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Final Project for Obtaining of a Bachelor's Degree in Computer Science
Option: Software Engineering

Toward Building a Secure Competitive Learning Platform for Computer Science Technical Challenges

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Abstract

In the ever-evolving world of computer science, practicality plays a crucial role in driving innovation and translating theoretical concepts into real-world solutions. To address this opportunity for growth, a groundbreaking web application is being developed specifically for cybersecurity practitioners. The envisioned application aims to bridge the gap between theoretical knowledge and practical application by providing comprehensive tools, resources, and challenges. Its focus on cybersecurity will offer curated challenges, simulations, and real-world scenarios to reflect the dynamic nature of the field. The application will also foster collaboration and community engagement through discussion forums, knowledge-sharing platforms, networking and job opportunities. By simplifying and enhancing the programming practice experience, the web application aims to empower professionals with the skills and expertise needed to protect digital ecosystems from evolving threats.

ملخص

في عالم علوم الكمبيوتر المتتطور باستمرار ، تلعب التجربة العملية دوراً حاسماً في دفع الابتكار وترجمة المفاهيم النظرية إلى حلول واقعية. لمعالجة هذه الفرصة للنمو ، يتم تطوير تطبيق ويبر رائد خصيصاً لممارسي الأمان السيبراني. يهدف التطبيق التصور إلى سد الفجوة بين المعرفة النظرية والتطبيق العملي من خلال توفير أدوات وموارد وتحديات شاملة. سيوفر تركيزها على الأمان السيبراني تحديات منسقة ومحاكاة وسيناريوهات من العالم الحقيقي لعكس الطبيعة الديناميكية للمجال. سيعمل التطبيق أيضاً على تعزيز التعاون والمشاركة المجتمعية من خلال منتديات المناقشة ومنصات مشاركة المعرفة والشبكات وفرص العمل. من خلال تبسيط وتعزيز تجربة ممارسة البرمجة ، يهدف تطبيق ويبر إلى تمكين المهنيين بالمهارات والخبرات اللازمة لحماية النظم البيئية الرقمية من التهديدات المتطورة.

Résumé

Dans le monde en constante évolution de l'informatique, l'aspect pratique joue un rôle crucial dans la conduite de l'innovation et la traduction de concepts théoriques en solutions concrètes. Pour saisir cette opportunité de croissance, une application Web révolutionnaire est développée spécifiquement pour les praticiens de la cybersécurité. L'application envisagée vise à combler le fossé entre les connaissances théoriques et l'application pratique en fournissant des outils, des ressources et des défis complets. Son accent sur la cybersécurité offrira des défis organisés, des simulations et des scénarios du monde réel pour refléter la nature dynamique du domaine. L'application favorisera également la collaboration et l'engagement communautaire par le biais de forums de discussion, de plateformes de partage des connaissances, de réseautage et d'opportunités d'emploi. En simplifiant et en améliorant l'expérience pratique de la programmation, l'application Web vise à doter les professionnels des compétences et de l'expertise nécessaires pour protéger les écosystèmes numériques contre l'évolution des menaces.

- Dedication -

To my teachers, parents, and friends,

I am forever grateful for the invaluable impact you have had on my life. Your guidance, support, and belief in me have shaped the person I am today. Your dedication to education, unwavering love, and unwavering friendship have been the driving forces behind my growth. I am privileged to have such remarkable teachers who have nurtured my thirst for knowledge. My parents, your sacrifices and encouragement have given me the strength to pursue my dreams. And to my friends, your unwavering support and camaraderie have made every moment memorable. Thank you for being the guiding lights in my life.

With heartfelt appreciation,

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General Introduction

In the dynamic realm of computer science, where knowledge and mastery surpass theoretical concepts, lies a deep rooted passion for practice. As computer scientists, we thrive on experimentation, iteration, and hands on problem-solving. The success and evolution of our field can be attributed to our unwavering affinity for practicality, which empowers us to unleash our creativity, drive innovation, and translate theoretical concepts into tangible solutions that fuel our modern world.

How can we revolutionize the learning experience to make it more effective, efficient, and enjoyable?

Recognizing this issue as an opportunity for growth, we have embarked on a mission to develop a ground breaking web application that specifically caters to the unique requirements of cybersecurity practitioners.

Our envisioned web application will bridge the gap between theoretical knowledge and practical application in the field of cybersecurity. By providing a comprehensive set of tools, resources, and challenges, we aim to create an environment that fosters effective and efficient programming practices for cybersecurity professionals. Through this application, we aspire to empower practitioners to strengthen their skills, expand their knowledge, and tackle the complex challenges that arise in the cybersecurity landscape.

With a focus on cybersecurity, our web application will offer curated challenges, simulations, and real world scenarios that reflect the dynamic nature of the field. We understand that cybersecurity practice requires hands-on experience with cutting-edge technologies, vulnerabilities, and defensive techniques. Therefore, our web application will provide a secure and immersive platform for practitioners to simulate real-world scenarios, test their skills, and gain practical insights.

Additionally, we recognize the significance of collaboration and community engagement in the cybersecurity domain. Our web application will incorporate features such as discussion forums, knowledge sharing platforms, and networking opportunities, enabling practitioners to connect, learn from one another, and stay updated with the latest trends and techniques.

Through our mission to simplify and enhance the programming practice experience in cybersecurity, we aim to empower professionals with the skills and expertise needed to protect digital ecosystems from ever-evolving threats. By harnessing the power of practice and practicality, we strive to contribute to a safer and more secure cyber landscape.

Chapter 1: Analyse: During this phase, we establish the program's rules, functions, behaviors, and interactions, which set the foundation for the entire project.

Chapter 2: Conception: This phase involves brainstorming to generate ideas, researching to determine the feasibility of the project, and creating a detailed plan that outlines the steps needed to bring the project to fruition.

Chapter 3: Implementation: This phase involves the actual development and coding of the web application, bringing the planned design to life through meticulous implementation and testing.

Chapter 1

Requirement Analysis

1.1 Introduction

The analysis phase is arguably the most critical phase of any software development project because of its significant impact on the program's future success.

During this phase, we establish the program's rules, functions, behaviors, and interactions, which set the foundation for the entire project.

In this phase, we must focus on understanding the program's requirements and its boundaries.

The first step is to establish the project's context, including triggers, problematic areas, and objectives. Next, we identify the actors of the system and their roles and create a static context diagram. Then, we define the program's functional and non-functional needs and specify the use cases, actor by actor, before creating the global use case diagram.

Finally, we select only five use cases for further development, creating a descriptive sheet, system sequence diagram, and prototype for human-computer interaction. Afterward, we draw conclusions about the analysis phase, considering how we can improve the project's outcomes based on our findings.

1.2 Requirement analyses

1.2.1 Market Study

1.2.1.1 HackerRank

What is HackerRank?

HackerRank [1] is a technology company that provides a platform for coding and programming competitions, as well as practice problems and assessments for businesses to screen job candidates. The company was founded in 2012 and is headquartered in Palo Alto, California.

HackerRank main features :

- ▶ One of the main features of HackerRank is its collection of coding challenges and competitions, which are designed to help developers improve their skills and showcase their abilities to potential employers. The platform offers a wide range of challenges in various domains, including algorithms, mathematics, data structures, and artificial intelligence.
- ▶ In addition to its coding challenges, HackerRank also provides a suite of assessment tools for businesses. These tools allow companies to evaluate job candidates based on their technical skills, coding abilities, and problem-solving skills. Companies can use HackerRank to administer coding tests, take-home assignments, and other types of assessments as part of their hiring process.
- ▶ HackerRank has a large and active community of developers, who participate in coding challenges and competitions, as well as provide feedback and support to each other. The platform also provides a leaderboard that allows users to track their progress and compare their scores with others.

How does the Hackerrank system run?

The Hackerrank system runs by providing an online platform that hosts programming challenges, coding competitions, and technical assessments for software developers. When a user submits their code to solve a programming challenge or compete in a coding competition, the Hackerrank system runs the code through a series of tests to determine if it produces the correct output for a given input.

To evaluate the submitted code, the Hackerrank system typically runs it in a secure sandbox environment, which is a virtual machine that is set up specifically for running the submitted code. The sandbox environment is designed to prevent any potential security risks or unintended side effects, and it does not have access to the user's local system or network.

Used technologies :

- ▶ Front-end technologies: The front-end of HackerRank is built using HTML, CSS, and JavaScript. The platform uses a modern web stack, including React.js for the user interface, and Redux for state management.
- ▶ Back-end technologies: The back-end of HackerRank is built using a microservices architecture, with various services written in different programming languages, including Java, Python, and Node.js. The platform uses a mix of open-source and proprietary technologies, including Kafka for messaging, Elasticsearch for search, and MongoDB and MySQL for data storage.
- ▶ Cloud infrastructure: HackerRank runs on the cloud infrastructure provided by Amazon Web Services (AWS). The platform uses a range of AWS services, including EC2 for compute, S3 for storage, and RDS for database management.
- ▶ Security technologies: HackerRank takes security very seriously, and employs a range of security technologies to protect its platform and users. These include SSL/TLS encryption, OAuth authentication, and various security testing tools and processes.

System Actors :

- ▶ admin: create update delete modify account.
- ▶ Developers: create account, practice and improve their coding skills, participate in coding challenges and competitions
- ▶ Recruiters and Hiring Managers: screen and assess the technical skills of job candidates, create customized coding challenges, evaluate candidates' performance.
- ▶ Educational Institutions :provide coding challenges, assignments to their students, evaluate their performance and provide feedback.
- ▶ Companies: assess the technical skills of their existing employees, identify and hire new talent

Conclusion :

Overall, HackerRank is a valuable resource for both individual developers and companies. It provides a platform for improving coding skills and showcasing abilities, as well as a tool for evaluating job candidates. With its growing user base and broad range of features, HackerRank is poised to become an increasingly important player in the tech industry.

1.2.1.2 TryHackMe

What is TryHackMe ?

TryHackMe [2] is an online platform that provides hands-on cyber security and hacking training for individuals and organizations. It was founded in 2019 and is based in the United Kingdom.

Tryhackme main features :

- ▶ One of the key features of TryHackMe is its virtual hacking labs, which allow users to practice their skills in a safe and controlled environment. These labs simulate real-world scenarios and provide hands-on experience with various tools, techniques, and exploits. Users can work through the labs at their own pace, and they receive instant feedback on their progress
- ▶ In addition to its virtual labs, TryHackMe also offers a range of courses and training programs. These courses cover a wide range of topics, including ethical hacking, network security, and web application security. The platform's courses

How does the Tryhackme system run ?

The TryHackMe system runs on virtual machines that simulate various aspects of real-world cybersecurity scenarios, such as network attacks, web application vulnerabilities, and malware analysis.

When a user selects a challenge, the system generates a virtual machine specifically for that challenge, which the user can then access via a web browser or remote desktop protocol (RDP).

The virtual machine typically runs a specific operating system, such as Ubuntu or Kali Linux, and is pre-configured with various tools and services that are relevant to the challenge. For example, a web application vulnerability challenge might include a virtual machine with a pre-installed web server and vulnerable web application that the user needs to exploit.

To complete the challenge, the user needs to use various hacking techniques to gain access to the system or application, exploit vulnerabilities, and achieve the objective of the challenge.

The system provides real-time feedback to the user on their progress and results, such as successful exploitation of a vulnerability or identification of a misconfigured service

Used technologies :

- ▶ Front-end technologies: TryHackMe's front-end is built using HTML, CSS, and JavaScript, and uses modern web frameworks such as React.js and Next.js for the user interface. The platform also leverages various UI libraries such as Material-UI and React-Bootstrap.
- ▶ Back-end technologies: The back-end of TryHackMe is built using a microservices architecture, with various services written in different programming languages, including Python and Node.js. The platform uses a mix of open-source and proprietary technologies, including RabbitMQ for messaging, Elasticsearch for search, and MongoDB and PostgreSQL for data storage.
- ▶ Cloud infrastructure: TryHackMe runs on the cloud infrastructure provided by Amazon Web Services (AWS) and DigitalOcean. The platform uses a range of AWS and DigitalOcean services, including EC2 for compute, S3 for storage, and RDS and Postgres for database management.
- ▶ Security technologies: TryHackMe focuses on providing a secure platform and employs a range of security technologies to protect its platform and users. These include SSL/TLS encryption, multi-factor authentication, and various security testing tools and processes.

System Actors :

- ▶ Admin : create update delete modify account.
- ▶ Students and learners : participate in challenge, courses and learning path.
- ▶ Cybersecurity professionals : stay up-to-date with the latest security threats and techniques , participate in advanced challenges.
- ▶ Companies : assess the technical skills of their existing employees, identify and hire new talent.

Conclusion

Overall, TryHackMe is a valuable resource for individuals and organizations who are looking to improve their cyber security skills. With its hands-on approach and growing community of users, the platform provides an engaging and effective way to learn about cyber security and to develop real-world skills.

1.2.1.3 Tianchi

What is Tianchi ?

Tianchi [3] is a global competition platform hosted by Alibaba Cloud, the cloud computing arm of Alibaba Group. It provides a platform for machine learning and artificial intelligence enthusiasts to compete and collaborate on real-world data analysis problems.

Tianchi main features :

- ▶ The Tianchi platform hosts a range of competitions in various fields, including computer vision, natural language processing, and recommendation systems. The competitions are open to individuals and teams from around the world, and provide real-world data sets for analysis
- ▶ One of the key features of the Tianchi platform is the extensive community support it provides. Participants have access to a range of resources, including technical support, learning materials, and online forums for communication and collaboration. The platform also provides a leaderboard to track the progress of participants and rank the top performers in each competition.
- ▶ In addition to hosting competitions, Tianchi also serves as a research and development platform for Alibaba Cloud. It provides a testing ground for new technologies and algorithms, and enables the company to stay at the forefront of machine learning and artificial intelligence research.

How does the Tianchi system run ?

When a user logs into the Tianchi platform, they can access various competitions that are currently active or browse through previous competitions. Each competition typically provides a real-world dataset for participants to analyze using machine learning and artificial intelligence techniques.

To participate in a competition, users typically need to register and create a team.

Once registered, participants have access to the competition dataset, which they can use to train their machine learning models. Participants can then submit their trained models for evaluation and scoring. The system runs the submitted models on a test dataset and evaluates their performance based on various criteria, such as accuracy, speed, and efficiency.

The Tianchi platform also provides extensive technical support for participants, including access to online forums, documentation, and community resources.

Participants can use these resources to collaborate with other participants, share ideas and best practices, and ask for help from technical experts.

The platform also provides a leaderboard to track the progress of participants and rank the top performers in each competition.

The leaderboard provides real-time feedback to participants and encourages competition among participants to achieve the best results.

Used technologies :

- ▶ Front-end technologies: The front-end of Tianchi is built using HTML, CSS, and JavaScript, and uses modern web frameworks such as React.js and Vue.js for the user interface
- ▶ Back-end technologies: The back-end of Tianchi is built using a microservices architecture, with various services written in different programming languages, including Python, Java, and Scala. The platform uses a mix of open-source and proprietary technologies, including Apache Kafka for messaging, Elasticsearch for search, and MySQL and Hadoop for data storage.
- ▶ Cloud infrastructure: Tianchi runs on the cloud infrastructure provided by Alibaba Cloud. The platform uses a range of Alibaba Cloud services, including Elastic Compute Service (ECS) for compute, Object Storage Service (OSS) for storage, and ApsaraDB for database management
- ▶ Machine learning and AI technologies: Tianchi is designed to support machine learning and AI challenges and leverages various machine learning and AI frameworks, including TensorFlow, PyTorch, and Scikit-learn.

- ▶ Security technologies: Tianchi takes security very seriously and employs a range of security technologies to protect its platform and users. These include SSL/TLS encryption, multi-factor authentication, and various security testing tools and pr

System Actors :

- ▶ Admin: create update delete modify account
- ▶ Students and learners: participate in challenge,courses and learning path.

Conclusion

The Tianchi platform has gained significant traction in the global machine learning and artificial intelligence community, with over 450,000 registered users from over 200 countries and regions. The platform has hosted over 200 competitions to date, with many of them attracting top talent and yielding ground breaking research results.

Overall, the Tianchi platform is a valuable resource for individuals and teams interested in machine learning and artificial intelligence, offering access to real-world data sets, technical resources, and a supportive community.

1.2.1.4 Compare between platforms

The following table provides a comparison between three popular platforms: TryHackMe, HackerRank, and Tianchi. These platforms are widely used for various purposes, including cybersecurity training, coding challenges, and technical skill assessment. The table highlights key features and aspects of each platform

Platforms	Hackerrank	Tryhackme	Tianchi
organize competition	true	true	true
search job	true	false	false
participate on challenges	true	true	true
Learn and practice	true	true	true
Evaluate the challenges using score system	true	true	true
get certificated	true	true	true
Participate to interviews	true	false	false
companies Post a job offer	true	false	false
high level security	true	true	true
using AI	true	true	true

Table 1.1: Compare between platforms table

1.2.1.5 Market Study Conclusion

the market study on HackerRank, TryHackMe, and Tianchi highlights the diverse approaches and audiences in the online learning and skill development space. By leveraging the strengths of these platforms, identifying gaps, and focusing on differentiation and community building,Now we can create a unique and successful platform .

1.2.2 Project Description

The COVID-19 pandemic has forced many educational institutions to shift to online learning, which has resulted in a surge in demand for online education platforms. However, the sudden shift to online learning has also highlighted the limitations of existing platforms, particularly when it comes to ensuring

the security and integrity of the learning experience.

This project is aimed at addressing these challenges by developing a secure competitive learning platform that provides a level playing field for all students, while also protecting the privacy and security of their data.

The platform will be designed to be engaging and interactive, with features that promote collaboration and critical thinking, and also allow for real-time feedback and assessment , also this system allows companies to find workers according to the job position and the skills required in this

1.2.2.1 Problematic

As education has shifted to digital platforms in recent years, there has been a growing need to make online learning more engaging, effective, and practical. Traditional methods of study can often be dull and unstimulating, leading to a lack of motivation and engagement among students. and for this, we can pose the following questions:

- ▶ How can we avoid the classic system of study and make it more fun and practical?
- ▶ How can we evaluate the effectiveness of the platform in improving student learning outcomes and developing thinking and collaboration skills?
- ▶ How can we incentivize student participation and ongoing learning through a gamification system that is engaging and effective?
- ▶ How can we ensure fair and balanced competition among students, while still allowing for diverse learning styles and backgrounds?
- ▶ How can we effectively monitor and prevent cheating or other forms of academic dishonesty on the platform?
- ▶ How can we take the developer beyond learning and providing him with employment opportunities ?
- ▶ How can companies hire developers and how can job opportunities be equal and fair among them?

1.2.2.2 Objective

The main objective of our system is :

- ▶ Automate the planning and scheduling of challenges to ensure fair and balanced competition among students.
- ▶ Develop engaging and interactive features, such as challenges, courses and learning paths pattern creation , quizzes, challenges, and real-time feedback, to promote student engagement and critical thinking
- ▶ Implement a gamification system based on points and badges, to incentivize student participation and encourage ongoing learning
- ▶ Ensure the platform is user-friendly and scalable, with the ability to integrate with other online learning tools and platforms.
- ▶ Test and refine the platform through a series of pilot studies and user testing, to ensure that it meets the needs of educators and students
- ▶ Create mechanisms for monitoring and detecting cheating or other forms of academic dishonesty, in order to maintain the integrity and credibility of the platform.
- ▶ By achieving these objectives, the project aims to create a secure and engaging competitive learning platform that promotes student learning and development, while also protecting their privacy and ensuring the integrity of their education. The platform adapt to the changing landscape of education in the online era. The automation of planning and scheduling of challenges and the implementation of a gamification system based on points and badges will enhance student engagement and encourage ongoing learning.
- ▶ Providing job opportunities for developers
- ▶ giving companies the opportunity to find and hire skilled developers and innovate faster.

1.2.3 Expression of needs

1.2.3.1 Identification of actors

In our System we have FIVE actors :

Actors	Roles
Admin	Secondary
Developer	Principal
Instructor	Principal
Company	Principal
Analyst	Secondary

Table 1.2: Actors Table

1.2.3.2 Context Diagram

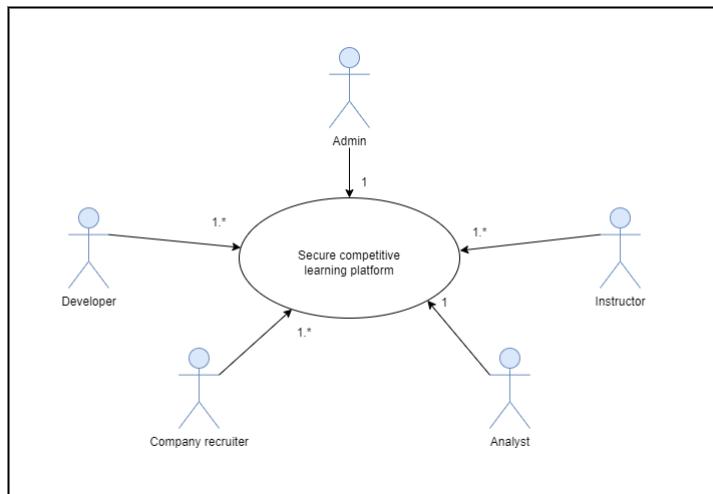


Figure 1.1: Context Diagram

1.2.3.3 Functional need

Admin

- ▶ Access to modify any attribute in the program.
- ▶ Add sup admins.
- ▶ Create instructors and analyst accounts.
- ▶ Manage users profiles: view, edit, delete.
- ▶ Manage challenge schedules: create, view, edit.
- ▶ Management of learning paths: create, view, edit, delete.
- ▶ Assign courses and challenges to instructors.

Developer

- ▶ Create a profile.

- ▶ Manage profile: view, edit, delete.
- ▶ Participate in any challenge.
- ▶ Register in a challenge.
- ▶ Review: comments , advices or feedbacks.
- ▶ Search for a job .
- ▶ Apply for a job .
- ▶ Participate in interviews.

Instructor

- ▶ Create gamified courses.
- ▶ Manage profile: view, edit, delete.
- ▶ Create challenges.
- ▶ Delete and Edit challenges.
- ▶ Management of learning paths: create, view, edit, delete.

Company Recruiter

- ▶ Send and schedule interviews.
- ▶ Post a job.
- ▶ Create challenge.
- ▶ Sponsoring challenges.
- ▶ Consult company offer jobs.

Analyst

- ▶ consult leader board.
- ▶ Track student progress.
- ▶ consult recommendation.
- ▶ consult statistics.

1.2.3.4 Non Functional need

- ▶ Security and privacy .
- ▶ Performance .
- ▶ Robustness and reliability.
- ▶ Data integrity.
- ▶ Portability.
- ▶ Multi factor Authentication of every user .
- ▶ The system need to be fast when it comes to validation.
- ▶ High quality of challenges.
- ▶ High quality of jobs opportunities.
- ▶ The developer will receive coins when he passes every challenge.
- ▶ The developer will receive emails if he missed any challenge.

1.2.4 Specifications of need

1.2.4.1 Use Cases Priority

Use Case	Priority	Risk
Login	Hight	Low
Planify Challenges	Hight	Medium
Create Challenges	Hight	Medium
Participate Challenges	Hight	Medium
Post a job	Hight	Medium

Table 1.3: Use Cases Priority Table

1.2.4.2 Use Cases Diagram

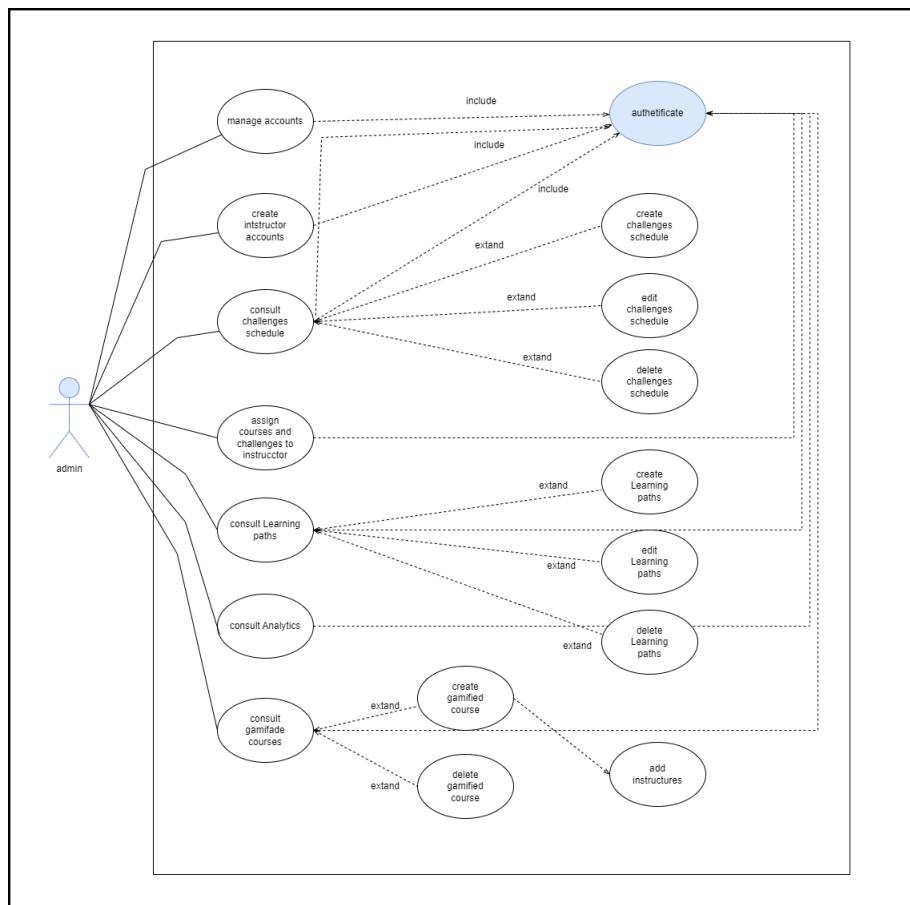


Figure 1.2: Admin use case Diagram

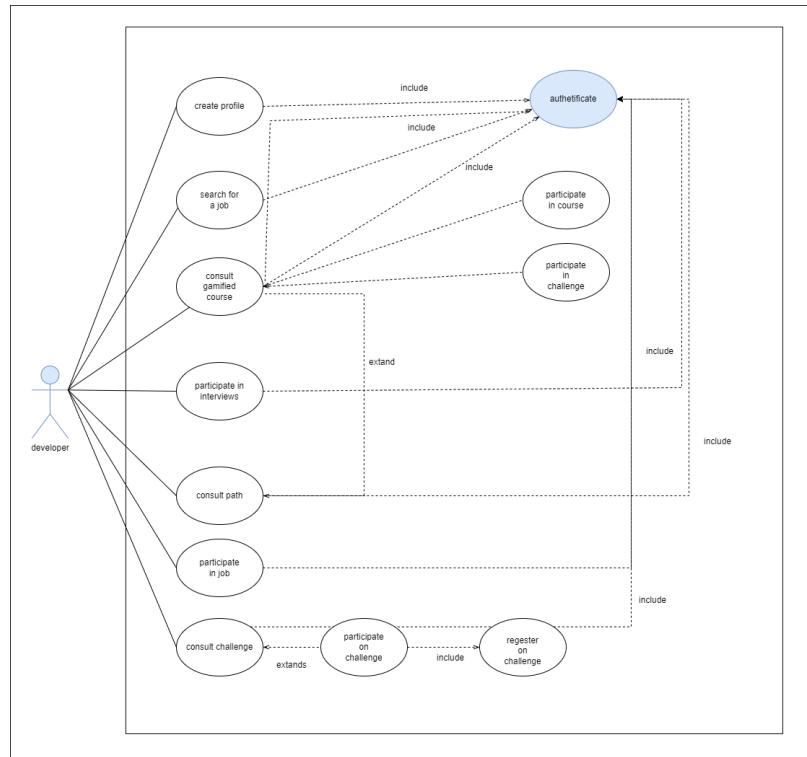


Figure 1.3: Developer use case Diagram

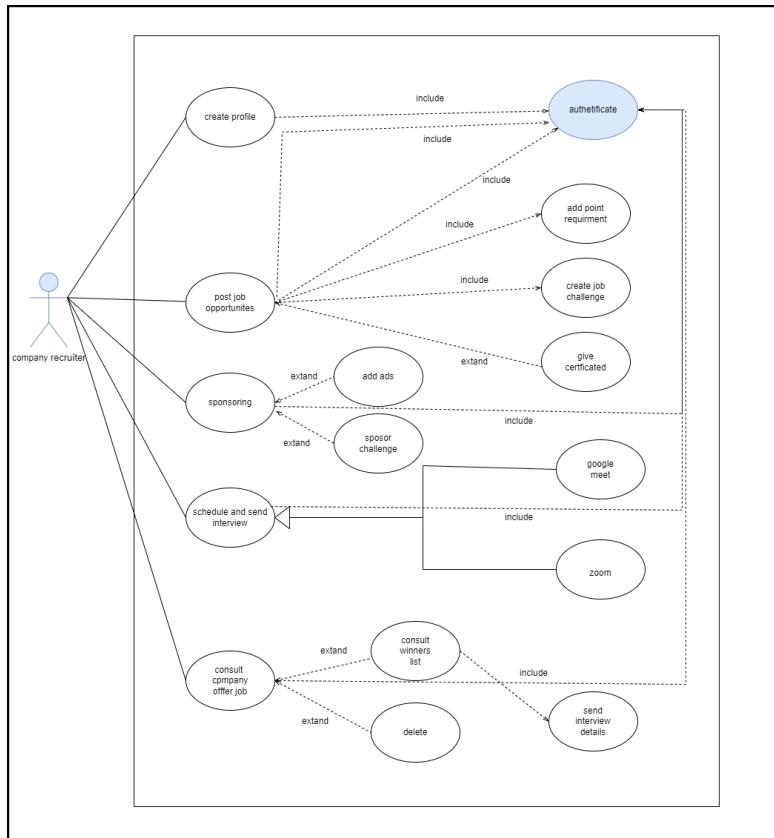


Figure 1.4: Company Recruiter use case Diagram

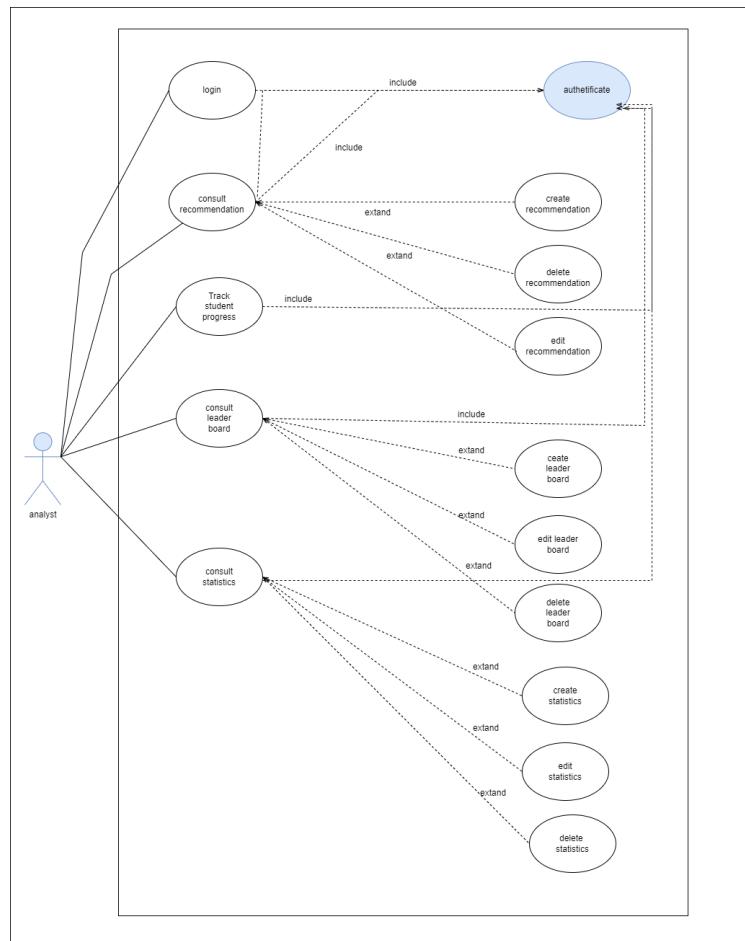


Figure 1.5: Analyst use case Diagram

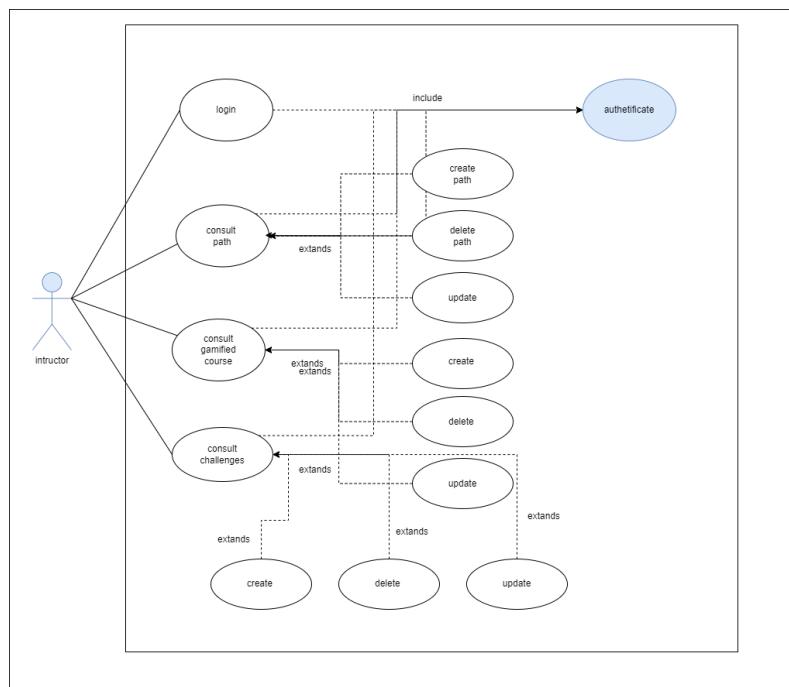


Figure 1.6: Instructor use case Diagram

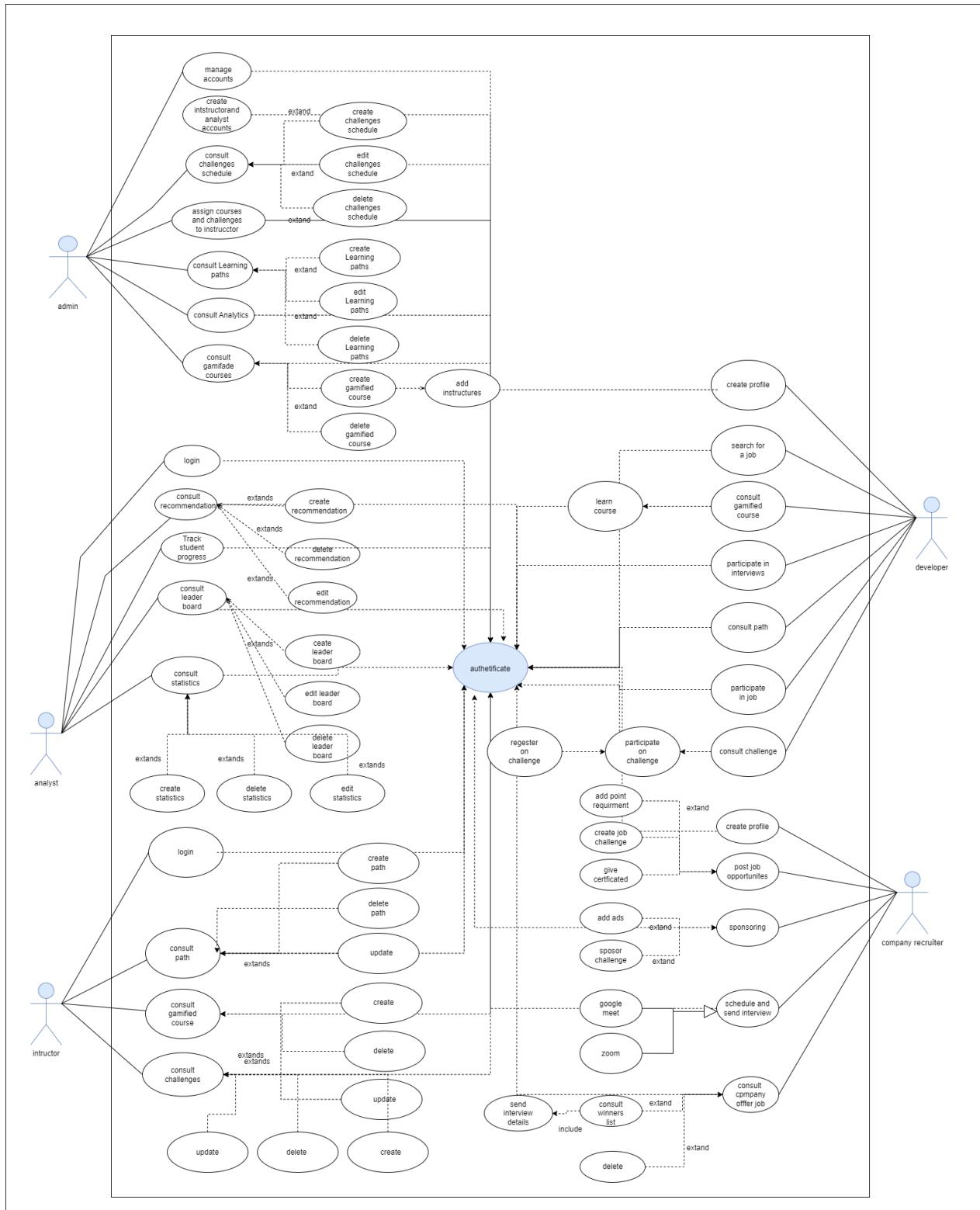


Figure 1.7: Global Diagram

1.2.5 Specification of the five Use Cases:

1.2.5.1 Login

Login descriptive sheet:

This descriptive sheet explains the step-by-step process that users need to follow to login and access the platform's resources.

Case name	Login
Type	Principal
Actor	All the actors
Objective	Gain access to platform resources
Precondition	Already have an account
Normal Scenario	<ol style="list-style-type: none"> 1. The user opens the website in their browser 2. The system displays the authentication page 3. The user inputs their username and password into the form 4. The user clicks on the 'login' option 5. The system verifies the information and authenticates the user if it is correct 6. After successful authentication, the system displays the user's home page
Alternative Scenario	<p>A1)</p> <ol style="list-style-type: none"> 1. The user chooses the 'forgot password' option 2. The system requests the user's email to reset their password 3. The user inputs their email address 4. The system sends the password of this email to it. 5. The system returns to point 2 (returns to the login page) <p>A2)</p> <ol style="list-style-type: none"> 1. If the entered username or password does not match any in the system, an error message is displayed: "Password or username is incorrect"
Exception Scenario	If the user enters an incorrect password five times, the system locks their account for security reasons: the system will automatically ban the user account for one day and show the message "This account is locked for one day"
Postcondition	The user gains access to the platform and can start using its resources

Table 1.4: Login descriptive sheet

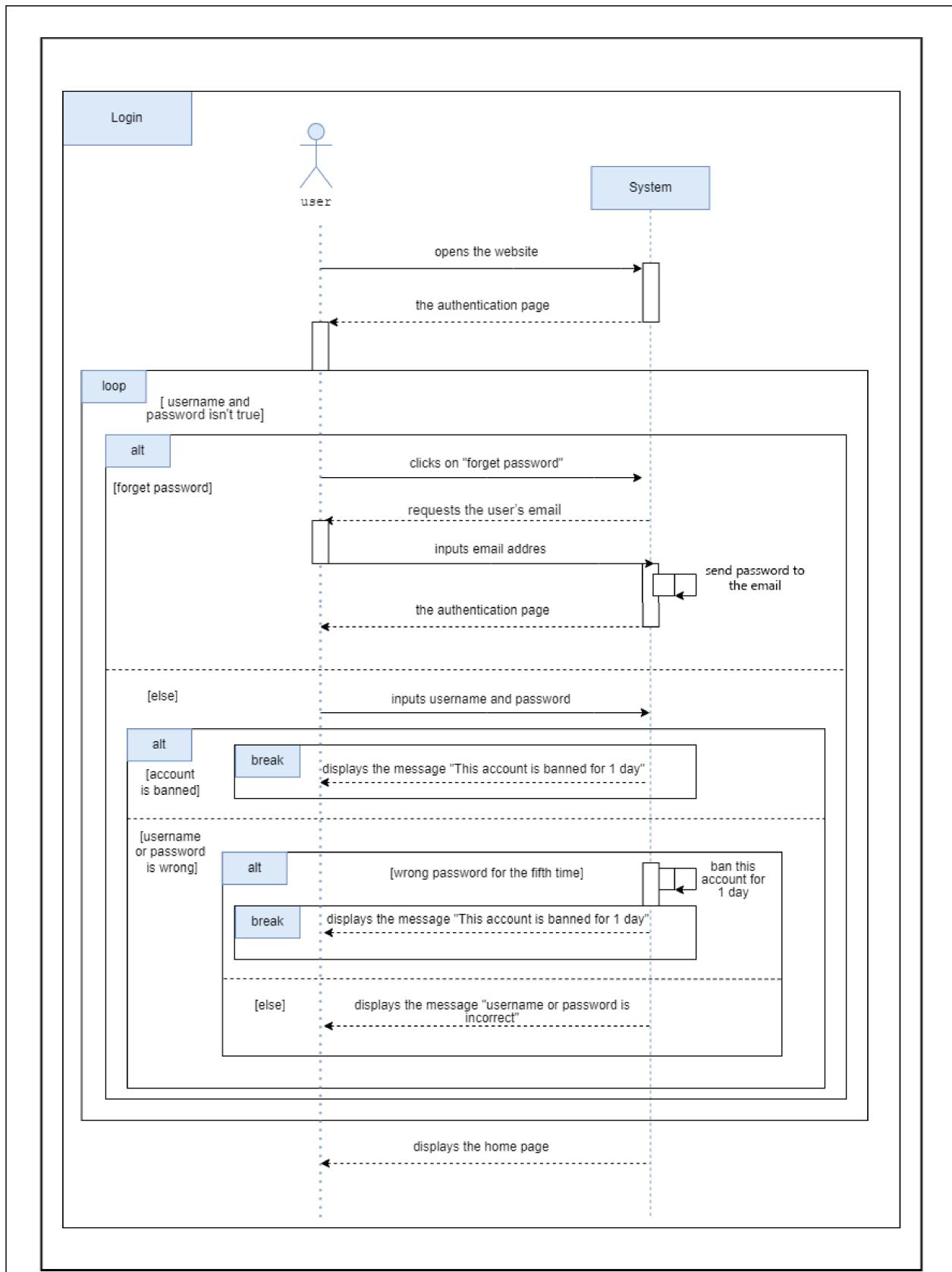
Sequence Diagram:


Figure 1.8: Login Sequence Diagram

Login UI :

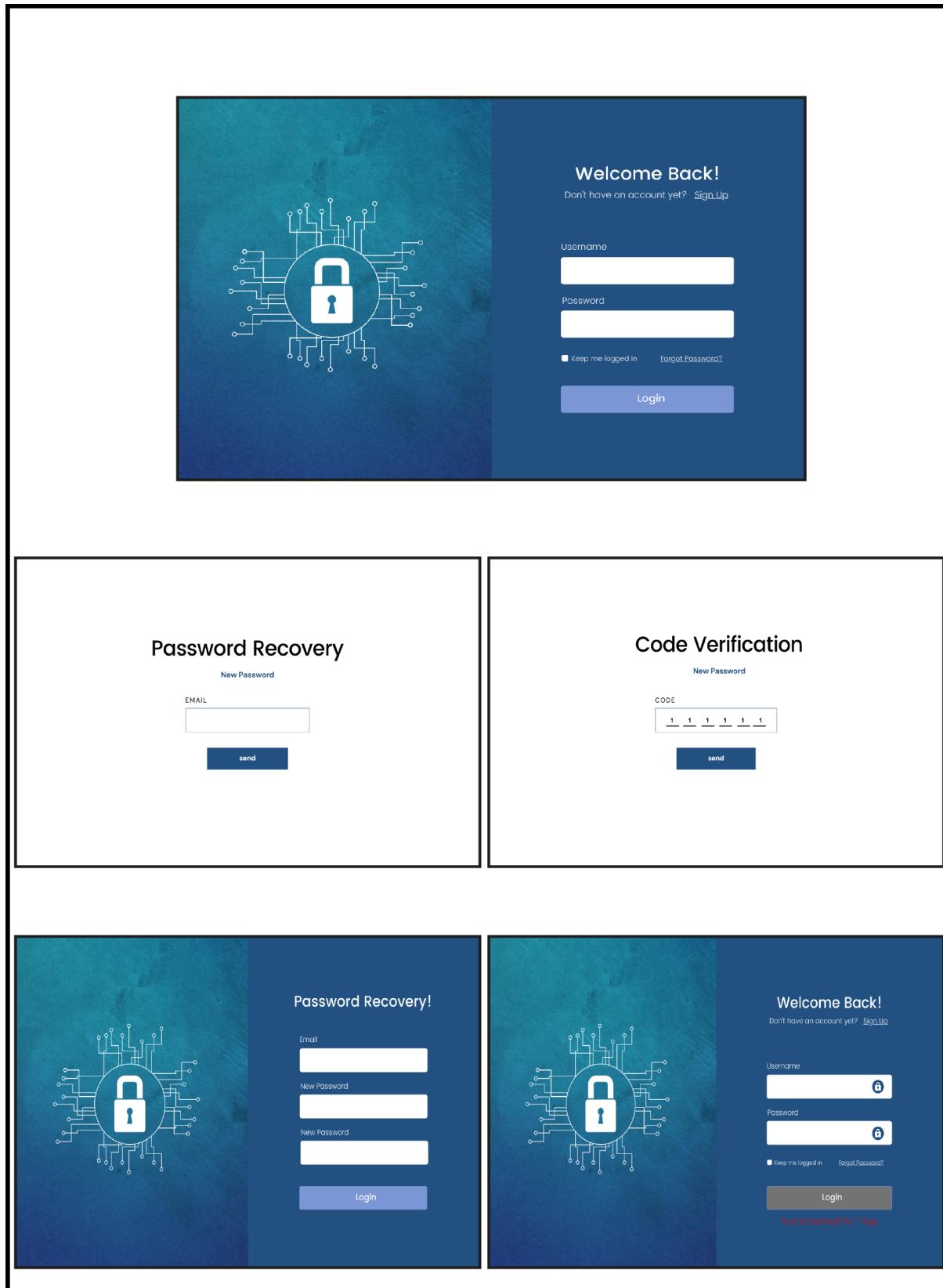


Figure 1.9: Login UI

1.2.5.2 Planify Challenges

Planify Challenges descriptive sheet:

This descriptive sheet explains step-by-step how the admin can planify challenges, from accessing their dashboard to scheduling a challenge.

Case name	Planning challenge
Type	Principal
Actor	Admin
Objective	Schedule challenges
Precondition	The admin must be authenticated
Normal Scenario	<ol style="list-style-type: none"> 1. The admin opens the admin dashboard 2. The system displays the dashboard page 3. The admin navigates to the 'Schedule' option on the sidebar and clicks on it 4. The system displays the calendar and presents two options on the sidebar: 'Planify Challenges' and 'Planify Job Challenges' 5. The admin selects one of the options from the sidebar: either 'Planify Challenges' or 'Planify Job Challenges' 6. The system displays pending challenges 7. From the list of pending challenges, the admin selects a challenge to planify 8. The system displays a form to planify the selected challenge 9. After completing the form, the admin clicks on 'Planify' to confirm the scheduling 10. The system saves the information and displays the pending challenges page with the updated scheduling information
Alternative Scenario	A1) (at point 8) The admin selects the 'Cancel' option: <ol style="list-style-type: none"> 1. (go to point 10) the system displays the list of pending challenges again
Exception Scenario	
Post condition	The challenge is scheduled

Table 1.5: Planify Challenges descriptive sheet

Sequence Diagram:

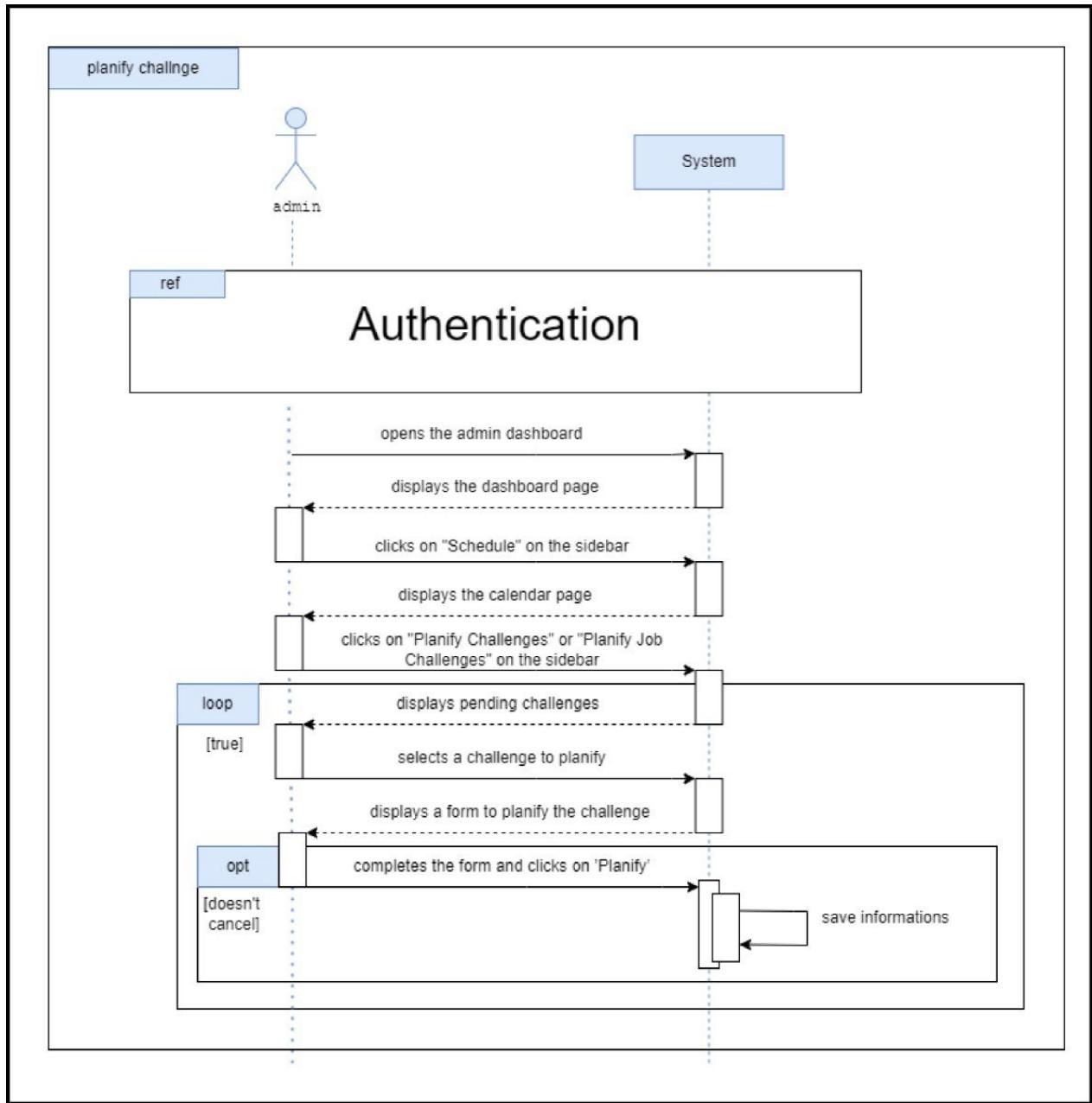


Figure 1.10: Planify Challenges Sequence Diagram

Planify Challenges UI :

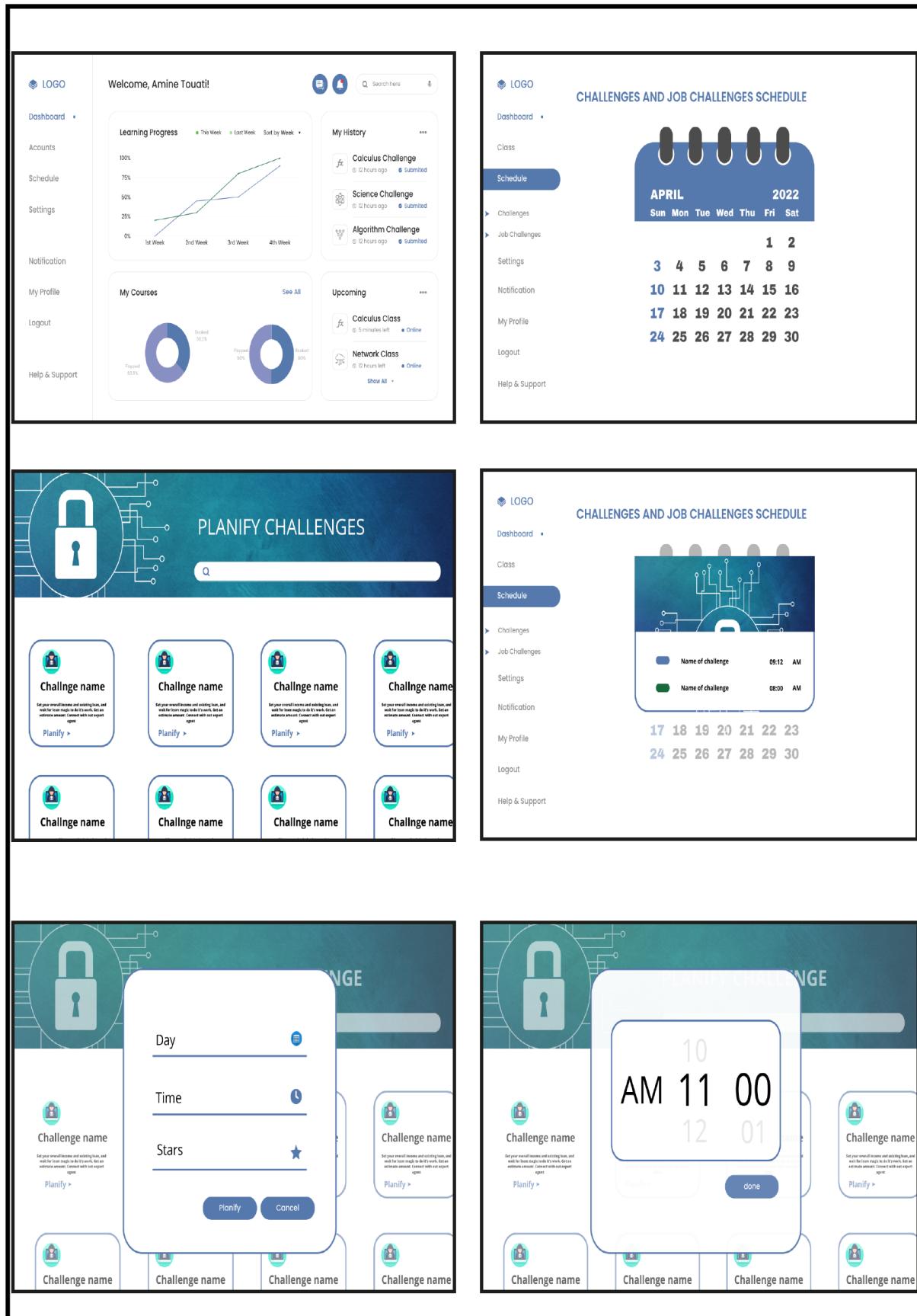


Figure 1.11: Planify Challenges UI

1.2.5.3 Create Challenges

Create Challenges descriptive sheet:

This descriptive sheet provides a step-by-step guide for instructors on how to create challenges on the platform, starting from accessing their workspace to posting a challenge with tasks.

Case name	Create challenge
Type	Principal
Actor	Instructor
Objective	Create a new challenge
Precondition	The Instructor must be authenticated
Normal Scenario	<ol style="list-style-type: none"> 1. The instructor opens the platform website on his browser 2. The system displays the home page 3. The instructor clicks on the "Challenges" tab located in the header and the system displays the challenge page 4. The instructor clicks on the floating button "Create Challenge" 5. The system displays a form to create the details of this challenge 6. The instructor completes the form and clicks on "Next" 7. The system displays a workspace page for the instructor to create the tasks of challenge 8. The instructor clicks on Task 1 9. The system displays a workspace page for the instructor to create the task 10. The instructor clicks on "Add New Paragraph" (picture, video, answer...) 11. The system displays a field for the instructor to create the paragraph 12. The instructor creates the paragraph 13. The instructor clicks on "Save" 14. The system returns to the creating tasks workspace 15. The instructor clicks on "Submit" 16. The system saves the challenge and notifies the instructor that it has been successfully created 17. The system returns the instructor to the challenge page, where they can see the challenge they just created

Alternative Scenario	<p>A1) (at point 6) The instructor does not complete the form and clicks on "Next":</p> <ol style="list-style-type: none"> 1. still on point 6 2. displays the message "please complete the form" <p>A2) (at point 8) The instructor clicks on the "Add Task" button to create more tasks for their challenge</p> <ol style="list-style-type: none"> 1. The system displays another workspace page to the instructor for creating another task <p>A3) (at point 13) The instructor clicks on the "Add new content" button to create more content:</p> <ol style="list-style-type: none"> 1. The system returns to point 10 2. The system returns to point 2 <p>A4) (at point 13) The instructor clicks on "Cancel":</p> <ol style="list-style-type: none"> 1. The system returns to point 2 <p>A5) (at point 15) The instructor clicks on "Submit" without completing the other details:</p> <ol style="list-style-type: none"> 1. The system remains on the workspace page
Exception Scenario	<p>E1) The instructor uploads wrong image or video format</p> <ol style="list-style-type: none"> 1. The system displays an alert message "You uploaded the wrong format"
Post condition	Challenge created and awaiting approval from the administrator for scheduling

Table 1.6: Create Challenges descriptive sheet

Sequence Diagram:

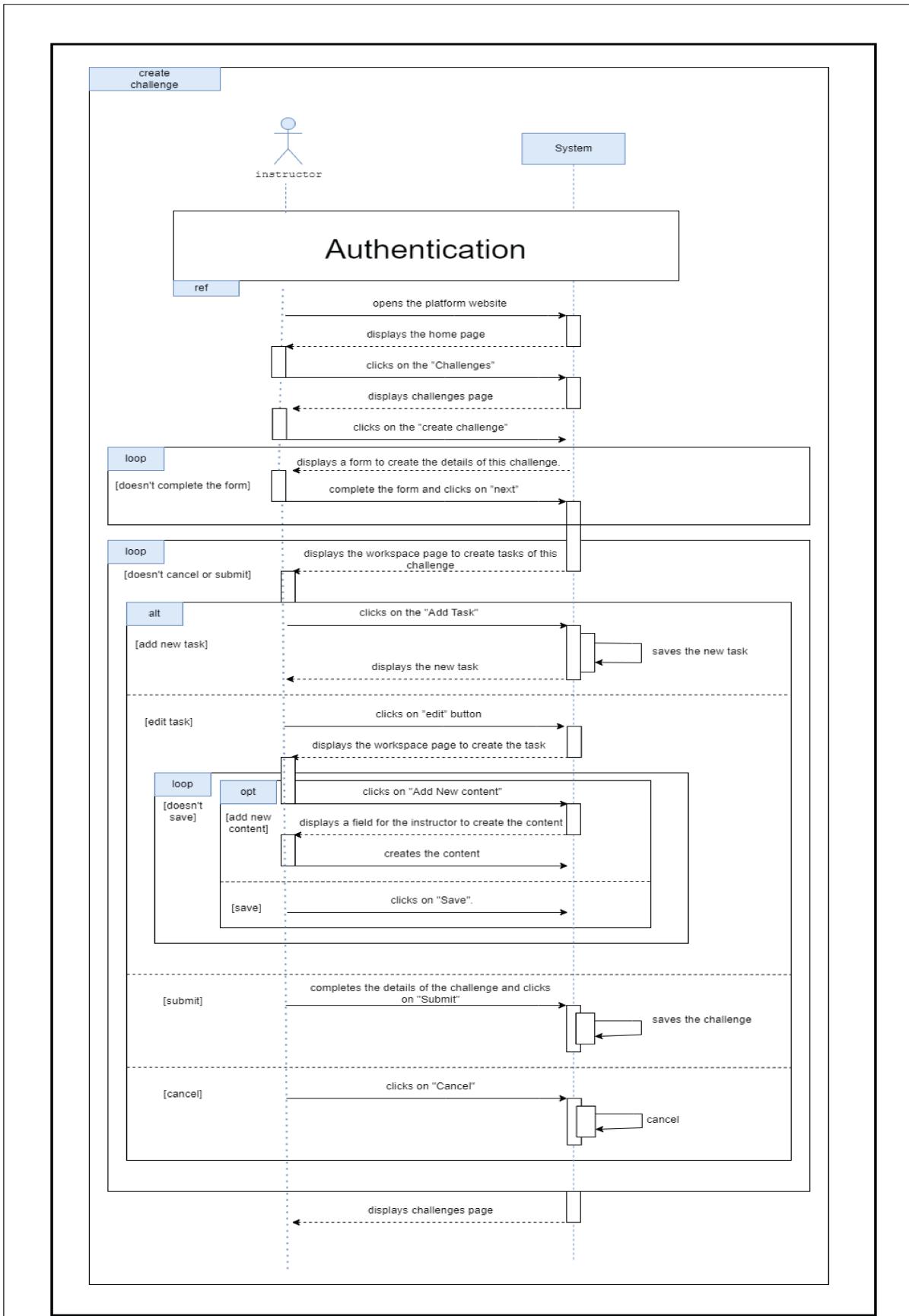


Figure 1.12: Create Challenges Sequence Diagram

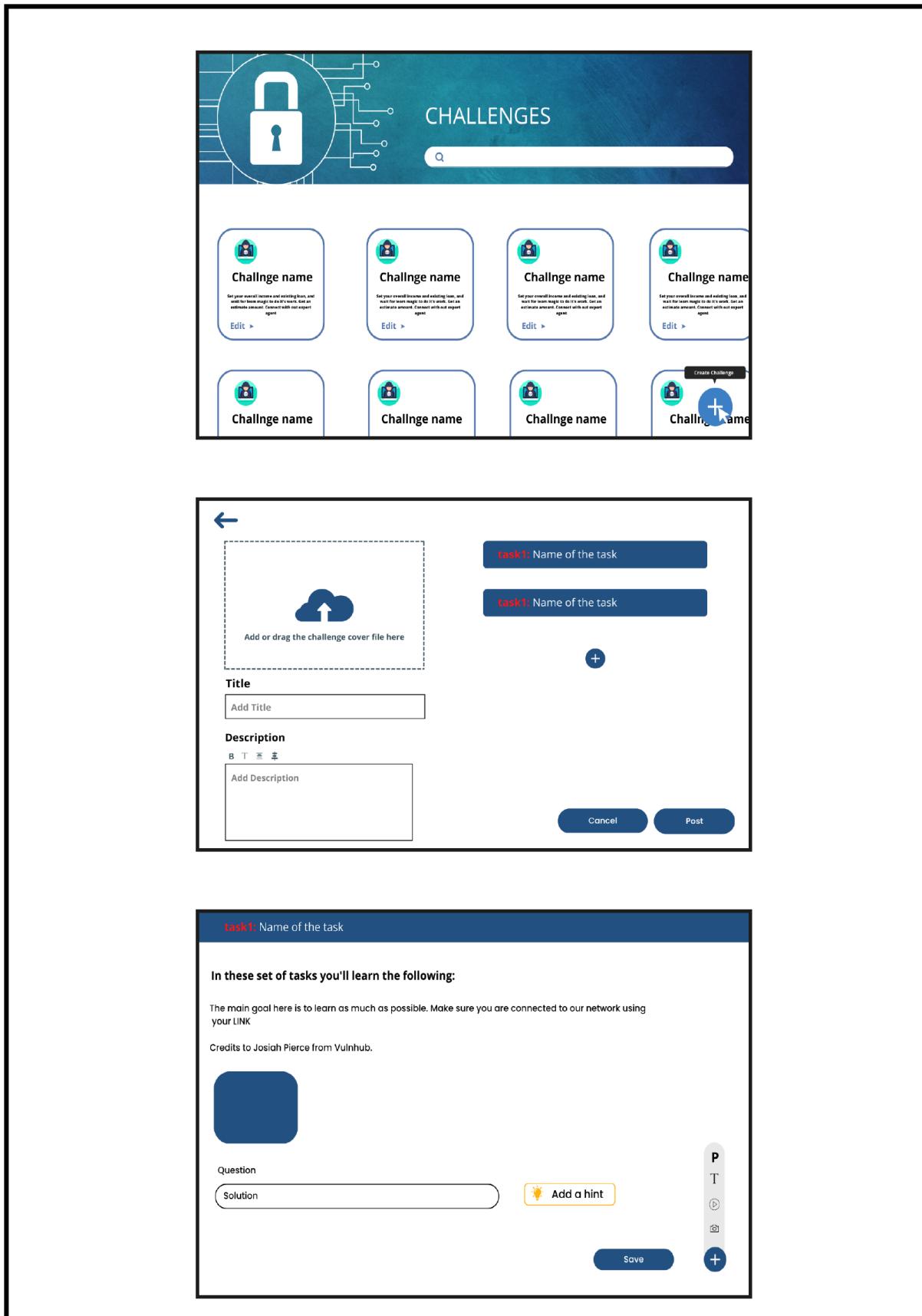


Figure 1.13: Create Challenges UI

Register in challenge :**Register in challenge descriptive sheet :**

This descriptive sheet provides a step-by-step guide for developers on how to register for challenges on the platform, starting from accessing the website to completing the challenge registration process.

Case name	Register in challenge
Type	Principal
Actor	Developer
Objective	Gain access to participate in the challenge
Precondition	The developer must be authenticated
Normal Scenario	<ol style="list-style-type: none"> 1. The developer opened the platform website on his browser 2. The system displays the landing page 3. The developer clicks on the "Challenges" tab located in the header 4. The system displays challenges page 5. The developer selects the challenge that he wants to register for 6. The system displays the challenge details 7. The developer clicks register 8. The system displays a message letting the developer know that their registration has been approved 9. The system will automatically navigate the developer back to the challenge page once their registration has been confirmed 10. Once the challenge is open for participation, the system will notify the developer via email.
Alternative Scenario	<p>A1) If Challenge time passed :</p> <ol style="list-style-type: none"> 1. the system will display a message 'Started' <p>A1) If Challenge Finished :</p> <ol style="list-style-type: none"> 1. The system will display a message 'Finished' <p>A1) If Challenge time not passed :</p> <ol style="list-style-type: none"> 1. The developer click register. 2. The system will register the developer on that challenge 3. The system will display a message 'registered'
Exception Scenario	
Post condition	The developer has completed the registration process for the challenge and is now ready to participate

Table 1.7: Register in challenge descriptive sheet

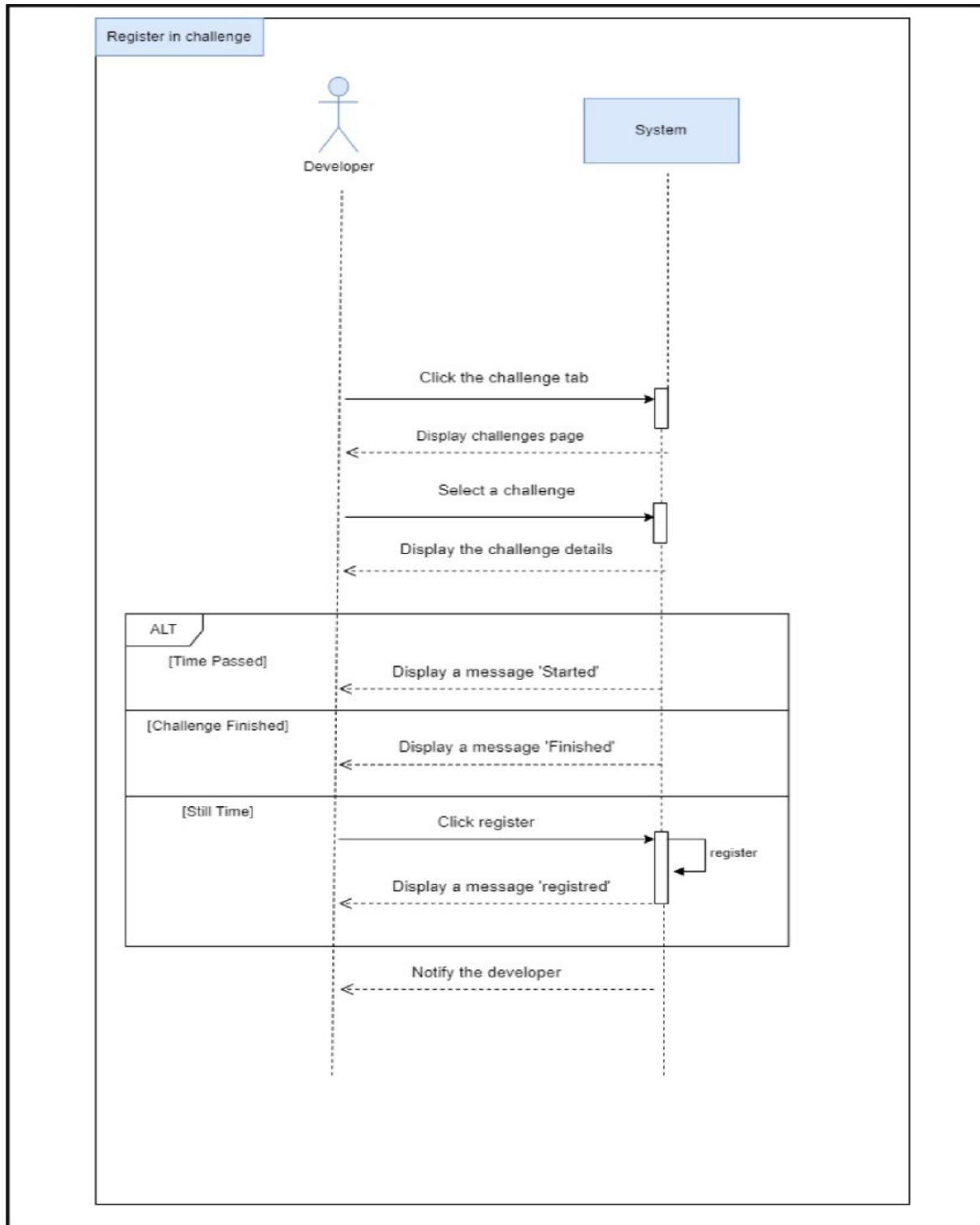
Sequence Diagram:

Figure 1.14: Register in challenge Sequence Diagram

Register in challenge UI :



Figure 1.15: Register in challenge UI

1.2.5.4 Participate on Challenges

Participate in challenge descriptive sheet :

This descriptive sheet explains step-by-step how the admin can planify challenges, from accessing their dashboard to scheduling a challenge.

Case name	Participate in challenge
Type	Principal
Actor	Developer
Objective	Participate on a challenge
Precondition	The developer must be authenticated
Normal Scenario	<ol style="list-style-type: none"> 1. The developer opens the platform website in their browser. 2. The landing page is displayed by the system. 3. The developer clicks on the "Challenges" tab located in the header. 4. The system displays the challenges page 5. The developer chooses the challenge for which they have already completed the registration process 6. The system displays the challenge tasks. 7. The developer enters their answers into the designated area. 8. The developer clicks the "Validate" button. 9. If the answer is correct, the system assigns the corresponding points to the developer. 10. After awarding points, the system updates the leaderboard to reflect the new scores and rankings. 11. Upon completing the challenge, the developer is automatically redirected back to the challenge page.
Alternative Scenario	A1)The developer puts the wrong answer(Start from the point 7): <ol style="list-style-type: none"> 1. The system shows that the answer is wrong. 2. The developer will stay in the challenge area until they put the right answer.
Exception Scenario	
Post condition	The developer receives rewards, points and certificate.

Table 1.8: Participate in challenge descriptive sheet

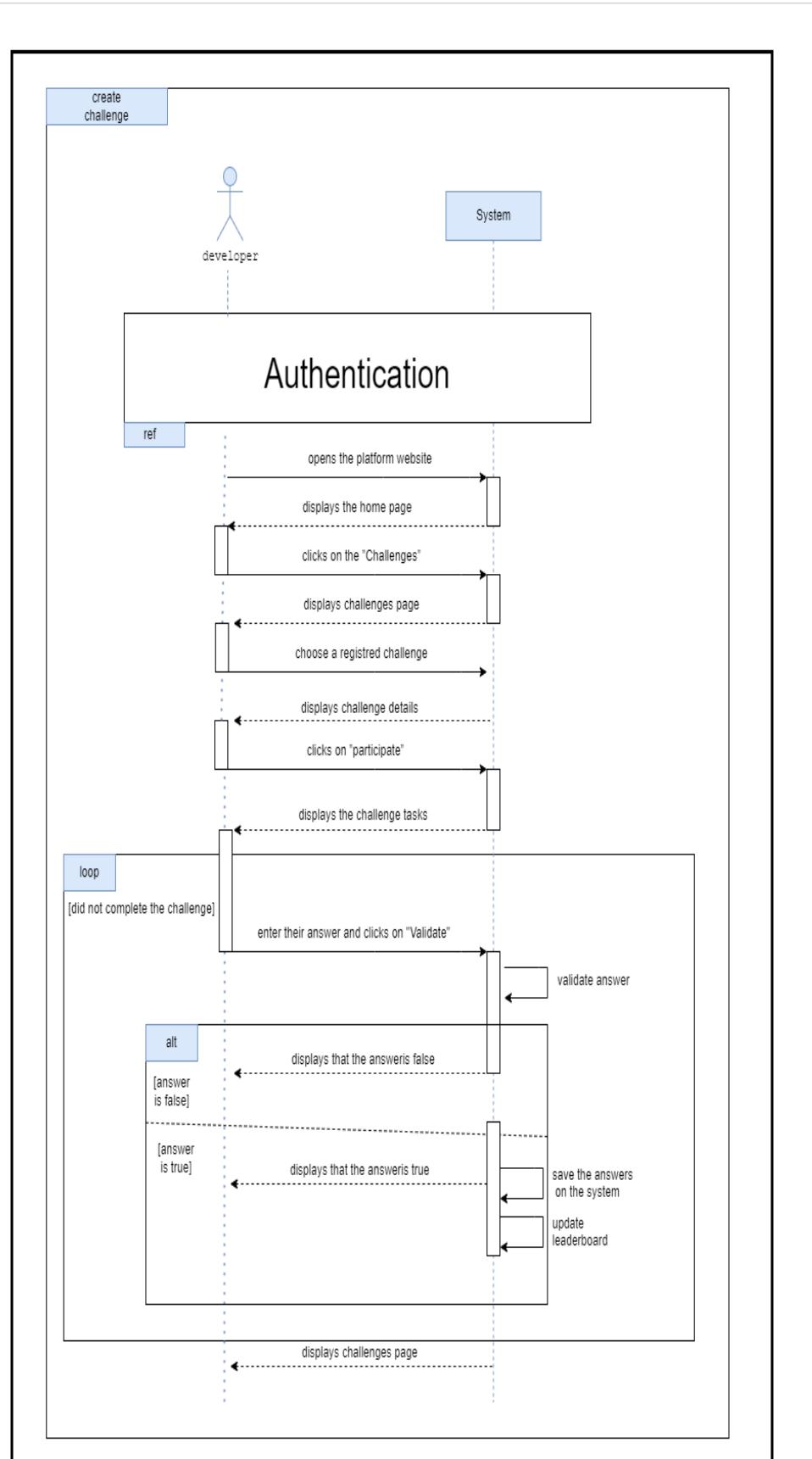


Figure 1.16: Participate in challenge Sequence Diagram

The figure consists of three vertically stacked screenshots of a web-based cybersecurity platform.

Screenshot 1: Home Page

- Header:** LOGO, Home | Challenges | Paths | About | LOGOUT
- Text:** Experience the ultimate ONLINE COMPETITIVE, SECURE PLATFORM
- Text:** Unlock the power of CYBERSECURITY with our platform
- Buttons:** GET STARTED, ...
- Image:** A white rocket ship launching from a cloud of blue circles and squares against a dark blue background.

Screenshot 2: Practice Section

- Header:** LOGO, Home | Challenges | Paths | About, with a user icon showing a star and a notification badge.
- Section Header:** PRACTICE
- Text:** Reinforce what you're learning
- Text:** Put your knowledge into practice with gamified cyber security challenges.
- Challenge Cards:** Four cards, each with a camera icon and placeholder text "Challenge name". Below each card are two smaller camera icons.

Screenshot 3: Challenge Details

- Left Sidebar:** Icons for user profile, credits, answer questions, and find services.
- Text:** In these set of tasks you'll learn the following:
 - brute forcing
 - hash cracking
 - service enumeration
 - Linux Enumeration
- Text:** The main goal here is to learn as much as possible. Make sure you are connected to our network using your [OpenVPN configuration file](#).
- Credits:** Credits to Josiah Pierce from Vulnhub.
- Text:** Answer the questions below
- Form:** An input field with a green "Completed" button next to it.
- Text:** Answer the questions below
- Form:** An input field with a green "Completed" button next to it.
- Text:** Find the services exposed by the machine
- Form:** An input field with a green "Completed" button next to it.
- Text:** User brute-forcing to find the username & password
- Form:** An input field with a "Submit" button and a "Hint" button.

Figure 1.17: Participate in challenge UI

1.2.5.5 Post job offer

Post job descriptive sheet :

This descriptive guide provides step-by-step instructions for the company recruiter on how to post a job offer for their company, from filling out the initial job details form to adding job challenges

Case name	Post job offer
Actor	Company recruiter
Objective	Attract new employees
Precondition	The company recruiter must be authenticated
Normal Scenario	<ol style="list-style-type: none"> 1. The company recruiter opens the platform website on his browser 2. The system displays the home page 3. The company recruiter clicks on the "Job offers" tab located in the header and the system displays the challenge page 4. The company recruiter clicks on the floating button "Create job offer" 5. The system displays a form to create the details of this job offer. 6. The company recruiter completes the form and clicks on "Next" 7. The system displays a workspace page for the company recruiter to create the tasks of this job offer 8. The company recruiter clicks on Task 1 9. The system displays a workspace page for the company recruiter to create the task 10. The company recruiter clicks on "Add New Paragraph" (picture, video, answer...) 11. The system displays a field for the company recruiter to create the paragraph 12. The company recruiter creates the paragraph 13. The company recruiter clicks on "Save" 14. The system returns to the creating tasks workspace 15. The company recruiter clicks on "Submit" 16. The system saves the job offer and notifies the company recruiter that it has been successfully created 17. The system returns the company recruiter to the jobs page, where they can see the job offer they just created

Alternative Scenario	<p>A1)(at point 6) The company recruiter does not complete the form and clicks on "Next":</p> <ol style="list-style-type: none"> 1. still on point 6 2. displays the message "please complete the form" <p>A2) (at point 8) The company recruiter clicks on the "Add Task" button to create more tasks for their job offer</p> <ol style="list-style-type: none"> 1. The system displays another workspace page to the company recruiter for creating another task <p>A3) (at point 13) The company recruiter clicks on the "Add new content" button to create more content:</p> <ol style="list-style-type: none"> 1. The system returns to point 10 <p>A4) (at point 13) The company recruiter clicks on "Cancel":</p> <ol style="list-style-type: none"> 1. The system returns to point 2 <p>A4) A5) (at point 15) The company recruiter clicks on "Submit" without completing the other details:</p> <ol style="list-style-type: none"> 1. The system remains on the workspace page
Exception Scenario	
Post condition	The job offer has been added successfully

Table 1.9: Post Job descriptive sheet

Sequence Diagram:

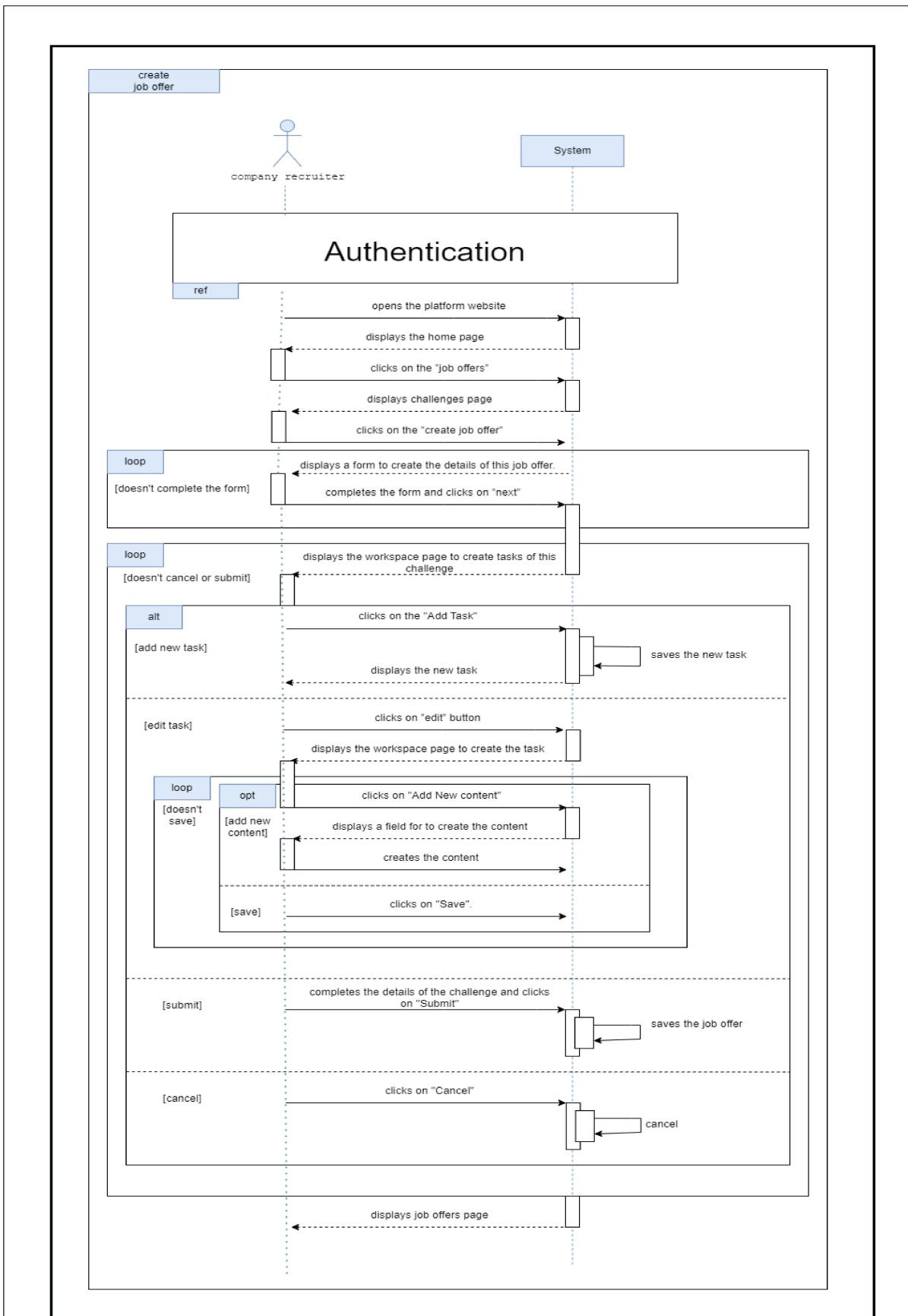


Figure 1.18: Post Job Sequence Diagram

Post Job UI :

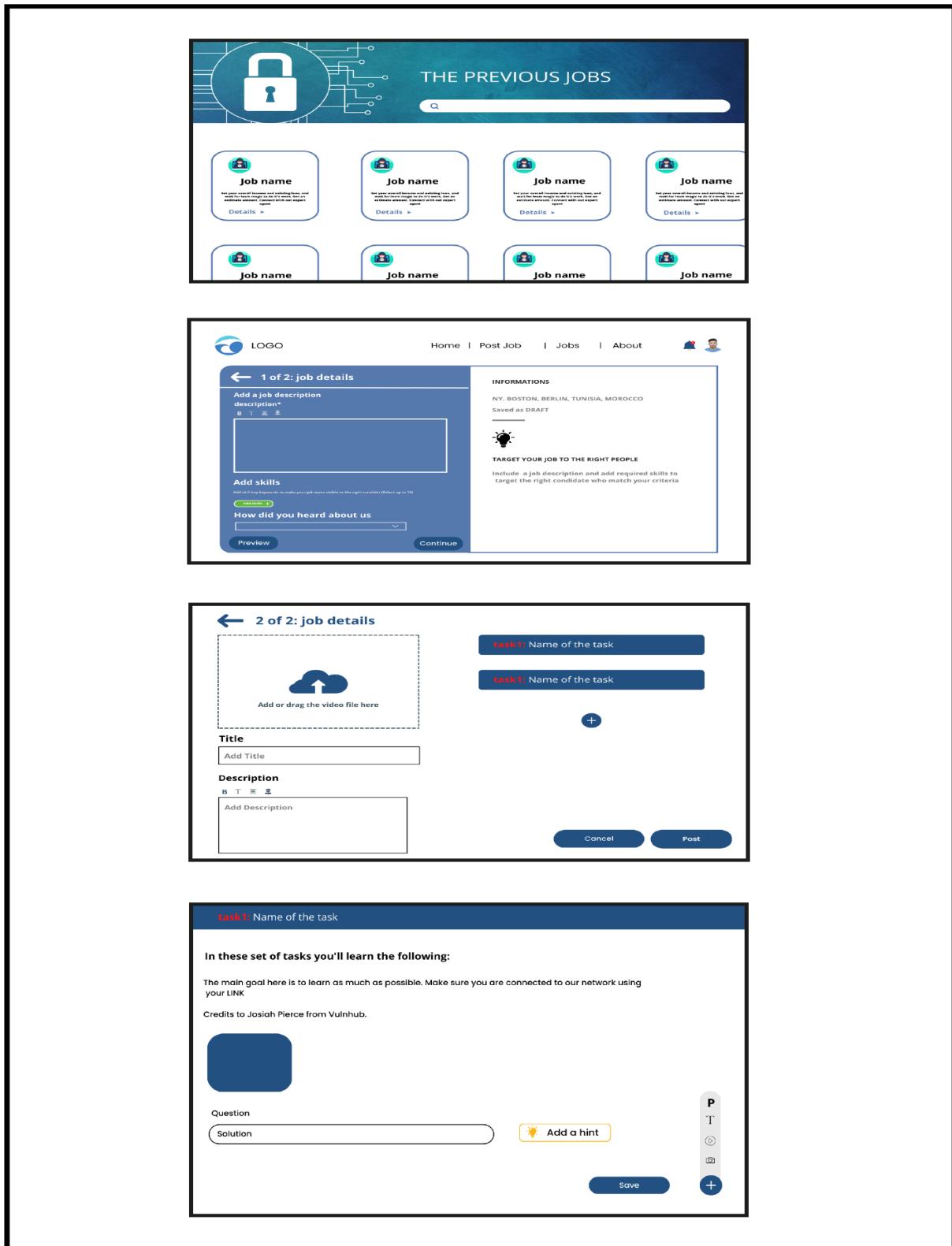


Figure 1.19: Post Job UI

Send and schedule interviews :

This descriptive guide provides a step-by-step process for the company recruiter on how to schedule and send interview invitations, starting from consulting the job details to sending out the interview details

Case name	Send and schedule interviews
Type	Principal
Actor	Company recruiter
Objective	Share the interview schedule with the selected candidates
Precondition	The company recruiter must be authenticated
Normal Scenario	<ol style="list-style-type: none"> 1. The company recruiter opens the platform website on their browser 2. The system displays the home page 3. The company recruiter clicks on the "Jobs" tab located in the header 4. The system displays a page with all the job offers posted by the company 5. The recruiter selects a job offer 6. The system displays a page containing the job details and a list of the selected candidates. 7. The recruiter selects a winner candidate 8. The system displays the profile and information of the selected winner 9. The recruiter clicks on the "send interview details" button to schedule an interview 10. The system displays a form for the recruiter to enter the interview details 11. The recruiter fills out the interview details form and clicks on the 'send' button 12. The system sends a notification to the candidate via email to inform them about the upcoming interview
Alternative Scenario	<p>A1) If the recruiter clicks on "cancel" button (at point 7):</p> <ol style="list-style-type: none"> 1. The system displays a warning message "Are you sure you want to cancel this process?" 2. The system returns the recruiter to the job detail page after canceling the process
Exception Scenario	
Post condition	interview details have been successfully sent to the selected candidate(s)

Table 1.10: Send and schedule interviews descriptive sheet

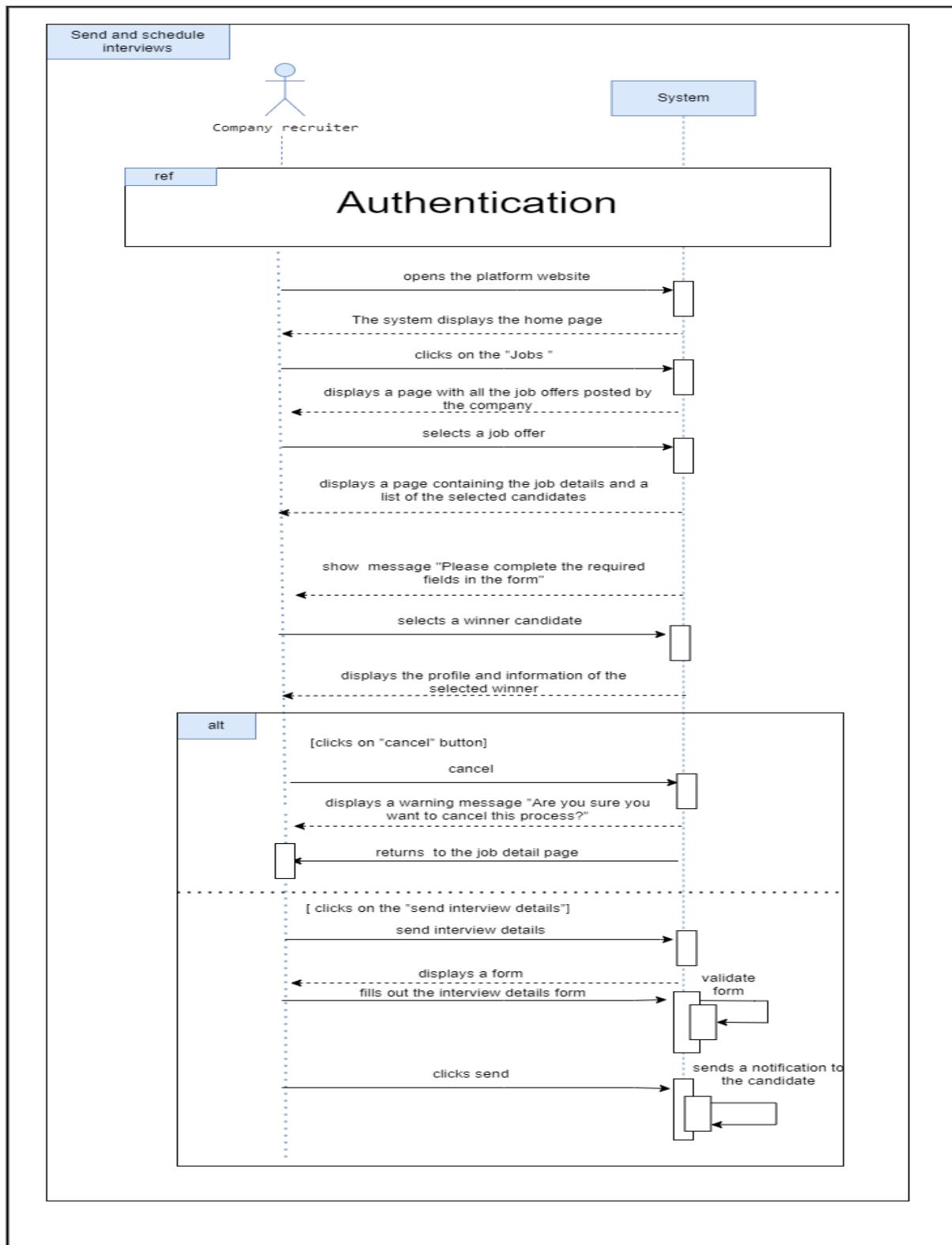
Sequence Diagram:


Figure 1.20: Send and schedule interviews Sequence Diagram

Send and schedule interviews UI :

The figure consists of three vertically stacked screenshots of a user interface for managing previous jobs and scheduling interviews.

Top Screenshot: THE PREVIOUS JOBS

This screen displays a grid of eight job entries, each with a small icon, the job name, and a detailed description below it. The descriptions mention overall income, existing loan, and estimated amount, along with a link to contact an expert agent.

Job Name	Description
Job name	Set your overall income and existing loan, and calculate the estimated amount. Contact with our expert agent.
Job name	Set your overall income and existing loan, and calculate the estimated amount. Contact with our expert agent.
Job name	Set your overall income and existing loan, and calculate the estimated amount. Contact with our expert agent.
Job name	Set your overall income and existing loan, and calculate the estimated amount. Contact with our expert agent.
Job name	Set your overall income and existing loan, and calculate the estimated amount. Contact with our expert agent.
Job name	Set your overall income and existing loan, and calculate the estimated amount. Contact with our expert agent.
Job name	Set your overall income and existing loan, and calculate the estimated amount. Contact with our expert agent.

Middle Screenshot: JOB DETAILS

This screen shows detailed information for a specific job entry. It includes a list of 10 items, a learning progress chart, and two donut charts.

- Learning Progress:** A line graph showing progress from week 1 to week 4. The Y-axis ranges from 0% to 100%.

Week	Progress (%)
1st Week	~25%
2nd Week	~45%
3rd Week	~75%
4th Week	~95%
- My Courses:** Two donut charts showing completion status.
 - Completed: 55.2%
 - Pending: 44.8%

Bottom Screenshot: JOB DETAILS

This screen shows a detailed view of a specific job entry for "Med Amine Touati". It includes a profile picture, badge (Gold), rank (#1), points (10800), and skills (Cybersecurity, Python and Java). It also features a "Cancel" and "Interview Details" button.

Bottom-most Screenshot: JOB DETAILS

This screen shows a form for scheduling an interview. It includes fields for Description, Day, Time, Link, and a "Send" button. To the right is a learning progress chart and two donut charts.

Figure 1.21: Send and schedule interviews UI

1.3 Conclusion

During this chapter, we conducted a preliminary study and specification of user needs, and we obtained a use case model that helps us in making a detailed description of user needs in the following chapter.

Chapter 2

CONCEPTION

2.1 Introduction

Conception is the starting point of any project where the idea is generated and refined into a more tangible form. This phase involves brainstorming to generate ideas, researching to determine the feasibility of the project, and creating a detailed plan that outline the steps needed to bring the project to fruition.

In this phase, our primary focus will be on creating a comprehensive domain model. Once we have established the domain model, we will proceed to the next step, which involves creating a detailed description of the classes. After that, we will construct the domain class diagram, followed by the conception class diagram.

2.2 Domain model

2.2.1 Description of classes

Classes	Description
User	The User class is an abstract class that represents all system users, this class have attributes such as email, name, password.
Admin	The Admin class extends the User class and represents individuals responsible for managing the platform (accounts, challenges).
Developer	The Developer class extends the User class and represents individuals who use the platform to register and participate on challenges also search and apply for job opportunities.
CompanyRecruiter	The CompanyRecruiter class extends the User class and represents individuals responsible for recruiting new employees
Analyst	The Analyst class extends the User class and represents individuals who analyze data generated by platform to create statics also track student progress
Instructor	The Instructor class extends the User class represents individuals who create challenges and courses on the platform
Challenges	The Challenges class represent 1 the challenges on the platform it might be include many tasks, this class have attributes such as name,description,stars,solution and a list of Task objects

ChallengeType	The ChallengeType enumeration represents the type of challenges on the platform. This enumeration might have three attributes: "Competition" "Competition", "PathChallenge" and "JobOffer"
Task	The Task class represents a specific task that is part of a Challenge on the platform. This class have attributes such as title, description and expected outputs
Register	The Register class represents the association between a Developer and a Challenge on the platform. This class have attributes such as a ID,registertype
Register Type	The RegisterType enumeration represents the type of registration for a Developer in a Challenge on the platform. This enumeration might have two attributes: "solo" and "team"
ParticipationResult	The ParticipationResult class represents the association between a Developer and a Challenge that he is participating in. This class has attributes such as the start date and end date of the participation
Questions	The Questions class represents the collection of all questions on the platform. This class have attributes such as a name, description, answer
Path	The Path class represents a pathway on the platform, consisting of a series of gamification Courses related to a specific topic or skill area. This class might have attributes such as a name, description, image
GamificationCourse	The GamificationCourse class represents a course within challenges that combines gamification techniques with a specific field of study. This class might have attributes such as name, description, field, points, certificate
Pathchallenge	The PathChallenge class represents a challenge that is part of a specific course but does not have any associated points or rewards
PathInstructors	The PathInstructors class represents a represents the association between an instructor and a learning path
Planification	The Planification class represents the association between an admin and a challenge in which the admin plans challenges to be included in the schedule
Job	The Job class represents a job posting on the platform. It includes attributes such as job title, job description, company, location, salary, and required qualifications or skills
Interview	The Interview class represents the association between an Company Recruiter and a Developer for a job position that he won on it
Statics	The Statics class represents the statistics of developers on the platform, including information such as the number of successful challenges completed and the average score on challenges
Feedback	The Feedback class represents feedback provided by a Developer r for a specific Challenge or Course. It contains attributes such as the feedback text
Badge	The Badge class represents a digital badge that is earned by a Developer for completing certain challenges or courses on the platform. It has attributes such as name, description, and image
Recommendation	The Recommendation class represents a suggestion or advice provided by an analyst to the admin of the platform regarding the system. This can include recommendations for fixing issues, adding new features and improving performance

Table 2.1: Description of classes Table

2.2.2 Domain class diagram

The Domain class is a fundamental class that serves as a blueprint for creating all other classes on our platform. It defines the overall architecture of the system and how different entities are related to each other. It also encapsulates the business logic and rules governing the behavior of the system. The Domain

class is a key component of our platform,

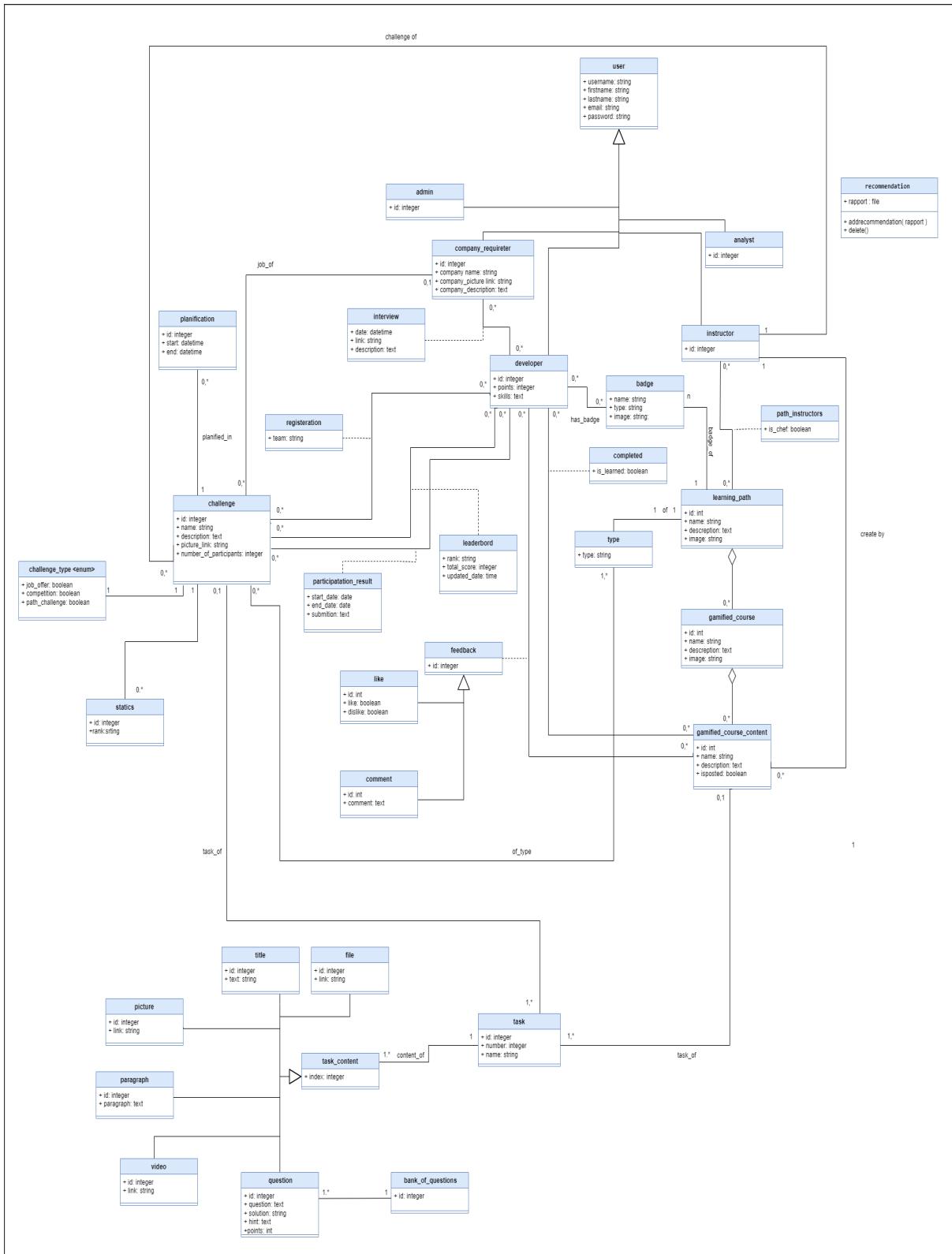


Figure 2.1: Domain class diagram

2.3 Conception classes diagram

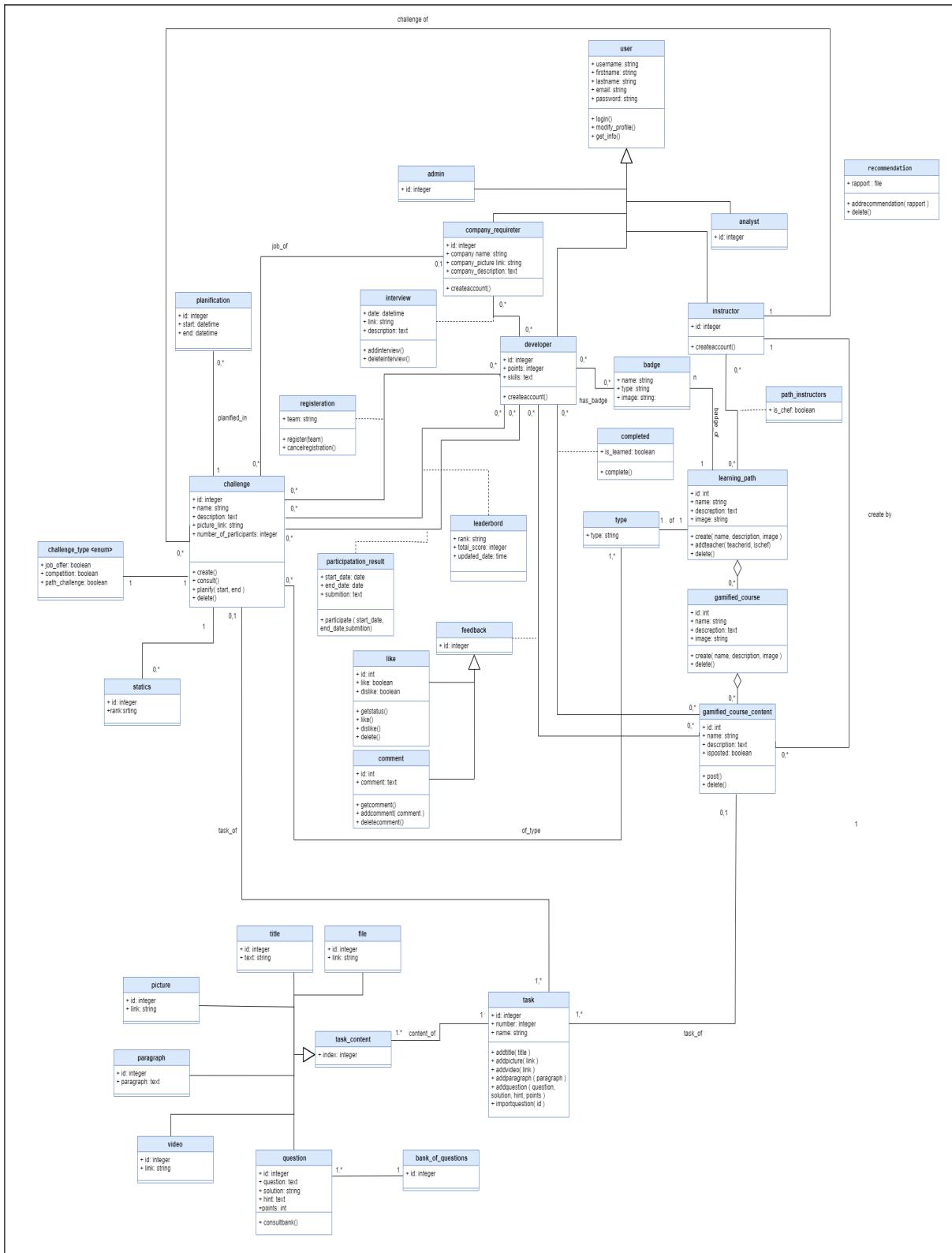


Figure 2.2: Conception classes diagram

2.4 Data Base

This database schema represents the underlying structure of our database and outlines how the data is organized, how tables are interrelated, and what the individual fields in each table represent.

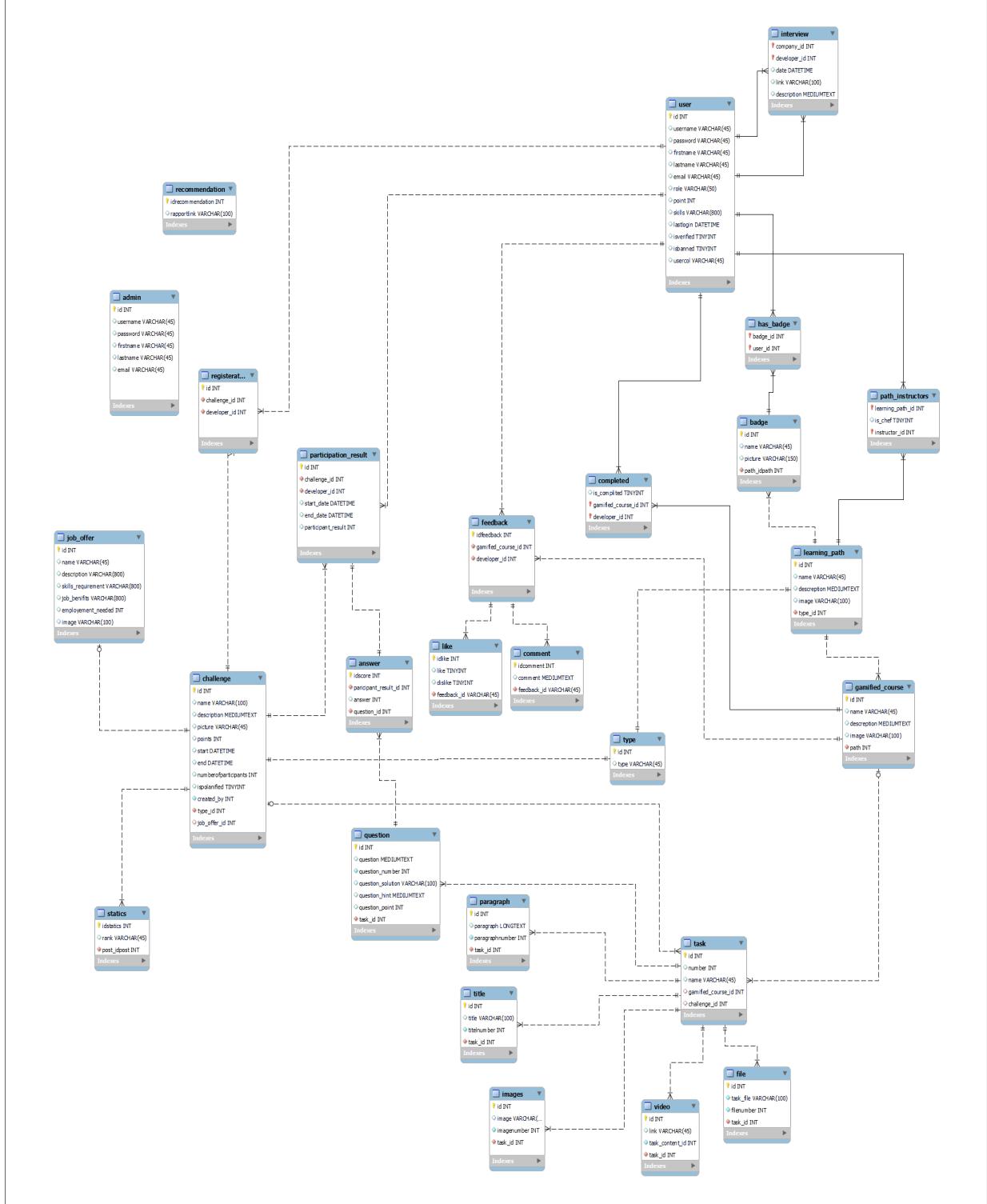


Figure 2.3: Database Schema

2.5 Gamification System

2.5.1 What are the ways in which I can accumulate badges on this platform?

One can obtain badges by completing challenges on the different domains offered on our website. If you participate in a domain and successfully solve a challenge, you will receive points towards your progress once the challenge is made available on the practice site.

The badges earned will be displayed on your profile and visible to other users.

2.5.2 Which badges are available for me to earn on Aacademy?

Our website offers multiple paths for users to follow, each with its own unique set of achievements. These paths are designed to help users develop skills and knowledge in specific areas, and as they progress, they can earn badges as a symbol of their accomplishments. It is important to note that each path on our platform has a distinct set of badges, which serve as a recognition of the different skills and achievements associated with that path.

2.5.3 Leader board

A unique leader board exists for each domain on our website.

who has a lot of points will be on the top of leader board. The rating and rank of a user in the leader board of a particular domain is determined by their performance in the rated contests within that path.

2.5.4 Rating

Once a developer practise on a challenge he earns 30 points, when he successfully passed the challenge, he earns 60 points .

For example: (these points are random because each challenge has its own points) The one who participated will earn 50The one who successfully passed the challenge will earn 100The first one will get +50 points bonus The second one will get +20 bonus Ect...

2.6 Conclusion

In conclusion, conception is a crucial starting point in any project as it sets the foundation for the entire process. The conception phase involves generating and refining ideas, determining feasibility through research, and creating a detailed plan outlining the necessary steps to bring the project to completion. In software development, this phase includes creating a comprehensive domain model, generating a conception classes diagram to represent the project's architecture, and creating the database schema. Investing time and effort into the conception phase can greatly increase the chances of success in the overall project

Chapter 3

IMPLEMENTATION

3.1 Introduction

Implementation is the process of building the system according to the design specifications, using hardware, software, and programming tools. It's crucial for testing and refining the system and ensuring its efficiency, effectiveness, and user-friendliness. A proper implementation leads to a successful application that meets the needs of its users.

Firstly, we will explain our system design and then describe the tools that we used, including both hardware and software. Next, we will discuss the programming languages and frameworks that we used. Finally, we will present our application along with screenshots, demonstrating its features and explaining our motivation for design choices.

3.2 System design

A design pattern is a general reusable solution to a commonly occurring problem in software design. It is a proven and tested solution to a design problem that can be adapted to different contexts and scenarios.

MVVM :

MVVM [5] stands for Model-View-ViewModel. It is a software architectural pattern that is commonly used in the development of user interfaces, especially in the context of graphical user interfaces (GUIs) and applications.

Model: The Model represents the data and business logic of the application. It encapsulates the application's data and exposes methods to manipulate and access that data. The Model component is independent of the user interface and does not contain any UI-related code.

View: The View represents the user interface components or screens that the user interacts with. It is responsible for displaying the data to the user and capturing user input. In MVVM.

ViewModel: The ViewModel acts as an intermediary between the Model and the View. It provides data and behavior that the View needs to display and interact with the data. The ViewModel exposes properties and commands that the View can bind to. It also contains the logic and operations that are specific to the user interface, such as handling user input and updating the Model. The ViewModel does not have any direct reference to the View, making it easier to test and maintain.

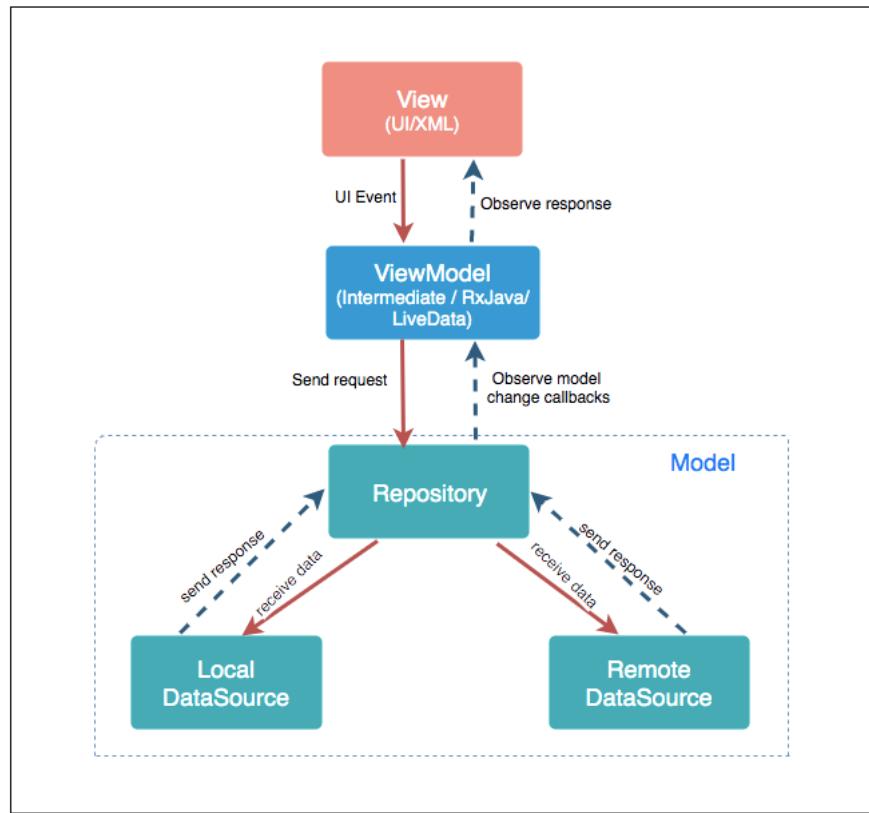


Figure 3.1: MVVM design pattern

3.3 Presentation of the work environment

3.3.1 Hardware Platforms

3.3.1.1 Laptops :

Characteristics	Description
Screen	15.6 Full HD LED IPS 144Hz
CPU	AMD Ryzen 7 4800H Renoir (2.9 GHz, 8 coeurs, TDP 45W)
RAM	16 Go (2 x 8 Go) DDR4 3200 MHz (32 Go), 2 slots
GPU	NVIDIA Turing GeForce GTX 1660 Ti 6 Go GDDR6
Stockage	SSD M.2 de 512 Go (NVMe PCIe 3.0 x4)
Weight	2.3 Kg / 359.8 x 256 x 24.7-24.9

Table 3.1: Asus TUF Gaming A15 AMD Ryzen 7 4800H

Characteristics	Description
Screen	15.6 Full HD LED IPS 144Hz
CPU	Intel® Core™ i5-7200U (2.5 GHz base frequency, up to 3.1)
RAM	8 GB DDR4-2133 SDRAM (1 x 8 GB)
GPU	NVIDIA® GeForce® 940MX (2 GB GDDR5 dedicated)
Stockage	1 TB 5400 rpm SATA
Weight	2.12 Kg

Table 3.2: Dell Inspiron 15 5000

Characteristics	Description
Screen	FHD 1 920 x 1 080
CPU	Intel® Core™ i5-7200U 7 generation
RAM	16 Go (2 x 8 Go) DDR4 3200 MHz (32 Go), 2 slots
GPU	Carte graphique Intel® HD 620
Stockage	2 TB (SATA)
Weight	2.13Kg

Table 3.3: HP Spectre X360

3.3.1.2 Mobile Devices:

- Redmi Note 8 (2021)
- Poco X3 pro
- Oppo a5s

3.3.2 Software Platforms

In order to develop this project, we utilized a variety of software programs and environments, which are listed above.

MySQL Workbench :

MySQL Workbench is a visual database design tool that allows users to create and manage MySQL databases. It provides a graphical interface to design, create, and edit database schemas, tables, and relationships.

Why we choose MySql Workbench ?

- User-friendly interface: MySQL Workbench has a well-designed graphical user interface that makes it easy to manage and manipulate database objects.
- Open-source: MySQL Workbench is free and open-source software, which means that it can be downloaded and used without any licensing costs.
- Comprehensive features: The tool provides a wide range of features, including schema design, SQL development, database administration, and performance tuning.

VSCode :

VSCode (Visual Studio Code) is a free and open-source code editor developed by Microsoft. It provides a lightweight and customizable interface for coding and debugging various programming languages, including JavaScript, TypeScript, Python, and many others.

Pycharm :

PyCharm is an Integrated Development Environment (IDE) for the Python programming language. It is developed by JetBrains, a software development company .

Postman :

Postman is a popular collaboration platform for Application Programming Interface (API) development. It provides a comprehensive set of tools for designing, testing, and documenting APIs.

Google chrome :

Google Chrome is a popular web browser developed by Google. It is available for free on various platforms, including Windows, macOS, Linux, Android, and iOS.

Microsoft Edge :

Microsoft Edge is a web browser developed by Microsoft that is available for Windows, macOS, Android, and iOS. It is the successor to the legacy version of Microsoft's web browser, Internet Explorer.

Github :

Github is an online platform used by developers to store, manage, and collaborate on code. It is a cloud-based hosting service for version control, which allows developers to keep track of changes in their code, collaborate with other developers, and manage their projects.

Google drive :

Google Drive is a cloud-based storage and file sharing service provided by Google. It allows users to store and access files from any device with an internet connection.

Google docs :

Google Docs is a web-based word processing application provided by Google. It allows users to create and edit documents online, and collaborate with others in real-time.

Draw.io :

Draw.io is a free and open-source web-based application that allows users to create diagrams, charts, and other visual representations. It offers a range of pre-made templates and shapes, as well as the ability to import custom shapes and images.

Why we choose Draw.io ?

- It is free and open-source: Draw.io is a free and open-source web-based application, which means that it can be used by anyone without any cost or licensing requirements. This makes it a popular choice for individuals and organizations who want to create diagrams without incurring any additional expenses.
- It is user-friendly: Draw.io provides a user-friendly interface that is easy to navigate and use. It offers drag-and-drop functionality, a range of pre-made templates and shapes, and the ability to import custom shapes and images, which makes it easy to create and edit diagrams.
- It offers collaboration features: Draw.io allows users to collaborate in real-time on diagrams, with the ability to comment and suggest changes.

Texmaker :

Texmaker is a free and open-source LaTeX editor for Windows, macOS, and Linux. It is designed to simplify the creation of LaTeX documents by providing a range of features and tools that make it easy to write and edit LaTeX code.

Figma :

Figma is a web-based design and prototyping tool that allows designers to create, collaborate, and share design projects in real-time. It is a popular tool used by UI/UX designers, product designers, and design teams for creating wireframes, prototypes, and user interfaces.

Telegram :

Telegram is a cloud-based instant messaging app that allows users to send text messages, voice messages, photos, videos, and other files over the internet. It is available on multiple platforms, including mobile devices, desktop computers, and web browsers.

3.4 Programming Languages and Frameworks Used in the Platform

Python :

Python is a high-level, [7] general-purpose programming language that is widely used in various domains such as web development, data analysis, machine learning, and scientific computing. It is known for its simple syntax, ease of use, and powerful libraries that allow developers to accomplish complex tasks with minimal code.

Why we choose Python ?

- Robust Libraries and Frameworks: Python has powerful libraries and frameworks such as NumPy, Pandas, Django, Flask, TensorFlow, and PyTorch that simplify development and accelerate the building process.
- Cross-Platform Compatibility: Python code can run on various platforms such as Windows, Linux, and macOS, making it easier for developers to build applications that work on different systems.
- Versatile: Python can be used for a wide range of applications such as web development, data analysis, machine learning, scientific computing, and more.

Django :

Django is a high-level web framework for Python that follows the Model-View-Template (MVT) architectural pattern. It provides a set of tools and libraries that simplify the development of web applications by enforcing best practices and reducing the amount of boilerplate code required.

Why we choose Django ?

- Rapid Development: Django's built-in tools and libraries make it easy to create web applications quickly and efficiently.
- Built-in Administration Interface: Django provides a built-in administration interface that makes it easy to manage data models and content.
- Security: Django provides several built-in security features such as password hashing and cross-site scripting (XSS) protection.

Rest Framework :

Django REST framework [6] is a powerful and flexible toolkit for building Web APIs. It is built on top of the Django web framework and provides a set of tools and features for building RESTful APIs.

Why we choose rest framework ?

- It provides a powerful set of tools and features for building RESTful APIs, such as serialization, authentication, permissions, and throttling.
- It follows the best practices and standards for building RESTful APIs, making it easy to create APIs that are easy to use, maintain, and scale.
- Authentication policies, including packages for OAuth1a and OAuth2.

SQL :

SQL (Structured Query Language) [11] is a standard programming language used to manage and manipulate relational databases. It provides a set of commands that allow users to create, modify, and query databases, as well as perform other tasks such as data migration and database administration.

Why we choose SQL ?

- Scalability: SQL databases are known for their ability to scale and handle large amounts of data effectively.

- Documentation and community support: SQL is a well-established technology with a large community of developers who actively contribute to its development and provide support to users.

- Structured data: SQL databases are particularly good at handling structured data, which makes them an ideal choice for storing data in a way that is easy to query and analyze.

Html :

(Hypertext Markup Language) is a markup language used to create web pages and web applications.

JavaScript :

JavaScript [10] is a popular and versatile programming language that can be used for both front-end and back-end development.

why we choose JavaScript ?

- Client-side interactivity: JavaScript allows us to add dynamic and interactive features to our web pages, making the user experience more engaging and user-friendly.

- Wide range of frameworks and libraries: There are many JavaScript frameworks and libraries available, such as React, Angular, and Vue, that can speed up the development process and provide additional functionality.

Vue js :

Vue.js [9] is a progressive JavaScript framework used for building user interfaces. It is known for its simplicity, flexibility, and ease of integration with other libraries or existing projects.

textbf{Why we choose Vue js ?}

- Simple and intuitive syntax: Vue.js has a simple and easy-to-understand syntax that makes it easy for developers to get started and build complex applications quickly.

- Modular architecture: Vue.js has a modular architecture that allows developers to use only the features they need, making it easy to customize and scale as required.

- Lightweight and fast: Vue.js is a lightweight framework that is designed to be fast and performant.

JSON :

JSON (JavaScript Object Notation) is a lightweight data interchange format that is easy for humans to read and write, and easy for machines to parse and generate. It is a language-independent format and is commonly used for transmitting data between a server and a web application, as well as for storing and exchanging data.

Why use JSON?

- Simplicity: JSON is easy to read and write compared to other data interchange formats such as XML.

- Lightweight: JSON is a lightweight format, which means it can be transmitted quickly over the network.
- Easy to parse: JSON can be parsed easily by JavaScript, which is commonly used in web applications.

LaTex :

LaTeX is a typesetting system that is widely used for scientific and technical documentation, such as research papers, technical reports, and books.

Dart :

Dart is a programming language developed by Google. It was designed to be easy to learn, productive, and capable of building high-performance applications. Dart is primarily used for developing web, mobile, and desktop applications, and it serves as the primary language for building applications with the Flutter framework.

Flutter :

Flutter [8] is an open-source UI (User Interface) framework developed by Google. It allows developers to create cross-platform mobile applications, web applications, and desktop applications using a single codebase. With Flutter, you can write code once and deploy it on multiple platforms, including iOS, Android, web browsers, and even desktop operating systems like Windows, macOS, and Linux.

Why we choose Flutter ?

- Cross-Platform Development: Flutter allows developers to create applications that can run on multiple platforms, including iOS, Android, web, and desktop, using a single codebase.
- Fast Development and Hot Reload: Flutter's hot reload feature enables developers to see the changes they make in the code almost instantly in the app.
- Native-Like Performance: Flutter's architecture and rendering engine enable applications to achieve high performance and deliver a smooth user experience.
- Rich and Customizable UI: Flutter provides a wide range of pre-designed widgets that follow the Material Design and Cupertino design guidelines.
- Access to Native Features: Flutter provides access to native platform APIs and services, allowing developers to leverage the full capabilities of the underlying platforms.

3.5 Application presentation

3.5.1 Authentication User Interface

3.5.1.1 Login:

This interface represents the login interface of the app , it allows users to log into the app by entering their email and password, after which they are directed to the corresponding user profile.

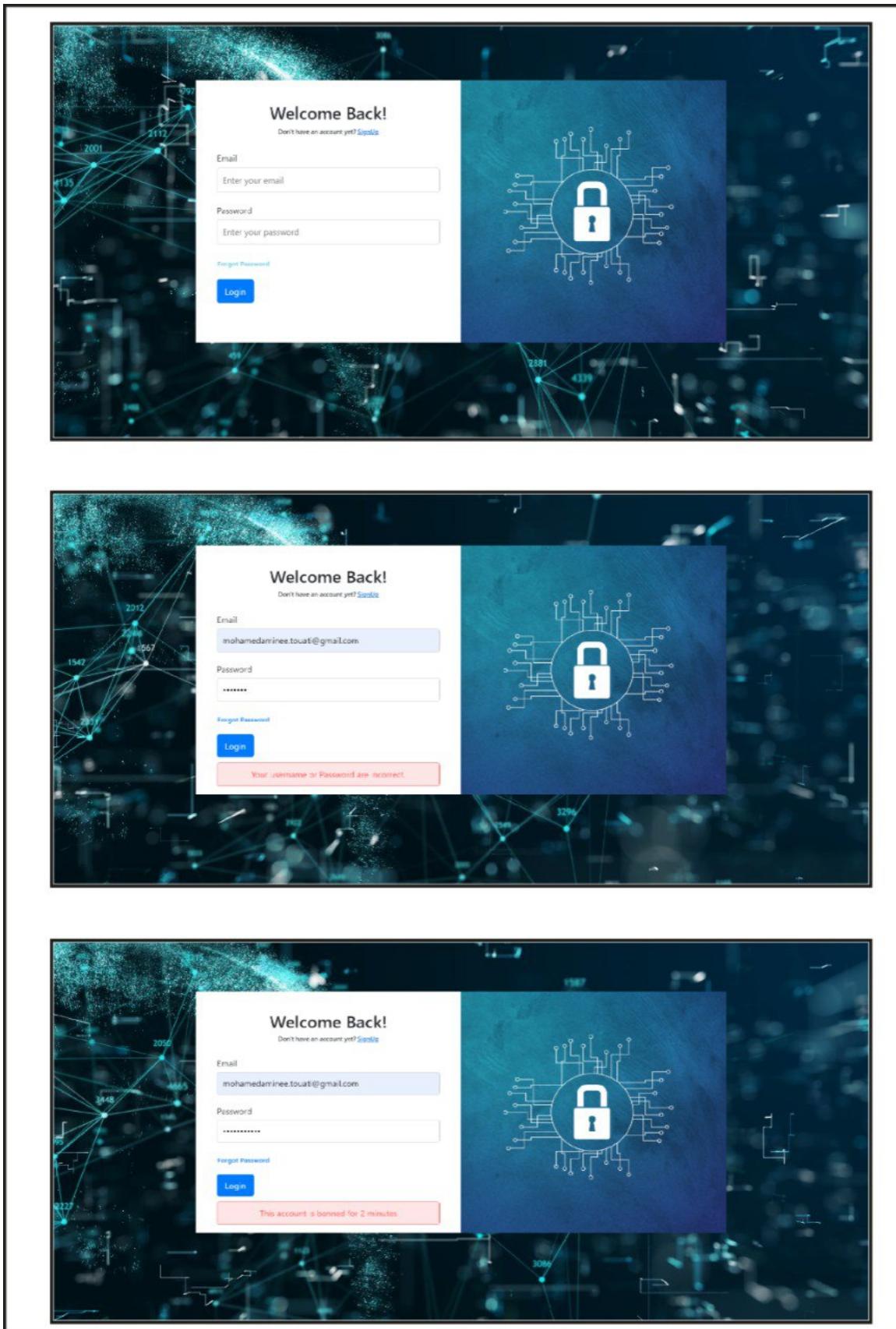


Figure 3.2: Login Interface

3.5.1.2 SignUp:

This interface represents the signup page for our application. This page enables visitors to create a profile in the app by providing their email address, it incorporates two-factor authentication (2FA). This additional security measure ensures that users have an extra layer of protection when creating their profiles..

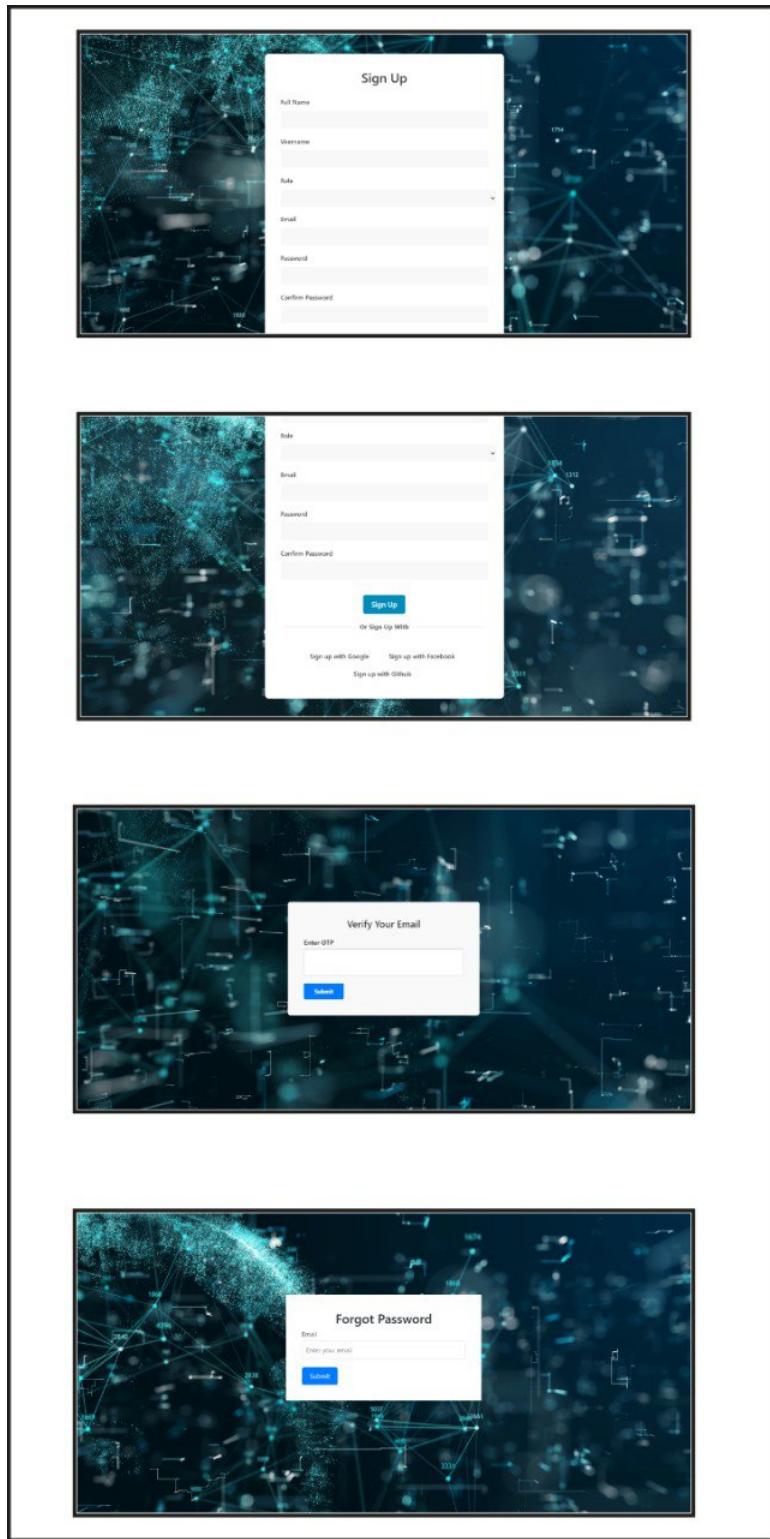


Figure 3.3: SignUp Interface

3.5.2 Participate on Challenge User Interface

This UI displays the process by which developers can participate in a challenge. Showing the content of a challenge and the scenario how he can use hints and submit his answer.

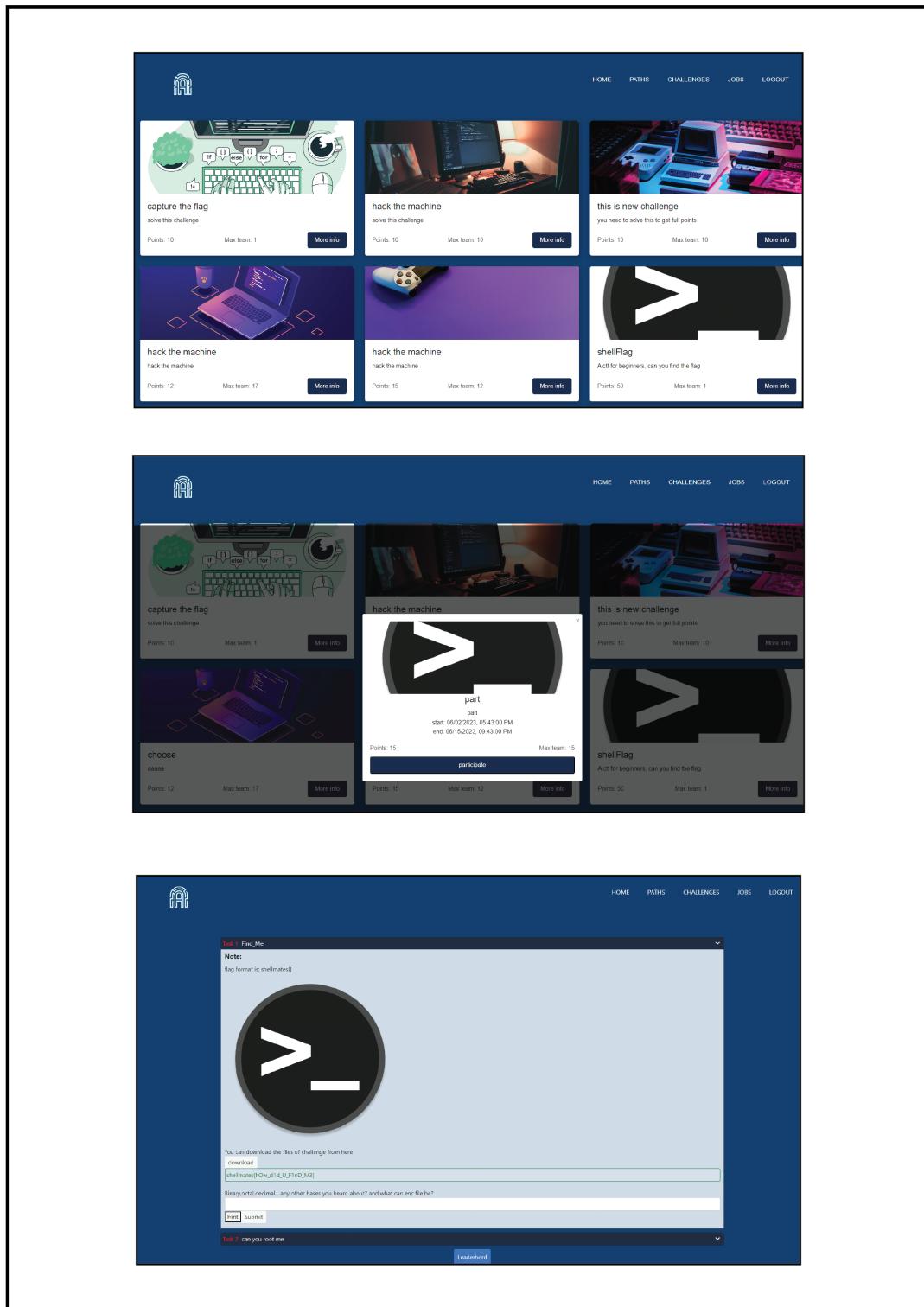


Figure 3.4: Participate on Challenge Interface

3.5.3 Planify Challenge User Interface

This UI displays how the admin will plan the challenges, showing how he can set the start and end dates and times and how he will notify who created the challenge.

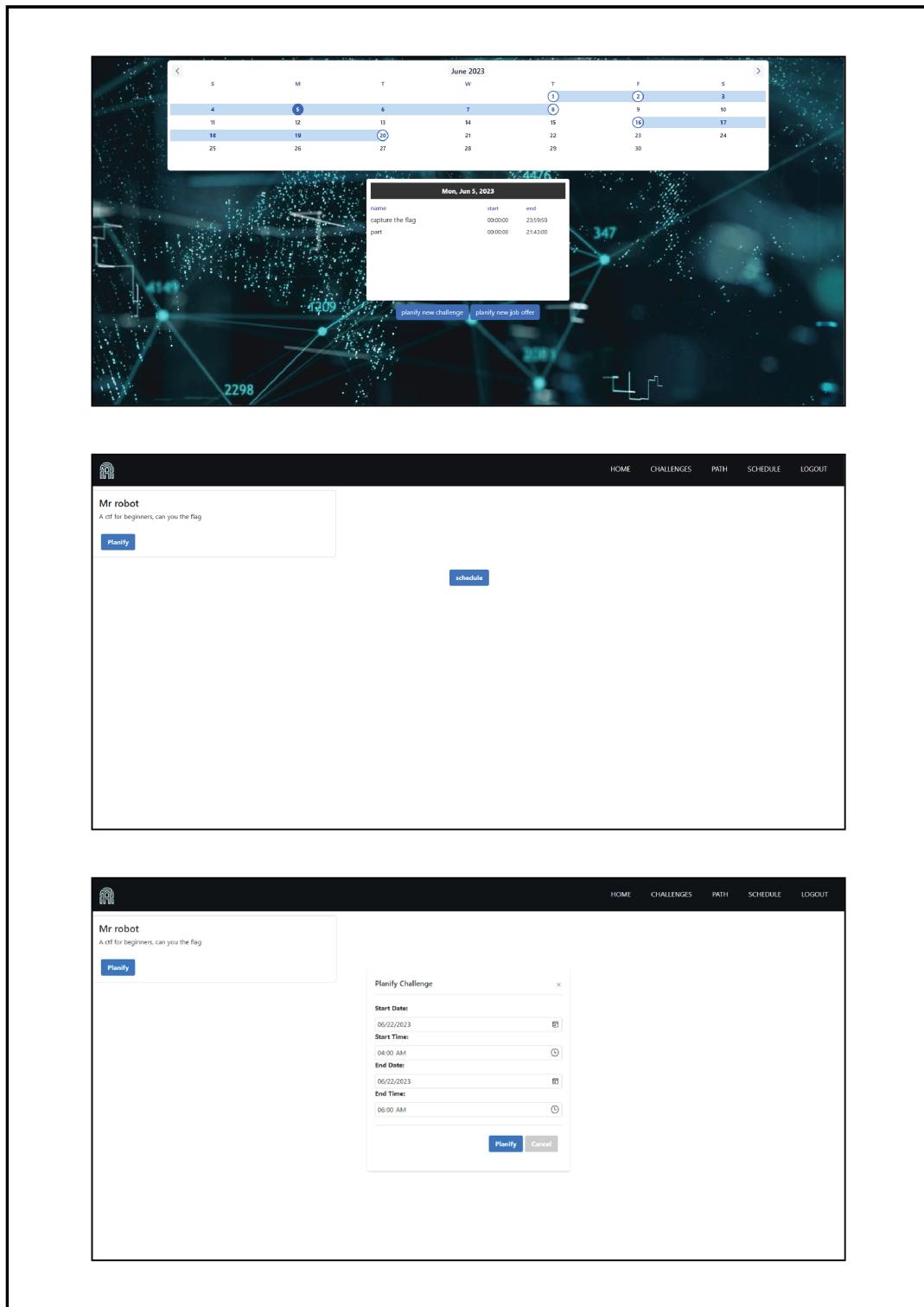


Figure 3.5: Planify Challenge Interface

3.5.4 Create Challenge User Interface

This UI displays how the instructor can create a challenge where he fills a form with all information about the challenge then creates its tasks and the content of each task

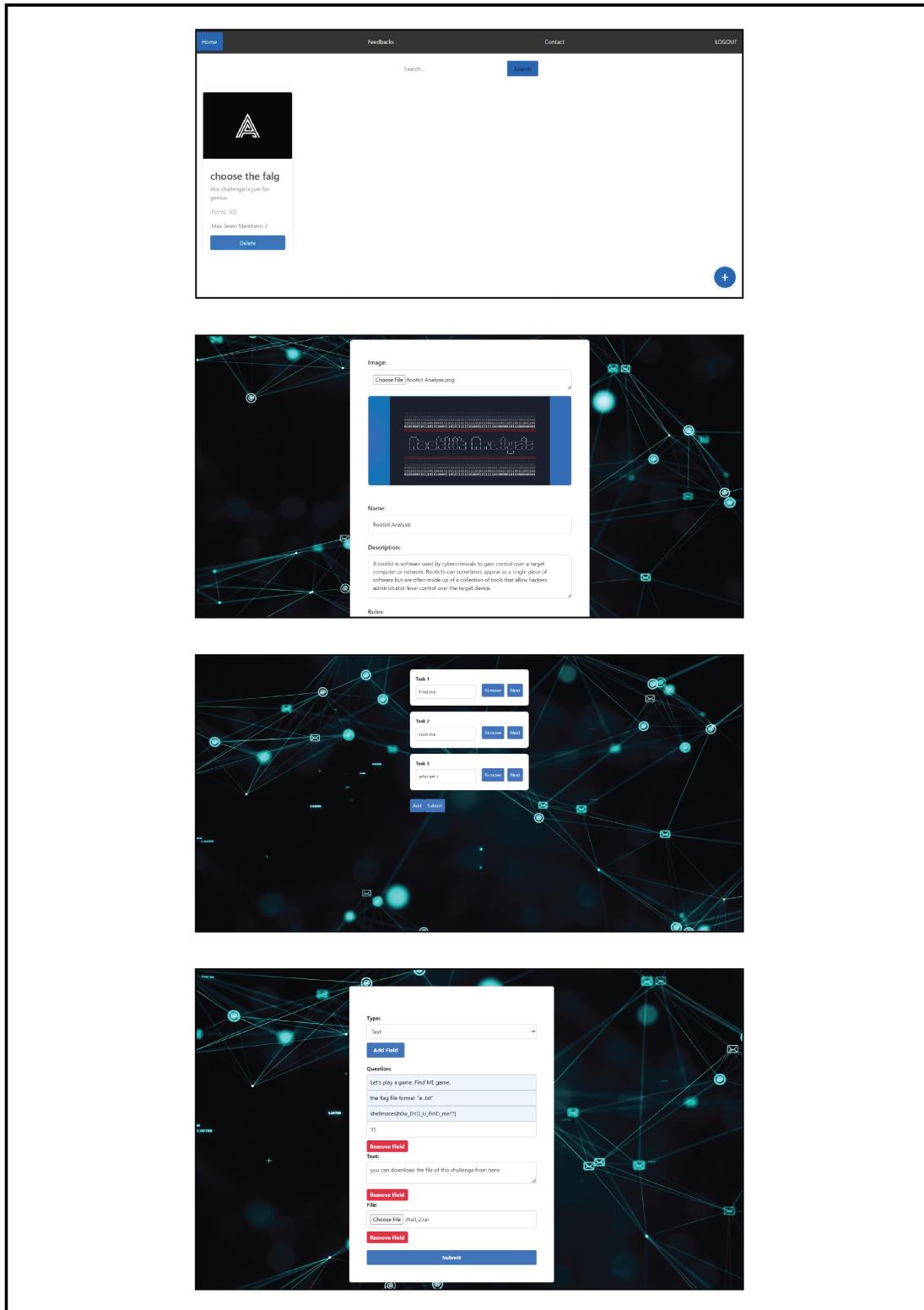


Figure 3.6: Create Challenge Interface

3.5.5 Post Job Offer

This UI displays how the company CompanyRecruiter can create a challenge and his tasks and content.

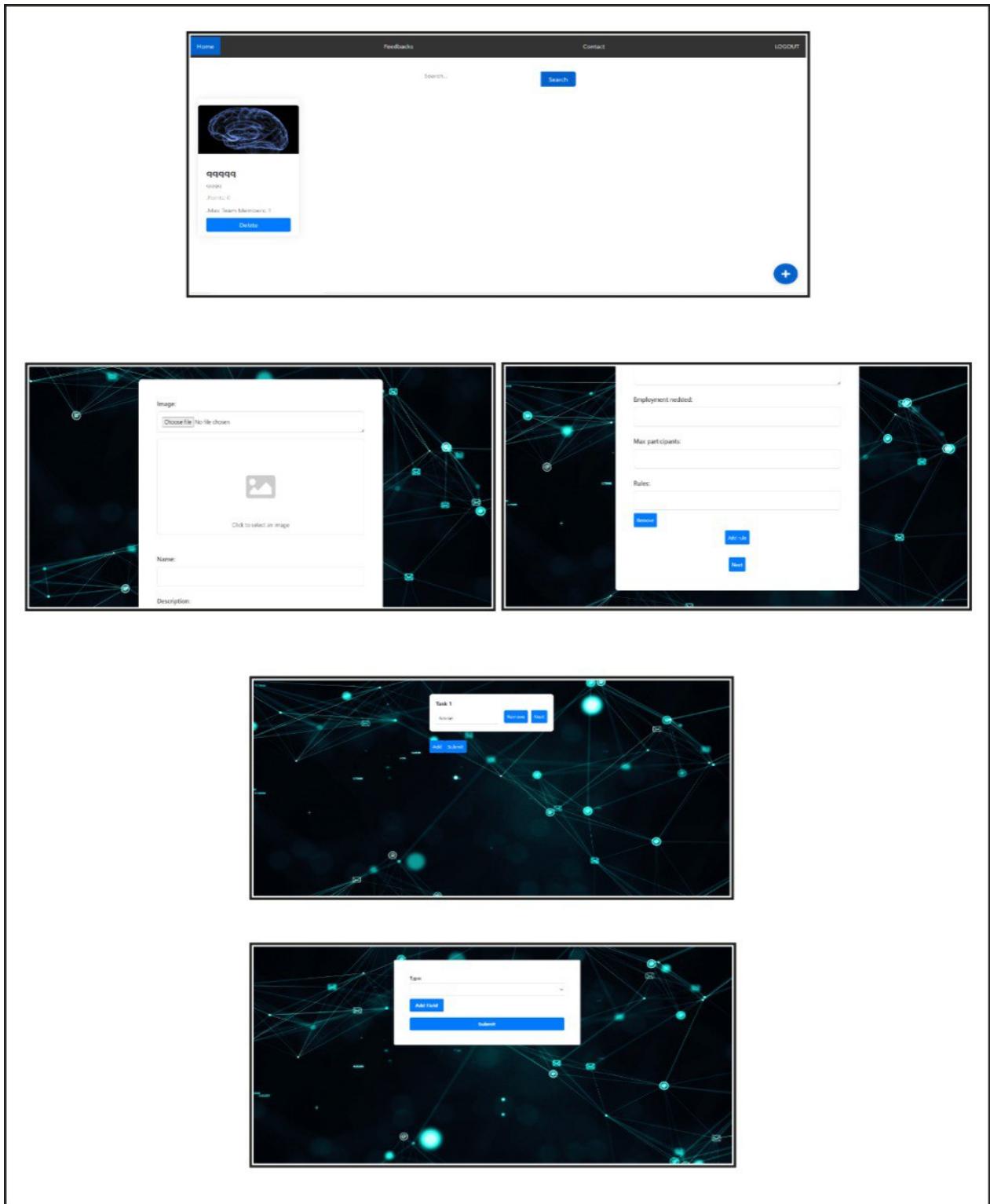


Figure 3.7: Post Job Offer

3.6 Conclusion

In summary, a successful implementation is vital for developing a successful application that meets user needs. Developers can create efficient and effective systems by following a structured approach to system design and utilizing appropriate tools and programming languages. The proper implementation ensures that the system is user-friendly, scalable, and maintainable, leading to high-quality applications that meet requirements and achieve goals.

GENERAL CONCLUSION

In conclusion, the process of creating this web app was not only a critical endeavor but also a fun experience. Despite the challenges and complexities, we found excitement and satisfaction in establishing the project's rules, functions, and interactions. The collaborative brainstorming sessions and research activities allowed us to explore new ideas and push the boundaries of what was possible.

In the end, while the development of the web app was a significant undertaking, we can confidently say that we had a great time working together, finding satisfaction in every step of the way, and ultimately delivering a product that we are proud of.

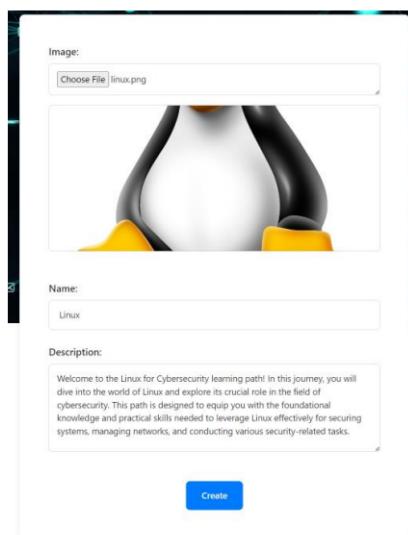
Future Work and Perspectives

- ▶ Achievement Sharing: Integrate with social media platforms to enable users to share their completed challenges, milestones, or achievements with their networks.
- ▶ Customization Options: Offer customization features such as personalized themes, color schemes, or layout options to allow users to tailor the app's appearance to their preferences.
- ▶ Discussion Forums or Chat: Provide a platform for participants to discuss challenges, seek advice, or share experiences through forums or real-time chat features
- ▶ Media Integration: Allow users to upload and share images, videos, or other media related to their challenges to showcase their progress or achievements..
- ▶ AI can help detect and prevent fraudulent activities, such as cheating or fake challenge submissions, by analyzing user behavior patterns, content authenticity, and other relevant factors
- ▶ Sentiment Analysis: AI can analyze user feedback, ratings, and reviews to extract sentiments, identify trends, and provide insights for improving challenges or identifying areas of user satisfaction or dissatisfaction
- ▶ Personalized Recommendations: AI algorithms can analyze user preferences, past challenge participation, and performance to provide personalized challenge recommendations that align with their interests and goals.
- ▶ Adaptive Difficulty Levels: AI algorithms can dynamically adjust the difficulty level of challenges based on user performance and feedback, ensuring a challenging yet achievable experience.
- ▶ Team Challenges: Enable teams to participate in challenges together. These challenges can be specifically designed for team engagement, requiring coordinated efforts and collaboration among team members to achieve shared objectives.
- ▶ VR Challenge Environments: Create virtual environments where users can immerse themselves in challenges, providing a more engaging and realistic experience. Users can explore and interact with virtual objects or scenarios relevant to the challenge.

APPENDIX

Gamified Course Scenario

We want to create a new gamified course on our site about "Linux Fundamentals". First, the site admin should create a new path for Linux. They need to go to the paths page, click on "Create New Path," add a name, description, and picture, and then click the "Create" button.



After that, and after logging in as an instructor, we can proceed to open the "Paths" section. Within this section, there is an option to create a new gamified course. By clicking on this option, we can begin the process of creating an engaging and interactive course for our learners.

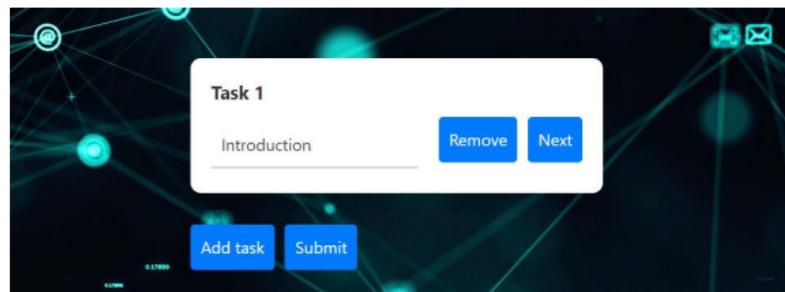
A screenshot of the 'Learning Paths' section. It shows a card for the 'Linux' path, featuring the Tux logo, the path name, a brief description, and a 'Learn More' button. The card has a light gray background with rounded corners.

introduction to Cybersecurity

After that, a form will be displayed on the site, prompting you to complete the details for the gamified course. You will need to select a relevant picture or image, provide the course name, and write a description that highlights the key aspects of the course. Once you have filled in the required information, click on the "Next" button to proceed to the next

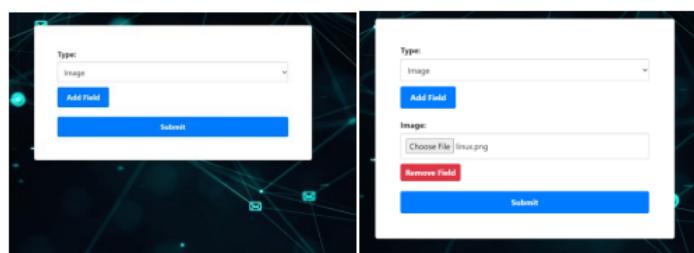


After completing the form, the site will display a page where you can create tasks for the gamified course. At this point, you have the option to add additional tasks, remove existing tasks, or modify them. To create the content for a specific task, you will need to add a name for the task and click the "Next" button.



On the content of the course, you have the flexibility to add various elements such as Title, Text, Picture, Video, File, and Question. These elements enable you to create a rich and interactive learning experience for the course participants.

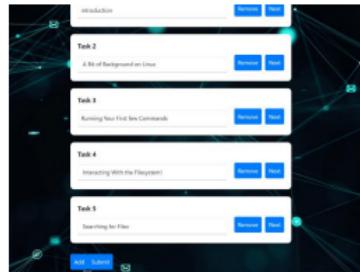
Now, as you focus on creating the content for the introduction task, you can start by adding an image and a simple introduction. To do this, select the "Image" option from the available options and click the "Add Field" button. This will allow you to upload or choose an image that is relevant to the introduction of the course.



Next, we need to add the introduction text. Choose the "Text" option and add the text field. You can now write the introduction in the provided text field.

To confirm that the users have read the introduction and completed the task, we add a question that does not require an answer to earn points. The developer just needs to click the "Submit" button to receive the points. By following these steps, you can create engaging tasks for your gamified course, including an introduction with an image, text, and a question to assess comprehension.

After clicking "Submit," the system will return you to the tasks page, where you can proceed to create additional tasks using the same process.



Here is another example for the content of the task "Searching for Files":

First, we add a small paragraph. We then upload the folder that we will be working on as a RAR file, allowing users to download it and perform the required tasks.

Next, we assign a title to our task: "Using Find." This title will explain how to utilize the "find" command in Linux for efficient file searching

Title:

Remove Field

Text:

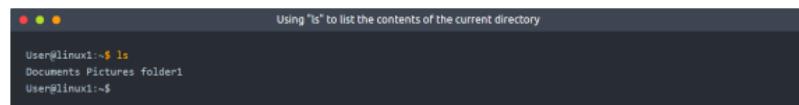
The find command is fantastic in the sense that it can be used both very simply or rather complex depending upon what it is you want to do exactly. However, let's stick to the fundamentals first.

Take the snippet below; we can see a list of directories available to us:

Remove Field

Submit

And we add another paragraph and another picture



And we add another paragraph and another picture

Image:

Choose File Capture.PNG

Remove Field

Text:

1-Documents
2-Pictures
3-folder1
Now, of course, directories can contain even more directories within themselves. It becomes a headache when we're having to look through every single one just to try and look for specific files. We can use "find" to do just this for us!

Let's start simple and assume that we already know the name of the file we're looking for — but can't remember where it is exactly! In this case, we're looking for "passwords.txt".

If we remember the filename, we can simply use "find -name passwords.txt" where the command will look through every folder in our current directory for that specific file like so:

Remove Field

Image:

Choose File Capture 2.PNG

Remove Field

Submit

After that, we add another title: "Using Grep." In this section, we will explore how to effectively use the "grep" command in Linux for pattern matching and searching within files. The content for this title will consist of a combination of pictures and paragraphs to provide a comprehensive understanding of the topic.

Image:

Choose File Capture 2.PNG

Remove Field

Title:

Remove Field

Text:

Another great utility that is a great one to learn about is the use of "grep". The "grep" command allows us to search the contents of files for specific values that we are looking for.

Take for example, the access log of a web server. In this case, the access log of a web server has 244 entries.

Remove Field

Image:

Choose File Capture 3.PNG

Remove Field

Text:

Using a command like "cat" isn't going to cut it too well here. Let's say for example if we wanted to search this log file to see the things that a certain user/IP address visited! Looking through 244 entries isn't all that efficient considering we want to find a specific value.

After that we can add some question about the task:

The left screenshot shows a form for adding questions. It has two sections, each with a 'Remove Field' button. The first section has a question about finding a flag in 'access.log' and its answer is 'grep "Flag" access.log'. The second section has a question about finding files with suffix '.txt' and its answer is 'find -name *.txt'. Both sections have a 'Submit' button at the bottom.

The right screenshot shows a tasks page with five tasks. Task 1 is 'Introduction'. Tasks 2 through 5 are labeled 'Task 2', 'Task 3', 'Task 4', and 'Task 5' respectively. Each task has a 'Solved' button next to it. The background of the tasks page features a network graph.

After clicking "Submit," the system will return you to the tasks page, and we can submit the course and it will be enable on our path

The screenshot shows a course page titled 'introduction to Cybersecurity'. Below it is a section titled 'Linux Fundamentals Part 1' featuring a penguin icon and the text: 'Embark on the journey of learning the fundamentals of Linux. Learn to run some of the first essential commands on an interactive terminal.'

Create Challenge Scenario

Here is the challenge we want to create, focusing on "Linux Fundamentals" and incorporating elements of "Privilege Escalation." We have assigned a picture to this challenge, named "shellFlag," and provided a brief description outlining the nature of the challenge and any applicable rules. The maximum number of participants is set to 50, and the challenge is designed for solo participation only, with a maximum of one team member. To proceed, click on the "Next" button to navigate to the tasks page. Next we will create the tasks of this challenge first we add a simple task about the command "find" so this is the task

The screenshot shows a challenge creation form. It includes fields for 'Image' (with a file input), 'Name' (set to 'shellFlag'), 'Description' (a brief text about a CTF for beginners), 'Rules' (a detailed list of competition rules), 'Participants counter' (set to 50), and 'Max Team Members' (set to 1). A 'Next' button is at the bottom.

Now we need to create the content of this task so we click at "next" and the system display the page of content, In this task, we have a question: "Let's play a game. Find ME game." The hint provided is "the flag file format is .txt". This question is worth 15 points, and the solution to this question is "shellmates h0w D1 DU FInD me??". Additionally, we have a challenge file consisting of multiple directories, files and one flag file. You need to locate this specific file in order to obtain the flag



Question:
Let's play a game. Find ME game.
the flag file format is 'txt'
shellmates(h0w_D1DU_FInD_me??)

Value:
15

Remove Field

Text:
you can download the file from here.

Remove Field

Title:

Remove Field

Title:
note

Remove Field

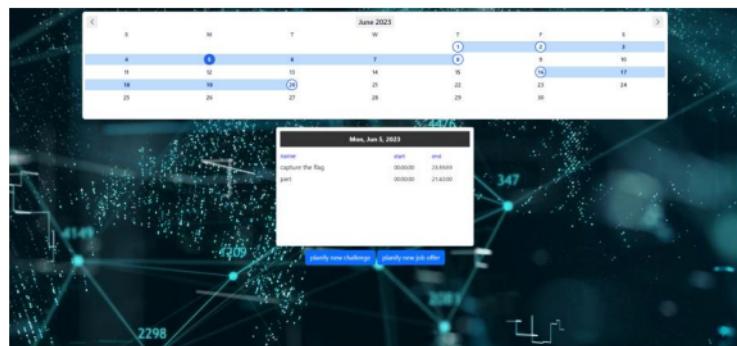
Text:
The flag format is shellmate(s).

Remove Field

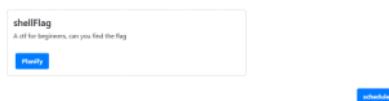
After submit this task, we back to the page of tasks and we submit the challenge.

Planify:

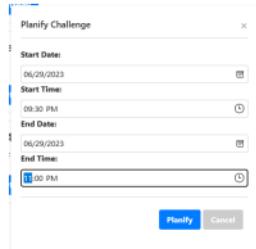
To plan this challenge, the administrator should log in and navigate to the schedule page. Then, they need to click on the "Planify New Challenge" button



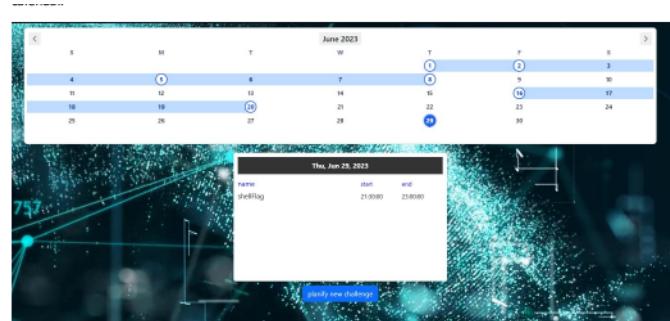
Afterward, the system will display all challenges that have not been planned



The administrator should click on the "Planify" button corresponding to the challenge they want to schedule. And he give the challenge start date and end date and clicks on "Planify".

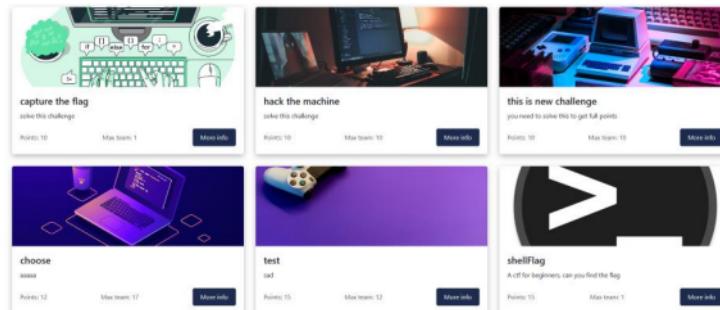


When we return to the calendar, we can see that the challenge has been successfully scheduled and added to the calendar.



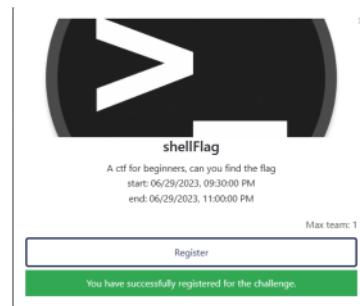
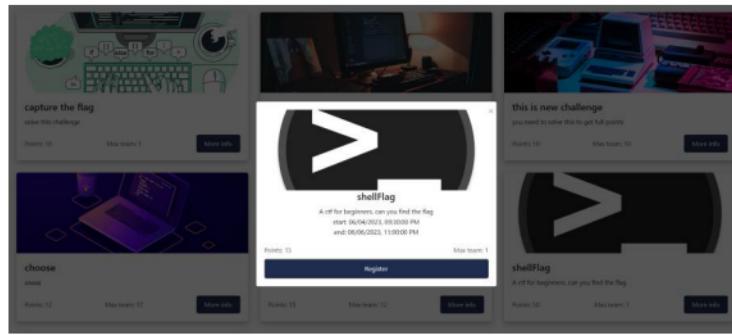
Register on challenge

After completing the steps mentioned, the developer can access the site and log in. Once logged in, they can navigate to the challenges page where they will find a list of all available challenges.



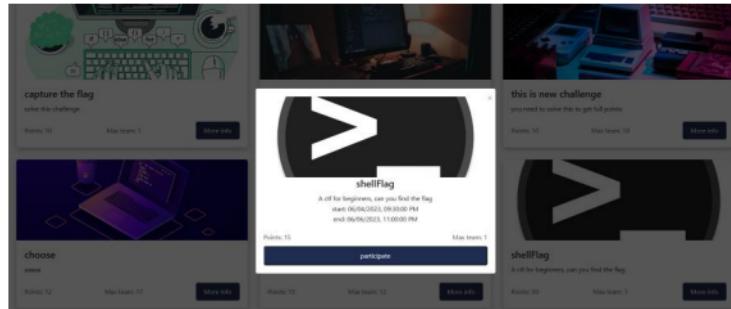
The developer has the option to register for any desired challenge from the list.

And he gets successfully registration



Participate on challenge

When the date of challenge comes, he can participate on this challenge



When the developer clicks on the "Participate" button for a specific challenge, they will be joined to that challenge

Task 1: Find_me

Let's play a game. Find ME game.

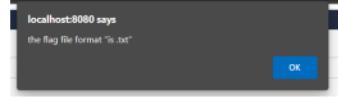
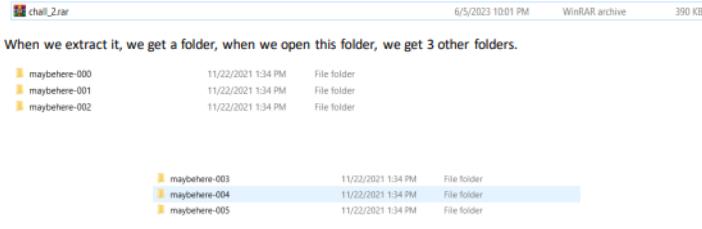
you can download the file from here
[download](#)

Note:
The flag format is : "shellmate1"

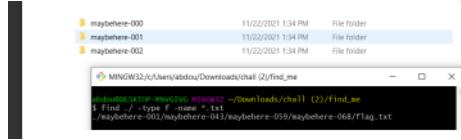
To solve this challenge, we need first to download the file of challenge, it is a rar file.

When we extract it, we get a folder, when we open this folder, we get 3 other folders.

So, we can't see the flag file like this, so let's see the hint.



Now we know that the file we search for has “.txt” text. So, we open the terminal and use the command “find” first



Now that we have the file path, let's take a look at it



We didn't get the flag, we need to use the command “grep” here.



Now we have the flag, we just need to submit it and finish the challenge——



Extra Work

Cyber Security

Two-factor authentication (2FA)

Is a security method that adds an extra layer of protection to user accounts. It requires users to provide two separate pieces of evidence to verify their identity, typically a combination of something they know (such as a password) and something they have (such as a mobile device or token). This two-step verification process significantly enhances account security by making it more difficult for unauthorized individuals to gain access, even if they have obtained the user's password.

```
class LoginView(APIView):
    permission_classes = [AllowAny]

    def post(self, request):

        email = request.data.get('email')
        password = request.data.get('password')
        try:
            user = NewUser.objects.get(email=email)
            bancount=user.bancount
        except NewUser.DoesNotExist:
            return Response({'error': 'Invalid email or password'}, status=status.HTTP_401_UNAUTHORIZED)

        if user.is_verified == False :
            return Response({'error': 'This account must be verified'}, status=status.HTTP_401_UNAUTHORIZED)

        if user.bancount ==3 :
            bancount =bancount+1
            user.bancount= bancount
            user.is_banned = True
            user.banned_time=timezone.now()+timedelta(minutes=2)
            user.save()

            print(user.banned_time)

        if timezone.now() > user.banned_time :
            user.is_banned = False
            user.bancount = 0

        if timezone.now() > user.banned_time :
            user.is_banned = False
            user.bancount = 0
            user.save()
            print(user.bancount)

        if user.is_banned :
            return Response({'error': 'this account banned for 2 min'}, status=status.HTTP_401_UNAUTHORIZED)

        if not user.check_password(password):
            bancount =bancount+1
            user.bancount= bancount
            user.save()
            print(user.bancount)

        return Response({'error': 'Invalid email or password'}, status=status.HTTP_401_UNAUTHORIZED)

    serializer=CustomUserSerializer(user)
    return Response({
        'data':serializer.data
    },
    status=status.HTTP_200_OK
)
```

```

class CustomUserCreate(APIView):
    permission_classes = [AllowAny]

    def post(self, request, format='json'):
        serializer = CustomUserSerializer(data=request.data)
        if serializer.is_valid():
            user = serializer.save()
            send_otp_via_email(serializer.data['email'])

            if user:
                json = serializer.data
                return Response({
                    'message': 'registration successfully check email',
                    'data': json,
                    'status': status.HTTP_200_OK
                })

        return Response({
            'message': 'something went wrong',
            'data': serializer.errors,
            'status': status.HTTP_400_BAD_REQUEST
        })

```

```

class Verifyotp(APIView):
    def post(self, request):
        serializer = VerifyOtpSeriliezer(request.data)
        email = serializer.data['email']
        otp = serializer.data['otp']
        user_queryset = NewUser.objects.all().filter(email=email)

        if not user_queryset.exists():
            return Response({
                'message': 'invalid email',
            },
            status=status.HTTP_400_BAD_REQUEST
        )

        user = user_queryset.first()
        if user.otp != otp:
            return Response({
                'message': 'wrong otp',
            },
            status=status.HTTP_400_BAD_REQUEST
        )

```

Password or Knowledge Factor

This is the most common factor of authentication and involves something that the user knows, typically a password or passphrase. Users enter their unique password to prove their identity. It is important to encourage users to create strong, complex passwords and regularly update them to enhance security.

OWASP ESAPI (Enterprise Security API):

OWASP ESAPI is a set of security libraries and APIs that provide protection against common web application vulnerabilities, such as cross-site scripting (XSS), SQL injection, and cross-site request forgery (CSRF). It is available for multiple programming languages, including Java, .NET, PHP, and Ruby.

Django Security Middleware:

Django, a Python web framework, includes built-in security middleware that helps protect against common web vulnerabilities. It offers features such as CSRF protection, clickjacking prevention, and XSS protection, helping developers build more secure web applications.

REFERENCES

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