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SCUOLA DI INGEGNERIA INDUSTRIALE
E DELL'INFORMAZIONE

Students & Companies

RASD Document
Software Engineering 2 Project

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Academic Year: 2024-25

Contents

1 | Introduction

1.1. Purpose

As the demand for skilled interns in various industries continues to rise, providing students with relevant internship opportunities is essential for their professional growth. Traditionally, students often struggle to find internships that match their skills, experiences, and career aspirations, while companies face challenges in sourcing qualified candidates. Students&Companies (S&C) aims to bridge this gap by creating a dynamic platform that helps the matching of university students with companies offering internships tailored to their profiles.

S&C provides a unified framework for students to search for internships, allowing them to showcase their CVs and preferences. Companies can advertise their internship opportunities, detailing the required skills, tasks, and benefits offered. The platform employs sophisticated recommendation mechanisms, utilizing keyword searches and statistical analyses to enhance the matching process, thereby ensuring a better fit between students and internships. Furthermore, S&C allows for the tracking of the interview process and provides constructive suggestions for improving project descriptions and CVs. Additionally, it facilitates the management of complaints from universities, enhancing overall communication and collaboration.

The main goals of the platform are the following:

1.1.1. Goals

[G1] Companies should be able to advertise the internships they want to offer

[G2] Students should be able to look for internships

[G3] Students should be able to be informed about internships that can be interesting

[G4] Companies should be able to be informed about the availability of a student's CV that its interesting to them

[G5] Students and Companies should be able to accept a recommendation of a possible match

[G6] Students should be able to apply for an internship.

[G7] Students and Companies should be able to establish contact and participate in an interview

[G8] Companies should be able to finalize the selection.

[G9] Students and Companies should be able to provide feedback and suggestions on the provided recommendations

[G10] Students and companies should be able to receive suggestions regarding how to make their submissions (project descriptions for companies and CVs for students)

[G11] Students and companies should be able to keep track of the matchmaking and internship processes

[G12] Students and Companies should be able to complain and communicate problems

[G13] Universities should be able to monitor internships

[G14] Universities should be able to handle complaints

1.2. Scope

Students & Companies (S&C) is a comprehensive platform designed to facilitate the connection between students seeking internship opportunities and corporations offering such positions. This digital interface allows companies to advertise their available internship roles and receive tailored recommendations pertaining to potential candidates. When a recommendation of a candidate, made by the system, has been accepted by the company, an invitation is sent to the student.

Conversely, students can engage in both proactive and passive searches for internship opportunities. Proactively, they can explore open positions through customized alerts and autonomously apply to them, while passively, they receive notifications from the system when job offers align with their specified criteria.

Once both parties express interest and the student's application has been accepted, the platform facilitates the selection process, assisting companies in conducting interviews and selecting the right candidates. Throughout this process, users can leave comments and suggestions, which the system uses to enhance statistical analysis and provide tips for improving their appeal.

Additionally, while internships are ongoing, the platform monitors the experience and collects feedback or complaints from both students and companies. In this stage, universities are involved in addressing complaints, handling them and taking action when necessary.

1.2.1. World Phenomena

[WP1] Students prepare their CVs

[WP2] Students want to take part in an internship experience

[WP3] Companies want to employ a student as an intern

[WP4] Companies interview possible candidates

[WP5] Students inform their university about the internship when it's in the course

[WP6] Companies choose the best candidate

1.2.2. Shared Phenomena

World-controllled

[SP] Unregistered users create an account

[SP1] Students upload their CVs

[SP2] Students go through available internships

[SP3] Companies advertise their internship

[SP3] Students accept the recommendation of an internship

[SP4] Companies accept the recommendation of a student

[SP5] Companies use the system to manage interviews

[SP6] Companies use the system to finalize the selections

[SP7] Universities monitor the situation of the internship

[SP8] Universities use the system to handle complaints

[SP9] Students and companies use the system to complain, communicate problems, and provide information about the internship status.

Machine-controllled

[SP10] The system informs students when an interesting internship becomes available

[SP11] The system informs companies when an interesting CV becomes available

[SP12] The system asks students and companies to provide feedback and suggestion

[SP13] The system provides suggestions both to companies and students on how to make submissions

[SP14] The system provides a mechanism to monitor the process and internship (? forse è già nel world controlled questa è solo una ripetizione al contrario)

1.3. Definitions, Acronymous, Abbreviations

Abbreviation	Description
RASD	Requirements Analysis & Specification Document
G*	Goal
WP*	World phenomena
SP*	Shared phenomena
D*	Domain assumption
R*	Functional requirement
UC*	Use case
S&C	Students & Companies
ST	Students
COM	Companies
UML	Unified Modelling Language
UI	User Interface

Table 1.1: List of Definitions, Acronymous, and Abbreviations

1.4. Revision History

- Version 1.0 (22/12/2024)

1.5. Reference Documents

The document is based on the following materials:

- IEEE Standard Documentation For RASD
- The specification of the RASD and DD assignment of the Software Engineering II course a.a. 2024/25
- Slides of the course on WeBeep

1.6. Document Structure

1. **Introduction**: it aims to give a brief description of the project. In particular, it's focused on the reasons and the goals that are going to be achieved with its development;
2. **Overall Description**: it is a high-level description of how the system works with a detailed explanation of the phenomena that involve the world, the machine, or both, there is also the domain description with its assumptions;
3. **Specific Requirements**: in this section, there is a detailed analysis of the requirements needed to achieve the goals. Moreover, it contains more information useful for developers (i.e constraints about HW and SW);
4. **Formal analysis**: it's a formal description of the world phenomena using Alloy;
5. **Effort spent**: it shows the time spent to realize this document organized by section;

2 | Overall Description

This section is devoted to giving an overall description of every part of the system.

2.1. Product Perspective

2.1.1. Scenarios

The following scenarios are devoted to providing a set of possible user usages of the system.

1. **A student creates an account**

   Mario Rossi, a university student eager to participate in an internship, is unsure of how to directly contact companies.

   After learning about Students&Companies, he decides to explore the platform and create an account. Searching for the site in his browser, Mario arrives at a login page, where he sees an option to create a new account if he is not yet registered. He clicks on this option and follows the account creation steps: entering his email, first name, last name, and date of birth.

   Upon completing these basic details, Mario is presented with additional options to enhance his profile, such as uploading a CV and adding a brief personal description. However, he decided to skip this step for now, intending to add these details later, as he is currently focused on just exploring what the platform looks like.

2. **A student uploads their CV**

   After exploring the site and deciding he would like to be contacted by companies, Mario decides it's time to enhance his profile by uploading his CV. To do this, he follows a series of steps:

   First, Mario clicks on his profile to access his personal information. Within his profile, he finds a button labeled *"Add your CV"* and selects it. This action opens his computer's file browser, where he locates his CV and clicks *"Upload."*

Once the file is uploaded, Mario clicks *"Publish"*, making his CV visible to anyone who views his profile.

This update is also noted by the platform, which analyzes the information within his CV. Based on this analysis, the platform notifies relevant companies who may be searching for profiles similar to Mario's, informing them of the availability of a new candidate.

3. **A company advertizes their internship**

   TechSolutions, a company seeking interns for a new project, is already familiar with Students&Companies and has an active account on the platform.

   To advertise their open internship position, they navigate to their company profile and select the *"Add a new project description"* button. This opens a page where they write a detailed description of the job responsibilities and the type of student profile they are seeking.

   Once they have completed the description, they click *"Publish"*, making the internship opportunity visible to all visitors to their profile.

   The platform then analyzes this new project listing and notifies students whose profiles match the requirements for the position.

   Additionally, students visiting the profile will now be able to click an *"Apply"* button next to the project description to submit their applications directly, even if they have not received a notification from the system.

4. **A student accepts a recomendation**

   Mario, a student with a profile and CV on Students&Companies, receives a recommendation email from the platform and a message directly on the site, notifying him of an internship opportunity at a company, TechSolutions, that aligns with his interests.

   In this email, Mario clicks on a *"See Recommendation"* button, which redirects him to his profile. There, he finds a new message containing a link to the company's account.

   Mario reviews the company's profile and examines the project that the platform has recommended to him. If he finds it appealing, he can return to the message on his profile and click the *"Accept Recommendation"* button.

   This action is then flagged by the system to the company, allowing them to contact

Mario directly through the platform to coordinate the next steps in the selection process.

5. **A company uses the system to manage the interview**

   TechSolutions has established contact with Mario Rossi, a student, via Students&Companies and begins the preselection process using the tools provided by the platform.

   The first step involves setting up a structured questionnaire through Microsoft Forms, featuring predefined questions designed to help TechSolutions better understand Mario's interests, skills, and overall suitability for the role.

   Mario completed the questionnaire, and TechSolutions was pleased with his responses. Based on his answers, they decided to move forward with the next stage of the interview process. (Had they found his responses unsatisfactory, they would have notified Mario that he was no longer being considered.)

   TechSolutions then initiates a direct chat with Mario to arrange an interview. The interview can be conducted in person if Mario is able to travel, or via video call if travel is not possible.

   During the interview, the company takes advantage of additional tools offered by Students&Companies, such as a shared digital whiteboard for collaborative problem-solving, real-time file and document sharing, and access to preloaded questions or skills assessments available within the system. These tools facilitate a more interactive and efficient interview experience, and TechSolutions is pleased with the outcome.

6. **A company uses the system to finalize the selection** TechSolutions, a company using the Students&Companies (S&C) platform, recently completed its selection process for an internship position. Four candidates were interviewed for the role: Mario Rossi, Giulia Verdi, Marco Blu, and Martina Azzurri.

   Throughout the process, each candidate was evaluated based on detailed scoring provided by the company, assessing both technical and behavioral competencies during various stages of the interview. After reviewing the results, TechSolutions considered whether to focus on specialized skills demonstrated during specific tasks or overall performance.

   Ultimately, Mario Rossi emerged as the ideal candidate. He excelled in the technical exercises while also embodying the company's core values, making him the perfect fit for the internship.

Following the decision, TechSolutions initiated the formal internship agreement with Mario. The other candidates were notified of their rejection, in line with the company's policy of providing personalized feedback: Giulia Verdi was informed that her time management skills needed improvement, while Marco Blu and Martina Azzurri were advised that while they were strong candidates, the role was awarded to someone with a more specialized technical background. By using the S&C platform, TechSolutions successfully concluded its hiring process while maintaining transparency and professionalism, ensuring all candidates received constructive feedback to support their future endeavors.

7. **Students are asked to provide feedback and suggestions after an internship**

   Mario is a student who has participated in an internship found through Students&Companies. After completing the internship he receives both an email and a message on Students&Companies.

   The message reads:

   "Subject: Feedback Request on Your Internship Experience with TechSolutions

   Dear Mario,

   We would like to thank you for your participation in the internship with TechSolutions through Students&Companies. We hope you had a valuable experience and have gained new skills during your time with the company.

   In an effort to continuously improve our platform and the internship process, we would greatly appreciate your feedback. Please take a few moments to fill out a brief form where you can share your thoughts, suggestions, and any areas for improvement. Simply follow this link to access the form: [link].

   Your feedback is essential in helping us refine our services and support both students and companies more effectively.

   Thank you once again for your time and for being a part of Students&Companies.

   Best regards,

   The Students&Companies Team"

   Mario wishes to provide feedback, so he clicks on the link in the message and fills out the form with his insights.

8. **Companies recieve a suggestion on how to make their project description more appealing**

   TechSolutions, a company with an active account on Students&Companies, has published a project description for an internship position they are looking to fill with a student. After the description is published on their profile, a button remains visible next to it, allowing the company to modify the description at any time.

   A few days later, the company notices that they are not receiving many applications. The system, analyzing the lack of responses, sends both a message and an email to the company with helpful tips and suggestions to improve the visibility and appeal of their internship listing. The system provides specific feedback on their project description, pointing out what may be missing and offering recommendations on how to make it more engaging for students.

   Upon reviewing the message and suggestions, TechSolutions chooses to update and modify their project description to enhance its appeal and attract more applicants.

9. **A student makes a complaint**

   Mario Rossi has been interning at TechSolutions for one month, working in a department focused on developing an interactive application for a gym. He joined the internship hoping to gain practical experience and explore his future career interests.

   However, Mario's experience has fallen far short of his expectations. Since his arrival, the department's supervisor has largely ignored him, assigning only menial tasks such as fetching coffee, operating the copy machine, and sending emails. Frustrated and disappointed, Mario feels the internship has failed to provide the meaningful learning opportunities he was promised.

   Determined to address the issue, Mario logs into the Students&Companies (S&C) platform and navigates to the page for monitoring his current internship. Using the formal complaint feature, he submits a detailed report about his dissatisfaction with the experience. In his complaint, Mario includes the official task schedule provided by the company and explains how the assigned duties have not aligned with his expectations or the internship's advertised role.

   This formal complaint will now be reviewed by the appropriate parties, initiating a process to address Mario's concerns and improve the situation.

10. **A university monitors the situation of an internship** Mario Rossi, a student at Politecnico di Milano, has been participating in an internship at TechSolutions

for two months.

Monica Marrone, a member of the HR department at Politecnico di Milano, is responsible for overseeing the progress of students' internships. To carry out her duties, she logs into the Students&Companies (S&C) platform using the university's account, which grants her access to detailed information about students' ongoing experiences.

Focusing on Mario's journey, Monica reviews his internship data through the platform. She notes that Mario has consistently met his required working hours and reads glowing reviews from TechSolutions, highlighting him as a hardworking, open-minded individual who reliably meets deadlines.

In addition, Monica reviews Mario's feedback about the company. He shares that TechSolutions provided a warm and supportive onboarding experience, equipping him with learning materials and guidance right from the start. They also engaged him in meaningful projects, rather than relegating him to passive observation, which has greatly enriched his learning experience.

Satisfied with what she has learned about Mario's positive progress and the supportive environment at TechSolutions, Monica plans to check back in two weeks to monitor any updates or changes in the internship.

11. **A university handles a complaint** Mario Rossi has been interning at TechSolutions for three months, but his behavior has caused significant issues for the company. He has repeatedly failed to show up for work without prior notice, missed important deadlines, and even left a negative impression on one of the company's largest clients, resulting in disruptions for his technical department.

    As a result, TechSolutions submitted a detailed complaint through the Students&Companies (S&C) platform. In their report, they outlined specific concerns about Mario's behavior, including missed schedules, unmet deadlines, and the broader impact on their operations.

    Monica Marrone, who works in HR at Politecnico di Milano, the university where Mario is enrolled, received a notification about the complaint. She accessed Mario's internship monitoring page via the S&C platform and reviewed the formal document submitted by TechSolutions. After reading the complaint, Monica decided to follow up directly with the company to gather more details.

    Following her conversation with TechSolutions, Monica contacted Mario through his institutional email and summoned him to the HR office. After evaluating the

situation, the university decided to terminate Mario's internship with immediate effect. Furthermore, this incident was recorded on Mario's institutional and S&C accounts as a negative performance he held.

12. **A Student proactively search for an internship and apply** Mario Rossi, a new user of the Students&Companies (S&C) platform, decides to explore internship opportunities one afternoon. While browsing the available positions, in the gloabal browser page of the application, he discovers two that align with his interests: one at TechSolutions and another at InnovativeAI. Both internships focus on areas he is passionate about—IoT app design and neural network training.

    To carefully evaluate his options, Mario saves both advertisements to his favorites, giving himself time to consider which opportunity suits him best.

    After reflecting for a few days, Mario decides that TechSolutions aligns more closely with his personal values and professional goals. Confident in his choice, he uses the platform's dedicated application function to submit his interest in the TechSolutions internship.

    TechSolutions, in turn, receives a notification on their S&C account, along with Mario's full application and accompanying documents, ready to review and take the next steps in the selection process.

13. **A company accepts a recommendation of a student** TechSolutions recently posted an internship advertisement on the Students&Companies (S&C) platform for a research project focused on genetically inherited diseases. The project aims to develop high-performance computational solutions to identify genetic patterns in DNA efficiently.

    The S&C platform's recommendation system identifies two potential candidates for the role and notifies TechSolutions:

    - Mario Rossi, a Computer Science Engineer with a strong interest in biotechnological research.
    - Giulia Blu, a Biotechnical Engineer with a keen interest in computer science.

    Along with the recommendations, the platform provides the candidates' CVs and supporting documents for review. After evaluating the profiles, TechSolutions determines that Mario's background and interests make him an excellent fit for their internship. Using the platform's dedicated recommendation page, they formally invite Mario to apply for the position, signaling their acceptance of the system's

suggestion.

The following day, Mario logs into the platform and sees the invitation from TechSolutions. If he is interested, he can proceed by submitting a formal application to the internship using the appropriate function..

14. **A student recieves a suggestion on how to make his cv more appealing and modifies his cv after**

    Mario Rossi created an account on the Students&Companies (S&C) platform two months ago. During this time, he applied to five different internship positions but was rejected each time. The rejections were largely due to shortcomings in how he composed his CV.

    In his CV, Mario only mentioned the name of his degree program, omitting critical details such as the technical skills he had acquired during his studies, the programming languages he knew, and the technologies or software he could use. This lack of information not only discouraged companies from considering his applications but also prevented the S&C system from accurately matching his profile with internship opportunities during the recommendation process.

    While attempting to generate recommendations for Mario, the system flagged the absence of key technical competencies in his CV. In response, the platform automatically created a suggestion to help him improve.

    Mario received a notification advising him to revise his CV by adding specific details about his technical skills. The suggestion emphasized that including such information would significantly enhance his chances of securing an internship.

    Taking the advice, Mario updated his CV to include his technical skills, programming expertise, and familiarity with various technologies and updated his profile loading this new version of his CV. Shortly after, one of his applications was accepted by TechSolutions, who invited him to an interview for an open internship position.

15. **A student/company provides feedback about the recomendation process**

    Mario Rossi, a Computer Science Engineer with a strong interest in the biological field, is an active user of the Students&Companies (S&C) platform. Recently, the platform sent him a recommendation for an internship at TechSolutions, a tech company offering a position to help program a website for a new restaurant.

    Mario was disappointed by the recommendation. His professional interests are fo-

cused exclusively on projects related to the biomedical field, and he felt that the suggested position did not align with his career goals or expertise.

After Mario declined the recommendation, the system prompted him to provide feedback on why he found the match unsuitable. Through the platform's feedback form, Mario explained that the suggested internship did not meet his expectations, as it was unrelated to his primary interest in biomedical applications.

By submitting this detailed feedback, Mario contributed valuable information to the platform's statistical analysis tools, helping to refine its recommendation algorithms and improve the accuracy of future matches for both himself and other users.

2.1.2. Class diagram

The following image shows the system class diagram.

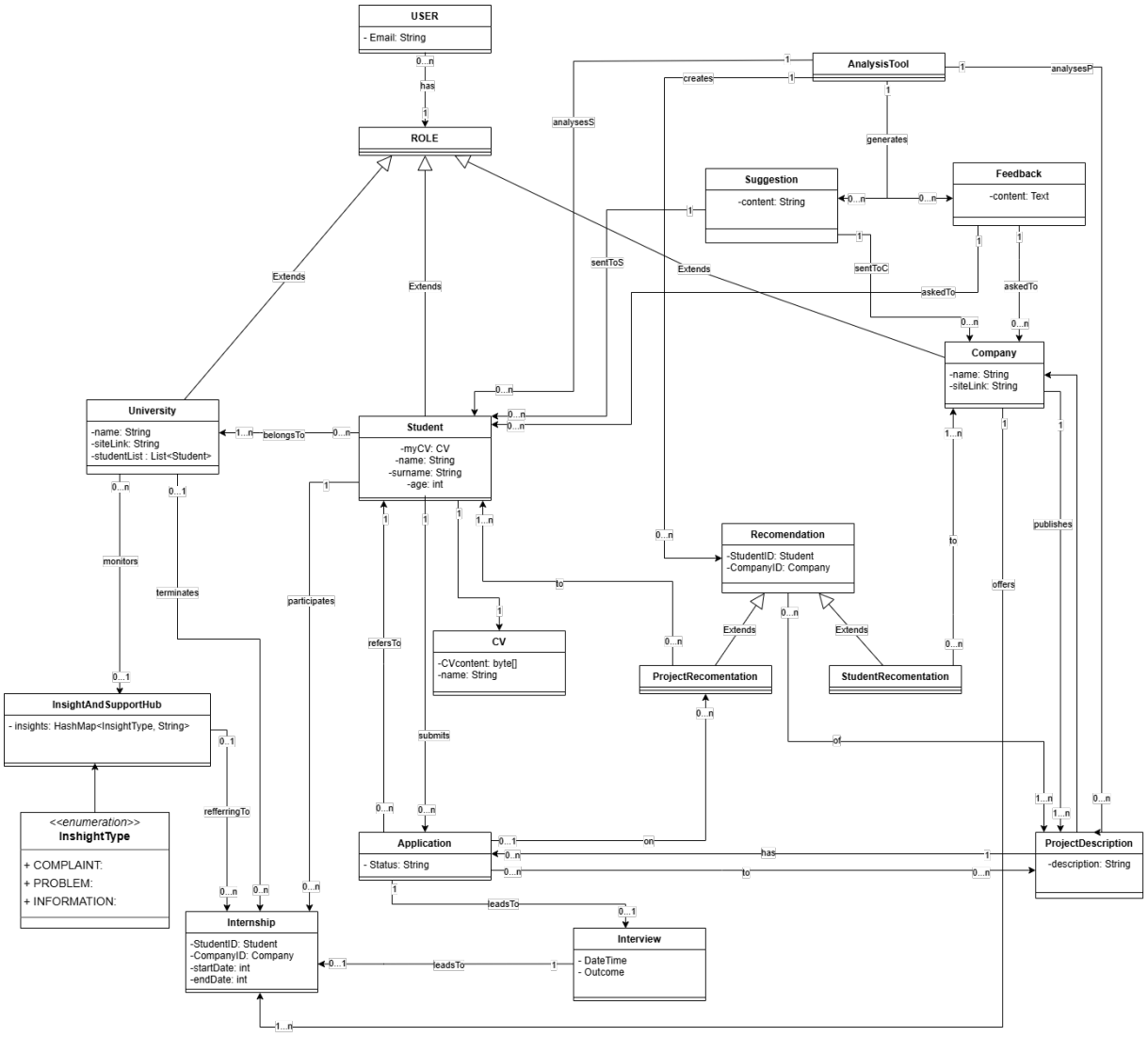

Figure 2.1: Class diagram

2.1.3. State diagrams

We will include some state diagrams to model the states of different objects, and the transitions between these states based on events and conditions; we chose a few examples that we illustrate below.

1. **Recomendation process**

   Entity Modeled: A recommendation generated by the platform (either for a student or a company)

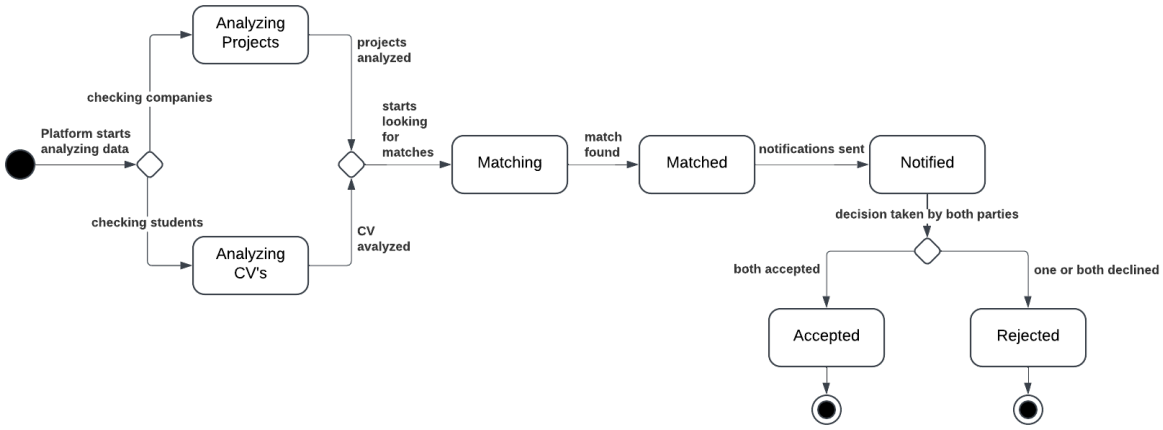

Figure 2.2

2. **Student's application**

   In this diagram, the student's internship application is the entity. We track the different states the application goes through as it moves from one stage to another in the selection process.

   (da rivedere perche non è un vero e proprio oggetto che cambia stato nel tempo)

   The selection process begins once both the student and the company have accepted the recommendation, and contact has been established. Initially, the company uses tools provided by S&C to evaluate the candidate, such as sending a structured questionnaire. The student responds to the questionnaire, and if the company is satisfied with the answers, they proceed to schedule an interview. Both parties agree on a time and place for the interview, which then takes place. After the interview, the company makes a final decision on whether to offer the position to the student and communicates their choice to them.

3. **Interview process**

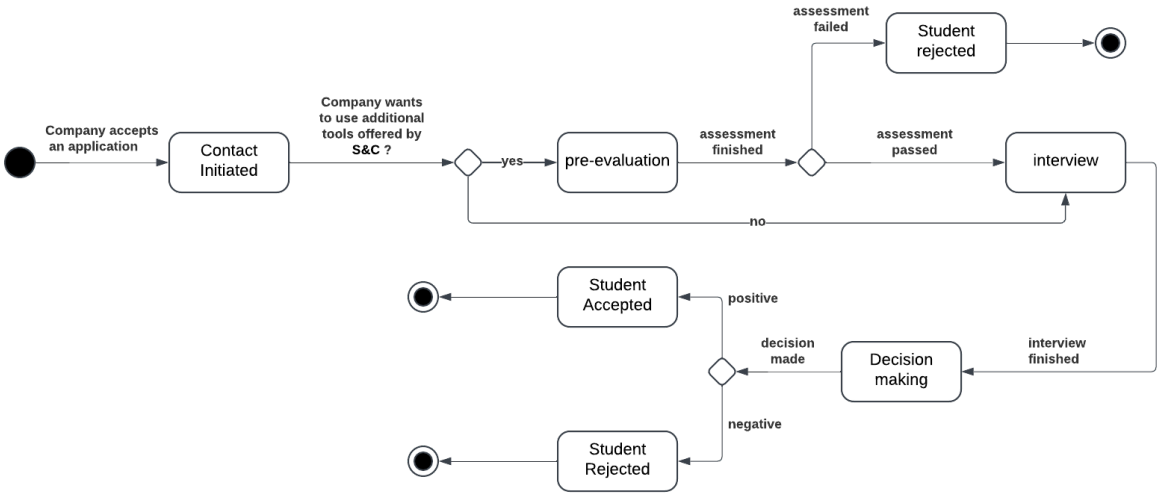

Figure 2.3

4. **CV suggestion**

   The main entity here is the student's CV, which goes through different states based on the system's analysis.

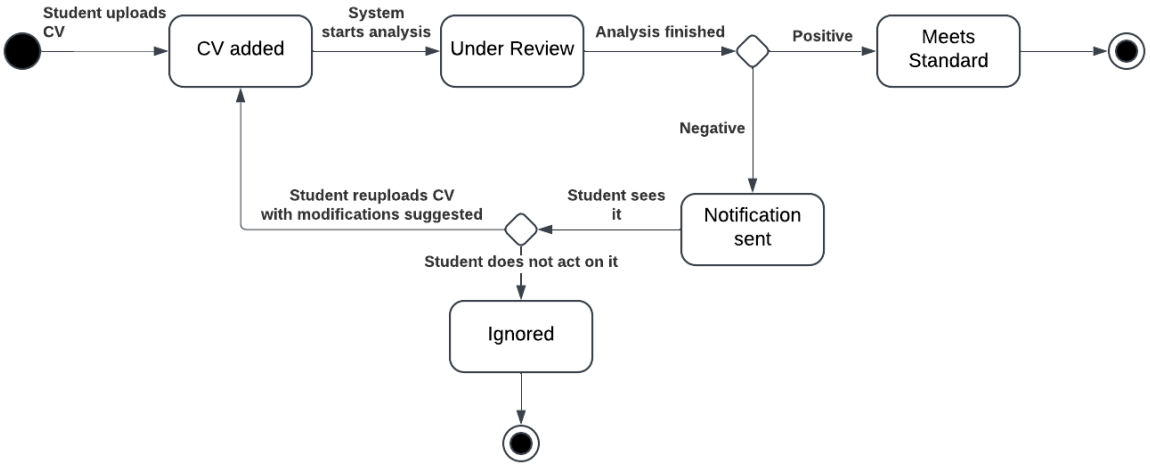

Figure 2.4

5. **University handlling complaints** The entity modeled is a complaint submitted by a student or company. The complaint goes through the following states:

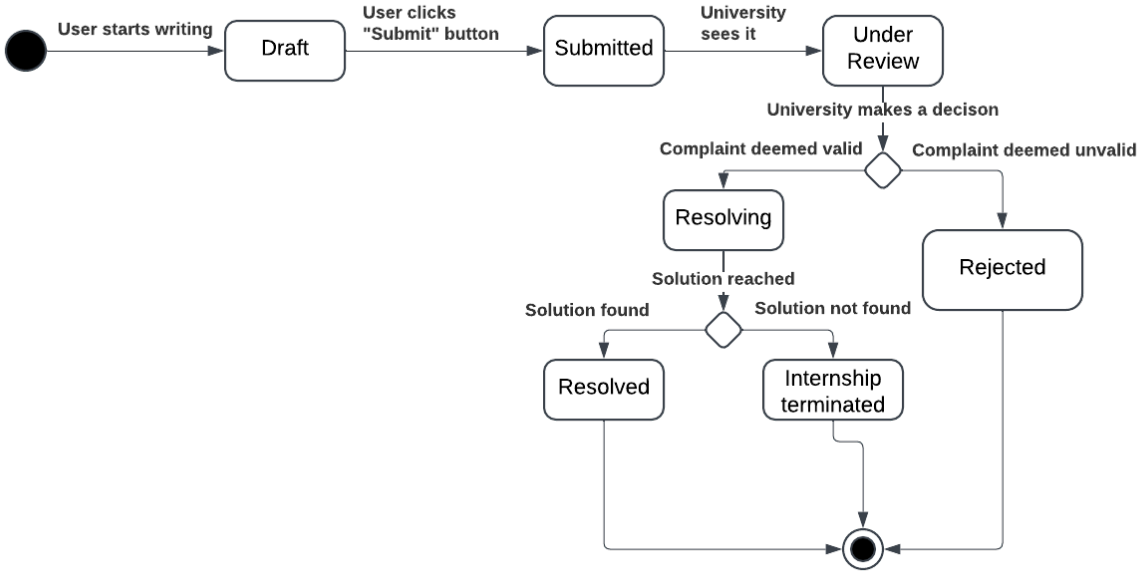

Figure 2.5

6. **Feedback collection process**

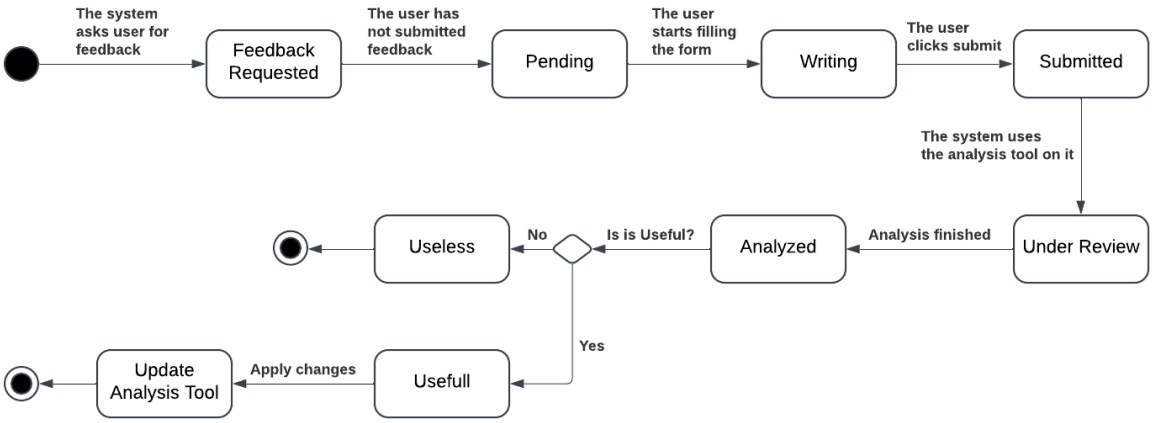

Figure 2.6

2.2. Product Functions

Here we will include the most important categories of use cases, so the main functions that the system should provide to its users.

1. **Account creation and User login** The platform supports secure account creation for both students and company representatives. This feature ensures that only authenticated users can access the system, safeguarding personal and professional information. Students and companies can maintain personalized profiles, which serve as the foundation for interactions on the platform. The user management system enables role-based access to different features.

2. **Internship posting** Companies can post detailed descriptions of internship opportunities, including the tasks involved, required skills, application procedures, and associated benefits (e.g., mentorship, training, or compensation). The system allows companies to categorize internships by domain, location, and duration, ensuring that postings are discoverable by the most relevant candidates. By providing a structured template for submissions, the platform standardizes postings and enhances their clarity for prospective applicants.

3. **CV analysis** A key functionality of the platform is its automated analysis of student CVs. Using natural language processing and pattern recognition techniques, the system extracts and evaluates relevant details such as skills, academic achievements, extracurricular activities, and prior experience. This analysis facilitates the matching process by identifying the most suitable candidates for specific internships and offering students insights into how their CVs align with industry expectations.

4. **Project description analysis** Similarly, the platform analyzes project descriptions provided by companies. This feature evaluates the scope, required skills, and potential learning outcomes of each internship project. By standardizing and comparing these descriptions, the system enhances compatibility with student profiles and ensures that companies present opportunities in ways that attract the best talent.

5. **Recomendation system and statistical analysis**

   One of the key features of Students&Companies is its recommendation system, which acts like a career matching service by connecting students with suitable internship opportunities and informing companies of potential candidates. This system operates through advanced statistical analysis methods, implementing a rec-

ommender system that uses data-driven algorithms within its system to optimize the matching process, making it easier for students and companies to connect over mutually beneficial opportunities.

6. **Interview and Selection management** The platform supports the organization and management of the selection process. Companies can schedule interviews, send invitations, and manage applicant responses directly through the system. Structured tools, such as pre-defined questionnaires and assessment templates, allow companies to evaluate candidates systematically. This feature reduces administrative overhead and ensures that the selection process remains efficient and transparent.

7. **Feedback collection and analysis** To foster continuous improvement, the platform enables users to provide feedback at various stages. Students can evaluate their internship experiences, while companies can assess the quality of applicants and their performance. This feedback is aggregated and analyzed to identify areas for improvement in the matching process, project design, and internship management.

8. **Complaint collection** The platform includes mechanisms for students and companies to submit complaints regarding internships. Complaints may address issues such as mismatched expectations, workplace conditions, or performance concerns. By providing a structured avenue for grievance reporting, the system ensures that all parties can voice their concerns constructively.

9. **Internship evolution monitoring** During the internship period, the platform facilitates the monitoring of progress. Students, companies, and universities can access tools to track milestones, evaluate performance, and identify potential issues early. This feature promotes accountability and helps ensure that internships deliver meaningful outcomes for all stakeholders.

10. **Complaints handling** Universities, as key stakeholders, are responsible for resolving complaints that require intervention. The platform supports this process by providing access to all relevant data, enabling universities to make informed decisions. This feature ensures that internships adhere to agreed-upon standards and that issues are addressed promptly to protect the interests of students and companies alike.

2.3. User charatteristic

There are three types of registered users in S&C: Students (STs) and Companies (COMs) and Universities (UNs). Each user type has distinct characteristics and roles within the platform:

- **STs**: Students use S&C to find a company offering internships. To access the platform, they must have a device with an internet connection and an account that includes their email and personal data. Once registered, students can browse available internships, apply for them, and participate in interviews with companies
- **COMs**: Companies join S&C to find students suitable for internships. To use the platform, they need a device with an internet connection and an account that includes their email and company information. Through S&C, companies can view student applications, schedule interviews, and select candidates for internships.
- **UNs**: Universities that allow their students to use the Students&Companies (S&C) platform to find internships are provided with a dedicated institutional account. This account is typically managed by the university's HR department or an equivalent administrative body. The HR department uses the account to periodically monitor the progress of internships involving their enrolled students. Through the platform, universities have access to comprehensive reports on the status of ongoing internships, including performance evaluations, feedback, and complaints submitted by either the students or the hosting companies.

All STs, COMs, and UNs must register with the platform to access its services. This enables seamless communication between students seeking internships, companies offering opportunities, and universities to monitor.

2.4. Assumptions, dependencies, constraints

[DA1] Students and companies need to have a device and an internet connection

[DA2] Companies need to have detailed internship descriptions

[DA3] Students need to have a CV

[DA4] Students need to be enrolled at a university

[DA5] Students need to create an account on S&C as students.

[DA6] Companies need to create an account on S&C as Companies.

[DA7] Universities need to create an account on S&C as Universities.

[DA8] Companies need to be able to conduct an interview

[DA9] Companies need to be able to evaluate an interview

[DA10] Universities need to be informed about a current student's internship

[DA11] Universities need to be able to communicate with Students and Companies

3 | Specific Requirements

This section provides a detailed description of the various types of requirements the system must address to achieve all the functionalities outlined. These requirements are essential to ensure the platform operates efficiently, and securely meeting users needs.

3.1. External Interface Requirements

3.1.1. User Interfaces

The Students&Companies (S&C) user interface will be a web app developed to be used by STs, COMs, and UNs. It will be accessible to anyone with a device equipped with an internet browser and a reliable internet connection. The platform will provide an intuitive and user-friendly experience, ensuring that users can easily navigate and access its features regardless of their device or operating system.

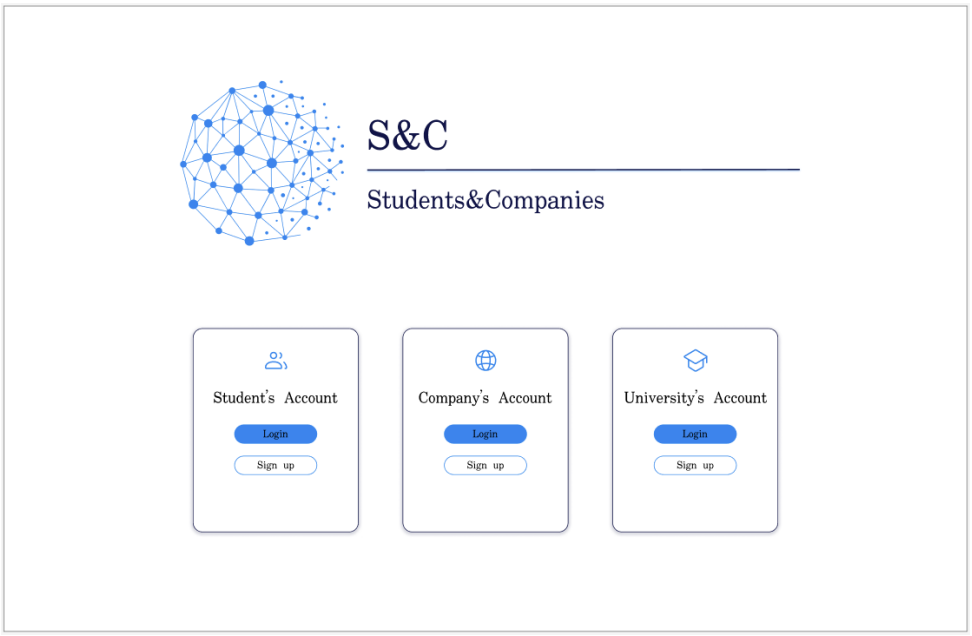

Figure 3.1: UI - Login Page

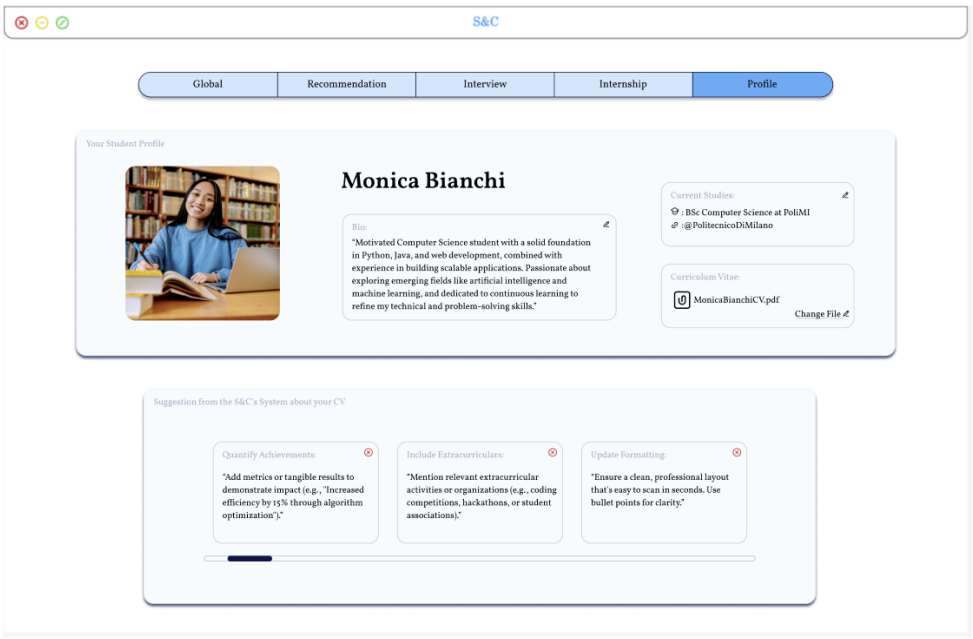

Figure 3.2: UI - Student's Profile

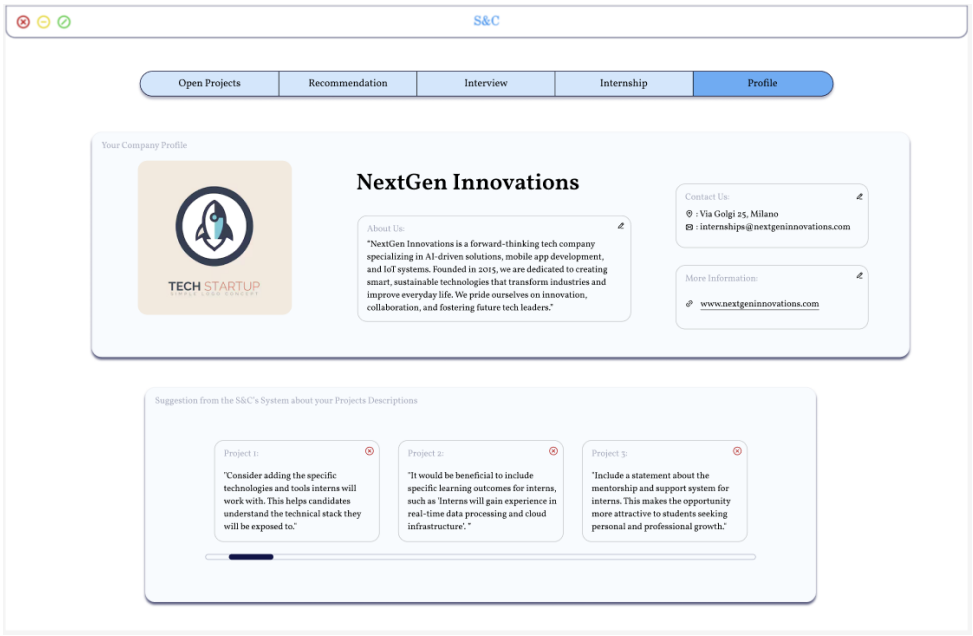

Figure 3.3: UI - Company's Profile

3.1.2. Hardware Interfaces

The system will be accessible from every device with an Internet Browser to access the website and a reliable Internet connection. The User is free to choose his device like a computer, a tablet, or a smartphone.

The system will be accessible from any device with an internet browser and a reliable internet connection. Users can choose their preferred device, whether it is a computer, tablet, or smartphone. This ensures flexibility and convenience, allowing users to access the platform from anywhere and at any time.

3.1.3. Software Interfaces

The system requires an API to facilitate email sending. These emails can include, for instance, 2FA (two-factor authentication) confirmations or general notifications. This functionality is essential to ensure secure user authentication and to keep users informed about important updates and communications through email.

3.1.4. Communication Interfaces

The communication interfaces needed by the system are the HTTPS (Hypertext Transfer Protocol Secure) protocol and the Mail System Transfer Protocol (SMTP).

- **HTTPS** will be used to ensure secure communication between the client and the server, protecting data integrity and confidentiality during transactions such as login, registration, and other sensitive operations.
- **SMTP** will be used for sending emails, enabling the system to handle tasks such as sending account 2FA confirmations, notifications, and other user-related communications efficiently and securely.

3.2. Functional Requirements

[R1] The system allows unregistered users to create an account

[R2] The system allows students to upload their CV

[R3] The system allows companies to publish new internships

[R4] The system allows companies to add a description to their internships

[R5] When students want to do a proactive research, the system allows them to go through the available internships

[R6] When doing a search the system allows users to filter internships by a key (?)

[R7] When finding an internship that suits their interests, the system allows students to apply for it.

[R8] When a new internship that might interest some students becomes avaible, the system notifies them.

[R9] When a student's CV that corresponds to a company's needs becomes available the system informs them.

[R10] The system allows students to accept a recommendation, applying for that particular internship.

[R11] The system allows companies to accept a recommendation, inviting the candidate that was proposed.

[R12] The system allows students to accept an invitation of a company for a particular internship, applying for it.

[R13] When the two parties have accepted a recommendation, or when the company has accepted an application received, the system allows them to establish a contact

[R14] When conducting an interview, the system supports the companies with the interview process

[R15] When conducting an interview, the system supports the companis with the finalization of the selection

[R16] The system allows students and companies to provide feedback and suggestions to feed statistical analysis.

[R17] The system provides suggestions to students regarding how to make their CVs more appealing

[R18] The system provides suggestions to companies regarding how to make their project descriptions more appealing

[R19] During the matchmaking process, the system allows all users to keep track of its execution and outcome

[R20] During the internship the system allows all interested parties to monitor it

[R21] During and ongoing internship, the system allows all users to complain

[R22] During and ongoing internship, the system allows all users to communicate problems

[R23] During and ongoing internship, the system allows all users to provide information on its status

[R24] When reports or complaints about the status of an ongoing internship are made, the system allows Universities to see them.

[R25] When complaints about the status of an ongoing internship are made, the system allows Universities to handle them.

3.2.1. Use case diagram

The following image shows the system use case diagram.

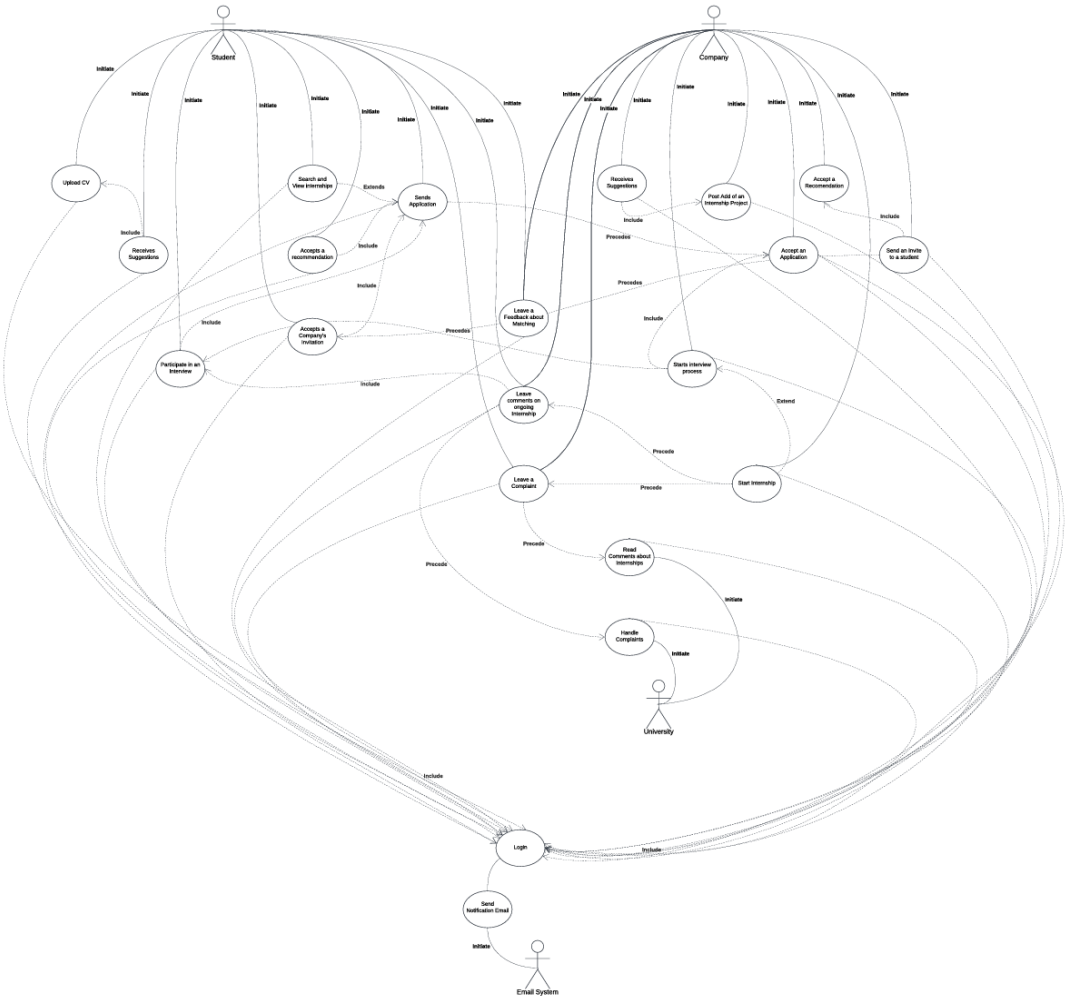

Figure 3.4: Use case diagrams

3.2.2. Use cases

UC1

Name	Student creates an account
Actor	Student
Entry Condition	The Student has a valid institutional email, the student enters the platform for the first time.
Event Flow	1. The student opens the platform homepage. 2. The student selects the "Sign up" in the "Student's Account" option. 3. The platform displays a registration form. 4. The student inputs the following details: institutional email address. legal name, birth date, location of residence. 5. The student clicks the "Sign-Up" button 6. The system verifies the email address format, and checks for duplicate email addresses in existing accounts. 7. If validations pass the system generates a username based on the student's legal name. 8. The platform sends a verification email to the provided email address. 9. The student opens the verification email and clicks the provided link to validate their identity. 10. Upon successful verification, the system creates and activates the account. 11. The system sends a welcome message, inviting the student to upload their CV if desired. 12. If the student decides to upload a CV they click on the message, which redirects them to the CV upload page. 13. The student uploads their CV and confirms the upload. 14. If the student chooses not to upload a CV, they dismiss the message by clicking the "X" button.

Exit Condition	1. The student's account is created, verified, and activated. 2. Optional: The student's CV is uploaded.
Exception	1. If the email address is already associated with an existing account, the system displays an error message, the student is redirected to the login page to access their existing account. 2. If the email address is invalid, the system displays an error message and requires the student to re-enter the email address. 3. If the student fails to confirm their identity within a set time (e.g., 24 hours), the account creation process is canceled.

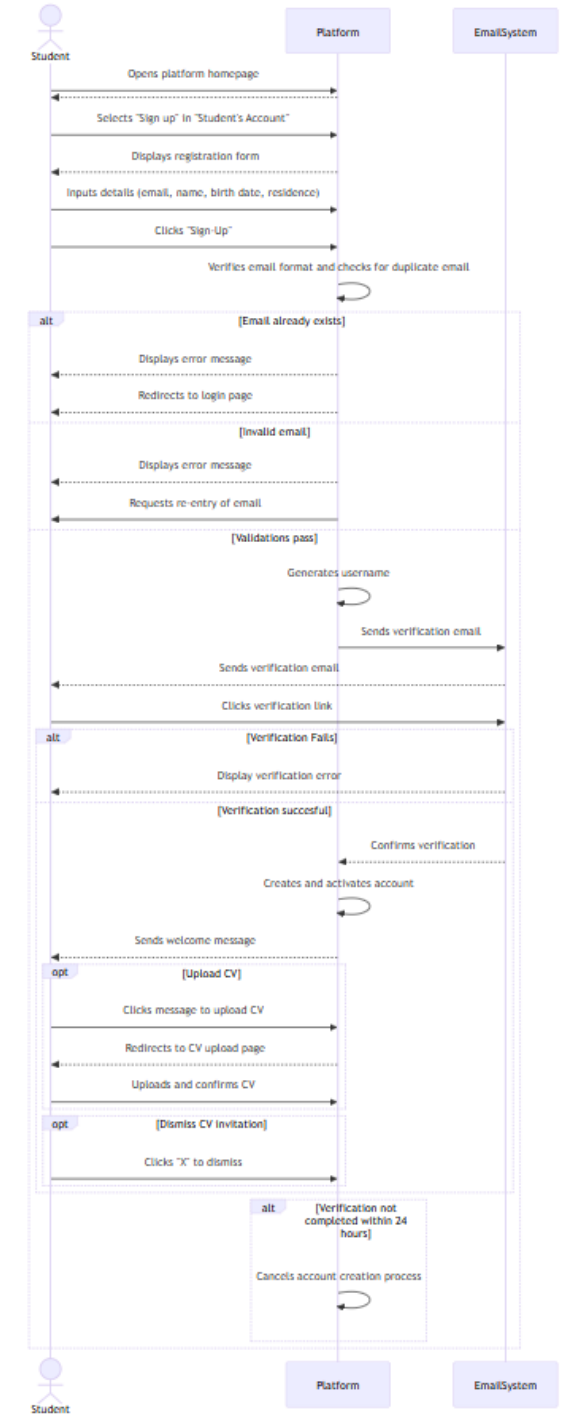

Figure 3.5: UC1

UC2

Name	Company creates an account
Actor	Company
Entry Condition	The Company has a valid email addess, the company enters the platform for the first time.
Event Flow	1. The company opens the platform homepage. 2. The company selects the "Sign up" in the "Company's Account" option. 3. The platform displays a registration form. 4. The company inputs the following attributes: email address, company name, location. 5. The company clicks the "Sign-Up" button. 6. The system verifies the email address format and checks for duplicate email addresses in existing accounts. 7. If validations pass, the system generates a username based on the company name. 8. The platform sends a verification email to the provided email address. 9. The company opens the verification email and clicks the provided link to validate their identity. 10. Upon successful verification, the system creates and activates the account. 11. The system sends a welcome message inviting the company to upload project descriptions. 12. The company clicks the message. 13. The system redirects them to a page to upload project descriptions. 14. The company writes and publishes project descriptions using the provided form.
Exit Condition	1. A new account is created, verified, and activated. 2. The company has uploaded their first project descriptions.

Exception	1. If the email address is already associated with an existing account, the system displays an error message and the company is redirected to the login page to access their existing account. 2. If the email address is invalid, the system displays an error message and requires the company to re-enter the email address. 3. If the company fails to confirm their identity within a set time (e.g., 24 hours), the account creation process is canceled.

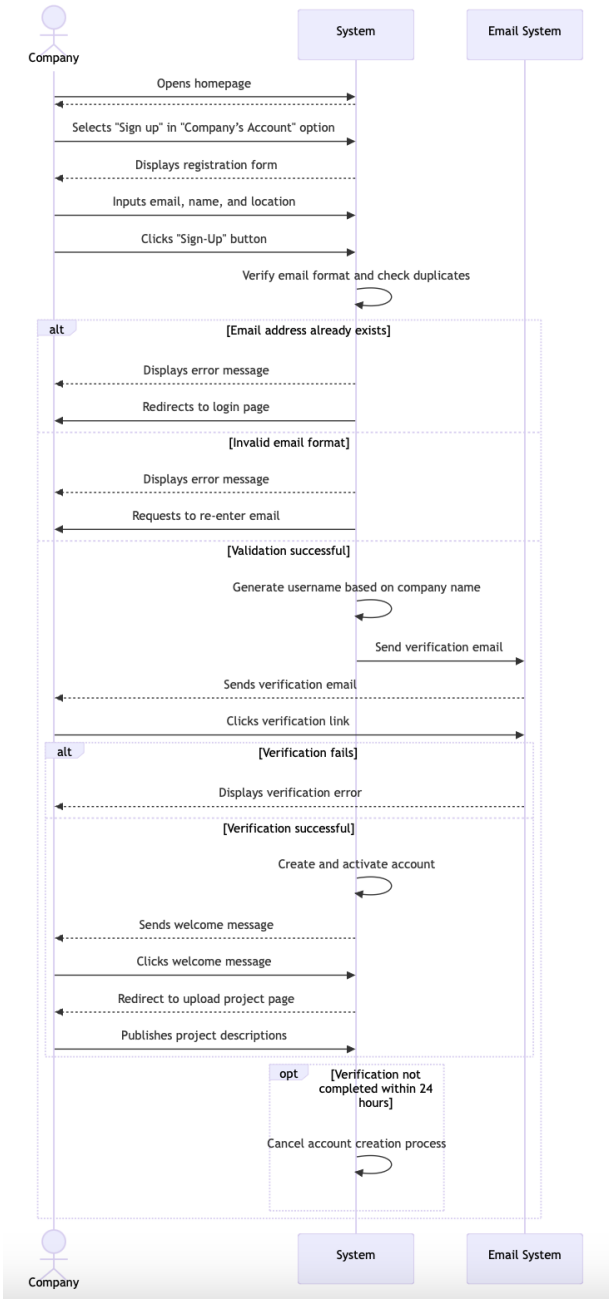

Figure 3.6: UC2

UC3

Name	Student searchs and applies for an internship
Actor	Student, Company
Entry Condition	The student is correctly logged in and has decided he wants to look for an internship. He is on the home page of S&C.
Event Flow	1. The student clicks on the "Global" button on the homepage. 2. S&C displays the "Global" page with a list of internships available. 3. The student scrolls through and reads the list of available internships. 4. If the student identifies an internship of interest they click on the internship's title. 5. S&C displays the project description page for that internship. 6. The student reads the description. 7. If the student is still interested in applying they click on the "Apply" button. 8. S&C sends the application, along with the student's profile, to the company managing the internship. 9. The system displays a confirmation message to the student, confirming the application has been sent. 10. If the student is not interested after reading the description, they click the "Back" button to return to the list of available internships. 11. S&C redirects the student to the correct page. 12. If the student does not find any interesting internships in the list they close the browser, ending the session.
Exit Codition	1. The student successfully submits an application and receives confirmation. 2. The student exits without applying for an internship.

Exception	1. The "Global" page fails to load due to a technical error. 2. The internship project description fails to display after the student clicks on a title. 3. The application submission fails due to an error, and the system provides an appropriate error message. 4. The student encounters internet connectivity issues, preventing them from completing the process.

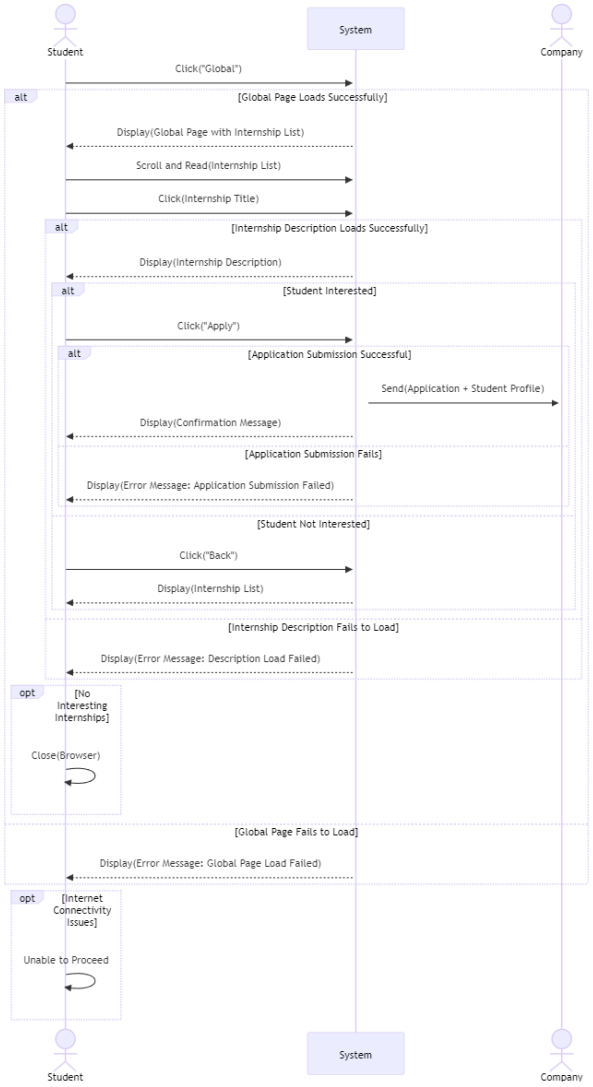

Figure 3.7: UC3

UC4

Name	Student recieves an internship recomendation
Actor	Student, Company
Entry Condition	The student has a valid email account and is able to log into the system. The student has uploaded a CV on his profile.
Event Flow	1. S&C finds a match between a student and a company based on the student's CV and the company's project description.. 2. S&C sends an email to the student notifying them of the internship recommendation.. 3. The student recieves an email and clicks on the "Go to Recommendation" button. 4. S&C redirects the student to their profile page, displaying the recommendation details, including the project description. 5. The student reviews the project description, if the student accepts the recommendation they click the "Apply" button. 6. S&C notifies the company that the recommended student has applied for the position. 7. The system confirms the application to the student. 8. If the student rejects the recommendation, they click the "Reject Recommendation" button. 9. S&C removes the match from its database. 10. S&C notifies the company they matched with that the recomendation has been rejected by the student.
Exit Codition	1. The student has successfully applied to the internship and received confirmation. 2. The student has exited the process without applying.

Exception	1. The student does not see the email in time, and the internship application window has already closed when they attempt to apply. 2. The email fails to reach the student due to a technical issue. 3. The link in the email to the recommendation page is broken or inaccessible.

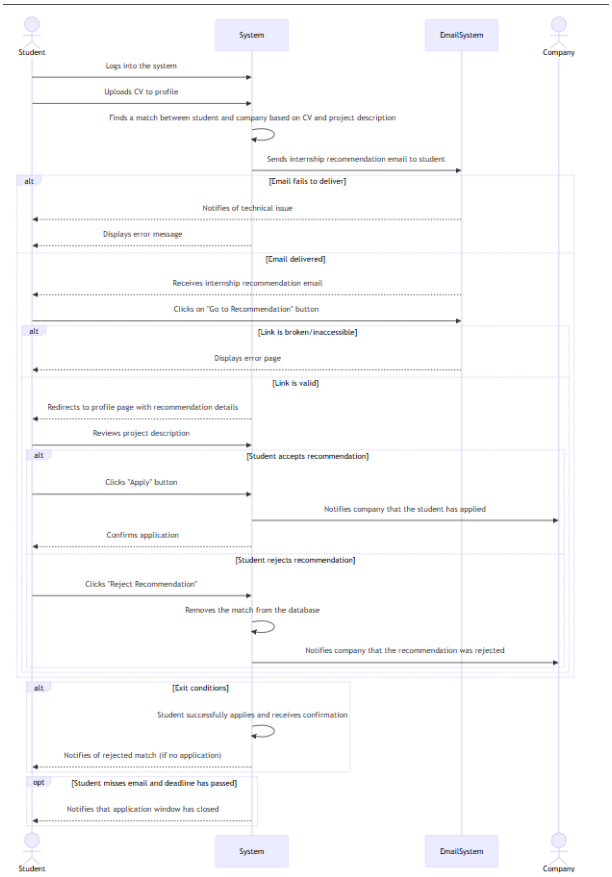

Figure 3.8: UC4

UC5

Name	Company recieves a student's recomendation
Actor	Company, Student
Entry Condition	1. The company has a valid email account and is able to log into the system. 2. The company has uploaded at least one project description on their profile.

Event Flow	1. S&C identifies a match between a student and a company based on the uploaded project description and student CV. 2. S&C sends an email to the company notifying them of the recommendation. 3. The company's employee receives the email and clicks on the "Go to Recommendation" button. 4. The system redirects them to their profile page, displaying the recommendation details, including a link to the student's profile. 5. The company's employee reviews the student's CV, If the employee is interested in the student: 6. If the student has already applied, the company clicks the "Accept" button. 7. S&C notifies the student that their application has been accepted, and contact between the two parties is established. 8. If the student has not applied, the company clicks the "Invite" button. 9. S&C sends a notification to the student requesting that they submit an application. 10. If the employee is not interested in the student: 11. If the student has already applied, the company clicks the "Reject Application" button. 12. S&C notifies the student that their application has been rejected. 13. If the student has not applied, the company clicks the "Reject Recommendation" button. 14. S&C removes the match from the system. 15. S&C notifies the student they matched with that the recomendation has been rejected by the company.
Exit Codition	1. Contact is successfully established between the student and the company. 2. The student is notified of a rejected match.

Exception	1. The email fails to reach the company due to a technical issue. 2. The link in the email to the recommendation page is broken or inaccessible. 3. The company's employee does not respond to the email or does not review the recommendation on the platform.

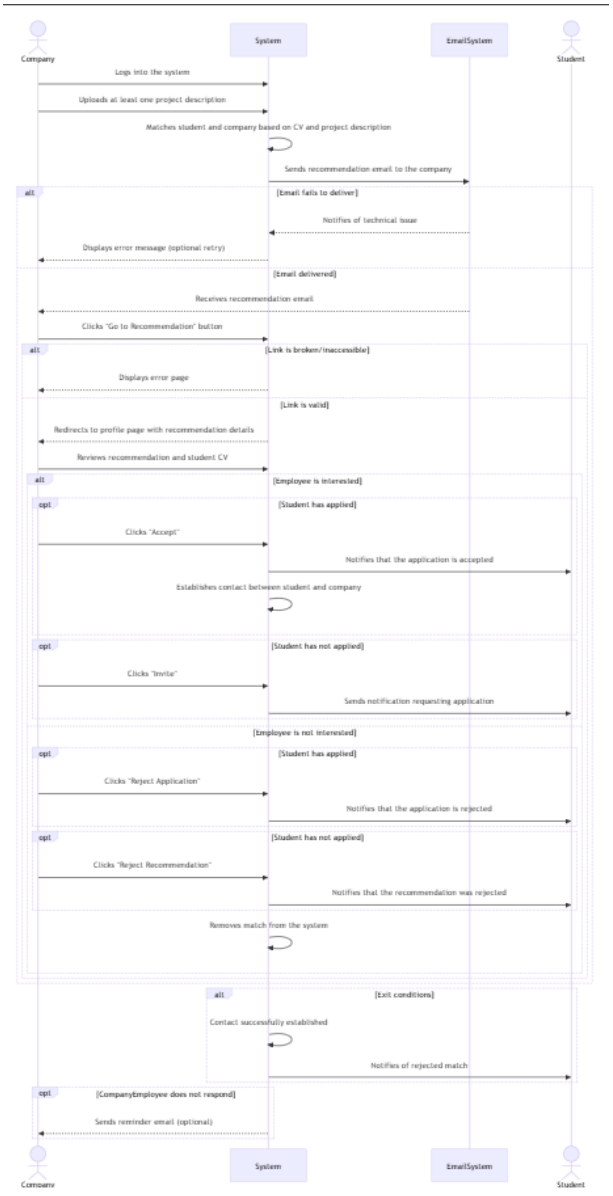

Figure 3.9: UC5

UC6

Name	Interview
Actor	Student, Company
Entry Condition	• A student has been matched with a company. • The company and student have been notified of the match. • The company has initiated contact by either accepting the student's application or requesting an interview.

Event Flow	1. The company contacts the student through the platform.. 2. The student receives a notification from the platform that a company is requesting to initiate contact. 3. The student accepts, and they begin the interview process. 4. The company may use platform tools, such as questionnaires, to pre-assess the student's qualifications before scheduling the interview. 5. The student completes the pre-assessment through the system, providing relevant information and responses. 6. Upon reviewing the pre-assessment, the company decides whether to move forward with the interview process. If they decide to proceed, the company proposes an interview date and time for the student to consider. 7. The student reviews the proposed interview details and, if they are available, accepts the scheduled date and time. 8. If the student is unavailable at the proposed time, they request the company to reschedule the interview. 9. This process repeats until both parties agree on a time for the interview. 10. Once a suitable time has been found, the system confirms the interview date and time with both the student and the company. 11. The student and company receive a reminder notification prior to the interview. 12. The company and student conduct the interview (this could be through the platform or an external tool as specified). 13. After the interview, the company uses some tools offered by the system to help with the selection process. 14. Once they have made a choice, they send a notification to the student with thier choice. 15. The student is notified whether they have been selected for the internship or not.

	16. If the student is selected, they receive a final confirmation message about joining the internship. 17. If the student is not selected, they are notified of the rejection and may seek other opportunities.
Exit Codition	1. The student has either been selected or rejected for the internship. 2. The company has completed the interview process and provided feedback.
Exception	1. If the interview cannot be scheduled due to technical issues (e.g., platform or communication failures), the system alerts both parties to reschedule. 2. If the student fails to respond to the interview request within a set period (e.g., 48 hours), the system sends a reminder, and after another 24 hours, the interview is canceled. 3. If the company fails to provide feedback or confirmation post-interview, the system will remind the company to complete the process.

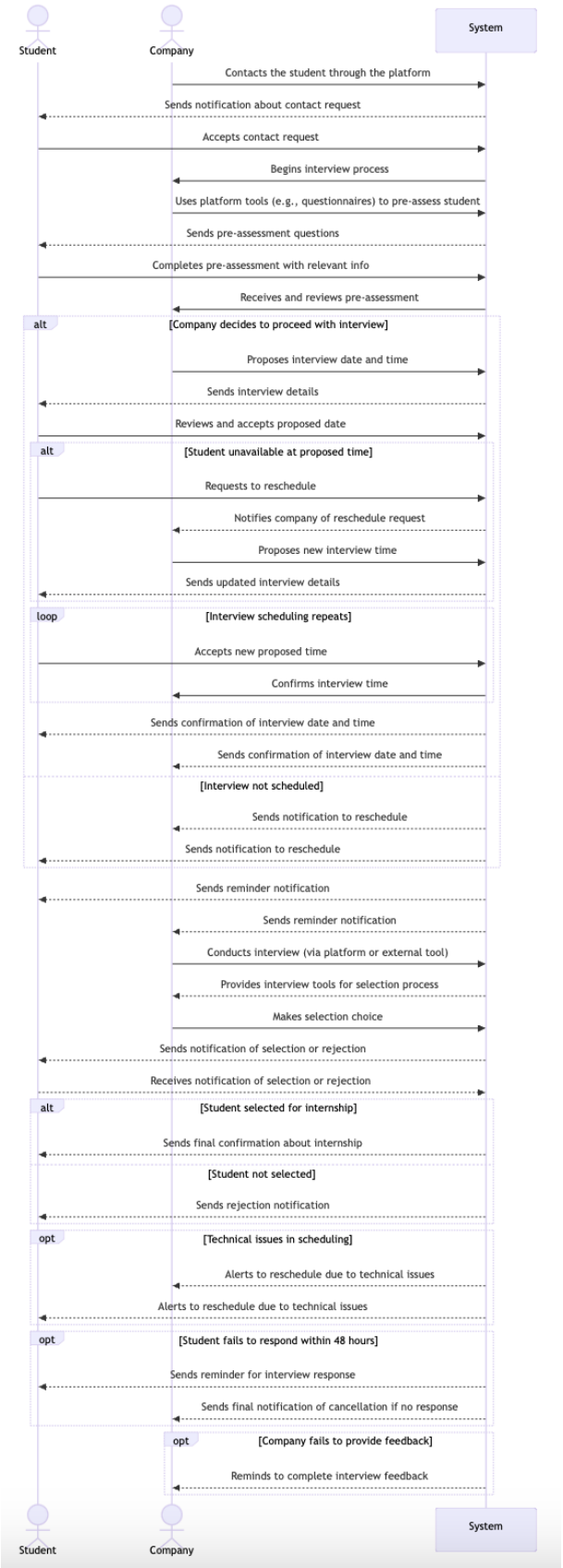

Figure 3.10: UC6

UC7

Name	User leaves feedback
Actor	User (either student or company representative)
Entry Condition	1. The user has a valid email account. 2. The user has an account on S&C. 3. The user has participated in an internship through S&C.
Event Flow	1. The system sends an email to the user requesting feedback about their internship experience. 2. The user reads the email and decides whether to provide feedback. 3. If the user chooses to provide feedback, they click the "Leave Feedback" button in the email. 4. The system redirects them to the S&C platform, displaying the "Internships to Monitor" page on their profile and an empty space to fill out with the feedback. 5. The user writes the feedback. 6. If the user does not wish to provide feedback, they ignore the email.
Exit Codition	1. The system successfully collects and stores the feedback for analysis. 2. No feedback is received if the user ignores the email.
Exception	1. The email fails to reach the user due to a technical issue. 2. The link to the feedback form in the email is broken or inaccessible.

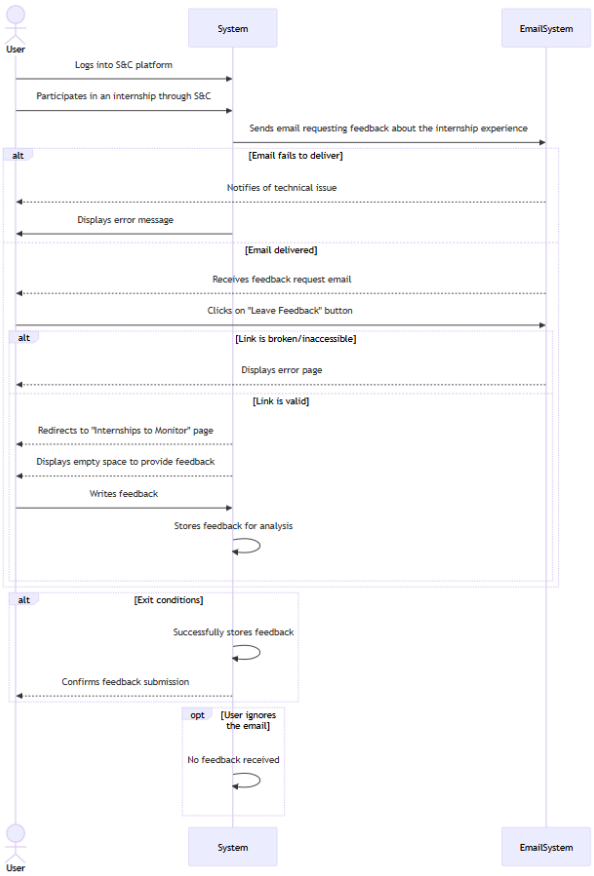

Figure 3.11: UC7

UC8

Name	Student recieves suggestion on CV
Actor	Student
Entry Condition	1. The student has an valid email account. 2. The student has an account on S&C. 3. The student has uploaded a CV
Event Flow	1. The student receives an email notification from the system about a new suggestion for their CV. 2. The student clicks the "See Suggestion" button in the email. 3. The system redirects the student to the platform, displaying the page in their profile with the new suggestions. 4. The student reads the suggestion. 5. If the student finds the suggestion useful: they navigate to their profile and click the "Change File" button underneath their CV. 6. The platform opens a page where they can upload a new CV. 7. The student revises their CV according to the suggestion and reuploads the updated CV to the platform. 8. If the student does not find the suggestion useful, they ignore the email.
Exit Codition	1. The system has a new CV to analyze. 2. The system retains the original CV if no updates are made.
Exception	1. The email fails to send. 2. The link to the platform is broken.

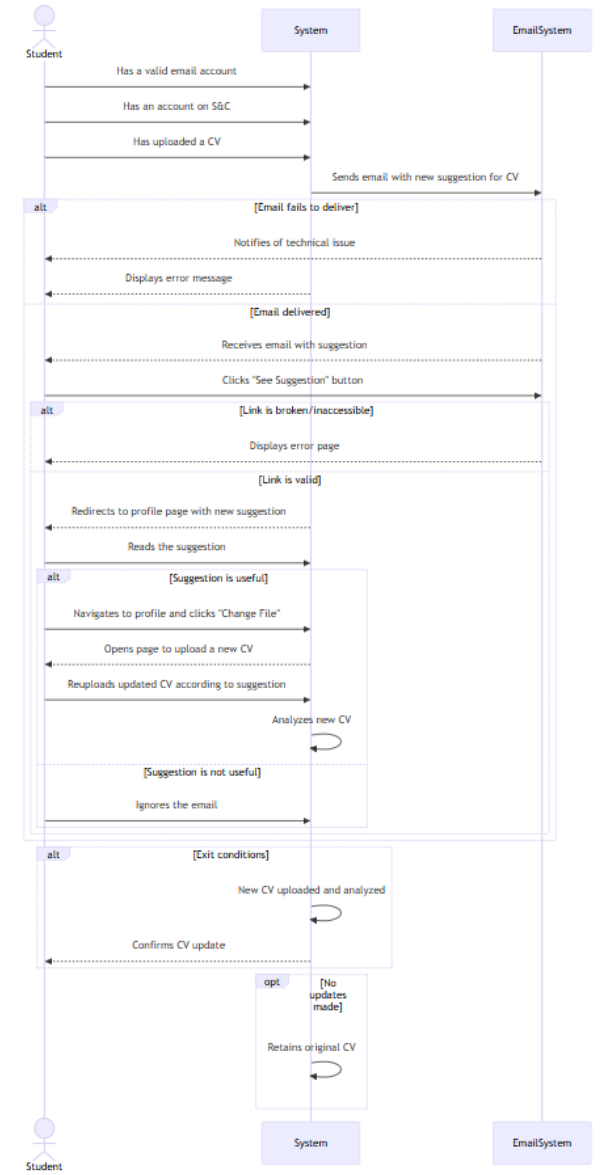

Figure 3.12: UC8

UC9

Name	Company recieves suggestion on project description
Actor	Company
Entry Condition	1. The company has a valid email account. 2. The company has an S&C account. 3. The company has uploaded a project description.
Event Flow	1. The company receives an email notification from the system about a new suggestion. 2. The company clicks the "See Suggestion" button in the email. 3. The system redirects the company to the platform, displaying the suggestions in their profile page. 4. The company reads the suggestion. 5. If the company finds the suggestion useful: They navigate to their profile and click the modify button next to the project description they wish to update. 6. The platform opens an editor page where they can update the project description. 7. The company writes a new description following the system's instructions and submits it. 8. If the company does not find the suggestion useful, they ignore the email.
Exit Codition	1. The system has a new project description to analyze. 2. The system retains the original project description if no changes are made.
Exception	1. The email fails to send 2. The link to the platform is broken.

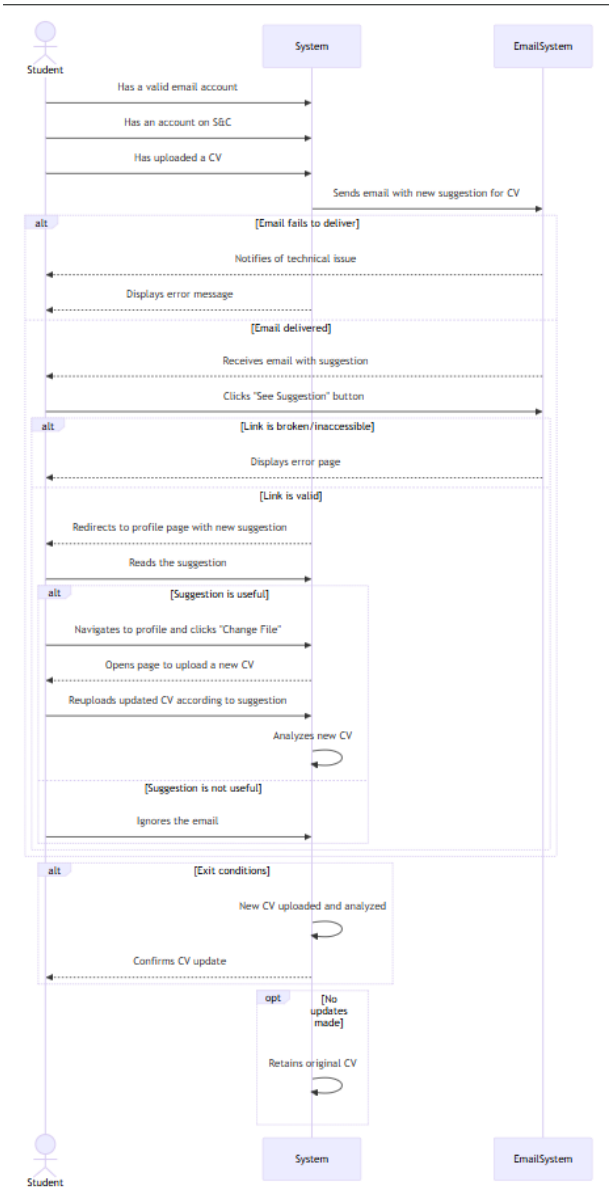

Figure 3.13: UC9

UC10

Name	User makes a complaint
Actor	Student, Company, University
Entry Condition	The user is logged into their S&C account. The user is partecipating in an ongoing internship (the user can be either the company or the student)
Event Flow	1. The user navigates to their profile page. 2. The user clicks the "Internships to Monitor" button which brings them to a space in which they can leave comments and complaints. 3. The user clicks the "Leave a Comment" button. 4. The system opens a comment form. 5. The user writes their comment or complaint about the ongoing internship. 6. The user submits the complaint. 7. The system publishes the complaint on the "Internship to Monitor" page of all parties involved (student, company and university). 8. The university is notified of the new complaint. 9. The university reviews the complaint. 10. If the complaint is deemed important, the university handles the issue by clicking the "Contact to Manage" button. 11. After handling, the university clicks the "Resolved" button on the complaint record. 12. The system updates the status of the complaint to "Resolved". 13. If the university does not act on the complaint, the complaint remains visible until manually deleted. 14. If the university deems the complaint too critical they can terminate the internship by clicking the "Therminate the internship" button. 15. The system notifies all parties involved of the termination of the internship.

Exit Codition	1. The complaint has been handled and resolved (marked as resolved). 2. The complaint remains unresolved but visible. 3. The internship has been terminated
Exception	1. The user submits an incomplete or empty complaint. 2. The system fails to notify the university. 3. The university overlooks the complaint unintentionally.

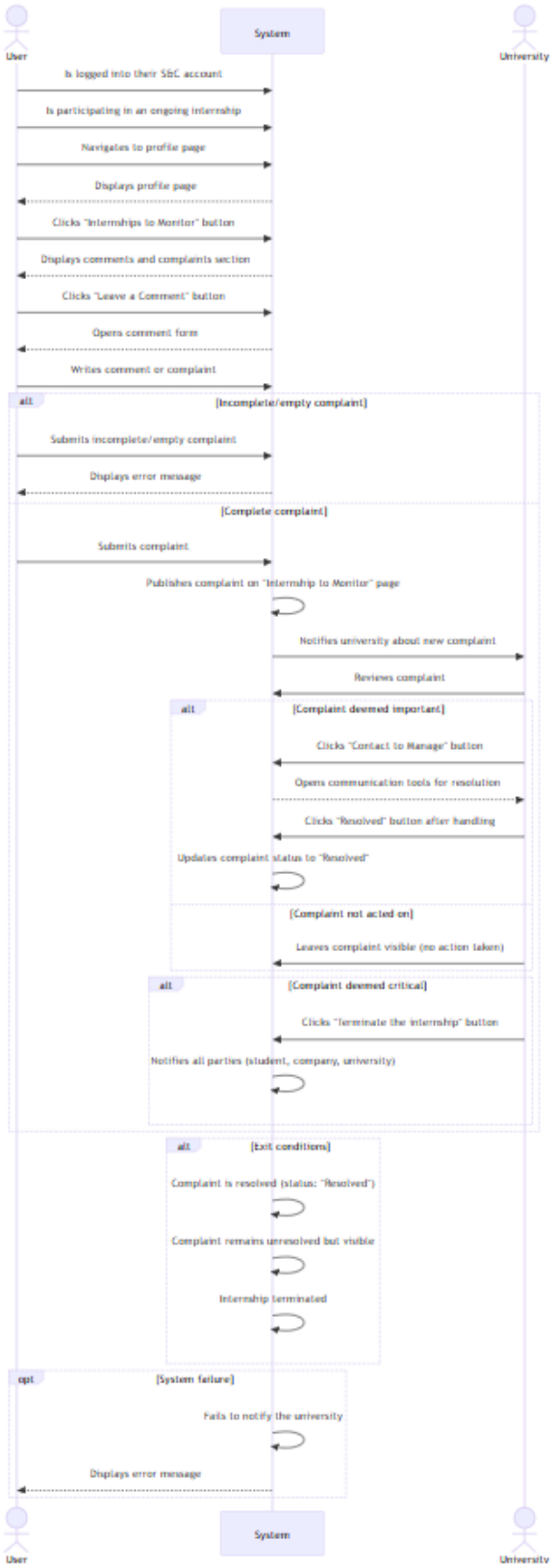

Figure 3.14: UC10

3.2.3. Mapping

Mapping to prove that requirements and domains lead to goals.

Goal	Requirements and Domain Assumptions
[G1] Companies should be able to advertise the internships they want to offer	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R3]** The system allows companies to publish new internships • **[R4]** The system allows companies to add a description to their internships **Domain Assumptions:** • **[DA1]** Students and companies need to have a device and an internet connection • **[DA2]** Companies need to have detailed internship descriptions • **[DA6]** Companies need to create an account on S&C as Companies.

[G2] Students should be able to look for internships	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R2]** The system allows students to upload their CV • **[R3]** The system allows companies to publish new internships • **[R5]** When students want to do a proactive research, the system allows them to go through the available internships • **[R6]** When doing a search the system allows users to filter internships by a key **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies.

[G3] Students should be able to be informed about internships that can be interesting	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R2]** The system allows students to upload their CV • **[R3]** The system allows companies to publish new internships • **[R8]** When a new internship that might interest some students becomes avaible, the system notifies them **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies.

[G4] Companies should be able to be informed about the availability of a student's CV that its interesting to them	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R2]** The system allows students to upload their CV • **[R3]** The system allows companies to publish new internships • **[R9]** When a student's CV that corresponds to a company's needs becomes available the system informs them. **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies.

[G5] Students and Companies should be able to accept a recommendation of a possible match	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R2]** The system allows students to upload their CV • **[R3]** The system allows companies to publish new internships • **[R8]** When a new intership that might interest some students becomes avaible, the system notifies them • **[R9]** When a student's CV that corresponds to a company's needs becomes available the system informs them. • **[R10]** The system allows students to accept a recommendation, applying for that particular internship. • **[R11]** The system allows companies to accept a recommendation, inviting the candidate that was proposed. **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies.

[G6] Students should be able to apply for an internship	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R2]** The system allows students to upload their CV • **[R3]** The system allows companies to publish new internships • **[R5]** When students want to do a proactive research, the system allows them to go through the available internships • **[R7]** When finding an internship that suits their interests, the system allows students to apply for it • **[R8]** When a new intership that might interest some students becomes avaible, the system notifies them • **[R10]** The system allows students to accept a recommendation, applying for that particular internship. • **R11]** The system allows companies to accept a recommendation, inviting the candidate that was proposed. • **[R12]** The system allows students to accept an invitation of a company for a particular internship, applying for it. **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies.

[G7] Students and Companies should be able to establish contact and participate in an interview	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R2]** The system allows students to upload their CV • **[R3]** The system allows companies to publish new internships • **[R7]** When finding an internship that suits their interests, the system allows students to apply for it • **[R10]** The system allows students to accept a recommendation, applying for that particular internship. • **R11]** The system allows companies to accept a recommendation, inviting the candidate that was proposed. • **[R12]** The system allows students to accept an invitation of a company for a particular internship, applying for it. • **[R13]** When the two parties have accepted a recommendation, or when the company has accepted an application received, the system allows them to establish a contact • **[R14]** When conducting an interview, the system supports the companies with the interview process **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies. • **[DA8]** Companies need to be able to conduct an interview

[G8] Companies should be able to finalize the selection.	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R2]** The system allows students to upload their CV • **[R3]** The system allows companies to publish new internships • **[R7]** When finding an internship that suits their interests, the system allows students to apply for it • **[R10]** The system allows students to accept a recommendation, applying for that particular internship. • **R11]** The system allows companies to accept a recommendation, inviting the candidate that was proposed. • **[R12]** The system allows students to accept an invitation of a company for a particular internship, applying for it. • **[R13]** When the two parties have accepted a recommendation, or when the company has accepted an application received, the system allows them to establish a contact • **[R14]** When conducting an interview, the system supports the companies with the interview process • **[R15]** When conducting an interview, the system supports the companis with the finalization of the selection **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA5]** Companies need an account on S&C • **[DA4]** Students need an account on S&C • **[DA9]** Companies need to be able to evaluate an interview

[G8] Students and Companies should be able to provide feedback and suggestions on the provided recommendations	**Requirements:** • **[R13]** The system allows students and companies to provide feedback and suggestions to feed statistical analysis. **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies.
[G10] Students and companies should be able to receive suggestions regarding how to make their submissions (project descriptions for companies and CVs for students)	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R2]** The system allows students to upload their CV • **[R3]** The system allows companies to publish new internships • **[R17]** The system provides suggestions to students regarding how to make their CVs more appealing • **[R18]** The system provides suggestions to companies regarding how to make their project descriptions more appealing **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies.

[G11] Students and companies should be able to keep track of the matchmaking and internship processes	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R2]** The system allows students to upload their CV • **[R3]** The system allows companies to publish new internships • **[R13]** When the two parties have accepted a recommendation, or when the company has accepted an application received, the system allows them to establish a contact • **[R19]** During the matchmaking process, the system allows all users to keep track of its execution and outcome • **[R20]** During the internship the system allows all interested parties to monitor it **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies.

[G12] Students and Companies should be able to complain and communicate problems	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R21]** During and ongoing internship, the system allows all users to complain • **[R22]** During and ongoing internship, the system allows all users to communicate problems • **[R23]** During and ongoing internship, the system allows all users to provide information on its status **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies.

[G13] Universities should be able to monitor internships	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R21]** During and ongoing internship, the system allows all users to complain • **[R22]** During and ongoing internship, the system allows all users to communicate problems • **[R23]** During and ongoing internship, the system allows all users to provide information on its status • **[R24]** When reports or complaints about the status of an ongoing internship are made, the system allows Universities to see them. **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies. • **[DA7]** Universities need to create an account on S&C as Universities • **[DA10]** Universities need to be informed about a current student's internship

[G14] Universities should be able to handle complaints	**Requirements:** • **[R1]** The system allows unregistered users to create an account • **[R21]** During and ongoing internship, the system allows all users to complain • **[R22]** During and ongoing internship, the system allows all users to communicate problems • **[R23]** During and ongoing internship, the system allows all users to provide information on its status • **[R24]** When reports or complaints about the status of an ongoing internship are made, the system allows Universities to see them. • **[R25]** When complaints about the status of an ongoing internship are made, the system allows Universities to handle them. **Domain Assumptions:** • **[DA1]** Students and companies need a device and internet connection • **[DA3]** Students need to have a CV • **[DA4]** Students need to be enrolled at a university • **[DA5]** Students need to create an account on S&C as students. • **[DA6]** Companies need to create an account on S&C as Companies. • **[DA7]** Universities need to create an account on S&C as Universities • **[DA10]** Universities need to be informed about a current student's internshi • **[DA11]** Universities need to be able to communicate with Students and Companies

3.3. Performance Requirements

- **Number of concurrent Users**: According to recent research, websites with similar goals as S&C have approximately 1.8 million users. Our target is to attract at least 25% of this user base, which means that S&C should be capable of handling up to 500,000 concurrent users. This is crucial to ensure the platform operates efficiently and provides a seamless, enjoyable experience for a substantial number of users.
- **Data storage**: The S&C platform needs to store and manage extensive data related to both STs and COMs. Additionally, it must handle data pertaining to interviews, complaints, issues, data analytics, and other critical information. This requires robust data storage solutions that ensure data integrity, security, and scalability.
- **Time response**: All operations directly executed by S&C, such as user registration, login, file upload, and evaluation, should have response times within the range of milliseconds. This quick response time is essential to deliver a smooth user experience and maintain user satisfaction.

3.4. Design Constraints

3.4.1. Standards Compliance

The S&C platform is designed to strictly follow several standards to ensure quality, security, and interoperability.

- **HTTPS Protocol**: The platform implements the HTTPS protocol according to the cryptographic standards established by the Internet Engineering Task Force (IETF), ensuring secure communication between users and the platform.
- **Accessibility Stand**: S&C complies with the Web Content Accessibility Guidelines (WCAG) to ensure that the platform is accessible to all users, including those with disabilities.
- **Security Standards**: The platform follows security best practices as defined by OWASP (Open Web Application Security Project) and NIST (National Institute of Standards and Technology). This includes password storage encryption using HASH512 + Salt, SSL certificates, and end-to-end communication encryption to protect user data.
- **API Standard**: The platform uses open standards for API design, such as RESTful APIs, and adheres to specifications like OpenAPI (Swagger) to ensure smooth integration with other systems.
- **Coding Standards**: S&C follows universally accepted coding guidelines for the primary programming languages used in system development (e.g., Python, Java). This includes adherence to coding conventions such as PEP 8 for Python and Java Coding Conventions for Java.
- **Compliance and Privacy**: The platform complies with privacy regulations such as the General Data Protection Regulation (GDPR) for European citizens, ensuring the protection of user privacy and data rights.

3.4.2. Hardware Limitations

To access the S&C platform, students, companies, and universities must have an electronic device, such as a computer, tablet, or smartphone, with a reliable internet connection.

- **STs**: Students need a device that allows them to access the platform, upload applications, attend interviews, and perform other required activities. They must also have the ability to upload and download files, such as CVs or application documents.
- **COMs**: Companies also need a device with internet access to view applications, schedule interviews, and manage internship postings. They must also have the ability to upload and download files, such as application descriptions or received applications.
- **UNs**: Universities also need a device with internet access to view application status, handle complaints, and manage them.

Students, companies, and universities must have devices that enable them to receive notifications from the platform, ensuring they stay informed about important updates and actions required. The devices should be able to support modern web browsers to access the S&C platform effectively.

3.5. Software System Attributes

3.5.1. Reliability

The S&C platform does not manage critical operations. If an operation fails, it can be re-executed without any significant consequences. For example, if the curriculum upload fails, students can simply re-upload it without any issues. Given this non-critical nature, it is reasonable to permit a failure rate of around 1%, as it does not adversely impact the overall user experience or platform functionality.

3.5.2. Availability

The S&C platform should have high availability, aiming for 24/7 uptime. This is essential to provide continuous access to users without unexpected interruptions, ensuring they can reliably access services whenever needed.

To achieve this, techniques such as load balancing to distribute traffic evenly, failover systems to switch to backup resources during outages, and regular data backups to protect against data loss should be implemented. These measures help maintain seamless operation and ensure that the platform remains robust and dependable at all times.

3.5.3. Securuty

Communication between the user and the S&C platform is encrypted to avoid data breaches, and unauthorized access, and to ensure the confidentiality and integrity of information shared on the platform.

Furthermore, users must only be able to perform operations that they are authorized to do. For example, a student must not be able to publish an internship, as this function should be restricted to users with specific permissions, such as platform administrators or authorized representatives. Proper access controls and role-based permissions must be implemented to ensure that only authorized users can perform specific actions within the platform

3.5.4. Maintainability

The system should be divided into scalable and reusable modules, making it easier to maintain and replace components in case of failure. This modular approach enhances the platform's flexibility and simplifies the process of updating or scaling specific parts without affecting the entire system.

Ordinary maintenance, including bug fixes and improvements, will be scheduled during nighttime hours when user traffic is minimal to minimize disruption and maintain a smooth user experience. This strategy ensures that the system remains reliable and maintainable while supporting continuous service improvements.

3.5.5. Portability

The S&C platform does not require any specific hardware or software and must be accessible from any operating system with a modern web browser. This ensures broad compatibility and ease of use for all users. Additionally, a mobile application can be developed to allow users to view the state of battles and other platform activities. Since the mobile app does not require any specialized functions, a non-native approach can be used. This makes it feasible to leverage cross-platform development tools, which can accelerate the development process and reduce the resources needed for maintaining separate codebases for different platforms.

4 | Formal Analysis using Alloy

This section provides a formal specification of the entire model using the Alloy language. We will use Alloy 6 to describe entities and relationships in systems. We choose Alloy 6 because is suited for modeling and analyzing the properties of software systems to ensure correctness and consistency.

4.1. Code

```
open util/relation
open util/boolean

//----SIGNATURES----
// User's role: it can be a student or a company
abstract sig Role {}
sig Student extends Role {
        applications: some Application,
        cv: one CV
}
sig CV{}
sig Company extends Role {
        postings: some Internship
}

// Users' personal information
sig User {
        email: one Email,
        otherInformation: one PersonalData,
        role: one Role
}
sig Email{}
sig PersonalData{}

```

```
25 // Internship
26 sig Internship {
27         postedBy: one Company,
28         applicants: some Application,
29         description: one Description,
30 }
31 sig Description{}
32
33 // Application for an internship
34 sig Application {
35         submittedBy: one Student,
36         relatedTo: one Internship,
37         interviews: one Interview,
38         var status:  Status
39 }
40 enum Status {Pending, Accepted, Rejected}
41
42 // Interview
43 sig Interview {
44         schedule: one DateTime,
45         var outcome:  Outcome
46 }
47 enum Outcome {Passed, Failed, InProgress}
48 sig DateTime{}
49
50 //----FACTS----
51 // No two Users can have the same email or personal info
52 fact UniqueUsersEmailsAndPersonalInfo {
53         all u1, u2: User | u1 != u2 implies
54                 u1.email != u2.email and
55                 u1.otherInformation != u2.otherInformation
56 }
57
58 // A role can only be associated with one User
59 fact OneUserPerStudentAndCompany{
60         all s: Student | one u: User |
61                 s in u.role
62         and
63         all c: Company |  one u: User |
```

```
64                  c in u.role
65  }
66
67  //DoubleArrowConstraint
68  fact DoubleAssociation {
69          //An application can only be associated with a student
70          all a: Application | one s: Student |
71                  s in a.submittedBy and
72                  a in s.applications and
73                  s.applications.submittedBy=s
74          //An application can only be associated with a Intenship
75          all a: Application | one i: Internship |
76                  a in i.applicants and
77                  i in a.relatedTo and
78                  i.applicants.relatedTo = i
79          //An internship can only be associated with a Company
80          all  i:Internship | one c: Company |
81                  c in i.postedBy and
82                  i in c.postings and
83                  c.postings.postedBy = c
84  }
85
86  //Unique Description, CV, and Interview
87  fact UniqueItems {
88          //description
89          all i1, i2: Internship | i1 != i2 implies
90                  i1.description != i2.description
91          all dd: Description | one ii:Internship |
92                  dd in ii.description
93          //CV
94          all s1,s2: Student| s1 != s2 implies
95                  s1.cv != s2.cv
96          all ccvv:CV | one ss: Student |
97                  ccvv in ss.cv
98          //interview
99           all a1,a2: Application | a1!=a2 implies
100                 a1.interviews != a2.interviews
101         all i: Interview | one a: Application |
102                  i in a.interviews
```

```
103 }
104
105 //Unique Application
106 fact UniqueApplications{
107         all i1, i2: Internship | i1 != i2 implies
108                 #(i1.applicants & i2.applicants) <= 0
109         all c1, c2: Company | c1 != c2 implies
110                 #(c1.postings & c2.postings) <= 0
111         all s1,s2: Student | s1 !=s2 implies
112                 #(s1.applications & s2.applications) <=0
113 }
114
115 // A student can make only an application for one internship
116 fact UniqueApplicationsPerStudent {
117         all s: Student | all i: Internship |
118                 #(s.applications & i.applicants) <= 1
119 }
120
121 //A role cannot have a mettengs the same day
122 fact SameDayMeetings {
123         all ss1,ss2: Student | all cc1,cc2: Company |
124         all a1,a2: Application | a1!=a2 and
125                 ((ss1 in a1.submittedBy and
126                    ss2 in a2.submittedBy and
127                    cc1 in a1.relatedTo.postedBy and
128                    cc1 in a1.relatedTo.postedBy)
129         or
130                  (ss1 in a1.submittedBy and
131                   ss1 in a2.submittedBy and
132                   cc1 in a1.relatedTo.postedBy and
133                   cc2 in a1.relatedTo.postedBy))
134         implies a1.interviews.schedule != a2.interviews.schedule
135 }
136
137 // Interview process
138 fact InterviewProess{
139         all a: Application |
140                 always( a.interviews.outcome = InProgress
141                         implies a.status = Pending)
```

```
142                 and always(a.interviews.outcome = Passed
143                         implies a.status = Accepted)
144                 and always(a.interviews.outcome = Failed
145                         implies a.status = Rejected)
146 }
```

4.2. Models

4.2.1. Static Analysis

[MS1] The model shows the basic scenario where one student is applying for an internship at a company with pending status and an in-progress interview.

```
1 //one student and one company
2 pred oneStudentOneCompanyOneInternship {
3     #Student = 1
4     #Company = 1
5     #Internship = 1
6 }
7 run oneStudentOneCompanyOneInternship for 2
```

#6:Instance found oneStudentOneCompanyOneInternship is consistent.

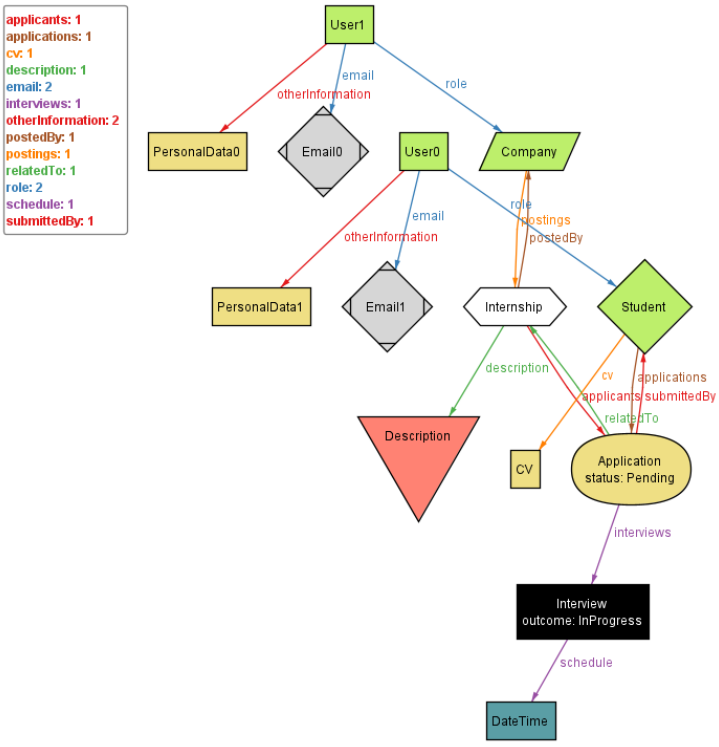

Figure 4.1: 1 Student, 1 Company, 1 Internship

[MS2] The model shows a scenario where two students are applying for an internship at a company with pending status and an in-progress interview.

```
1 //two students and one company
2 pred twoStudentOneCompanyOneInternship {
3     #Student = 2
4     #Company = 1
5     #Internship = 1
6 }
7 run twoStudentOneCompanyOneInternship for 3
```

#7:Instance found twoStudentOneCompanyOneInternship is consistent.

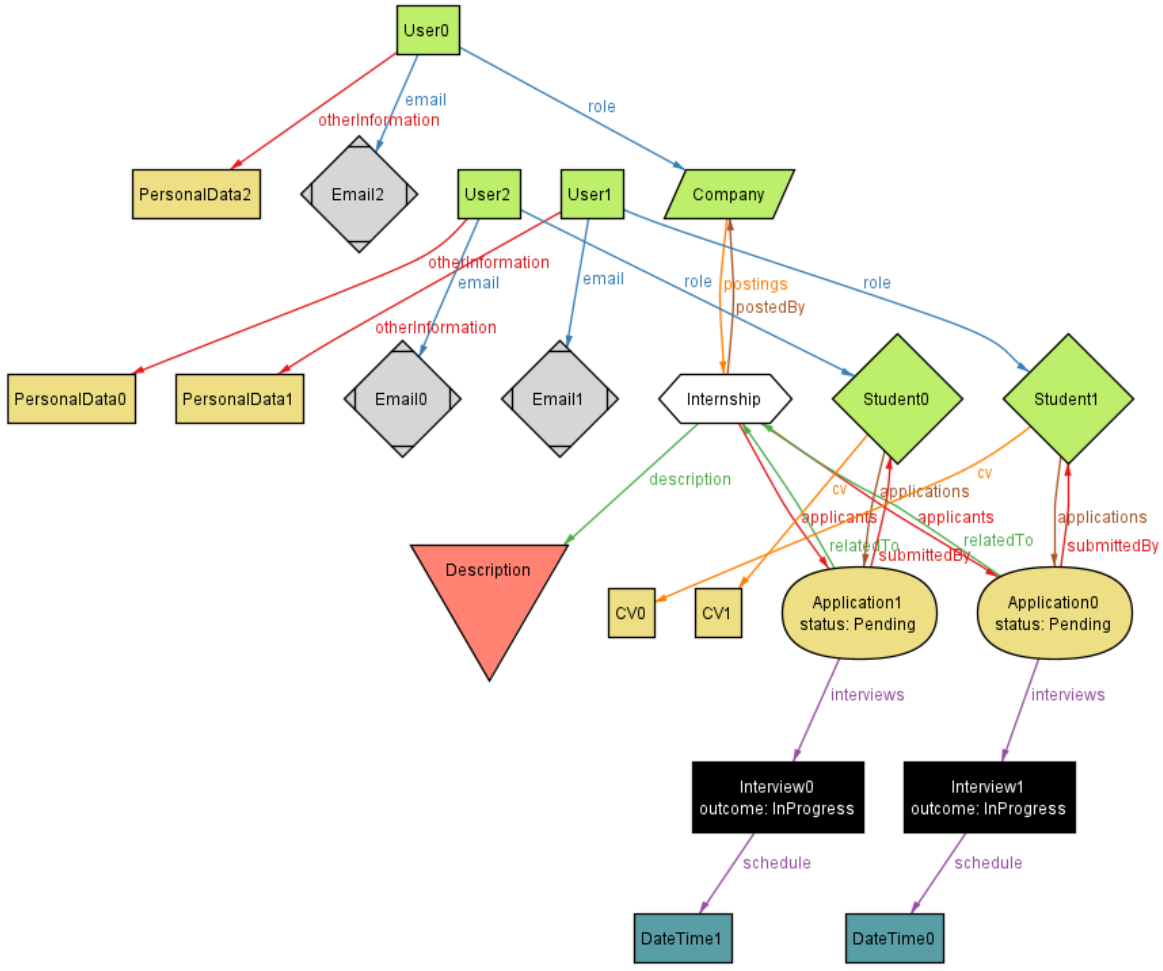

Figure 4.2: 2 Student, 1 Company, 1 Internship

[MS3] The model shows a scenario where one student is applying for three internships 2 at company A and one at company B with pending status and an in-progress interview.

```
1 //one student and one two companies
```

```
pred oneStudentTwoCompanyThreeInternship {
    #Student = 1
    #Company = 2
    #Internship = 3
}
run oneStudentTwoCompanyThreeInternship for 3
```

#8:Instance found oneStudentTwoCompanyThreeInternship is consistent.

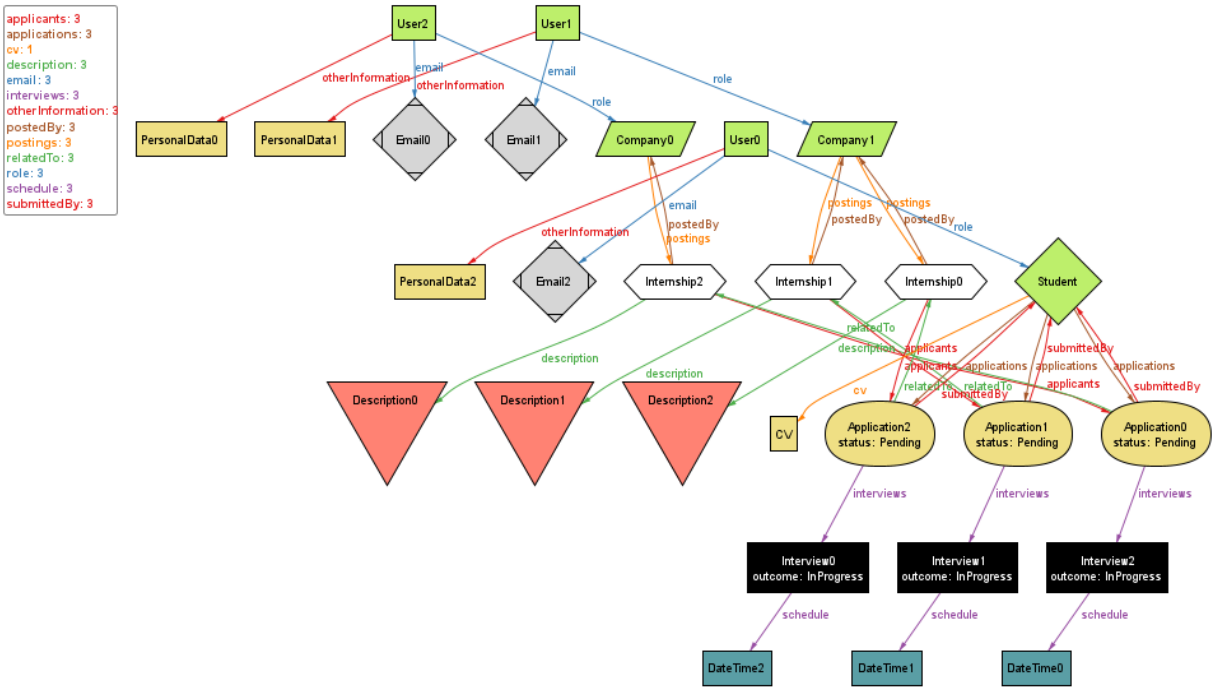

Figure 4.3: 1 Student, 1 Company, 3 Application

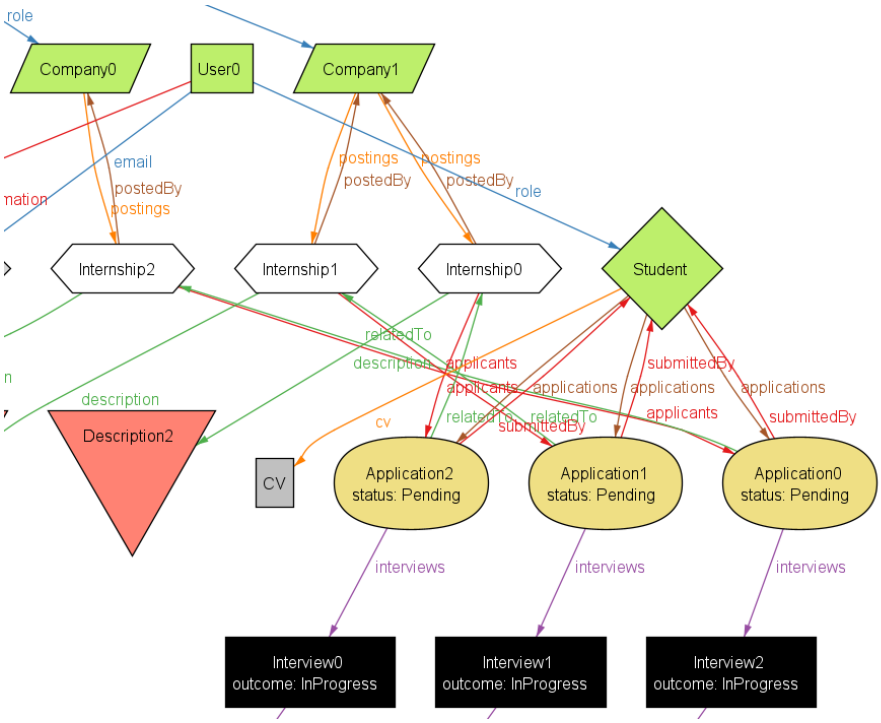

Figure 4.4: 1 Student, 1 Company, 3 Application - zoom on the relations

4.2.2. Dynamic Analysis

[MD1]The model shows the basic scenario where one student applies for an internship at a company. The dynamic analysis shows how the positive interview status influences the application outcome.

If InProgress => Passed then Pending => Accepted

```
1 //passed interview
2 pred interviewPassed[ap:Application, s:Student, c:Company]{
3         ap.interviews.outcome = InProgress ;
4         ap.interviews.outcome = Passed
5         #Student = 1
6         #Company = 1
7         #Internship = 1
8 }
9 run interviewPassed for 2
```

#9:Instance found interviewPassed is consistent.

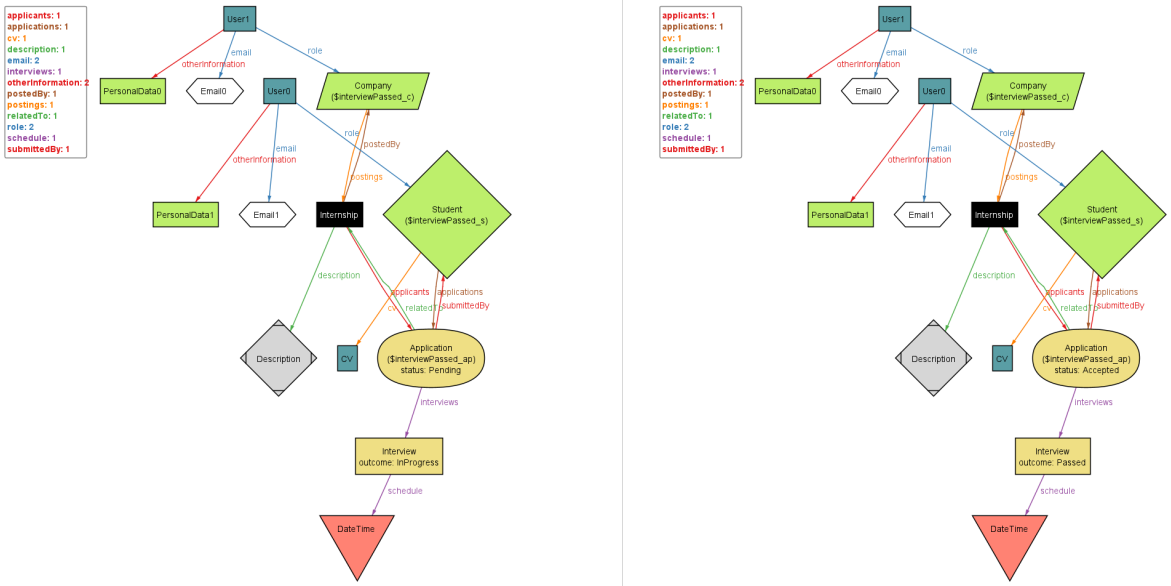

Figure 4.5: Passed inteview

[MD2]The model shows the basic scenario where one student applies for an internship at a company. The dynamic analysis shows how the negative interview status influences the application outcome.

If InProgress => Failed then Pending => Rejected

```
1
2  //failed interview
3  pred interviewRejected[ar:Application, s:Student, c:Company]{
4          ar.interviews.outcome = InProgress ;
5          ar.interviews.outcome = Failed
6          #Student = 1
7          #Company = 1
8          #Internship = 1
9  }
10 run interviewRejected for 2
```

#10:Instance found interviewRejected is consistent.

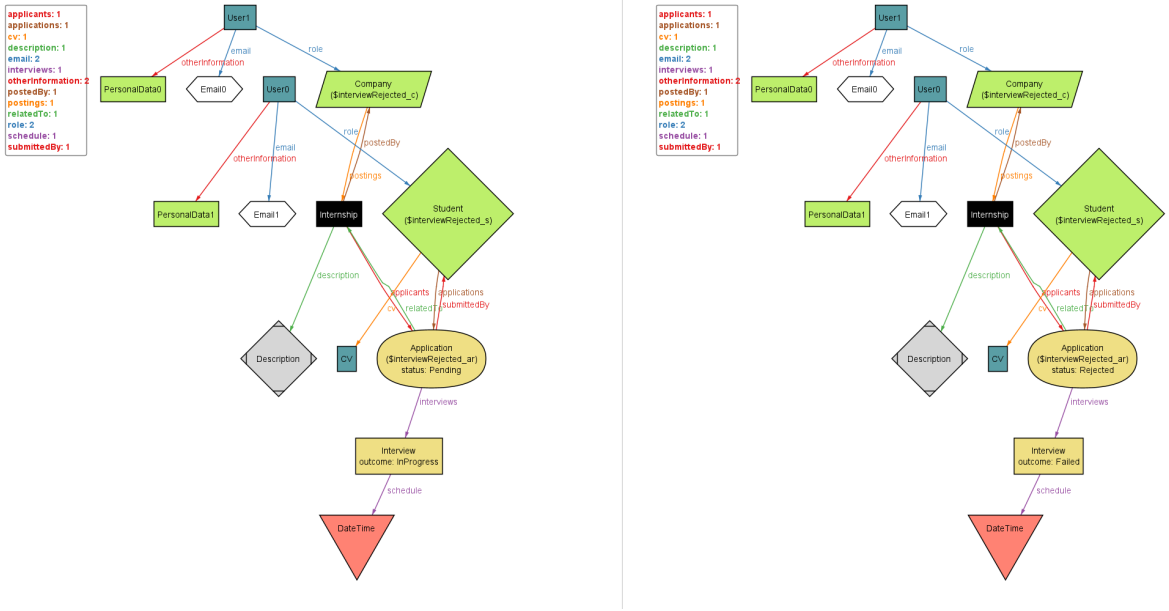

Figure 4.6: Failed interview

4.3. Assertions

[A1] Assertion to verify the correctness of the user structure as:

- No Users will have the same email or the Personal info
- Each role can only be associated with one User

```
// Assertion to verify the correctness of the user structure as:
assert VerifyUserStructure{
        //mail and personal info
        all u1, u2: User | u1 != u2 implies
                u1.email != u2.email and
                u1.otherInformation != u2.otherInformation
        //role
        all s: Student | one u: User | u.role = s
        all c: Company | one u: User | u.role = c
}
check VerifyUserStructure
```

#1: VerifyUserStructure may be valid.

[A2] Assertion to verify DoubleArrowConstraint:

- An application can only be associated with a student
- An application can only be associated with a Intenship
- An internship can only be associated with a Company

```
//Assertion to verify DoubleArrowConstraint
assert VerifyDoubleAssociation {
        //An application can only be associated with a student
        all a: Application | one s: Student |
        s in a.submittedBy and a in s.applications and
        s.applications.submittedBy=s
        //An application can only be associated with a Intenship
        all a: Application | one i: Internship |
        a in i.applicants and  i in a.relatedTo and
        i.applicants.relatedTo = i
        //An internship can only be associated with a Company
        all  i:Internship | one c: Company |
        c in i.postedBy and i in c.postings and
        c.postings.postedBy = c
```

```
}
check VerifyDoubleAssociation
```

#2: VerifyDoubleAssociation may be valid.

[A3] Assertion to verify all Internship application structure

- Unique Description, CV, and Interview
- Unique Application
- A student can make only an application for one internship

```
// Assertion to verify all Internship application structure
assert VerifyInternshipStructures {
        //Unique Description, CV, and Interview
        all i1, i2: Internship | i1 != i2 implies
                i1.description != i2.description
        all dd: Description | one ii:Internship |
                dd in ii.description
        all s1,s2: Student| s1 != s2 implies s1.cv != s2.cv
        all ccvv:CV | one ss: Student |  ccvv in ss.cv
        all a1,a2: Application | a1!=a2 implies
                a1.interviews != a2.interviews
        all i: Interview | one a: Application |
                i in a.interviews
        //Unique Application
         all i1, i2: Internship | i1 != i2 implies
        #(i1.applicants & i2.applicants) <= 0
        all c1, c2: Company | c1 != c2 implies
        #(c1.postings & c2.postings) <= 0
        all s1,s2: Student | s1 !=s2 implies
        #(s1.applications & s2.applications) <=0
        ////Student can make only 1 application for 1 internship
        all s: Student | all i: Internship |
        #(s.applications & i.applicants) <= 1
}
check VerifyInternshipStructures
```

#3: VerifyInternshipStructures may be valid

[A4] Assertion to verify all Internship meeting schedules. Two meetings cannot be on the

same day if:

- are carried by the same company
- are carried by the same student

Therefore meetings have a schedule if they are submitted by a student

```
//Two meetings cannot be in the same day if:
assert VerifyInterviewStructures {
        all ss1,ss2: Student | all cc1,cc2: Company |
        all a1,a2: Application | a1!=a2 and
                //are carried by the same company
                ((ss1 in a1.submittedBy and
                   ss2 in a2.submittedBy and
                   cc1 in a1.relatedTo.postedBy and
                   cc1 in a1.relatedTo.postedBy)
        or
                //are carried by the same student
                 (ss1 in a1.submittedBy and
                  ss1 in a2.submittedBy and
                  cc1 in a1.relatedTo.postedBy and
                  cc2 in a1.relatedTo.postedBy))
        implies a1.interviews.schedule != a2.interviews.schedule
        //meetings have a schedule if a student submits them
        all a: Application | a.interviews.schedule != none
                 implies a.submittedBy in Student
}
check VerifyInternshipStructures
```

#4: VerifyInterviewStructures may be valid

[A5] Assertion to verify if the interview process is correctly related to the application process. Three cases are considered:

- Failed => Rejected
- Passed => Accepted
- InProgress => Pending

```
//Check interview process
assert InterviewProcess{
    all a: Application |
```

```
4           //Failed => Rejected
5           some i: a.interviews | i.outcome = Failed
6                   implies a.status = Rejected
7           and
8           //Passed => Accepted
9           some i: a.interviews | i.outcome = Passed
10                  implies a.status = Accepted
11          and
12          //InProgress => Pending
13          some i: a.interviews | i.outcome = InProgress
14                  implies a.status = Pending
15  }
16  check InterviewProcess
```

#5: InterviewProcess may be valid

5 | Effort Spent

Member of group	Effort spent	
Arianna Paone	Introduction	6h
	Overall description	9h
	Specific requirements	15h
	Formal analysis	2h
	Homework	3h
	Total	**35h**
Matteo Pasqual	Introduction	6h
	Overall description	7h
	Specific requirements	8h
	Formal analysis	11h
	Homework	3h
	Total	**35h**
Matilde Restelli	Introduction	7h
	Overall description	11h
	Specific requirements	13h
	Formal analysis	2h
	Homework	3h
	Total	**36h**

Table 5.1: Effort spent by each member of the group.