and selected courses are visualized.

Fig. 12. Table with registered students

Fig. 13. Table with selected disciplines

When registering lecturers or students, all the checks available to the system are tested: for the length of the password, for the strings in the First and Last Name field, the numeric format in the Course and Semester field, whether the requested format for the university email followed, etc.

6 Conclusion

The proposed web-based application was developed with the idea of automating and facilitating the work process of students and lecturers in choice of disciplines and allocation of students to groups of elective disciplines.

The application has been tested with students studying food and biotechnology disciplines, and the conducted experiments demonstrate the main functionalities of the application and prove its reliability. Validations help to avoid misuse and restrict the application to be used only by University of Food Technology alumni – students in the food and biotech industry.

References