



SOFTWARE ENGINEERING II

REQUIREMENT ANALYSIS AND SPECIFICATION DOCUMENT

Students&Companies

POLITECNICO DI MILANO

COMPUTER SCIENCE AND ENGINEERING

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Academic year
2024-2025
Version 2.1

Professor
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Deliverable: RASD

Title: Requirement Analysis and Specification Document

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Date: 18/12/2024

Download page: [GitHub](#)

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1 Introduction

1.1 Purpose

With an increasingly competitive job market, students want to have an adequate jumpstart in their working career by looking for internships. Companies also want to find new workers to train with the help of internships since they are more likely to keep working for the same company after training. This is where Students&Companies helps to close the gap and create a platform where both parties can exchange information about internships. Students will upload to the platform previous experiences, attitudes, skills as well as their CV, which makes them easily selectable by interested companies. Companies on the other hand will create internship offerings that can be filtered by students. The platform can also facilitate the interview process, after both parties agreed on an internship.

1.1.1 Goals

Goals are why the system is made. For this project the following goals have been found:

- G1: Students and companies want to use the platform.
- G2: Students want to look for internships that satisfy their needs.
- G3: Students want to get hired to internships that satisfy their needs.
- G4: Companies want to accept/decline internships requests from students
- G5: Universities want to monitor their student's ongoing internships.

1.2 Scope

The scope of the project will cover the users that interact with the system, the user-generated actions that influence the system and the system-generated actions that have an effect on the outside world.

For the project the following users that interact with the system have been found:

- Students.
- Companies.
- Universities.

Students will be able to upload relevant information (experiences, skills and attitudes of students, as listed in their CVs) and will browse available internship offerings. After an internship is found, the student can apply to it and wait for the company to accept his request, meanwhile the student can browse for other internships. Once the company accepts the request, the student is notified and a contact is established, after which a selection process starts. During this process the student can be asked to fill questionnaires or have interviews with the company. If the student passes the selection phase he can start the internship; after this point any other pending internship request from the student is automatically cancelled. During the internship, the student can use the platform to provide information about the internship, like complaints, problems or other relevant information.

Companies will be able to open internship positions specifying the projects, number of open positions and other relevant information. Companies can get in touch with students that satisfy their needs. Companies will be able to accept incoming requests from students that apply for available internships after which the selection process starts. During this process the company can create questionnaires and host interviews with the student. If the student is hired, the internship position is removed from the available listings. During the internship, the company can use the platform to provide information about the internship, like complaints, problems or other relevant information.

1.2.1 World phenomena

- WP1: Companies open new positions for internships.
- WP2: Students want to look for an internship.
- WP3: All users (students, companies and universities) regularly check the platform for notifications.

1.2.2 Shared phenomena

1.2.2.1 *World controlled*

- SP1: Students upload their experiences, skills and attitudes.
- SP2: Students upload their CV.
- SP3: Companies create new internships, containing a description of the job and other relevant information.
- SP4: Students search for an available internship.
- SP5: Students apply for an available internship.
- SP6: Companies accept or decline a student's request for an internship.
- SP7: Companies create questionnaires and interviews to finalise the selection process.
- SP8: Students and companies can share thoughts, problems and other relevant information about the internship.
- SP9: Universities monitor the complaints, shared by students and/or companies.

1.2.2.2 *Machine controlled*

- SP10: The system notifies the company if a student applies for an internship.
- SP11: The system connects to Microsoft APIs to create embedded MS Forms questionnaires and MS Teams calls for interviews.
- SP12: The system shows the newly created questionnaires and calls space to the company and the student.

1.3 Definitions, Acronyms and Abbreviations

This section contains the definitions for people that may not know what a specific concept is, acronyms and abbreviations used throughout the document.

1.3.1 Definitions

- **Contact:** phase of the internship process in which an internship offer has been accepted by a student and that same student has been accepted by the company. After this phase, both parties can get in touch with each other.
- **Selection:** phase of the internship process where students are interviewed with questionnaires and virtual meetings.

1.3.2 Acronyms

- **S&C:** Students & Companies
- **CV:** Curriculum Vitae
- **UI:** User Interface
- **MS:** Microsoft

1.3.3 Abbreviations

- **G*:** Goal
- **D*:** Domain property
- **R*:** Requirement
- **WP*:** World phenomena
- **SP*:** Shared phenomena
- **UC*:** Use case

1.4 Revision History

- Version 2.1 (18/12/2024):
 - Split requirement R12 into R12 and R13.
- Version 2.0 (17/12/2024):
 - Removed not requested scenarios and use cases.
 - Fixed missing requirements in section 3.2.4
- Version 1.0 (11/12/2024):
 - First release.

1.5 Reference Documents

This document is based on the following materials:

- The specification of the RASD and DD assignment of the Software Engineering II course a.y. 2024/25.
- Course slides shared on WeBeep.
- Past Requirement Analysis and Specification Documents.

1.6 Document Structure

1. **Introduction:** this section introduces the project. It contains the main goals and objectives that the final system wants to achieve.
2. **Overall description:** this section is a high-level representation of the system and of the interactions of the system with the other actors.
3. **Specific requirements:** this section focuses on the requirements needed for the system to achieve the goals. It contains valuable information for developers.
4. **Formal analysis using Alloy:** this section has a formal description of the model (or part of) of the system with Alloy.
5. **Effort spent:** this section shows the time spent on each section of the document, for each member of the group.
6. **References:** this section contains all the various references used to write this document.

2 Overall Description

2.1 Product perspective

2.1.1 Scenarios

2.1.1.1 Students share their experiences, skills and attitudes

The student A wants to share this data on the platform. He can do this by logging in, navigating to his own account, clicking settings and in the section named “My public data” he can fill in or update it with all the relevant information. After the update the student saves the changes.

2.1.1.2 Students upload their CV

The student B wants to upload the CV on the platform. He can do this by logging in, navigating to his own account, clicking settings and in the section named “My CV” he can upload by drag and drop or by file selection a PDF file which is his CV. The CV will not be visible publicly, unlike the previous experiences, skills and attitudes due to the sensitive content of the document. The CV will be only visible to the company that accepts the student’s internship.

2.1.1.3 Companies create a new internship

The company C wants to advertise a new internship position on the website. It can do this by logging in and navigating to “Create new internship” section. In the creation page the company adds the internship’s project scope, the number of open positions for that internship and all the other relevant information, such as specifying if the internship is paid or not, mentorships and other benefits.

2.1.1.4 Students search for internships

The student D wants to search for internships on the platform. He can do this by logging in and in the homepage write in the search field. The text will be searched after pressing enter or clicking the magnifying glass icon. This search will do a keyword match for the titles and descriptions of the available internships. The student will be able to apply filters after the search to narrow down the choices.

2.1.1.5 Students apply for internships

The student E wants to apply for an internship. He can do this by searching for an internship of interest following the same behaviour of Scenario 2.1.1.4. After finding a suitable internship he can click on the offer to open the details. If the internship is interesting, he can apply to it by clicking the “Apply now!” button. After the application, he can still search and apply for other internships on the platform as long as he’s not currently hired in an internship; this means that the student can search for other internships while being in one or more selection.

2.1.1.6 Companies accept a student’s request

The company F has received an internship request from a student and wants to accept it. It can do this by logging in, navigating to “My internships” and clicking the appropriate student request. After opening the request, the company can press the “Hire” or “Decline” button to hire the student or not. If the company presses “Hire”, a contact is made with the student, otherwise if the company presses “Decline” the request is removed from the view and the company can optionally write a comment in the on-screen popup to the student stating why the request was rejected.

2.1.1.7 Companies create new questionnaires

The company G has made a contact with a student, now the selection begins. The company can create questionnaires by logging in, navigating to “My internships” and clicking on a student with a valid contact. On this page the company can create new questionnaires by clicking the “Create new questionnaire” button;

after clicking the button the company will have a complete questionnaire editor, powered by MS Forms. After the form is saved and published, a notification will be sent to the student.

2.1.1.8 Students fill in the questionnaires

The student H has made a contact with a company, now the selection begins. The student can answer questionnaires by logging in, navigating to “My questionnaires”. On this page the student can view all the open questionnaires and by clicking one he will be able to fill it in by using an embedded MS Forms application. After the questionnaire is saved and sent, a notification will be sent to the company.

2.1.1.9 Companies schedule new interviews

The company I has made a contact with a student, now the selection begins. The company can create interviews by logging in, navigating to “My internships” and clicking on a student with a valid contact. In the student’s page the company can schedule new interviews by clicking the “Create new interview” button. This will open a popup in which the company can choose on a calendar the date and time of the meeting. After the date is chosen and published, a notification will be sent to the student.

2.1.1.10 Students connect to a virtual meeting for an interview

The student J is in the selection phase with a company and has to connect to a meeting for an interview. He can join a meeting by logging in and navigating to the “My interviews” section. Here he can see all the available interviews with the date, time and the internship that the interview is for. After clicking on an interview, the student will use an embedded MS Teams application that will take care of the meeting.

2.1.1.11 Companies connect to a virtual meeting for an interview

The company K is in the selection phase with a student and has to connect to a meeting for an interview. It can join a meeting by logging in and navigating to the “My interviews” section. Here it can see all the available interviews with the date, time and the student that the interview is with. After clicking on an interview, the company will use an embedded MS Teams application that will take care of the meeting.

2.1.1.12 Students write comments about the current internship

The student L is currently hired in an internship and wants to share thoughts and comments about it. He can do this by logging in, navigating to “My internships” and clicking the internship marked by “Ongoing” that will always be at the top of the list. After clicking the internship, the student can click the “Write comment” button, after which a new form (in this case not powered by MS Forms) will open prompting the user to insert the nature of the comment (complaint/suggestion/etc.) and write the comment itself. After submitting the form, the company will receive a notification.

2.1.1.13 Companies write comments about the students in the internship

The company M currently has hired a student for an internship and wants to share thoughts and comments about him. It can do this by logging in, navigating to “My internships” and clicking the internship marked by “Ongoing” that will always be at the top of the list. After clicking the internship, the company can click the “Write comment” button, after which a new form (in this case not powered by MS Forms) will open prompting the user to insert the nature of the comment (complaint/suggestion/etc.) and write the comment itself. After submitting the form, the student will receive a notification.

2.1.1.14 All involved users want to read all comments about the internship

The student N of university O has been hired by company P for an internship, all the users want to see and read all comments for the ongoing internship. They can do this by logging in, navigating to “My internships” and clicking the internship marked by “Ongoing” that will always be at the top of the list. After clicking the internship there will be a list of all previous comments, sorted by date, from newest to oldest.

2.1.2 Domain class diagram

In this section a high-level class diagram of the application is presented.

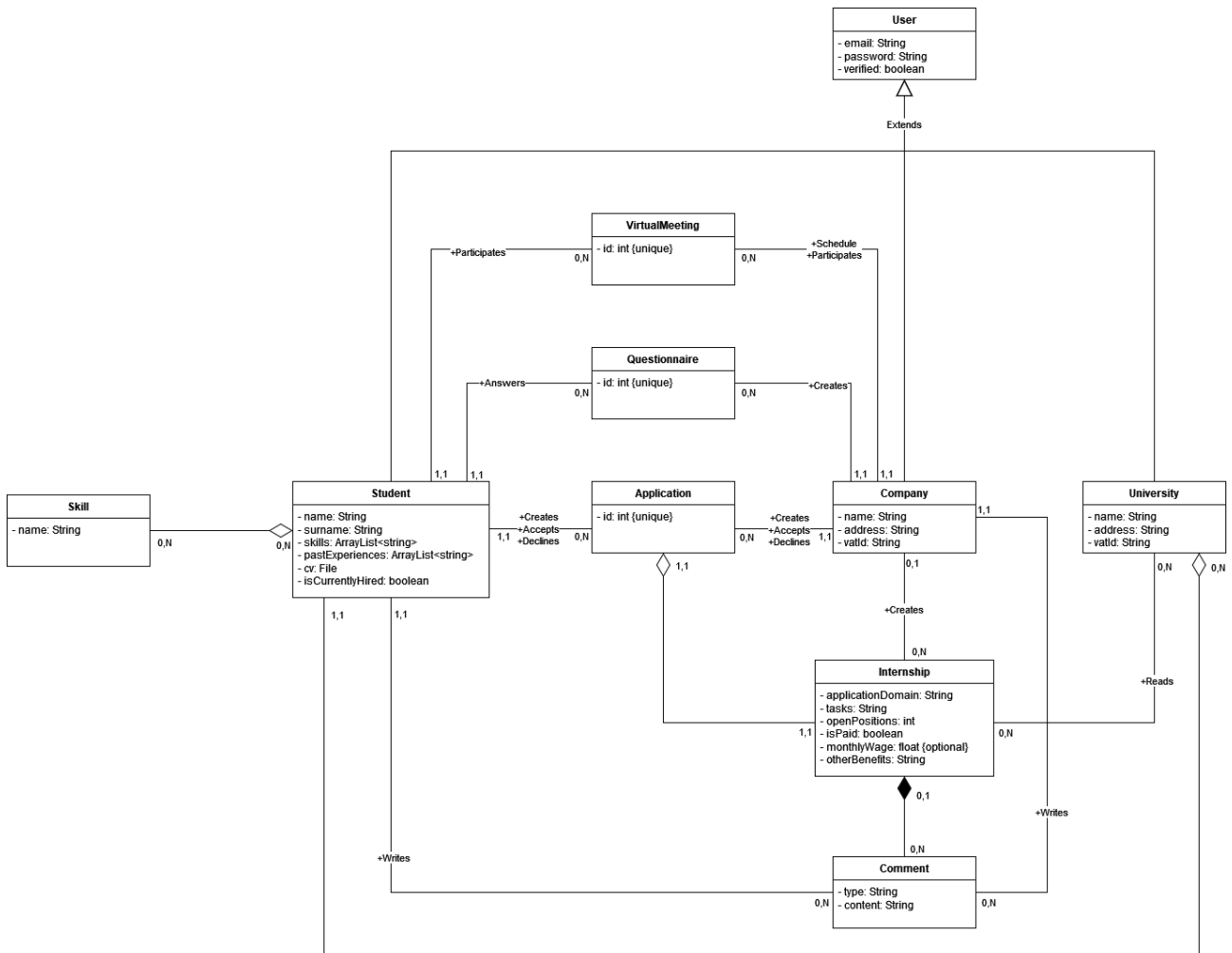


Figure 2-1: Domain class diagram

In figure 2-1 there's the domain class diagram. There was an attempt to avoid code repetition, so the super class User has been created; its children are Student, Company and University. Thanks to this, in case in the future there needs to be a fourth user, we can just extend User and have a standard base to work with.

A set of generic skills is generated at the start of the life cycle of the application, then if a student adds a skill that is not in the set, it is added and becomes available to select to all other students. This may save time for search filters, but is prone to repetitions if a student makes a typo or uses abbreviations: for example, the skill "Web development" is already in the set of available skills, if a student writes "Web dev" and saves the preferences, there will be both "Web development" and "Web dev" in the set of available skills. This problem can be alleviated by using an algorithm that groups similar skills into meta-skills, then use these meta-skills as search filters.

Comments are appended to internships so they must be in a composition with internships because if the internship is removed, all its comments must be deleted as well.

The university only has read permissions to the internships of its students, as described before.

2.1.3 State diagrams

In this section there are some state diagrams to better understand some parts of the system.

2.1.3.1 Student searches and applies for an internship

This diagram describes the possible states that happen when a student searches and applies for internships.

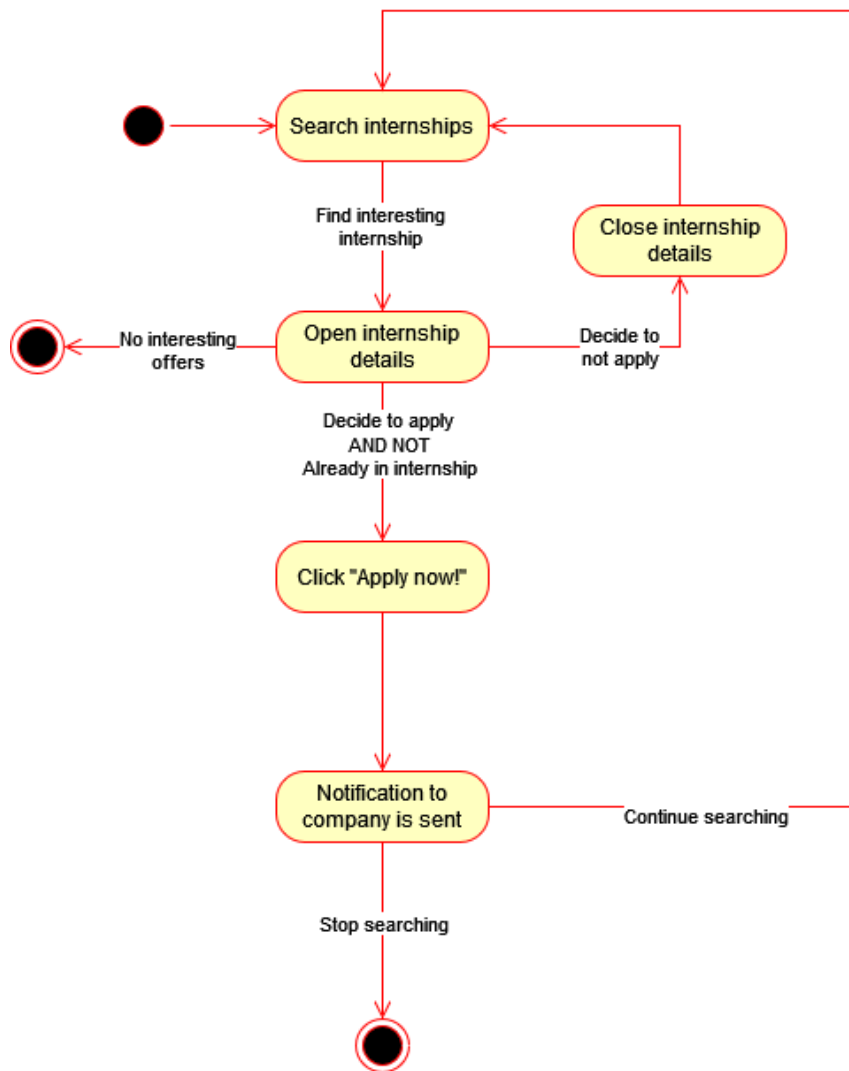


Figure 2-2: Search and application of internship

By default the student searches for internships. If an internship is found he can decide to apply or search for other offers. If he applied, a notification is sent to the internship's company. After the notification is sent the student can still search for other internships. Only after the student is hired by a company, he can no longer apply for internships, until the current one is completed.

2.1.3.2 State of a student inside the system

The following diagram shows the states a student can be in, during his life cycle within the application.

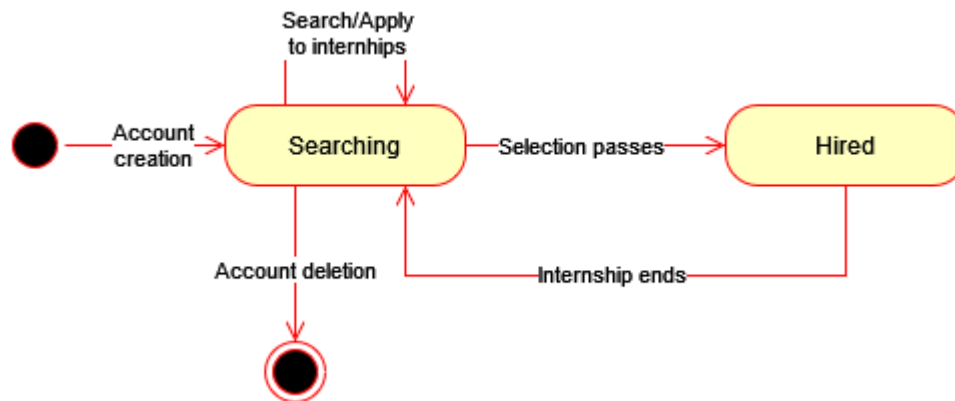


Figure 2-3: Student life cycle

The diagram follows the previous diagram's actions (Figure 2-2) but focuses only on the student's possible states and not his actions inside the platform. For database integrity reasons, the student is not allowed to delete his account during an active internship.

2.1.3.3 Possible events after a student's internship request

The following diagram shows the possible states that happen when a student has applied to an internship:

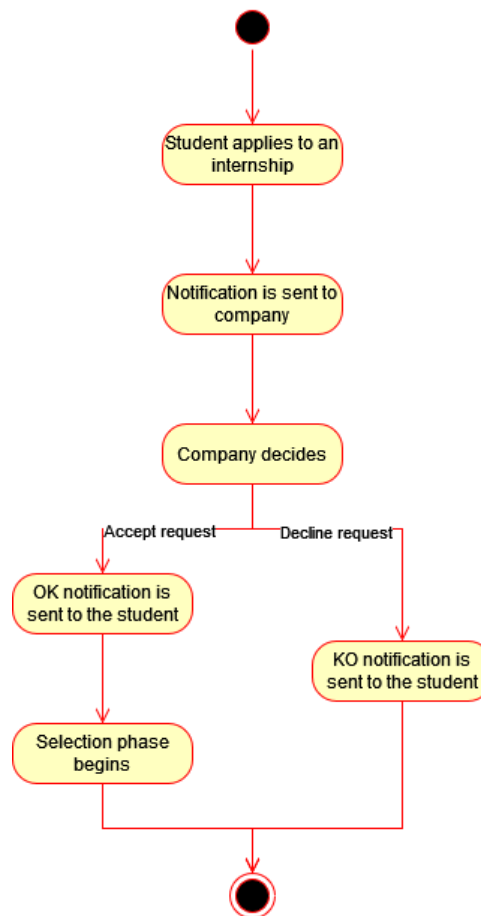


Figure 2-4: Possible events after an internship request

The company, after the notification is received, can decide whether to accept or decline the request. In case of acceptance, a contact between company and student is made, a confirmation notification is sent to the student and the selection phase can begin; in case of rejection, a KO notification is sent to the student and no further actions are performed.

2.2 Product functions

2.2.1 Registration and login

This function is available to anyone that wants to use the platform. When a new user opens the platform, he can sign up by pressing the “Register” button; a new page will load where the user must specify whether he’s registering as a student, a company or an university from a drop down menu, then add all the relevant information: students must write their name, surname, email and finally a password. Companies and universities must write the full company name, a company identification (company number/VAT identification number/SSN/etc.), an email and a password. After the account is created, the users can login using the specified credentials.

2.2.2 Managing user settings

This function is available to students, companies and universities. They can do this by navigating to “My account”, then clicking “Settings”. Here they can update their information. After the update they can submit the new information. If the email or the password are changed, after the submission the user will be logged off automatically and prompted to log back in.

2.2.3 Sharing work-related information

This function is available to students only. They can do this by navigating to “My account”, then clicking “My public data”. In this page the student can share all the previous experiences, skills and attitudes in text boxes, then save the changes.

2.2.4 Uploading CVs

This function is available to students only. They can do this by navigating to “My account”, then clicking “My CV”. In this page the student can upload by drag and drop or by file selection a PDF file which is his CV. The CV will not be visible publicly due to the sensitive content of the document. The CV will be only visible to the company that accepts the student’s internship.

2.2.5 Creation of an internship offer

This function is available to companies only. They can do this by navigating to “Create new internship” section. In the creation page the company adds the internship’s project scope, the number of open positions for that internship and all the other relevant information, such as specifying if the internship is paid or not, mentorships and other benefits. After submission, the internship is available for all students to see.

2.2.6 Search of an available internship

This function is available to students only. They can do this by writing in the search field in the homepage. The text will be searched after pressing enter or clicking the magnifying glass icon. This search will do a keyword match for the titles and descriptions of the available internships. The student will be able to apply filters after the search to narrow down the choices. Examples of the filters can be:

- Show only paid internships.
- Show internships within a radius in kilometres on a map.

2.2.7 Application of a student to an internship

This function is available to students only. They can do this by clicking on the internship, then clicking on the “Apply now!” button, after which a notification is automatically sent to the company.

2.2.8 A company accepts incoming requests

This function is available to companies only. They can do this by opening the request: here they’ll see a view of the student’s details then decide whether to click the “Hire” or “Decline” button to hire the student or not. If the company presses “Apply”, a contact is made with the student, otherwise if the company presses “Decline” the request is removed from the view and the company can optionally write a comment in the on-screen popup to the student stating why the request was rejected. This comment is then automatically sent to the student.

2.2.9 Creation of questionnaires

This function is available to companies only. They can do this by navigating to “My internships” and clicking on a student with a valid contact with them. On this page the company can create new questionnaires by clicking the “Create new questionnaire” button; after clicking the button the company will have a complete questionnaire editor, powered by MS Forms. After the form is saved and published, a notification will be sent to the student.

2.2.10 Scheduling of meetings

This function is available to companies only. They can do this by navigating to “My internships” and clicking on a student with a valid contact with them. In the student’s page the company can also schedule new interviews by clicking the “Create new interview” button. This will open a popup in which the company can choose on a calendar the date and time of the meeting. After the date is chosen and published, a notification will be sent to the student.

2.2.11 Videoconferencing

This function is available to students and companies only. They can do this by navigating to the interview, clicking on it, then use an embedded MS Teams application that will take care of the meeting. Since the system uses MS Teams, all of its functionalities are included and available in the meeting.

2.2.12 Creation of comments regarding the ongoing internship

This function is available to students and companies only. They can do this by navigating to “My internships” and clicking the internship marked by “Ongoing” that will always be at the top of the list. After clicking the internship, the user can click the “Write comment” button, after which a new form (in this case not powered by MS Forms) will open prompting the user to insert the nature of the comment (complaint/suggestion/etc.) and write the comment itself. After submitting the form, the other party will receive a notification.

2.2.13 View of comments regarding the ongoing internship

This function is available to students, companies and universities. They can do this by navigating to “My internships” and clicking the internship marked by “Ongoing” that will always be at the top of the list. After clicking the internship there will be a list of all previous comments, sorted by date, from newest to oldest.

2.3 User characteristics

The platform supports 3 types of users: students, companies and universities.

2.3.1 Student

The student can perform the following actions inside the platform:

- Create an account and login.
- Modify the account preferences.
- Search internships.
- Create an internship request.
- Reply to questionnaires.
- Participate in videoconferences.
- Read comments about the ongoing internship.
- Write comments about the ongoing internship.
- Delete the account.

2.3.2 Company

The company can perform the following actions inside the platform:

- Create an account and login.
- Modify the account preferences.
- Create an internship entry.
- Accept an internship request.
- Decline an internship request.
- Create questionnaires.
- Schedule videoconferences.
- Participate in videoconferences.
- Read comments about the ongoing internship.
- Write comments about the ongoing internship.
- Delete the account.

2.3.3 University

The university can perform the following actions inside the platform:

- Create an account and login.
- Modify the account preferences.
- Read all ongoing internships for all of its students.
- Read comments about the ongoing internship.
- Delete the account.

2.4 Assumptions, dependencies and constraints

2.4.1 Domain assumptions

The following assumptions have been taken into consideration for the domain. The system will take for granted these conditions during its operation:

- D1: The system has a reliable internet connection.
- D2: Companies add internship offers containing correct data.
- D3: Students add their CVs containing correct data.
- D4: MS Teams and MS Forms are reliable.

2.4.2 System dependencies

The system depends on MS Teams and MS Forms to handle the selection phase. Without these services, the system partially works. In case MS Teams and/or MS Forms are not available, the maintenance team should put a warning in the homepage, explaining the situation; an example of such warning could be the following:

“Due to an outage outside of our control, the platform will not support the following features until further notice:

- *Selection-phase questionnaires creation and submission.*
- *Scheduling and participation in videoconferences.”*

2.4.3 System constraints

The system needs to comply with GDPR regulations due to the personal data that is on the platform.

The system will share diagnostic data of MS Teams and MS Forms to Microsoft in compliance with Azure Communication Services privacy policy¹.

¹ More information here: <https://learn.microsoft.com/en-us/azure/communication-services/concepts/privacy#data-collection>

3 Specific requirements

3.1 External interface requirements

3.1.1 User interface

The mock-ups don't represent the final product, they just show how things should be placed in the page. Many of the views are very similar between company and student, so it was decided to represent the most significative ones in the document.

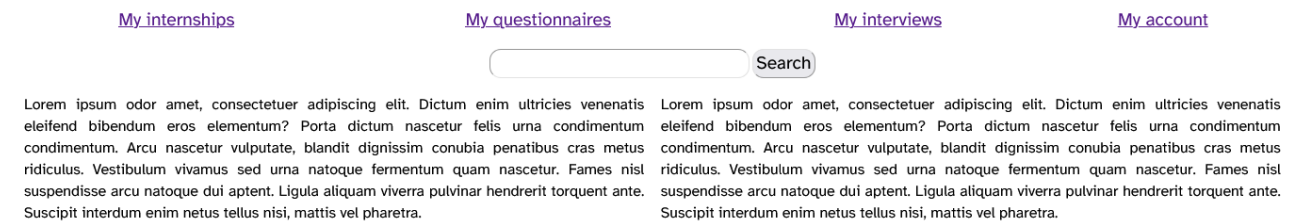


Figure 3-1: Homepage

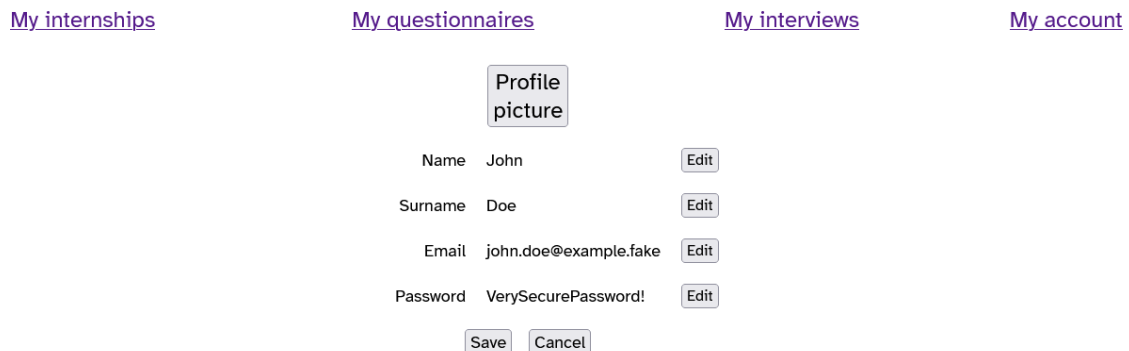


Figure 3-2: Account settings page

Past experiences

Lorem ipsum odor amet, consectetur adipiscing elit. Magna tempus turpis maximus sem donec. Hendrerit quis habitant senectus torquent eleifend dictumst? Conubia vehicula praesent elit viverra facilisi eros velit. Himenaeos per nisi conubia justo dictum consequat mauris molestie. Libero leo ante suspendisse eleifend ad scelerisque pharetra dolor class. Nascetur tempus accumsan senectus ornare libero nibh scelerisque? Adipiscing potenti sed phasellus interdum id nibh.

Edit

Skills

Lorem ipsum odor amet, consectetur adipiscing elit. Magna tempus turpis maximus sem donec. Hendrerit quis habitant senectus torquent eleifend dictumst? Conubia vehicula praesent elit viverra facilisi eros velit. Himenaeos per nisi conubia justo dictum consequat mauris molestie. Libero leo ante suspendisse eleifend ad scelerisque pharetra dolor class. Nascetur tempus accumsan senectus ornare libero nibh scelerisque? Adipiscing potenti sed phasellus interdum id nibh.

Edit

Attitudes

Lorem ipsum odor amet, consectetur adipiscing elit. Magna tempus turpis maximus sem donec. Hendrerit quis habitant senectus torquent eleifend dictumst? Conubia vehicula praesent elit viverra facilisi eros velit. Himenaeos per nisi conubia justo dictum consequat mauris molestie. Libero leo ante suspendisse eleifend ad scelerisque pharetra dolor class. Nascetur tempus accumsan senectus ornare libero nibh scelerisque? Adipiscing potenti sed phasellus interdum id nibh.

Edit

Save

Cancel

Figure 3-3: Manage student's public data page

PDF Preview here

Allowed file type: PDF Maximum size: 5MB

Drag and drop your file on the page or

Browse

Figure 3-4: Upload CV page

[Create new internship](#)[My internships](#)[My questionnaires](#)[My interviews](#)[My account](#)

Project scope:

Open positions:

Paid internship? ☐ Yes ☐ No

Other information:

Figure 3-5: Internship creation page

[My internships](#)[My questionnaires](#)[My interviews](#)[My account](#)

Internship title

Lorem ipsum odor amet, consectetur adipiscing elit. Cubilia aenean ullamcorper phasellus maximus vitae diam. Orci dui libero interdum luctus ut. Fusce massa torquent morbi nec turpis suscipit amet dapibus. Diam augue varius ipsum dapibus netus blandit neque tortor.

Paid internship? Yes

Open positions: 5

Company: Megaditta S.r.l.

Other information: Lorem ipsum odor amet, consectetur adipiscing elit. Cubilia aenean ullamcorper phasellus maximus vitae diam. Orci dui libero interdum luctus ut.

Figure 3-6: Viewing internship page

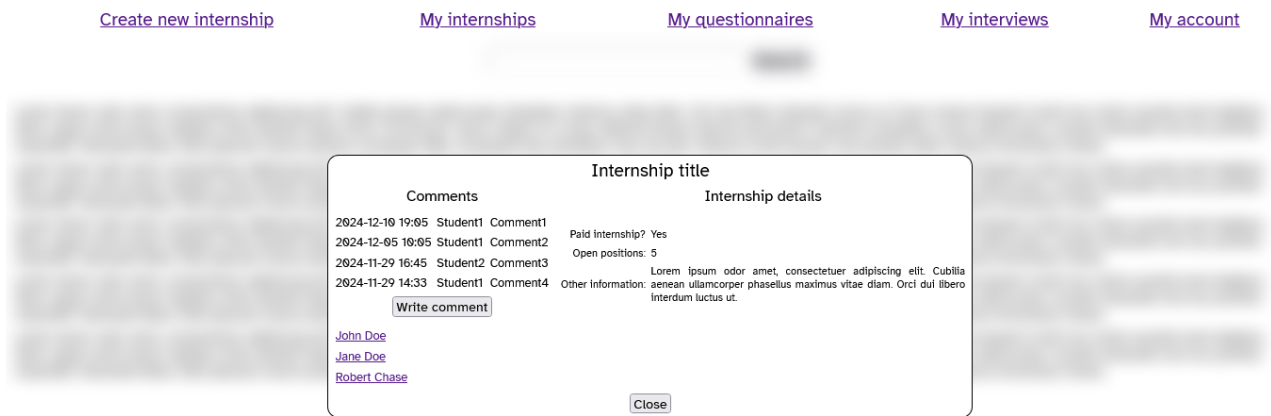


Figure 3-7: Company point of view of the ongoing internship page

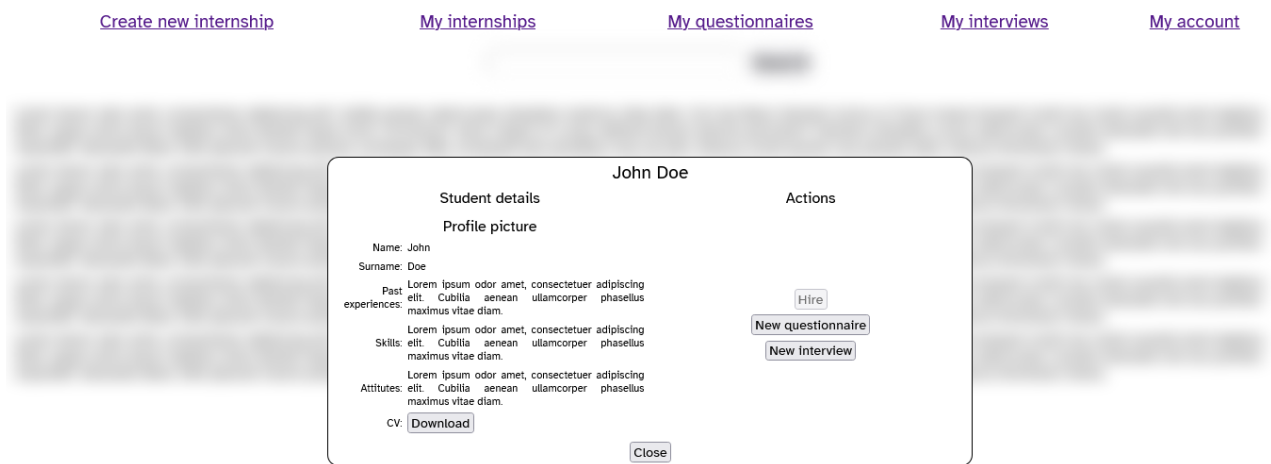


Figure 3-8: Company point of view of the student's page

3.1.2 Hardware interface

C&S is a web application, so there are no particular hardware requirements other than an internet connection and an updated browser. The platform can be used from mobile, but it's better suited for desktop use.

3.1.3 Software interface

The platform uses Microsoft Graph API to embed MS Forms and MS Teams applications into the webapp. S&C itself will not publish any API to the end user since it's not needed.

3.1.4 Communication interface

S&C is a RESTful application, in fact all the communications done to and from it are performed with REST APIs using HTTP or HTTPS.

3.2 Functional requirements

In this section all the functional requirements are listed. These requirements describe what the system is expected to do:

- R1: The system allows students to register to the platform by providing their personal information.
- R2: The system allows companies and universities to register to the platform by providing business information.
- R3: The system allows registered users to login using the specified credentials.
- R4: The system allows students to list their experiences, skills and attitudes.
- R5: The system allows students to upload their CV.
- R6: The system allows students to filter internships according to their preference.
- R7: The system allows students to create an application with a company if the internship is interesting.
- R8: The system allows companies to create internships by writing a description of the job and other relevant information.
- R9: The system allows companies to accept an application from a student if the student's CV corresponds to the company's need.
- R10: The system allows companies to decline an application from a student if the student's CV does not correspond to the company's need.
- R11: The system allows students and companies to get in touch with each other with a selection process, after the initial contact is made.
- R12: The system allows companies to collect information from students during the selection process, with questionnaires using MS Forms.
- R13: The system allows companies to collect information from students during the selection process, with interviews using MS Teams.
- R14: The system allows students and companies to keep track of the ongoing internship, by providing spaces where both parties can write their opinions, problems and other relevant information regarding the internship.
- R15: The system allows universities to monitor the comments for ongoing internships of its students.

3.2.1 Use case diagram

In this section, the use case diagram is presented.

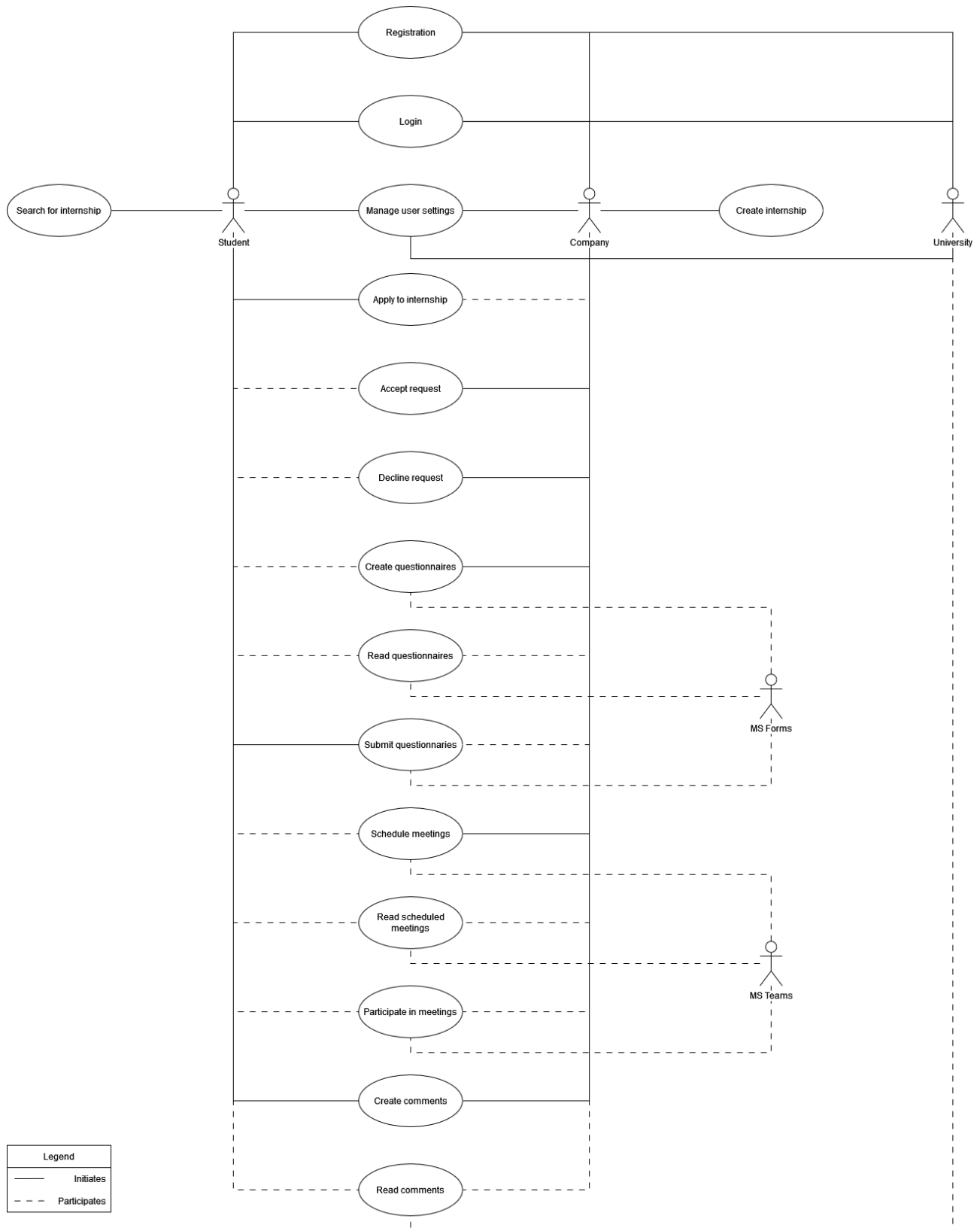


Figure 3-9: Use case diagram

3.2.2 Use cases

Name	User registration
ID	UC1
Actors	Non registered users
Entry conditions	The actor wants to create an account on the platform.
Events flow	<ol style="list-style-type: none">1. The actor navigates to the sign up page.2. The actor fills the sign up form with the relevant information.<ol style="list-style-type: none">a. User type: Student or Company/Universityb. For students:<ol style="list-style-type: none">i. Nameii. Surnameiii. Emailiv. Passwordc. For companies and universities:<ol style="list-style-type: none">i. Full company nameii. Company identificationiii. Emailiv. Password3. The actor submits the form.4. The system creates a new account with the information provided.
Exit condition	The actor has created a new account.
Exceptions	<ul style="list-style-type: none">• The provided email has already been used.<ul style="list-style-type: none">○ The system shows an error informing the actor that the email is already associated to an existing account.• The actor tries to submit a form without all the needed information.<ul style="list-style-type: none">○ The system shows an error informing the actor that there are empty fields.

Name	User login
ID	UC2
Actors	Registered users
Entry conditions	The actor wants to login to the platform.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to the sign in page. 2. The actor fills in the form with email and password. 3. The actor submits the form. 4. The system authenticates the actor.
Exit condition	The actor has signed in to his account.
Exceptions	<ul style="list-style-type: none"> • The provided credentials are not correct. <ul style="list-style-type: none"> ○ The system shows an error informing the actor that the credentials are not correct.

Name	Manage user settings
ID	UC3
Actors	Registered users
Entry conditions	The actor wants to manage his user settings.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My account” page. 2. The actor navigates to “Settings” page. 3. The actor updates the information as needed. 4. The actor saves the changes. 5. The system updates the actor’s personal information. 6. If the email or password were changed, the system invalidates the current user’s token and redirects him to the login page, else the user is shown the current “Settings” page.
Exit condition	The actor’s personal information is updated.
Exceptions	<ul style="list-style-type: none"> • The actor updates his email with one that’s already used by another account. <ul style="list-style-type: none"> ○ The system shows an error informing the actor that the email is already associated to an existing account.

Name	Share work-related information
ID	UC4
Actors	Students
Entry conditions	The actor wants to share his past experiences, skills and attitudes.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My account” page. 2. The actor navigates to “My public data” page. 3. The actor writes in the text boxes the previous experiences, skills and attitudes. 4. The actor saves the changes. 5. The system updates the actor’s page by including this new information.
Exit condition	The actor’s work-related information is updated.
Exceptions	

Name	Upload CV
ID	UC5
Actors	Students
Entry conditions	The actor wants to upload his CV.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My account” page. 2. The actor navigates to “My CV” page. 3. The actor drags and drops or uploads by file the CV as a PDF file. 4. The actor saves the changes. 5. The system stores the CV of the user.
Exit condition	The actor’s CV is uploaded to the platform.
Exceptions	<ul style="list-style-type: none"> • The file is not in PDF. <ul style="list-style-type: none"> ○ The system shows an error informing the actor that the file is in the wrong format. • The file is larger than 5 MB. <ul style="list-style-type: none"> ○ The system shows an error informing the actor that the file is too large.

Name	Search for internship
ID	UC6
Actors	Students
Entry conditions	The actor wants to search for internships.
Events flow	<ol style="list-style-type: none"> 1. The actor clicks on the “Search” bar in the homepage. 2. The actor inputs the text to search. 3. The actor presses the search icon. 4. The system does a text based match of the titles and descriptions of the available internships. 5. The actor can put additional filters on the search. 6. The system uses the user selected filters to narrow down the results.
Exit condition	The actor sees the search results.
Exceptions	

Name	Create internship
ID	UC7
Actors	Companies
Entry conditions	The actor wants to publish a new internship offer.
Events flow	<ol style="list-style-type: none"> 1. The actor clicks on “Create new internship”. 2. The actor writes in the fields the relevant information such as: <ol style="list-style-type: none"> a. Project’s scope. b. Number of open positions. c. Paid internship. d. Other benefits. 3. The actor submits the form. 4. The system saves the data and publishes the new offer.
Exit condition	The actor has published a new internship offer on the platform.
Exceptions	<ul style="list-style-type: none"> • Some of the fields are empty. <ul style="list-style-type: none"> ○ The system shows an error informing the actor that there are empty fields.

Name	Apply to internship
ID	UC8
Actors	Students, companies
Entry conditions	The actor (student) wants to apply to an internship.
Events flow	<ol style="list-style-type: none"> 1. The actor clicks on an interesting internship, opening the details. 2. The actor clicks the “Apply now!” button. 3. The system notifies the internship’s company about the request. 4. The actor closes the internship details.
Exit condition	The actor has applied to an internship, notifying the company.
Exceptions	

Name	Accept request (company to student)
ID	UC9
Actors	Students, companies
Entry conditions	The actor (company) accepts an incoming request from a student.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My internships”. 2. The actor clicks the student that applied to that internship. 3. The actor clicks the “Hire” button. 4. The system sends a notification to the student.
Exit condition	The actor has accepted a student’s request and is now in contact with the student.
Exceptions	

Name	Decline request (company to student)
ID	UC10
Actors	Students, companies
Entry conditions	The actor (company) declines an incoming request from a student.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My internships”. 2. The actor clicks the student that applied to that internship. 3. The actor clicks the “Decline” button. 4. The actor can write a comment in the text box. 5. The actor confirms the action. 6. The system sends a notification to the student.
Exit condition	The actor has declined a student’s request.
Exceptions	

Name	Create questionnaires
ID	UC11
Actors	Students, companies, MS Forms
Entry conditions	The actor (company) wants to create a new questionnaire.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My internships”. 2. The actor clicks the student. 3. The actor clicks the “New questionnaire” button. 4. The actor uses the editor powered by MS Forms. 5. The actor saves and publishes the questionnaire. 6. The system sends a notification to the student.
Exit condition	The actor (company) has created a new questionnaire for a student with a valid contact with the actor.
Exceptions	<ul style="list-style-type: none"> • MS Forms is not available. <ul style="list-style-type: none"> ○ The system shows an error informing the actor of the outage of MS Forms. • The student does not have a valid contact <ul style="list-style-type: none"> ○ The system will not show the “New questionnaire” button.

Name	Read questionnaires
ID	UC12
Actors	Students, companies, MS Forms
Entry conditions	The actor (company or student) wants to read a questionnaire.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My questionnaires”. 2. The actor clicks on a questionnaire. 3. The actor reads the questionnaire.
Exit condition	The actor (company or student) reads a questionnaire.
Exceptions	<ul style="list-style-type: none"> • MS Forms is not available. <ul style="list-style-type: none"> ○ The system shows an error informing the actor of the outage of MS Forms.

Name	Submit questionnaires
ID	UC13
Actors	Students, companies, MS Forms
Entry conditions	The actor (student) wants to submit a questionnaire.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My questionnaires”. 2. The actor clicks on a questionnaire. 3. The actor fills the questionnaire. 4. The actor submits the questionnaire. 5. The system notifies the company.
Exit condition	The actor (student) has filled in a questionnaire.
Exceptions	<ul style="list-style-type: none"> • MS Forms is not available. <ul style="list-style-type: none"> ○ The system shows an error informing the actor of the outage of MS Forms. • Some of the mandatory fields are empty. <ul style="list-style-type: none"> ○ The system shows an error informing the actor that there are empty fields.

Name	Schedule meetings
ID	UC14
Actors	Students, companies, MS Teams
Entry conditions	The actor (company) wants to schedule a new meeting.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My internships”. 2. The actor clicks on the student. 3. The actor clicks the “New interview” button. 4. The actor selects a date and a time on the calendar. 5. The actor submits the information. 6. The system notifies the student.
Exit condition	The actor (company) has scheduled a new meeting.
Exceptions	<ul style="list-style-type: none"> • MS Teams is not available. <ul style="list-style-type: none"> ○ The system shows an error informing the actor of the outage of MS Teams. • The chosen date or time are back in the past. <ul style="list-style-type: none"> ○ The system shows an error informing the actor that the date and time must be in the future.

Name	Read scheduled meetings
ID	UC15
Actors	Students, companies
Entry conditions	The actor (company or student) wants to read the scheduled meetings.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My interviews”. 2. The actor reads all the possible interviews.
Exit condition	The actor (company or student) reads the scheduled meetings.
Exceptions	

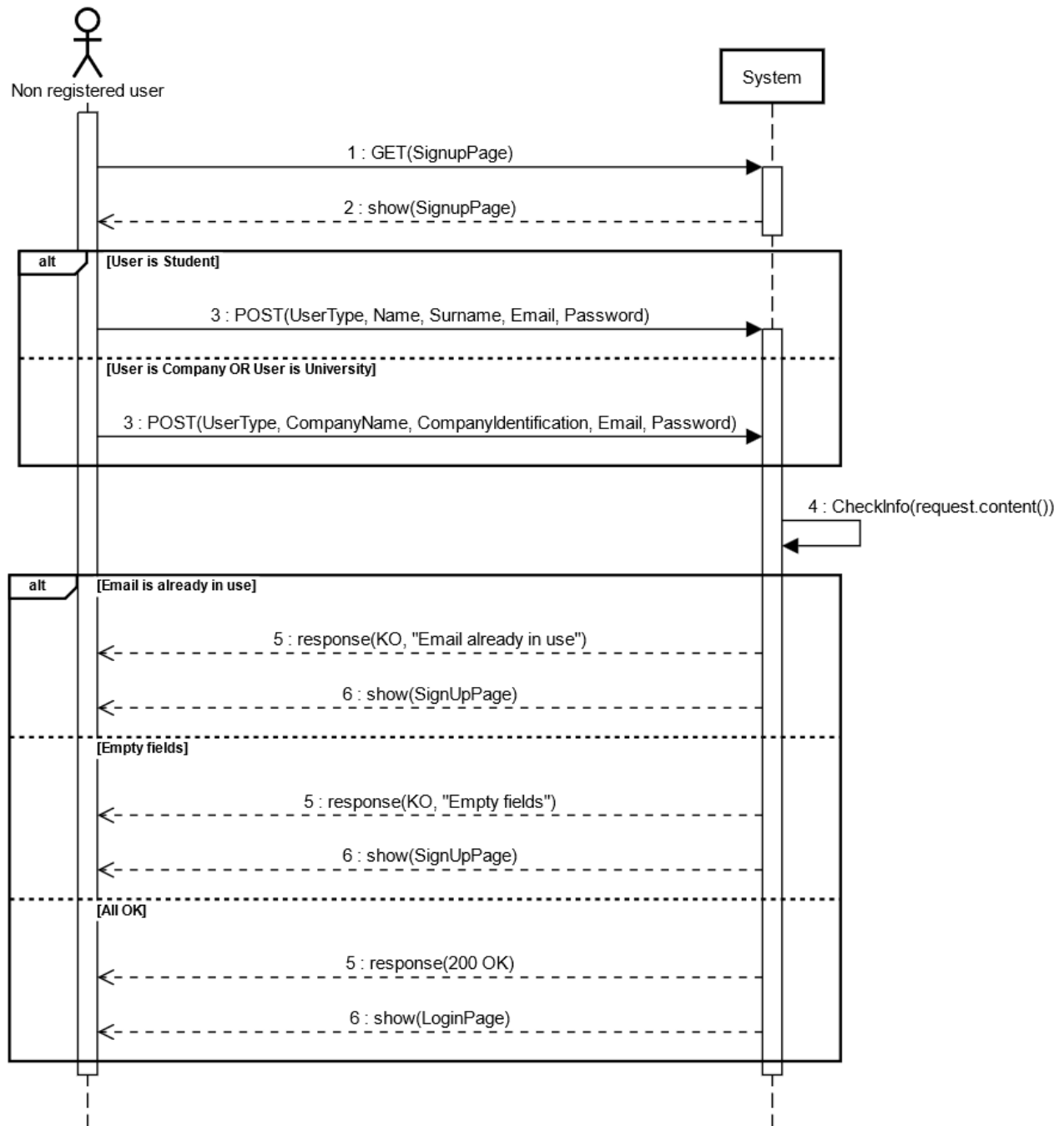
Name	Participate in meetings
ID	UC16
Actors	Students, companies, MS Teams
Entry conditions	The actor (company or student) wants to participate in a scheduled meeting.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My interviews”. 2. The actor clicks on an interview. 3. The actor participates in a meeting hosted via MS Teams.
Exit condition	The actor (company or student) participates in a scheduled meeting.
Exceptions	<ul style="list-style-type: none"> • MS Teams is not available. <ul style="list-style-type: none"> ○ The system shows an error informing the actor of the outage of MS Teams.

Name	Create comments
ID	UC17
Actors	Students, companies
Entry conditions	The actor (company or student) wants to create comments during an internship.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My internships”. 2. The actor clicks on an internship marked by “Ongoing”. 3. The actor clicks on the “Write comment” button. 4. The actor fills in the form with the following information: <ol style="list-style-type: none"> a. Nature of the comment (complaint/suggestion/etc.). b. Comment itself. 5. The actor submits the form. 6. The system makes the comment visible on the internship panel. 7. The system sends a notification to the other party.
Exit condition	The actor (company or student) creates a comment during the internship.
Exceptions	<ul style="list-style-type: none"> • The nature of the comment is left blank. <ul style="list-style-type: none"> ○ The system shows an error informing the actor that there are empty fields.

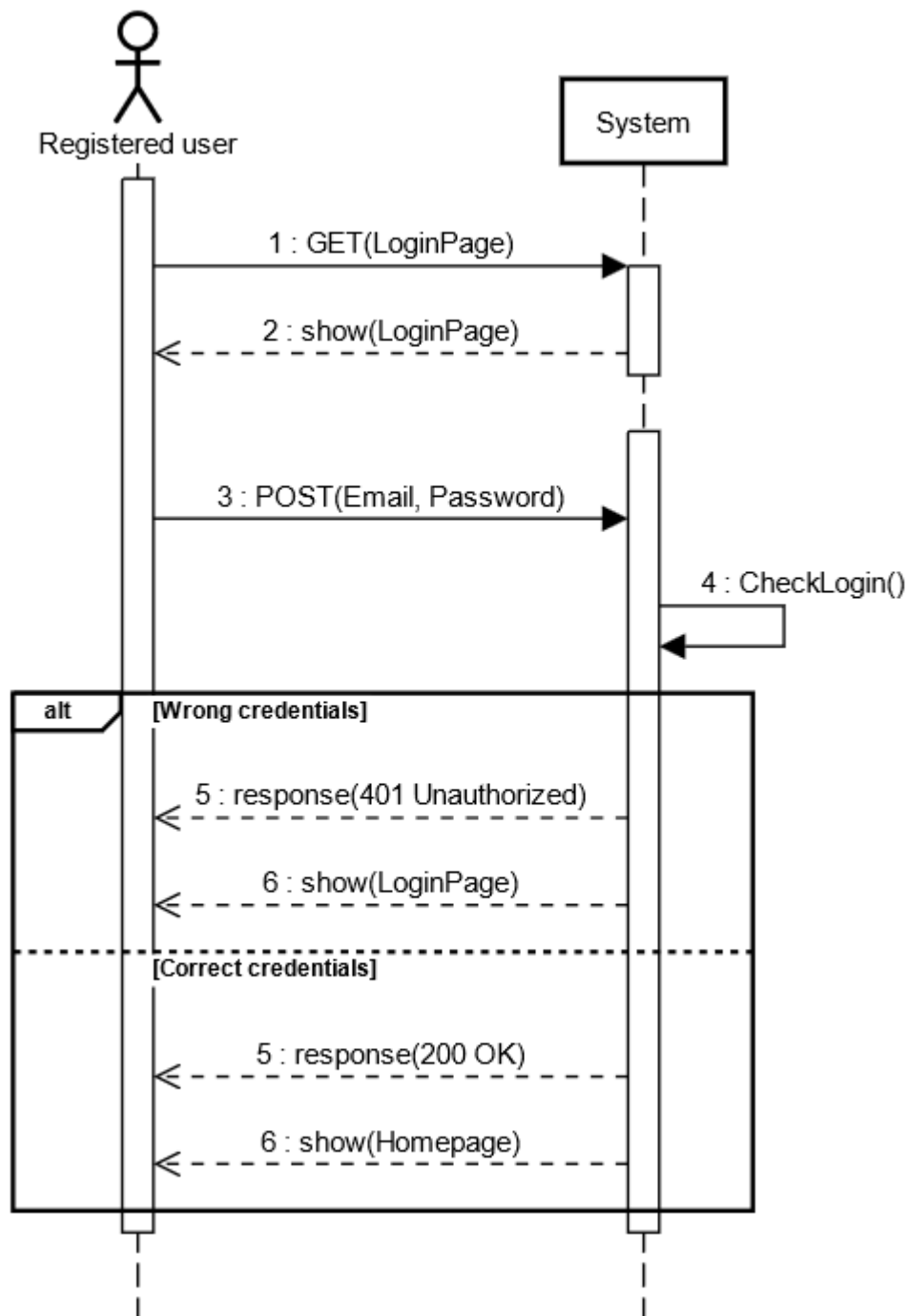
Name	Read comments
ID	UC18
Actors	Students, companies, universities
Entry conditions	The actor (company or student or university) wants to read the comments of an ongoing internship.
Events flow	<ol style="list-style-type: none"> 1. The actor navigates to “My internships”. 2. The actor clicks on an internship marked by “Ongoing”. 3. The actor reads the comments that are presented in a list.
Exit condition	The actor (company or student or university) reads a comment of an ongoing internship.
Exceptions	<ul style="list-style-type: none"> • The university tries to open an internship not of one of its students. <ul style="list-style-type: none"> ○ The system shows an error informing the actor that it has no permissions to see the page.

3.2.3 Sequence diagrams

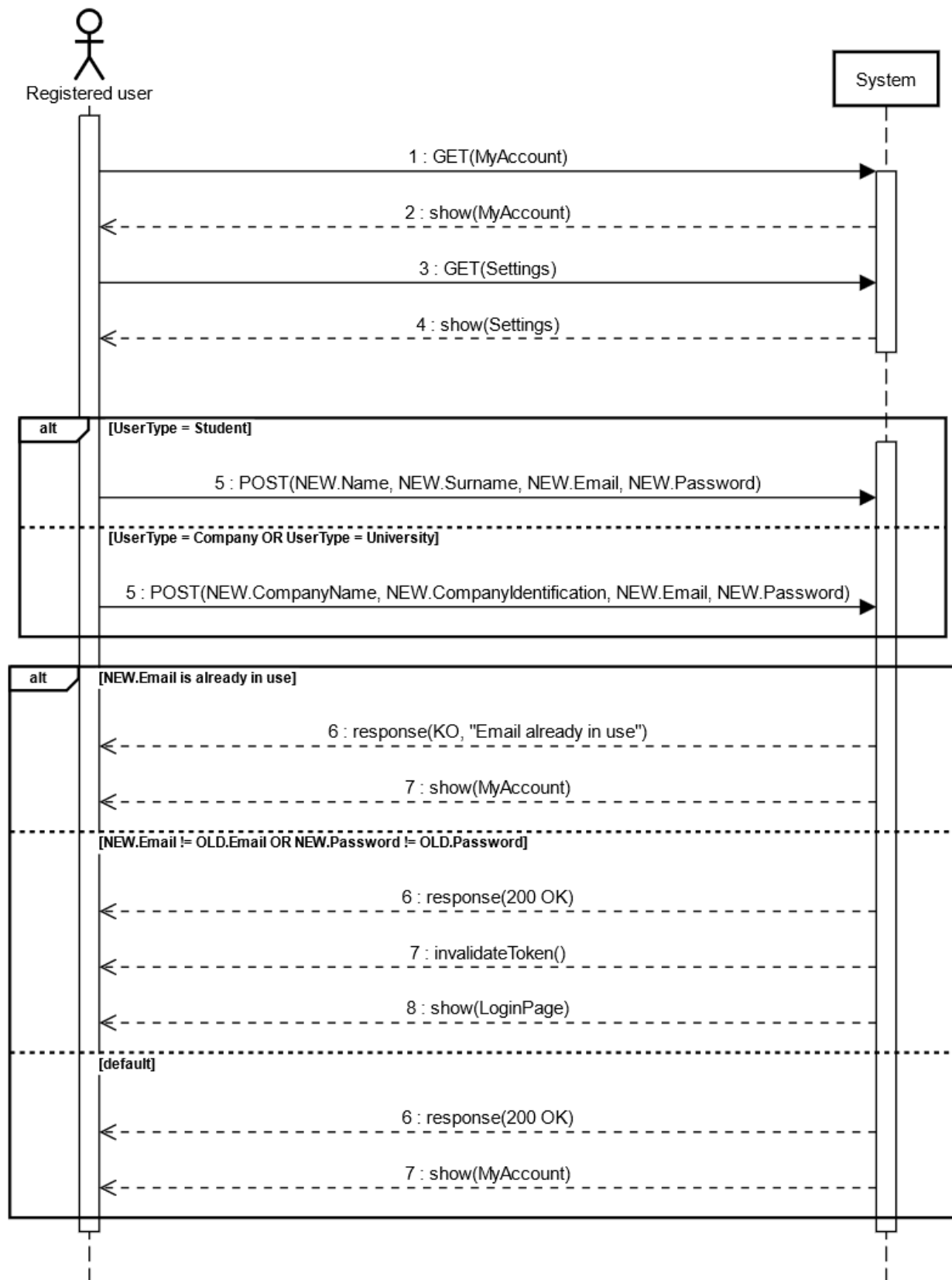
[UC1] User registration



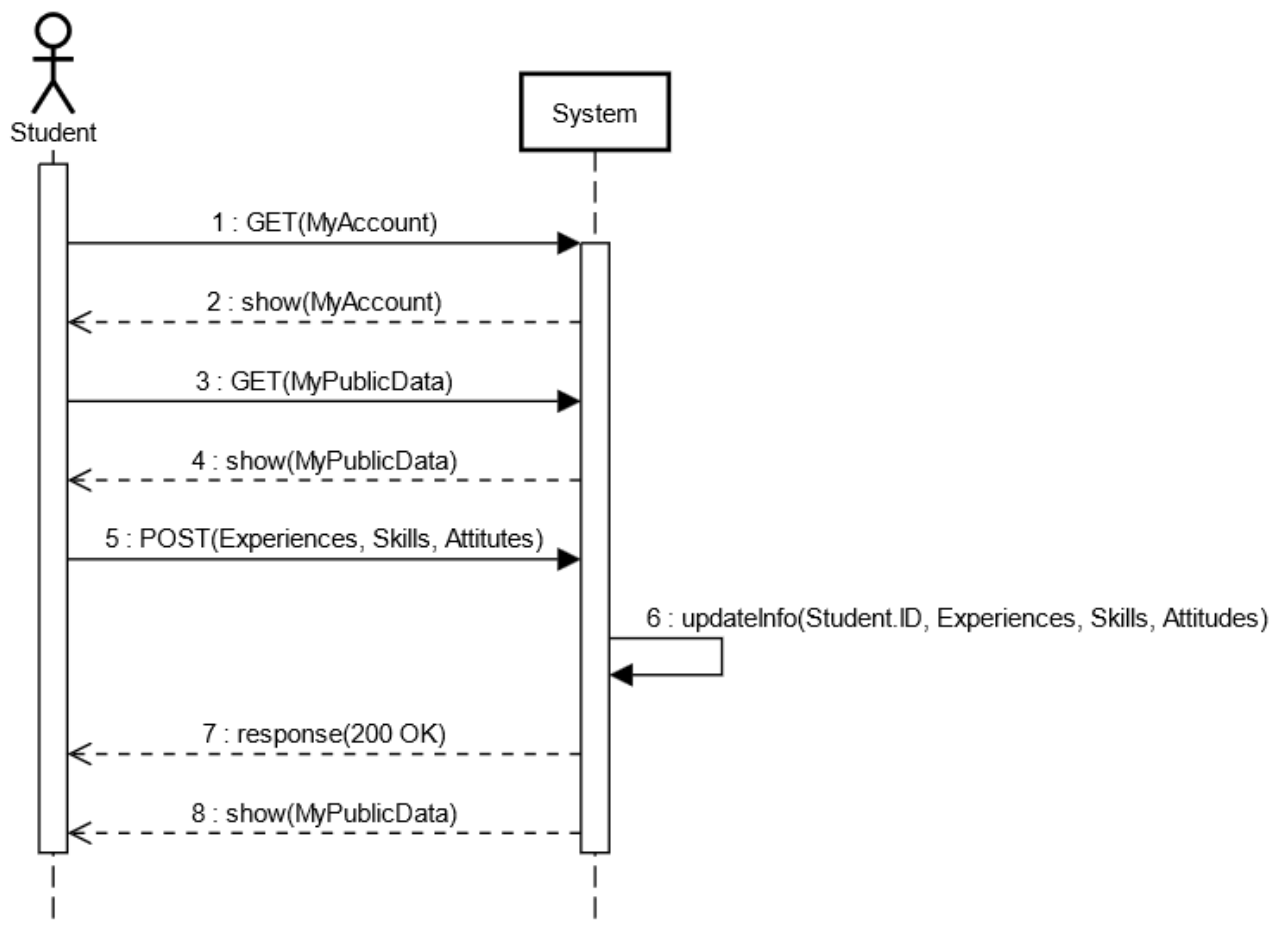
[UC2] User login



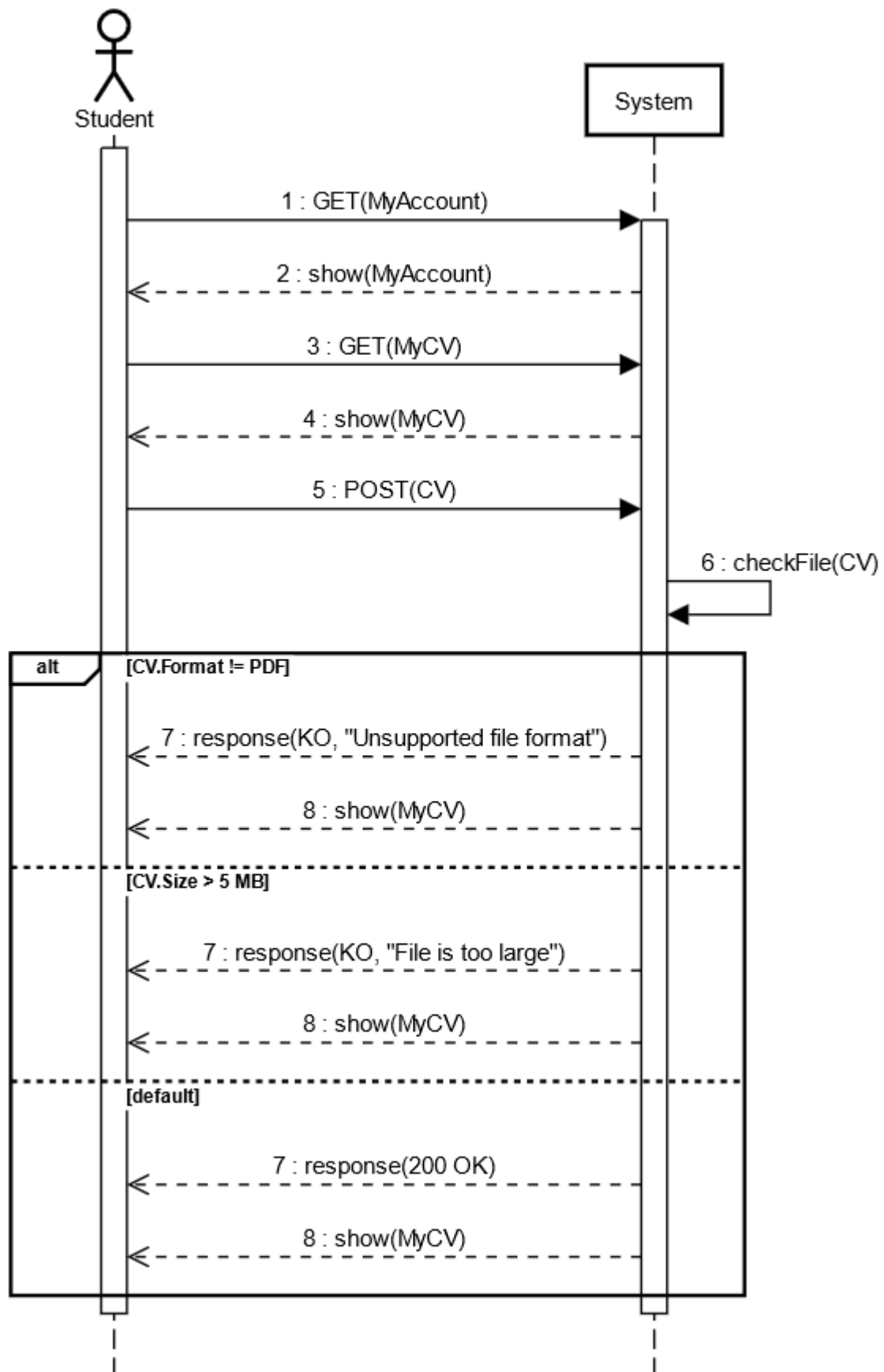
[UC3] Manage user settings



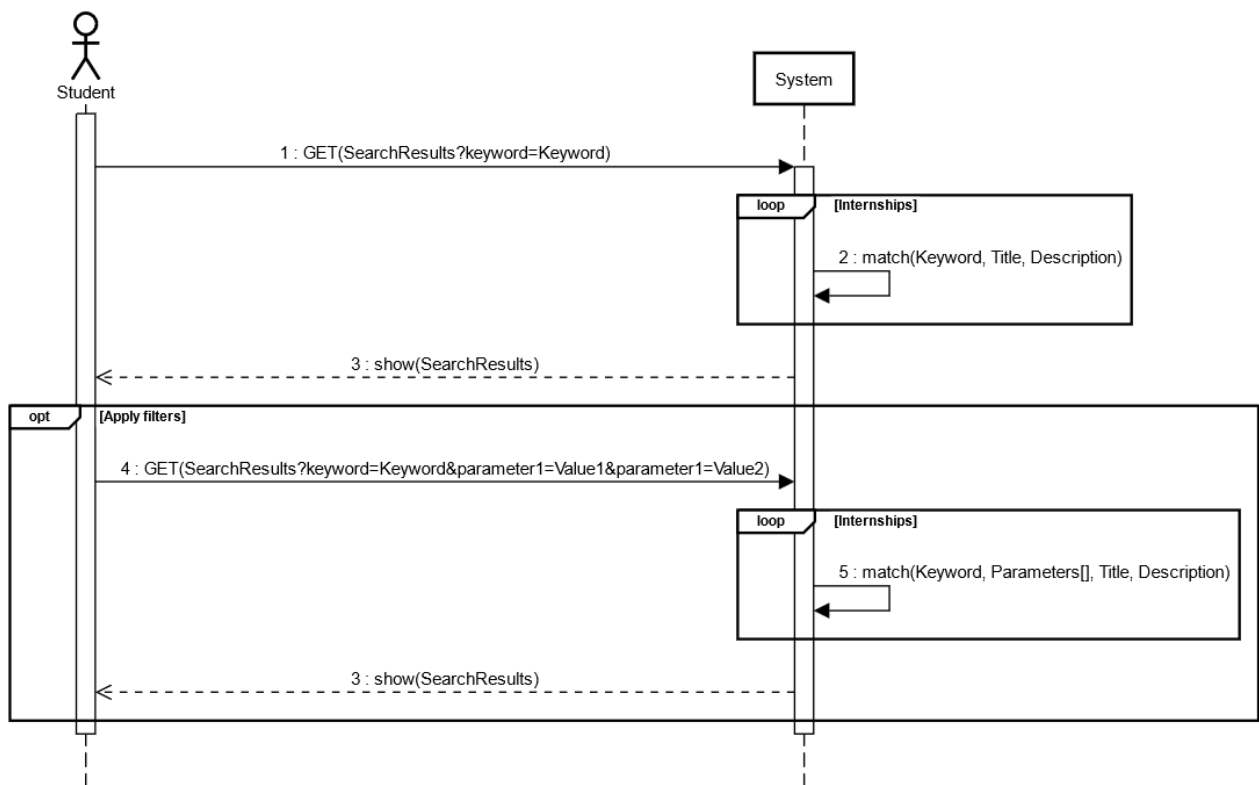
[UC4] Share work-related information



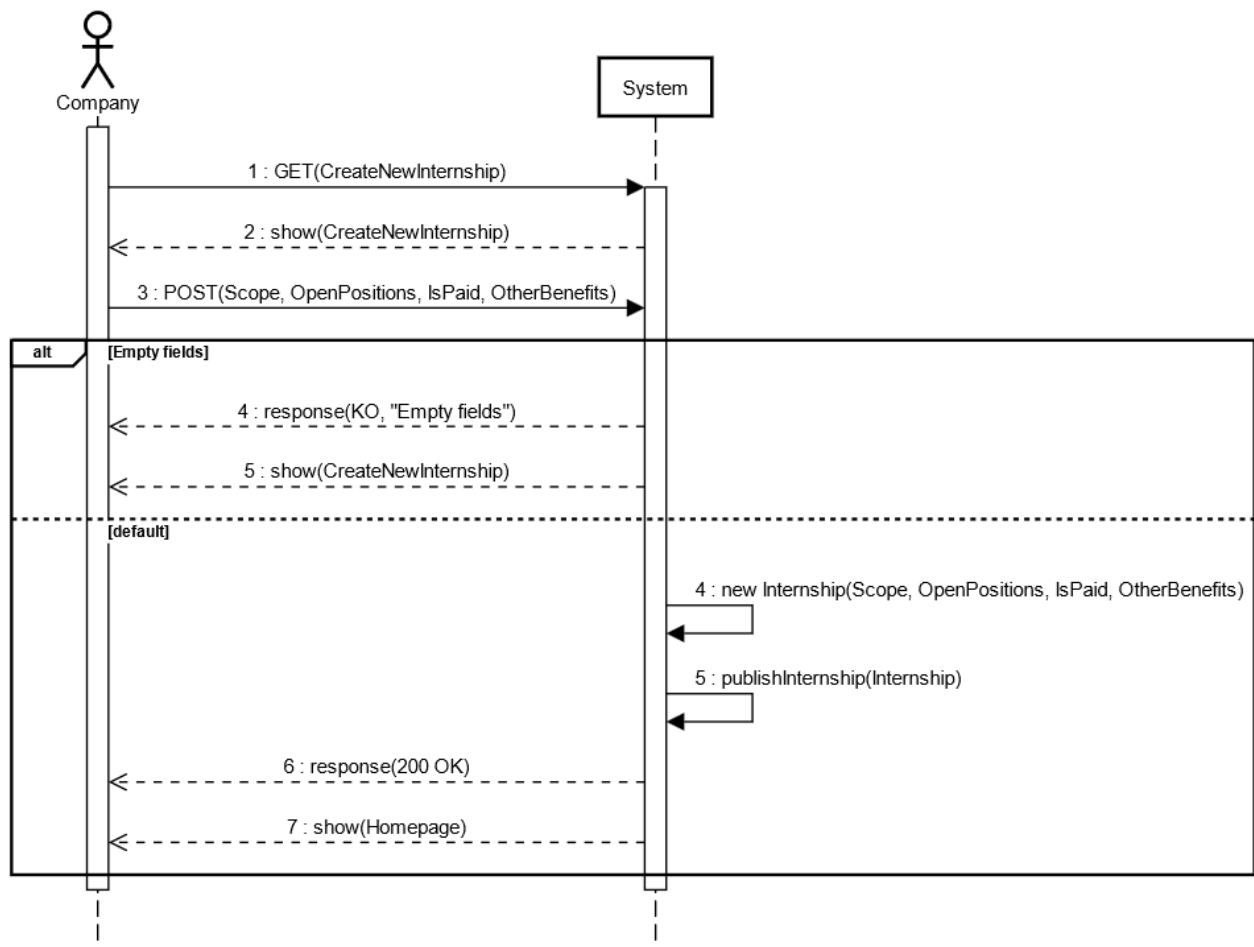
[UC5] Upload CV



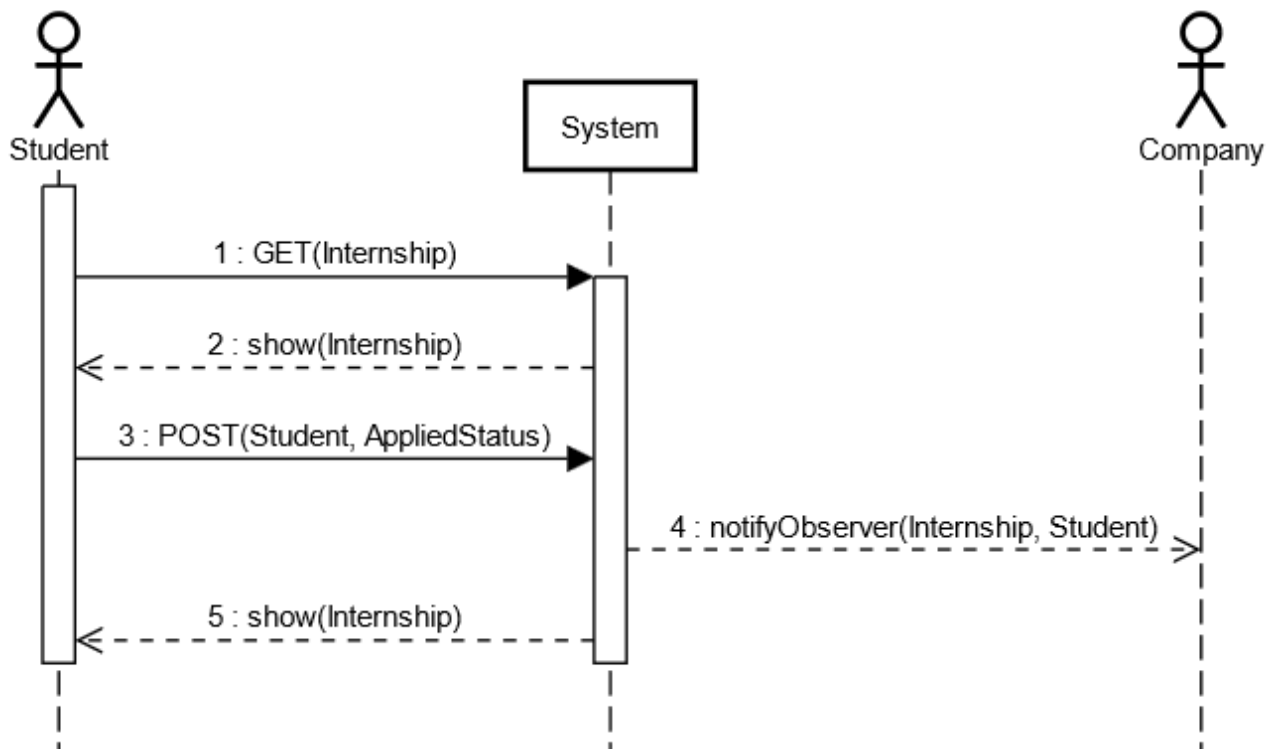
[UC6] Search for internship



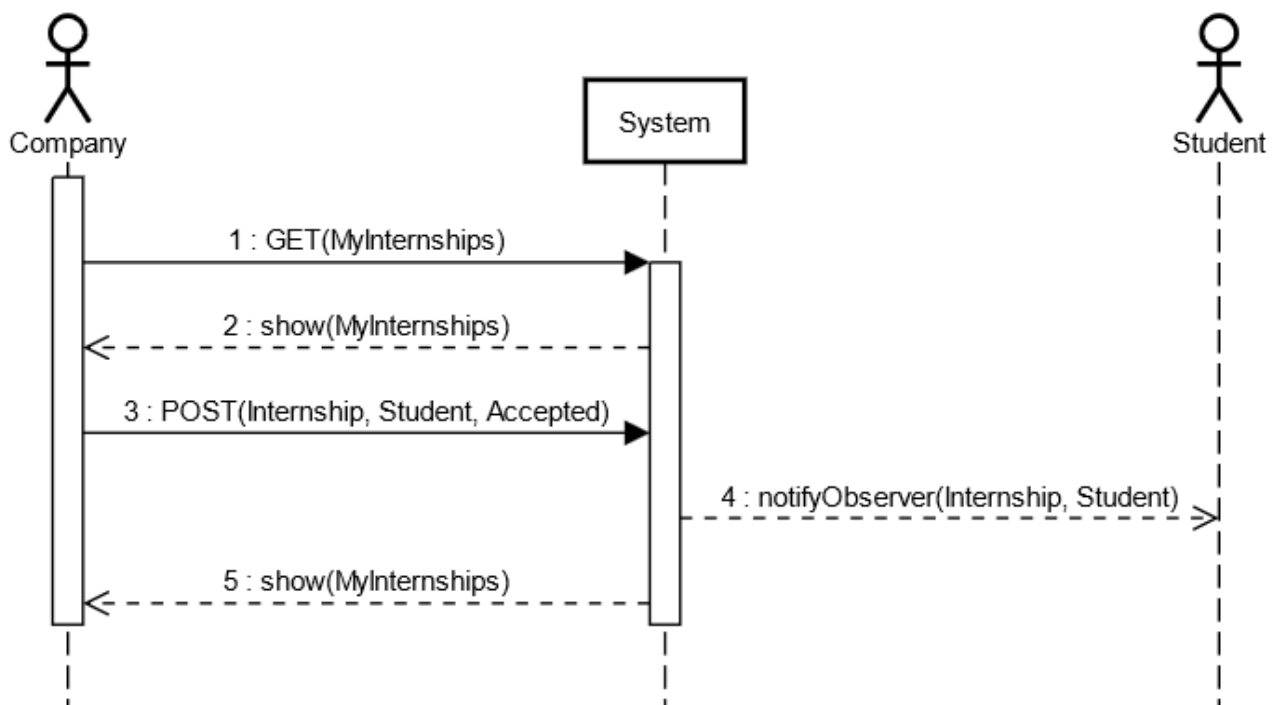
[UC7] Create internship



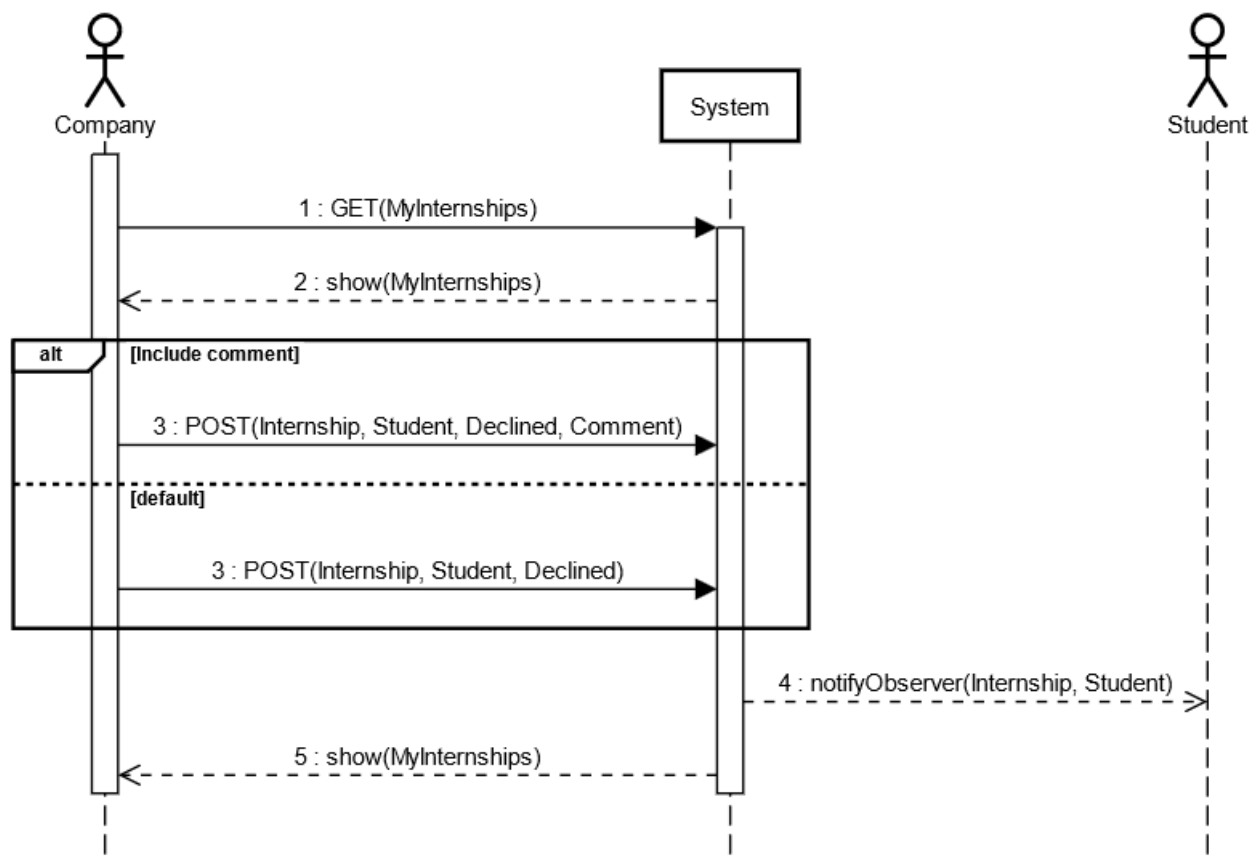
[UC8] Apply to internship



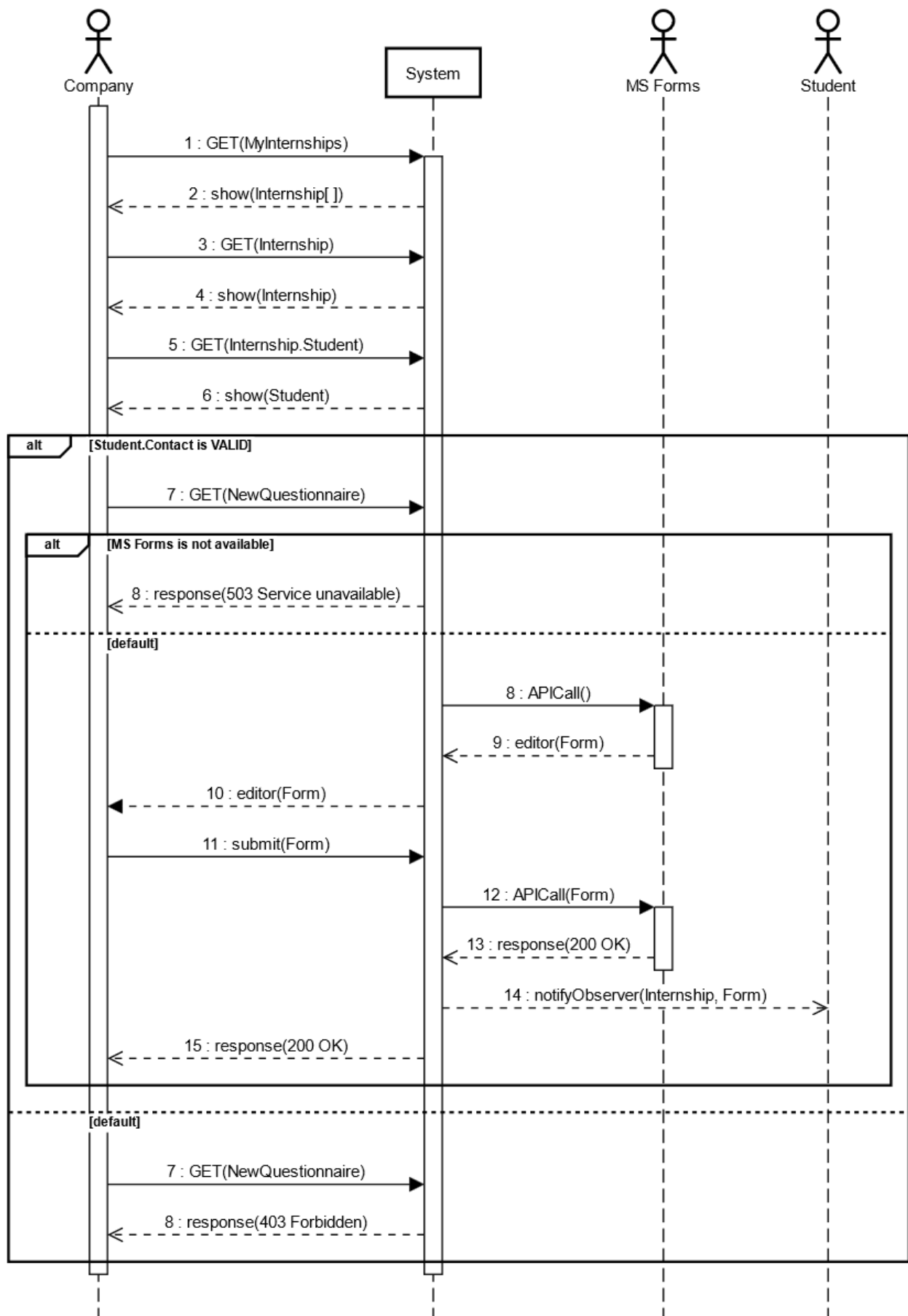
[UC9] Accept request (company to student)



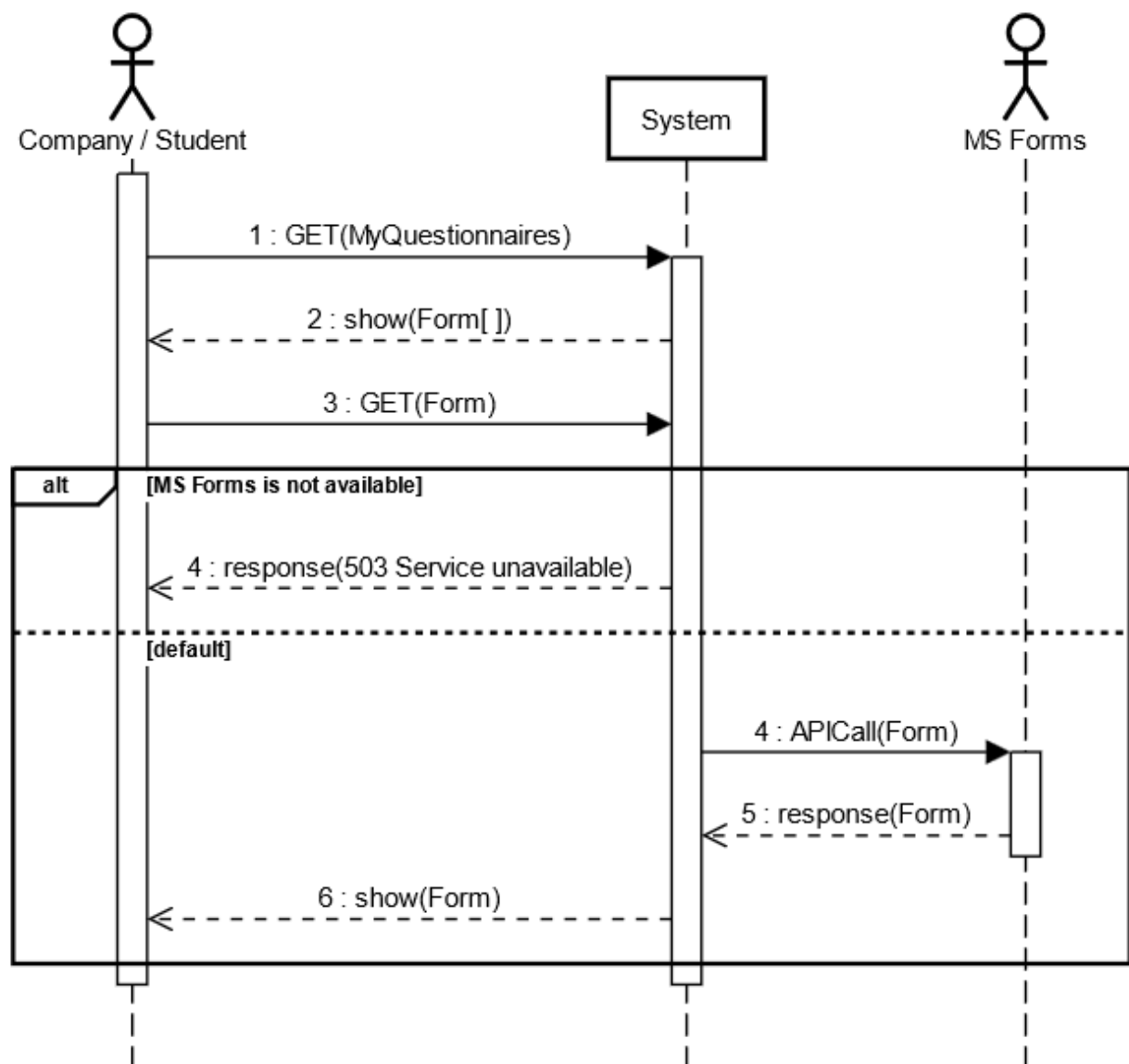
[UC10] Decline request (company to student)



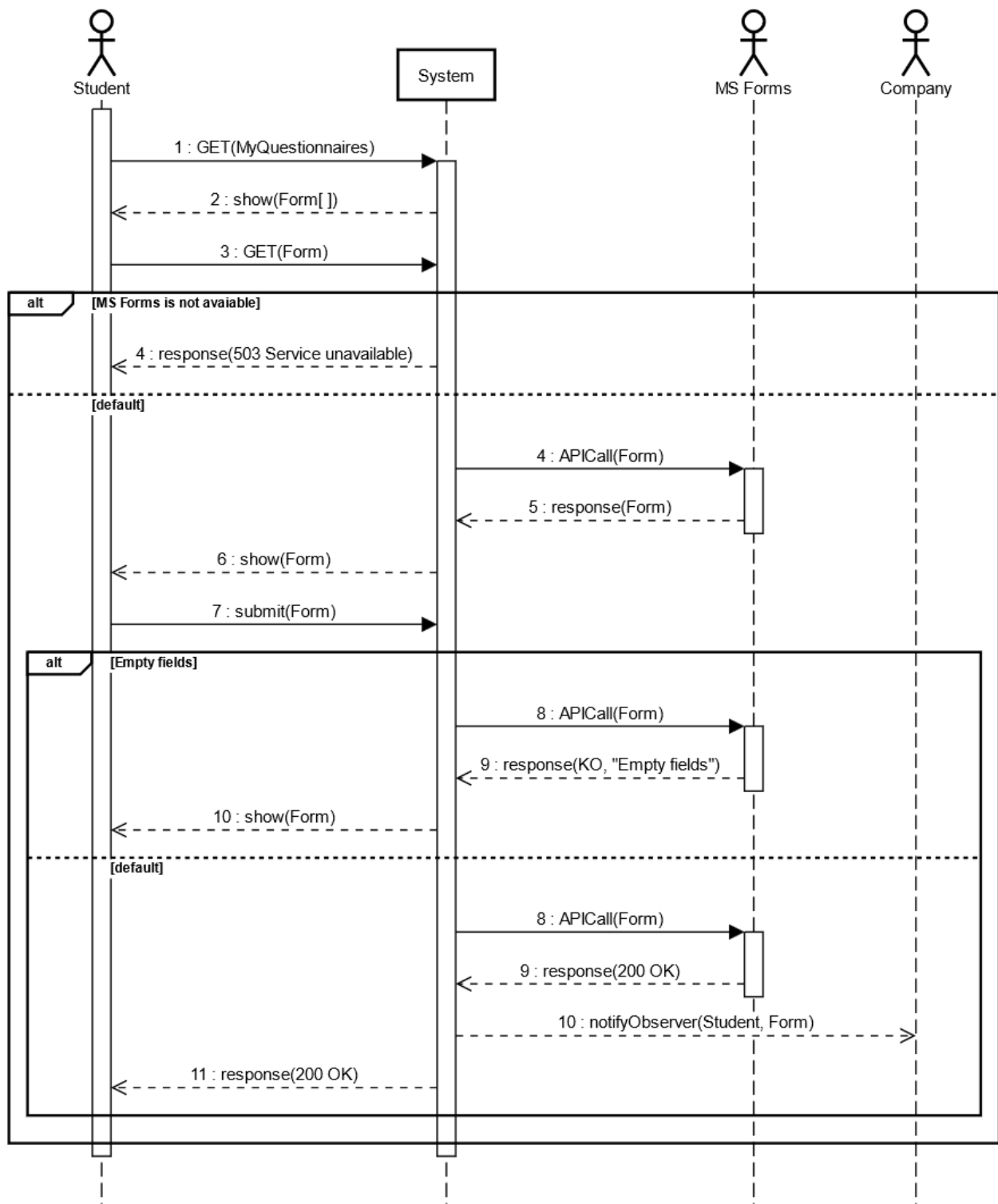
[UC11] Create questionnaires



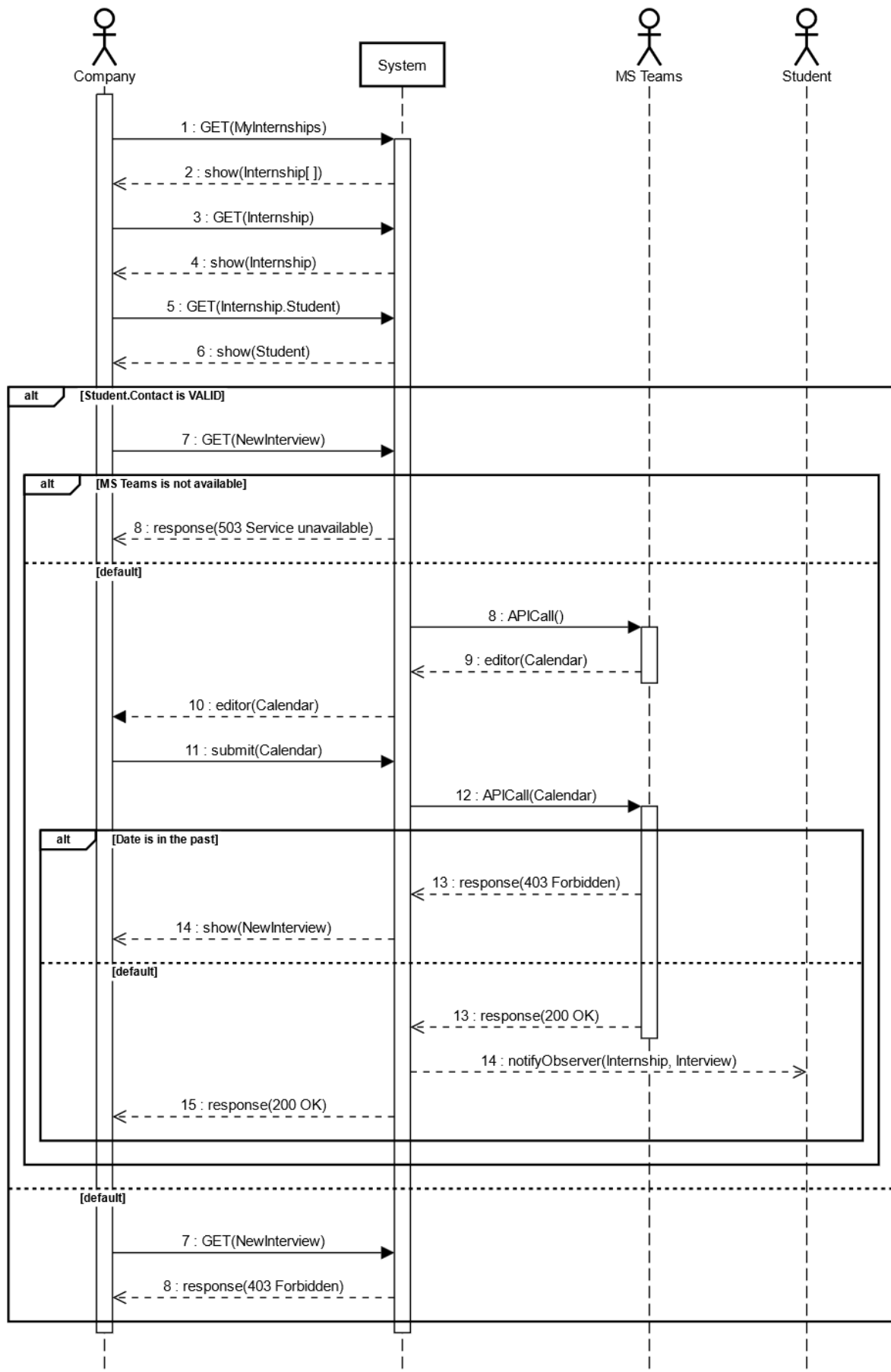
[UC12] Read questionnaires



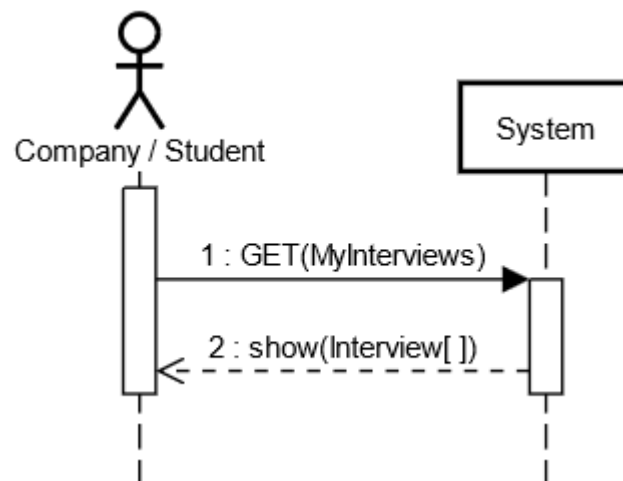
[UC13] Submit questionnaires



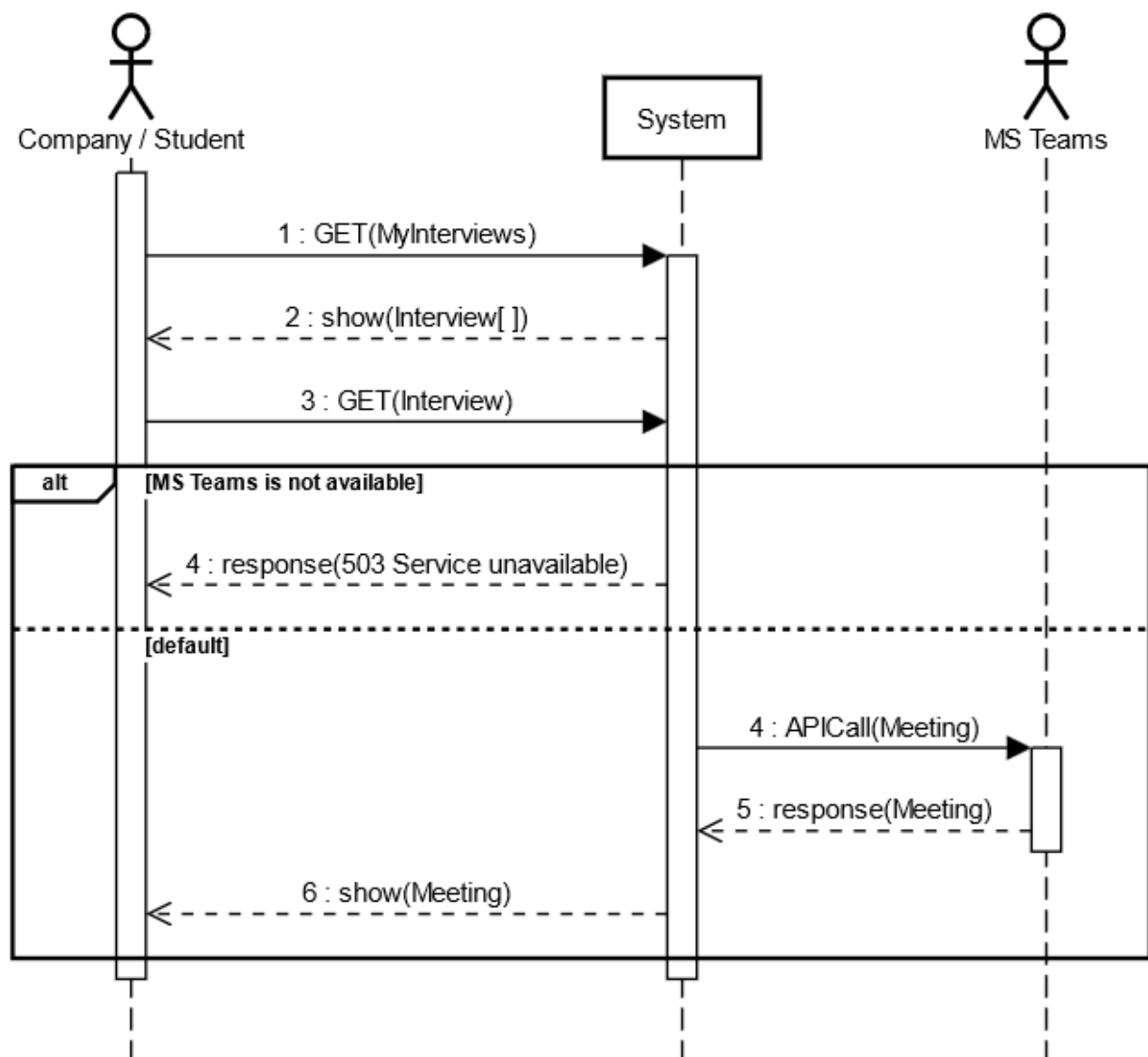
[UC14] Schedule meetings



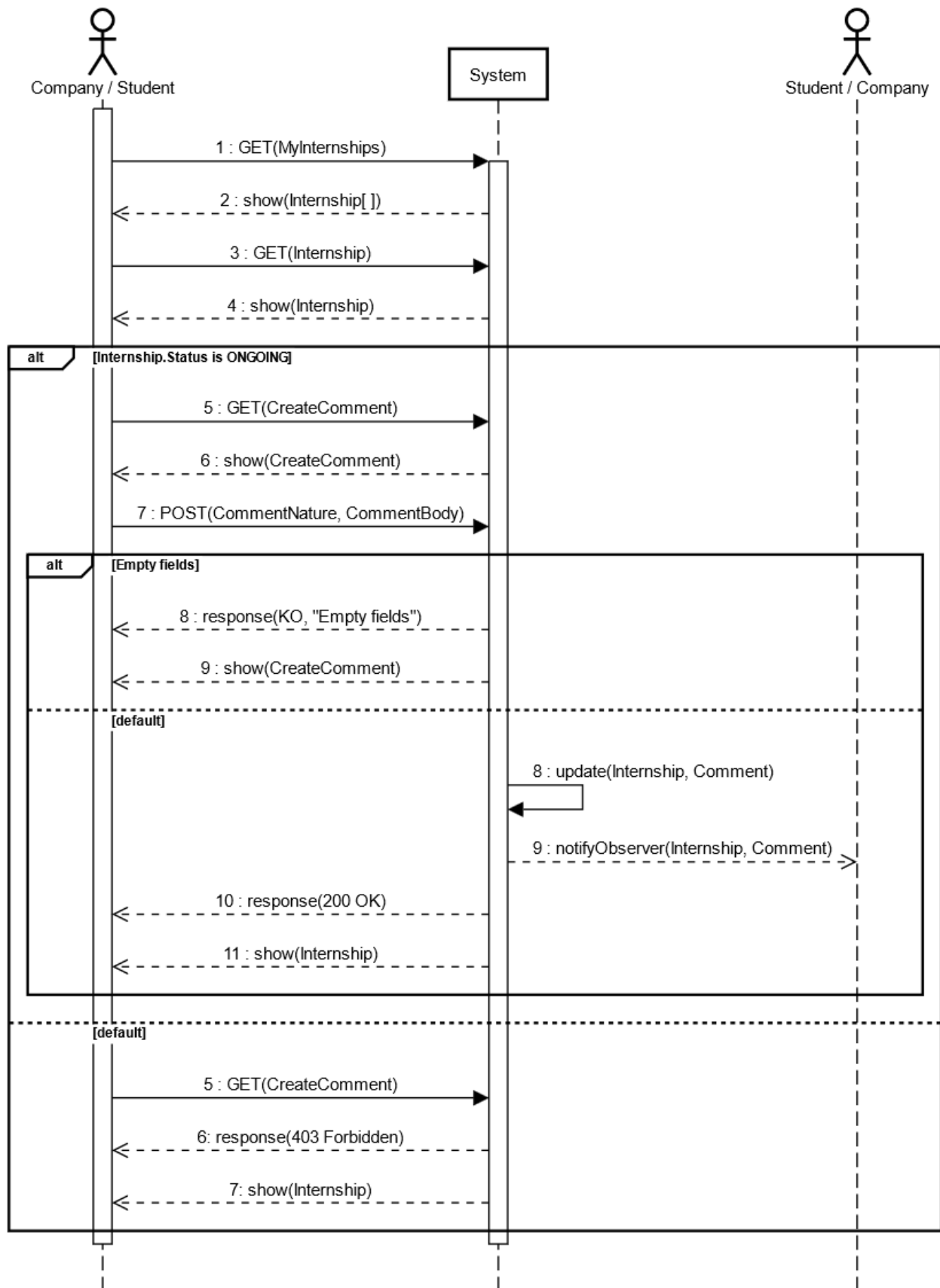
[UC15] Read scheduled meetings



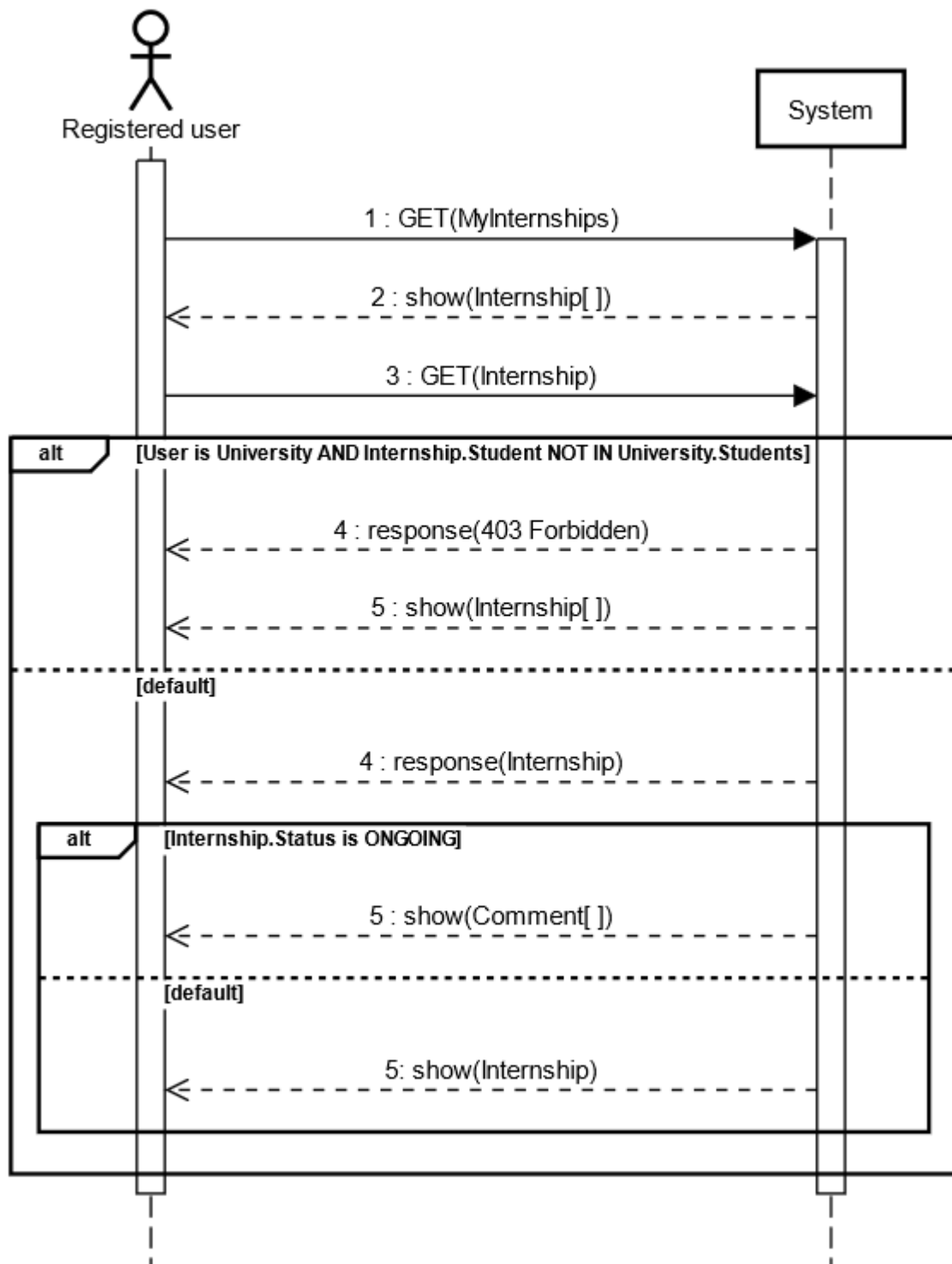
[UC16] Participate in meetings



[UC17] Create comments



[UC18] Read comments



3.2.4 Requirements mapping

In this section are illustrated correlations with the functional requirements and domain assumptions for each goal:

G1: Students and companies want to use the platform	
R1: The system allows students to register to the platform by providing their personal information. R2: The system allows companies and universities to register to the platform by providing business information. R3: The system allows registered users to login using the specified credentials. R4: The system allows students to list their experiences, skills and attitudes. R5: The system allows students to upload their CV. R8: The system allows companies to create internships by writing a description of the job and other relevant information.	D1: The system has a reliable internet connection.

G2: Students want to look for internships that satisfy their needs	
R1: The system allows students to register to the platform by providing their personal information. R2: The system allows companies and universities to register to the platform by providing business information. R3: The system allows registered users to login using the specified credentials. R6: The system allows students to filter internships according to their preference. R7: The system allows students to create an application with a company if the internship is interesting. R8: The system allows companies to create internships by writing a description of the job and other relevant information.	D1: The system has a reliable internet connection. D2: Companies add internship offers containing correct data.

G3: Students want to get hired to internships that satisfy their needs	
<p>R1: The system allows students to register to the platform by providing their personal information.</p> <p>R2: The system allows companies and universities to register to the platform by providing business information.</p> <p>R3: The system allows registered users to login using the specified credentials.</p> <p>R4: The system allows students to list their experiences, skills and attitudes.</p> <p>R5: The system allows students to upload their CV.</p> <p>R6: The system allows students to filter internships according to their preference.</p> <p>R7: The system allows students to create an application with a company if the internship is interesting.</p> <p>R8: The system allows companies to create internships by writing a description of the job and other relevant information.</p> <p>R9: The system allows companies to accept an application from a student if the student's CV corresponds to the company's need.</p> <p>R10: The system allows companies to decline an application from a student if the student's CV does not correspond to the company's need.</p> <p>R11: The system allows students and companies to get in touch with each other with a selection process, after the initial contact is made.</p> <p>R12: The system allows companies to collect information from students during the selection process, with questionnaires using MS Forms.</p> <p>R13: The system allows companies to collect information from students during the selection process, with interviews using MS Teams.</p>	<p>D1: The system has a reliable internet connection.</p> <p>D2: Companies add internship offers containing correct data.</p> <p>D3: Students add their CVs containing correct data.</p> <p>D4: MS Teams and MS Forms are reliable.</p>

G4: Companies want to accept/decline internships requests from students	
<p>R1: The system allows students to register to the platform by providing their personal information.</p> <p>R2: The system allows companies and universities to register to the platform by providing business information.</p> <p>R3: The system allows registered users to login using the specified credentials.</p> <p>R4: The system allows students to list their experiences, skills and attitudes.</p> <p>R5: The system allows students to upload their CV.</p> <p>R6: The system allows students to filter internships according to their preference.</p> <p>R7: The system allows students to create an application with a company if the internship is interesting.</p> <p>R8: The system allows companies to create internships by writing a description of the job and other relevant information.</p> <p>R9: The system allows companies to accept an application from a student if the student's CV corresponds to the company's need.</p> <p>R10: The system allows companies to decline an application from a student if the student's CV does not correspond to the company's need.</p> <p>R11: The system allows students and companies to get in touch with each other with a selection process, after the initial contact is made.</p> <p>R12: The system allows companies to collect information from students during the selection process, with questionnaires using MS Forms.</p> <p>R13: The system allows companies to collect information from students during the selection process, with interviews using MS Teams.</p>	<p>D1: The system has a reliable internet connection.</p> <p>D2: Companies add internship offers containing correct data.</p> <p>D3: Students add their CVs containing correct data.</p> <p>D4: MS Teams and MS Forms are reliable.</p>

G5: Universities want to monitor their student's ongoing internships	
<p>R1: The system allows students to register to the platform by providing their personal information.</p> <p>R2: The system allows companies and universities to register to the platform by providing business information.</p> <p>R3: The system allows registered users to login using the specified credentials.</p> <p>R4: The system allows students to list their experiences, skills and attitudes.</p> <p>R5: The system allows students to upload their CV.</p> <p>R6: The system allows students to filter internships according to their preference.</p> <p>R7: The system allows students to create an application with a company if the internship is interesting.</p> <p>R8: The system allows companies to create internships by writing a description of the job and other relevant information.</p> <p>R9: The system allows companies to accept an application from a student if the student's CV corresponds to the company's need.</p> <p>R10: The system allows companies to decline an application from a student if the student's CV does not correspond to the company's need.</p> <p>R11: The system allows students and companies to get in touch with each other with a selection process, after the initial contact is made.</p> <p>R12: The system allows companies to collect information from students during the selection process, with questionnaires using MS Forms.</p> <p>R13: The system allows companies to collect information from students during the selection process, with interviews using MS Teams.</p> <p>R14: The system allows students and companies to keep track of the ongoing internship, by providing spaces where both parties can write their opinions, problems and other relevant information regarding the internship.</p> <p>R15: The system allows universities to monitor the comments for ongoing internships of its students</p>	<p>D1: The system has a reliable internet connection.</p> <p>D2: Companies add internship offers containing correct data.</p> <p>D3: Students add their CVs containing correct data.</p> <p>D4: MS Teams and MS Forms are reliable.</p>

3.3 Performance requirements

Since S&C is a webapp, it must ensure a good user experience with low response times and efficient handling of user interactions. The system should respond to user actions within 2 seconds under standard conditions and maintain the following uptimes:

Period	Uptime per period	Maximum allowed downtime
30 days	99%	7 hours, 12 minutes
1 year	99.9%	8 hours, 46 minutes

If the system does not respect the given service level agreements it is considered unreliable and should be pulled offline for investigations. MS Forms and MS Teams outages are not counted as downtime as they are not within the platform's control.

Server resources should be optimized to ensure CPU utilization below 70% and memory usage below 85% under normal circumstances. During peak periods, the servers should be scaled up as needed.

These steps will ensure a reliable, responsive and scalable S&C platform.

3.4 Design constraints

3.4.1 Standards compliance

The system will use the following standards:

Standard	Description
ISO 8601	Standard used for timestamps throughout the platform.
ISO/IEC 27000	Family of standards for information security and privacy protection.

The system will use the user's email address only to send notifications about the status of an application, creation of a questionnaire, submission of a questionnaire, scheduling of a meeting and creation of a comment. The user will have the ability to opt-out of such emails via the user settings; after opting out, the notifications will only be visible while using S&C.

3.4.2 Hardware limitations

The users should have all the necessary hardware to connect to and use S&C, that is, an updated browser and an internet connection.

A broadband internet connection faster than 4 Mb/s is recommended² for the best performance during MS Teams calls.

² Recommended by Microsoft: <https://learn.microsoft.com/en-us/microsoftteams/prepare-network#bandwidth-requirements>

3.5 Software system attributes

3.5.1 Reliability

The system is designed with robust error handling mechanisms to manage unexpected events, preventing catastrophic failures. The system will be backed up regularly following the “3 2 1” rule, which means:

- 3 copies of the data.
- Using 2 different media for storage.
- While keeping at least 1 copy off-site.

This best practice guarantees a very high level of reliability in case of data loss on the main server.

3.5.2 Availability

Since the platform is not mission critical for emergency services, its availability can be of 99% in a period of 30 days and 99.9% in a period of 1 year. This can be achieved through the implementation of redundant servers, load balancers and scalable infrastructure.

3.5.3 Security

As seen in Standards compliance, the system shall be compliant with the ISO/IEC 27000 family. This includes employing secure authentication protocols, encryption of sensitive data and regular audits from third party companies to identify and address vulnerabilities.

3.5.4 Maintainability

The system shall be characterized by scalable and reusable modules which will be easier to maintain and replace in case of failure. Ordinary maintenance, for bug fixes and improvements, will be scheduled during night time, when the user traffic is minimal. The core aspects of maintainability and modularity will be addressed in the design document.

3.5.5 Scalability

The system shall be scalable for both peak hours and future growth. This will ensure a good level of responsiveness for all users at all times.

3.5.6 Portability

S&C is inherently portable since it's a web application. This means that users can use the platform from a wide range of devices including phones, tablets, desktops and laptops. The website will be developed using responsive design techniques ensuring optimal viewing and interaction experiences across various screen sizes and resolutions.

3.5.7 Accessibility

The system interface will try to minimize the number of clicks needed to do something. The use of a special highly readable font³ will ensure that users with poor vision can still navigate the website. Wherever possible the website will be readable by text-to-speech assistants for blind people.

³ [Atkinson Hyperlegible Font](#) has been chosen for the platform, not only for the free license, but also for the awards it won.

4 Formal analysis using Alloy

The model is created to show how the system can be at any moment in time. Thanks to Alloy 6 it was also possible to model how the system behaves as time passes. The Alloy model is a simplified version of the real system since it does not take into account delays between the application and its acceptance/rejection.

4.1 Signatures

```
enum StudentStatus {Searching, Hired}

enum ApplicationStatus {AcceptedForContact, Declined, Ongoing}

sig Student {
    var studentStatus: one StudentStatus,
}

sig Company {

}

sig Internship {
    company: one Company,
    var openPositions: one Int
} {
    openPositions >= 0
}

sig Application {
    student: one Student,
    internship: one Internship,
    var applicationStatus: one ApplicationStatus
}
```

4.2 Facts

```
// No student can be hired without an application
fact {
    always(no s:Student | all a:Application | s not in a.student and
s.studentStatus = Hired)
}

// No searching student with an ongoing application
fact {
    always(all a:Application | a.applicationStatus = Ongoing iff
a.student.studentStatus = Hired)
}

// Some applications become ongoing.
fact {
    eventually(some a:Application | a.applicationStatus =
AcceptedForContact and a.applicationStatus' = Ongoing)
}

// Some applications become declined
fact {
    eventually(some a:Application | a.applicationStatus =
AcceptedForContact and a.applicationStatus' = Declined)
}

// If an internship goes from AcceptedForContact to Ongoing, the student
must go from Searching to Hired
fact {
    always(all a:Application | (a.applicationStatus = AcceptedForContact
and a.applicationStatus' = Ongoing) iff (a.student.studentStatus = Searching
and a.student.studentStatus' = Hired))
}

// No regression of application status
fact {
    always(no a:Application | a.applicationStatus = Ongoing and
a.applicationStatus' = Declined) and
    always(no a:Application | a.applicationStatus = Ongoing and
a.applicationStatus' = AcceptedForContact)
    always(no a:Application | a.applicationStatus = Declined and
(a.applicationStatus' = AcceptedForContact or a.applicationStatus' =
Ongoing))
}

// No regression of student status
fact {
    always(no s:Student | s.studentStatus = Hired and s.studentStatus' =
Searching)
}

// The number of open positions must decrease if a student is hired
fact {
    always(all a:Application | (a.applicationStatus = AcceptedForContact
and a.applicationStatus' = Ongoing) implies a.internship.openPositions' =
minus[a.internship.openPositions, #(SubsetOfOngoingApplications[a]))
}
```

```

// The number of open positions must not change for internships that do not
have interns
fact {
    always(all a:Application | (a.applicationStatus = AcceptedForContact
and a.applicationStatus' != Ongoing) implies a.internship.openPositions' =
a.internship.openPositions)
}

// If an internship is not in any application, its open positions must not
change
fact {
    always(all i:Internship, a:Application | i not in a.internship implies
i.openPositions' = i.openPositions)
}

// No student can be in more than 1 ongoing internship at a time
fact {
    always(all disj a1, a2:Application | (a1.applicationStatus = Ongoing
and a2.applicationStatus = Ongoing) implies a1.student != a2.student)
}

// Initialization state
fact init{
    Student.studentStatus = Searching
    Internship.openPositions > 0
}

```

4.3 Functions

```

fun SubsetOfOngoingApplications[a:Application]: Application {
    {x:a | x.applicationStatus' = Ongoing and x.internship = a.internship}
}

```

4.4 Predicates

```

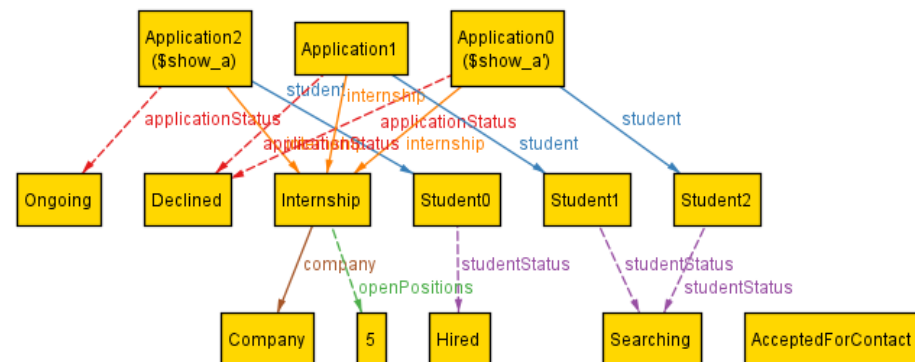
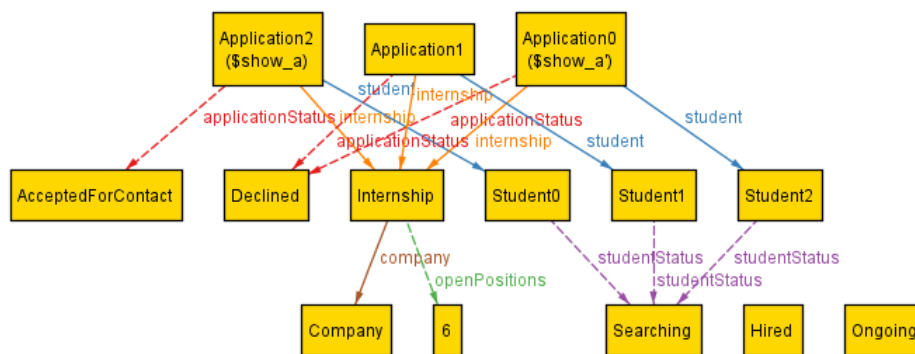
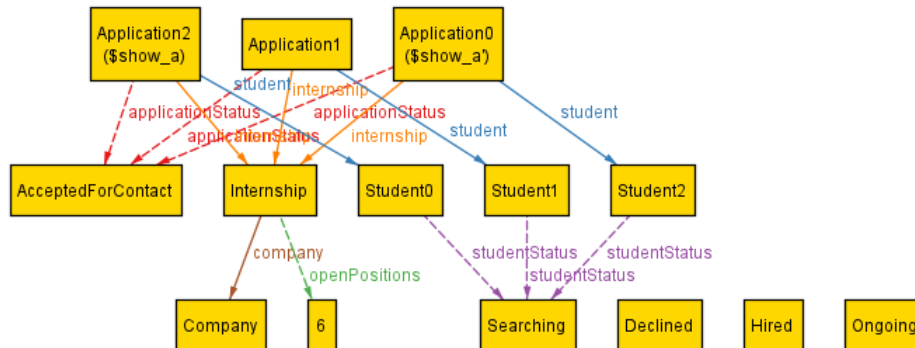
pred show {
    #student = 3
}

```

4.5 Run show

Following are some models of the system obtained by running the model on Alloy Analyzer.

- Student hired with one available internship



As shown, the students have an accepted application. This means they are in contact with the company. Two of the students have been rejected and can still search for other internships, while one has been accepted and is now hired.

- Student hired with two available internships, one of which has no applicants

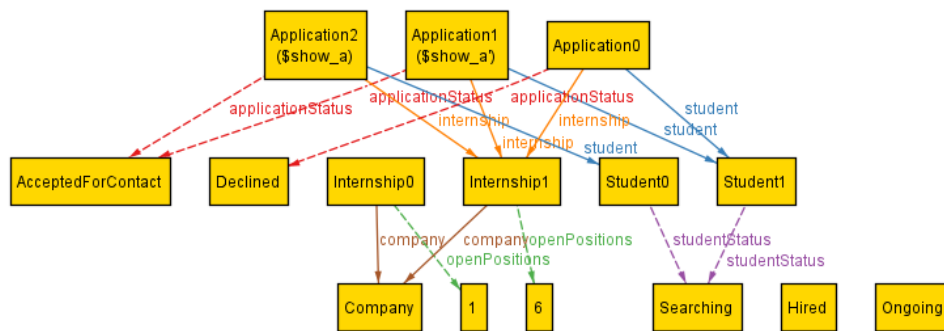


Figure 4-4: Step 0 of the simulation

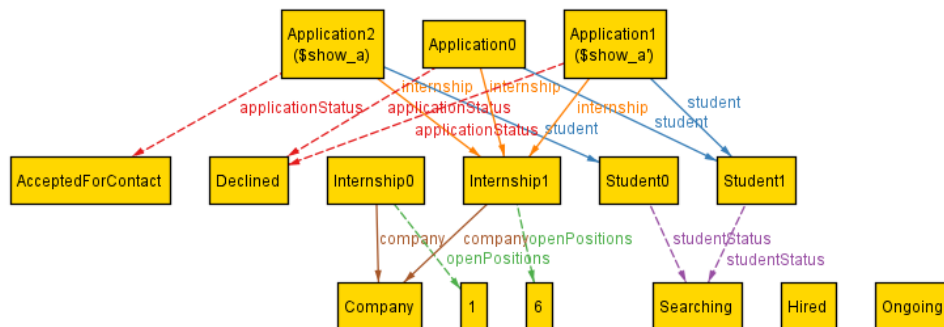


Figure 4-5: Step 1 of the simulation

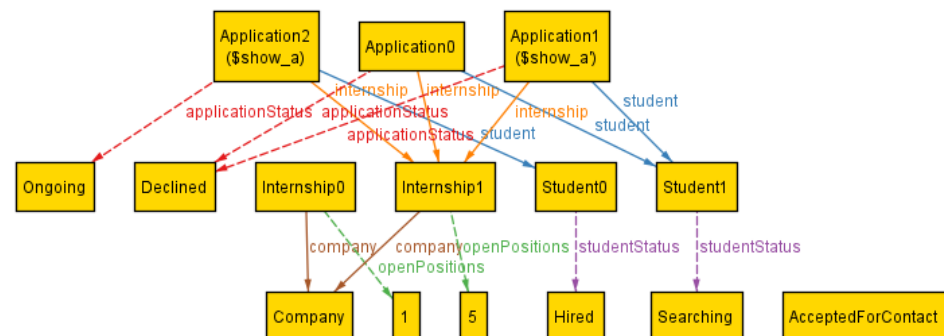


Figure 4-6: Step 2 of the simulation

As shown, the students have some accepted and some declined applications. The declined application stay declined during the simulation steps. After the student is hired, only the internship where he applied to has a decreased number of open positions.

5 Effort spent

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6 References

- IEEE standard for RASD documents: <https://ieeexplore.ieee.org/document/8559686>
- Embed MS Teams guide by Microsoft: <https://devblogs.microsoft.com/microsoft365dev/want-to-embed-microsoft-teams-in-your-app-heres-how/>
- State machine, use case and class diagrams made with: <https://app.diagrams.net>
- Sequence diagrams made with: <https://sequencediagram.org>