POLITECNICO
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SCUOLA DI INGEGNERIA INDUSTRIALE
E DELL'INFORMAZIONE

Software Engineering II
Computer Science and Engineering

Requirement Analysis and Specification Document
Students&Companies

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Academic Year:
2024-25

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1 | Introductionn

1.1. Purpose

The *Students&Companies (S&C)* platform bridges the gap between university students seeking internships and companies offering them. It simplifies the process of matching students with internship opportunities based on their skills, experiences, and preferences, as well as companies' requirements and offered benefits.

The software involves three main actors: **students**, **companies**, and **universities**.

- **Students** use the platform to search and apply for internships, submit their CVs, and receive recommendations tailored to their profiles.
- **Companies** advertise internships, specify requirements, and manage the selection process for suitable candidates.
- **Universities** monitor the execution of internships and handle complaints or issues that may arise.

S&C features a **recommendation system** that matches students and internships using mechanisms ranging from keyword-based searches to advanced statistical analyses. The platform also facilitates communication, supports the selection process, and tracks internship progress to ensure transparency for all involved parties.

The main objectives of the system can be summarized as follows:

- **G1)** The system allows students to proactively look for internships.
- **G2)** The system allows companies to advertise the internships that they offer.
- **G3)** The system recommends students suitable internships based on their CVs and recommends companies student CVs corresponding to their needs.
- **G4)** The system enables students and companies to initiate and manage the selection process.
- **G5)** The system allows communication between the two parties throughout the ongoing internship process.
- **G6)** The system allows universities to monitor internships and handle complaints.

1.2. Scope

The *Students&Companies (S&C)* platform is designed to address the challenge of connecting university students seeking internship opportunities with companies offering them. By streamlining the entire internship lifecycle, S&C simplifies the processes of advertisement, recommendation, selection, and management of internships, creating value for students, companies, and universities alike.

The platform allows students to actively search for internships by browsing opportunities advertised by companies. Students can upload their CVs, highlighting their skills, experiences, and attitudes, and receive tailored recommendations based on the relevance of their profiles to available internships. These recommendations are generated using mechanisms that range from basic keyword searches to advanced statistical analyses. This ensures that students are made aware of internships that align with their skills and preferences while helping companies identify candidates who meet their requirements. Beyond recommendations, students can also take the initiative to directly apply for internships of interest.

For companies, S&C serves as a centralized platform to advertise internships and specify essential details such as the application domain, required tasks, adopted technologies, and offered benefits, including tangible incentives like stipends or intangible elements such as mentorship and training. Through its recommendation system, the platform automatically identifies and suggests student CVs that best fit the company's specified needs. Once a mutual interest is established, the platform facilitates the subsequent selection process by supporting interview scheduling, managing communication between companies and students, and even offering tools like structured questionnaires to streamline evaluations.

Universities play a monitoring role within the system. Given their responsibility to oversee internships and ensure their educational value, universities can track ongoing internships through the platform. They are empowered to handle complaints or intervene in cases where conflicts arise, including managing serious issues that might necessitate the interruption of an internship. This oversight mechanism helps maintain a standard of quality and accountability across all internships facilitated by the platform.

The platform also supports communication and transparency throughout the internship process. Once students and companies establish contact, S&C provides mechanisms to manage interviews and selections, ensuring that both parties remain engaged and informed. During the internship, the platform allows ongoing communication between students and companies, helping address concerns, report progress, and resolve issues as they arise. Additionally, the system collects feedback from all parties, which serves as valuable input for refining recommendations and improving the overall efficiency of the platform.

A critical aspect of S&C is its focus on tracking and monitoring the outcomes of internships. Companies and students can provide updates and feedback regarding the progress of ongoing internships, ensuring transparency and accountability for all actors involved. This information not only helps universities oversee the process but also contributes to the

continuous improvement of the platform's recommendation and matching mechanisms.

Overall, the *Students&Companies* platform integrates proactive internship searching, intelligent recommendation, seamless communication, and effective monitoring to create an ecosystem that benefits students, companies, and universities. By simplifying each phase of the internship lifecycle, S&C promotes meaningful matches between students and opportunities, fostering better experiences and outcomes for all stakeholders involved.

1.2.1. World, Machine and Shared Phenomena

This section summarizes the previous description into lists of phenomena (events) that occur in the world of interest for the system to be developed. Phenomena have to be interpreted simply as events occurring in the whole domain that is being analyzed in the document, so they have been stripped of any constraint (that will be better specified in the requirements section).

Phenomena can be divided into:

- **World phenomena:** events happening outside the system and on which the system has no control.
- **Machine phenomena:** events happening internally in the system, independent from the outside world.
- **Shared phenomena:** events that have an influence on both the system and the world surrounding it. Usually they are further split into two classes:
  - **World controlled shared phenomena:** events initiated by entities of the world that are impactful for the system.
  - **Machine controlled shared phenomena:** events triggered or initiated by the system with a relevant impact in the domain in which the system works.

World Phenomena

- **WP1) Student** wants to begin an internship.
- **WP2) Student** writes their CV.
- **WP3) Company** engages in the development and execution of projects.
- **WP4) Company** aims to present and showcase their projects.
- **WP5) Company** needs staff.
- **WP6) University** wants to monitor the situation of its students.

Machine Phenomena

- **MP1) The system** collects data of students' CV, analyzes them and identifies a company that may be suitable for the student.

- **MP2) The system** collects data of internships, analyzes them and identifies a student that may be suitable for the company.
- **MP3) The system** collects data regarding internships and feedback from both parties to carry out statistical analyzes in order to refine the recommendation process.
- **MP4) The system** is able to provide suggestions both to companies and to students regarding how to make their submissions.
- **MP5) The system** supports the selection process by helping manage (set up, conduct, etc.) interviews and also allows to finalize the selections.

World Controlled Shared Phenomena

- **WSP1) Student** creates their personal profile on the platform uploading their personal information.
- **WSP2) Student** uploads his/her CV.
- **WSP3) Student** applies for an available internship.
- **WSP4) Company** creates its personal profile.
- **WSP5) Company** uploads on the platform an available project comprehensive of all the details such as (application domain, tasks to be performed, relevant adopted technologies-if any, benefits, mentorship).
- **WSP6) University** creates its own profile on the platform.
- **WSP7) Company** accepts the **Student** for the interview.
- **WSP8) Student** fills the preliminary questionnaire.
- **WSP9) Company** reports preliminary questionnaire progress.
- **WSP10) Company** starts selection process.
- **WSP11) Company** finalizes the selection.
- **WSP12) Student** communicates in the provided space.
- **WSP13) Company** communicates in the provided space.
- **WSP14) University** reads complaints.
- **WSP15) University** requires the interruption of the internship.

Machine Controlled Shared Phenomena

- **MSP1) The system** notifies the **Student** if it identifies an internship that matches his skills.
- **MSP2) The system** notifies the **Company** if it identifies a **Student** who matches the requirements for the internship.

- **MSP3) The system** collects feedback from **Students** and **Companies** during the recommendation process.
- **MSP4) The system** notifies the **University** of a complaint.

1.3. Definitions, Acronyms, Abbreviations

1.3.1. Definitions

A brief list of the most meaningful and relevant terms and synonyms used in this document is reported here, in order to make reading process smoother and clearer:

Term	**Description**
Internship, Placement, Work-Experience	A temporary work opportunity offered by a company, designed for students to gain practical experience in a professional environment while applying their academic knowledge.
CV, Resume	A document created by a student containing their personal information, skills, educational background, and work experience, used to apply for internships or jobs.
Recommendation System, Suggestion System	A feature of the platform that identifies and matches suitable internships for students or suitable candidates for companies based on their profiles, preferences, and requirements.
Student Profile	A digital representation of a student within the system, containing personal details, uploaded CVs, skills.
Company Profile	A digital representation of a company within the system, containing details about the company, uploaded projects or internships.
Recommendation Process	The sequence of steps executed by the system to align the skills and preferences of students with the requirements of available internships offered by companies.
Feedback, Suggestions	Information collected from students and companies after the internship or during the process to refine the matching system and improve user satisfaction.
Communication Space, Chat Feature, Messaging System	A feature in the platform that allows students, companies, and universities to interact and share important updates or resolve concerns.
Selection Process	A phase in which companies evaluate student applications, conduct interviews, and finalize the selection of candidates for internships.
Interview Setup, Interview Management	The process supported by the system to schedule, conduct, and manage interviews between companies and students.

Term	Description
Monitoring by University	The process where the university oversees the activities and outcomes of student internships and intervenes if necessary.
Complaint Resolution	The process of identifying and addressing issues raised by students or companies during or after the internship period.
Submission Deadline, Application Deadline	The last date for students to submit applications for an internship or for companies to post available projects on the platform.
Notification System, Alert System	A functionality in the platform that keeps users informed about new opportunities, deadlines, or important events.
Platform, System, Application	All synonyms for the software platform being developed to manage the interactions and processes related to internships.
Statistical Analysis	The process by which the system evaluates collected feedback and interactions to improve its recommendation algorithms and user experience.

1.3.2. Acronyms

A list of acronyms used throughout the document for simplicity and readability:

1. RASD - Requirements Analysis and Specification Document
2. S&C - Students&Companies

1.4. Reference Documents

Here's a list of reference documents that have been used in order to shape the Requirements Analysis and Specification Document of the *Students&Companies* system. In the following, all external sources of information that have contributed to the design of this document are mentioned.

1. Stakeholders' specification provided by the R&DD assignment for the Software Engineering II course at Politecnico Di Milano for the year 2024/2025.
2. "29148-2018, ISO/IEC/IEEE International Standard, Systems and software engineering, Life cycle processes, Requirements engineering", by IEEE, 2018.
   Link: `https://ieeexplore.ieee.org/document/8559686`
3. UML specifications, version 2.5.1.
   Link: `https://www.omg.org/spec/UML/2.5.1/About-UML`
4. Alloy documentation, version 6.1.0.8.
   Link: `https://alloy.readthedocs.io/en/latest/`

1.5. Document Structure

This Requirements and Analysis Specification Document is composed of four major sections.

The **Introduction** serves to familiarize the reader with the domain relevant to the system being developed. It primarily uses natural language to describe the fundamental actors and elements involved in the interactions between the system and its external environment.
The **Purpose** section outlines the primary goals of the application.
The **Scope** section reinterprets the original stakeholders' requirements into a new, high-level description of the domain. Its aim is to ensure clarity and eliminate ambiguity. This section identifies the key actors within the system's environment, explains their roles, and briefly outlines the interactions between these actors and the system. This high-level overview provides context for the remainder of the document and supports the justification of design decisions presented later in the RASD. Following this, the description transitions into defining the system, the external world, and machine-related phenomena.
The **Definitions** subsection clarifies the terminology and vocabulary used throughout the document, minimizing potential ambiguity. It includes a table listing synonyms for terms employed in the RASD to ensure consistency and understanding.

The second major section of this document is the **Overall Description**, which serves multiple purposes through its subsections.
The first subsection focuses on **Scenarios**, aiming to validate the stakeholders' needs by presenting concrete examples and instances of interactions with the system under development.
The **Domain Class Diagram** and **State Charts** subsections utilize UML diagrams to provide a graphical representation of the domain of interest, aligning with the details introduced earlier in the document.
The **Product Functions** subsection systematically lists the system's functional requirements. This analysis builds on the previous sections, leveraging the insights gained from observing and describing the domain to identify the necessary system requirements.
Lastly, the **Assumptions, Dependencies, and Constraints** subsection enumerates domain elements and events that lie outside the system's control or involve dependencies on external factors.

The third main section of this RASD, **Specific Requirements**, focuses on transforming the functional requirements outlined in the Product Functions section into structured and graphical representations.
The **External Interface Requirements** subsection addresses the interfaces and interaction modes between the system and external users or software products.
The **Functional Requirements** subsection provides a structured view of the functional requirements using tools like use cases, use case diagrams, and sequence diagrams. It also includes a mapping between these graphical elements and their associated requirements.
The **Design Constraints** subsection outlines the constraints the system must adhere to during development. The **Software System Attributes** subsection specifies the quali-

ties the software must possess, such as reliability and availability, along with approaches to achieving them.
The final section, **Alloy**, presents an analysis of the system using Alloy, a tool designed to evaluate system design correctness.

2 | Overall Description

2.1. Product Perspective

2.1.1. Scnearios

This section focuses on scenarios, which represent specific examples of interactions between the system being developed and external actors in the environment. These scenarios are described as concise narratives, intended to bridge the gap between system developers or designers and stakeholders, who often lack technical expertise. Through detailed, tangible descriptions, scenarios provide a way for developers to present straightforward examples of how the system might be used. This approach helps stakeholders confirm their requirements and ensure alignment with their expectations. To achieve this, the scenarios presented here are both creative and detailed, aiming to effectively convey the intended concepts to the reader.

SCENARIO 1 - Student logs in the system

Marco is a university student at Politecnico di Milano, pursuing a degree in Computer Engineering. The Politecnico di Milano has decided to rely on the Student&Comapny platform to help its students find an internship.

Marco opens the S&C website on his laptop and is greeted by a clean and intuitive login interface. The platform prompts him to log in page. Marco enters his credentalites and then confirms.

After successfully logging in, Marco is taken to his personalized dashboard. Here, he can immediately see options to upload his CV, browse internship opportunities, and explore the system's features, such as recommendations and feedback tools. Excited about the possibilities, Marco begins updating his profile to enhance his chances of finding the perfect internship.

SCENARIO 2 - Company logs in the system

Elena is a recruitment manager at TechCorp, a mid-sized software development company specializing in AI solutions. TechCorp has recently started offering internships to attract and nurture young talent, and Elena wants to use the Students&Companies (S&C) platform to advertise their new openings.

Elena opens the S&C website on her office computer. The homepage greets her with a

login interface. After filling in her credentials, Elena successfully logs in.

She is directed to TechCorp's company dashboard. Here, she can view an overview of her active internship postings, check pending student applications, and explore suggestions for refining job descriptions to attract suitable candidates. Motivated to proceed, Elena decides to update one of the internship postings and review the recommended student CVs tailored to TechCorp's needs.

SCENARIO 3 - University logs in the system

Laura is the internship coordinator at the University of Bologna, responsible for overseeing the internships of students across various departments. The University of Bologna has decided to rely on the Student&Comapny platform to help its students find an internship.

Laura navigates to the S&C platform website and is presented with the login interface. She inserts her credentialities, she successfully logs in and she is directed to the university-specific dashboard.

On the dashboard, Laura can see a comprehensive overview of the internships involving students from her university. She notices features to handle complaints, monitor internship statuses, and view reports submitted by students and companies. Laura decides to review a recent complaint submitted by a student and initiates the process to resolve the issue.

SCENARIO 4 - Student modifies his/her profile and uploads his/her CV

Giulia is a computer science student at the University of Florence and has recently created an account on the Students&Companies (S&C) platform. After logging in, she decides to update her profile to increase her chances of finding an internship that matches her skills and interests.

From the profile page, Giulia navigates to the "Modify Profile" section. Here, she updates her personal information, including her current university program, areas of interest, and key skills. She also adds details about her past experiences, such as a part-time job as a web developer and a group project on machine learning completed during her studies.

Next, Giulia clicks on the "Upload CV" button. She selects her CV file from her computer and uploads it to the platform. Giulia saves her profile and returns to the dashboard, ready to explore internship opportunities recommended by the platform.

SCENARIO 5 - Company uploads its projects

Marco, the project manager at InnovateTech, a leading tech firm specializing in artificial intelligence solutions, is responsible for managing the company's internship program. To attract the right candidates, he decides to upload the company's projects to the Students&Companies (S&C) platform.

He logs into the platform using his company credentials. From the company dashboard,

he navigates to the "Project Management" section. Here, Marco clicks on the "Upload New Project" button. He is prompted to fill out a form detailing the project title, description, tasks, and required skills. Marco provides a detailed description of the project, including the application domain, the technologies used, and the learning outcomes for interns. He also specifies the terms of the internship, such as whether it is paid, and if there are any additional benefits like training or mentorship.

After reviewing all the details, Marco uploads the project to the platform. The project is now available for students to view when they search for internships that match their skills and interests. Marco feels confident that this will help attract suitable candidates to InnovateTech's internship program.

SCENARIO 6 - Student receives recommendations regarding projects that may be of interest to him

Alessandro, a computer science student at the University of Naples, has been actively using the Students&Companies (S&C) platform to explore internship opportunities. One day, he receives a notification from the platform highlighting projects that align with his skills and interests.

Alessandro logs into his account and finds a list of recommended projects tailored to his profile. Each project listing provides a brief description, the required skills, and the terms offered by the companies. He can easily review these details or express interest in projects he likes. This feature helps Alessandro stay informed about new opportunities and makes it easier for him to connect with companies offering internships that match his goals.

SCENARIO 7 - Company receives recommendations regarding students who might be interesting for its projects

Marco, the project manager at InnovateTech, logs into the Students&Companies (S&C) platform to check on potential candidates for the company's internships. He receives a notification from the platform suggesting students whose profiles match the requirements of InnovateTech's projects. These recommendations are based on the students' skills, experiences, and interests, as well as the project details Marco previously uploaded.

He can review the students' CVs, see their academic backgrounds, and assess their fit for the roles available. This feature helps Marco quickly identify promising candidates and streamline the hiring process for InnovateTech's internship program.

SCENARIO 8 - Student applies for a position and starts the selection process

Maria, a computer science student at Politecnico di Milano, is exploring internship opportunities on the Students&Companies (S&C) platform. She finds a project that aligns with her skills and interests and decides to apply. Maria clicks the "Apply" button on the project page, expressing her interest in the position. S&C promptly notifies the company about her request.

The compan then reviews Maria's profile, considering her academic background and

relevant experiences listed on her CV. If they find her a good fit for the project, the company accepts her into the selection process.

SCENARIO 9 - Company manages the student's selection process

John, the HR manager at TechInnovators, logs into the Students&Companies (S&C) platform to manage the selection process for an internship position. He clicks the button to allow a student, Maria, to fill out the preliminary questionnaire. S&C promptly notifies Maria that she can start the questionnaire. Maria completes the questionnaire, providing her background, skills, and experiences. S&C then notifies John that Maria has filled out the questionnaire. In the platform's dedicated private space, John reviews Maria's responses and assesses her suitability for the role.

Next, John invites Maria to an online interview. S&C sends Maria a notification containing the date and time of the interview. A reminder notification is sent to Maria at the scheduled time of the appointment, ensuring she doesn't miss it. During the interview, John evaluates Maria's fit for the position, asking questions and discussing her experiences and goals. After the interview, John updates the platform with his notes and assessment of Maria's performance. The platform helps John keep track of Maria's progress throughout the selection process.

Once Maria is selected for the internship, S&C automatically sends her a notification informing her of the decision. This notification ensures that Maria is kept in the loop about her selection status without needing to log in to the platform regularly. John finalizes the selection of Maria directly on the S&C platform, and Maria receives a final confirmation notification about her acceptance into the internship program.

SCENARIO 10 - Company manages the student's internship

John, the HR manager at TechInnovators, has finalized the selection of Maria for an internship position. Once the selection is confirmed, S&C creates a dedicated page for Maria's specific internship, where all official announcements and updates will be posted. S&C then opens a communication channel between John and Maria. Both John and Maria receive notifications informing them that the communication channel is now open. John begins by writing important information about the start of Maria's internship in the dedicated space. S&C notifies Maria about the publication of this information, ensuring she is well-informed about the internship's details.

From that moment, Maria and John can communicate through the platform using the communication channel, following scenario 11 for communication. This allows John to provide regular updates, answer Maria's questions, and keep her informed about her responsibilities and ongoing projects. John also uses the dedicated space to post information about the current status of the internship, such as task updates or project milestones. Maria responds by writing comments in the dedicated space, engaging actively in the ongoing discussions.

As approaches the end of her internship period, John confirms the end of the internship through the dedicated space. S&C then notifies Maria and John that the internship is

over. The communication channel is then closed, and the dedicated page for Maria's internship is deleted by S&C. This ensures a smooth and organized closure to Maria's internship, leaving both Maria and John well-prepared for future opportunities.

SCENARIO 11 - Student and company communicate with each other

Maria, a computer science student at the Politecnico di Milano, has just started her internship at TechInnovators. To ensure smooth communication throughout the internship, S&C provides a dedicated communication channel between Maria and John, the HR manager overseeing her internship.

At the beginning of the internship, John uses the communication channel to send Maria important information about her first tasks and upcoming deadlines. Maria promptly replies, confirming she has received the details and asking clarifying questions about specific requirements. The clear and structured communication ensures Maria knows exactly what is expected of her.

A few weeks into the internship, Maria encounters a challenge while working on her assigned project. She uses the communication channel to notify John about the issue, explaining the technical difficulty and proposing potential solutions. John reviews her message and quickly responds with guidance, offering support from the IT department if needed.

During the internship, John also uses the channel to address minor concerns regarding Maria's punctuality in submitting weekly updates. He communicates this issue politely, asking if there are any difficulties impacting her workflow. Maria appreciates the constructive feedback and commits to improving her timeliness.

Similarly, Maria uses the channel to provide her feedback on the internship experience. She notes that the initial onboarding process was slightly overwhelming and suggests a more gradual introduction to company tools for future interns. John thanks Maria for her input and assures her that her suggestions will be taken into consideration for improvement.

Toward the end of the internship, both Maria and John use the channel to coordinate the final tasks and confirm the submission of her final project. The communication remains professional and efficient, with both parties ensuring that all expectations are met before the internship concludes.

The S&C communication channel proves invaluable in maintaining open, transparent, and respectful interactions between Maria and John. It helps manage tasks, resolve issues, and address concerns, ensuring a positive and productive internship experience for both parties.

SCENARIO 12 - Student responds to the feedback requested by the system

Maria, a computer science student from Politecnico di Milano, is participating in an internship at TechInnovators, secured through the S&C platform. During both the selection process and the internship, S&C periodically requests feedback from students like

Maria to ensure a high-quality experience.

While still in the selection process, Maria received a notification prompting her to answer questions about her experience. She was asked about the clarity of communication with the company, the usefulness of the interview preparation, and her overall satisfaction so far. Maria quickly provided her input, appreciating the platform's proactive approach.

Later, during the internship, Maria received another notification asking her to evaluate her current experience. She shared feedback about her assigned tasks, the mentorship provided, and the work environment, noting both positive aspects and areas for improvement.

Maria felt valued throughout the process, knowing her feedback was contributing to improving internships for herself and future participants.

SCENARIO 13 - Company responds to the feedback requested by the system

TechInnovators, a dynamic software development company, started using the S&C platform to find talented students for their internships and has recently selected for an internship Maria, a computer science student from Politecnico di Milano. John, the manager supervising Maria, finds the system helpful not only for selecting candidates but also for maintaining a structured internship process.

During the selection phase, the S&C platform sent a notification to John, asking for feedback on how effectively the system matched candidates with the project requirements. The questions included topics like the clarity of student profiles, the quality of the preliminary questionnaires, and the interview process. John completed the form, noting that Maria's profile was well-aligned with the company's needs, and he appreciated the platform's intuitive design.

Halfway through the internship, the system sent another feedback request. This time, the focus was on Maria's performance and the internship experience. John received a notification and took a few minutes to answer questions about her progress, technical skills, and her integration within the team. He commended Maria for her proactivity and ability to learn quickly, while also suggesting minor adjustments to the S&C platform to provide companies with additional onboarding resources.

The feedback process helped TechInnovators evaluate their own practices and ensure a productive internship experience, while S&C ensured the feedback loop was seamless and efficient.

SCENARIO 14 - University receives the complaint report

At the Politecnico di Milano, Professor Marco Bianchi, responsible for overseeing internships in the Computer Engineering department, receives a notification from the S&C platform. The notification informs him that a complaints report related to ongoing internships has been prepared and is ready for review.

Marco logs into the platform and navigates to the "Complaints" section. There, he finds a detailed report outlining issues raised by students and companies. One of the

complaints is from Luca, a computer engineering student interning at Innovatech, who reported insufficient guidance during the development of a software module he was assigned. Another complaint comes from Clara, the HR manager at Innovatech, who flagged delays in Luca's completion of his weekly progress updates.

S&C's organized format allows Marco to quickly assess the situation, with each complaint categorized and accompanied by relevant timestamps. Recognizing the importance of resolving these issues promptly, Marco decides to reach out to both Luca and Clara to discuss the concerns and find a resolution that benefits both parties.

Thanks to S&C's efficient reporting and notification system, Marco can act swiftly to maintain the quality and integrity of the internship experience.

SCENARIO 15 - University interrupts internship

Luca, a computer engineering student at the Politecnico di Milano, has been facing significant issues during his internship at Innovatech. Professor Marco Bianchi, responsible for managing internships, has received multiple complaints from both Luca and Clara, the HR manager at Innovatech. These complaints indicate serious concerns regarding Luca's guidance and communication throughout the internship.

Upon reviewing the complaints and the ongoing situation, Professor Bianchi decides to visit the "Internship Interruption" page on the S&C platform. Here, he selects Luca as the student in question and then picks the Innovatech internship.

Marco then clicks the button to interrupt the internship. Once confirmed, S&C promptly notifies both Luca and Clara about the decision. For Luca, the notification explains that his internship with Innovatech has been officially interrupted due to unresolved issues. For Clara, the notification informs her that Luca will no longer be interning at Innovatech.

This process ensures clear communication and quick action, maintaining the integrity of the internship program at Politecnico di Milano.

2.1.2. Domain Class Diagram

The class diagram provided below offers a high-level overview of the domains of interest for the software implementation. The diagram can be divided into three main sections:

The central section contains the main entities related to users: Student, Company and University. This section contains also the related classes StudentProfile and Internship.

The lower section illustrates the primary interactions between students and companies necessary for successfully performing an internship: PreliminaryMatch, SelectionProcess, FinalMatch, and Internship. This area also includes important management classes such as SelectionProcessManager and InternshipManager.

The upper section displays the main classes related to the recommendation system: RecommendationEngine, NotificationSystem and PreliminaryData, while on the right side it displays the classes for Feedback, Suggestion and Complaint.

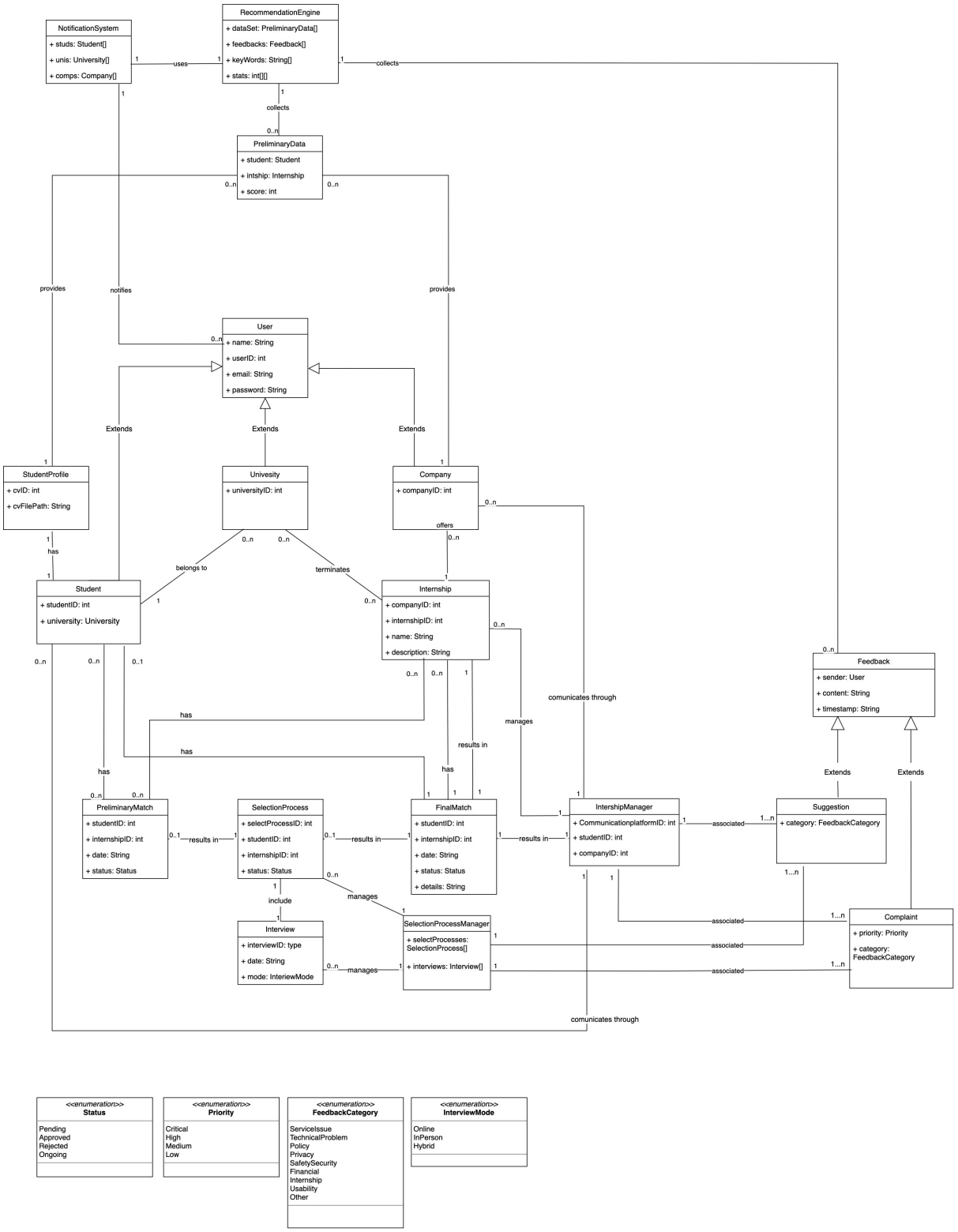


Figure 2.1: Class Diagram

2.1.3. State Charts

In this section, we analyze the state charts related to the selection process and the management of complaints by universities. We believe these two scenarios are the most significant to represent with this type of diagram due to their structured sequences of well-defined events.

Selection Process

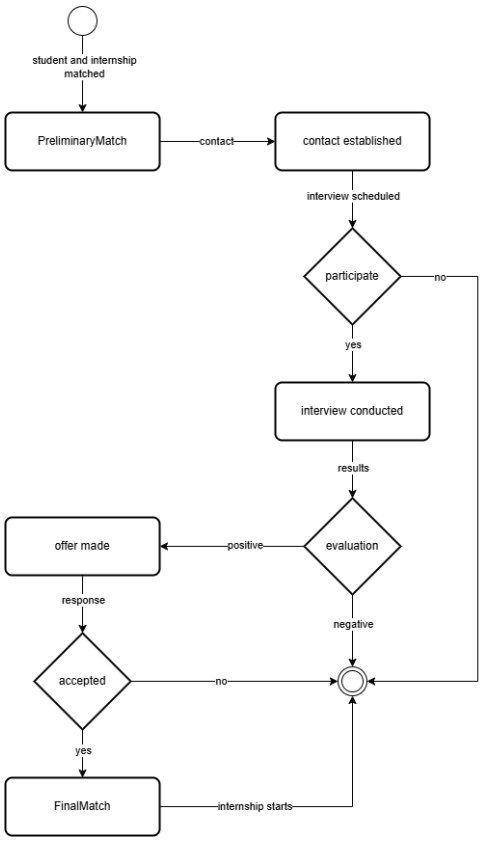


Figure 2.2: State Charts 1 - Selection Process

The diagram illustrates the phases of the selection process. The initial stage begins with the student being matched to an internship opportunity, represented as the "PreliminaryMatch" state. Once the match occurs, the system establishes contact between the company and the student, transitioning the process to the "contact established" state.

At this point, an interview is scheduled. If the student does not participate in the interview, the process halts. However, if the student participates, the interview is conducted, leading to the evaluation phase.

During the evaluation, the company assesses the student's performance and suitability. If the evaluation is positive, the company makes an offer, indicated as the "offer made" state. If the evaluation is negative, the process terminates without any further steps.

Following the offer, the next stage depends on the student's response. If the student

declines the offer, the process concludes without an agreement. On the other hand, if the student accepts, the process progresses to the "FinalMatch" state. At this point, the internship officially begins, marking the finalization of the selection process.

Complaints management

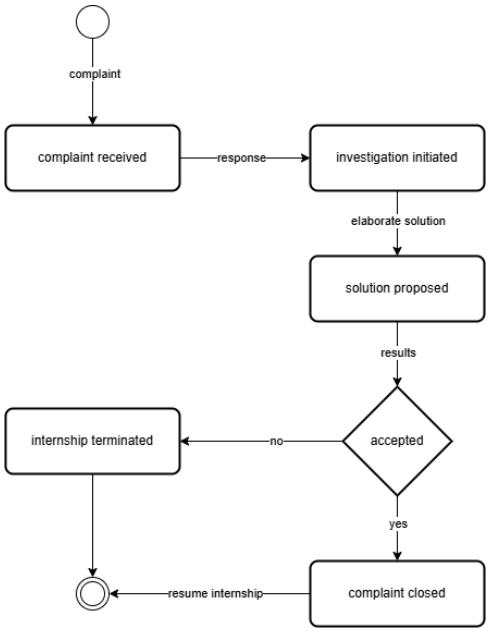


Figure 2.3: State Charts 2 - Complaints management

The diagram illustrates the complaint management process within the context of an internship. The flow begins when a complaint is received, prompting an investigation to examine the issue. Once the investigation is completed, a solution is proposed to address the complaint. At this stage, a critical decision determines the outcome.

If the proposed solution is accepted, the complaint is closed, and the internship can continue as usual. However, if the solution is not accepted, the internship is terminated, bringing the process to an end.

This diagram clearly highlights the two possible outcomes of the complaint resolution process: a positive resolution, which results in the complaint being closed, or a negative outcome, which leads to the termination of the internship.

2.2. Product Functions

2.2.1. Requirements

This section presents a detailed list of functional requirements that Student&Comapny must fulfill during its development. Functional requirements define the operations and decisions the system under consideration must perform to satisfy the needs of its stakeholders. These requirements have been derived through a process of elicitation and abstraction, as discussed in the earlier sections of this document. The analysis of relevant aspects within the domain, the validation of stakeholder needs through scenarios, and the visual representations offered by various diagrams provide a strong foundation for the design phase outlined in the subsequent part of this document.

G1 - The system allows students to proactively look for internships

R 1.1 - The system allows students to create their profile.

R 1.2 - The system allows students to upload their CV.

R 1.3 - The system provides suggestions to students on how to submit their CV.

R 1.4 - The system allows students to browse internships.

G2 - The system allows companies to advertise the internships that they offer

R 2.1 - The system allows companies to create their profile.

R 2.2 - The system allows companies to upload their internships.

R 2.3 - The system provides suggestions to companies on how to submit their internship descriptions.

G3 - The system recommends students about suitable internships and recommends companies about student CVs corresponding to their needs

R 3.1 - The system notifies students about suitable internships.

R 3.2 - The system notifies companies about suitable student CVs.

R 3.3 - The system recommends based on keyword searching.

R 3.4 - The system recommends based on the characteristics of students and internships.

R 3.5 - The system recommends based on statistical analysis.

R 3.6 - The system collects information regarding the selecion process.

R 3.7 - The system collects information regarding the internship.

R 3.8 - The system asks students and companies to provide feedback and suggestions.

G4 - The system enables students and companies to initiate and manage the selection process

R 4.1 - The system allows students to apply for an internship.

R 4.2 - The system allows companies to accept student applications.

R 4.3 - The system allows students to fill the preliminary questionnaire for the internship.

R 4.4 - The system allows companies to report preliminary questionnaire progress for the internship.

R 4.5 - The system supports the selection process by helping manage interviews and also finalise the selections.

G5 - The system allows internship's management and communication between the two parties throughout the ongoing internship process

R 5.1 - The system provides spaces for the official announcements.

R 5.2 - The system provides spaces where interested parties can complain, communicate problems, and provide information about the current status of the ongoing internship.

G6 - The system allows universities to monitor the situation and handle complaints.

R 6.1 - The system allows universities to create their profile.

R 6.2 - The system allows universities to monitor the situation of internships and handle complaints.

R 6.3 - The system allows universities to interrupt an internship.

2.3. User Characteristics

2.3.1. Student

The student is an individual pursuing higher education at a university. The student utilizes the S&C platform to actively search for suitable internships based on their skills, experiences, and interests. The student is familiar with creating and maintaining a CV that highlights their technical skills, educational background, and personal attributes. Proficient in navigating online platforms, the student can initiate the process of finding internships, explore available opportunities, and communicate with companies. The student may also receive recommendations from the system about internships that match their profile.

2.3.2. Company

The company represents an organization offering internships to university students. The HR manager or hiring personnel at the company use the S&C platform to advertise internship opportunities, manage the selection process, and communicate with potential candidates. They are responsible for setting up interviews and gathering student feedback to gauge fit with the company's requirements. The company also monitors the status of ongoing internships and addresses any concerns or issues raised by the student. The platform allows the company to manage the entire internship lifecycle from initial advertisement to final selection and beyond.

2.3.3. University

The university plays a crucial role in overseeing the internship opportunities provided to its students through the S&C platform. The career services department or relevant faculty members monitor the status of internships and manage any complaints that may arise during the internship period. They ensure that students are benefiting from their internships and address any potential issues that may require intervention or adjustment. The university also uses the platform to keep track of the overall success of the internship program and to provide support to students and companies in maintaining a smooth and beneficial internship experience.

2.4. Assumptions, Dependencies and Constraints

2.4.1. Domain Assumptions

The following assumptions are made for the domain. These are properties or conditions that the system will rely on to ensure correct platform behavior. They must be validated to guarantee proper functioning of the platform.

D 1 - The user must have a functioning internet connection.

D 2 - The information uploaded by the user to their profile must be correct.

D 3 - The information regarding the internship uploaded by the company must be accurate.

D 4 - The authentication system used by the student's university, upon which S&C relies, must function properly.

D 5 - The authentication system used by the company, upon which S&C relies, must function properly.

D 6 - The system enabling video calls, which S&C relies on for online interviews, must function correctly and communicate smoothly with S&C.

D 7 - The network must allow notifications sent by S&C to successfully reach the users.

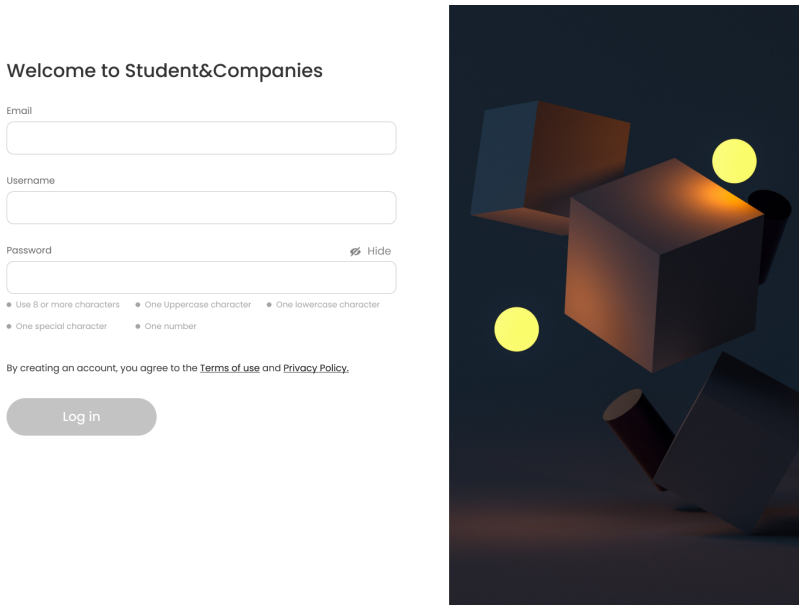
3 Specific Requirements

3.1. External Interface Requirements

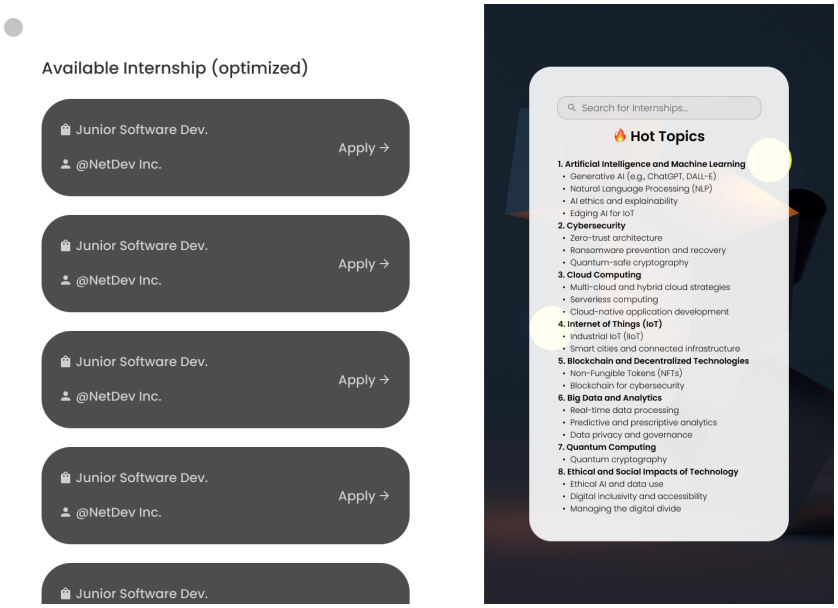
3.1.1. User Interface

This section presents mockups of the most relevant graphical user interfaces (GUIs) used by the Student&Companies platform to interact with external users, such as companies' employees and students. The purpose of these representations is to outline the logical characteristics of the interfaces and provide guidelines on the style and appearance of the final product.

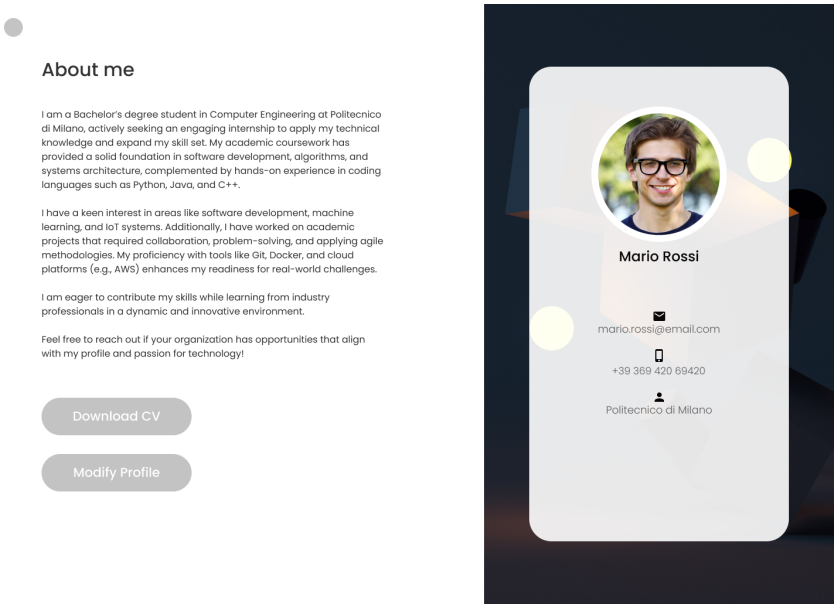
Log In Interface Log In Interface for both Companies and Students, username, email and password are required. Once every field is filled correctly the user can access pressing the Log In button.

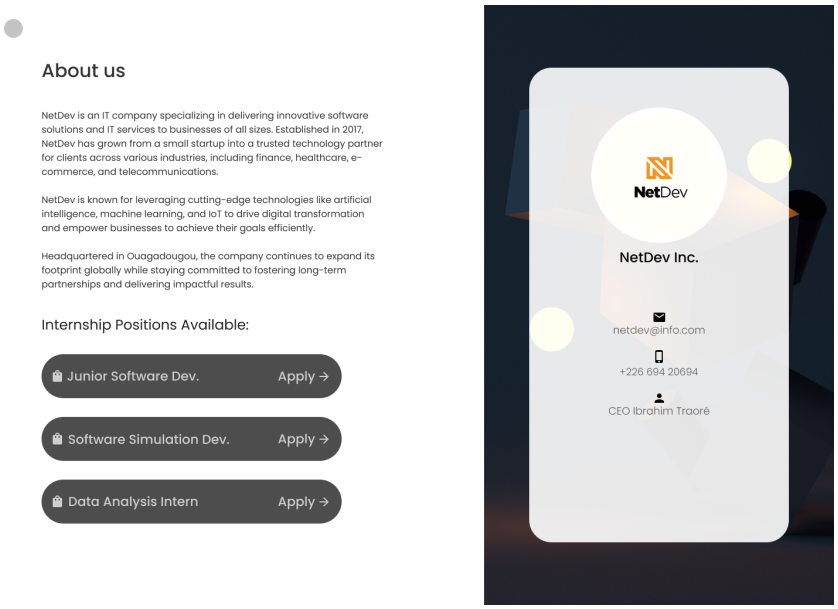


Available Intership List This inteface displays the available internships, the view is optimized based on the Recommendation Engine.

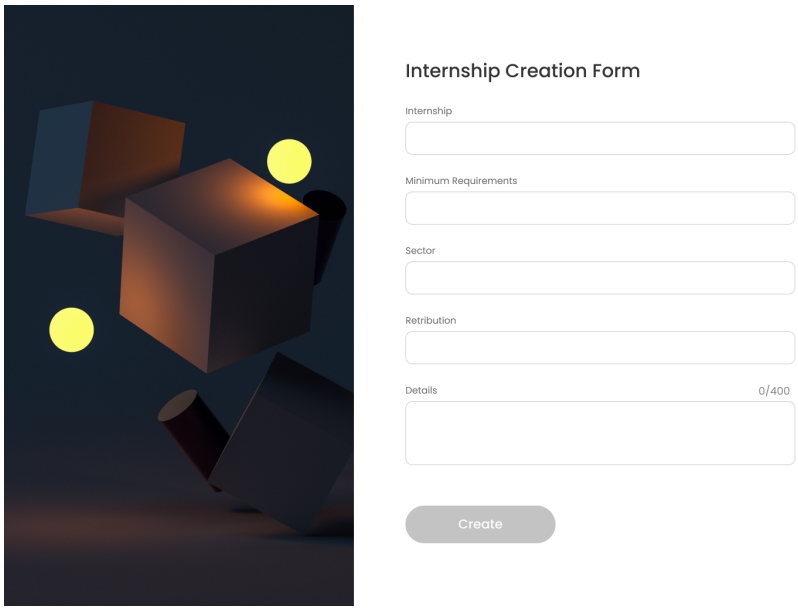


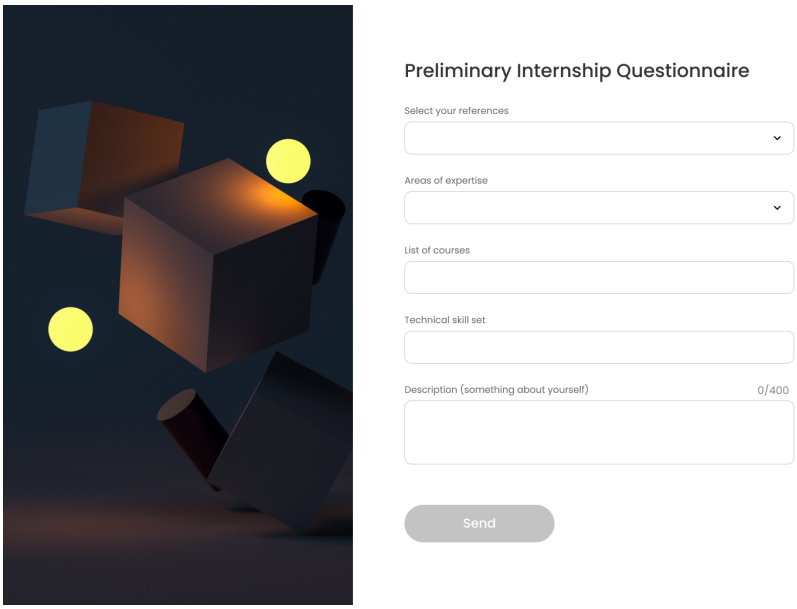
Student and Company Profile View Both Students and Companies pages have a profile picture of their choice, an email and a phone number as contact information, however they differ slightly, as the Student has the university in which he/she belongs displayed at the bottom, while the Company has the the name of the current CEO. Furthermore, on the left, the Student page allows anyone to download the Student's CV, whereas the Company's page displays its available internships.





Internship Creation Form and Preliminary Internship Questionnaire Both interfaces are forms with different purposes, the first is exclusively for Companies, mandatory in order to create a new intership position which will be available for Students' application. The second is exclusively for Students, this form will appear after a Student click apply on an available internship.





3.1.2. Hardware Interface

The S&C platform requires a server to host all its functionalities, in order to offer the best service possible the server machine requires some key hardware components with their corresponding interfaces:

- A processor (CPU) capable of handling concurrent user requests and process data.
- Main memory (RAM).
- Data Storage (Hard Disk/SSD).
- Network Interface Card (NIC): A reliable network interface for communication between the server and users' devices.

S&C will be an online web platform so the following hardware components are also mandatory:

- High speed and reliable Internt Connection in order to maintain a running platform and guarantee efficiency
- Firewall and Security Protocols for the safety of users data
- Load Balancers

The end-users' minimus requirements (hardware wise) are:

- Computer or Mobile devices
- Reliable Internet connection
- Network Interface Card

3.1.3. Software Interface

- Client-server interactions occur by the means of a HTTPS protocol to exchange data and information
- Database Interface as a database is needed to store and manipulate users' data

3.2. Functional Requirements

3.2.1. Use Case Diagram

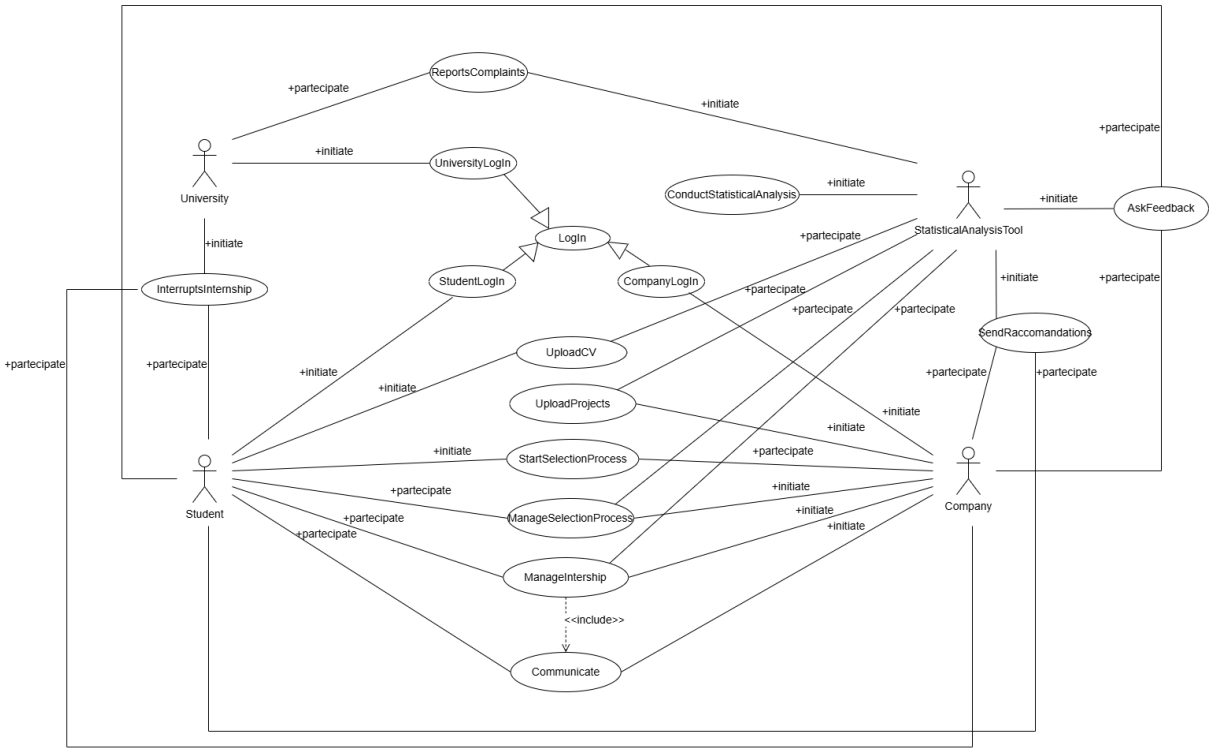


Figure 3.1: S&C Use Case Diagram

A UML Use Case Diagram visually represents the interactions between users (actors) and the system. It focuses on identifying the system's functionalities (use cases) and how various actors engage with them. These diagrams are essential for understanding system requirements, defining its scope, and providing a high-level overview of user-system interactions, making them particularly useful in requirement analysis. The diagram identifies key actors such as Students, Companies, Universities, and the Statistical Analysis Tool (internal to the platform) and captures their interactions with the system's core processes. Key use cases include:

- Searching and Applying for Internships: Students can proactively search through available internships and apply to those matching their skills and interests.
- Publishing Internship Offers: Companies can advertise internships, providing detailed descriptions, requirements, and terms.
- Recommendation Mechanism: The system matches students with suitable internships based on keyword searches, statistical analysis, and feedback data.
- Selection and Interview Management: Companies use the platform to manage interviews and assess candidates through questionnaires.

- Feedback and Complaints: Both students and companies provide feedback, which is used to improve the recommendation process and refine submissions (e.g., CVs or project descriptions).
- Monitoring and Issue Handling Universities, monitor internships, address complaints, and ensure proper resolution of disputes.

3.2.2. Use Cases

This section outlines the primary interactions between users and the system, detailing the various scenarios in which the system is utilized to achieve specific goals. Each use case describes the roles of actors, the sequence of actions, and the expected outcomes, providing a clear understanding of how the system fulfills its functional requirements.

Use Case ID	[UC1] - StudentLogsIn
Name	StudentLogIn
Actors	Student
Entry Condition	Student has opened the S&C application.
Event Flow	1. S&C shows the log in interface. 2. Student inserts his/her credentials and confirms. 3. Student logs in.
Exit Condition	S&C shows the initial (home) page of the application for a student.
Exceptions	1. If the student inserts incorrect credentials, the authentication page will return an error and ask him/her to retry.

Use Case ID	[UC2] - CompanyLogsIn
Name	CompanyLogIn
Actors	Company
Entry Condition	Company has opened the S&C application.
Event Flow	1. S&C shows the log in interface. 2. Company clicks on the button to sign in. 3. Company is redirected to its login page. 4. Company inserts his/her credentials and confirms.
Exit Condition	S&C shows the initial (home) page of the application for a company.
Exceptions	1. If the company inserts incorrect credentials, the authentication page will return an error and ask him/her to retry.

Use Case ID	[UC3] - UniversityLogIn
Name	UniversityLogIn
Actors	University
Entry Condition	University has opened the S&C application.
Event Flow	1. S&C shows the log in interface. 2. University clicks on the button to sign in. 3. University is redirected to their login page. 4. University inserts his/her credentials and confirms.
Exit Condition	S&C shows the initial (home) page of the application for a university.
Exceptions	1. If the university inserts incorrect credentials, the authentication page will return an error and ask him/her to retry.

Use Case ID	[UC4] - UploadCV
Name	UploadCV
Actors	Student, StatisticalAnalysisTool
Entry Condition	Student is logged in to the S&C platform.
Event Flow	1. Student clicks on the button to modify his/her profile. 2. S&C shows the form to fill with the information for the profile to be modified, including the space to upload the CV. 3. Student modifies his/her profile. 4. Student uploads his/her CV. 5. Student confirms the changes. 6. S&C applies the changes. 7. StatisticalAnalysisTool collects data regarding the student's profile.
Exit Condition	The student's profile is modified.
Exceptions	1. The CV is not in one of the supported formats. S&C returns an error message indicating the correct formats. 2. One of the mandatory fields has not been filled. S&C returns an error message indicating the mandatory fields.

Use Case ID	[UC5] - UploadProjects
Name	UploadProjects
Actors	Company, StatisticalAnalysisTool
Entry Condition	Company is logged in to the S&C platform.
Event Flow	1. Company clicks on the button to create a new project. 2. S&C shows the form to fill with the information about the new project. 3. Company fills out the form. 4. Company confirms the details. 5. S&C creates a new page dedicated to the project. 6. StatisticalAnalysisTool collects data regarding the company's project.
Exit Condition	The page dedicated to the company's project is created.
Exceptions	1. One of the mandatory fields has not been filled. S&C returns an error message indicating the mandatory fields. 2. One of the documents to upload is not in one of the supported formats. S&C returns an error message indicating the correct formats.

Use Case ID	[UC6] - StartSelectionProcess
Name	StartSelectionProcess
Actors	Student, Company
Entry Condition	Student is logged in to the S&C platform, and the page dedicated to the project has been created.
Event Flow	1. Student visits the page dedicated to the project. 2. Student clicks on the button to ask to start the selection process. 3. S&C notifies the company about the student's request. 4. Company visits the profile of the student to check if he/she meets the project's requirements. 5. Company downloads the student's CV to check if he/she meets the project's requirements. 6. Company visits the page of the requests for its project. 7. Company accepts the student for the selection process. 8. S&C establishes a contact between the student and company.
Exit Condition	The selection process has started, and a contact has been established between the student and the company.
Exceptions	1. The student tries to apply for an internship for which the time window available for requests has ended. S&C displays an error message informing the student that the time window has closed. 2. The student tries to apply for an internship for which all places have already been assigned. S&C displays an error message informing the student that the places have been filled.

Use Case ID	[UC7] - ManageSelectionProcess
Name	ManageSelectionProcess
Actors	Student, Company, StatisticalAnalysisTool
Entry Condition	The selection process of the student has started.
Event Flow	1. Company clicks the button to allow the student to fill the preliminary questionnaire. 2. S&C notifies the student that he/she can fill the preliminary questionnaire. 3. Student fills the preliminary questionnaire. 4. S&C notifies the company that the student has filled the questionnaire. 5. Company fills out a form regarding the progress of the preliminary questionnaire in the dedicated private space provided by the platform. 6. StatisticalAnalysisTool collects data about the first part of the selection process. 7. Company asks the student to participate in an interview. 8. S&C notifies the student that he/she has been invited to participate in an online interview. 9. Student accepts the invitation. 10. Company interviews the student. 11. Company fills out a form regarding the progress of the interview in the dedicated private space provided by the platform. 12. Company finalizes the selection of the candidate student for the internship. 13. StatisticalAnalysisTool collects data about the selection process.
Exit Condition	The selection process is over, and the student has been selected by the company for the internship.
Exceptions	1. The student tries to participate in the online interview on a different date and/or time than the pre-established ones. S&C displays an error message indicating the correct date and time.

Use Case ID	[UC8] - ManageInternship
Name	ManageInternship
Actors	Student, Company, StatisticalAnalysisTool
Entry Condition	Student has been selected by the company for the internship.
Event Flow	1. Company finalizes the selection of the candidate student for the internship. 2. S&C creates a page dedicated to the specific internship of the specific student for official announcements. 3. S&C opens the communication channel. 4. S&C notifies the student that the communication channel is opened. 5. S&C notifies the company that the communication channel is opened. 6. Company writes in the dedicated space information about the beginning of the internship. 7. S&C notifies the student about the publication of information about the internship. 8. Student and company communicate through the communication channel (see UC11). 9. Company publishes information about the current status of the ongoing situation in the dedicated space. 10. Student writes comments in the dedicated space. 11. S&C notifies the student about the new publication. 12. At the end of the pre-established period of the internship, the company confirms the end of the internship through the dedicated space. 13. S&C notifies the student that the internship is over. 14. S&C notifies the company that the internship is over. 15. S&C closes the communication channel. 16. S&C deletes the page dedicated to the specific internship of the specific student for official announcements. 17. StatisticalAnalysisTool collects data about the internship.
Exit Condition	The internship is over.
Exceptions	1. The student tries to write in a dedicated part of the page for which he/she does not have permission. An error message is displayed indicating the spaces in which the student can write.

Use Case ID	[UC9] - Communicate
Name	Communicate
Actors	Student, Company
Entry Condition	Internship is ongoing, and the communication channel is open.
Event Flow	1. Company communicates information to the student. 2. Student communicates information to the company. 3. Company communicates problems to the student. 4. Student communicates problems to the company. 5. Company complains about the student. 6. Student complains about the company.
Exit Condition	The communication channel has been closed.

Use Case ID	[UC10] - AskFeedback
Name	AskFeedback
Actors	Student, Company, StatisticalAnalysisTool
Entry Condition	The internship has begun.
Event Flow	1. StatisticalAnalysisTool asks feedback from the student. 2. Student responds to the feedback. 3. StatisticalAnalysisTool collects data about the student's feedback. 4. StatisticalAnalysisTool asks feedback from the company. 5. Company responds to the feedback. 6. StatisticalAnalysisTool collects data about the company's feedback.
Exit Condition	The internship is over.
Exceptions	1. The student does not fill in one of the mandatory fields. S&C returns an error message indicating the mandatory fields. 2. The company does not fill in one of the mandatory fields. S&C returns an error message indicating the mandatory fields.

Use Case ID	[UC11] - ConductStatisticalAnalysis
Name	ConductStatisticalAnalysis
Actors	StatisticalAnalysisTool
Entry Condition	StatisticalAnalysisTool has collected the data required for the statistical analyses.
Event Flow	1. StatisticalAnalysisTool organizes the collected data. 2. StatisticalAnalysisTool performs statistical analysis on the data. 3. StatisticalAnalysisTool organizes and groups the analysis results based on their use.
Exit Condition	Information needed by the recommender system is complete.

Use Case ID	[UC12] - SendRecommendations
Name	SendRecommendations
Actors	StatisticalAnalysisTool, Student, Company
Entry Condition	Information needed by the recommender system is complete.
Event Flow	1. StatisticalAnalysisTool retrieves the results of its statistical analyses. 2. StatisticalAnalysisTool groups the information based on the recipient concerned. 3. S&C sends the recommendation to the student. 4. S&C notifies the student about the new recommendation. 5. S&C sends the recommendation to the company. 6. S&C notifies the company about the new recommendation.
Exit Condition	All the recommendations have been sent.

Use Case ID	[UC13] - ReportsComplaints
Name	ReportsComplaints
Actors	StatisticalAnalysisTool, University
Entry Condition	StatisticalAnalysisTool has collected data needed to produce the complaints' report.
Event Flow	1. StatisticalAnalysisTool retrieves data about complaints. 2. StatisticalAnalysisTool organizes data about complaints and produces a report. 3. S&C sends the complaints' report to the university. 4. S&C notifies the university that the complaints' report is ready. 5. University has received the complaints' report.
Exit Condition	University has received the complaints' report.

Use Case ID	[UC14] - InterruptInternship
Name	InterruptInternship
Actors	University, Student, Company
Entry Condition	University has read the report about complaints.
Event Flow	1. University visits the page dedicated to the interruption of the internship. 2. University selects the student. 3. University selects the internship. 4. University clicks on the button to interrupt the internship. 5. University confirms its selection. 6. S&C notifies the student about the interruption of the internship with the selected company. 7. S&C notifies the company about the interruption of the internship with the selected student.
Exit Condition	The internship has been interrupted.
Exceptions	1. University selects a student and does not select any internship and confirms. S&C shows an error message asking to select an internship. 2. University selects an internship and does not select any student and confirms. S&C shows an error message asking to select a student. 3. University selects a student-internship pair for which there is no ongoing internship. S&C displays an error message indicating that an internship with these characteristics does not currently exist.

3.2.3. Sequence Diagrams

In this section is displayed every sequence diagram relative to every use case.

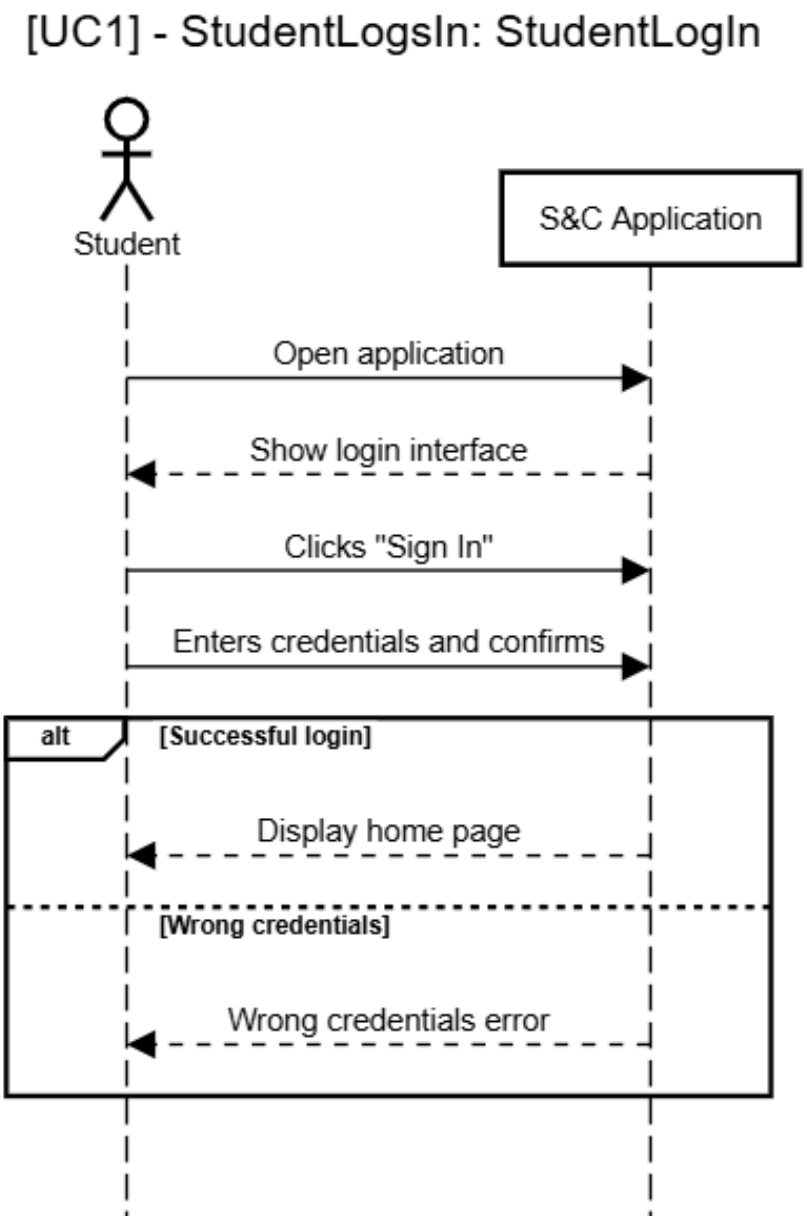


Figure 3.2: Student Login

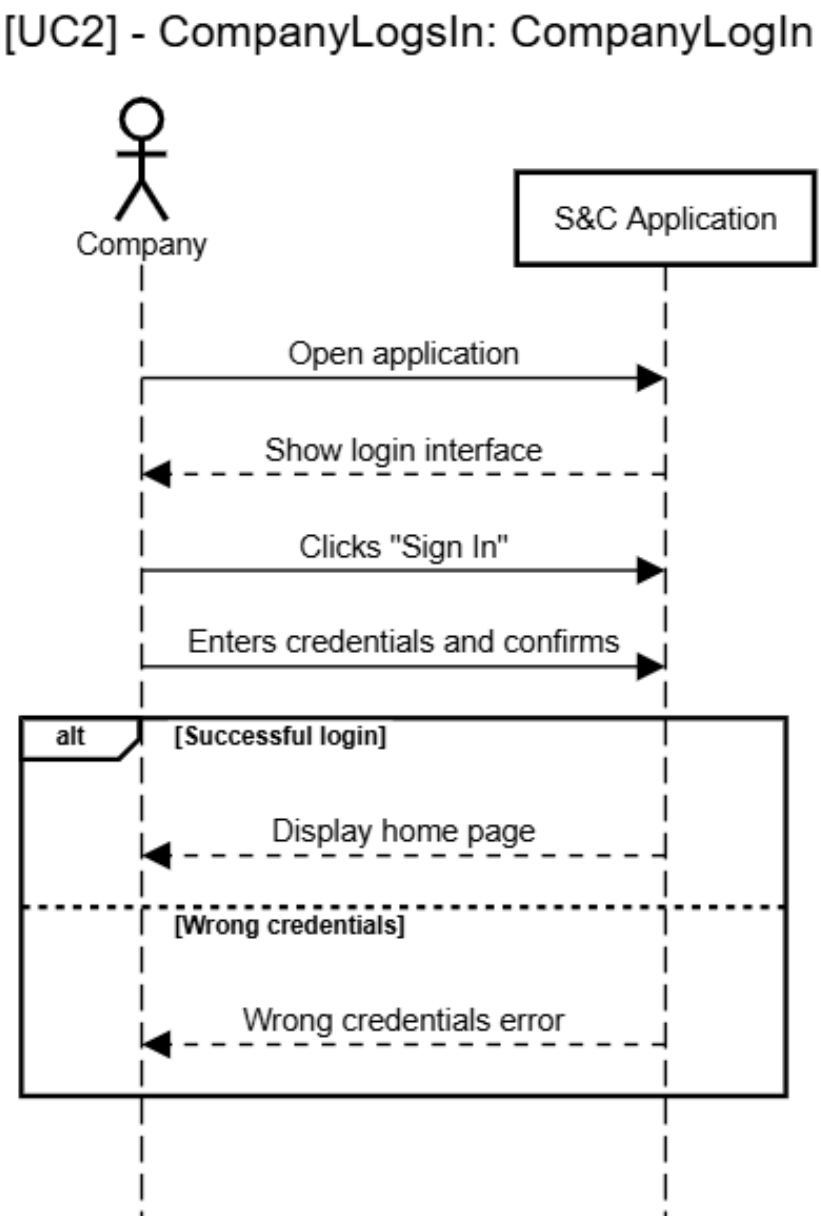


Figure 3.3: Company Login

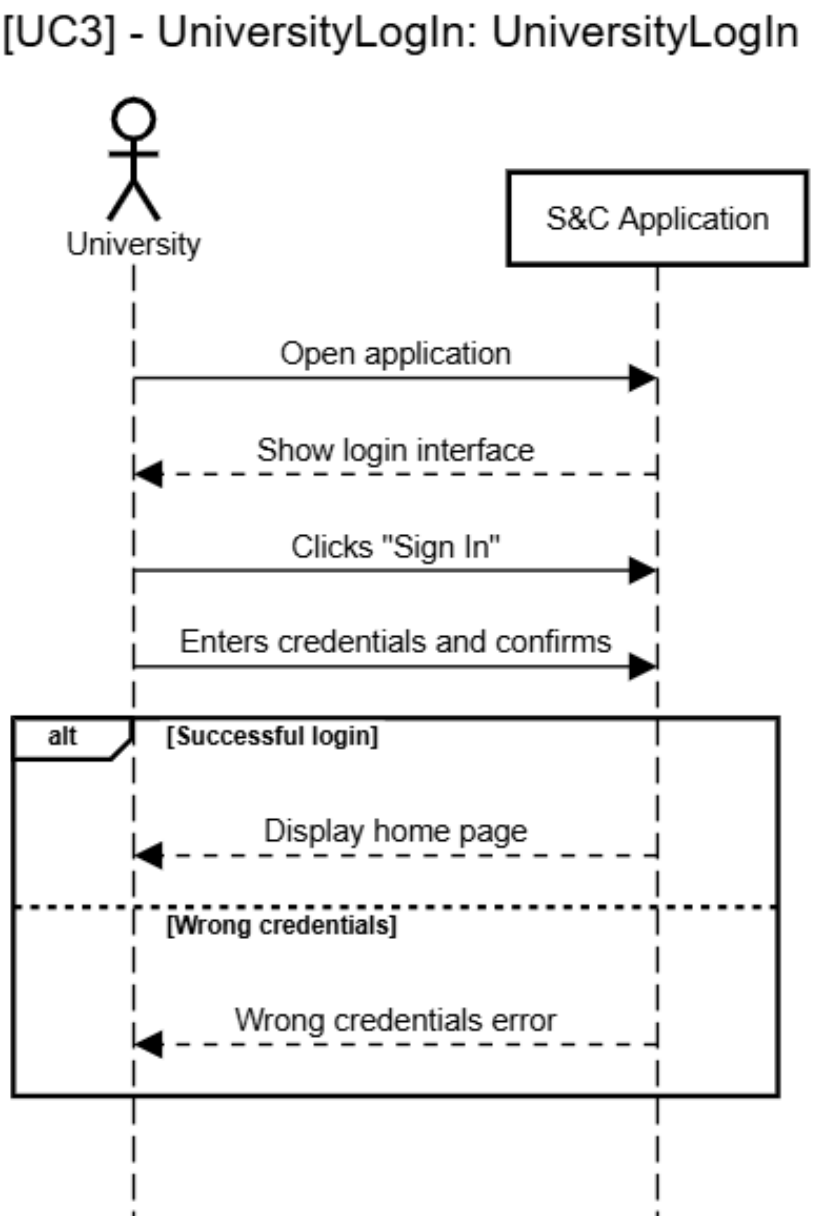


Figure 3.4: University Login

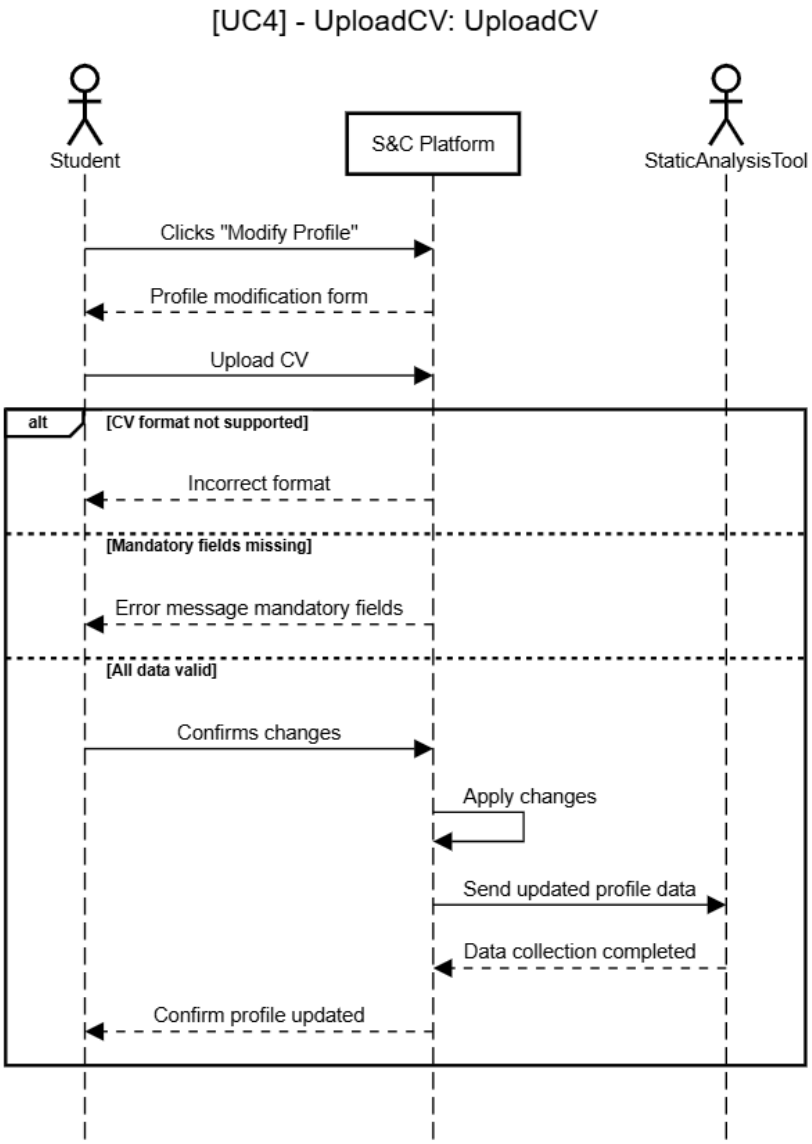


Figure 3.5: Upload CV

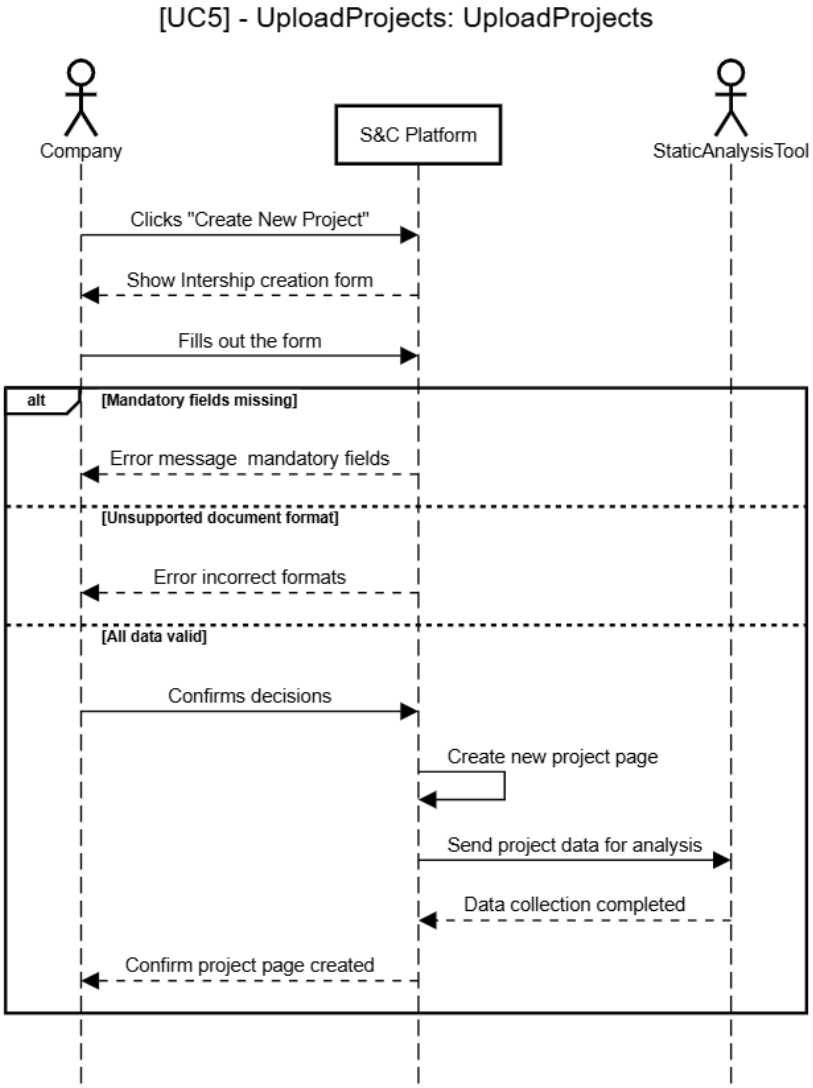


Figure 3.6: Upload Projects

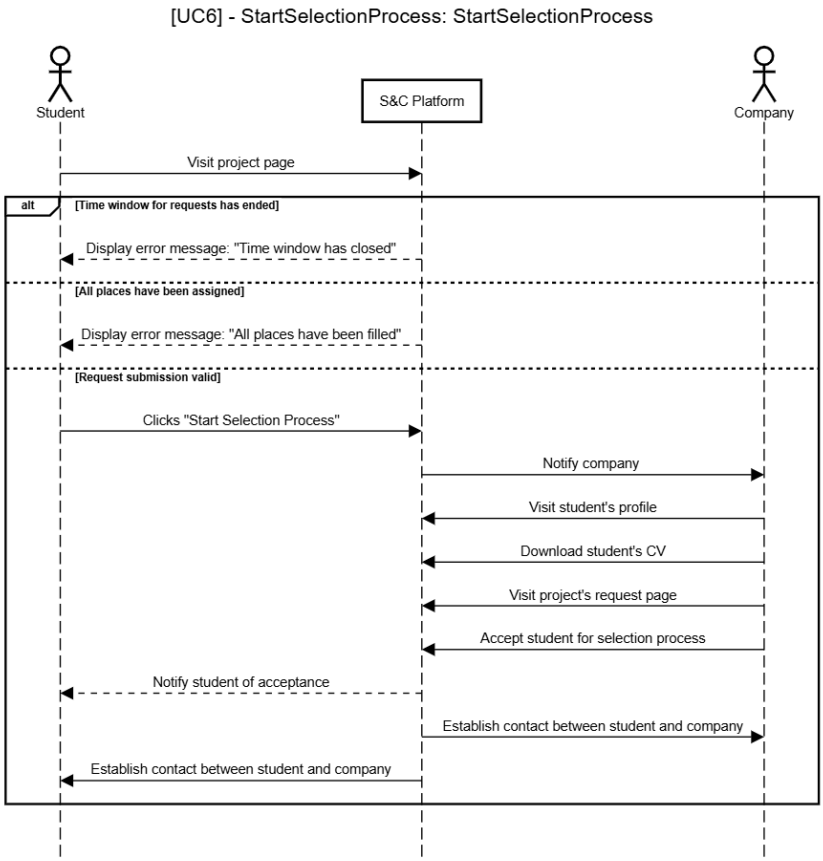


Figure 3.7: Start Selection Process

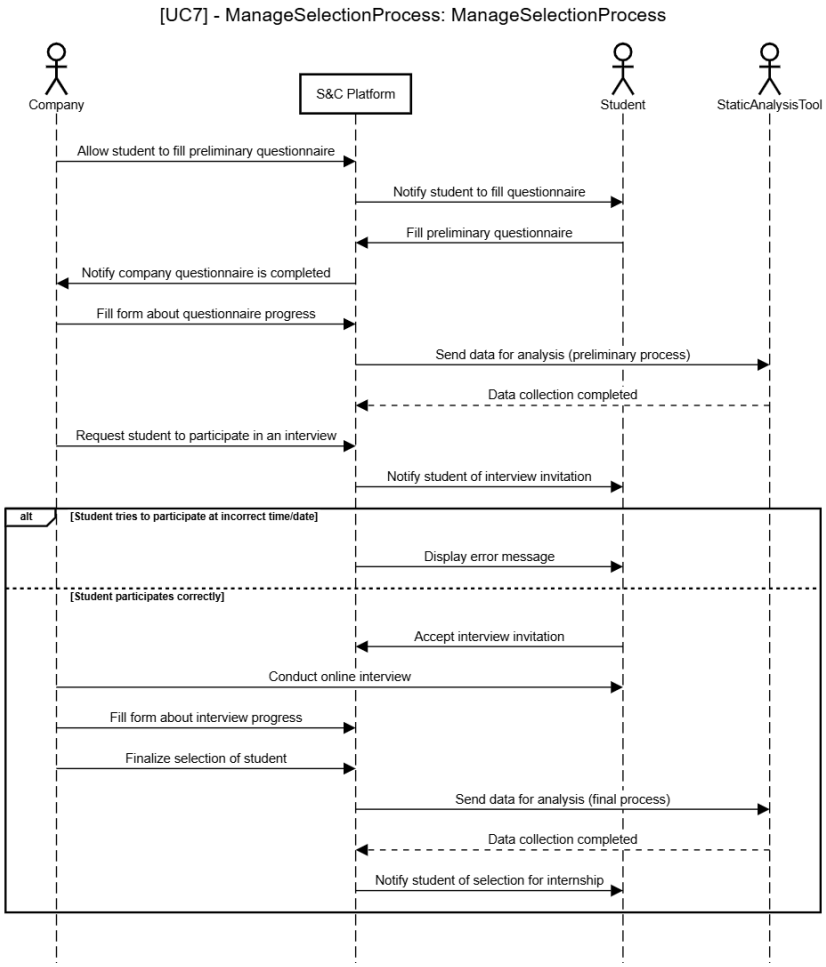


Figure 3.8: Manage Selection Process

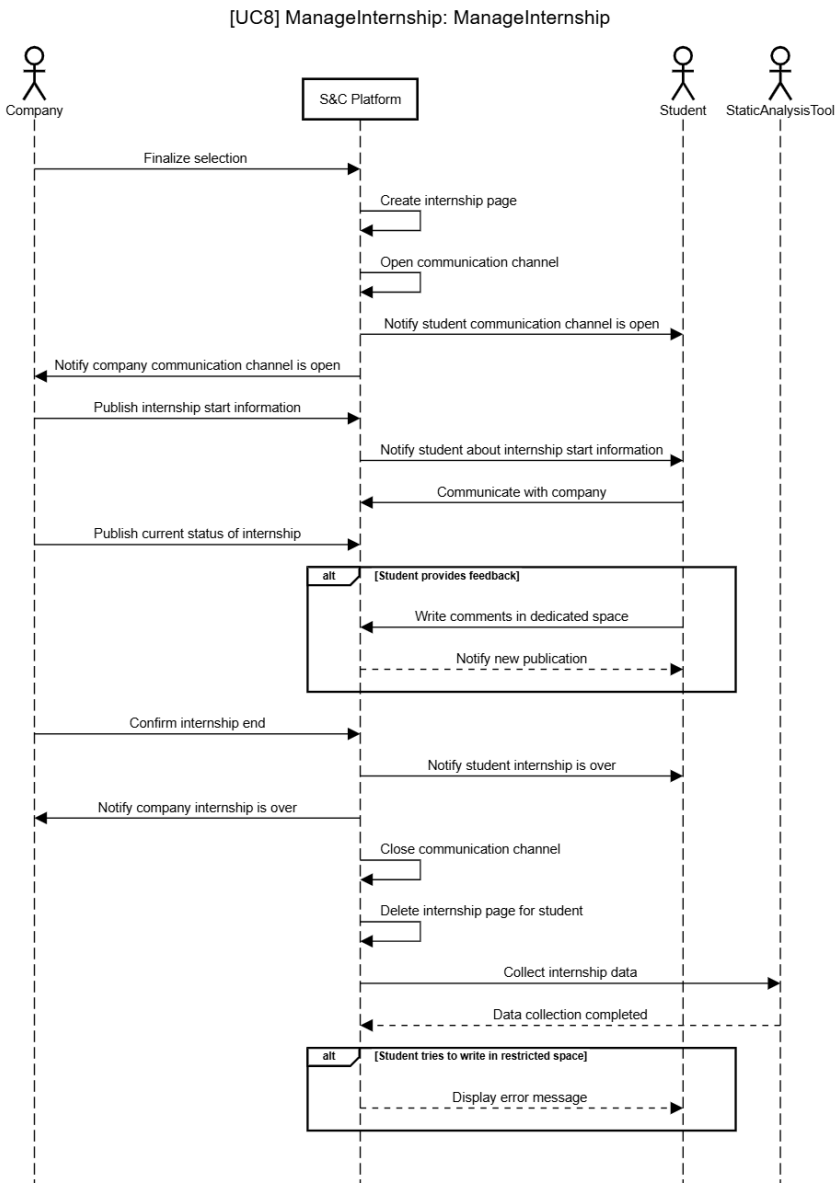


Figure 3.9: Manage Internship

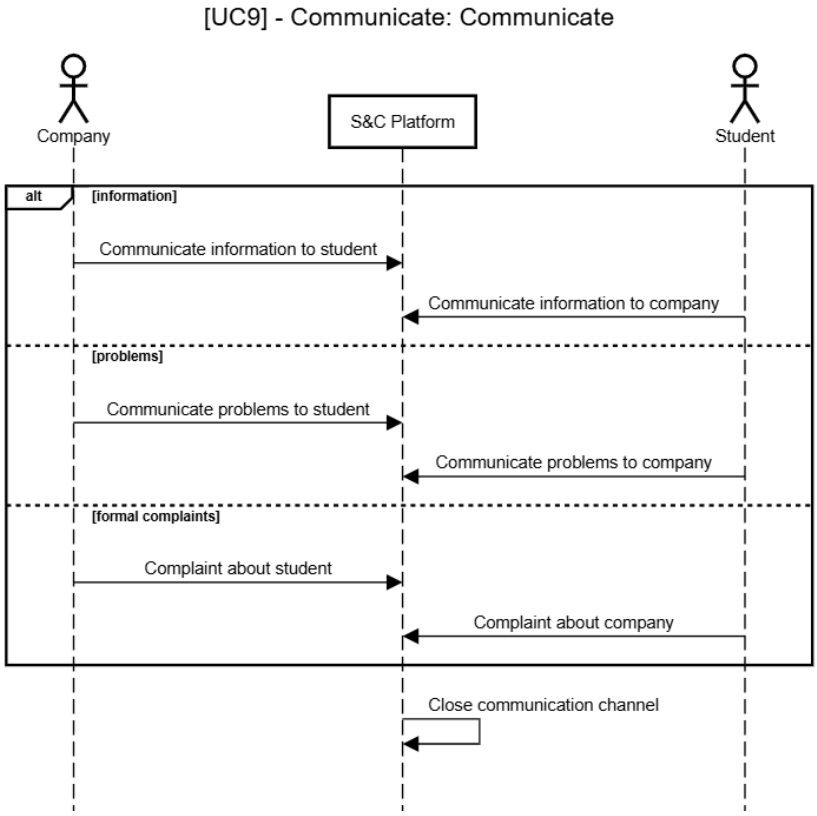


Figure 3.10: Communicate

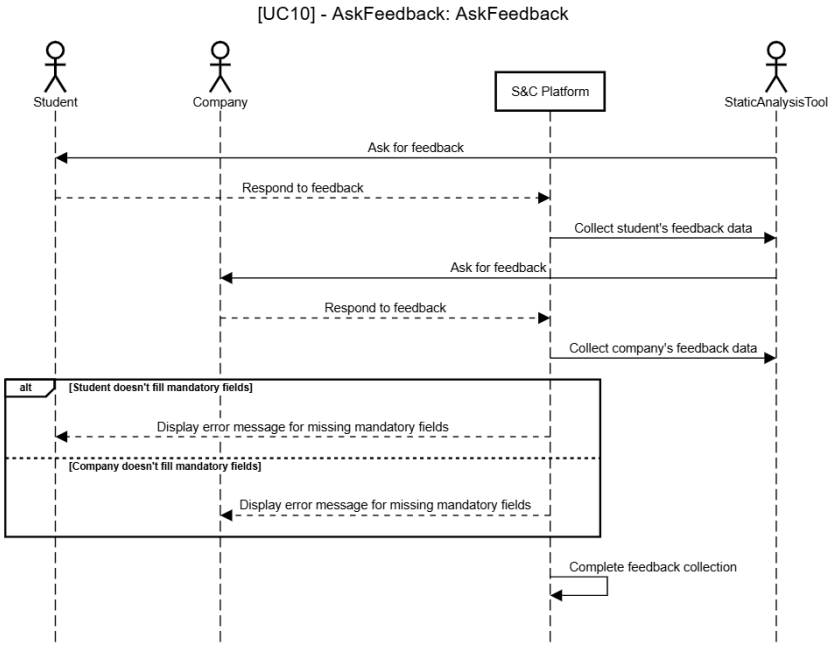


Figure 3.11: Ask Feedback

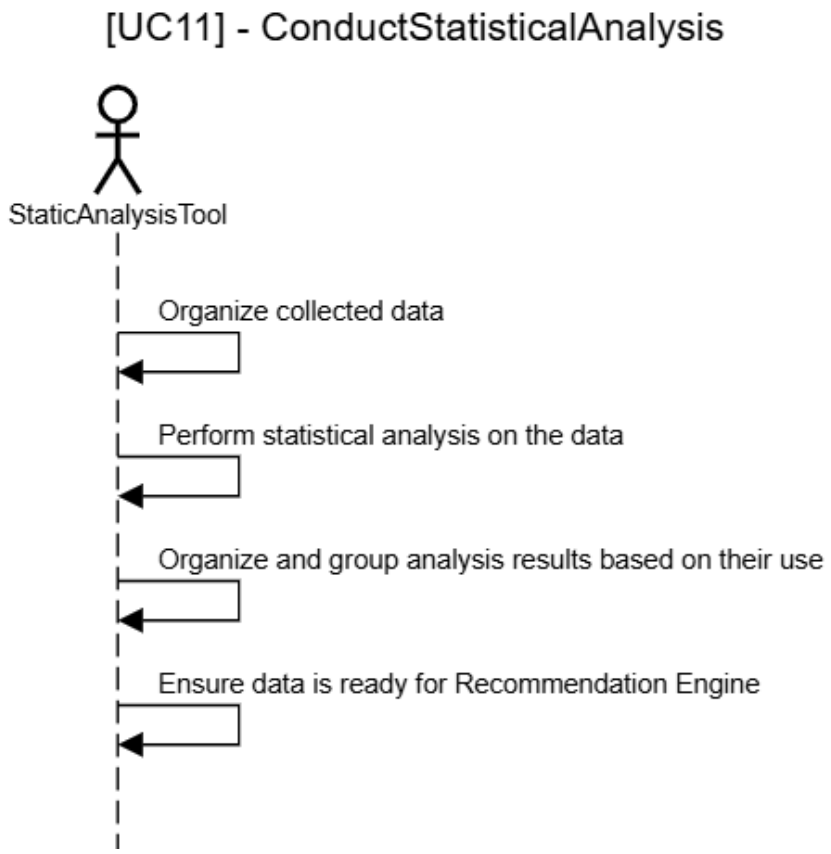


Figure 3.12: Conduct Statistical Analysis

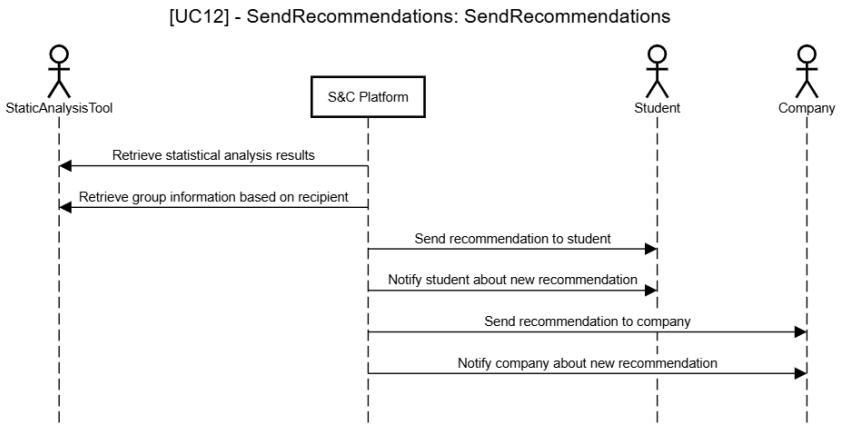


Figure 3.13: Send Reccommendations

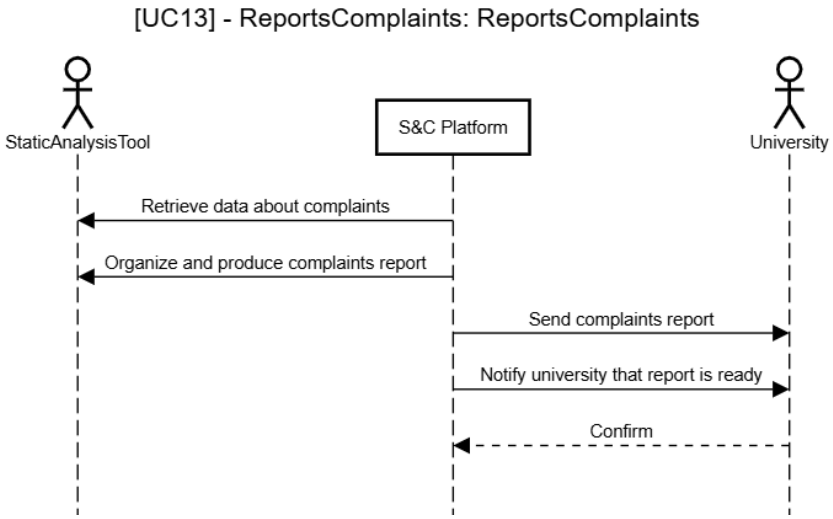


Figure 3.14: Reports Complaints

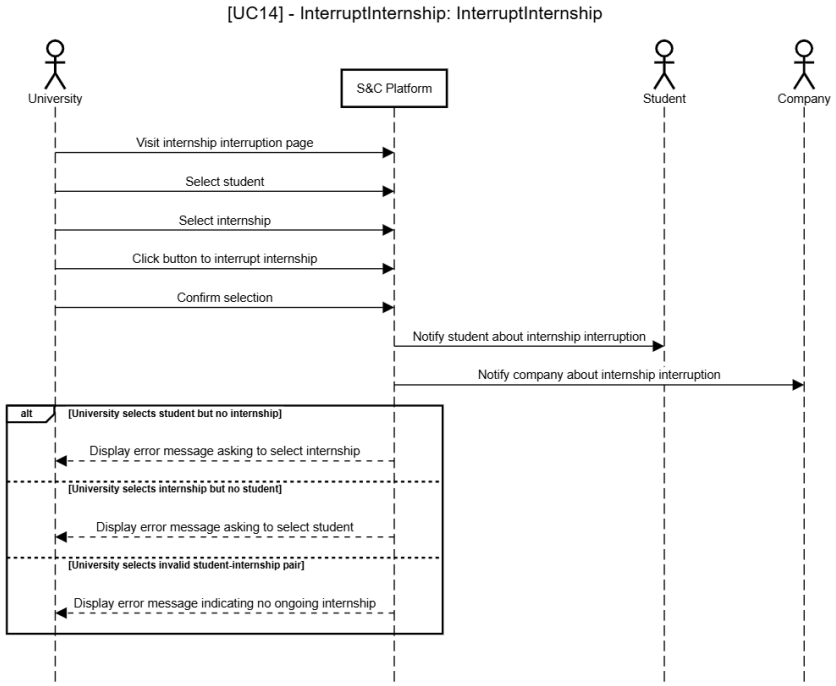
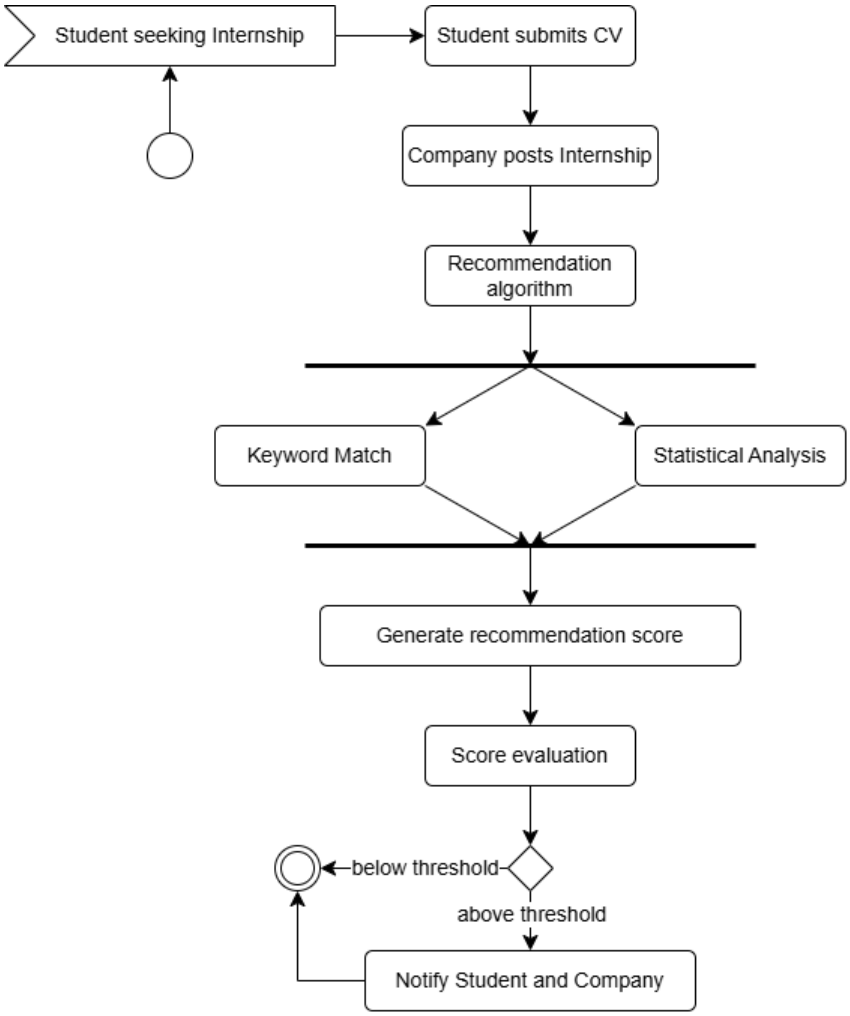


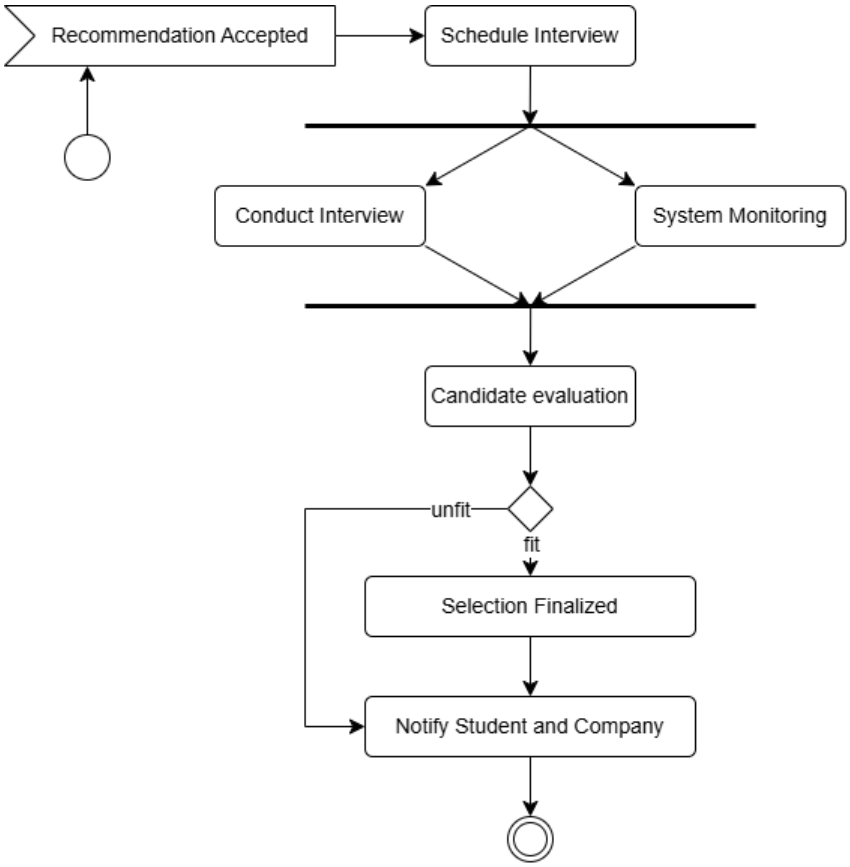
Figure 3.15: Interrupt Internship

3.2.4. Activity Diagrams

Activity diagrams are created to give insights about specific sequences of operations occurring in some parts of the system being described. Recommendation Engine process and Internship Selection Process are being represented:



The Recommendation Engine diagram illustrates the process through which the platform matches students with internships based on the evaluation of their CVs and the internship details. It starts when a student submits their CV and a company posts an internship. The system analyzes both using keyword matching and statistical analysis to generate a recommendation score. The score is then evaluated against a predefined threshold. If the score is above the threshold, the student and company are notified of a suitable match.



The Internship Selection Process diagram captures the steps taken once a student has been matched with an internship. After a recommendation is accepted, the company schedules and conducts an interview with the student. The candidate is evaluated based on the interview outcome. If the candidate is deemed a good fit, both the student and the company are notified, and the selection is finalized.

3.2.5. Requirements Mapping

This table shows a mapping between:

- Requirements, presented in section 2.2.1.
- Goals, presented in section 1.1.
- Use Cases, presented in section 3.2.2.
- Sequence Diagrams, presented in section 3.2.3

Requirement	**Goal**	**UseCase**	**SequenceDiagram**
R1.1	G1	UC1	SD1
R1.2	G1	UC4	SD4
R1.3	G1	UC4	SD4
R1.4	G1	UC6	SD6
R2.1	G2	UC2	SD2
R2.2	G2	UC5	SD5
R2.3	G2	UC5	SD5
R3.1	G3	UC12	SD12
R3.2	G3	UC6	SD6
R3.3	G3	UC4-5	SD4-5
R3.4	G3	UC12	SD12
R3.5	G3	UC11	SD11
R3.6	G3	UC7	SD7
R3.7	G3	UC8	SD8
R3.8	G3	UC10	SD10
R4.1	G4	UC6	SD6
R4.2	G4	UC6	SD6
R4.3	G4	UC7	SD7
R4.4	G4	UC7	SD7
R4.5	G4	UC7	SD7
R5.1	G5	UC8	SD8
R5.2	G5	UC9	SD9
R6.1	G6	UC3	SD3
R6.2	G6	UC13	SD13
R6.3	G6	UC14	SD14

3.3. Performance Requirements

The S&C Platform must meet the efficiency standards for all users. The system should be optimized for high performance, with an emphasis on low latency and fast processing speed. Response times must not exceed a few seconds under typical operating conditions. Additionally, the system should prioritize accuracy in data delivery, as a significant portion of users will be professionals in their respective fields.

3.4. Design Constraints

3.4.1. Standard Compliance

The S&C Platform must follow the industry standards and the best practices to ensure security and scalability. These include, but are not limited to, data protection regulations such as GDPR (General Data Protection Regulation) for safeguarding user data, in addition to all the different national regulations regarding privicy and security. Additionally, the platform should comply with the IEEE standards for software development processes.

3.4.2. Hardware Limitations

The S&C Platform is designed to operate on standard web servers with configurations capable of handling a high volume of concurrent users. While specific hardware requirements will vary depending on deployment scale, the platform should be able to run efficiently on typical cloud infrastructure, such as AWS, Microsoft Azure, or Google Cloud, with adequate CPU, memory, and storage capacity. The system architecture must be flexible to scale horizontally in order to accommodate very dynamic traffic loads without lowering the performance.

3.4.3. Other Constraints

Other constraints affecting the design of the S&C Platform include:

- Browser Compatibility: The system must support major web browsers, including Chrome, Firefox, Edge, and Safari, with full functionality available on both desktop and mobile platforms.
- User Privacy and Security: The platform must ensure that all user data, including sensitive information such as CVs and personal profiles, is encrypted both in transit and at rest.
- Internationalization and Localization: The platform should be designed to support multiple languages and regional settings, allowing accessibility based on every geographical areas served by the platform.

3.5. Software System Attributes

3.5.1. Reliability

The S&C Platform must be designed for high reliability, ensuring that the system operates without failure under normal usage conditions. The System should be capable of handling errors gracefully and maintaining stable performance even during peak load scenarios. The platform should provide a consistent user experience avoiding unnecessary failures, monitoring tools will be implemented to detect issues and allow for quick responses to any system failures.

3.5.2. Availability

The S&C Platform must be highly available, minimizing downtime and maximizing uptime. The system architecture will include automated backups and recovery procedures to protect users' data and allow for quick restoration in case of failure. The system is aiming for an uptime goal of 99.9% or higher.

3.5.3. Security

Security is a top priority for the S&C Platform, given the sensitive nature of user data (e.g., CVs, personal information, passwords and emails). The platform will implement strong encryption (e.g., AES-256) for both data at rest and data in transit. Furthermore, the platform will follow secure coding practices and conduct regular security audits to identify and address potential vulnerabilities. Compliance with data protection regulations, such as GDPR, will also be ensured to safeguard user privacy.

3.5.4. Maintainability

The S&C Platform will be designed with maintainability in mind, ensuring that the system can be easily updated and extended. The codebase will follow established software engineering best practices, such as modularity, code reusability and design patterns, to allow for easier debugging and bug fixes, every aspect of the codebase should be well documented for future developments. A rigorous testing routine that covers at least 80% of the codebase will avoid major risks.

3.5.5. Portability

The S&C Platform will be built with portability in mind, ensuring that it can run across different environments, including various operating systems (e.g., Windows, Linux, macOS) and web browsers. The platform's front-end will also be responsive, adapting seamlessly to different screen sizes and devices (e.g., desktops, tablets, smartphones).

4 | Alloy

In this section it is provided a representation of the world of S&C using the Alloy language. Every run and every check are commented in order to guarantee a syntactical correct compilation of the code: it is up to the reader to decide what to uncomment based on their will.

```
-- (lexicographic order)

// ------------------------------------------------
// SIGNATURES //
// ------------------------------------------------

sig Company extends User {
    intershipsOffered: disj set Internship
}

sig CV {}

sig Internship {}

sig Password {}

sig Student extends User {
    university: one University,
    cv: disj one CV,
    var status: one StudentStatus,
    var internship: lone Internship,
    var complaintPresence: one Boolean
}

sig University extends User {}
```

```
abstract sig User {
    username: disj one Username,
    password: disj one Password
}

sig Username {}


// ------------------------------------------------
// ENUMERATIONS //
// ------------------------------------------------

enum Boolean {
    True,
    False
}

enum StudentStatus {
    Searching,
    PreliminaryMatch,
    SelectionProcess,
    FinalMatch
}


// ------------------------------------------------
// FACTS //
// ------------------------------------------------

fact ifFinalMatchOnceSelectionProcess {
    all s: Student |
        always (
            s.status = FinalMatch implies
            once s.status = SelectionProcess
        )
}
```

```
fact ifPreliminaryMatchOnceSearching {
    all s: Student |
        always (
            s.status = PreliminaryMatch implies
            once s.status = Searching
        )
}

fact ifSearchingNoComplaint {
    all s: Student |
        always (
            s.status = Searching implies
            s.complaintPresence = False
        )
}

fact ifSelectionProcessOncePreliminaryMatch {
    all s: Student |
        always (
            s.status = SelectionProcess implies
            once s.status = PreliminaryMatch
        )
}

fact internshipIffMatched {
    all s: Student |
        always (
            s.internship = none iff s.status =
              ↪ Searching
        )
}

fact noUnmappedCVs {#CV = #Student.cv}

fact noUnmappedInternships {all i: Internship | i
  ↪ in Company.intershipsOffered}
```

```
fact noUnmappedPasswords {#Password = #User.
  ↪ password}

fact noUnmappedUsernames {#Username = #User.
  ↪ username}

fact studentBehaviour {
    all s: Student |
        always(
            (one i: Internship |
              ↪ studentFindingMatch[s, i]) or
            studentStatusUpgrade[s] or
            studentEndingInternship[s] or
            companyComplains[s] or
            companyRemovesComplaint[s] or
            studentNotPassingSelectionProcess[s]
              ↪ or
            universityTerminatesInternship[s] or
            doNothing[s]
        )
}


// ------------------------------------------------
// PREDICATES //
// ------------------------------------------------

pred companyComplains [s: Student] {
    s.complaintPresence = False and
    s.complaintPresence' = True and
    statusUnchanged[s] and internshipUnchanged[s]
}

pred companyRemovesComplaint [s: Student] {
    s.complaintPresence = True and
    s.complaintPresence' = False
```

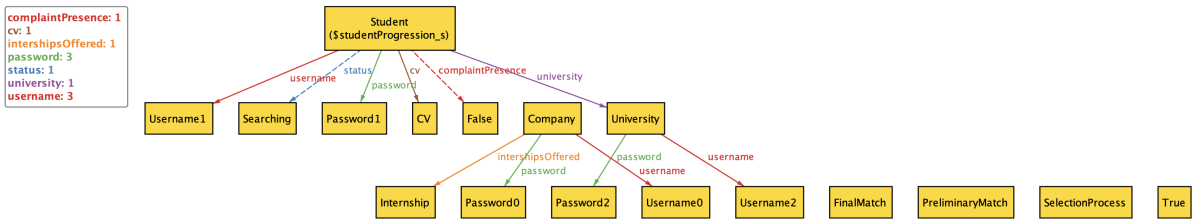
```
    statusUnchanged[s] and internshipUnchanged[s]
}

pred complaintPresenceUnchanged [s: Student] {
    s.complaintPresence' = s.complaintPresence
}

pred doNothing [s: Student] {
    statusUnchanged[s]
    internshipUnchanged[s]
    complaintPresenceUnchanged[s]
}

pred internshipUnchanged [s: Student] {
    s.internship' = s.internship
}

pred statusUnchanged [s: Student] {
    s.status' = s.status
}

pred studentEndingInternship [s: Student] {
    s.status = FinalMatch
    s.status' = Searching
    s.internship' = none
    s.complaintPresence' = False
}

pred studentFindingMatch [s: Student, i:
  ↪ Internship] {
    s.status = Searching
    s.status' = PreliminaryMatch
    s.internship' = i
    s.complaintPresence' = False
}

pred studentStatusUpgrade [s: Student] {
```

```
    (s.status = PreliminaryMatch and
    s.status' = SelectionProcess and
    internshipUnchanged[s] and
      ↪ complaintPresenceUnchanged[s]) or
    (s.status = SelectionProcess and
    s.status' = FinalMatch and
    internshipUnchanged[s] and
      ↪ complaintPresenceUnchanged[s])
}

pred studentNotPassingSelectionProcess [s: Student
  ↪ ] {
    s.status = SelectionProcess
    s.status' = Searching
    s.internship' = none
    s.complaintPresence' = False
}

pred universityTerminatesInternship [s: Student] {
    s.status ≠ Searching
    s.status' = Searching
    s.internship' = none
    s.complaintPresence' = False
}


// ------------------------------------------------
// RUN //
// ------------------------------------------------

// pred complaintTransition [s: Student] {
//     s.complaintPresence = False
//     s.complaintPresence''' = True
// }
// run complaintTransition for 10 but 4 steps

pred studentProgression [s: Student] {
```

```
    s.status = Searching
    s.status' = PreliminaryMatch
    s.status'' = SelectionProcess
    s.complaintPresence''' = True
    s.status'''' = FinalMatch
    s.complaintPresence''''' = False
    s.complaintPresence'''''' = True
    s.status''''''' = Searching


    #University = 1
    #Internship = 1
    #Company = 1
    #Student = 2
}
run studentProgression for 10

// run {} for 3 steps

// pred show {
//     #Student = 2
//     #Company = 2
//     #University = 2
//     #Internship = 5
// }
// run show for 30
```

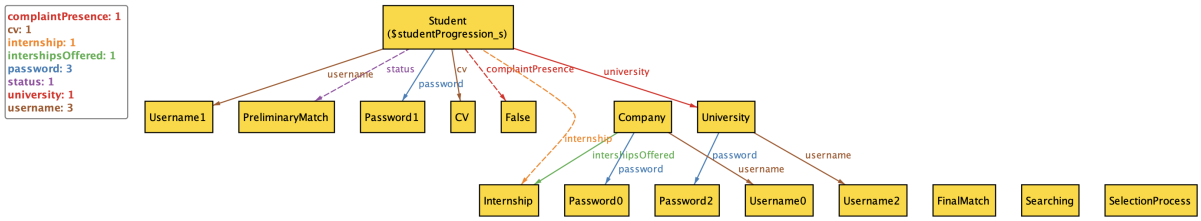
4.1. Generated Worlds

4.1.1. Student Progression



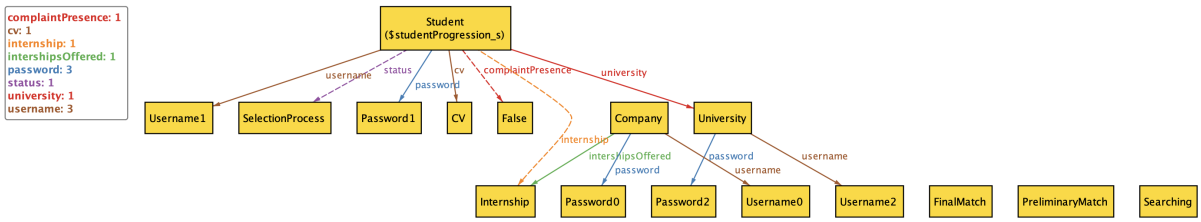
Instant 1: Initial State

The system begins with a single **Student** in the ***Searching*** status, actively looking for an internship. At this stage, the student's `complaintPresence` is set to `False`, indicating no complaints have been filed. The `internship` field is `none`, aligning with the requirement that students in the ***Searching*** status cannot have an internship assigned. This state is stable and represents the starting point of the student's progression.



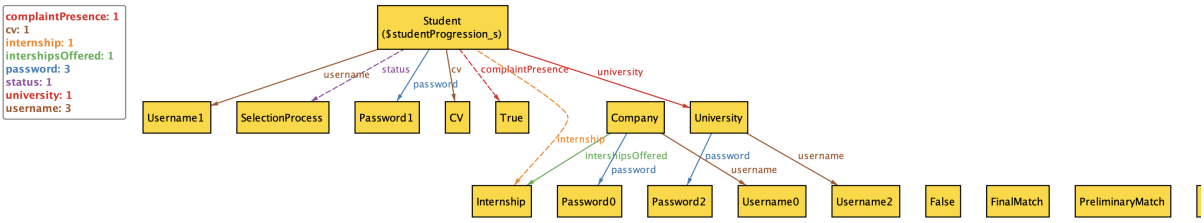
Instant 2: Preliminary Match

The student transitions to the ***PreliminaryMatch*** status, signifying the first significant step in their progression. The `internship` field is now associated with a specific internship offered by a company, demonstrating a tentative match between the student and the internship. The `complaintPresence` remains `False`, ensuring compliance with the fact that the student in this status does not have unresolved complaints. This evolution reflects the student's movement closer to securing an internship.



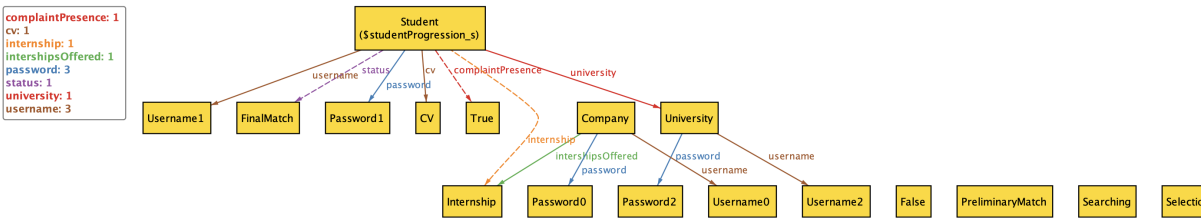
Instant 3: Selection Process

In this instant, the student progresses further to the ***SelectionProcess*** status. This transition signifies the student's entry into an evaluation phase for the assigned internship. Both the `internship` and `complaintPresence` fields remain unchanged, ensuring the continuity of their association with the preliminary match. This evolution highlights the system's adherence to the predefined progression hierarchy, advancing the student toward a possible final match.



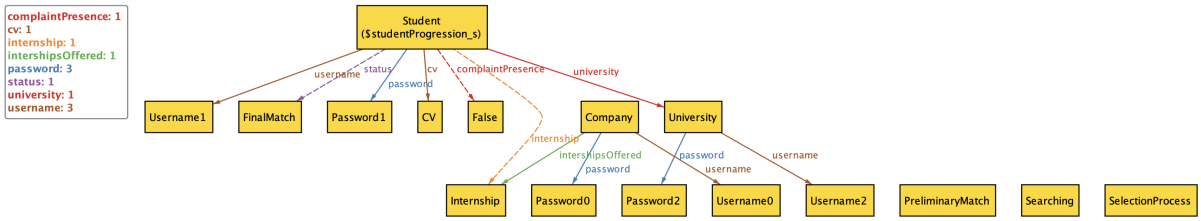
Instant 4: Complaint Registered

A new development occurs where the `complaintPresence` changes from `False` to `True`. This indicates that the company or another entity has raised a concern or issue regarding the student. Despite this change, the `status` and `internship` fields remain unaffected, showing that the complaint is logged without disrupting the ongoing selection process. This state marks the introduction of external feedback into the student's progression.



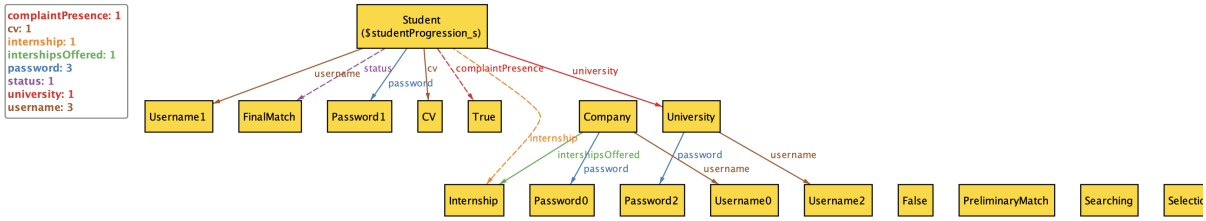
Instant 5: Final Match

The student successfully advances to the ***FinalMatch*** status, indicating they have secured the internship after completing the selection process. The `internship` association remains intact, reflecting their confirmed placement.



Instant 6: Complaint Removed

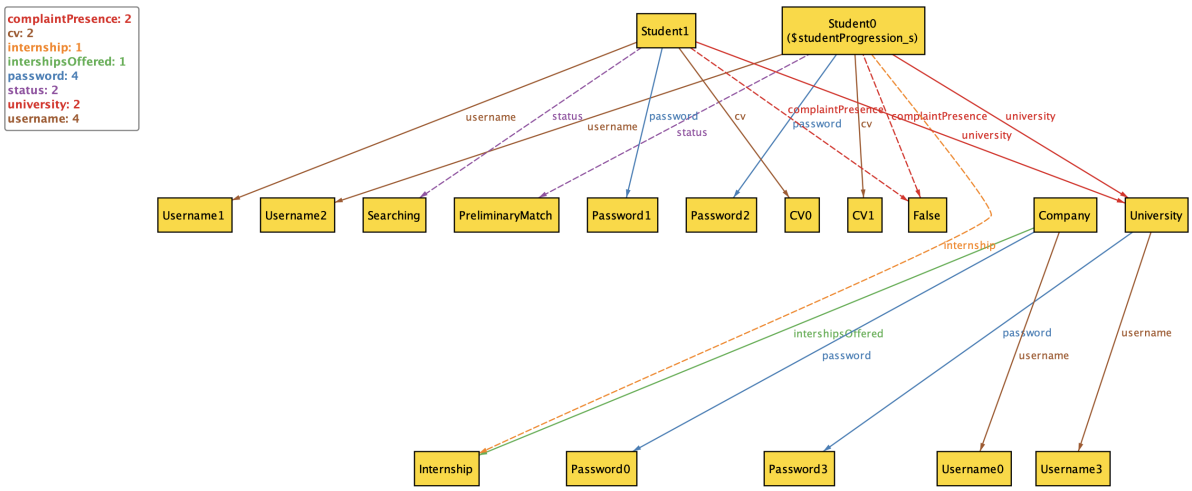
The student remains in the ***FinalMatch*** status, and their `internship` association is preserved. Importantly, the `complaintPresence` reverts to `False`, signifying resolution or removal of the previously registered complaint.



Instant 7: Return to Searching

The student transitions back to the ***Searching*** status, marking a reset in their progression. The `internship` field is set to `none`, and the `complaintPresence` reverts to `False`, demonstrating a clean slate for the student. This evolution likely represents the end of the internship or a termination event, initiated either by the student, the university, or another actor. This state brings the progression full circle, aligning with the cyclic nature of internship matching.

4.1.2. Multiple Entities



Complex State with Multiple Students

In this new, more complex world, we now observe two students within the system. Both students have distinct progressions, but they are at different stages of their internship journey. The first student remains in the ***Searching*** status, while the second student has recently transitioned to the ***PreliminaryMatch*** status, indicating that they have found a potential internship match. The `internship` fields for this last student is populated, reflecting his internship assignments. Importantly, the `complaintPresence` is `False` for both students, suggesting that no complaints are present at this moment. This screenshot highlights the diversity of student experiences within the system, with one student during matching process and the other still in the early stages of searching an internship. The presence of multiple students in different statuses shows the system's capacity to handle multiple entities and track their progress individually while maintaining the overall coherence of the internship matching process.

5 | Effort Spent

Time spent (mesured in hours) on every section of the RASD document by team member

Student	Introduction	Overall Description	Specific Requirements	Alloy
Simone	20	10	10	30
Toni	15	15	35	5
Valeria	15	25	25	5

6 | References

- Diagrams created using: draw.io
- Mockups designed using: Figma
- Alloy models created, executed, and verified using: alloy-6.1.0.8, AlloyGui

7 | Updated Version

- used actor convention in sequence diagrams
- vocabulary alignment (“preliminary questionnaire” instead of “contract”)