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SCUOLA DI INGEGNERIA INDUSTRIALE
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Software Engineering 2

Requirements Analysis and

Specification Document

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1 | Introduction

Today, enriching our CVs to give us more opportunities in the job world became a very important challenge. Fortunately, many universities have contact with several companies that offer students many opportunities to join internships. This platform facilitates the contact between companies that need students for internships and students interested in enriching their CVs.

S&C not only connects the two sides, it also helps them to become attractive to each other, providing advice: to students during the registration and upload of their CVs, to the companies during the process of publishing internships.

Moreover S&C provides a recommendation service that advertises internships to potentially interested students, and notifies companies about the availability of students CVs corresponding to their needs.

1.1. Purpose

The purpose of this document is to provide:

- a full and detailed description of the S&C platform to enable developers to implement requirements;
- a potential contract between supplier and customer;
- a clear and unambiguous description of the high-level functionalities and system goals that can allow customers to verify if the system meets expectations.

1.1.1. Goals

Below there is a table that lists all the goals of the S&C system:

ID	Description
G1	Allow companies to post their internship opportunities
G2	Allow students to search for available internships
G3	Notify students when an internship that might be of interest to them is posted
G4	Notify companies when a student matching their needs becomes available
G5	Provide tools for both companies and students to manage the selection process
G6	Collect feedback from students and companies to improve the matchmaking process
G7	Provide suggestions for companies to improve internship descriptions and for students to improve their resumes
G8	Allow all parties to monitor the status of the matchmaking process and the assigned internship
G9	Allow universities to monitor internships and handle any problems

Table 1.1: Goals table.

1.2. Scope

In the S&C platform, there are three main participants: students, companies, and universities.

Students can register on the platform by filling in some questionnaires and uploading their CVs.

Companies can publish new internships with the corresponding information about domain, topics, technologies adopted ecc.

Students can apply for internships.

The university monitors the situation of internships to handle complaints.

1.2.1. World Phenomena

ID	Description
WP1	The Company wants to publish its internships
WP2	The Student wants to upload his information
WP3	The Student wants to look for available internships
WP4	The Student wants to apply for an internship
WP5	The Company wants to offer an internship to a student
WP6	The Company wants to accept a student for an internship
WP7	The Company wants to interview a student
WP8	The Student wants to monitor application status
WP9	The Company wants to make a complaint
WP10	The Student wants to make a complaint
WP11	The University wants to handle complaints
WP12	The Company wants to submit questionnaires to students
WP13	The Student wants to respond to questionnaires
WP14	The company makes a final selection after all interviews

Table 1.2: World Phenomena.

1.2.2. Shared phenomena

ID	Description	Controller	Observer
SP1	The Company logs in his account in the S&C system	CP	S&C
SP2	The Company logs out of his account from the S&C system	CP	S&C
SP3	The Student creates an account in the S&C system	ST	S&C
SP4	The Student logs in his account in the S&C system	ST	S&C
SP5	The Student logs out of his account from the S&C system	ST	S&C
SP6	The Company sets the domain for the internship	CP	S&C
SP7	The Company sets the topics for the internship	CP	S&C
SP8	The Company sets the technologies adopted in their project	CP	S&C

SP9	The Company sets the terms of the internship	CP	S&C
SP10	The Company publish its internship	CP	S&C
SP11	The Company checks his published internships	CP	S&C
SP12	The Student fills the experiences form	ST	S&C
SP13	The Student fills the skills form	ST	S&C
SP14	The Student fill the attitudes form	ST	S&C
SP15	The Student upload his CV on the system	ST	S&C
SP16	The Student visualize his profile overview	ST	S&C
SP17	The Students check for internship with keyword searching	ST	S&C
SP18	The Students check for internship in his recommendation list	ST	S&C
SP19	The Student apply for an internship	ST	S&C
SP20	The Company check for students in his recommendation list	CP	S&C
SP21	The Company contacts a student for an internship	CP	S&C
SP22	The Company accept an application for an internship	CP	S&C
SP23	The Student accept an offer for an internship	ST	S&C
SP24	The Company creates questionnaires to be submitted to internship applicants	CP	S&C
SP25	The Student completes questionnaires or tasks given to him	ST	S&C
SP26	The Company finalize the selection and submit it to the system	CP	S&C
SP27	The Company fills the feedback form	CP	S&C
SP28	The Students fills the feedback form	ST	S&C
SP29	The Company makes a complaint about a student	CP	S&C
SP30	The Student makes a complaint about an internship	ST	S&C
SP31	The university monitors the status of an internship	ST	S&C
SP32	The University handle a complaint from the Company	UV	S&C
SP33	The University handle a complaint from the Student	UV	S&C
SP34	The University interrupt an internship	UV	S&C
SP35	S&C adds the internship to the Company's Internship list	S&C	CP

SP36	S&C informs Companies about the availability of students corresponding to their needs	S&C	CP
SP37	S&C informs Students about an internship offer	S&C	ST
SP38	S&C informs Students about an internship that might interest them	S&C	ST
SP39	S&C informs the Company about a student's application for an internship	S&C	CP
SP40	S&C informs the Student about an internship acceptance	S&C	ST
SP41	S&C informs the Company about an internship acceptance	S&C	CP
SP42	S&C keeps track of the responses submitted by the students	S&C	ST
SP43	S&C informs the Students that they've been selected or rejected	S&C	ST
SP44	S&C collect feedback and suggestions from Students	S&C	ST
SP45	S&C collect feedback and suggestions from Company	S&C	CP
SP46	S&C collect complaints from Students	S&C	ST
SP47	S&C collect complaints from Company	S&C	CP

Table 1.3: Shared Phenomena.

1.3. Definitions, Acronyms, Abbreviations

1.3.1. Definitions

- **Internship:** Temporary work position offered by a company for students.
- **Matchmaking:** This term is central to the operation of the S&C system. It describes the key process that matches students with internship opportunities, distinguishing the system from a simple job search platform.

1.3.2. Acronyms

- **RASD:** Requirements Analysis & Specification Document

- **UI:** User Interface
- **UML:** Unified Modelling Language
- **API:** Application Programming Interface
- **S&C:** Students & Companies
- **CV:** Curriculum Vitae
- **GX:** Goal X
- **DAX:** Domain Assumption X
- **WPX:** World Phenomena X
- **SPX:** Shared Phenomena X
- **RX:** Requirement X
- **UCX:** Use Case X

1.3.3. Abbreviations

- **ST:** Student
- **CP:** Company
- **UV:** University

1.4. Revision history

- Version 1.0 - 22/12/2024

1.5. Reference Documents

The document is based on the following materials:

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

1.6. Document Structure

The document is divided into six sections, each with its unique focus, as outlined below.

Introduction: The first section provides a brief overview of the project, presenting its objectives, purposes, and motivations, along with a concise analysis of global and shared phenomena. It also highlights the goals to be achieved through its development and includes a glossary of abbreviations and definitions essential for understanding the problem.

Overall Description: The second section offers a comprehensive overview of the problem, providing a high-level description of how the system operates. It includes a detailed analysis of the phenomena involving the world, the machine, or both, alongside a thorough exploration of the domain, including its assumptions, dependencies, and constraints. Additionally, it examines various scenarios and outlines the characteristics of both the product and its users.

Specific Requirements: The third section focuses on an in-depth analysis of the specific requirements necessary to achieve the project goals. It provides detailed insights into external interface requirements, functional requirements, and performance requirements, as well as additional information valuable for developers, including hardware and software constraints.

Formal Analysis Using Alloy: The fourth section provides a formal description of the world phenomena using Alloy. Its primary purpose is to validate the accuracy of the model described in the preceding sections, presenting the results of the conducted checks and meaningful assertions.

Effort Spent: The fifth section details the contributions of each group member, outlining the time spent and individual efforts dedicated to the creation of this document, organized by section.

References: The final section serves as a bibliography, providing references to all documents, software, and additional resources utilized in the creation of this document.

2 | Overall Description

2.1. Product perspective

2.1.1. Scenarios

Scenario 1: Unregistered ST creates an account Aldo Pinesco is looking for an internship to get a taste of the working world, so he decides to join S&C. First, he opens the website and clicks on the Sign-up button, then he inserts his name, surname, email and password in order to create a new account.

Scenario 2: ST updated their resume When the student Cristiano Prendano has created his account on S&C platform, for make his profile visible to the CPs, he must to upload his CV. When Cristiano tries to upload his CV the S&C asks him to answer questions about CV such as his skills, attitudes and interests.

Scenario 3: CP creates and publishes a new internship The Lazzari Company, which is an established company in the Cybersecurity field, wants to offer a professional internship and reach out to as many students as possible. For doing so, they use the S&C system, so they first define the internship domain by choosing from the several available options, then they define the topics and technologies adopted still using the suggestions offered by the system, and finally they also define the terms of the internship, such as the possibility of being paid or other benefits that a company can offer. Finally, by clicking on the "Publish" button, the internship will be added to the company's showcase, which can be seen from everyone, and also to the system's database, on which the recommendation algorithm works, so that it can immediately start working to find potentially suitable people.

Scenario 4: CP updates or removes an internship One month ago, Corean Company published an internship for four students. During the last month 3 student have been accepted, so the Corean Company logs in their account, open his posts section, search for the internship and update the available position.

Scenario 5: ST receives internship recommendations The student Riccardo Pi-anabasso, who has already uploaded his information, has received a notification from the system informing him about a new internship match. After clicking on the message inbox section, he finds a message with all the information about the internship to which he has been matched. Now he has two options, accept or reject the internship. If he refuses, the match is discarded from the system and the company is notified; if he accepts the system will show either that the company has already accepted/rejected the student for the interview or that the company response is pending.

Scenario 6: ST apply for an internship After finding an internship suitable for him, the student Mirco Opaco , click on the apply button and waits for the company response. The system sends to company the application request by Mirco Opaco that will be reviewed.

Scenario 7: CP reviews applications for an internship The fintech company Sos-soldi is looking for an intern to join their budget management team. Their ad received several applications via S&C. Marco Lazzaro, the hiring manager, accesses the "Applications" section, where he reviews the details of each candidate. After going through their CVs and motivational letters, he selects the three best candidates and contacts them.

Scenario 8: CP contacts a student for an internship After finding a suitable student for the Company, the hiring manager opens the student profile and sends an application request to the student for an internship. The system sends a notification to the student about the application request.

Scenario 9: CP conducts interviews for candidates After both parties accept the application, the company begins to construct questionnaires or tasks to be submitted to the applicant, using the help provided by the system. Once this phase is completed, the company sends the material to the students, who can start the assignments. The system then collects the information and sends it to the company, which can decide how to proceed based on its own policies, such as requiring a personal interview, completing other tasks, or accepting the student.

Scenario 10: User makes a complaint While working at Pizza Tech, Emily realizes that her task are different from what was written in the internship description. So she logs into the S&C platform, goes to the internship page and clicks on the button "File a complaint". Emily fills out the form, clearly stating the differences between the job

description and the actual tasks assigned. The complaint is automatically forwarded to her university.

Scenario 11: Users provide feedback after an internship After completing his internship at BioTech, Lorenzo receives a notification from S&C asking him to leave feedback about his experience. He fills out a form indicating aspects such as the skills he gained, the support received from the company, and the clarity of objectives. At the same time, his mentor at BioTech fills out a similar form to evaluate Lorenzo, highlighting his problem-solving skills and enthusiasm. Both feedbacks are stored in the system and will be used to improve future matches.

Scenario 12: UV monitors internship progress The responsible for students participating in the internships periodically logs in in the S&C system and monitors the progress of students at his university through the list the systems shows him on his home page.

Scenario 13: UV handles complaints The university receives a notification from S&C about a complaint about one of its students. A partner company has reported that a student failed to show up for a scheduled interview. The university reviews the case details, contacts the student for clarification and sends a response to the company with an explanation and an approach to avoid similar issues in the future.

Scenario 14: S&C notifies Users about a new matching Every day, the S&C system runs its recommendation algorithms to identify matches between students and internships based on their profiles, preferences, and internship criteria. For instance, Chiara Lombardi, a computer science student specializing in artificial intelligence, receives a notification from S&C about a new internship opportunity at NeuralNet Solutions. The system highlights that this internship involves working on a project with AI-based recommendation systems, which aligns with Chiara's skills and preferences.

Chiara logs into her account, opens the "Notifications" section, and clicks on the recommended internship. She reviews the details and decides whether to express her interest in the position or dismiss the recommendation. Similarly, NeuralNet Solutions is notified about Chiara's profile matching their internship requirements. They can review her CV and decide whether to contact her for further evaluation.

Scenario 15: S&C updates ST on the progress of their application Franco applied for a data science internship offered by HugeData through the S&C system. A

few days later, he receives a notification that his application has been accepted and he is scheduled for an interview. In the notification, he finds the interview details: the date, time, and a link to join. He confirms his availability by clicking "Accept interview".

2.1.2. Class diagrams

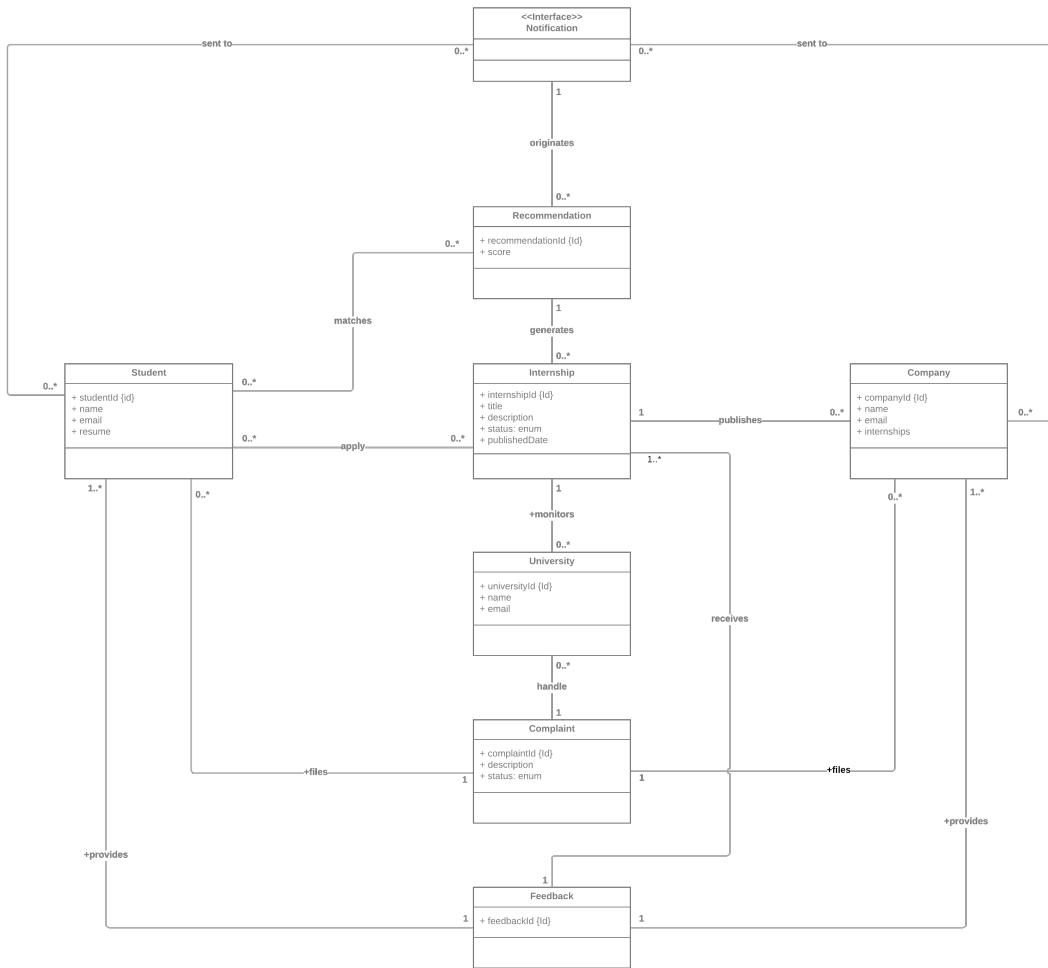


Figure 2.1: High level Class Diagram.

The UML class diagram illustrates the key entities and their relationships within the system. The Student entity represents users seeking internships, with attributes such as studentId, name, email, and resume. Students can apply for internships and are matched with recommendations generated by the system. The Company manages multiple internships and receives recommendations, which are lists of students matching their criteria.

The Recommendation entity, generated by internships and students, connects students to opportunities based on their profiles and scores. Notifications, represented by the

Notification interface, are sent to both students and companies, informing them of recommendations updates. The University oversees internships by monitoring their progress and handling Complaints, submitted by students or companies, which include attributes like description and status.

Lastly, Feedback, provided by students and companies, helps improve the internship experience. Relationships such as publishes, monitors, handles, and provides ensure clear responsibilities and interactions between entities, supporting a robust and scalable system.

2.1.3. State diagrams

In this section are presented the State Diagrams of the S&C system representing possible operations that a user can perform.

ST sign-up. When a student wants to register on S&C system, is asked to provide his credentials, like email address, password, name and surname, in a registration form. If the provided credentials are considered valid (i.e. ensuring that email already used or password is too weak), S&C system will send to the provided email a confirmation message. Upon the user confirming the registration through the provided email link, the new account is successfully created. If the provided credentials are considered not valid, S&C redirects user to the sign-up form with an error message.

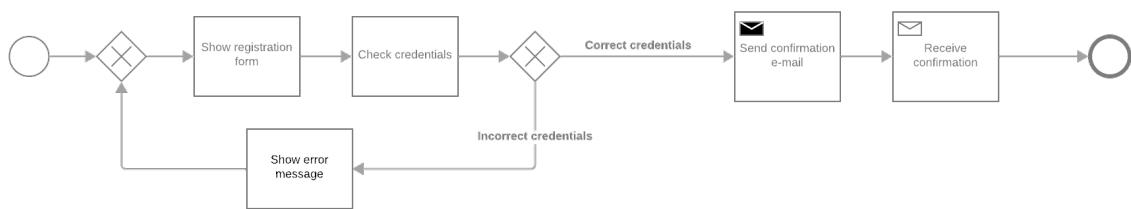


Figure 2.2: ST sign-up state diagram

Login. When a registered user wants to log in to his S&C account, he must enter his credentials into login form. If the provided credentials are valid (a corresponding account is in the S&C database) S&C redirect the user to his Home Page built according to the type of user:

- ST: S&C shows him the recommended internships and a search bar;
- CP: S&C shows him the recommended students;

- UV: S&C shows him the list of its students who are engaged in an internship.

If the provided credentials are considered not valid, S&C redirects user to the login form with an error message.

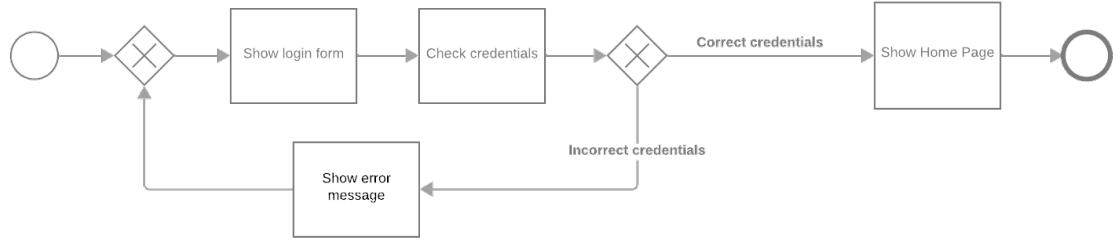


Figure 2.3: Login state diagram

Update CV. Once a student is registered, he must upload his CV for himself available for the internships, he can find the "upload CV" form in his personal area. First he must upload the .pdf file of the CV, then S&C start to ask him about his personal experiences, skills and attitudes with specially designed questionnaires. During this process if the student upload CV with wrong file format or insert some invalid parameters in questionnaires, S&C redirect him to the previous questionnaire showing an error message.

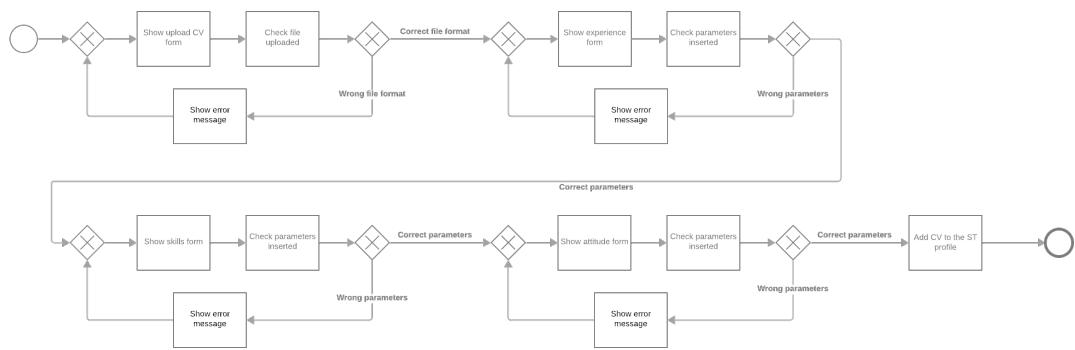


Figure 2.4: Update CV state diagram

Publish an internship. When a company intends to publish a new internship, it is required to input various parameters in the "publish internship" form. In this form, the company must specify various information regarding the project (application domain, tasks to be performed, relevant adopted technologies etc.) and terms offered by companies

(for example, some company might offer paid internships and/or provide both tangible and intangible benefits, such as training etc.). S&C checks the completeness of the data inserted and if it is incomplete, redirect the CP to the "publish internship" form showing an error message.

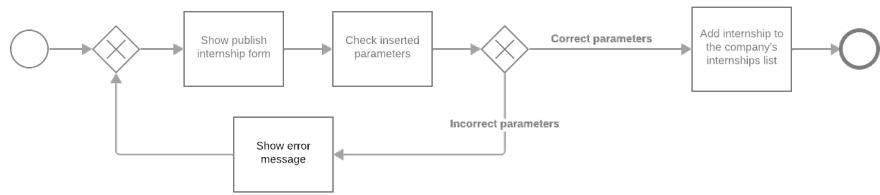


Figure 2.5: Publish an internship state diagram

Search for an internship. Students can use the search bar in their Home Page to search for a specific internship by entering a name or keyword. When a search query is entered, S&C will present a list of internships whose names contain the specified keyword. Students can click on a particular internship from the search results and S&C redirect them to the page that contain the internship detailed information and the "apply" button.



Figure 2.6: Search for an internship state diagram

Apply for an internship. After receiving a notification of a suggested internship or after a targeted survey, students can click on the "apply" button on the internship post to submit their request. S&C will send to the company a notification about the application request and redirect the student, who perform the request to the Progress Page of the application. Progress Page of the application contain all the information about the current state of the application request.

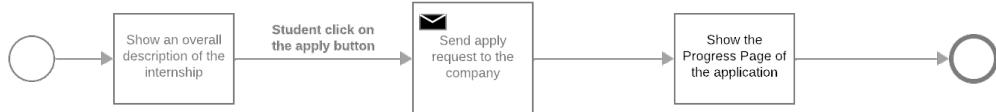


Figure 2.7: Apply for an internship state diagram

Ask for a ST application. On the "Published Internship" section, CP can see the list its published internship, select one of them and then retrieve the lis of recommended student for the selected internship. After selecting all suitable student, CP can click on the (now available) "invite" button, to send them a request of application. S&C will send a notification to the interested students and redirect the company to the Progress Page of the application that contain all the information about the actual state of the application request.

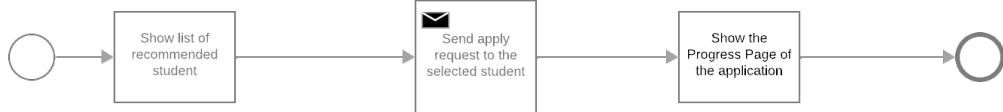


Figure 2.8: Ask for a ST application state diagram

Reviewing for an apply request. Companies can review the application requests from the section dedicate or after receiving a notification. They can click on the student names to view their profiles and then reviewing their CV. CP can decide to accept or reject the request with the dedicated buttons. If CP accept a request, S&C will send a notification to the student and authorizes the assignment of tasks by the company. If CP reject the request, S&C will send a notification to the student and also show the rejection in the progress page.

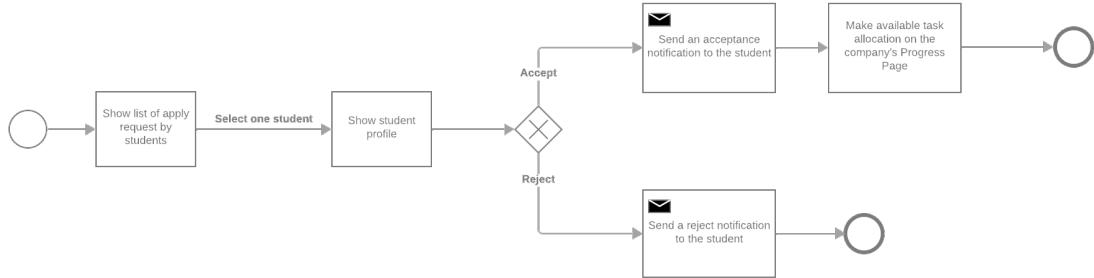


Figure 2.9: Reviewing for an apply request state diagram

Create task for interviews. When a CP wants to assign some task to a student, it can open the Progress Page of the student's application and click the "create task" button. Upon clicking button, CP has the task form and has to fill them with task's requirements, delivery instruction and deadline. Upon submission, S&C will add task to the Progress Page of the application and notify the ST about new assignments. S&C checks the completeness of the data inserted and if it is incomplete, redirect the CP to the task form showing an error message.

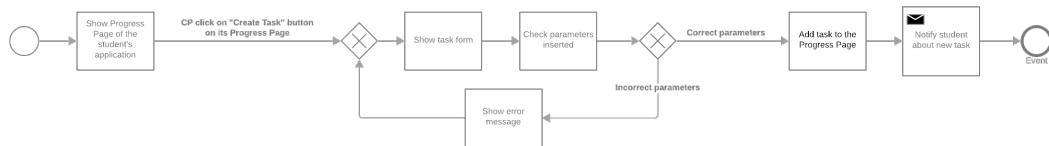


Figure 2.10: Create task for interviews state diagram

Solve tasks and questionnaires. Once receiving new task assignments, a student can go to the Progress Page of the application and select the task he wants to perform. If the deadline is expired, student cannot select the task. Students perform the task and complete the questionnaire according to the delivery instructions. Upon submission, S&C send a notification to the company and collect the answer.

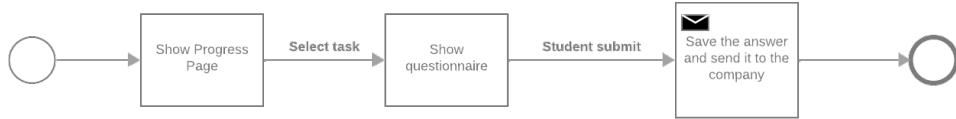


Figure 2.11: Solve tasks and questionnaires state diagram

Finalize selection. When CP decide to finalize de selection process, it can see the list of applicant for an internship through a dedicated page and select suitable student. Once CP submit names of suitable student, S&C add selected student to the internship's list and notifies both selected and rejected students.

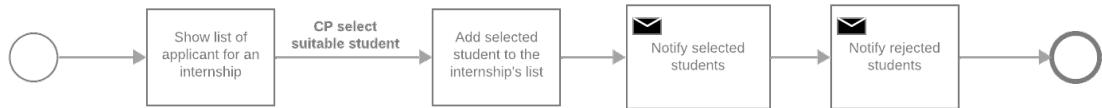


Figure 2.12: Finalize selection state diagram

Logout Users can log out from their account at any time by clicking the "logout" button. Upon clicking the button, S&C terminates the user's session and redirect him to the log in page, providing them the opportunity to rejoin the S&C system if they want to do so.

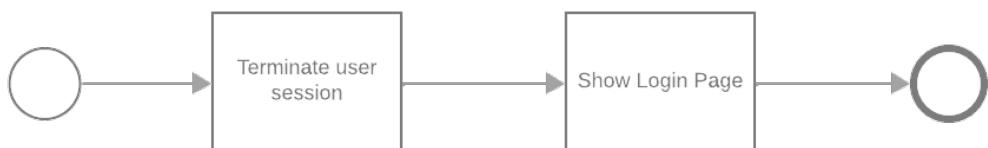


Figure 2.13: Logout state diagram

2.2. Product functions

Here are listed a summary of the main functions of the S&C system:

Sign-up: The ST submits his name, surname, email address and a new password. A confirmation mail is required to complete the process.

Login: The User sign in after typing his email and password in the login form.

Update CV: A ST can update their data after creating a new account, including experience, skills, attitude and the resume .

Publish an internship: A CP can publish an internship proposal through the "create new internship" section.

Search for an internship: A ST can look for an internship by keyword search or by setting some predefined filters, even both simultaneously.

Apply for an internship: A ST can apply for an internship by clicking on the "Apply" button on an internship post.

Ask for a ST application: A CP can send a notification of interest to a student from the list of recommendations provided by the system.

Reviewing an apply request: A company can decide whether to accept or reject a student's application from the application section or after receiving a notification via the inbox.

Create task for interviews: A CP can prepare tasks or questionnaires to evaluate candidates through the system's interview management section. These tasks may include technical challenges, situational assessments, or other relevant exercises, which are assigned to candidates. Once the tasks are completed and reviewed, the CP can schedule further interviews directly through the system, specifying the date, time, and format, and notifying candidates.

Solve tasks and questionnaires: A ST can access and complete the tasks or questionnaires assigned by a CP through their profile. After submission, the system automatically

records their responses and notifies the CP about the completion, allowing them to evaluate the candidate's performance.

Finalize selections : After reviewing completed tasks and conducting interviews, a CP can finalize their selections for an internship position. This includes marking the selected students and notifying them through the system, while also sending updates to unselected candidates.

Logout: A User session will be closed if the User clicks on "Logout" button. Next time the User opens S&C he will need to log in again.

2.3. User characteristic

There are three types of users in the S&C platform: Students (STs), Companies (CPs) and Universities (UVs). Below is a description of their main characteristics and functionalities within the platform.

- ST: Students are users seeking internships to gain experience or fulfill academic requirements. They can register and log in to the platform by providing their personal details, educational background, and resume. Once registered, they can:
 - Search for available internships.
 - Apply for internships that match their interests.
 - Receive personalized internship recommendations based on their profiles.
 - Accept or reject internship offers.
 - Provide feedback on their internship experiences after completing them.
- CP: Companies use the platform to find suitable candidates for their internships and ease the selection process. Companies must provide basic information about their organization when registering and then they can:
 - Create, publish, update, or remove internship postings.
 - Search for students who match their requirements.
 - Review applications and contact students.
 - Conduct interviews and finalize candidate selection.
 - Provide feedback about students post-internship.

- UV: Universities act as a supervisor to ensure proper conduct of internships. Universities have access to the feedback and status of internships to maintain oversight and address issues effectively. Universities must provide basic information about them when registering and their primary responsibilities are:
 - Monitoring the progress of internships.
 - Handling complaints or disputes raised by students or companies.
 - Ensuring compliance with academic and professional standards.

2.4. Assumptions, dependencies and constraints

2.4.1. Domain assumptions

ID	Description
DA1	The ST personal information must be correct.
DA2	The ST need to have a valid email address.
DA3	The CP need to have a valid email address.
DA4	The ST need to have a device and a reliable internet connection.
DA5	The CP need to have a device and a reliable internet connection.
DA6	The ST need to be currently enrolled in a UV.
DA7	The UV and CP must have an active partnership with S&C.

Table 2.1: Domain assumptions.

2.4.2. Dependencies

The system has no inherent dependencies on external systems. However, the use of existing infrastructure or third-party libraries could be a good choice to improve system efficiency and reduce development time. These dependencies are optional and would be considered based on a cost-benefit analysis. For example:

- Infrastructure: While the system can be deployed on a custom-built infrastructure, using existing cloud-based platforms (e.g., AWS, Azure, or Google Cloud) could significantly simplify deployment and scalability.
- Third-party Libraries or Tools: Even though the recommendation algorithm can be

developed from scratch, the use of pre-existing libraries could save time and ensure high-quality performance.

2.4.3. Constraints

While no explicit constraints have been provided by the assignment, the development of the system will be influenced by the following general considerations:

- Legal: Compliance with GDPR regulations is mandatory, ensuring the confidentiality and security of personal data provided by users.
- Resource: The system will be designed to operate efficiently on standard server configurations to minimize hosting costs and dependencies.

3 | Specific Requirements

3.1. External interface requirements

3.1.1. User interfaces

The S&C system will be a web app accessible by different devices and form factors, with a responsive UI. The UI will be different based on the type of user, reflecting the different functionalities they need. Every user will need to insert their credentials to have access to the platform and there will be a mechanism to recover them in case of a loss. The UI will comply with accessibility standards to ensure usability for all users, including those with disabilities.

3.1.2. Hardware interfaces

Our platform is a web app, as a consequence, it does not require any specific hardware interface. Users only need a device with a browser to access the website and an internet connection. Latest versions of browsers are suggested to ensure compatibility and optimal performance. The user is free to choose his device but accessing the web app from a desktop form factor is strongly recommended for the best user experience.

3.1.3. Software interfaces

No specific software interfaces are needed. However, a mailing system to send confirmation emails will be used to the users during the registration process. In the future, integrations with university and company tools will be possible to enhance interoperability.

3.1.4. Communication interfaces

The communication interfaces needed by the system include the HTTPS protocol for secure data transfer between the client and server. SSL/TLS certificates will ensure encrypted communication to protect user credentials and sensitive information.

3.2. Functional requirements

3.2.1. Requirements

ID	Description
R1	The system allows STs to register by providing personal information, email, and a password.
R2	The system shall allow Users to log in using their credentials.
R3	The system shall allow STs to edit their profiles, including personal details and contact information.
R4	The system shall enforce role-based access control to restrict access to specific functionalities based on the user type (ST, CP, UV).
R5	The system shall allow CPs to post new internship opportunities, including position details, required skills, duration, and compensation.
R6	The system shall allow STs to apply for internships by submitting a CV and optional cover letter.
R7	The system shall notify CPs when STs apply to an internship.
R8	The system shall allow CPs to review applications and schedule interviews with STs.
R9	The system shall allow CPs to submit questionnaires to STs.
R10	The system shall allow CPs to accept or reject applications and notify STs of the decision.
R11	The system shall allow UVs to manage their students and monitor their activity.
R12	The system shall send notifications to users for events such as application submissions, approvals, or rejections.
R13	The system shall allow CPs to track the progress of STs during the internship and provide regular feedback.
R14	The system shall allow CPs to evaluate the performance of STs at the end of the internship.
R15	The system shall allow UVs to review the feedback and evaluation provided by both CPs and STs.
R16	The system shall allow STs to search for internships using keywords, filters, or location.
R17	The system shall recommend internships to STs based on their skills, preferences, and past applications.

R18	The system shall recommend STs to CPs for specific internships based on their skills, preferences, and past applications.
R19	The system shall allow CPs to search for suitable STs based on their skills, academic background, and CVs.
R20	The system shall maintain a database of all internships, applications, and evaluations.

Table 3.1: Requirements.

3.2.2. Use case diagrams

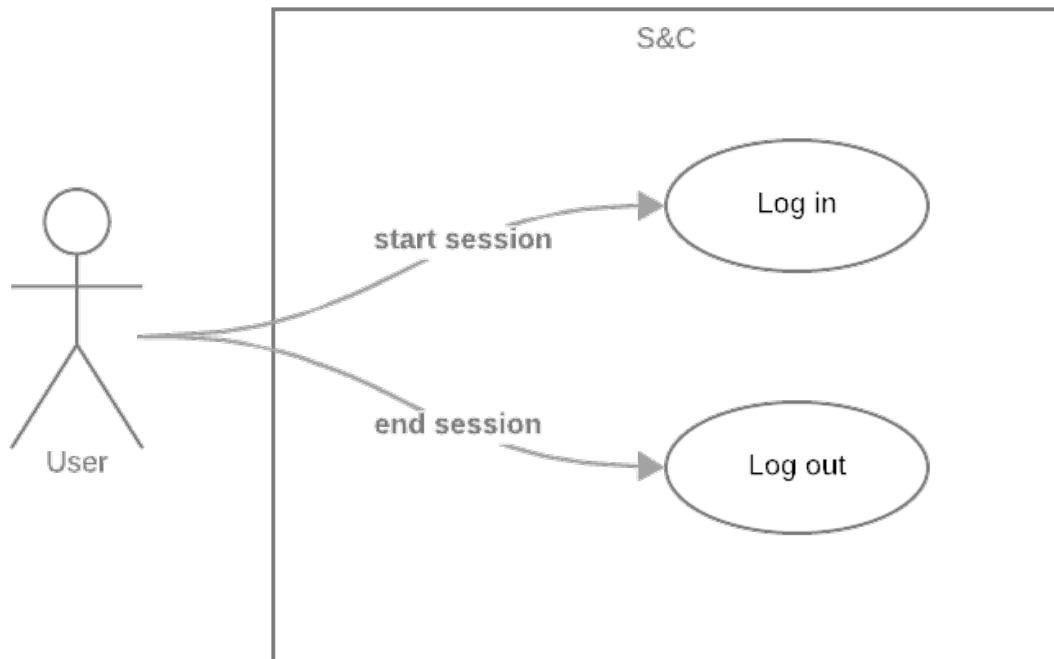


Figure 3.1: Use Cases Diagram for all users.

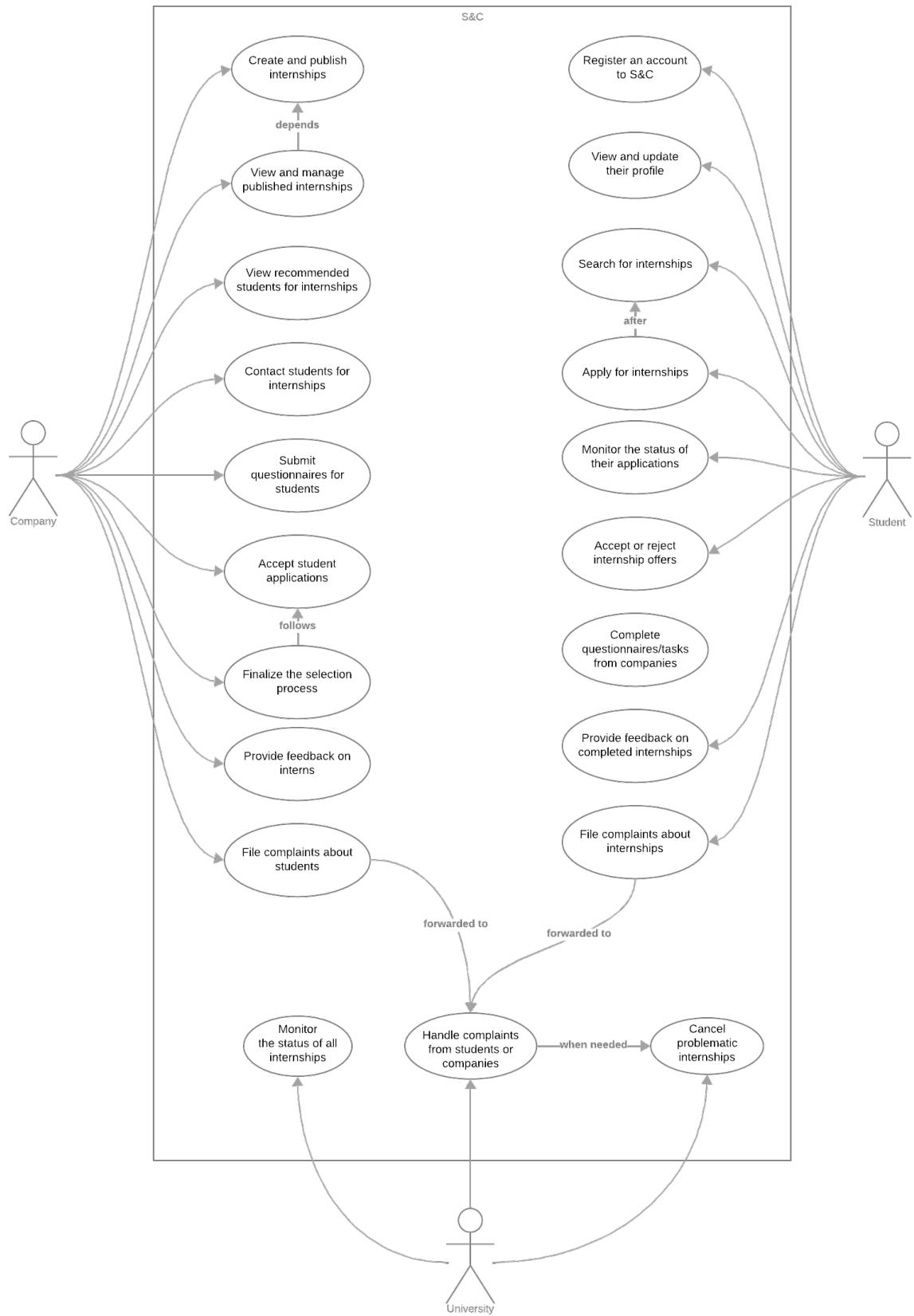


Figure 3.2: Use Cases Diagram for company, student and university.

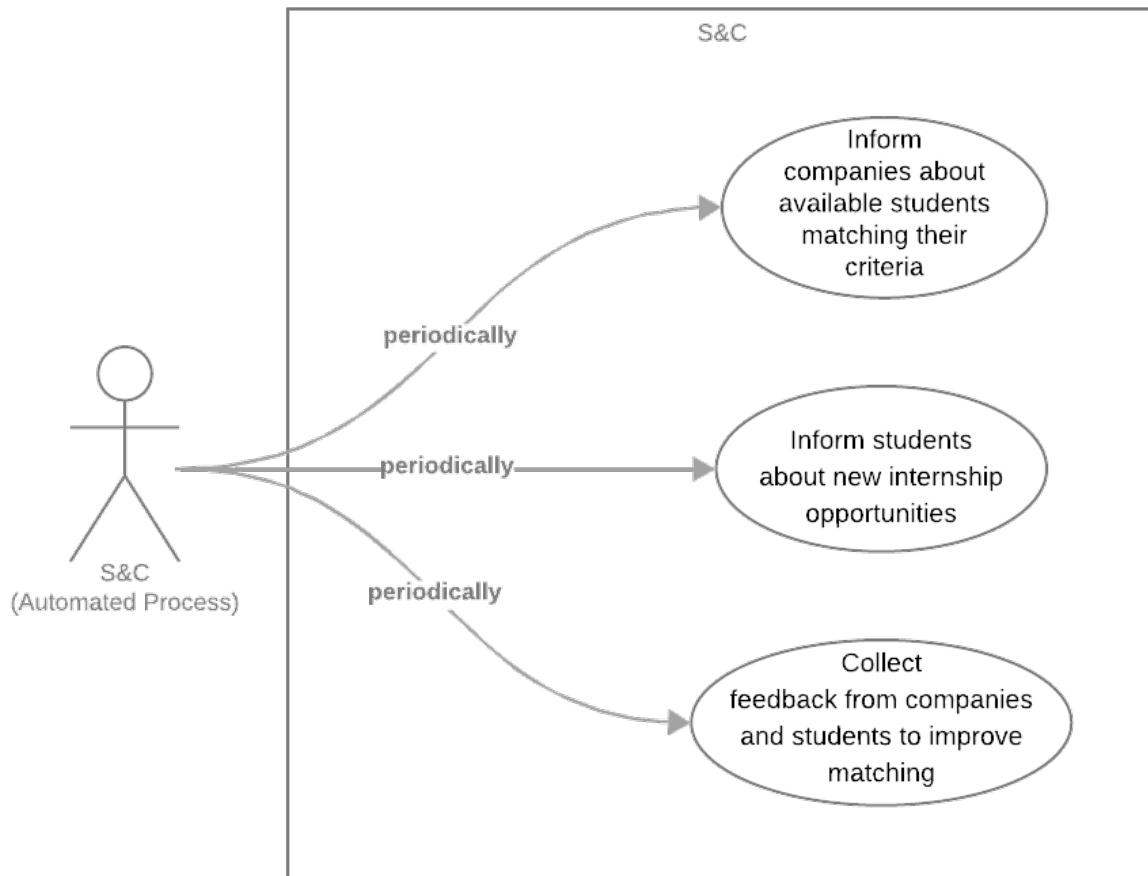


Figure 3.3: Use Cases Diagram for S&C.

3.2.3. Use cases

This section explains the main use cases and how they work. It includes a table for each use case that shows the starting conditions, steps involved, ending conditions, and any exceptions. There's also a sequence diagram that illustrates the messages exchanged between different entities and the functions that are called.

UC1. Log in to the system

Actor	Student (ST), Company (CP), University (UV)
Entry conditions	The user has valid credentials (email and password) and access to S&C's login page.
Event Flow	<ol style="list-style-type: none"> 1 - The user navigates to the login page. 2 - The user inputs their email and password. 3 - S&C validates the credentials. 4 - The user is redirected to their respective dashboard.
Exit condition	The user is logged into S&C and has access to their dashboard.
Exceptions	<ul style="list-style-type: none"> - Incorrect email or password: The system displays an error message. - System unavailable: S&C informs the user and retries later.

Table 3.2: Log in to the system

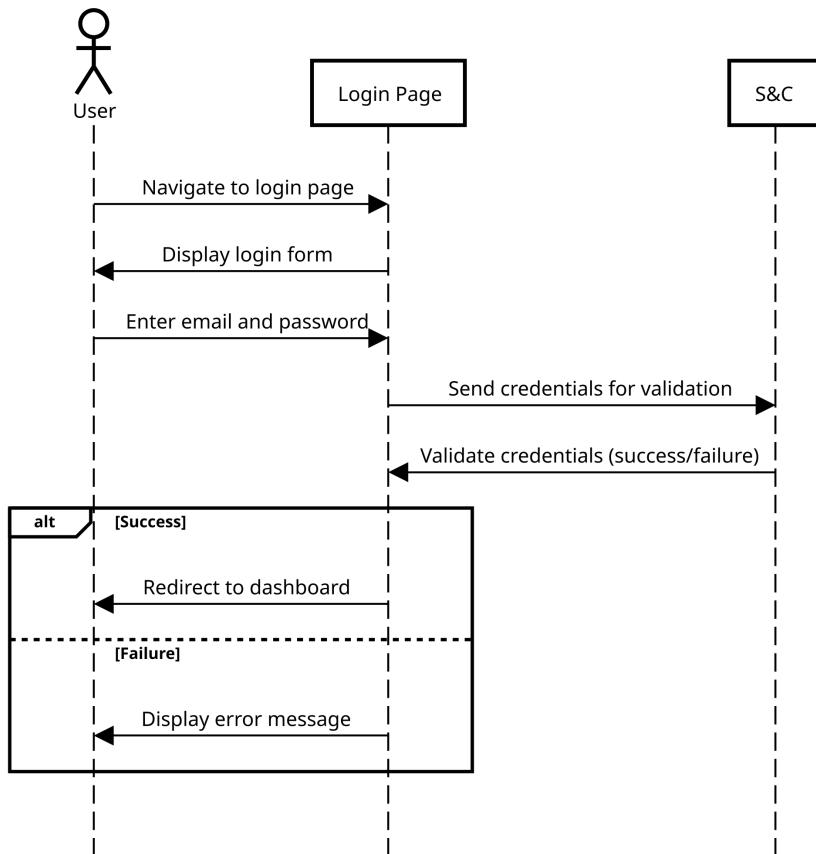


Figure 3.4: Log in to the system sequence diagram.

UC2. Log out from the system

Actor	Student (ST), Company (CP), University (UV)
Entry conditions	The user is logged into S&C and has access to their dashboard.
Event Flow	1 - The user clicks the "Log Out" button. 2 - S&C invalidates the user's session. 3 - S&C redirects the user to the login page.
Exit condition	The user is logged out of S&C and redirected to the login page.
Exceptions	- System unavailable: S&C informs the user and retries later.

Table 3.3: Log out from the system

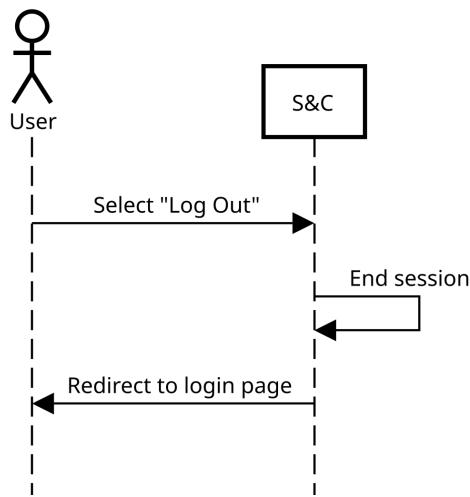


Figure 3.5: Log out from the system sequence diagram.

UC3. Register an account to S&C

Actor	Student (ST)
Entry conditions	The user accesses the registration page of S&C.
Event Flow	1 - The user navigates to the registration page. 2 - The user provides their details (e.g., name, email, password, university). 3 - S&C validates the entered data. 4 - S&C creates the account and sends a confirmation email.
Exit condition	The user receives a confirmation email and the account is created.

Exceptions	<ul style="list-style-type: none"> - Invalid data: S&C prompts the user to correct the information. - System unavailable: S&C informs the user and retries later.
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Table 3.4: Register an account to S&C

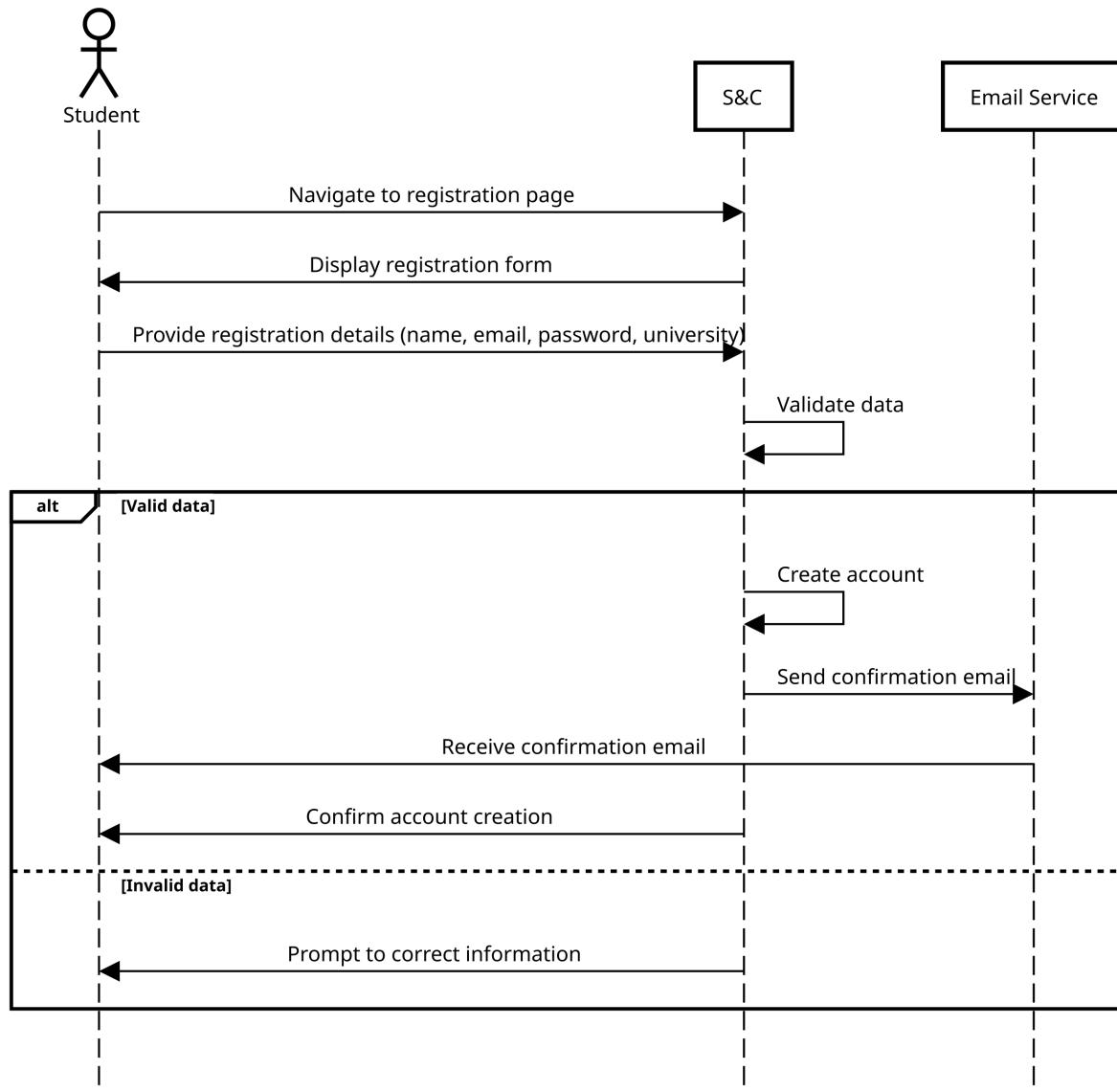


Figure 3.6: Register an account sequence diagram.

UC4. View and update their profile

Actor	Student (ST)
Entry conditions	The student is logged into S&C.
Event Flow	1 - The user navigates to the profile section. 2 - The user views their profile details. 3 - The user updates specific fields (e.g., contact info, skills, CV). 4 - S&C validates the changes. 5 - S&C saves the updated profile.
Exit condition	The user's profile is updated and saved successfully.
Exceptions	<ul style="list-style-type: none"> - Invalid data: S&C prompts the user to correct the information. - System unavailable: S&C informs the user and retries later.

Table 3.5: View and update their profile

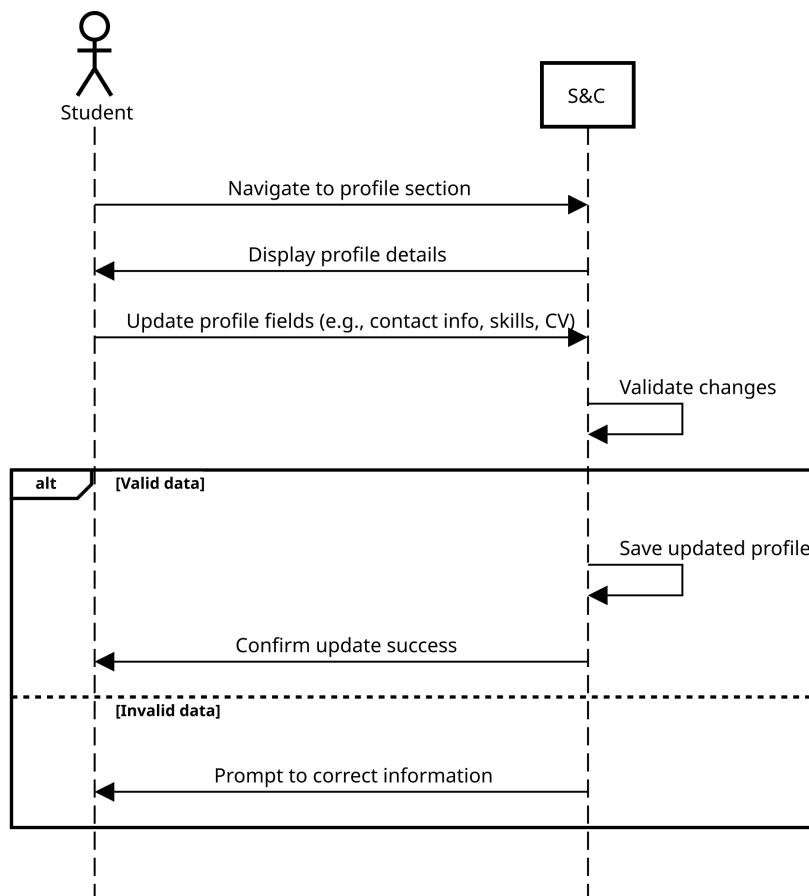


Figure 3.7: View and update profile sequence diagram.

UC5. Search for internships

Actor	Student (ST)
Entry conditions	The user is logged into S&C.
Event Flow	1 - The user navigates to the internships section. 2 - The user searches (e.g. by keywords, location, filters). 3 - S&C processes the search and retrieves results. 4 - The user views the list of available internships.
Exit condition	The user views relevant internship opportunities.
Exceptions	<ul style="list-style-type: none"> - No results: S&C informs the user that no internships match the criteria. - System unavailable: S&C informs the user and retries later.

Table 3.6: Search for internships

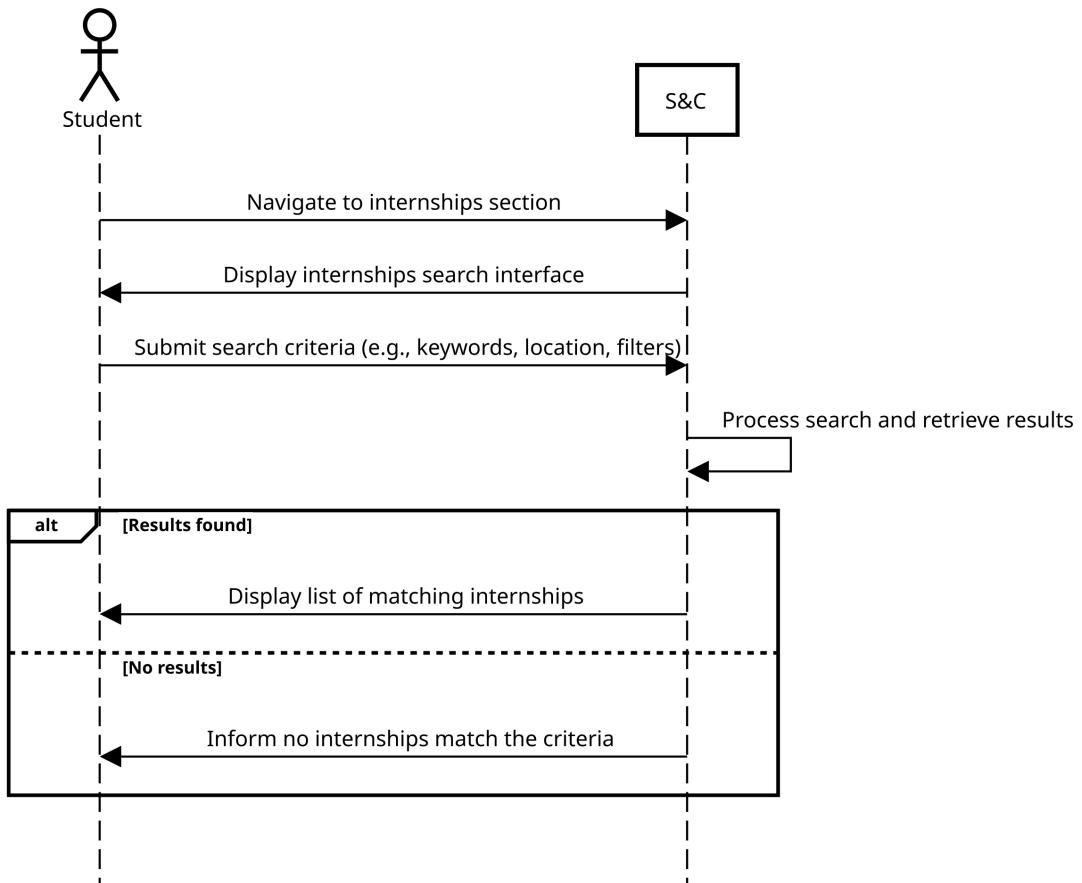


Figure 3.8: Search for internships sequence diagram.

UC6. Apply for an internship

Actor	Student (ST)
Entry conditions	The user is logged into S&C and has selected an internship.
Event Flow	1 - The user navigates to the internship details page. 2 - The user clicks the "Apply" button. 3 - S&C validates the user's eligibility. 4 - S&C submits the application. 5 - S&C confirms the application to the user.
Exit condition	The user's application is successfully submitted.
Exceptions	<ul style="list-style-type: none"> - Not eligible: S&C notifies the user with the reason for ineligibility (e.g. does not have the necessary skills). - System unavailable: S&C informs the user and retries later.

Table 3.7: Apply for an internship

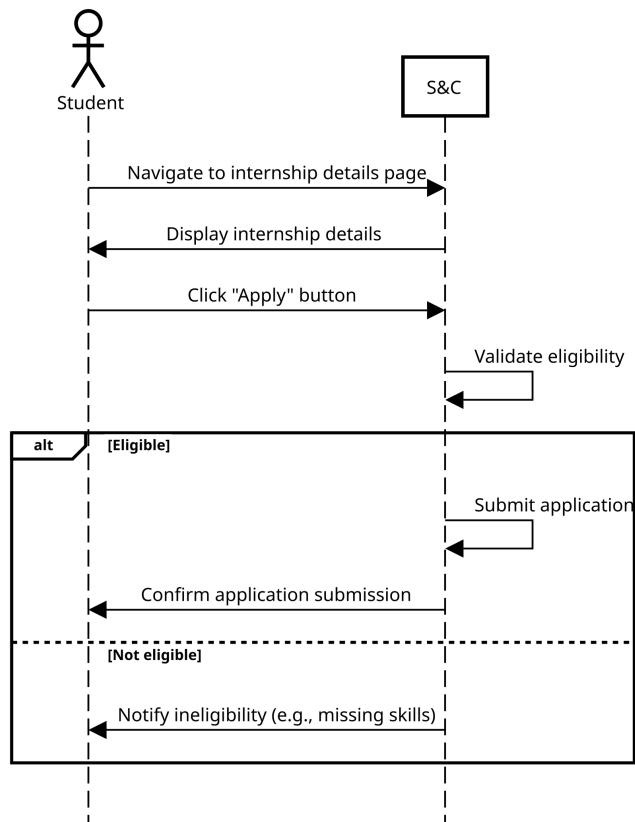


Figure 3.9: Apply for an internship sequence diagram.

UC7. Monitor the status of their applications

Actor	Student (ST)
Entry conditions	The user is logged into S&C and has submitted at least one application.
Event Flow	1 - The user navigates to the "My Applications" section. 2 - S&C retrieves the status of all submitted applications. 3 - The user views the list of applications and their statuses.
Exit condition	The user views the status of their applications.
Exceptions	<ul style="list-style-type: none"> - No applications: S&C informs the user that no applications have been submitted. - System unavailable: S&C informs the user and retries later.

Table 3.8: Monitor the status of their applications

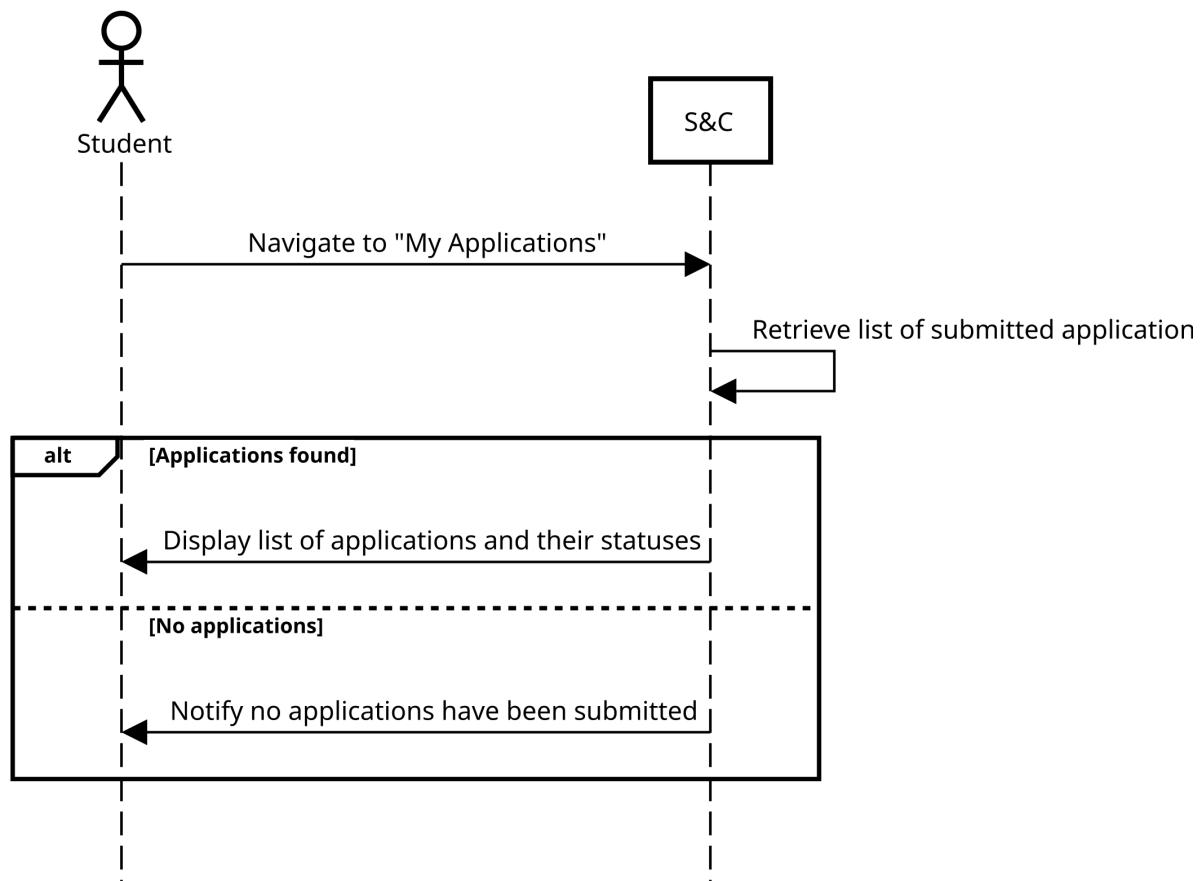


Figure 3.10: Monitor the status of their applications sequence diagram.

UC8. Accept or reject internship offers

Actor	Student (ST)
Entry conditions	The user is logged into S&C.
Event Flow	1 - The user navigates to the "Offers" section. 2 - S&C retrieves the list of received offers. 3 - The user selects an offer to review. 4 - The user chooses to accept or reject the offer. 5 - S&C updates the offer status.
Exit condition	The offer status is updated as accepted or rejected.
Exceptions	<ul style="list-style-type: none"> - No offers available: S&C notifies the user. - Offer expired: S&C notifies the user. - System unavailable: S&C informs the user and retries later.

Table 3.9: Accept or reject internship offers

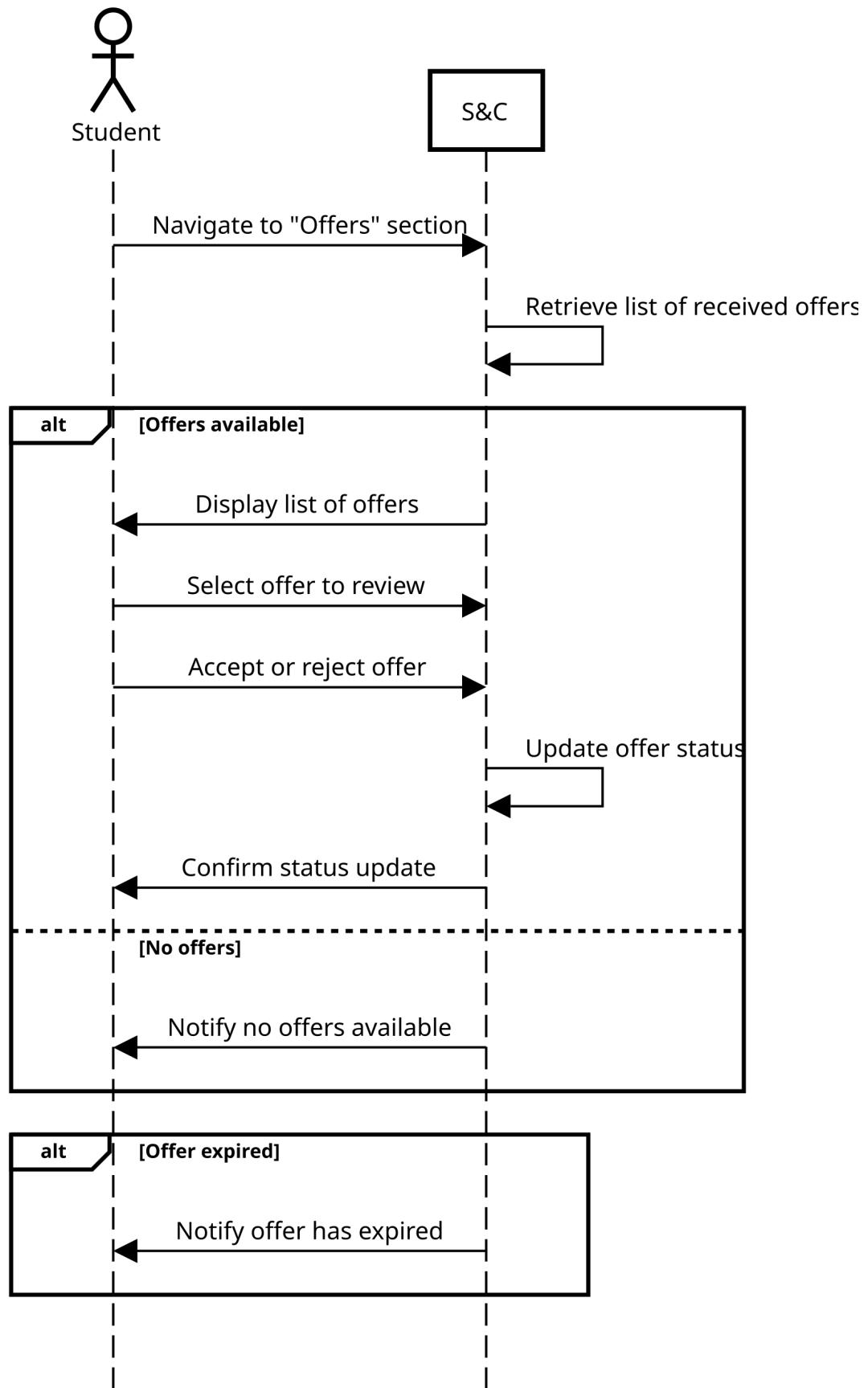


Figure 3.11: Accept or reject internship offers sequence diagram.

UC9. Complete questionnaires from companies

Actor	Student (ST)
Entry conditions	The user is logged into S&C and has received questionnaires by companies.
Event Flow	1 - The user navigates to the received questionnaires. 2 - The user fills out the required fields. 3 - S&C saves and submits the user's responses.
Exit condition	The questionnaire is marked as completed.
Exceptions	- System unavailable: S&C informs the user and retries later.

Table 3.10: Complete questionnaires from companies

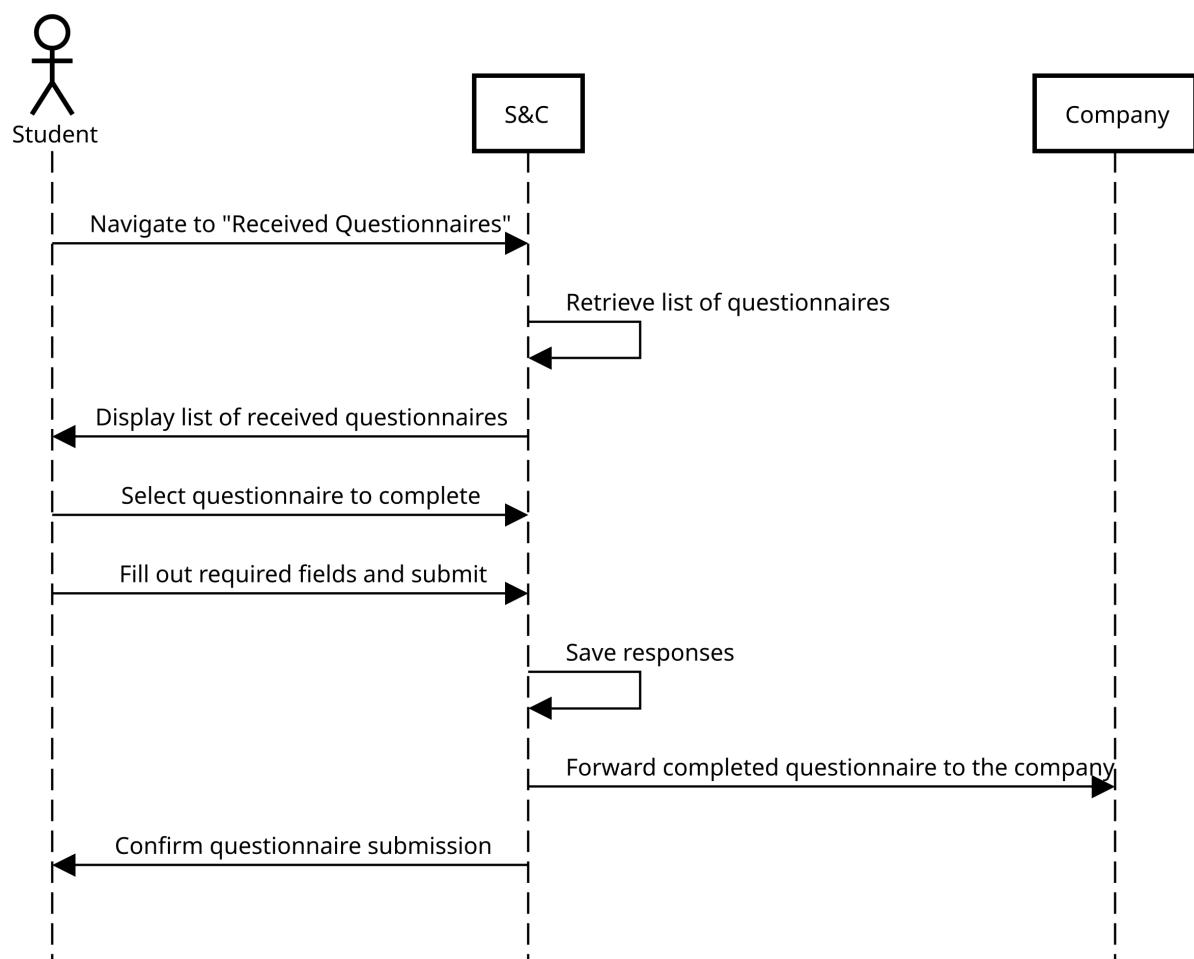


Figure 3.12: Complete questionnaires from companies sequence diagram.

UC10. Provide feedback on completed internships

Actor	Student (ST)
Entry conditions	The user is logged into S&C and has completed at least one internship.
Event Flow	1 - The user navigates to the "Completed Internships" section. 2 - S&C retrieves the list of completed internships. 3 - The user selects an internship to provide feedback on. 4 - The user fills out the feedback form. 5 - S&C saves the user's feedback.
Exit condition	Feedback for the internship is successfully submitted.
Exceptions	- System unavailable: S&C informs the user and retries later.

Table 3.11: Provide feedback on completed internships

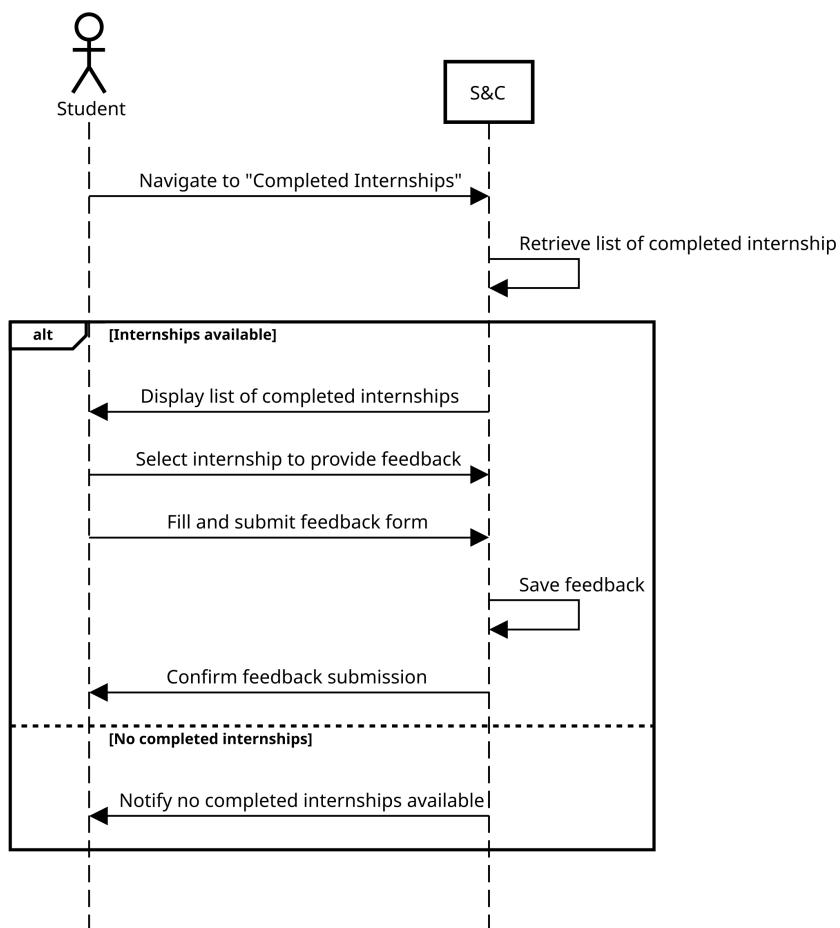


Figure 3.13: Provide feedback on completed internships sequence diagram.

UC11. File complaints about internships

Actor	Student (ST)
Entry conditions	The user is logged into S&C and has encountered an issue with an internship.
Event Flow	1 - The user navigates to the "Complaints" section. 2 - S&C provides the complaint form. 3 - The user fills out the complaint form, describing the issue. 4 - The user submits the complaint. 5 - S&C saves and forwards the complaint to the relevant parties.
Exit condition	The complaint is successfully filed and acknowledged by S&C.
Exceptions	- System unavailable: S&C informs the user and retries later.

Table 3.12: File complaints about internships

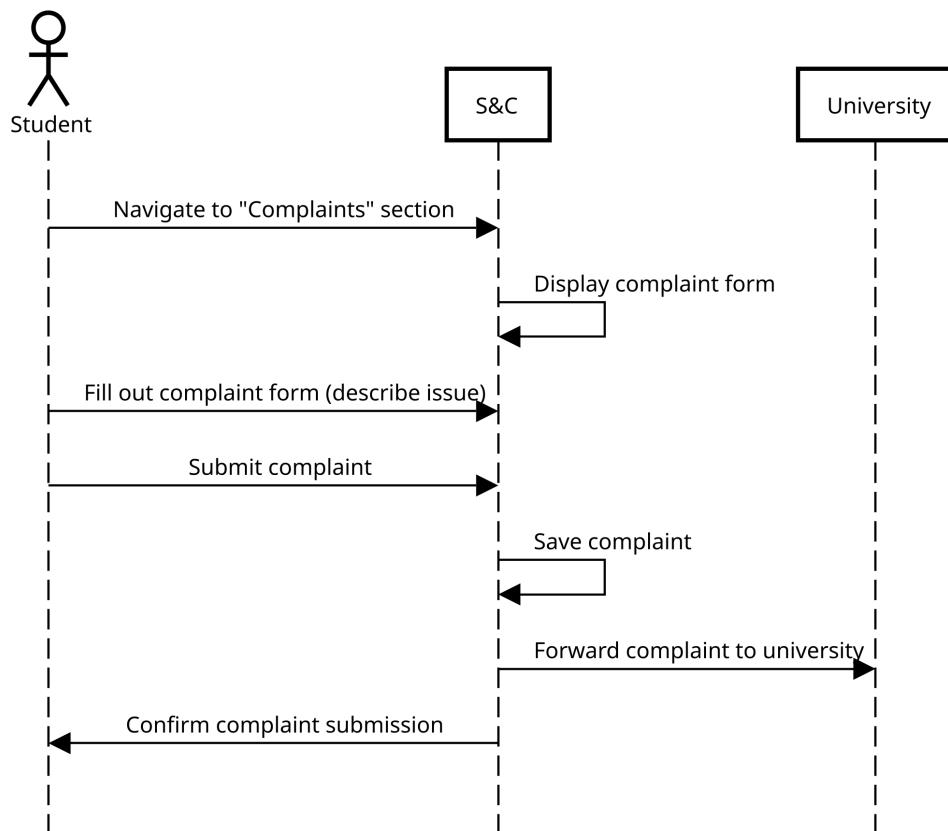


Figure 3.14: File complaints about internships sequence diagram.

UC12. Create and publish internships

Actor	Company (CP)
Entry conditions	The CP is correctly logged in. The CP has decided to create a internship. The CP is on his profile page.
Event Flow	<p>1 - The CP clicks on "Publish a Internship" button.</p> <p>2 - S&C returns the publish internship form.</p> <p>3 - The CP writes the internship name, specify the application domain, tasks to be performed, relevant adopted technologies ad terms offered</p> <p>4 - S&C stores the data of the internship and add it to the CP's internship list</p> <p>5 - S&C sends a notification to the STs that might be interested.</p>
Exit condition	The internship is correctly created and a confirmation message is shown to the CP.
Exceptions	- The internship's information are not correct (internship's name null or already exist, some parameter inserted with not correct format). An error message is shown and the CP is redirected back to the publish internship form.

Table 3.13: Create and publish internships

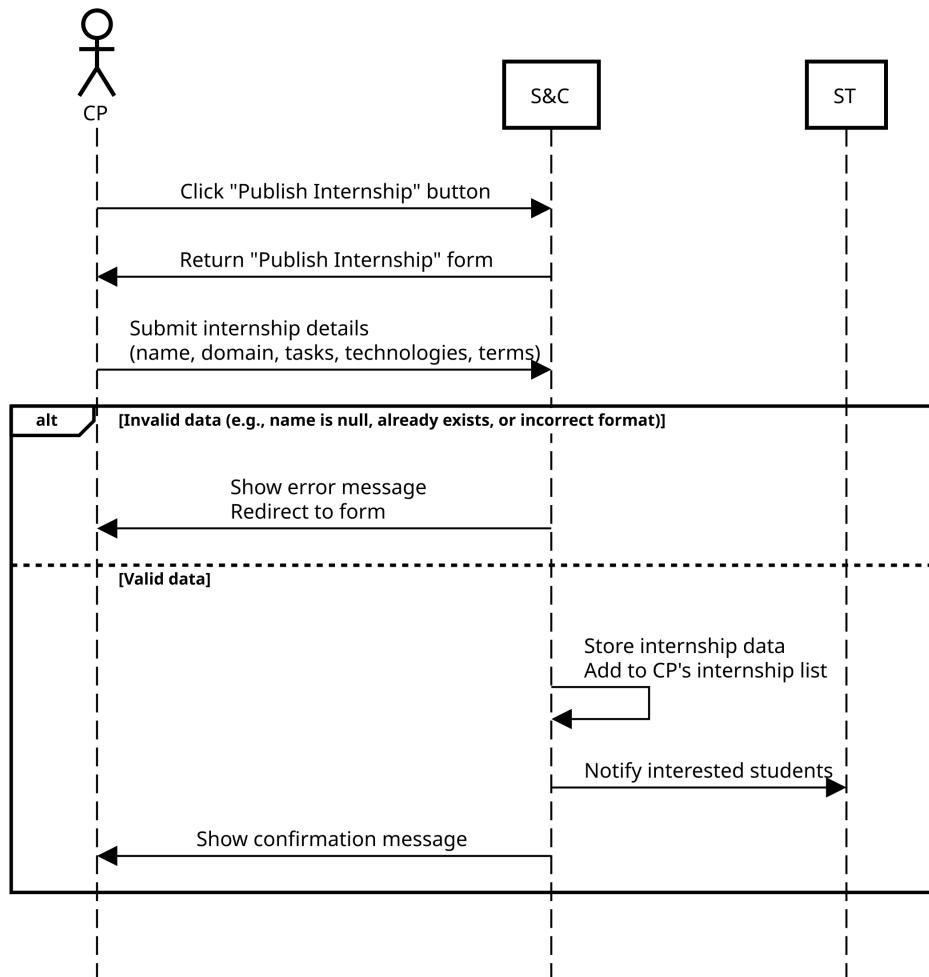


Figure 3.15: Create and publish internships sequence diagram.

UC13. View and manage published internships

Actor	Company (CP)
Entry conditions	The company is logged into S&C and has at least one published internship.
Event Flow	1 - The company navigates to the Published Internships section. 2 - S&C retrieves the list of internships published by the company. 3 - The company selects an internship to view its details. 4 - The company edits, updates, or deletes the internship if needed. 5 - S&C saves the changes or removes the internship.
Exit condition	The company successfully views, updates, or deletes their published internships.

Exceptions	<ul style="list-style-type: none"> - No internships published: S&C informs the company that no internships are available for management. - Invalid updates: S&C notifies the company of the errors and prompts for corrections. - System unavailable: S&C logs the issue and retries later.
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Table 3.14: View and manage published internships

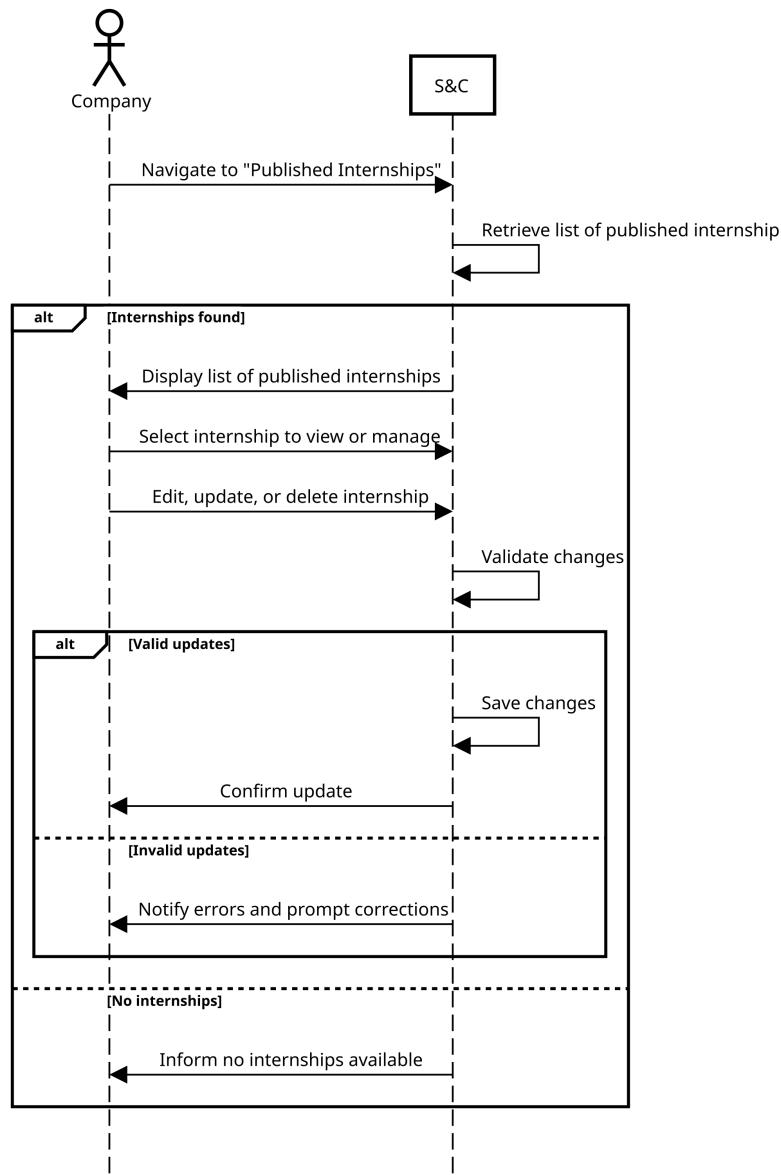


Figure 3.16: View and manage published internships sequence diagram.

UC14. View recommended students for internships

Actor	Company (CP)
Entry conditions	The company is logged into S&C and has at least one published internship.
Event Flow	1 - The company navigates to the "Published Internships" section. 2 - S&C retrieves the list of internships published by the company. 3 - The company selects an internship to view its details. 4 - S&C retrieves internship's details and the list of suggested students.
Exit condition	The company successfully views the list of suggested students.
Exceptions	<ul style="list-style-type: none"> - No recommended students: S&C informs the company that there aren't recommended students. - System unavailable: S&C logs the issue and retries later.

Table 3.15: View recommended students for internships

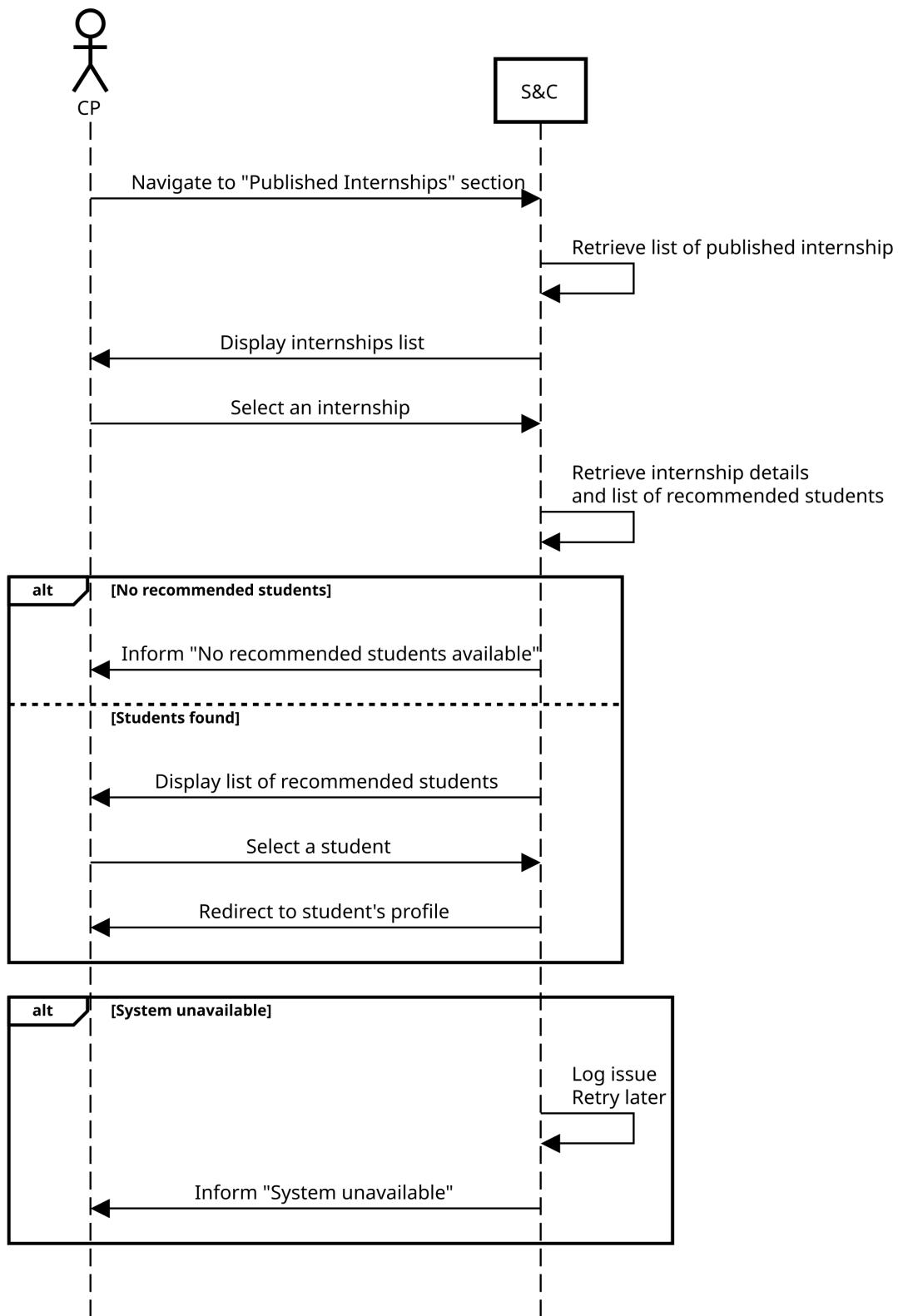


Figure 3.17: View recommended students for internships sequence diagram.

UC15. Contact students for internships

Actor	Company (CP)
Entry conditions	The company is logged into S&C. The company should be on a specific internship page to select a student's name from the recommended students list.
Event Flow	1 - The company click on a student's name. 2 - S&C returns the profile page of the selected student. 3 - The company click on the "invite" button. 4 - S&C sends to the student a request of application. 5 - S&C redirect the company to the "Progress Page" of the application.
Exit condition	The company successfully views profile of the student and sends correctly the notification.
Exceptions	- Student profile not existing: S&C informs company that the profile of the selected student is no longer available. - System unavailable: S&C logs the issue and retries later.

Table 3.16: Contact students for internships

UC16. Accept student applications

Actor	Company (CP)
Entry conditions	The company is logged into S&C. The company wants to review apply requests.
Event Flow	1 - The company navigates to the "Published Internships" section. 2 - S&C retrieves the list of internships published by the company. 3 - The company selects an internship to view its details. 4 - S&C retrieves internship's details and the list of apply requests. 5 - Company click on the students name. 6 - S&C returns the profile page of the selected student. 7 - Company check the profile of the student and his CV. 8 - Company decide to accept or reject the apply request. 9 - S&C send a notification to the student with the company's decision.

	10 - If the company has accepted, S&C authorizes the assignment of tasks by the company.
Exit condition	The company successfully accept the request and the student receive the notification.
Exceptions	<ul style="list-style-type: none"> - Student profile not existing: S&C informs company that the profile of the selected student is no longer available. - System unavailable: S&C logs the issue and retries later.

Table 3.17: Accept student applications

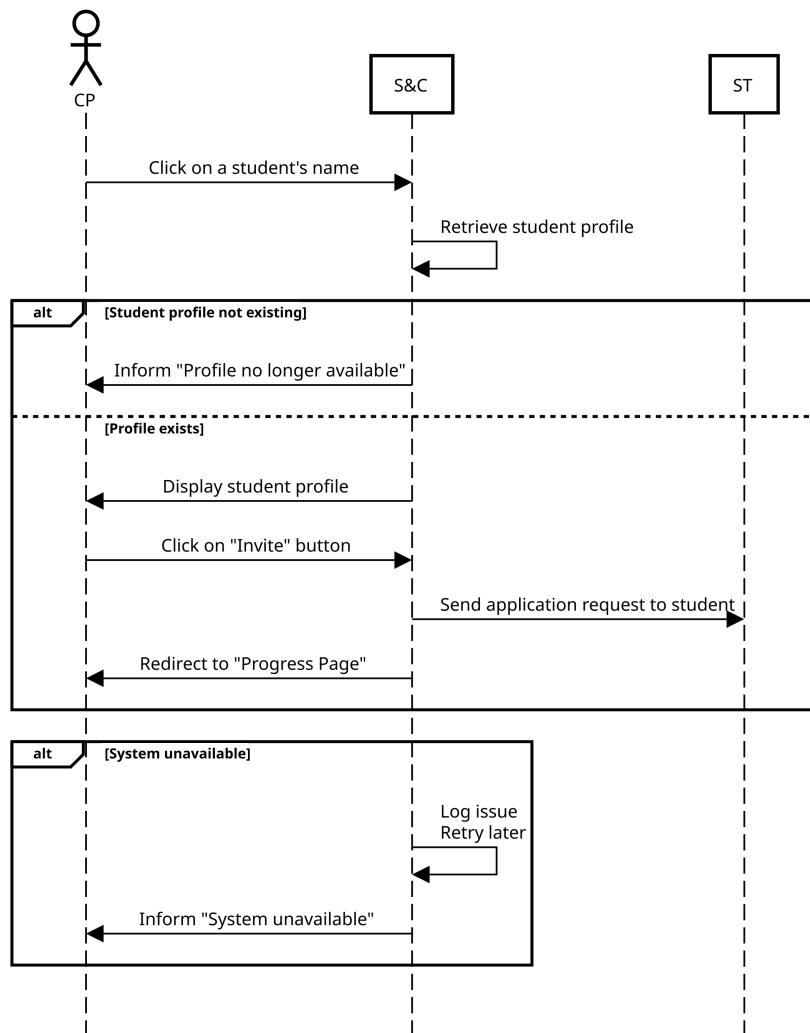


Figure 3.18: Contact students for internships sequence diagram.

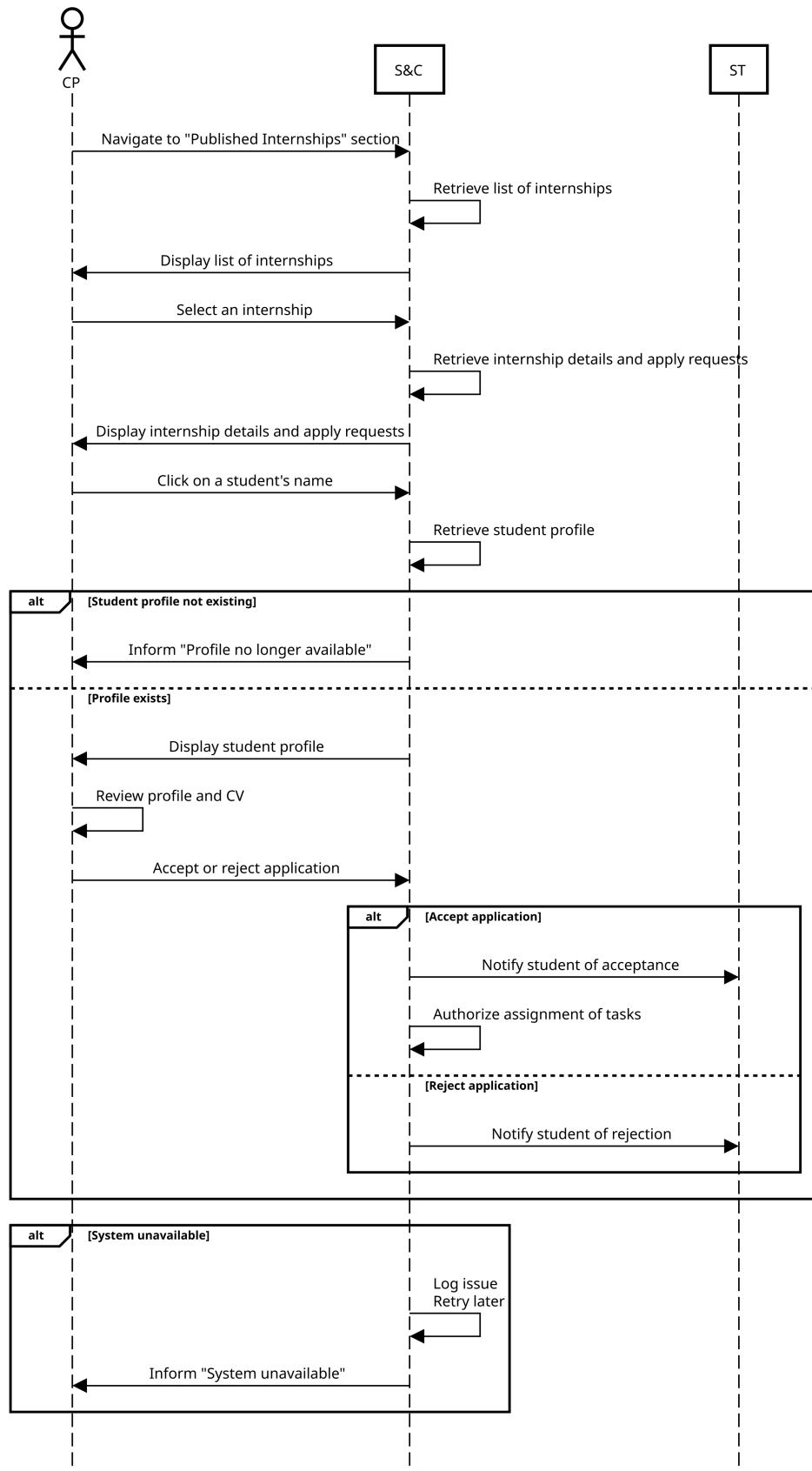


Figure 3.19: Accept student applications sequence diagram.

UC17. Submit questionnaires for students

Actor	Company (CP)
Entry conditions	The company is logged into S&C. The company wants to send questionnaires to students.
Event Flow	<p>1 - The company goes to a student's application "Progress Page".</p> <p>2 - The company click the "create task" button.</p> <p>3 - S&C returns the task form.</p> <p>4 - Company fill the form with task's requirements, delivery instruction and deadline.</p> <p>5 - S&C adds task to the Progress Page of the application and notify the ST about new assignments.</p>
Exit condition	The company successfully add the task and the student receive the notification.
Exceptions	<ul style="list-style-type: none"> - Data inserted by the company incomplete: an error message is shown and the CP is redirected back to the task form. - System unavailable: S&C logs the issue and retries later.

Table 3.18: Submit questionnaires for students

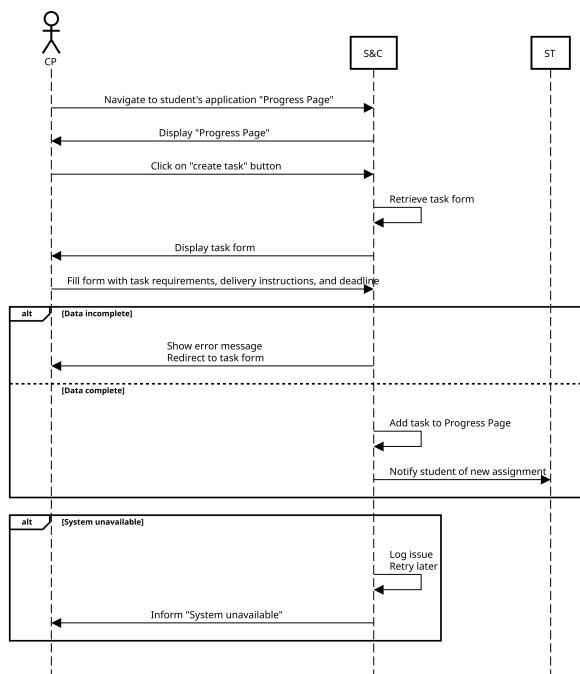


Figure 3.20: Submit questionnaires for students sequence diagram.

UC18. Finalize the selection process

Actor	Company (CP)
Entry conditions	The company is logged into S&C. The company wants to finalize the selection process.
Event Flow	<p>1 - The company navigates to the "Published Internships" section.</p> <p>2 - S&C retrieves the list of internships published by the company.</p> <p>3 - The company selects an internship to view its details.</p> <p>4 - S&C retrieves internship's details and the list of applicant students.</p> <p>5 - The company selects students.</p> <p>6 - S&C add selected student to the internship's list and notifies both selected and rejected students.</p>
Exit condition	The company successfully select the students and all the students receive the notification.
Exceptions	<ul style="list-style-type: none"> - One student profile not existing: S&C informs company that the profile of the selected student is no longer available. - System unavailable: S&C logs the issue and retries later.

Table 3.19: Finalize the selection process

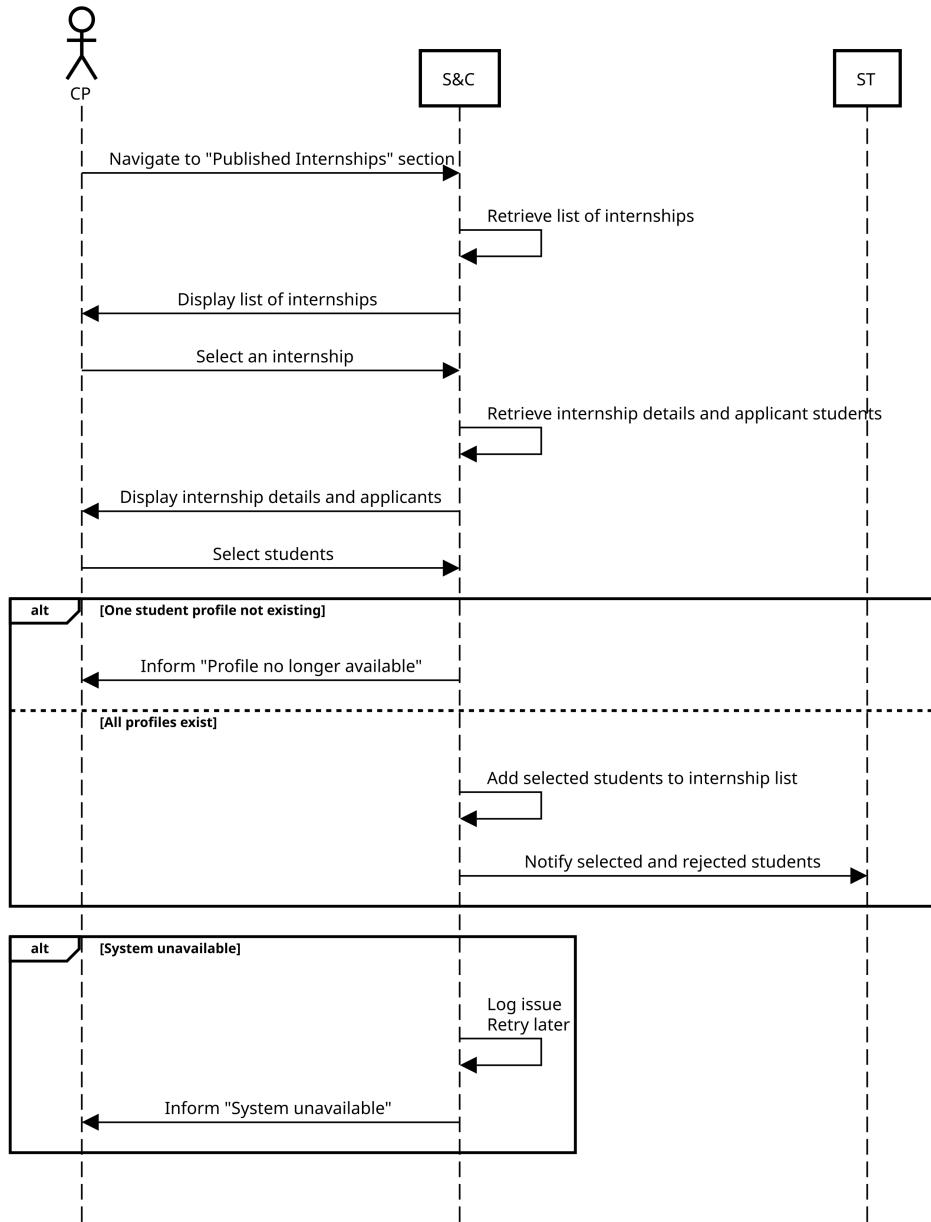


Figure 3.21: Finalize the selection process sequence diagram.

UC19. Provide feedback on interns

Actor	Company (CP)
Entry conditions	The company is logged into S&C and has completed at least one internship with an intern.
Event Flow	<p>1 - The company navigates to the Feedback section.</p> <p>2 - S&C retrieves a list of interns who completed internships with the company.</p>

	<p>3 - The company selects an intern to provide feedback on.</p> <p>4 - The company fills out a feedback form, evaluating the intern's performance.</p> <p>5 - S&C saves and submits the feedback.</p>
Exit condition	Feedback for the selected intern is successfully submitted and stored.
Exceptions	<ul style="list-style-type: none"> - Feedback already submitted: S&C informs the company that feedback for this intern has already been provided. - System unavailable: S&C logs the issue and retries later.

Table 3.20: Provide feedback on interns

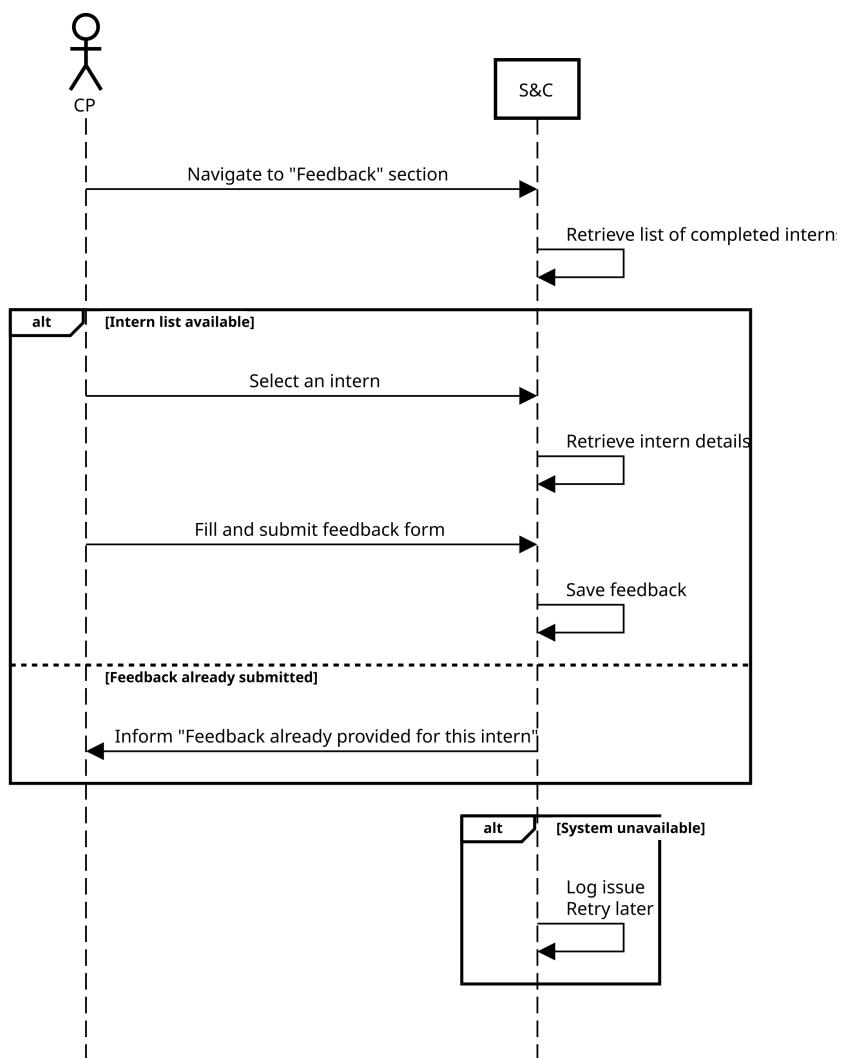


Figure 3.22: Provide feedback on interns sequence diagram.

UC20. File complaints about students

Actor	Company (CP)
Entry conditions	The company is logged into S&C and has had an issue with a student during an internship.
Event Flow	<p>1 - The company navigates to the Complaints section.</p> <p>2 - S&C provides a complaint form specific to the student.</p> <p>3 - The company selects the student and describes the issue.</p> <p>4 - The company submits the complaint.</p> <p>5 - S&C logs the complaint and forwards it to the university.</p>
Exit condition	The complaint is successfully filed and forwarded for review.
Exceptions	- System unavailable: S&C logs the issue and retries later.

Table 3.21: File complaints about students

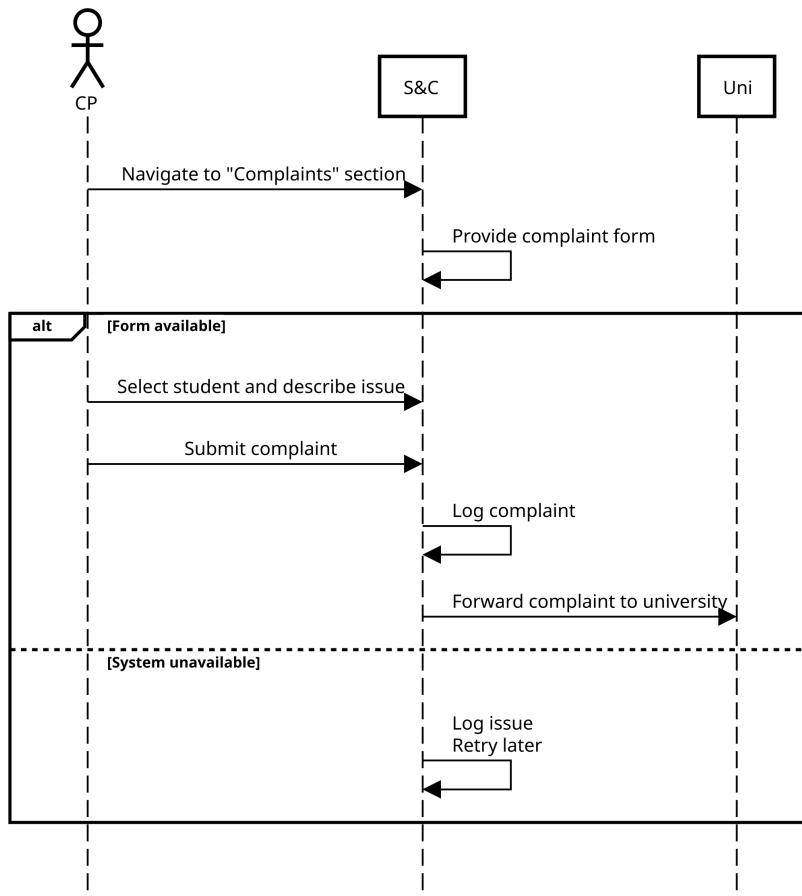


Figure 3.23: File complaints about students sequence diagram.

UC21. Monitor the status of all internships

Actor	University (UV)
Entry conditions	A student from this university is accepted for an internship.
Event Flow	<p>1 - The university navigates to the monitoring section.</p> <p>2 - S&C provides the list of all the university's students taking internships.</p> <p>3 - The university selects a student and looks at the overview of the internship.</p>
Exit condition	The University successfully manages to monitors all of its Student Internships.
Exceptions	<ul style="list-style-type: none"> - No matching students found: S&C informs the university that no students are in an ongoing internship at the moment. - System unavailable: S&C logs the issue and retries later.

Table 3.22: Monitor student's internships

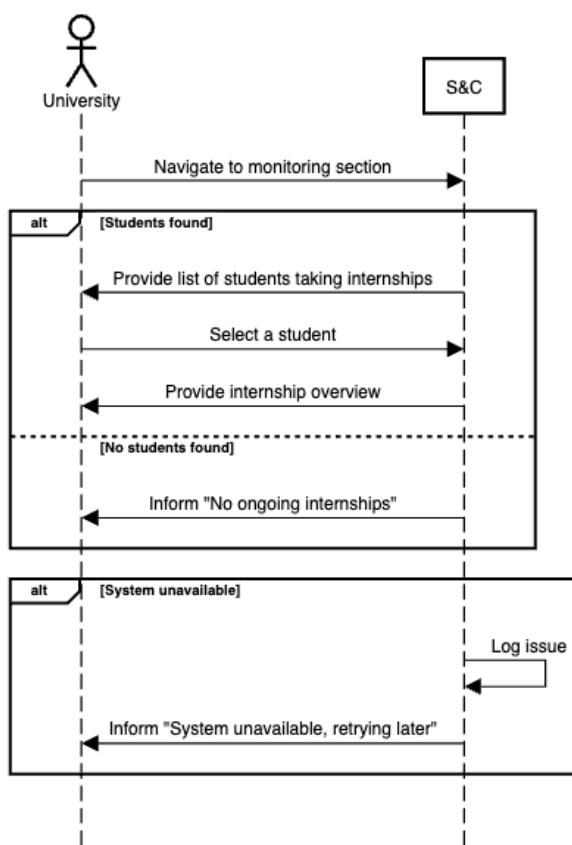


Figure 3.24: File complaints about students sequence diagram.

UC22. Handle complaints from students or companies

Actor	University (UV), Student (ST), Company (CP)
Entry conditions	A student or a company makes a complaint about the internship or the student.
Event Flow	<p>1 - The university navigates to the complaints section.</p> <p>2 - S&C provides the list of all the complaints that must be handled by the university.</p> <p>3 - The university selects the complaints that want to handle.</p> <p>4 - The university opens the chat with student or company, and try to get a better understanding of the problem.</p> <p>5 - If the problem is resolved, the university will mark the complaint as resolved, otherwise the university may decide to cancel the internship.</p>
Exit condition	The University marks the complaint as resolved.
Exceptions	- System unavailable: S&C logs the issue and retries later.

Table 3.23: Handle internship's complaints

UC23. Cancel problematic internships

Actor	University (UV), Student (ST), Company (CP)
Entry conditions	University can't resolve a student or company complaint.
Event Flow	<p>1 - The university navigates to the monitoring section.</p> <p>2 - S&C provides the list of all the university's students taking internships.</p> <p>3 - The university choose the problematic internship.</p> <p>4 - The university click on cancel internship.</p> <p>5 - S&C informs both student and company about the cancellation of the internship.</p>
Exit condition	The University successfully canceled the internship.
Exceptions	- System unavailable: S&C logs the issue and retries later.

Table 3.24: Cancel an internship

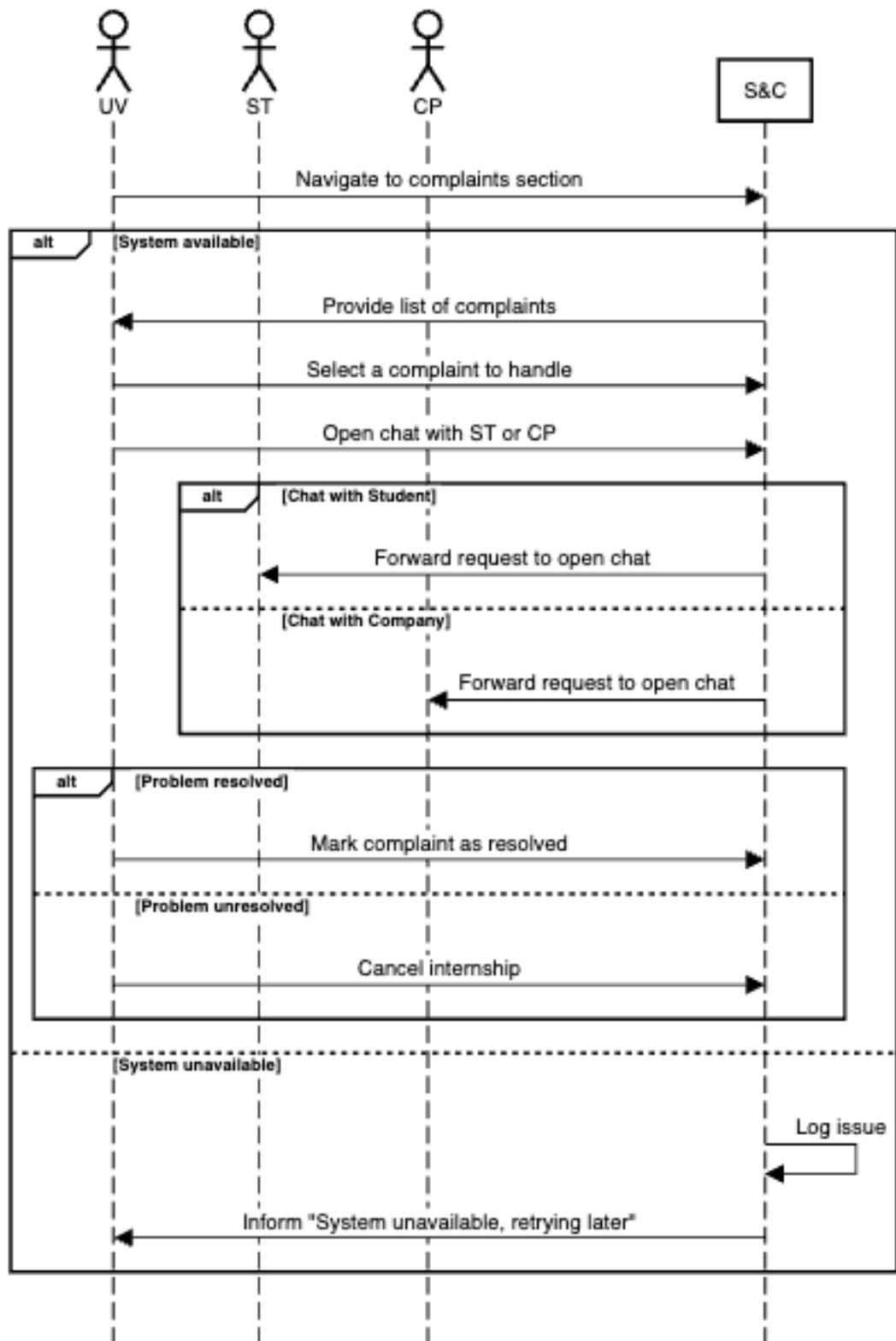


Figure 3.25: File complaints about students sequence diagram.

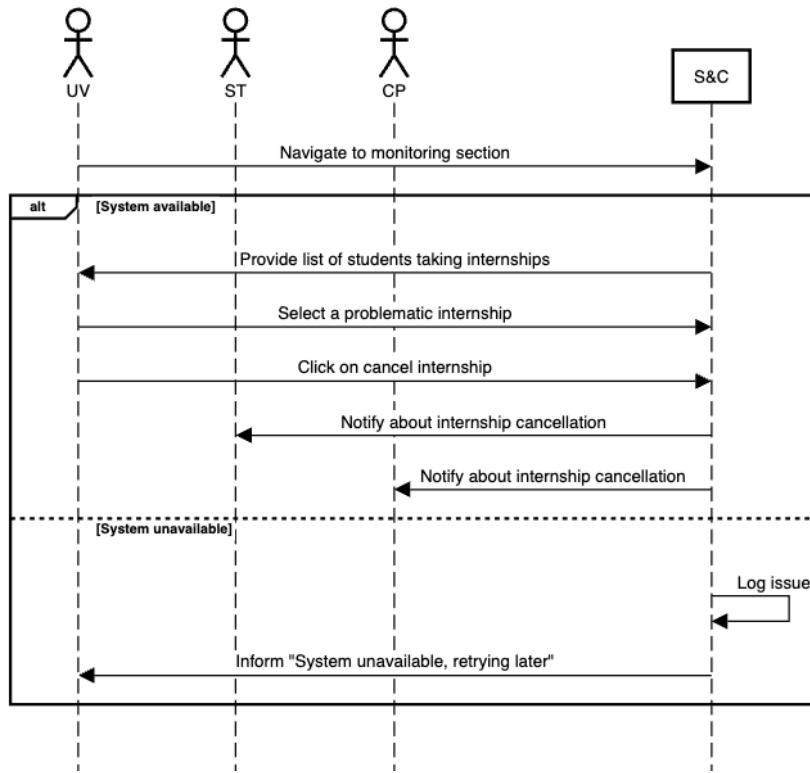


Figure 3.26: Cancellation of an internship sequence diagram.

UC24. Collect feedback from companies and students to improve matching

Actor	S&C (automated process), User (ST or CP)
Entry conditions	A Feedback is provided by a User.
Event Flow	<p>1 - A User submit a feedback about an internship.</p> <p>2 - The S&C system saves the feedback.</p> <p>3 -</p> <p>The S&C system processes the feedback and integrates it into the dataset used by the recommendation algorithm. .</p> <p>4 - The S&C system retrains the recommendation algorithm to refine its matching accuracy using the updated dataset.</p>
Exit condition	The system successfully enhances the recommendation algorithm by incorporating user feedback.
Exceptions	- System unavailable: S&C logs the issue and retries later.

Table 3.25: Improving recommendation algorithm

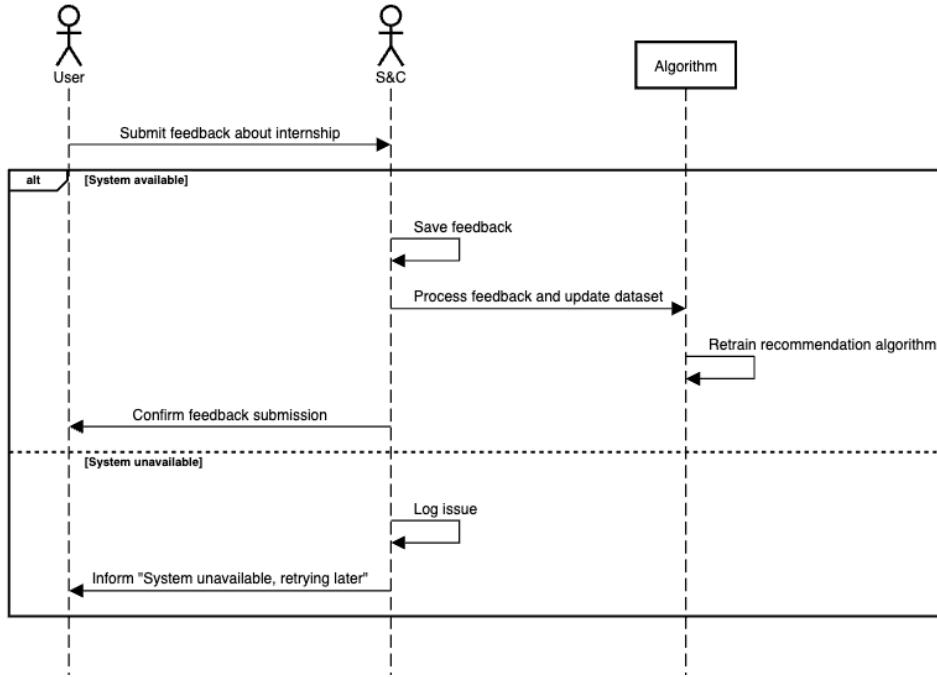


Figure 3.27: Improving the recommendation algorithm.

UC25. Inform companies about available students matching their criteria

Actor	S&C (automated process)
Entry conditions	Companies have posted internships, and students have uploaded their CV.
Event Flow	1 - S&C periodically checks for new or updated student profiles. 2 - S&C matches student profiles with the companies' defined requirements. 3 - S&C generates a list of suitable students for each internship. 4 - S&C sends a notification or email to the companies with the list of matching students.
Exit condition	Companies are notified about students matching their criteria.
Exceptions	<ul style="list-style-type: none"> - No matching students found: S&C informs the company that no students match their criteria at the moment. - System unavailable: S&C logs the issue and retries the process later.

Table 3.26: Inform companies about available students matching their criteria

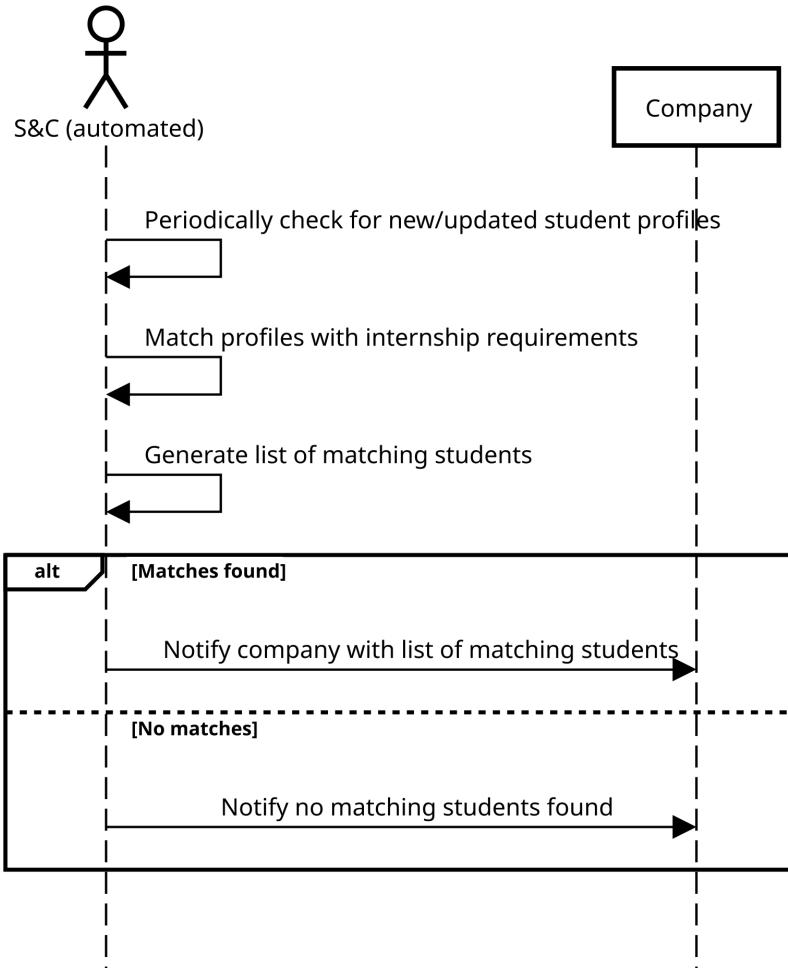


Figure 3.28: Inform companies about available students sequence diagram.

UC26. Inform students about new internship opportunities

Actor	S&C (automated process)
Entry conditions	New internships have been posted or updated by companies, and students have provided their preferences.
Event Flow	<ol style="list-style-type: none"> 1 - S&C monitors for new or updated internship postings. 2 - S&C matches internship postings with student preferences. 3 - S&C generates a list of suitable internships for each student. 4 - S&C sends a notification to students with the list of matching internships.
Exit condition	Students are notified about internships matching their preferences.

Exceptions	<ul style="list-style-type: none"> - No matching internships found: S&C informs the student that no new opportunities match their preferences. - System unavailable: S&C logs the issue and retries the process later.
-------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Table 3.27: Inform students about new internship opportunities

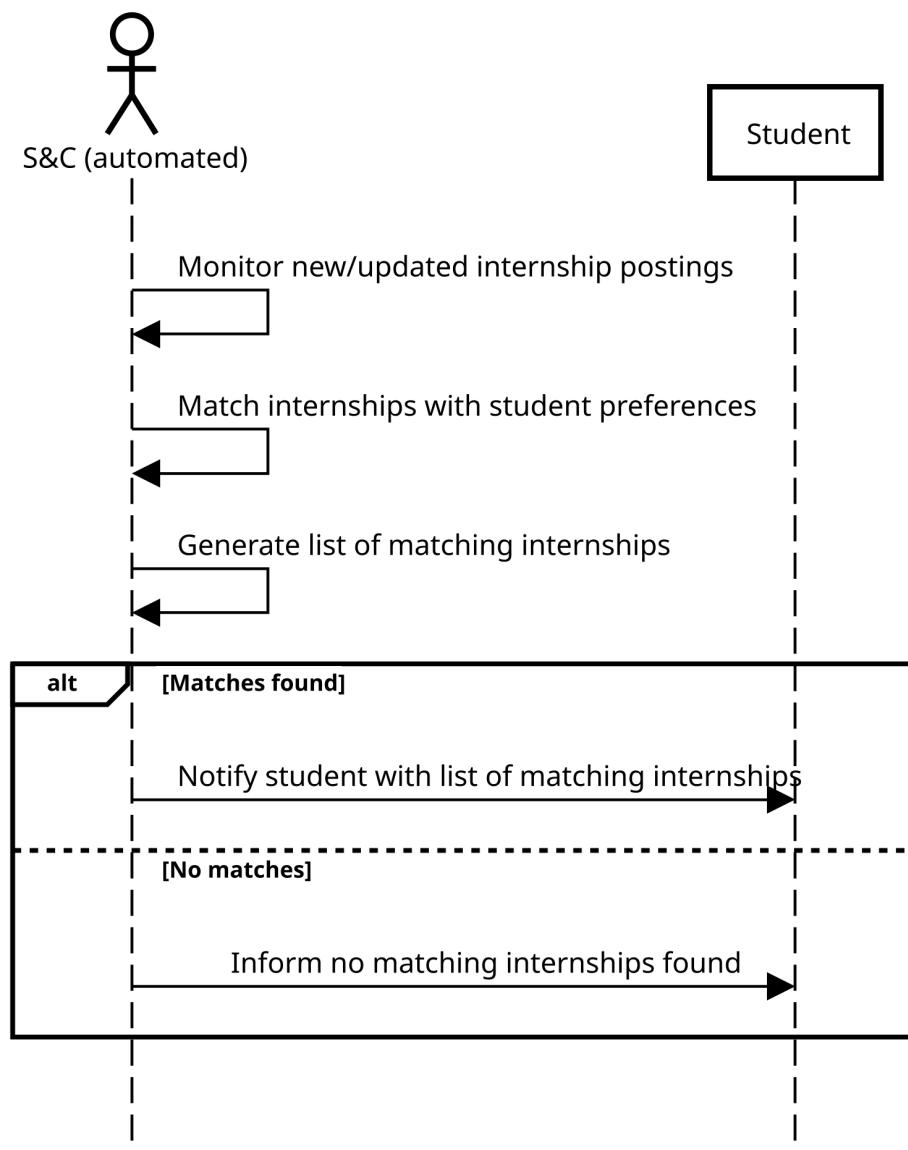


Figure 3.29: Inform students about new internship opportunities sequence diagram.

3.2.4. Requirement mapping

G1 - Allow companies to post their internship opportunities.

- R2: The system shall allow Users to log in using their credentials.
- R4: The system shall enforce role-based access control to restrict access to specific functionalities based on the user type (ST, CP, UV).
- R5: The system shall allow CPs to post new internship opportunities, including position details, required skills, duration, and compensation.
- R20: The system shall maintain a database of all internships, applications, and evaluations.

G2 - Allow students to search for available internships.

- R1: The system allows STs to register by providing personal information, email, and a password.
- R2: The system shall allow Users to log in using their credentials.
- R3: The system shall allow STs to edit their profiles, including personal details and contact information.
- R16: The system shall allow STs to search for internships using keywords, filters, or location.
- R17: The system shall recommend internships to STs based on their skills, preferences, and past applications.

G3 - Notify students when an internship that might be of interest to them is posted.

- R12: The system shall send notifications to users for events such as application submissions, approvals, or rejections.
- R17: The system shall recommend internships to STs based on their skills, preferences, and past applications.

G4 - Notify companies when a student matching their needs becomes available.

- R6: The system shall allow STs to apply for internships by submitting a CV and optional cover letter.
- R7: The system shall notify CPs when STs apply to an internship.
- R18: The system shall recommend STs to CPs for specific internships based on their skills, preferences, and past applications.

G5 - Provide tools for both companies and students to manage the selection process.

- R2: The system shall allow Users to log in using their credentials.
- R8: The system shall allow CPs to review applications and schedule interviews with STs.
- R9: The system shall allow CPs to submit questionnaires to STs.
- R10: The system shall allow CPs to accept or reject applications and notify STs of the decision.
- R19: The system shall allow CPs to search for suitable STs based on their skills, academic background, and CVs.

G6 - Collect feedback from students and companies to improve the match-making process.

- R2: The system shall allow Users to log in using their credentials.
- R13: The system shall allow CPs to track the progress of STs during the internship and provide regular feedback.
- R14: The system shall allow CPs to evaluate the performance of STs at the end of the internship.
- R15: The system shall allow UVs to review the feedback and evaluation provided by both CPs and STs.

G7 - Provide suggestions for companies to improve internship descriptions and for students to improve their resumes.

- R4: The system shall enforce role-based access control to restrict access to specific functionalities based on the user type (ST, CP, UV).
- R17: The system shall recommend internships to STs based on their skills, preferences, and past applications.
- R18: The system shall recommend STs to CPs for specific internships based on their skills, preferences, and past applications.

G8 - Allow all parties to monitor the status of the matchmaking process and the assigned internship.

- R2: The system shall allow Users to log in using their credentials.
- R13: The system shall allow CPs to track the progress of STs during the internship and provide regular feedback.
- R20: The system shall maintain a database of all internships, applications, and evaluations.

G9 - Allow universities to monitor internships and handle any problems.

- R2: The system shall allow Users to log in using their credentials.
- R11: The system shall allow UVs to manage their students and monitor their activity.
- R12: The system shall send notifications to users for events such as application submissions, approvals, or rejections.
- R15: The system shall allow UVs to review the feedback and evaluation provided by both CPs and STs.

Requirements	G1	G2	G3	G4	G5	G6	G7	G8	G9
R1		✓							
R2	✓	✓			✓	✓		✓	✓
R3		✓							
R4	✓						✓		
R5	✓								
R6				✓					
R7				✓					
R8					✓				
R9					✓				
R10					✓				
R11									✓
R12			✓						✓
R13						✓		✓	
R14						✓			
R15						✓			✓
R16		✓							
R17		✓	✓				✓		
R18				✓			✓		
R19					✓				
R20	✓							✓	

Table 3.28: Traceability Matrix for Goals and Requirements

3.3. Performance requirements

Number of Concurrent Users: The S&C system is expected to handle a significant number of concurrent users, based on research from similar platforms. The system architecture will be designed to scale dynamically to ensure consistent performance under heavy loads. Load testing will be conducted during development to verify this capacity.

Data Storage and Management: The system must efficiently handle large volumes of data, including:

- Personal information of Students (ST) and Companies (CP).
- Records of all Internship Listings, Applications, and Interactions between users.
- Historical data for old internship offers. This information will remain stored indefinitely to allow CPs to review their previous postings and applicants.

To ensure scalability, a database management system with high throughput will be used. Additionally, data archiving strategies will be implemented to optimize storage for historical data without affecting performance.

Response Time: Actions executed directly by the S&C system must have a response time of less than 500 milliseconds in normal conditions. Operations involving external services such as email systems may experience delays depending on the response times of those services. In case of a slow internet connection on the user's side, performance might degrade..

3.4. Design constraints

3.4.1. Standard compliance

The system must be compliant with the following standards and regulations:

- EU's GDPR (General Data Protection Regulation), a set of regulations that is designed in order to protect the personal data, the privacy and security of the EU's citizens.
- WCAG (Web Content Accessibility Guidelines): The user interface will follow WCAG 2.1 Level AA guidelines to ensure accessibility for users with disabilities. This includes providing text alternatives for non-text content, keyboard navigation support, and ensuring sufficient contrast in the UI design.

3.4.2. Hardware limitations

The platform is designed as a web application and does not require specific hardware. The users must have a device with a modern web browser and a reliable internet connection with a minimum recommended speed of 2 Mbps to ensure a smooth experience.

3.5. Software system attributes

3.5.1. Reliability

The system has to be reliable because it will have to run continuously for a long period of time. To ensure this feature the platform must have:

- Some sort of replication and consistency policy to avoid system crash.
- Offline backups of the system in multiple locations to recover information after data loss or catastrophic failures.
- A monitoring system that alerts administrators in case of problems.

3.5.2. Availability

The most important attribute that the system has to provide is the availability. The system should have an availability of 99% to not interfere with users' activities. To achieve this:

- Replication policies must be implemented and a single point of failure should be avoided.
- Maintenance should be scheduled during low traffic periods (e.g., late-night) and notify users in advance.
- The recommendation algorithm should be optimized to run primarily during low-load hours, minimizing the impact on system performance during peak usage.

3.5.3. Security

To protect user data and system integrity. The system must implement:

- Authentication and authorization mechanisms, ensuring that only verified users can access the platform and perform actions based on their roles.
- Encryption for all sensitive data and communications between the client and server.

- Protection against common web vulnerabilities.
- Logging and monitoring of suspicious activities, such as repeated failed login attempts or unauthorized access attempts.

3.5.4. Maintainability

To ensure maintainability of the system the following actions are required:

- Follow modular and reusable design principles, ensuring that individual components can be updated or replaced without affecting the entire system.
- The code has to be well documented.
- A testing routine has to be provided and it has to cover at least 75% of the entire code excluding the UI code.

3.5.5. Portability

The system should be portable, ensuring access across different platforms and environments.

- Client-side the platform must be compatible with modern web browsers on both desktop and mobile devices.
- Server-side the backend should be deployable on multiple hosting environments, such as on-premises servers or cloud platforms without significant modifications. To ease this, use of containerization technologies is suggested.

4 | Formal Analysis Using Alloy

Here is an alloy specification of the system described in the RASD:

```

sig Student {
    university: one University,
    applications: set Internship,
    interviews: set Internship,
    acceptedInternships: set Internship,
    recommendations: set Recommendation,
}

sig Company {
    internships: set Internship,
    recommendations: set Recommendation
}

sig University {
    monitoredInternships: set Internship,
    complaints: set Complaint
}

sig Internship {
    publishedBy: one Company,
    applicantsST: set Student,
    interviewedST: set Student,
    selectedST: set Student,
    recommendations: set Recommendation,
    monitoredBy: set University,
    status: one Status,
    feedback: set Feedback
}

sig Recommendation {

```

```

student: one Student,
internship: one Internship,
score: Int
}

abstract sig Feedback {
    relatedTo: one Internship
}

sig StudentFeedback extends Feedback {
    providedByST: one Student
}

sig CompanyFeedback extends Feedback {
    providedByCP: one Company
}

abstract sig Complaint {
    relatedTo: Internship,
    handledBy: University
}

sig StudentComplaint extends Complaint {
    filedByST: one Student
}

sig CompanyComplaint extends Complaint {
    filedByCP: one Company
}

enum Status { available, interviews, ongoing, closed }


```

-- FACTS

```

-- The student university must be valid
-- All the applications , interviews and acceptedInternship must be of valid internship
-- The set of ST interviews is a subset of the ST applications
-- The set of ST acceptedInternship is a subset of the ST interviews
-- The university of the Student must be in the set of University that monitors the
  internship
fact StudentConstraints1 {
  all s: Student |
    s.university in University
    and s.applications in Internship
    and (s.interviews in Internship
      and ( s.interviews in s.applications
        or #s.interviews = 0 )
      and (s.acceptedInternships in Internship
        and ( s.acceptedInternships in s.interviews
          or #s.acceptedInternships = 0 )
        and ( s.acceptedInternships in s.applications
          or #s.acceptedInternships = 0 )
      and ( #s.acceptedInternships > 0
        implies s.university in s.acceptedInternships.monitoredBy )
    }
}

```

```

-- A student can't be in two different ongoing internships at the same time
fact StudentConstraints2 {
  no s: Student, disj i1, i2: Internship |
    i1 in s.acceptedInternships
    and
    i2 in s.acceptedInternships
    and
    i1.status = ongoing and i2.status = ongoing
}

```

```

-- A Company can only provide feedbacks on its own internships
fact CompanyConstraints {
  all i: Internship, f: i.feedback|
    f.relatedTo = i
}

```

```

and
( f.providedByCP in i.publishedBy )
}

-- A Student can only provide feedbacks on its accepted internships
fact StudentFeedbacks {
all i: Internship, f: i.feedback|
  f.relatedTo = i
  and
  ( f.providedByST in i.selectedST )
}

-- An internship in status available can only have applicantsST
fact InternshipConstraints1 {
all i: Internship |
  i.status = available implies ( #i.applicantsST >= 0
    and #i.interviewedST = 0
    and #i.selectedST = 0
    and #i.feedback = 0 )
}

-- An internship in status interviews has at least
-- 1 Student in interviewedST and no Students in selectedST
fact InternshipConstraints2 {
all i: Internship |
  i.status = interviews implies ( #i.applicantsST > 0
    and #i.interviewedST > 0
    and #i.selectedST = 0
    and #i.feedback = 0 )
}

-- An internship in status ongoing has at least
-- 1 Student in selectedST and no Feedbacks
fact InternshipConstraints3 {
all i: Internship |
  i.status = ongoing implies ( #i.applicantsST > 0
    and #i.interviewedST > 0
    and #i.selectedST > 0
}

```

```

        and #i.feedback = 0 )
}

-- An internship in status closed has 2 Feedback
-- one from ST and one from CP
fact InternshipConstraints4 {
    all i: Internship |
        i.status = closed implies ( #i.applicantsST > 0
            and #i.interviewedST > 0
            and #i.selectedST > 0
            and #i.feedback = 2)
}

-- If an internship has feedback is in status closed
fact FeedbackConstraints {
    all f: Feedback |
        f.relatedTo.status = closed
}

-- If an internship has complaints is either in status ongoing or closed
fact ComplaintConstraints {
    all c: Complaint |
        c.relatedTo.status = ongoing
        or c.relatedTo.status = closed
}

-- Complaints filed by a students must be handled by his university
fact STComplaintConstraints {
    all sc: StudentComplaint |
        sc.handledBy = sc.filiedByST.university
}

-- All recommendations scores must be between 0 and 100
fact ValidRecommendations {
    all r: Recommendation | r.score > 0 and r.score <= 100
}

-- A student can file only one complaint

```

-- about the same internship

```
fact OnlyOneComplaintPerST {
    no disj c1, c2: Complaint |
        c1.relatedTo = c2.relatedTo
        and
        c1.fileByST = c2.fileByST
}
```

-- A student can provide only one feedback

-- about the same internship

```
fact OnlyOneFeedbackPerST {
    no disj f1, f2: Feedback |
        f1.relatedTo = f2.relatedTo
        and
        f1.providedByST = f2.providedByST
}
```

-- A company can provide only one feedback

-- about the same internship

```
fact OnlyOneFeedbackPerCP {
    no disj f1, f2: Feedback |
        f1.relatedTo = f2.relatedTo
        and
        f1.providedByCP = f2.providedByCP
}
```

-- There cannot be two recommendations related

-- to the same student and same internship

```
fact UniqueRecommendations1 {
    no disj r1, r2: Recommendation |
        r1.student = r2.student
        and
        r1.internship = r2.internship
}
```

-- Every recommendation is unique

```
fact UniqueRecommendations2 {
    all disj c1, c2: Company |
        (c1.recommendations & c2.recommendations = none)
```

```
}
```

-- The universities of the selected ST
-- must be in the Internship.monitoredBy relation

```
fact InternshipMonitoredByUniv {
    all i: Internship |
        i.selectedST.university in i.monitoredBy
}
```

-- There can't be lone universities

```
fact NoUniversityWithoutST {
    no u: University | not u in Student.university
}
```

----- Bidirectional Facts -----

-- All feedbacks are related to an internship

```
fact InternshipsRelatedToFeedbacks {
    all i: Internship, f: Feedback |
        f in i.feedback iff f.relatedTo = i
}
```

-- An internship is in the list of company internships
-- iff its published by them

```
fact InternshipPublishedByCompany {
    all i: Internship, c: Company |
        i in c.internships iff c in i.publishedBy
}
```

-- The relation between University and Internships is bidirectional

```
fact UniversityConstraints1 {
    all u: University, i: Internship |
        i in u.monitoredInternships iff u in i.monitoredBy
}
```

-- The relation between University and Complaint is bidirectional

```
fact UniversityConstraints2 {
```

```

all u: University, c: Complaint |
  c in u.complaints iff u in c.handledBy
}

-- A complaint filed By a company about an internship
-- must be handled by a university in the universities
-- of the selected Students
fact ComplaintHandledByRightUniversity {
  all c: CompanyComplaint |
    c.handledBy in c.relatedTo.selectedST.university
}

-- The relations between Recommendation and Student is bidirectional
fact BidirRecommendationsConstraints1 {
  all r: Recommendation, s: Student |
    s in r.student iff r in s.recommendations
}

-- The relations between Recommendation and Internship is bidirectional
fact BidirRecommendationsConstraints2 {
  all r: Recommendation, i: Internship |
    i in r.internship iff r in i.recommendations
}

-- The relation between Student. applications
-- and Internship.applicantsST is bidirectional
fact STBidirectionalConstraints1 {
  all s: Student, i: Internship |
    i in s.applications iff s in i.applicantsST
}

-- The relation between Student. interviews
-- and Internship.interviewedST is bidirectional
fact STBidirectionalConstraints2 {
  all s: Student, i: Internship |
    i in s.interviews iff s in i.interviewedST
}

-- The relation between Student. acceptedInternships

```

```
-- and Internship.selectedST is bidirectional
fact STBidirectionalConstraints3 {
    all s: Student, i: Internship |
        i in s.acceptedInternships iff s in i.selectedST
}
```

-- ASSERTIONS

```
assert SubsetAcceptedInterviewsApplications {
    all s: Student |
        s.acceptedInternships in s.interviews
        and s.interviews in s.applications
}
```

```
check SubsetAcceptedInterviewsApplications for 10
```

```
assert FeedbackOnlyWhenClosed {
    all i: Internship |
        #i.feedback > 0 implies i.status = closed
}
```

```
check FeedbackOnlyWhenClosed for 10
```

```
assert ValidInternshipStates {
    all i: Internship |
        (i.status = available implies (#i.interviewedST = 0 and #i.selectedST
            = 0))
        and
        (i.status = interviews implies (#i.selectedST = 0 and #i.interviewedST
            > 0))
        and
```

```

(i.status = ongoing implies (#i.selectedST > 0 and #i.feedback = 0))
and
(i.status = closed implies (#i.feedback = 2))
}

check ValidInternshipStates for 10

assert MonitoredInternshipsByUniversity {
    all s: Student, i: Internship |
    i in s.acceptedInternships implies s.university in i.monitoredBy
}

check MonitoredInternshipsByUniversity for 10

assert UniqueFeedbackAndComplaints {
    no disj f1, f2: Feedback | f1.relatedTo = f2.relatedTo and f1 = f2
    and
    no disj c1, c2: Complaint | c1.relatedTo = c2.relatedTo and c1 = c2
}

check UniqueFeedbackAndComplaints for 10

assert FeedbackByPublishingCompany {
    all i: Internship |
    i.status = closed implies i.feedback.providedByCP = i.publishedBy
}

check FeedbackByPublishingCompany for 10

assert UniqueComplaintsByStudent {
    all s: Student |
        all i: Internship |
            lone c: Complaint | c.relatedTo = i and c filedByST = s
}

```

```

check UniqueComplaintsByStudent for 10

assert UniqueFeedbackByStudent {
    all s: Student |
        all i: Internship |
            lone f: StudentFeedback | f.relatedTo = i and f.providedByST = s
}

check UniqueFeedbackByStudent for 10

assert NoDuplicateInternshipsForStudent {
    all s: Student |
        no disj i1, i2: s.acceptedInternships | i1.status = ongoing and
            i2.status = ongoing
}

check NoDuplicateInternshipsForStudent for 10

```

-- PREDICATES

```

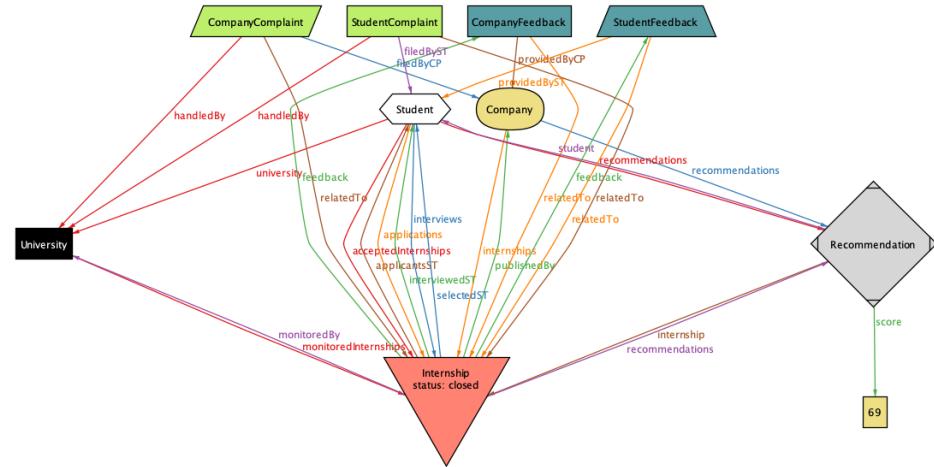
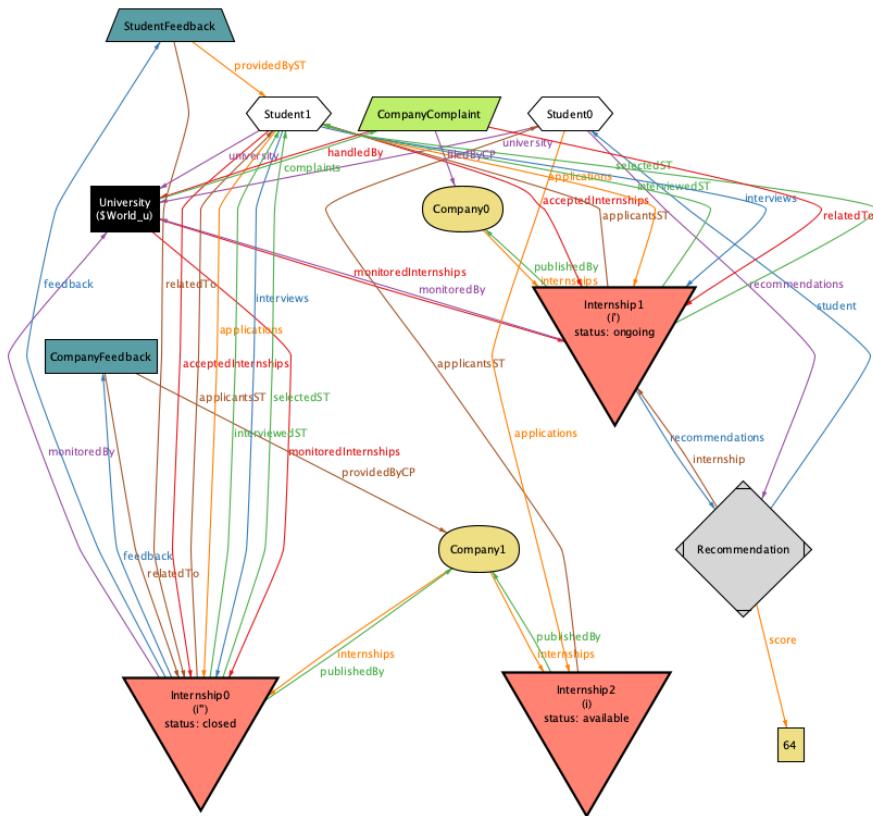
pred baseWorld {
    #Student = 1
    #Company = 1
    #University = 1
    #Internship = 1
    #Recommendation = 1
    #Complaint = 2
    one i: Internship | i.status = closed
}
run baseWorld for 10 but 8 Int

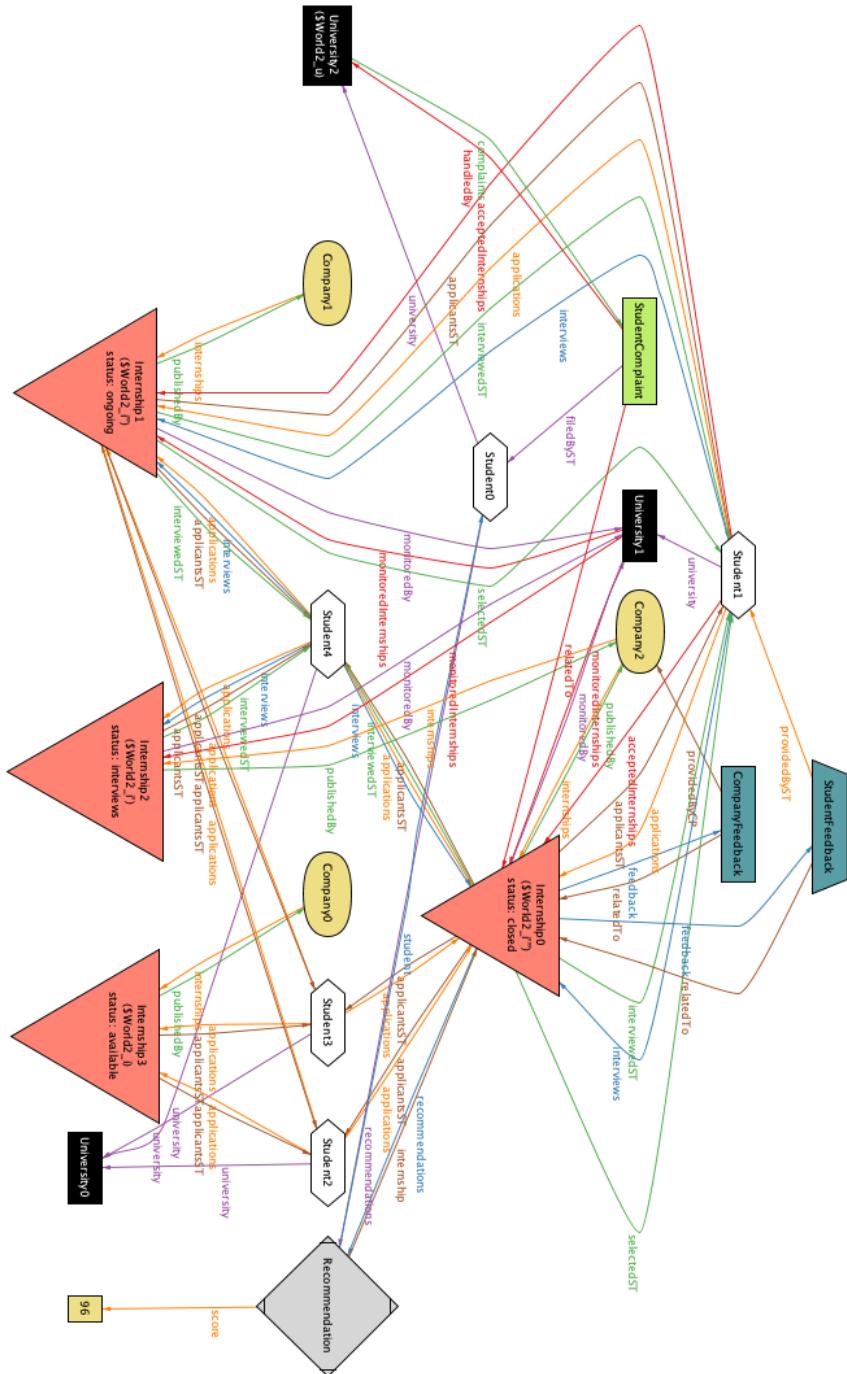
pred World1 {
    #Student > 1
    #Company > 1
}

```

```
all c: Company | #c.internships > 0
some i: Internship | i.status = available
some i: Internship | i.status = ongoing
some i: Internship | i.status = closed
#University > 0
some u: University | #u.complaints > 0
#Recommendation > 0
}
run World1 for 10 but 8 Int

pred World2 {
    #Student > 4
    #Company > 2
    all c: Company | #c.internships > 0
    some i: Internship | i.status = available
    some i: Internship | i.status = interviews
    some i: Internship | i.status = ongoing
    some i: Internship | i.status = closed
    #University > 2
    some u: University | #u.complaints > 0
    #Recommendation > 0
}
run World2 for 10 but 8 Int
```

Figure 4.1: Instance for *BaseWorld*.Figure 4.2: Instance for *World1*.

Figure 4.3: Instance for *World2*.

5 | Effort Spent

Member of group	Effort spent	
Pianalto Riccardo	Introduction	3h
	Overall description	11h
	Specific requirements	7,5h
	Formal analysis	3,5h
Pica Mirko	Introduction	2,5h
	Overall description	9h
	Specific requirements	12h
	Formal analysis	1,5h
Prendin Christian	Introduction	2h
	Overall description	3,5h
	Specific requirements	4,5h
	Formal analysis	15h

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

6 | References

6.1. References

- ISO/IEC/IEEE 29148:2018 - Systems and software engineering - Life cycle processes - Requirements engineering.
- The Requirement Engineering and Design Project specification document A.Y. 2024–2025.

6.2. Used Tools

- *GitHub* for project versioning and sharing.
- *LATEX* and *Overleaf* as editor for writing this document.
- *sequencediagram.org* for the sequence diagrams' design.
- *Lucidchart* for the other diagrams' design.
- *Alloy* for formal analysis.
- *Google Docs* for collaborative writing, notes and reasoning.

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