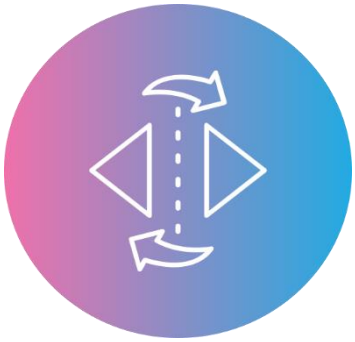
An-Najah National University

Faculty of Engineering and Information Technology
Computer Engineering Department

Graduation Project I

Skill-Swap



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Disclaimer

Aya Nassar and Ruoa Awaysa collaborated on the completion of this paper. The authors acknowledge full responsibility for any errors identified within. The ideas, suggestions, findings, and opinions expressed in this paper solely belong to the authors and do not reflect the viewpoint of An-Najah National University.

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Chapter 1

Abstract

In today's educational landscape, fostering meaningful connections and collaboration among students is crucial. Firstly, we as computer engineering students ,we need a culture of collaboration and lifelong learning among students by enabling us to share our expertise and acquire new skills from peers. Moreover, among students and both courses and societies. This promotes a dynamic and supportive learning environment, enhancing overall educational outcomes. Additionally, bridges the gap between students and student societies, facilitating seamless communication, resource sharing, and event coordination. We decide to create project named “Skill Swap” enables University Students to exchange skills and knowledge with others. It creates a platform where Students can share their experiences in some areas while learning something new from someone else in return as well as facilitate seamless skill-sharing and collaboration within the university community .It also enable students to find academic support through tutoring, study groups, and access to course materials and interact with societies.

Our app will include 3 personal accounts : Students , Societies , and Courses Center . Many functionalities are provided through the app:

- Students Account will include their academic achievements, majors, and educational background. And they can Specify skills they possess or skills they are looking to learn .

- Students can connect with peers who share similar academic interests helping to foster a sense of community by group chat.
- Students can search and participate to courses , events and workshops from courses center and Societies in their area of interest.

- Students can put the areas in which he interested in, and encloses that in profile area.

- Societies create profiles detailing their mission, objectives, and activities.

  • Student can join a society and be a member so, society makes announcements and updates visible to all members .

- Society has a calendar where they can mark their events, meetings and workshops, enabling students to join according to the society’s schedule.

- Students can book courses, view their bookings, and access details about the courses ,societies through their calendar.

- Course Center can list courses they offer, including course descriptions, objectives, and Trainer .And also share class schedules, meeting times, and locations if applicable to students.

- A course center Admin can add new courses, and the app can send notifications to students interested in these courses
- Course Center can view the students who have join courses and access information about them.
- There is a grouping chat between students according to their interests.
- Students receive notifications to stay informed about their booked courses appointments , interested society's events etc..
- Students have the ability to rate courses and view their ratings.
- An administrative page on our website, which is capable of displaying user information and facilitating the deletion of such data. Furthermore, the administrator has the ability to access a chart showcasing the earnings.

We have identified several applications that resemble parts of our own application. However, these features are currently scattered across multiple applications. Our goal is to consolidate all these features, along with additional new ones, into a single integrated application. This unified approach will greatly enhance user experience and make it much easier for users to navigate and utilize the application.

The project consists of a mobile application designed for users, along with a website accessible to both the admin and users. To develop the application and website, a variety of tools and frameworks were utilized. Specifically, the Flutter framework, which is built on the Dart programming language, was employed to create a cross-platform mobile application and website. Further details regarding this will be discussed in the methodology section.

CHAPTER 1. ABSTRACT

Chapter 2

Introduction

2.1 Problem

Traditional educational systems often fall short in providing avenues for students to collaboratively enhance their learning experiences. Limited platforms exist where students can share their unique expertise, seek assistance, or discover opportunities for skill development. This void hinders the potential for a vibrant and interconnected university community, where the exchange of knowledge is not confined to formal classroom settings.

2.2 Objective

The main goal of the "Skill Swap" app is to transform the collaborative interactions within the university community by providing a novel platform for seamless exchange of skills and knowledge. The app aims to promote a culture of collaboration among students, breaking down disciplinary barriers and creating a space for individuals with diverse academic interests to connect. By facilitating one-on-one tutoring, study groups, and resource sharing, the app seeks to improve educational outcomes and contribute to a dynamic and supportive learning environment. The app's comprehensive profiles for students, societies, and course centers allow users to showcase their accomplishments and goals, creating a lively community hub. Additionally, the app serves as a link between students, societies, and courses, ensuring effective communication, coordination of events, and easy access to academic resources. Through the innovative use of technology, the "Skill Swap" app aims to surpass existing platforms by offering a unique and user-friendly interface that integrates all necessary features for comprehensive student skill-sharing and collaboration.

2.3 Scope Of the Work

Our application focuses on the field of computer engineering includes the development of a specialized platform to facilitate collaboration and knowledge exchange among students. This involves creating user-friendly interfaces for three main account types—Students, Societies, and Courses Center. The application will enable students to showcase their academic achievements, majors, and technical skills, fostering connections with peers who share similar interests. Course Centers can list technical courses, share schedules, and notify students about new couses. Societies can create profiles, organize technical events, and engage with their members effectively. The work also encompasses essential features like one-on-one tutoring services, study group coordination, and access to course materials. The primary goal is to address the unique needs of computer engineering students, creating a purposeful platform

that enhances collaboration and academic experiences within the department. Additionally ,students have the opportunity to ask questions, join groups .

2.4 Importance

The lack of a dedicated platform for skill and knowledge exchange impedes the development of a robust collaborative culture among students. In today's fast-paced and technology-driven world, students need more than just academic courses to thrive. They require a space where they can showcase their skills, learn from peers, and actively participate in the diverse offerings of student societies and courses.

The complexity of the situation is further compounded, underscoring the significance of efficient and streamlined communication channels within the field of computer engineering. In light of this, the concept emerged to offer students the opportunity to explore their interests, events, and courses within their desired specialization. This initiative benefits students, course centers, and society at large, as it enables students to access the necessary expertise, while allowing course centers to effectively utilize their available resources. Consequently, the investment is realized for the users. The idea involves a platform where users can input various information, such as education, skills, certificates, and talents, to aid in the selection of suitable courses or events. Additionally, there is an// evaluation system for courses on the course center's page, enabling students to make informed decisions based on the most requested and highly rated courses, as well as their personal interests. Furthermore, the platform facilitates group chat for students to ask questions related to computer engineering, with the opportunity for any user to provide assistance . Society can also organize seminars for students on specific topics in computer engineering. Additionally, course centers can set their availability on the calendar at the desired price for the desired duration, //and students can select and pay for available and unreserved appointment slots using a credit card. Students have access to their own calendar displaying their booked appointments and relevant information. Course centers can view the information of students who have booked with them.

2.5 Report Organization

This report is organized as the following, Chapter1:The Abstract of our project, then in Chapter2: an introduction and overview about the importance and the scope of this project.In Chapter3: the problems and constraints that we faced in this project, Chapter4:literature review, Chapter5:the methodology used to complete the project. In Chapter 6: We explained in detail about the machine learning model, all the tools and languages used to design it, and how we used it in our application. Chapter7:Result and discussion, Chapter8: Conclusion and recommendation.

Chapter 3

Constraints, Standards and Earlier coursework

3.1 Constraints and limitations

1. Compilation of features: We tried to have our application familiar with all the features that the student needs in order to receive what he wants easily, so it was necessary to think deeply and conclude the best features to include them in the project.

2. Time limit: We had to learn new programming languages like Dart and mobile frameworks like flutter, as well as back-end frameworks like Node.js, since this is the first time we are creating a mobile application and we haven't learned it in previous courses. In order to use the Firebase Database, a cloud-hosted database, we also had to become familiar with it and learn how to use it. MongoDB database is something else we study and work with. This was more challenging than normal because we were working under pressure because we had other commitments, but we attempted to make everything we learned familiar to us in order to use the features and to program appropriately.

3. Internet connection: Always having an online connection is necessary for our application.The JSON requests are responsible for this.

3.2 Standards

3.2.1 MVC (Model View Controller)

The Model-View-Controller (MVC) pattern was employed in our system. We split the entire project into three parts, making it easier to track the flow of work. These components are: as follows:

- The Model: It represents the database we used, MongoDB. It is also in the ML model which is the recommendation system which is based on a detailed data model that includes all the necessary details about the experts and their profiles, which uses this data for training.The Model responds to both the requests from the view and the controller to keep itself updated.

- The View: It represents the graphical user interface (GUI) that will be used by users such as admins, students, and experts. It allows them to make reservations, manage bookings, inquire through questions, rate and search

- The Controller: It represents the back-end server built with Node.js for the application and website. It also serves as the server for the detection model. The controller facilitates coordination and cooperation between the Model and the View.

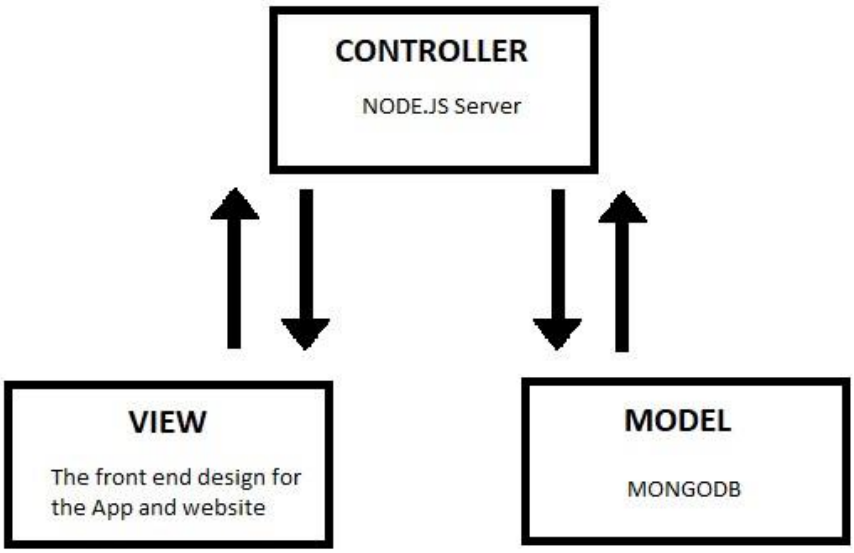

Figure 3.1: MVC Structure of the system.

3.2.2 Agile Model

We utilized the Agile model methodology to design and document our software system. We segmented the tasks into five stages, which include:

- Stage 1: Requierment analysis:

  During this stage, we engaged in brainstorming sessions and identified the fundamental features that we aim to offer through the application.

- Stage 2: Planing:

  We have established a timeline for completing the checks, with each task assigned a specific time-frame. Once a task is completed, it is reviewed and discussed with the project supervisor.

- Stage 3: Design the requirements:

  The project work was divided based on prioritization, with higher priority tasks being addressed first. There were almost daily meetings to review progress, discuss upcoming

work, and address any challenges encountered to facilitate their resolution. Additionally, each component of the project was divided into user stories to plan the why, for whom, and what of each desired feature.

- Stage 4: Development:

  For this phase, we began writing the code for both the front end and back end of each page. Additionally, we// trained our recommendation system model to be used within our application.

- Stage 5: Testing:

  First, we verify the functionality of the back-end by testing it in Postman and ensure that it works correctly. Then, we establish the connection between the back-end and front-end to ensure that every page functions are correct. Additionally, we perform tests to assess the accuracy of our machine learning model.

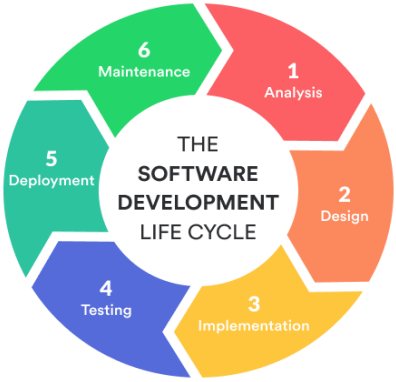

Figure 3.2: Applying Agile model.

3.3 Earlier coursework

During our Computer Engineering studies, we enrolled in several courses that provided us with valuable knowledge and skills. These courses included Web Programming, Object-Oriented Programming, and the Database course, which served as a foundation for learning frontend and back-end development and working with real databases. Additionally, the Software Engineering and Advanced Software courses were instrumental in helping us adhere to software engineering standards while writing our code. The knowledge gained from these courses greatly contributed to our project and accelerated the programming process, allowing us to rely on our existing knowledge rather than constantly referring to external resources. Furthermore, at the beginning of the semester, we independently learned Flutter, Dart, Node.js, MongoDB and Firebase, which further expanded our expertise in software development.

Chapter 4

Literature Review

In today's dynamic educational landscape, fostering meaningful connections and collaboration among students is paramount. The "Skill Swap" app emerges as a promising solution to enhance the learning experience for computer engineering students by facilitating seamless skill-sharing and collaboration within university communities.The app unfolds with three distinct personal accounts: Students, Societies, and Courses Center. Each account type encompasses tailored features aimed at enriching the educational journey.

The need of organizing the IT function within educational institutions is emphasized by Agarwal and Sambamurthy (2002). They underline the importance of strategic planning and the need to match IT activities with educational objectives in order to effectively promote the integration of technology in education.(2)

Computer conferencing in higher education and its potential for critical inquiry are topics covered in depth by Garrison, Anderson, and Archer (2000). The study emphasizes the value of text-based collaboration and communication in promoting student intellectual engagement and deep learning.(3)

Graham (2006) goes into more detail on blended learning systems, outlining the idea, present tendencies, and prospective directions. The author examines numerous blended learning models and strategies, highlighting both their advantages and disadvantages. To enhance learning outcomes, the study underlines the requirement for effective online and face-to-face component integration.(4)

In computer-supported collaborative learning (CSCL) environments, So and Bonk (2010) concentrate on the functions of blended learning approaches. The authors consult experts using a Delphi research to determine the main advantages and benefits of blended learning in promoting student collaboration and knowledge construction.(5)

In conclusion, the "Skill Swap" app represents a transformative platform poised to revolutionize collaborative learning within university communities. By fostering a culture of knowledge exchange and lifelong learning, the app empowers students to unlock their full potential and thrive in today's competitive educational landscape.

Chapter 5

Methodology

In this section, we provide a detailed explanation of the methodology as following :

5.1 Backend Development

We used specific architecture in our Node.js application during the development phase. The services, models, API, and middleware folders in the backend source were grouped to represent the structure components.

- Models:The models in our application reflected the underlying collections and data structures in the MongoDB database. To design and communicate with our models, we used the Mongoose library, which offers an Object Data Modeling (ODM) layer for MongoDB. We were able to construct schemas with Mongoose, which governed the structure, validation guidelines, and behavior of our data..

- Services: Services acted as the layer of communication between controllers and models. They handled data manipulations, engaged with external APIs when needed, and contained the application's business logic. We put in place a number of services, such as User Service for user-related tasks and Rates Service for Rating.

- API:To expose the backend functionality, we created and developed a RESTful API. The API had a number of well defined endpoints, each of which corresponded to a different action or resource. We used the necessary HTTP methods (such as GET, POST, PUT, and DELETE) for each endpoint while adhering to REST principles. Our API provided a number of functions including user login, appointment scheduling, and user data retrieval.

5.2 Frontend Development

We used the Flutter framework to build the front end for the web site and mobile application which prevented us from having to write duplicate code and saved us time.

- The design:we first decided on the colors to give it an official and educational feel. We went with blue, white, and gray, and we pulled some interface ideas from the Linkedin and Facebook websites because they are somewhat comparable to our idea

- Frameworks: Our choice to employ Flutter, a Google open source framework, was made after careful consideration of all of its qualities, the most crucial of which is its effective performance. Code can be exchanged between target systems thanks to a cross-platform framework. There are no other application frameworks besides Flutter that let you share both the code and the actual user interface,Additionally, because it is open source, there are numerous documentation and courses that can be studied and profited from, which speeds up the learning process and makes it easier to solve the problems that programmers frequently encounter. In conclusion, Flutter is the simplest way to generate speedier code developers with high-performing cross-platform mobile apps.

- Programming languages:Dart is a programming language that Google created with web and mobile application developers in mind. It may be used to create applications for Android . The language aims to function on all cutting-edge online browsers, mobile devices, and even web servers. It is obvious that we will use Dart as we'll be leveraging the flutter framework.

5.3 Database Design and Configuration

MongoDB is chosen as the database technology for the project due to the following reasons: • Flexibility: The NoSQL document-based architecture of MongoDB allows for flexible data handling. MongoDB does not need a predetermined schema, in contrast to conventional relational databases, making it simple to adapt and modify the data model as the project progresses. When working with dynamic and developing data structures, this flexibility is especially useful.

- Performance: When it comes to data retrieval activities, MongoDB performs incredibly well. Its document-oriented paradigm and effective indexing techniques make data querying quick and effective. Complex queries with several fields and criteria are supported by MongoDB along with other query types. Furthermore, built-in caching and memory management tools boost query performance and speed up response times.

- Evolution of the Schema: MongoDB's adaptable schema makes it simple to handle alterations to the data structure over time. With MongoDB, changing the fields in a document may be done quickly and without messing up the data already present. In agile development contexts where needs may change often, this flexibility is very advantageous.

- Node.js integration: The official MongoDB driver for Node.js enables easy interaction with the project's Node.js backend. A wide range of functions and utilities are offered by the driver, which makes it easier to perform CRUD activities, execute sophisticated queries, and use MongoDB's cutting-edge features inside of Node.js applications.

5. Management

Since the project consisted of a web page and a mobile application, we needed to use a Puppeteer in Node.js provides a flexible and efficient solution for automating web browser actions. It assists us in creating a mangament system between courses centers and students as well as between socities and students.

5.5 Calendar and Appointment Scheduling

We use a Flutter Calendar because of its wide range of capabilities, simplicity of use and flexibility . It enables us to easily add dynamic and practical calendars to their Flutter applications. Additionally, we used the provider to add an event to its internal state so that other widgets that depend on it might use it.

5.8 Evaluation and Rating System

In order to make it easier for the student to choose the appropriate course to learn according to what he want , and in order to support the course center page, the application also provides an opportunity for the student to evaluate the course with whom he booked and received information from him, so the student can only evaluate the course from 0 to 5 using stars.

5.9 API Testing

We all know that we need to regularly test different parts of the server to see if the API is functional and what happens when we provide the required data. All of this is accomplished using Postman, a software development tool that enables the user to validate the request he intends to submit to the server. A specific web server address is used to send the request, after which the server's response is displayed.

6.6: Training Accuracy Curve .

Chapter 7

Results and Discussions

The SKILL SWAP application is a versatile platform designed to cater to the diverse needs of students, course centers, and societies in Computer Engineering. Offering cross-platform accessibility, users can seamlessly engage with the application from various devices. User accounts form the nucleus of personalized experiences, enabling individuals to join courses, participate in events, and connect with peers who share similar interests. Appointment reservation functionality empowers students to schedule bookings with course centers and societies, enhancing flexibility and convenience. Direct communication channels facilitate meaningful interactions, fostering collaboration and knowledge exchange among users. The ability to reserve rooms within the Engineering College at An-Najah University streamlines logistical aspects, ensuring smooth coordination for academic and extracurricular activities. A robust communication system, coupled with a recommendation engine based on cosine similarity, enriches the user experience by providing personalized suggestions and fostering community engagement. Administrative features empower administrators to manage user information effectively, ensuring transparency and accountability throughout the platform. In essence, the SKILL SWAP application embodies a comprehensive solution aimed at enhancing learning and collaboration within the Computer Engineering domain.

7.0.1 Learning

In order to acquire new knowledge and skills, thorough research is essential. It is crucial to ensure optimal utilization of the technologies involved, which requires effort and time, especially when dealing with unfamiliar technologies. For our project, we selected Flutter as our platform and leveraged various online resources to facilitate the learning process. Additionally, we opted for Node.js and familiarized ourselves with it through documentation and other relevant sources. Similarly, we learned how to work with MongoDB by referring to documentation and other available resources.

7.0.2 Challenges

- We encountered several challenges during the project, with one of the significant ones being the frequent updates to the software versions. This posed problems with compatibility between the code and the libraries used. It was crucial to ensure that the libraries were compatible with the specific software version being used. Consequently, we had to make necessary modifications to the code to align it with the corresponding software version.

    - Understanding the causes of exceptions and errors in the code was not always straightforward. It involved investing time in research and troubleshooting to identify the root cause of the issue. Once the problem was identified, we would work on resolving it.

Chapter 8

Conclusion and Recommendations

8.1 Conclusion

Skill Swap project represents a significant step towards addressing the challenges and limitations within traditional educational systems, particularly in the context of computer engineering. The collaborative learning platform designed to connect students, societies, and course centers strives to create a vibrant and supportive community. By seamlessly integrating features such as one-on-one tutoring, study group coordination, and comprehensive user profiles, the application aims to enhance the overall educational experience for computer engineering students. The project not only consolidates existing features scattered across multiple applications but also introduces novel functionalities tailored to the specific needs of computer engineering students. Through this comprehensive approach, the project aims to foster a culture of collaboration, lifelong learning, and community engagement within the academic setting.

Building this application has allowed us to gain a wide range of skills:

- We have successfully created a mobile application and website using Flutter and the Dart programming language and Node.js. This has allowed us to leverage Flutter's extensive widget library and Dart's powerful features to build a robust and visually appealing app and make us familiar with Node.js.
- Throughout the project, we have collaborated with numerous Flutter packages to enhance the functionality of our app. These packages have provided us with ready-made solutions and features, saving us time and effort in development.
- We have successfully implemented a chatting system our application, providing users with the ability to communicate and exchange messages in real-time to enhances user interaction within the application.

- In our app, we have worked with non-relational databases such as MongoDB and Firebase. This has provided us with valuable experience in handling and managing data in a flexible and scalable manner.

8.2 Future work

We don't want to just stop there, there are a lot of features that we want to enhance, and some that we want to add to our app.

- Chat system :We intend to improve it by adding voice messages, images.
- Enhanced Recommendation Algorithms: Exploring advanced recommendation algorithms, such as content-based filtering, collaborative filtering, and hybrid approaches, can enhance the accuracy and relevance of expert recommendations. Incorporating machine learning and deep learning models can also enable more personalized and precise recommendations.
- Integration of GPS for Face-to-Face Meetings: Incorporating GPS functionality can allow students to search for the nearest available course centers for face-to-face meetings. This feature would enable students to have in-person discussions, consultations, or project collaborations with course trainer in their vicinity, promoting a more personalized and interactive learning experience.
- File Upload and Download Capability: The academic support platform may be improved by enabling users to upload and download books, lecture notes, and other learning resources. Students would be able to quickly access and distribute pertinent documents thanks to this feature, which would promote a cooperative and resourceful learning environment.
- Student can make a follow to the societies which have knowledge in the fields he needs.

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