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MILANO 1863

SCUOLA DI INGEGNERIA INDUSTRIALE
E DELL'INFORMAZIONE

Requirement Analysis and Specification

Computer Science and Engineering

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1 Introduction

Finding the right internship is a critical step for university students seeking to gain practical experience and develop skills in their chosen fields. At the same time, companies offering internships need efficient ways to attract suitable candidates who match their requirements. The "Students&Companies" (S&C) platform is designed to address these needs by facilitating an efficient and effective matchmaking process between students and companies. Through S&C, students can proactively search for internship opportunities that align with their skills, experiences, and career goals, while companies can advertise their offerings and connect with suitable candidates.

The platform leverages various mechanisms to enhance this matching process. From simple keyword-based searching to advanced statistical analyses, S&C aims to offer personalized recommendations, providing notifications to students about internships that meet their interests and alerting companies about potential candidates. Once a match is initiated, S&C supports the selection process by coordinating structured assessments, ensuring that both parties have the tools needed to make informed decisions.

Beyond matchmaking, S&C collects valuable data from users, offering insights into ways to improve student CVs and company project descriptions. This feedback loop helps make the platform a dynamic environment that not only connects students with internships but also offers ongoing support to students, companies, and universities in monitoring the progress and quality of internships. Additionally, S&C offers spaces for feedback, complaint management, and communication, enabling universities to oversee internship quality and address issues when necessary.

1.1. Purpose

The primary objective of the Students&Companies (S&C) platform is to create an efficient and effective environment for connecting university students seeking internships with companies offering them. The platform is designed to serve both students and companies by addressing their specific needs through targeted functionalities.

For students, S&C provides the capability to proactively search for internships that match their skills, experiences, and aspirations. It allows them to explore a variety of opportunities while receiving personalized recommendations that align with their interests. The

system further supports students by suggesting ways to improve their CVs to enhance their appeal to potential employers.

For companies, S&C offers a simple interface for publishing internship opportunities and accessing a diverse pool of student candidates. Companies benefit from receiving recommendations about students whose qualifications match their requirements, as well as having access to management tools that facilitate interviews and selection processes.

The platform also incorporates mechanisms to collect and analyze feedback from students and companies, providing valuable insights that can help improve future internship placements. Universities, as another key stakeholder, can leverage the platform to monitor internship progress, address issues, and support students throughout their internship experiences.

Below is a table that lists all the key goals of the S&C platform:

ID	**Description**
G1	Students can search for internships that match their skills and career goals.
G2	Companies can advertise internships and engage suitable candidates.
G3	The platform can recommend relevant internships to students.
G4	The platform can recommend potential candidates to companies.
G5	Companies can manage the selection process through an interview management system.
G6	Companies can evaluate candidates.
G7	Students and companies can provide feedback to continuously improve the matchmaking process.
G8	Universities can track and assess the ongoing progress of internships.
G9	The platform can provide suggestions to improve CVs.
G10	The platform can provide suggestions to companies to improve internship description.

Table 1.1: Goals of the Students&Companies (S&C) Platform

1.2. Scope

The S&C platform is a web-based solution that assists:

- **Students** in searching for internships that align with their skills and aspirations, providing mechanisms for submitting CVs and receiving internship recommendations.
- **Companies** in posting internships and finding suitable candidates based on the students' profiles and skills.
- **Universities** in overseeing the internships, monitoring progress, addressing complaints, and ensuring the quality of the internship experiences.

The platform supports interactions between these three user groups and handles tasks such as matching students with internships, managing interviews, providing feedback, and analyzing the success of the internships. It is expected to scale for use across multiple universities and support thousands of students and companies.

1.2.1. World phenomena

The following table lists the world phenomena relevant to the S&C platform, describing interactions and events within the system environment, that are not directly controlled by the system.

ID	Description
WP1	A company prepares the details for posting a new internship position.
WP2	A student writes down his CV, adding his own experience and skills.
WP3	A student wants to know if there are internships opportunities that match his skills and interests.
WP4	A company offers additional benefits such as training, mentorship, or compensation for an internship.
WP5	A student or company want to update their profile or internship listing to reflect new information.
WP6	Universities handles complaints received from companies and students about internships.
WP7	Students want to give feedback on the Companies' support during their internship.

Table 1.2: World Phenomena of the Students&Companies (S&C) Platform

1.2.2. Shared Phenomena

The table below lists the shared phenomena that represent interactions and communications between users and the S&C platform, including the controller and observer for each phenomenon.

ID	Description	Observer	Who Controls it
SP1	The platform performs the matchmaking between students and internships that best fit their skills and interests.	Student, Company	S&C
SP2	The S&C platform recommends internship opportunities based on a student's profile.	Student	S&C

SP3	Students are alerted to new internship opportunities matching their profiles.	Student	S&C
SP5	The S&C platform notifies students about any changes to their application status.	Student	S&C
SP6	Students are notified of upcoming interview dates and times for internship applications.	Student	S&C
SP7	The platform alerts students of upcoming interviews.	Student	S&C
SP9	The platform alerts companies of upcoming interviews.	Company	S&C
SP10	A student logs into the S&C platform to view internship opportunities.	S&C	Student
SP11	A student applies for an internship position through the platform.	S&C	Student
SP12	A student views the status of all their internship applications in their profile dashboard.	S&C	Student
SP13	A student applies for internships through the platform.	S&C	Student
SP14	A student uploads their CV through the platform.	S&C	Student
SP15	A student requests CV enhancement suggestions through the platform.	S&C	Student
SP16	A student creates an account on the S&C platform.	S&C	Student
SP17	A company registers on the platform to post internship listings.	S&C	Company
SP18	A student updates their profile to include new skills or experiences.	S&C	Student
SP19	A student submits their profile on the platform.	S&C	Student

SP20	A company accesses student profiles recommended by the platform's matching system.	S&C	Company
SP21	A company reviews applications for an internship position posted on the platform.	S&C	Company
SP22	A company updates an existing internship position to reflect changes in requirements or benefits.	S&C	Company
SP23	A company performs the internship selection process.	Student	Company
SP24	A company chooses the right candidate who meets their requirements.	Student	Company
SP25	A company schedules an interview with a candidate.	Student, S&C	Company
SP26	The system receives feedback regarding internship outcomes.	Student, University, Company	S&C
SP27	A student provides feedback on their internship experience.	S&C	Student
SP28	Companies provide feedback on the performance of interns.	S&C	Company
SP29	A company provides feedback on a student's performance during the internship period and at its conclusion.	Student	Company
SP30	The platform aggregates feedback data regarding internships.	Student, University, Company	S&C
SP31	The system stores feedback from students, universities, and companies.	Student, University, Company	S&C
SP32	The platform analyzes feedback data to improve quality.	Student, University, Company	S&C
SP33	Universities review internship completion reports generated by the S&C platform.	University	S&C

SP34	The S&C platform generates internship completion certificates for students upon request.	Student	S&C
SP35	Universities receive updates on the progress and status of internships.	University	S&C
SP36	The system receives and stores complaints from participants.	Student, University, Company	S&C
SP37	The system enables participants to address and resolve issues.	Student, University, Company	S&C
SP38	The platform provides recommendations to improve internship descriptions.	Company	S&C
SP39	The platform provides recommendations to enhance internship benefits.	Company	S&C

Table 1.3: Shared Phenomena of the Students&Companies (S&C) Platform

1.3. Definitions, Acronyms, Abbreviations

1.3.1. Acronyms

- **S&C**: Students&Companies platform.
- **CV**: Curriculum Vitae.
- **GDPR**: General Data Protection Regulation, ensuring privacy and data security for personal information.

1.3.2. Definitions

- **User**: A user in the platform can be one either a student, a company or a university
- **Recommendation System**: A feature in the platform that suggests internships to students and candidates to companies.
- **World phenomena**: Relationship between the students or universities and the companies, that happen outside the system's control.
- **Shared phenomena**: Interactions between the entities that are under the system's control.
  - **Machine Controlled**: All the phenomenons directly controlled by an automation or algorithms.
  - **World Controlled**: Involved the participation of the user, i.g. to login or register an account.

1.4. Revision History

Version	Date	Authors	Changes
1.1	02/02/2025	G. Vaccarino, V. Palladino, N. Vacis	Class diagram adapted to code
1.0	22/12/2024	G. Vaccarino, V. Palladino, N. Vacis	First release

1.5. Reference Documents

- 2024-2025 Software Engineering 2 - Assignment RASD

1.6. Document Structure

The document is organized into the following sections:

- **Section 1: Introduction**

  This section provides a concise overview of the problem, along with the purpose and scope of the system. It includes definitions, acronyms, and abbreviations that may appear throughout the document. Additionally, it contains the document's revision history, recording different versions, release dates, and corresponding changes.

- **Section 2: Overall Description**

  Describes the product's perspective, key functions, user characteristics, as well as assumptions, dependencies, and constraints.

- **Section 3: Specific Requirements**

  This section outlines the system's specific requirements, offering an in-depth analysis of external interfaces, including both user-facing and hardware/software components. It details the performance requirements, standards compliance, and attributes of the software system. Furthermore, it provides a comprehensive description of the system's functional requirements and elaborates on use cases with diagrams, mapping goals, requirements, and domains, and tracing each use case to the requirements it fulfills.

- **Section 4: Formal Analysis Using Alloy**

  Covers the formal analysis and validation of the system using the Alloy modeling language.

- **Section 5: Effort Spent**

  Provides details on the effort spent by each group member in preparing this document.

- **Section 6: References**

  Lists the reference documents used in preparing this RASD.

2 | Overall Description

2.1. Product Perspective

2.1.1. Domain's class diagram

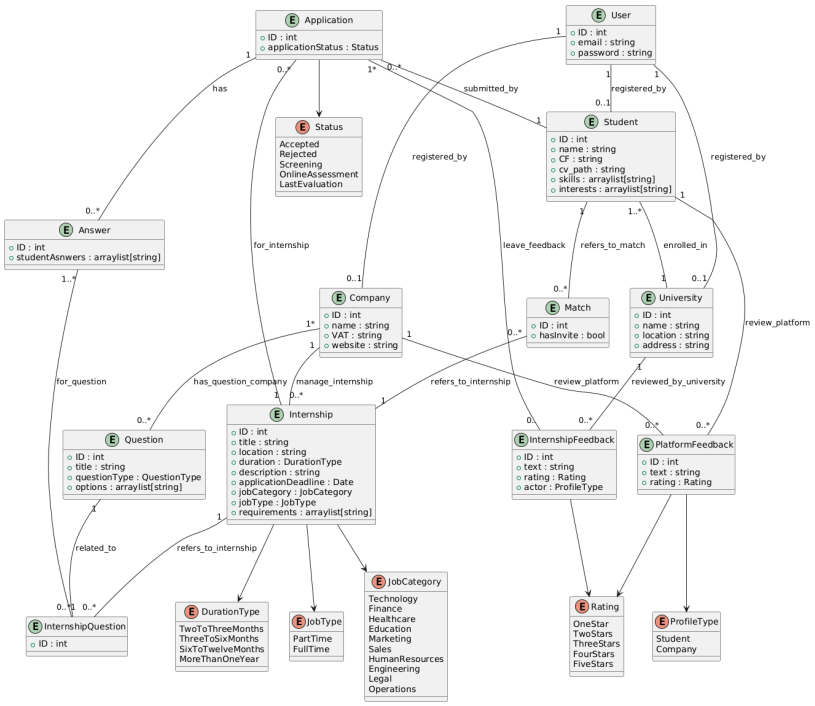


Figure 2.1: Class diagram

2.1.2. Scenarios and state diagrams

The following scenarios illustrate interactions between students, companies, and the S&C platform. In order to explain the behavior of some scenarios, we decide to adopt the use of BPMN instead of UML state diagrams, because better describes the exchange of information and messages between the actors (Look for it in the references).

- **Scenario 1: Student registers and uploads CV.**
  Maria, a third-year university student, is looking for internship opportunities to gain practical experience. She discovers the S&C platform, which connects students with relevant internships. To get started, she navigates to the registration page of the S&C platform. Maria provides her personal information, including her name, email, university, and sets up a secure password. The platform verifies her email through a confirmation link sent to her inbox. After verifying, Maria is successfully registered and directed to the homepage. By going into her profile section, she completes her profile by specifying her skills and interests, and uploads her CV to showcase her academic background, work experience, and skills. The system securely stores this information and uses it to generate internship recommendations tailored to Maria's profile. She is informed that she can update her profile over time.

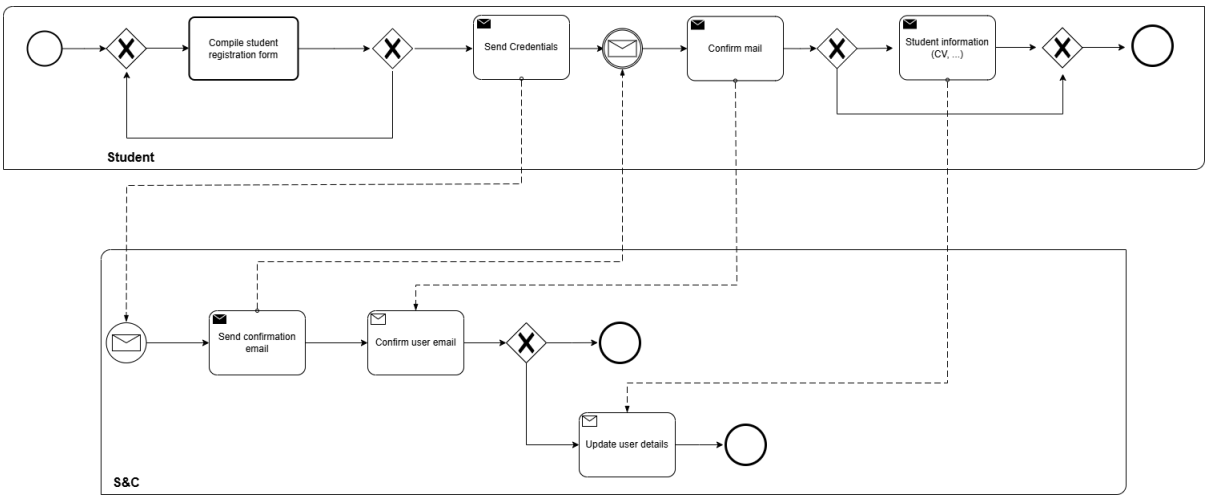


Figure 2.2: BPMN diagram scenario 1

- **Scenario 2: Company registers.**
  CodeWorks, a tech company specializing in front-end development, decides to utilize the S&C platform to find potential interns. The HR manager at CodeWorks begins by registering the company on the platform. They navigate to the company registration page, where they provide essential details such as the company name, VAT number, location, and a contact email, setting up a password for secure access. After submitting the information, a verification email is sent to the contact email provided. The HR manager completes the verification process by clicking the link, activating the company account on the platform.

- **Scenario 3: Company posts a new internship.**
  After creating a profile, CodeWorks is ready to post an internship position. The HR

manager logs into the S&C platform and selects the option to post a new internship. They complete fields for the job title, required skills, internship duration, and inside the description section they can define benefits, such as mentorship and training opportunities. Before submitting, the company must define the questions that will be asked to students in the online assessment phase. After submitting the internship details, the listing becomes visible to students.

- **Scenario 4: Student receives internship recommendations.**
  After setting up her profile, Maria begins exploring opportunities. Based on her profile, the S&C platform's recommendation engine suggests internships that align with her background. She receives a curated list of potential matches, including details like the position title, required skills, and company information. As Maria browses, she finds an internship at CodeWorks and decides to apply, with the platform offering further details on the job role expectations and deadlines.

- **Scenario 5: Company reviews applications and selects candidates for interviews.**
  CodeWorks reviews submissions for the internship. The HR team logs in to the S&C platform and accesses a list of applicants, including Maria, with CVs and profile details. After review, CodeWorks shortlists Maria and other candidates for the online assessment. The S&C platform updates Maria's application status to "Online Assessment," allowing her to independently complete the assessment questions on the platform provided by the company.

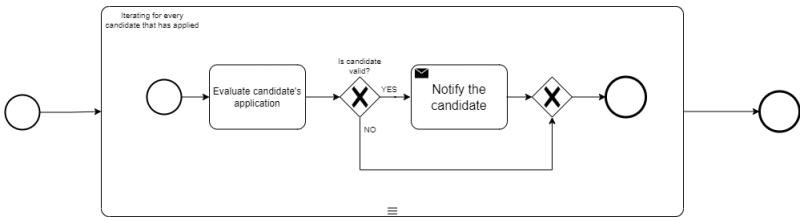


Figure 2.3: BPMN diagram scenario 5

- **Scenario 6: The student completes the online assessment, and the company reviews the responses.**
  Since Maria was accepted by the company, she now has access to the internship page where she can complete the online assessment by answering the questions prepared by the company. Once completed, she can submit it. After Maria submits her assessment, the company can review it and decide whether to accept her for the internship or exclude her via the application page.

- **Scenario 7: University monitors student internship progress.**
  Maria's university requires students to complete an internship and uses the S&C platform to monitor student progress. Once Maria secures the internship at CodeWorks, her university's coordinator views her status, including the start date, role, and completion date. A dashboard allows the coordinator to track Maria's feedback and address any concerns. If Maria or CodeWorks reports issues, the coordinator is notified, enabling them to assist in resolving challenges like scheduling conflicts or

misaligned expectations.

- **Scenario 8: Student Provides Internship Feedback and Receives Evaluation from the Company.**
  After completing her internship at CodeWorks, Maria can provide feedback on her experience by filling out a form and rating her overall satisfaction. Her feedback is anonymized and shared with CodeWorks to support future improvements. Similarly, CodeWorks provides feedback by rating Maria with stars and adding comments about her performance. This feedback is visible to companies during her future applications. Students, in turn, can view anonymized comments about the company before deciding to apply.

2.2. Product Functions

The Students&Companies (S&C) platform serves as an intermediary between students seeking internship opportunities and companies offering them. The primary goal of the platform is to facilitate a streamlined and efficient matchmaking process, providing both students and companies with a robust set of functionalities tailored to their unique needs. Below, the most important requirements of the system are outlined, focusing on core functions that enable users to interact, apply, and manage internships effectively.

2.2.1. G1: Students can search for internships that match their skills and career goals.

- R5: Profile editing — The S&C shall allow students to edit profiles and upload CV.
- R6: Skills and interests — The S&C shall allow students to edit personal details, skills, and interests in their profiles.
- R8: Internship search with filters — The S&C shall provide students with an internship search tool that includes filtering options for location, field of study, and publication date.

2.2.2. G2: Companies can advertise internships and engage suitable candidates.

- R15: Internship postings — The S&C shall allow companies to create internship postings, specifying job roles and required skills.
- R16: Edit postings — The S&C shall allow companies to edit existing internship postings after creation.
- R17: Dashboard for applications — The S&C shall allow companies to have a dashboard to review candidate applications and filter profiles.

2.2.3. G3: The platform can recommend relevant internships to students.

- R5: Profile editing — The S&C shall allow students to edit profiles and upload CV.
- R6: Skills and interests — The S&C shall allow students to edit personal details, skills, and interests in their profiles.
- R9: Tailored recommendations — The S&C shall allow students to get tailored internship suggestions based on their interests.
- R10: Improve recommendation engine — The S&C shall allow the recommendation engine to improve over time based on feedback from students and companies.
- R28: Skill improvement suggestions — The S&C shall allow suggestions to students on what skills to achieve based on their interests.

2.2.4. G4: The platform can recommend potential candidates to companies.

- R15: Internship postings — The S&C shall allow companies to create internship postings, specifying job roles and required skills.
- R17: Dashboard for applications — The S&C shall allow companies to have a dashboard to review candidate applications and filter profiles.
- R19: Candidate recommendation feed — The S&C shall allow companies to have a recommendation feed for candidates based on internship requirements.
- R20: Potential candidates — The S&C shall allow companies access to a "Potential Candidates" feature to view potential matches based on student profiles.

2.2.5. G5: Companies can manage the selection process through an interview management system.

- R13: View applications — The S&C shall allow companies to view submitted applications.
- R14: Accept or reject candidates — The S&C shall allow companies to accept or reject candidates directly from the submitted applications.
- R17: Dashboard for applications — The S&C shall allow companies to have a dashboard to review candidate applications and filter profiles.
- R18: Application tracking — The S&C shall allow companies access to a comprehensive page to track applications status.

2.2.6. G6: Companies can evaluate candidates.

- R13: View applications — The S&C shall allow companies to view submitted applications.
- R14: Accept or reject candidates — The S&C shall allow companies to accept or reject candidates directly from the submitted applications.
- R22: Candidate evaluation — The S&C shall allow companies to view feedback provided for candidates from previous internships.

2.2.7. G7: Students and companies can provide feedback to continuously improve the matchmaking process.

- R21: Feedback system — The S&C shall allow both students and companies to provide feedback, covering overall satisfaction.
- R22: Candidate evaluation — The S&C shall allow companies to view feedback provided for candidates from previous internships.

- R23: Company evaluation — The S&C shall allow students to view feedback provided for companies from previous interns.
- R25: Reporting feature — The S&C shall allow a reporting feature for users to report inappropriate or irrelevant internship environments, ensuring a safe and professional place.

2.2.8. G8: Universities can track and assess the ongoing progress of internships.

- R24: Feedback monitoring — The S&C shall allow universities to monitor feedback scores to ensure professional standards are met during internships.
- R26: University feedback — The S&C shall allow universities to write feedback on the platform to suggest improvements.
- R27: Direct feedback — The S&C shall allow universities to write feedback directly to students and companies.

2.2.9. G9: The platform can provide suggestions to improve CVs.

- R5: Profile editing — The S&C shall allow students to edit profiles and upload CV.
- R6: Skills and interests — The S&C shall allow students to edit personal details, skills, and interests in their profiles.
- R28: Skill improvement suggestions — The S&C shall allow suggestions to students on what skills to achieve based on their interests.

2.2.10. G10: The platform can provide suggestions to companies to improve internship description.

- R15: Internship postings — The S&C shall allow companies to create internship postings, specifying job roles and required skills.
- R16: Edit postings — The S&C shall allow companies to edit existing internship postings after creation.
- R29: Description suggestion - The S&C shall allow the platform to provide suggestions to companies for improving the quality and clarity of their internship descriptions.

2.3. User Characteristics

The Students&Companies (S&C) platform is designed to cater to three primary types of users: students, companies, and universities. Each user group has unique needs and characteristics, which the platform addresses to ensure a user-friendly and effective ex-

perience. Understanding these user characteristics is essential for aligning the platform's functionalities with user expectations and optimizing their interactions.

2.3.1. Students

Students are the primary user group for the S&C platform. Generally, they are undergraduate or graduate students from diverse academic backgrounds, including engineering, business, arts, and sciences. Students are often in search of practical experience, skill development, and improved employability, making internships highly valuable for their career growth.

The platform supports students by providing access to internship opportunities that match their specific skills, academic background, and career aspirations. With a simplified application process, students can easily apply for internships and submit their CVs directly through the platform, making the process efficient and accessible. To enhance the likelihood of securing a position, students receive notifications about recommended internships aligned with their profile, ensuring they don't miss out on opportunities. Additionally, students can track the status of their applications, allowing them to stay informed about each step of the process. To further support career development, the S&C platform offers students guidance on improving their CVs and profiles, enhancing their chances of selection for internships.

2.3.2. Companies

Companies on the S&C platform range from small startups to large enterprises across various industries, each seeking talented interns who can support their teams, bring fresh perspectives, and contribute to ongoing projects.

For companies, the S&C platform offers a straightforward registration process and an intuitive interface to post internships, allowing them to quickly reach a large pool of qualified students. Companies benefit from easy access to student profiles and CVs, enabling them to identify candidates with the skills and experiences that best fit their requirements. The platform also provides tools to manage applications efficiently, from the review stage through to collecting questions from the students. Companies can leave feedback to improve future offerings and to enhance the platform's recommendation algorithms.

2.3.3. Universities

Universities, particularly those involved in career services or specific academic departments, use the platform to oversee their students' internship experiences and ensure they align with the enstablished requirements. This group may include career service coordinators, faculty advisors, and program managers who play an active role in supporting students during their internships.

For universities, the S&C platform includes a monitoring dashboard that allows administrators to track students' internship statuses, review both student and company feedback,

and provide support when necessary. This feature is essential for maintaining an overview of students' progress and ensuring that internships meet academic standards. Additionally, administrators can mediate any complaints or issues that arise between students and companies, facilitating resolution and safeguarding the quality of the internship experience.

2.4. Assumptions, Dependencies, and Constraints

- **Internet Availability**: The platform assumes users have access to a stable internet connection to interact with the web-based interface.
- **Data Privacy**: The platform must comply with GDPR regulations, ensuring that all personal data from students and companies is handled securely and transparently.
- **Scalability**: The system must be able to scale to accommodate multiple universities and thousands of users simultaneously.
- **Cross-browser Compatibility**: The platform should work on all major browsers (e.g., Chrome, Firefox, Safari) and on both desktop and mobile devices.

2.5. Domain Assumptions

ID	Assumption
DA1	Students have varied skills and interests
DA2	Companies have specific internship requirements
DA3	The students need to provide a valid email address
DA4	The companies need to provide a valid email
DA5	The universities need to have a valid email
DA6	Both parties (students and companies) need to have a connection and a device to connect to the platform

DA7	The student and the university successfully register as a student and university, respectively.
DA8	Students are enrolled in the university they selected.
DA9	The company account accurately corresponds to the respective company.

3 | Specific Requirements

3.1. External Interface Requirements

3.1.1. User Interfaces

The system will provide a web-based user interface that caters to all user groups—students, companies, and universities. Each user group will have distinct interfaces designed to facilitate their respective roles. The interface must be intuitive, and supporting a seamless user experience for desktop devices.

For Students:

- **Recommendation Page**: Upon logging in, students will have access to a personalized page displaying recommended internships and company invites.
- **Profile Management**: The user interface will allow students to edit their profiles, including personal details, interests, and skills. It must support file uploads for CVs in common formats (PDF, DOCX).
- **Internships page**: Students will have access to an internship page with a search tool to filter internships by criteria such as name or localization.
- **Application Process**: A step-by-step guided process will follow students through the application process. The interface will show application deadlines, company requirements, and allow students to track their progress (e.g., application submitted, online assessment, etc.).

For Companies:

- **Internship Posting**: Companies will have a separate interface to create detailed internship postings. The interface will include fields for defining the role, required skills, compensation details, deadlines, and online assessment questions.
- **Candidate Review**: Companies will have a space that lists for each internship the students who have applied, including a summary of the students' profiles and CVs.
- **Recommendation Feed**: The interface will provide companies with a list of recommended candidates based on internship requirements, allowing them to invite those promising students to apply.

For Universities:

- **Monitoring Dashboard**: Universities will have access to a dashboard for overseeing the overall situation of internships, addressing complaints, and tracking student-company interactions. The dashboard will include a summary view of ongoing internships and flagged issues.
- **Complaint Management**: Universities will have a space dedicated to the complaints management. Administrators can log, track, and update complaint statuses through the interface, ensuring a transparent process for all parties involved.

3.1.2. Hardware Interfaces

The platform does not require specialized hardware; users only need a computer with an Internet connection to interact with the platform's servers.

3.1.3. Software Interfaces

The Students&Companies (S&C) platform interacts with various external software systems and tools to ensure its functionalities. The key software interfaces are as follows:

- **Database Interface:**
  - The system interacts with a relational database management system (e.g., PostgreSQL, MySQL) to store and retrieve user data, internship details, feedback, and recommendations.
  - The platform must ensure consistent data transactions (CRUD operations) with integrity and security.
- **Email Service Interface:**
  - The platform integrates with an external email service (e.g., SMTP server or third-party services like SendGrid) to send notifications for registration confirmation, interview schedules, internship updates, and feedback submissions.
- **Web Browser Compatibility:**
  - The system interfaces with modern web browsers (e.g., Chrome, Firefox, Safari) to ensure usability and consistent rendering of the web-based user interface.
- **File Upload and Validation Interface:**
  - The system supports file uploads (e.g., PDF for CVs) and integrates with tools to validate file format, size, and content security.

3.1.4. Communication Interfaces

The platform will use HTTPS for all communications to ensure secure data transmission between users and the system.

Email notifications will be sent using industry-standard email protocols (SMTP) with TLS encryption to ensure secure communication.

All this is done to ensure that users are promptly notified of important actions (e.g., internship recommendations) in real-time.

3.2. Functional Requirements

3.2.1. Use case diagrams

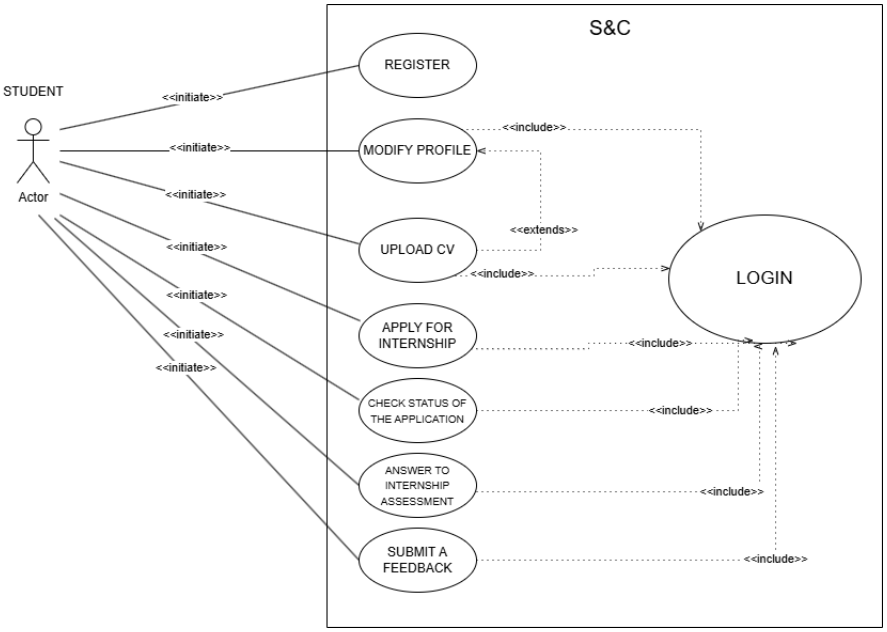


Figure 3.1: Student use case diagram

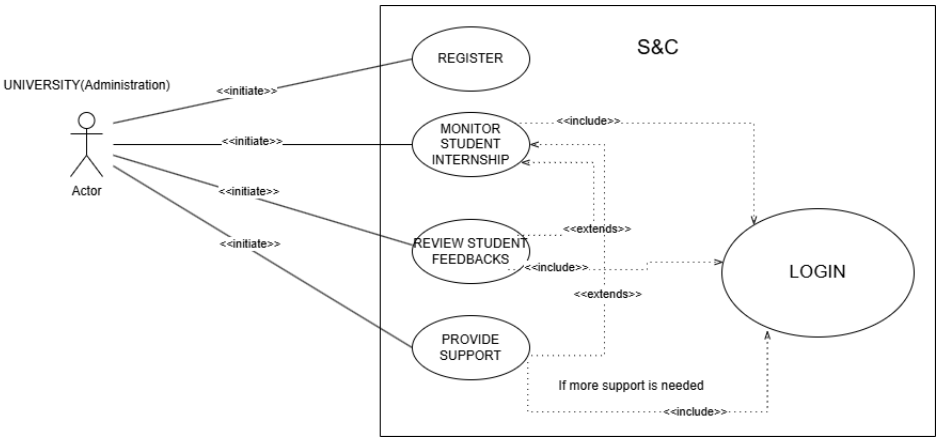


Figure 3.2: University use case diagram

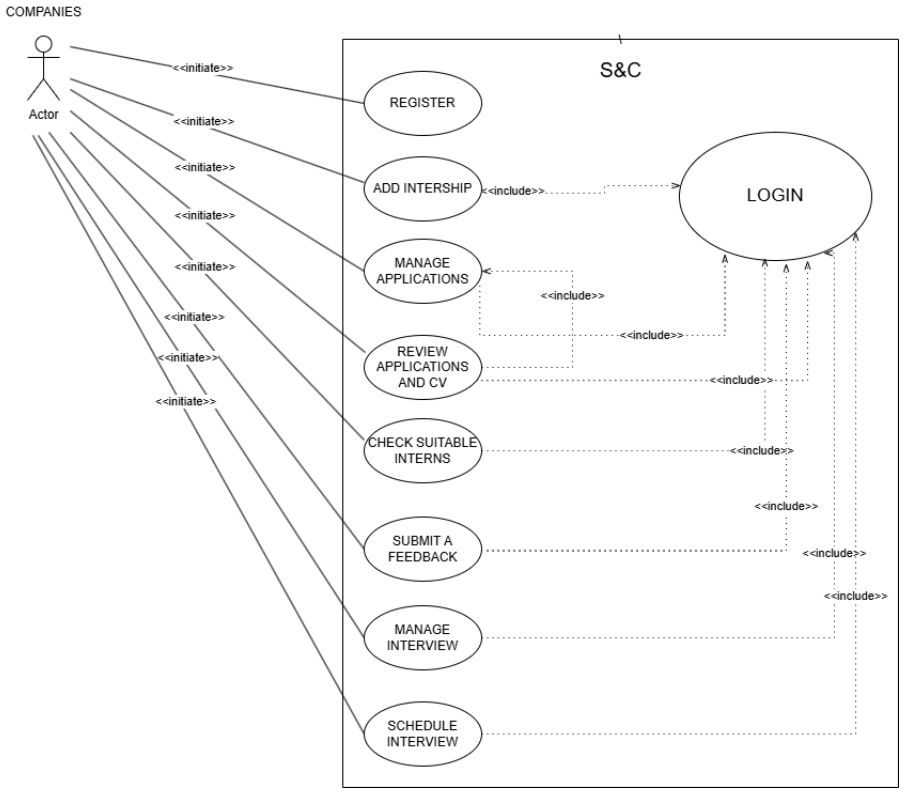


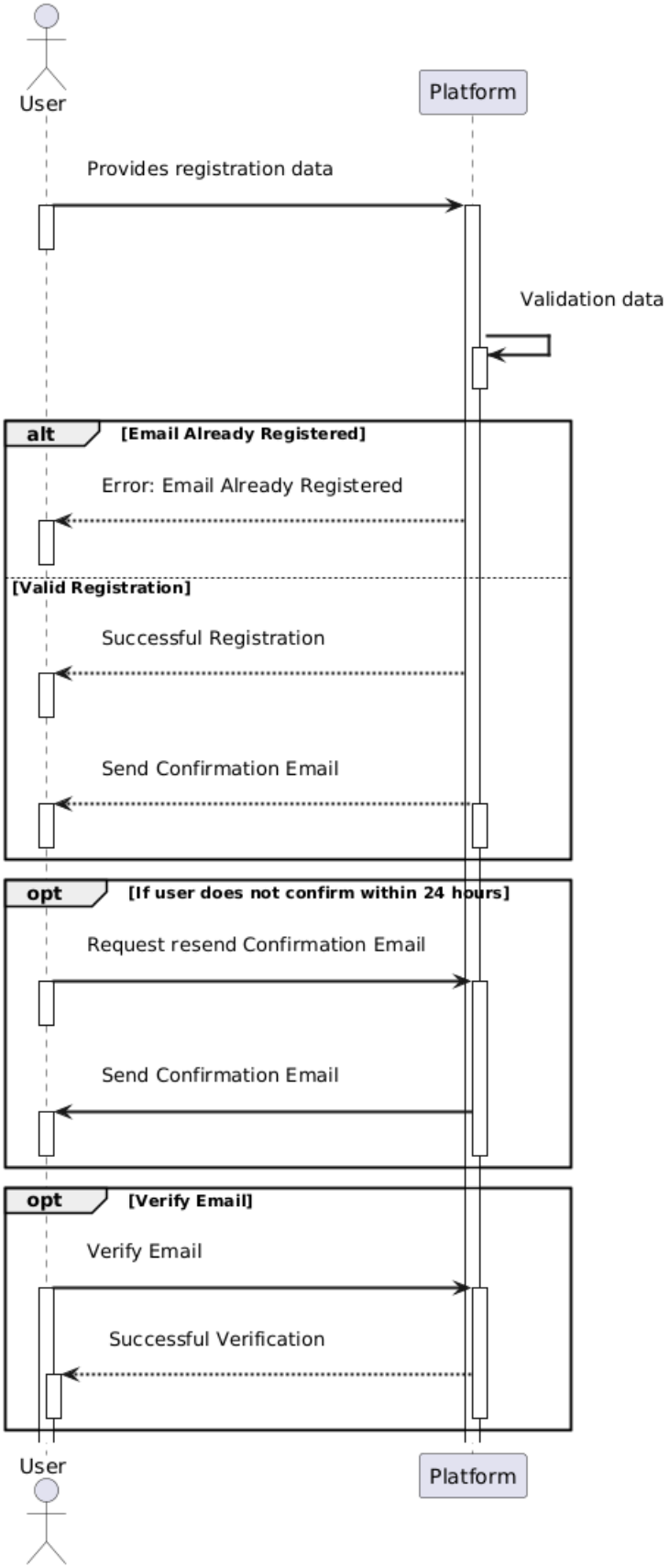
Figure 3.3: Company use case diagram

3.2.2. Use cases

1) User registration use case

Actor	User
Entry conditions	The user is on the registration page of the S&C platform and is ready to provide registration data.
Event Flow	1. The user provides registration data 2. S&C platform validates the given data. 3a. If the email is already registered, the platform returns an error: "Email already registered". 3b. If the data is valid, the registration is successful. 4. The user receives the confirmation email. 5a. she user clicks the confirmation link within 24 hours. 5b. If not, the user can request to resend the confirmation email.
Exit condition	The user registration process is successfully completed. The user might have confirmed his email.
Exceptions	3.a. The email is already registered.

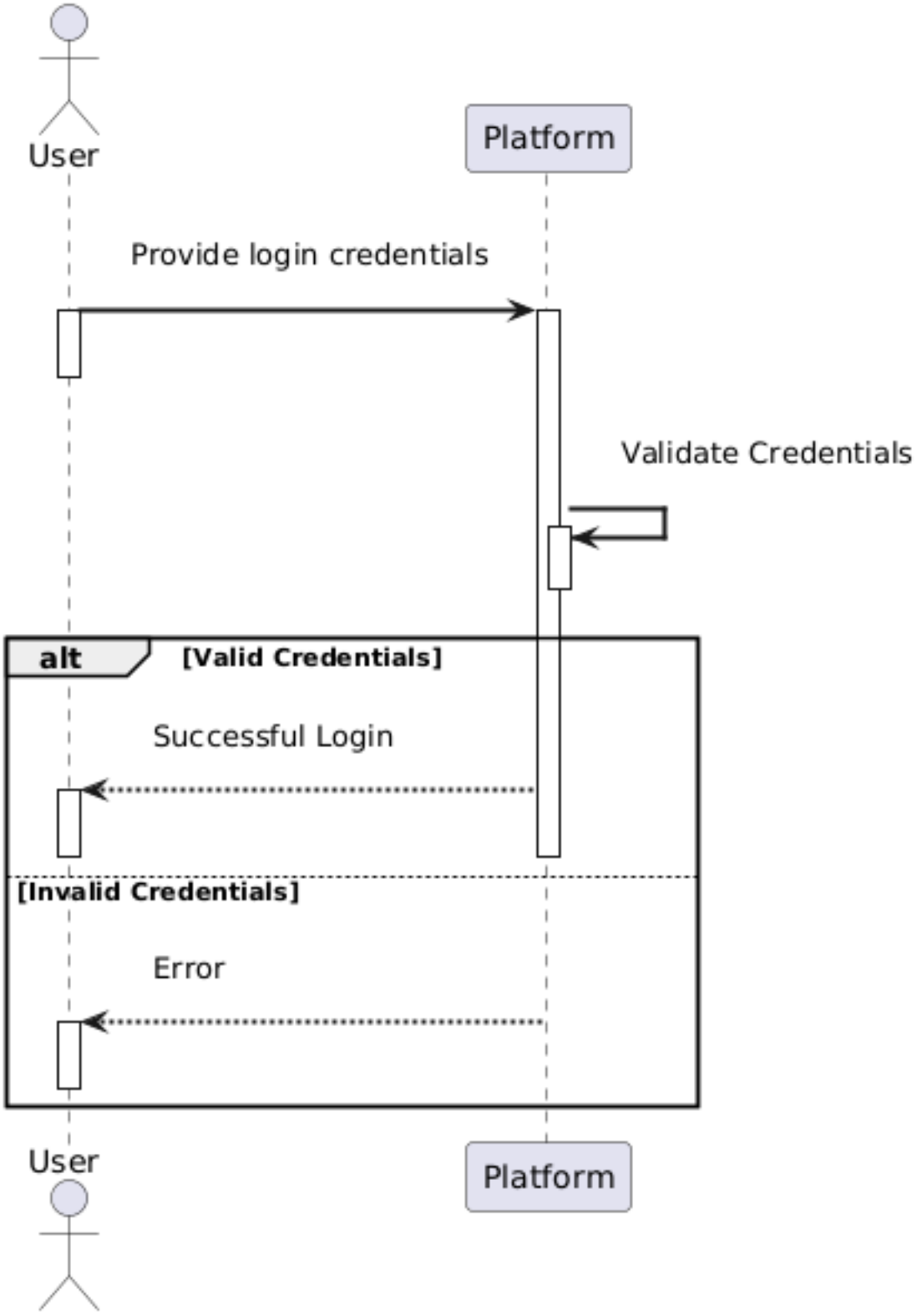
Table 3.1: User registration use case


User
Platform
Provides registration data
Validation data
alt
[Email Already Registered]
Error: Email Already Registered
[Valid Registration]
Successful Registration
Send Confirmation Email
opt
[If user does not confirm within 24 hours]
Request resend Confirmation Email
Send Confirmation Email
opt
[Verify Email]
Verify Email
Successful Verification
User
Platform

2) User Login

Actor	User
Entry conditions	The user is on the login page of the S&C platform, ready to enter credentials.
Event Flow	1. The user provides their login credentials 2. The S&C platform validates the credentials. 3a. If the credentials are valid, the platform successfully logs in the user. 3b. If the credentials are invalid, the platform returns an error: "Invalid email or password"
Exit condition	The user is logged into the platform if the credentials are valid.
Exceptions	3. Invalid email or password provided.

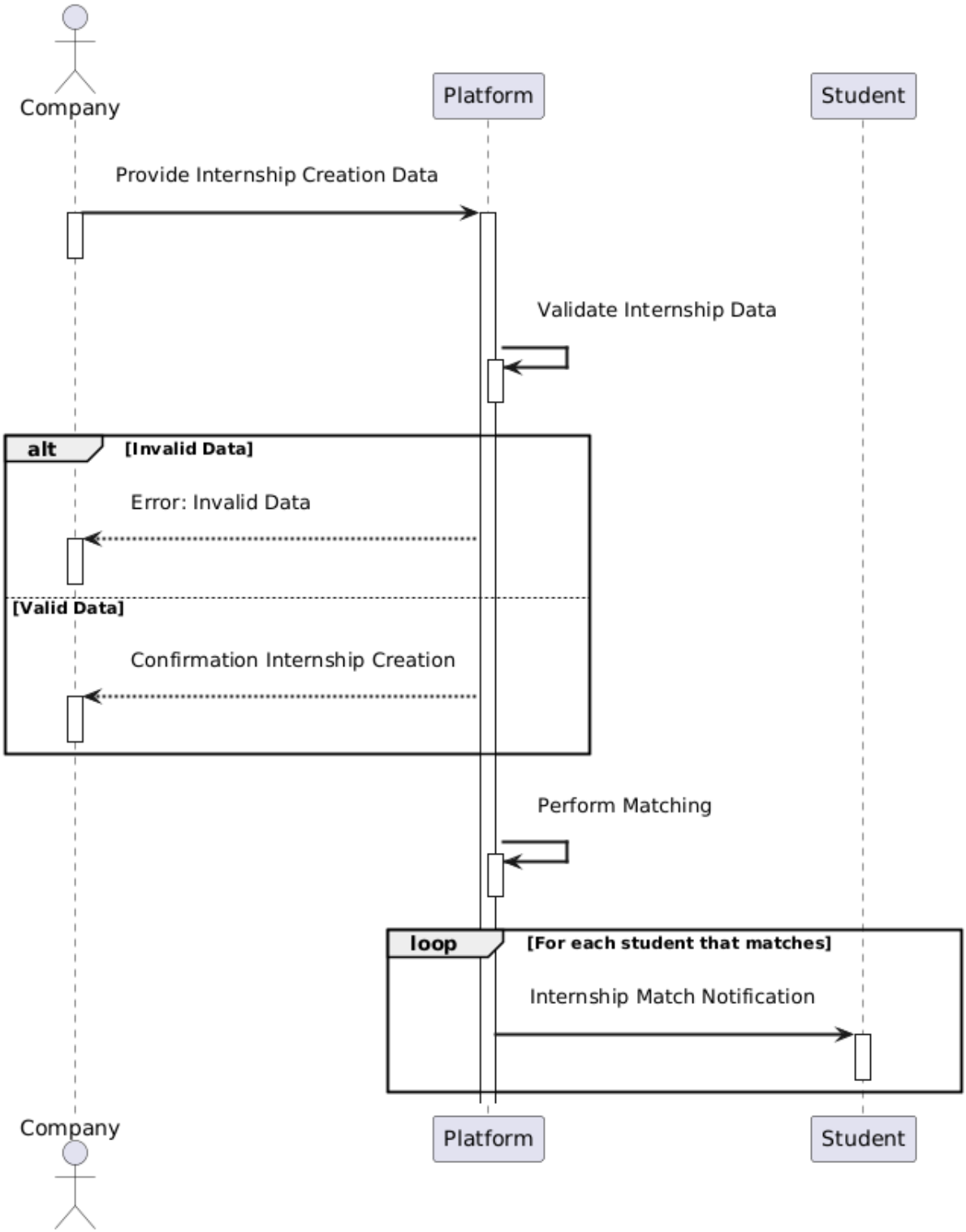
Table 3.2: User login use case


User
Platform
Provide login credentials
Validate Credentials
alt
[Valid Credentials]
Successful Login
[Invalid Credentials]
Error
User
Platform

3) Internship post creation use case

Actor	Company
Entry conditions	The company is correctly logged on the platform and it is ready to create a new internship post.
Event Flow	1. The company fills out the internship information form. 2. The S&C platform validates the internship data. 3a. If the data is valid, the platform creates the new internship post and confirms success to the company. 3b. If the data is invalid, the platform returns an error: "Error in internship data, please correct the form." 4. The platform performs matching to find relevant students for the internship post. 5. For each student that matches, the platform sends an internship post notification.
Exit condition	A new internship post is successfully created on the platform, and matching notifications are sent to relevant students.
Exceptions	3. Invalid internship data: The company must correct and resubmit the form until valid data is provided.

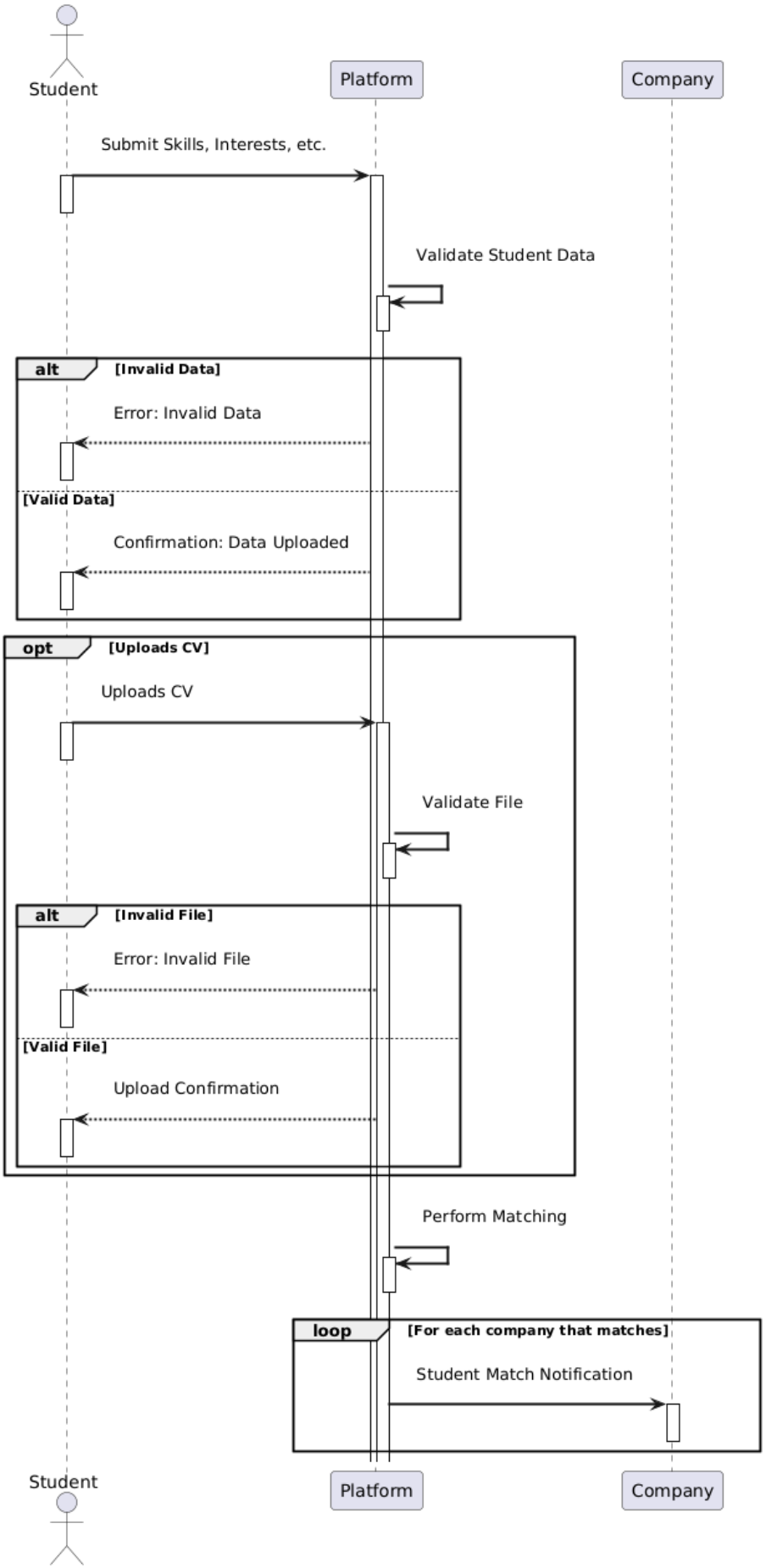
Table 3.3: Internship post creation use case


Company
Platform
Student
Provide Internship Creation Data
Validate Internship Data
alt
[Invalid Data]
Error: Invalid Data
[Valid Data]
Confirmation Internship Creation
Perform Matching
loop
[For each student that matches]
Internship Match Notification
Company
Platform
Student

4) Student updates his personal data and CV upload use case

Actor	Student
Entry conditions	The student is correctly logged on the S&C platform and he is ready to submit personal data and optionally upload his CV.
Event Flow	1. The student submits their skills, interests, and other personal data. 2a. If the personal data is invalid, the platform returns an error: "Error in personal data provided." 2b. If the personal data is valid, the platform confirms that the data was successfully uploaded. 3. The student optionally uploads their CV. 4a. If the CV is invalid, the platform returns an error: "Error in the file uploaded." 4b. If the CV is valid, the platform confirms that the upload was successful. 5. The platform performs matching based on the student data. 6. For each matching company, the platform sends a notification about the student.
Exit condition	The student's personal data and, if applicable, CV are successfully uploaded and relevant companies are notified.
Exceptions	2. Invalid personal data: The student must correct and resubmit their personal data. 4. Invalid CV: The student has uploaded an invalid file.

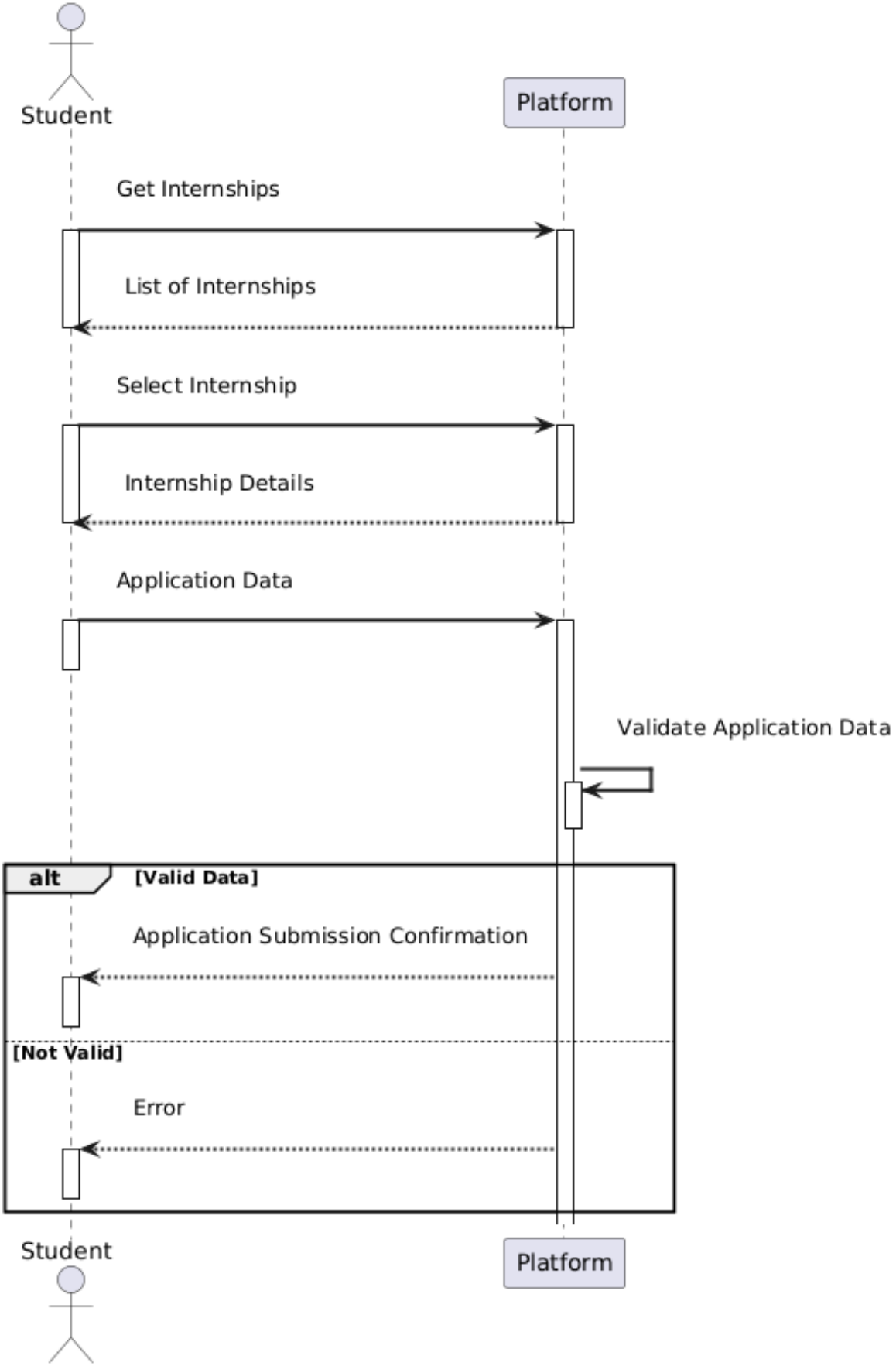
Table 3.4: Student updates his personal data and CV upload use case


Student
Platform
Company
Submit Skills, Interests, etc.
Validate Student Data
alt
[Invalid Data]
Error: Invalid Data
[Valid Data]
Confirmation: Data Uploaded
opt
[Uploads CV]
Uploads CV
Validate File
alt
[Invalid File]
Error: Invalid File
[Valid File]
Upload Confirmation
Perform Matching
loop
[For each company that matches]
Student Match Notification
Student
Platform
Company

5) Student submits an application to an internship

Actor	Student
Entry conditions	The student is logged on the S&C platform and he is ready to apply for an internship. The student has already updated his profile, inserting a CV and his skills and interests.
Event Flow	1. The student requests a list of internships. 2. The platform provides the list of available internships. 3. The student selects an internship from the list. 4. The platform provides the details of the selected internship. 5. The student submits their application data for the selected internship. 6. The platform validates the application data. 7a. If the data is valid, the platform confirms that the application submission was successful. 7b. If the data is not valid, the platform returns an error message.
Exit condition	The student's application for the internship is successfully submitted.
Exceptions	7b. Invalid application data.

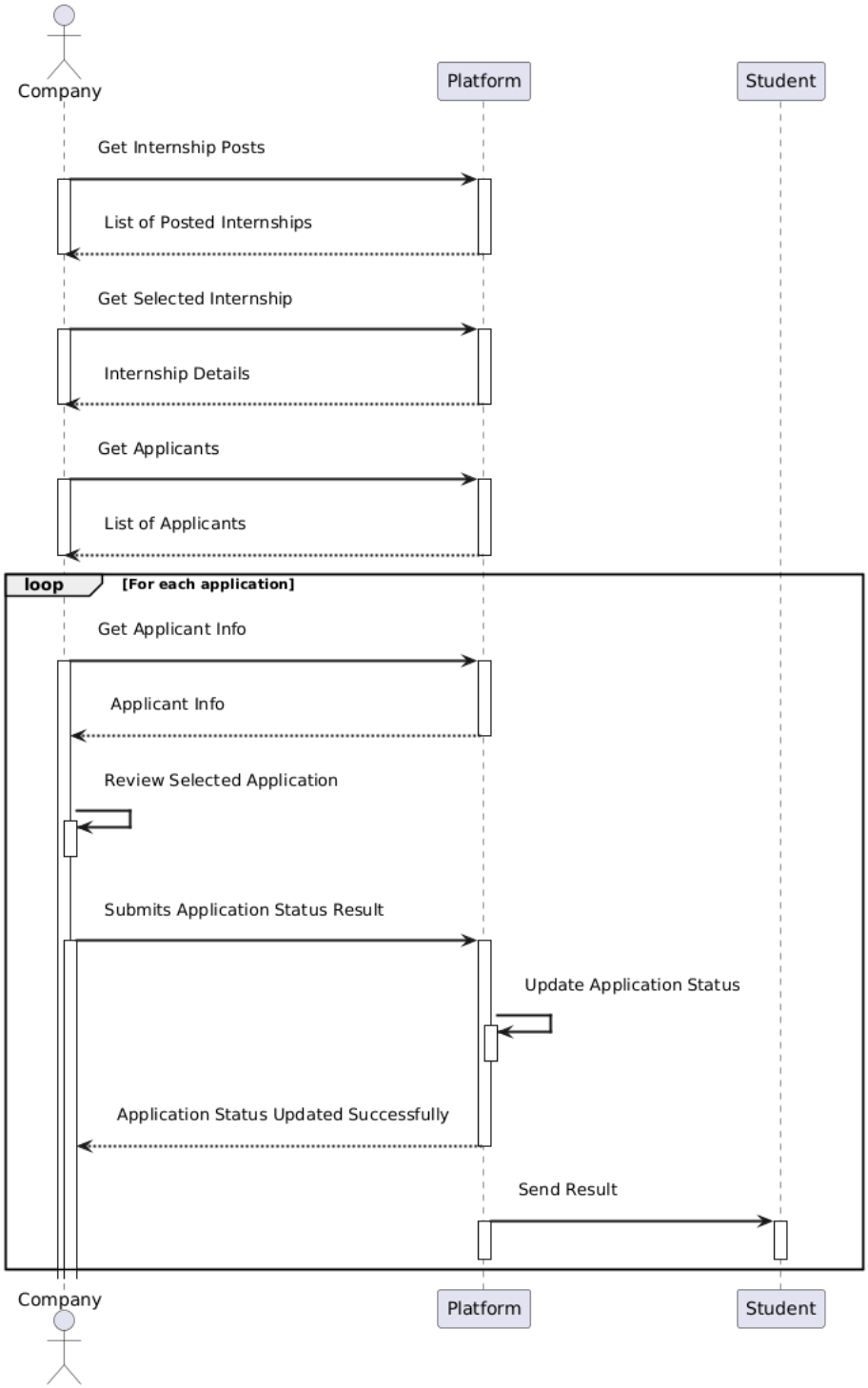
Table 3.5: Student submits an application to an internship


Student
Platform
Get Internships
List of Internships
Select Internship
Internship Details
Application Data
Validate Application Data
alt
[Valid Data]
Application Submission Confirmation
[Not Valid]
Error
Student
Platform

6) Company manages income applications

Actor	Company
Entry conditions	The company is logged on the S&C platform, ready to manage internship applications.
Event Flow	1. The company requests the list of internship posts. 2. The platform provides the list of posted internships. 3. The company selects a specific internship from the list. 4. The platform provides the details of the selected internship. 5. The company requests the list of applicants for the internship. 6. The platform provides the list of applicants. 7. For each applicant: a. The company requests applicant information. b. The platform provides the applicant information. c. The company reviews the selected application. d. The company submits the updated application status. e. The platform updates the application status f. Application status updated successfully g. The platform sends the result to the student.
Exit condition	The company's review and status update for each applicant are completed, and results are sent to students.
Exceptions	None specified.

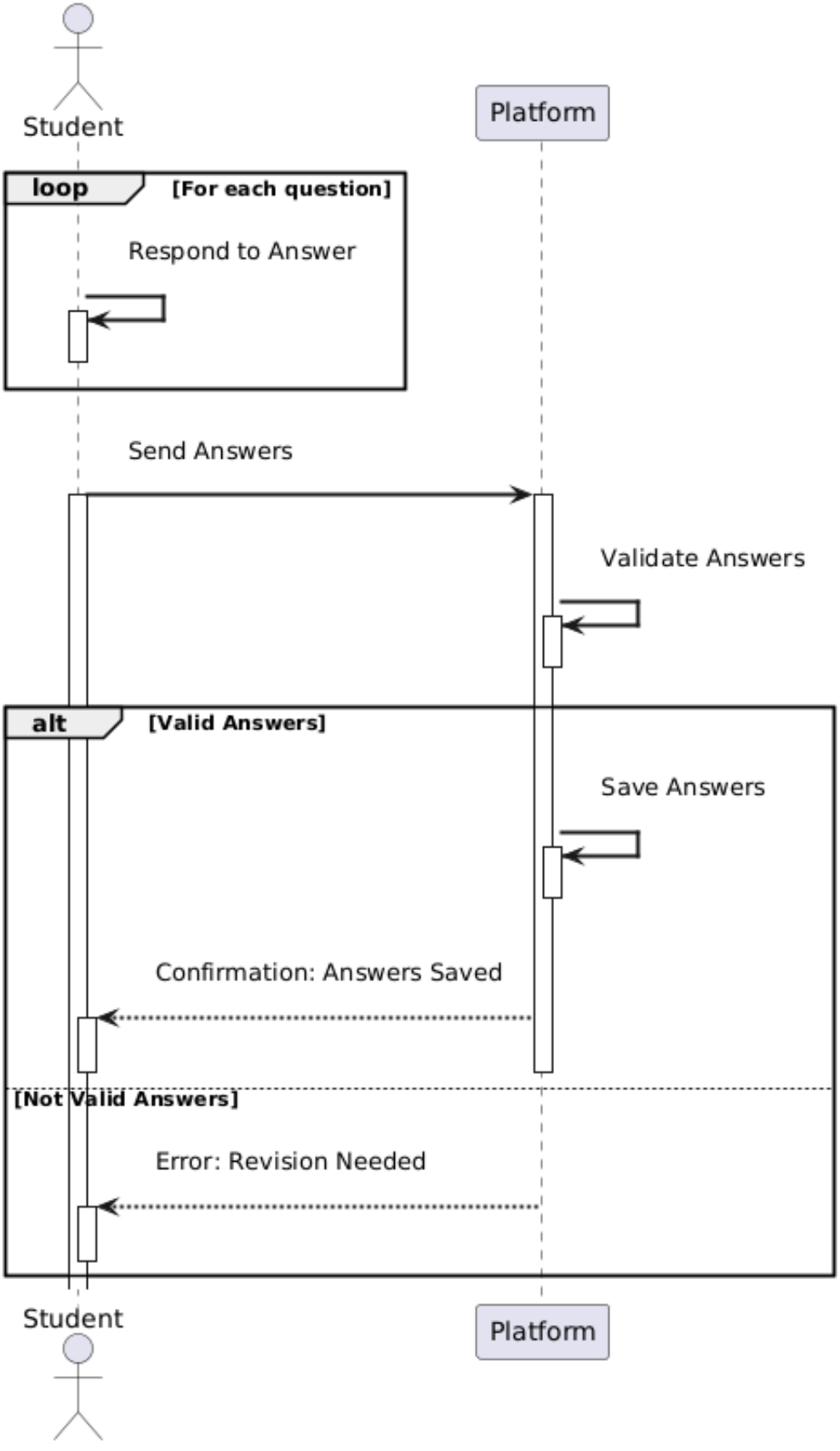
Table 3.6: Company management of internship applications use case


Company
Platform
Student
Get Internship Posts
List of Posted Internships
Get Selected Internship
Internship Details
Get Applicants
List of Applicants
loop
[For each application]
Get Applicant Info
Applicant Info
Review Selected Application
Submits Application Status Result
Update Application Status
Application Status Updated Successfully
Send Result
Company
Platform
Student

7) Student sends online assessment answers

Actor	Student
Entry conditions	The student is loggede on the platform, has passed the screening of the specific application and ready to respond to the online assessment questions. The student is already on the appropriate online assessment page on the platform.
Event Flow	1. The student responds to each question individually. 2. After answering all questions, the student sends their answers to the platform. 3. The platform validates the submitted answers. 4a. If the answers are valid, the platform saves the answers and sends a confirmation to the student. 4b. If the answers are not valid, the platform sends an error message to the student indicating that revision is needed.
Exit condition	The student's answers are successfully validated and saved on the platform, or the student is notified to revise the answers.
Exceptions	4. Invalid answers: The student must revise their answers.

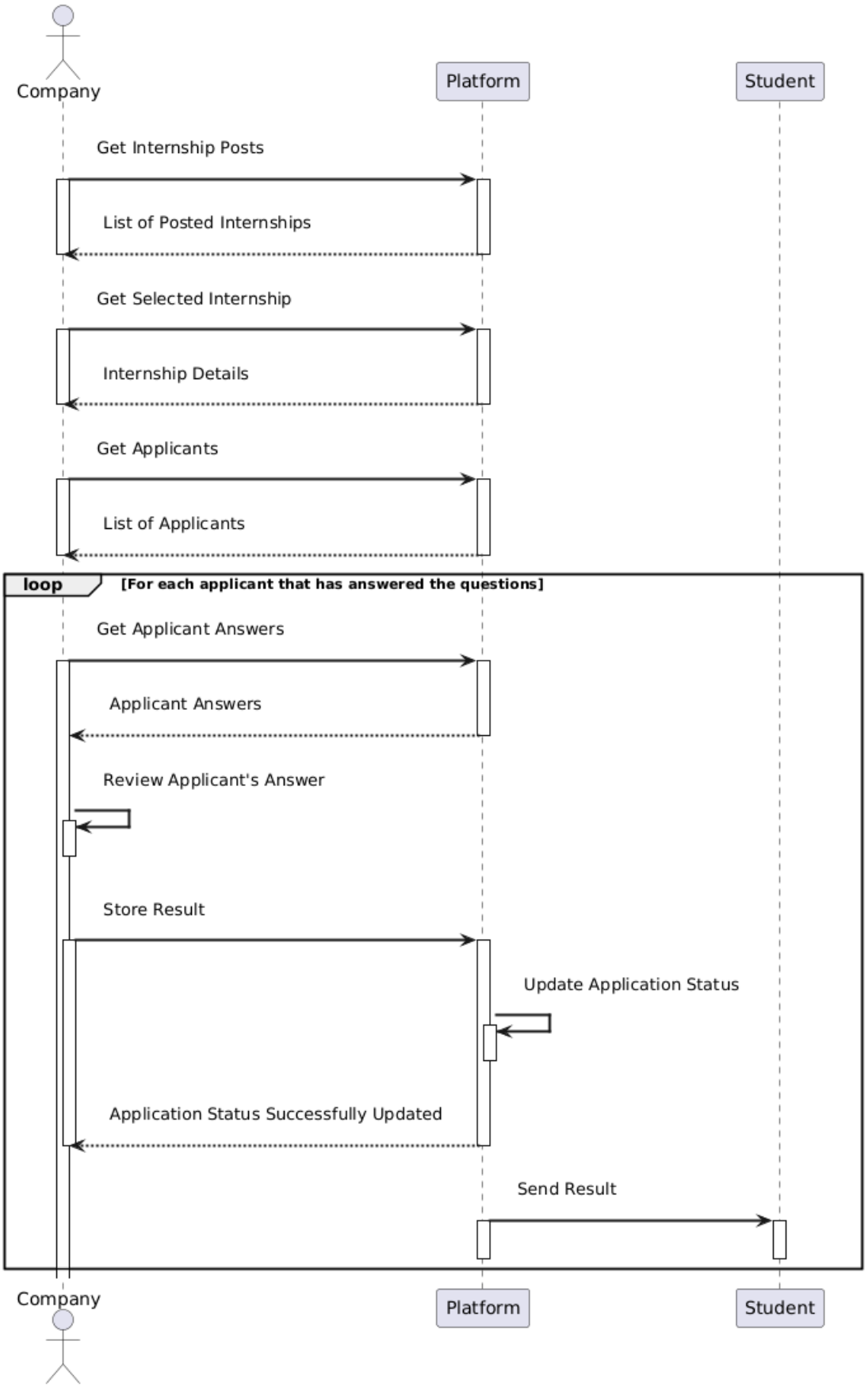
Table 3.7: Student answer submission and validation use case


Student
Platform
loop
[For each question]
Respond to Answer
Send Answers
Validate Answers
alt
[Valid Answers]
Save Answers
Confirmation: Answers Saved
[Not Valid Answers]
Error: Revision Needed
Student
Platform

8) Company reviews online assessment questions

Actor	Company
Entry conditions	The company is logged on the platform and it is ready to manage one of its internship online assessment questions.
Event Flow	1. The company requests the list of internship posts. 2. The platform provides the list of posted internships. 3. The company selects a specific internship from the list. 4. The platform provides the details of the selected internship. 5. The company requests the list of applicants for the internship. 6. The platform provides the list of applicants. 7. For each applicant that has answered the questions: a. The company requests the applicant's answers. b. The platform provides the applicant's answers. c. The company reviews the applicant's answers. d. The company submits the application status result. e. The platform updates the application status result f. The platform confirms to the company the successful update of the application status. g. The platform sends the result to the student.
Exit condition	The company's review and status update for each applicant are completed, and results are sent to the students.
Exceptions	None specified.

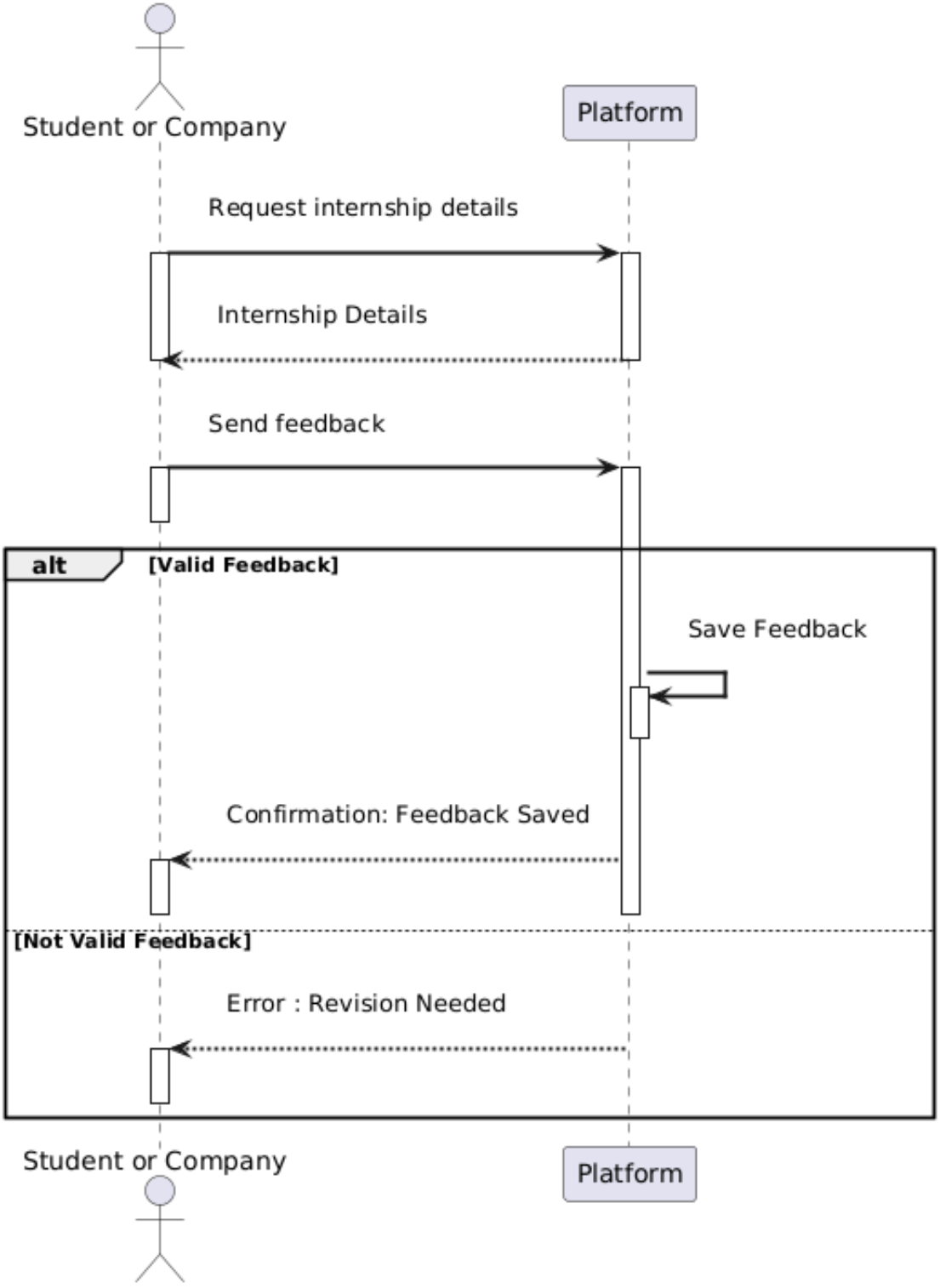
Table 3.8: Company management of internship applications use case


Company
Platform
Student
Get Internship Posts
List of Posted Internships
Get Selected Internship
Internship Details
Get Applicants
List of Applicants
loop
[For each applicant that has answered the questions]
Get Applicant Answers
Applicant Answers
Review Applicant's Answer
Store Result
Update Application Status
Application Status Successfully Updated
Send Result
Company
Platform
Student

9) Student or Company sends a feedback about the internship

Actor	Student or Company
Entry conditions	The student or the company provides a feedback on his experience with the internship. The actor is effectively involved in the related internship.
Event Flow	1. The actor selects the internship to review. 2. The platform responds with the internship details. 3. The actor sends the feedback. 4. The platform validates the provided feedback 5a. The platform responds with a confirmation feedback in case the validation is successful. 5b. The platform responds with an error feedback in case the validation has not been successful .
Exit condition	The feedback is well completed, and registered.
Exceptions	The validation of the feedback has been not successful.

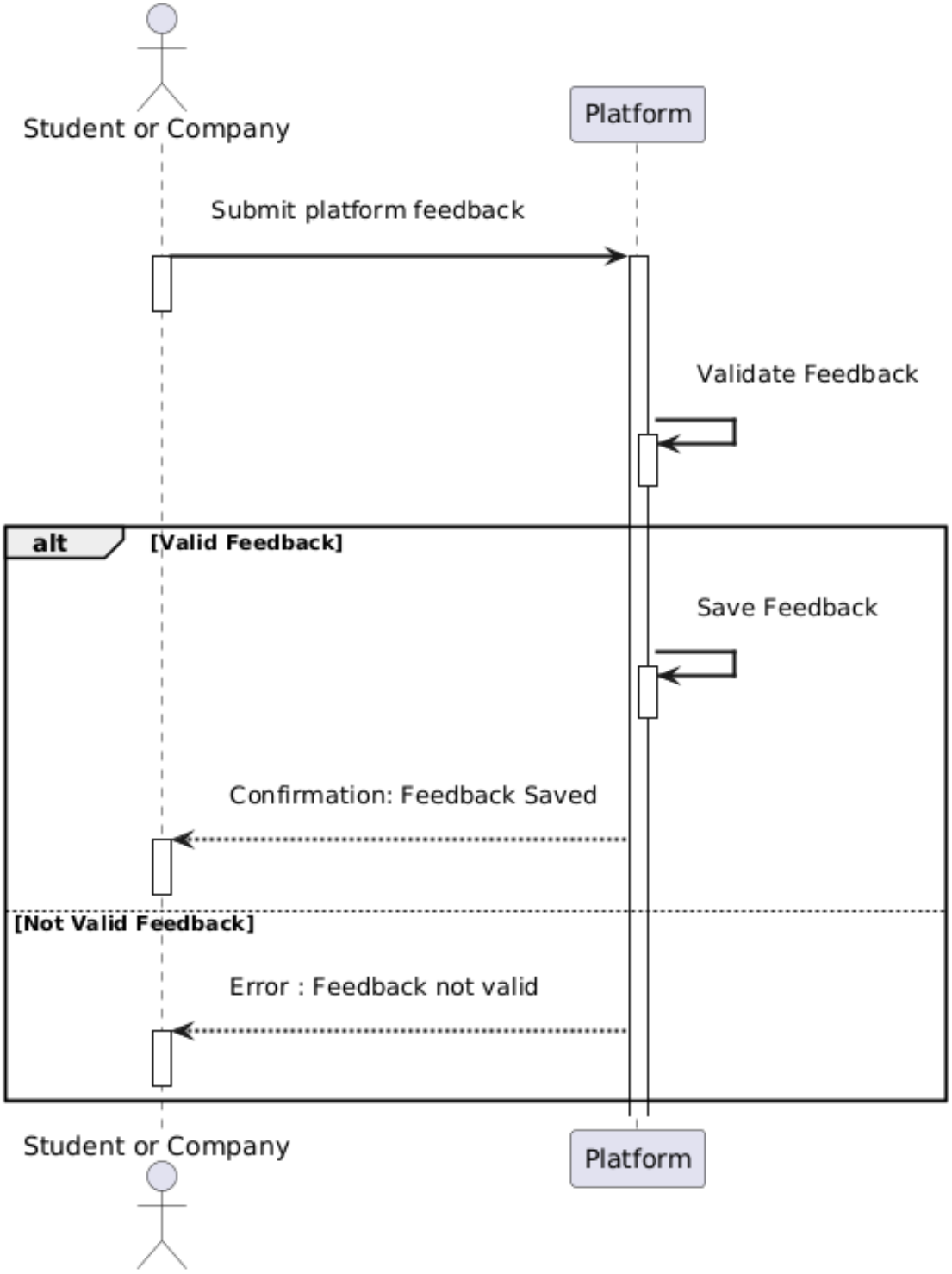
Table 3.9: Student or Company sends a feedback about the internship


Student or Company
Platform
Request internship details
Internship Details
Send feedback
alt
[Valid Feedback]
Save Feedback
Confirmation: Feedback Saved
[Not Valid Feedback]
Error : Revision Needed
Student or Company
Platform

10) Student or Company sends a feedback about the platform

Actor	Student or Company
Entry conditions	The student or the company provides a feedback on his experience on the platform.
Event Flow	1. The actor sends a platform feedback. 2. The platform validates the provided feedback 3a. The platform responds with a confirmation feedback in case the validation is successful. 3b. The platform responds with an error feedback in case the validation has not been successful .
Exit condition	The feedback is well completed, and has been correctly registered.
Exceptions	The feedback provided is not valid.

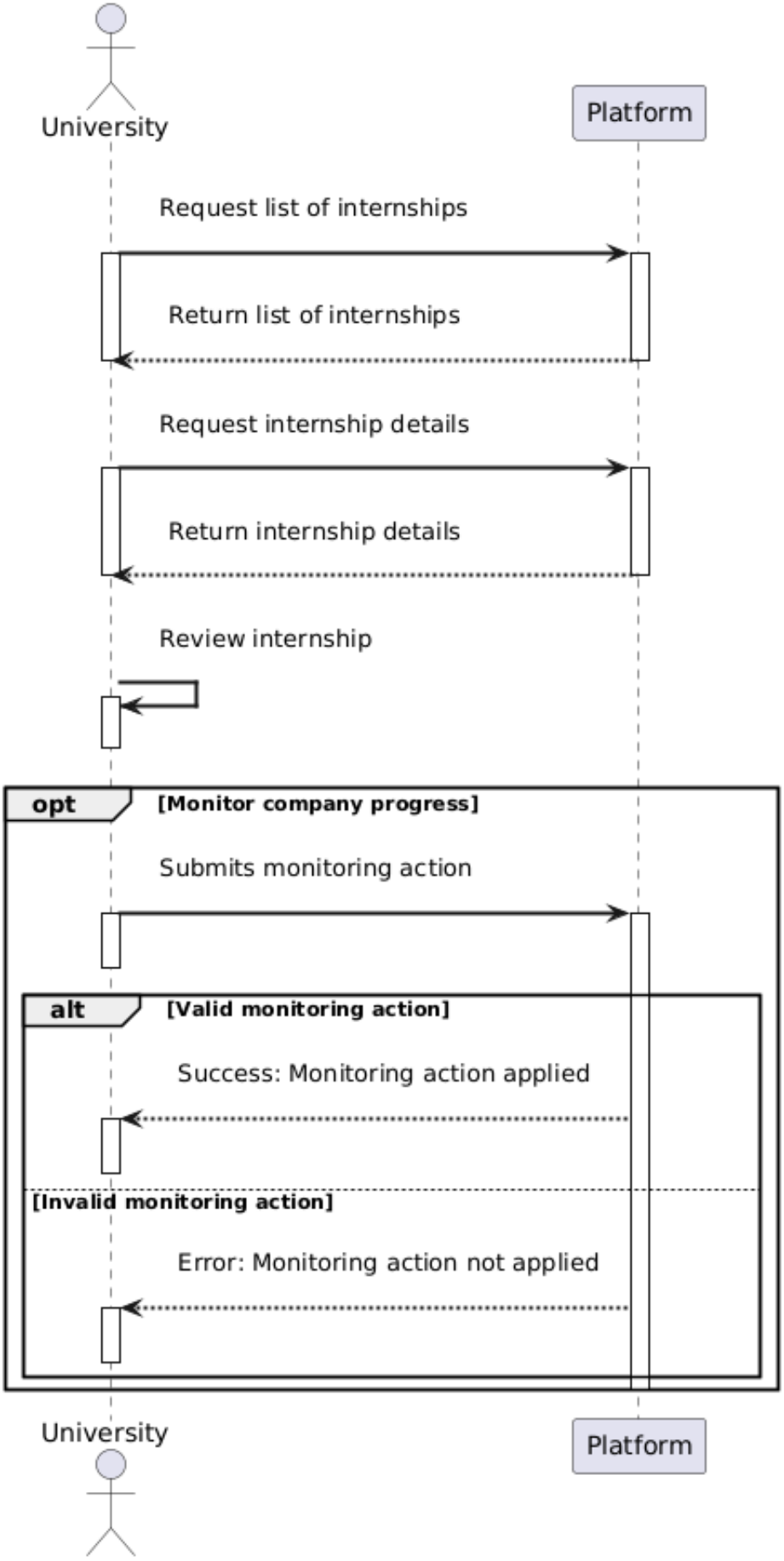
Table 3.10: The student or the company provides a feedback on his experience on the platform.


Student or Company
Platform
Submit platform feedback
Validate Feedback
alt
[Valid Feedback]
Save Feedback
Confirmation: Feedback Saved
[Not Valid Feedback]
Error : Feedback not valid
Student or Company
Platform

11) University monitors the progress of internships

Actor	University
Entry conditions	The university is correctly logged on the plaform and he is ready to monitor an internship.
Event Flow	1. The university requests a list of internships from the platform. 2. The platform returns the list of internships(including only those which involve students of that university). 3. The university selects a specific internship. 4. The platform returns the internship details. 5. The university reviews the internship. 6. The university optionally performs a monitoring action. 7a. The platform confirms that the action has been successfully applied. 7b. The platform returns an error, since the action is not valid.
Exit condition	Monitoring results (success or error) are retrieved, and relevant information is displayed or stored.
Exceptions	Missing data for monitoring action.

Table 3.11: University monitors the progress of internships


University
Platform
Request list of internships
Return list of internships
Request internship details
Return internship details
Review internship
opt
[Monitor company progress]
Submits monitoring action
alt
[Valid monitoring action]
Success: Monitoring action applied
[Invalid monitoring action]
Error: Monitoring action not applied
University
Platform

3.2.3. Summary of the Functional Requirements

R1	The S&C shall allow users to log in to their accounts using their registered email and password.
R2	The S&C shall allow users to reset their password via a "Forgot Password" feature, with verification sent to their registered email.
R3	The S&C shall allow users to log out securely from their accounts.
R4	The S&C shall allow users to register on the platform.
R5	The S&C shall allow students to edit profiles and upload CV.
R6	The S&C shall allow students to edit personal details, skills, and interests in their profiles.
R7	The S&C shall allow students to submit assessments, including answering open-ended and multiple-choice questions.
R8	The S&C shall provide students with an internship search tool that includes filtering options for location, field of study, and publication date.
R9	The S&C shall allow students to get tailored internship suggestions based on their interests.
R10	The S&C shall allow the recommendation engine to improve over time based on feedback from students and companies.
R12	The S&C shall allow real-time tracking of application statuses, showing students the progress of applications at each stage.
R13	The S&C shall allow companies to view submitted applications.
R14	The S&C shall allow companies to accept or reject candidates directly from the submitted applications.
R15	The S&C shall allow companies to create internship postings, specifying job roles and required skills.
R16	The S&C shall allow companies to edit existing internship postings after creation.
R17	The S&C shall allow companies to have a dashboard to review candidate applications and filter profiles.
R18	The S&C shall allow companies access to a comprehensive page to track applications status.
R19	The S&C shall allow companies to have a recommendation feed for candidates based on internship requirements.
R20	The S&C shall allow companies to access a "Potential Candidates" feature to view potential matches based on student profiles.
R21	The S&C shall allow both students and companies to provide feedback, covering overall satisfaction.
R22	The S&C shall allow companies to view feedback provided for candidates from previous internships.
R23	The S&C shall allow students to view feedback provided for companies from previous interns.
R24	The S&C shall allow universities to monitor feedback scores to ensure professional standards are met during internships.
R25	The S&C shall allow a reporting feature for users to report inappropriate or irrelevant internship environments, ensuring a safe and professional place.

R26	The S&C shall allow universities to write feedback on the platform to suggest improvements.
R27	The S&C shall allow universities to write feedback directly to students and companies.
R28	The S&C shall allow suggestions to students on what skills to achieve based on their interests.
R29	The S&C shall allow the platform to provide suggestions to companies for improving the quality and clarity of their internship descriptions.

3.2.4. Mapping on Goals

In the following table it is shown how the different goals map on the requirements and domain assumptions described in the previous chapters. Furthermore, the mapping is made in order to make this formula hold

$$R \wedge D \models G \tag{3.1}$$

Goal	**Domain Assumptions (DA)**	**Requirements (R)**
G1: Students can search for internships that match their skills and career goals.	DA1: Students have varied skills and interests. DA8: Students are enrolled in the university they selected.	R5: Allow students to create/edit profiles, upload CVs, and validate them in real-time. R6: Allow students to edit personal details, skills, and interests in their profiles. R8: Provide a search tool with filtering options for location, field of study, and publication date.
G2: Companies can advertise internships and engage suitable candidates.	DA2: Companies have specific internship requirements. DA9: The company account accurately corresponds to the respective company.	R15: Allow companies to create internship postings, specifying job roles and required skills. R16: Allow companies to edit existing internship postings after creation. R17: Provide companies with a dashboard to review candidate applications and filter profiles.

G3: The platform can recommend relevant internships to students.	DA1: Students have varied skills and interests. DA8: Students are enrolled in the university they selected.	R5: Allow students to create/edit profiles, upload CVs, and validate them in real-time. R6: Allow students to edit personal details, skills, and interests in their profiles. R9: Provide tailored internship suggestions based on students' interests. R10: Improve the recommendation engine over time using feedback from students and companies. R28: Suggest skills for students to develop based on their interests.
G4: The platform can recommend potential candidates to companies.	DA2: Companies have specific internship requirements. DA9: The company account accurately corresponds to the respective company.	R15: Allow companies to create internship postings, specifying job roles and required skills. R17: Provide companies with a dashboard to review candidate applications and filter profiles. R19: Provide companies with a recommendation feed for candidates based on internship requirements. R20: Enable companies to view potential matches through a "Potential Candidates" feature.

G5: Companies can manage the selection process through an interview management system.	DA2: Companies have specific internship requirements. DA9: The company account accurately corresponds to the respective company.	R13: Allow companies to view submitted applications. R14: Allow companies to accept or reject candidates directly from submitted applications. R17: Provide companies with a dashboard to review candidate applications and filter profiles. R18: Enable companies to track application statuses through a comprehensive page.
G6: Companies can evaluate candidates.	DA2: Companies have specific internship requirements. DA9: The company account accurately corresponds to the respective company.	R13: Allow companies to view submitted applications. R14: Allow companies to accept or reject candidates directly from submitted applications. R22: Enable companies to view feedback provided for candidates from previous internships.
G7: Students and companies can provide feedback to continuously improve the matchmaking process.	DA1: Students have varied skills and interests. DA2: Companies have specific internship requirements.	R21: Allow both students and companies to provide feedback covering overall satisfaction. R22: Enable companies to view feedback provided for candidates from previous internships. R23: Allow students to view feedback provided for companies from previous interns. R25: Provide a reporting feature for users to report inappropriate or irrelevant internship environments.

G8: Universities can track and assess the ongoing progress of internships.	DA7: The student and the university successfully register as a student and university, respectively.	R24: Allow universities to monitor feedback scores to ensure professional standards. R26: Enable universities to provide feedback on the platform to suggest improvements. R27: Allow universities to provide feedback directly to students and companies.
G9: The platform can provide suggestions to improve CVs.	DA1: Students have varied skills and interests. DA3: The students need to provide a valid email address.	R5: Allow students to create/edit profiles, upload CVs, and validate them in real-time. R6: Allow students to edit personal details, skills, and interests in their profiles. R28: Suggest skills for students to develop based on their interests.
G10: The platform can provide suggestions to companies to improve internship description.	DA2: Companies have specific internship requirements. DA4: The companies need to provide a valid email.	R15: Allow companies to create internship postings, specifying job roles and required skills. R16: Allow companies to edit existing internship postings after creation. R29: Suggest improvements to companies for the quality and clarity of their internship descriptions.

- **Student Profile Management**:
  - Students can create and manage profiles, including personal details, education history, skills, and work experience.
  - The profile interface will support dynamic updates, and validation of critical fields to ensure profile completeness.
  - Uploaded CVs must be in PDF or DOCX format, and the system must validate that the upload meets the required format.
  - Profiles must support a review system where students can preview how their information will appear to potential employers.
- **Internship Listings**:

  - Companies can create, update, and delete internship listings with detailed descriptions, requirements, and benefits.
  - Listings must include filters for location, skills, and compensation, allowing students to search effectively.
  - The system must allow companies to specify internship deadlines, and automatically remove expired listings.
  - A dynamic feedback mechanism will notify companies about the completeness and attractiveness of their internship postings, suggesting improvements if needed.
- **Recommendation System**:
  - The recommendation engine must take into account factors such as the student's skills, location preferences, previous internships, and company requirements.
  - The engine will learn and improve over time using feedback data from previous internships, adjusting future recommendations based on the outcomes and feedback provided by both students and companies.
- **Selection and Interview Process**:
  - Companies can select candidates for interviews and manage interview schedules directly through the platform.
  - Structured questionnaires will be provided by companies for student applicants to complete prior to interviews, with results stored in the system for company review.
  - Companies will be able to log interview outcomes, including scores and qualitative feedback, directly into the system to aid decision-making.
- **Feedback Collection**:
  - After each internship, both students and companies must provide structured feedback on the experience.
  - The feedback must cover multiple dimensions, including skills demonstrated, professionalism, and overall satisfaction.
  - The system will anonymize feedback to comply with GDPR regulations, ensuring privacy for both parties involved.
  - The feedback will be used as a data source for improving the recommendation system and internship matching algorithm.
- **Complaint Handling**:
  - Universities must have access to a complaint management system, allowing them to view and manage complaints filed by either students or companies.

- Complaints must be classified by type (e.g., harassment, contract breach) and tracked through a resolution workflow.
- Complaints can be escalated for review by a university administrator, who will have access to the full history of the issue.
- The system will automatically notify all relevant parties (students, companies, administrators) of complaint status updates.

3.3. Performance Requirements

3.3.1. Number of Users

The platform will be used by multiple parties, including students, companies, and universities. Based on market research, which includes a comparison with existing similar platforms such as the CareerService platform for Politecnico di Milano (Polimi) and other internship-matching services across Europe, we estimate that S&C will attract approximately 20,000 students and 2,500 companies from various universities and industries. Additionally, around 50 universities will be actively using the platform to monitor internships. This gives us an estimated total user base of 22,550 users.

Considering a worst-case scenario where 40% of the users are active simultaneously, the system must support up to 9,020 concurrent users. The platform must ensure smooth operation, even during peak usage times.

3.3.2. Data Storage

The platform needs to store various types of data related to students, companies, internships, and the matchmaking process. Below are the estimated storage requirements for the first year of operation:

- **Student data (profile)**: Each student will have a profile containing personal information such as name, contact details, and skillset. This profile data is estimated to require around 10 KB per student. Considering 20,000 students:

$$20,000 \times 10\,\text{KB} = 195.3\,\text{MB}$$

- **Student data (PDF CVs)**: In addition to the basic profile information, each student is expected to upload their CV in PDF format. The average size of a CV in PDF format is estimated to be around 300 KB. Thus, for 20,000 students:

$$20,000 \times 300\,\text{KB} = 5.72\,\text{GB}$$

- **Company data**: Each company will have a profile including company information, project descriptions, and internship offerings. Assuming 15 KB of storage per company profile and considering 2,500 companies:

$$2,500 \times 15\,\text{KB} = 36.6\,\text{MB}$$

- **Internship postings**: Each internship posting will include information about the project, tasks, technologies, and terms (e.g., paid/unpaid). Assuming each posting requires 10 KB and that each company posts five internships a year:

$$2,500 \times 5 \times 10\,\text{KB} = 122.1\,\text{MB}$$

- **Student feedback and internship outcomes**: Feedback data provided by students and companies will be stored for analysis. Assuming 5 KB per feedback submission and expecting each internship to receive three feedback entries, for 10,000 matched internships in the first year:

$$10,000 \times 3 \times 5\,\text{KB} = 146.5\,\text{MB}$$

- **Interview and selection data**: Information about interviews, questionnaires, and selection processes will also be stored. Assuming 8 KB per interview record and that each company interviews an average of five candidates per internship:

$$10,000 \times 5 \times 8\,\text{KB} = 390.6\,\text{MB}$$

Summing all storage requirements for the first year:

$$195.3\,\text{MB} + 5.72\,\text{GB} + 36.6\,\text{MB} + 122.1\,\text{MB} + 146.5\,\text{MB} + 390.6\,\text{MB} = 6.6\,\text{GB}$$

Thus, a storage allocation of **10 GB** will be sufficient to accommodate the platform's data storage needs for a year, including room for growth and additional data generated by the system.

3.3.3. Time Response

Although there are no strict time requirements for the S&C platform, it is important to maintain a responsive user experience. Reasonable average response times for key interactions could be as follows:

- Basic search queries and browsing operations should ideally be processed within **2 seconds**, to ensure a smooth navigation experience.
- More complex operations, such as generating personalized internship recommendations, should aim to complete within **5 seconds**, balancing the computational effort required with acceptable wait times for the user.

3.4. Design Constraints

3.4.1. Standards Compliance

The platform must adhere to EU's GDPR regulations to ensure secure data storage and transmission, particularly when handling sensitive student and company data. All data

interactions must comply with GDPR provisions regarding data ownership, user consent, and the right to access and delete data.

Additionally, the platform must comply with industry security standards to ensure the system is secure against potential threats.

3.4.2. Hardware Limitations

There are no specific hardware limitations imposed on end-users.

3.5. Software System Attributes

3.5.1. Reliability

The S&C platform must be reliable to ensure continuous operation, even in the presence of faults. The system should be designed to be fault-tolerant to prevent the propagation of errors and ensure uninterrupted usability. Mechanisms such as automated failover and data redundancy should be in place to mitigate the risk of downtime due to unexpected failures.

3.5.2. Availability

The platform must be available as much as possible, with a minimum uptime of 99.999%. Scheduled maintenance breaks should be minimized and, when necessary, performed during low-traffic periods (e.g., nighttime) to avoid disrupting critical usage, particularly around high-demand periods such as internship application deadlines.

3.5.3. Security

Security is critical for the S&C platform, as it handles sensitive student and company data. The system must implement strong authentication and authorization mechanisms. Authentication should ensure that users are properly identified before accessing the platform, while authorization should ensure that users can only perform actions they are permitted to.

3.5.4. Maintainability

The platform should be designed with scalability and modularity in mind to facilitate the easy addition of new features or modifications with minimal effort. The use of reusable code components and modular architecture will aid in making future updates efficient. Regular maintenance operations should be scheduled during times of low user activity, such as nighttime, to minimize disruptions to users.

3.5.5. Portability

The S&C platform must be accessible from a wide range of web browsers, ensuring compatibility across all major platforms (e.g., Chrome, Firefox, Safari, and Edge). On the client side, the platform should ensure accessibility on desktop devices. No specific portability requirements are imposed on the server side, provided the platform can run on common server configurations.

4 | Formal Analysis

Listing 4.1: Alloy Example

```
//ENUMERATIONS +++++++++++++++++++++++++++++++++++++++++++++++++++

enum ApplicationStatus { LastEvaluation, Rejected, Screening,
   OnlineAssessment, Accepted }
enum QuestionType { MultipleChoice, OpenQuestion, TrueOrFalse }
enum InternshipDuration { TwoToThreeMonths, ThreeToSixMonths,
   SixToTwelveMonths, MoreThanOneYear }
enum AnswerStatus {Completed, Uncompleted}

//SIGNATURE +++++++++++++++++++++++++++++++++++++++++++++++++++


abstract sig User{
    email: disj one Email,
    password: disj one Password
}

sig Student extends User{
        cv: disj one CV,
        appliedTo: Internship,
        skills: some Skills,
        feedback_of_internship: Internship -> some Feedback,
        feedback_of_platform: Feedback,
        enrolled: one University
 }

sig University extends User{
        tracked_internship : Student -> Internship,
        tracked_feedback : Internship -> Feedback,
        feedback_of_internship : Feedback -> Internship
}{this in Student.enrolled}


sig Company extends User {
        feedback_of_internship: Feedback -> Internship,
        feedback_of_platform: Feedback
}

sig Internship{
        suitable_skills: set Skills,
        feedback_internship: disj set Feedback,
        questions: set Internship_Question,
```

```
41          applications: disj set Student -> Application
42  }
43
44  sig Application{
45          title: String,
46          description: String,
47          status: ApplicationStatus,
48          forInternship: one Internship,
49          answers: set Answer
50  }
51
52  sig Internship_Question{
53          has_questions: set Question,
54  }{this in Internship.questions}
55
56  sig Match{
57          match: Student -> some Internship
58  }
59
60  sig Skills{}
61
62
63  sig Question {
64          answer: disj one Answer,
65          type: QuestionType
66  }{this in Internship_Question.has_questions}
67
68  sig Answer {
69          completed: one Bool
70  }
71
72  sig Feedback {}
73
74  sig Email {}
75  sig Password {}
76
77  sig CV {
78  }{this in Student.cv}
79
80
81  enum Bool {True, False}
82
83  //FACT
84  //+++++++++++++++++++++++++++++++++++++++++//
85
86  fact ApplicationMustHaveStatus{
87          all a: Application |
88                  one a.status
89  }
90
91
92  //Match between student and internship needs to have the same
        preferences
93  fact SameMatchSamePreferences{
94          all m: Match | all s: Student | all i: Internship |
```

```
                s->i in m.match iff #(s.skills & i.suitable_skills) != 0
}



//Intersection between match and application must be empty
fact MatchAndApplicationDisjoint {
    all s: Student, i: Internship|
        (s -> i in Match.match) implies not (i in (s.appliedTo))
}


//A student cannot apply to the same application more than one time
fact MaximumOneApplicationPerIntership{
        all s : Student
| no i : Internship | i in (s.appliedTo) and #(i & (s.appliedTo)) > 1
}


//Internship question must be a subset of question
fact InternshipQuestionsSubset {
    all iq: Internship_Question | iq.has_questions in Question
}

//In order to have an Accepted_Application all answer must be completed
fact AllAnswersMustBeCompletedForAcceptedApplication {
        all i: Internship| all q: Question| all s: Student |
        s.((i.applications).status) in Accepted implies q in i.questions
            .has_questions and q.answer.completed in True
}

//The answer are available only in an Accepted_Application status
fact AnswersOnlyInAcceptedApplication {
    all i: Internship, s: Student |
        some i.questions.has_questions implies s.((i.applications).
            status) in Accepted
}


//Application has feedback only if its status is either
   Accepted_Application or Rejected_Application
fact FeedbackOnlyForAcceptedOrRejectedApplication {
    all s: Student | all i: Internship |
        some i.(s.feedback_of_internship) implies s.((i.applications).
            status) in Accepted or s.((i.applications).status) in
            Rejected
}


//Cannot add feedback to application which are not Accepted_Application
fact NoFeedbackForNonAcceptedApplication {
    all i: Internship, s: Student |
        some i.feedback_internship implies (s.(i.applications).status)
            in Accepted
}
```

```
144
145 //PREDICATES
146 //+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
147
148 //User add a CV
149 pred StudentAddCV[s: Student, cv_new: CV]
150 {
151         s.cv = s.cv + cv_new
152 }
153
154 //User remove a CV
155 pred StudentRemoveCV[s: Student, cv_to_remove: CV]
156 {
157         s.cv = s.cv - cv_to_remove
158 }
159
160 //New Match has been found between a student and internship and added
161 pred AddNewMatch(s: Student, i: Internship, m: Match) {
162     s -> i in m.match
163     and s.skills & i.suitable_skills != none
164 }
165
166 //New feedback for an internship has been added by a student
167 pred NewFeedbackStudent[f_new: Feedback, s: Student, i: Internship]
168 {
169     i.(s.feedback_of_internship) = i.(s.feedback_of_internship) + f_new
170 }
171
172 //New feedback has been added by a company
173 pred NewFeedbackCompany[f_new: Feedback, c: Company, i: Internship]
174 {
175     (c.feedback_of_internship).i = (c.feedback_of_internship).i + f_new
176 }
177
178 //Every student's feeback must be tracked by his university
179 fact UniversityTracksFeedback {
180     all s: Student, i: Internship, u: University |
181         some i.(s.feedback_of_internship) implies i.(u.tracked_feedback)
                = i.(s.feedback_of_internship)
182 }
183
184 // Ensure the university tracks internships for students who have
    provided feedback
185 fact UniversityTracksInternships {
186     all s: Student, i: Internship, u: University |
187         some i.(s.feedback_of_internship) implies i in s.(u.
            tracked_internship)
188 }
189
190
191
192 //ASSERTION ++++++++++++++++++++++++++++++++++++++++++++++++++
193
194 assert FeedbackConsistency {
195     all i: Internship | all s: Student |  all u: University |
```

```
196     (i in (s.appliedTo) and #(i.(s.feedback_of_internship)) != 0)
           implies
197      i.(u.tracked_feedback) = i.(s.feedback_of_internship) and i in s.(u
            .tracked_internship)
198 }
199
200 assert ValidMatch {
201     all m: Match | all s: Student | all i: Internship |
202     s -> i in m.match implies s.skills & i.suitable_skills != none
203 }
204
205
206 pred simpleWorld{
207         #Student = 1
208         #University = 1
209         #Company = 1
210         #Internship = 2
211         #Internship_Question = 1
212         #Question = 1
213         #Skills = 1
214 }
215
216 //TO RUN ASSERTION AND PREDICATES
217
218 run StudentAddCV for 4
219
220 run StudentRemoveCV for 4
221
222 run AddNewMatch for 4
223
224 run NewFeedbackStudent for 4
225
226 run NewFeedbackCompany for 4
227
228 check FeedbackConsistency
229
230 check ValidMatch
231
232 run simpleWorld for 5
```

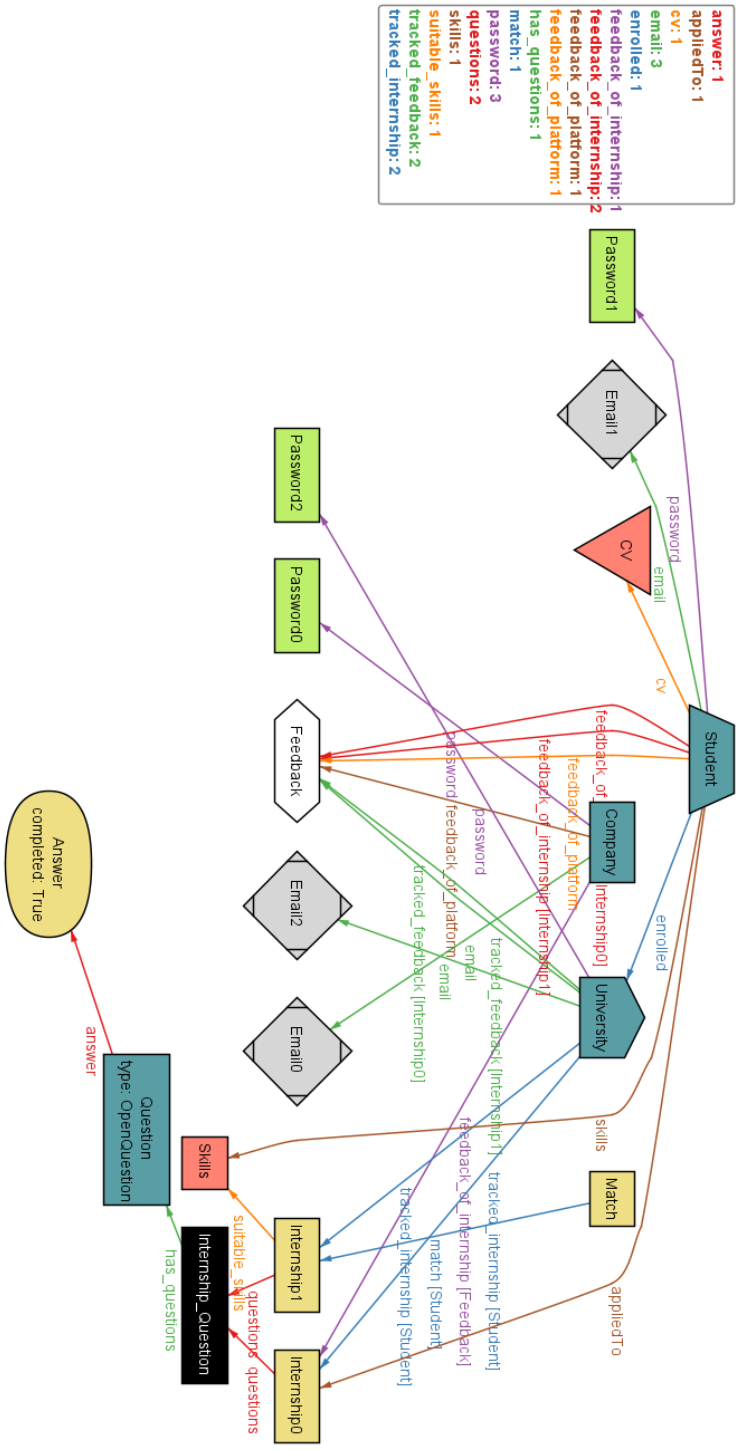


Figure 4.1: Simple world description in Alloy

5 | Effort Spent

Member of Group	Effort Spent	Hours
Giovanni Vaccarino	Introduction	5h
	Overall Description	10h
	Specific Requirements	12h
	Formal Analysis	1h
Vittorio Palladino	Introduction	6h
	Overall Description	6h
	Specific Requirements	7h
	Formal Analysis	10h
Nicolò Vacis	Introduction	7 h
	Overall Description	11h
	Specific Requirements	10h
	Formal Analysis	1h

Table 5.1: Effort spent by each member of the group

6 | References

- 2024-2025 Software Engineering 2 - Assignment RASD
- https://medium.com/@gmanzano.mx/state-machines-activity-diagrams-and-bpmn-strategic-decisions-and-modeling-perspective-ba2240aaa5ff
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