POLITECNICO
MILANO 1863

Software engineering 2 project - Lorenzetti Cimino

Requirement Analysis and Specification Document

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Contents

List of Figures

List of Tables

1 Introduction

1.1 Purpose

If you are looking for an internship or want to offer one, you are in the right place, S&C will help you!
Student&Companies is a platform that helps match university students looking for internships and companies offering them.
The primary objective of the platform are as follow:

- Students can search for an internship on their own or can be informed when an internship request compatible with their CV and characteristics is published.
- The system will help both student and companies find each other, by a system called "recommendation" that helps find the correspondence between the characteristic offered by the student and the ones asked by the company.
- The management of the selection process.
- The monitoring of the execution of the internships, including statistics, feedback, and complaints.

1.1.1 Goals

[G1]: All unregistered students and companies must be able to subscribe and login to the S&C platform.
[G2]: Students and companies must be able to write their descriptions and preferences.
[G3]: Students must be able to complete their CV.
[G4]: Companies must be able to create internship offers.
[G5]: Students must be able to search for an internship.
[G6]: Student and Company are informed when there is a match between them.
[G7]: Monitoring of the execution of the internships.
[G8]: Statistics collection.
[G9]: Feedbacks collection.
[G10]: Companies rank based on feedback.

1.2 Scope

S&C allows student and companies to communicate easily in a guided environment.
Students are able to upload their CVs and express their preferences about the work environment.
Companies upload their internship offers through the platform.
Students need to be able to actively search for an internship, through a keyword or by selecting some preferences.
The system implements a process called "recommendation": it's a mechanisms that apply a research through the internship preferences and students characteristics, to inform students when an interesting internship becomes available and informs also companies that a student matches with theirs preferences.
The platform also propose to help companies in the selection process. When there is a match between the two parts, and both of them accept it, the process start. Companies feed questionnaire to the students and collect their responses to evaluate their fit with the company and can finalize the selection. The platform also stores statistics about internship that are offered by companies and the feedback from the students.

1.2.1 Phenomena

Phenomenon	Who controls it?	Is shared?
Users decides to use S&C	W	N
User registration	W	Y
User login	W	Y
Check username and password	M	N
Student create CV	W	Y
Company create offer	W	Y
Recommendation process start	M	N
Student search offer	W	Y
Match notification	M	Y
Match acceptation	W	Y
Student's feedback	W	Y
Statistics collection	M	N
Companies rank computation	M	N
Companies rank publication	M	Y
Interview process start	M	N
Form sending	M	Y
Form compilation	W	Y
Interview schedule	M	Y

Table 1: Phenomena

1.3 Definitions, Acronyms, Abbreviations

1.3.1 Definitions

1.3.2 Acronyms

- **S&C:** Student and Companies
- **CV:** curriculum vitae
- **Zoom:** Zoom platform
- **G:** goal
- **A:** assumption
- **UC:** use cases
- **AD:** activity diagram

1.3.3 Abbreviations

1.4 Revision history

1.5 Reference Documents

- Slides of the course “Software Engineering 2”.
- Michael Jackson, The World and the Machine.
- Specification document "01. Assignment RDD AY 2024-2025”
- Alloy documentation - https://alloytools.org/documentation.html

1.6 Document Structure

1. **Introduction:** a description of the problem showing the purpose and the scope of the application. In order to precisely delineate the scope, phenomena and goals related to the problem are identified. In this section information about terms used in this document is also present, along with references and revision history.
2. **Overall Descriptions:** a high-level view of the project. The perspective of the product is developed with scenarios and descriptions about requirements of the service interfaces. Product functions describe the required functions of the system in order to fulfill the goals as specified by the stakeholders. Furthermore, possible actors are also identified in the user user characteristics section. In the end there is a list of the taken domain assumptions.
3. **Specific Requirements:** detailed description of the user interface, function and non-functional service requirements specification. Functional Requirements are supported from specific use cases and mappings that permit to acknowledge how the goals are satisfied.
4. **Formal Analysis Using Alloy:** Alloy model useful in checking necessary properties of the system, and generating possible world in which the same will operate.
5. **Effort Spent:** hours spent by each group member on the various activities related to the document developing.

2 Overall Description

2.1 Product perspective

2.1.1 Scenarios

Here are presented possible scenarios for the users of the S&C platform.

1. **A company wants to have access to the S&C services:**
   A company would like to offer one or more internships to students, but does not know how to find/contact them and how to choose the most suitable one. Therefore, the company registers on the S&C platform, entering its name, an email address, a password, its VAT number, contacts, a description of themselves and what it is interested in within relative fields. For subsequent times, to access it only has his/her e-mail and password.

2. **A student wants to have access to the S&C services:**
   A student wants to have the opportunity to gain more experience during his/her studies or, also, to earn some money during his/her studies and he/she doesn't know which company to choose, so he/she subscribes to the platform S&C. When subscribing, the student enters his/her first name, last name, e-mail, a password, contacts, a description of itself and the answers to questions about his/her preferences so as to facilitate the recommendation system, within relative fields. For subsequent times, to access he/she only has to enter his/her e-mail and password.

3. **A company insert internship offers, changes its personal data and description**
   Now that it is inside the platform, the company can add its new internship offer, inserting the title, an adequate description, the characteristics and the questions to be included in the relative form that will be filled out by the student at the beginning of the selection process. Or it can modify/update existing offers, its personal data and descriptions.

4. **A student insert his/her CV, changes his/her personal data, descriptions and preferences**
   Now that it is inside the platform the student can insert or modify his/her CV by uploading it as a PDF. He/She can also modify/update his/her personal data and description.

5. **A student search for an internship**
   To search for an internship, the student must enter a keyword or the name of a company in the search bar, and can customize his/her search through filters. Once he/she has chosen the offer that is right for him/her, he/she can request to start the selection process and S&C will take care of notifying the company in question.

6. **Recommendation system notification**
   Based on the preference inserted by the student and the companies and the statistical analysis from the data collected by the platform, they get notified when a match is available, throughout the research made by the recommendation system.

7. **Acceptance phase**
   When the student or the company receive a notification, they have to accept or refuse it through a button. if they accept they must indicate their availability spots and the platform will find the first free spot in common for the video interview. If that does not exists notify both with their e-mail.

8. **Selection process**
   After the establishment of a contact, the selection process start, and the student has to compile a form with specific questions to check if he/she really fit with the position. Then they proceed with the scheduled interview through a Zoom link provided by the platform. After the interview, both participant can accept or not the collaboration.

9. **Ending internship**
   At the end of the internship the student and the company can leave feedback on the counterpart.

2.1.2 Domain-level Diagram

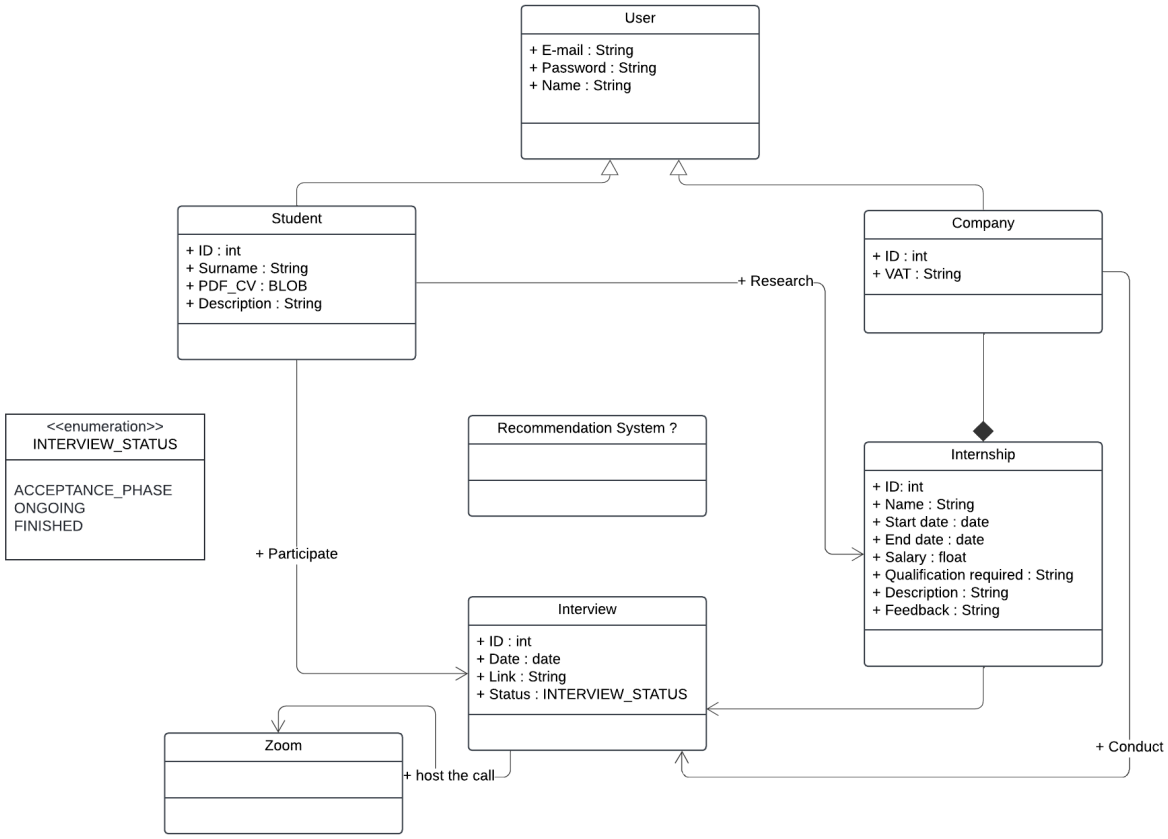

Figure 1: Class diagram

2.1.3 State Diagrams

State diagrams describe the behavior of the system while considering all possible states the system can deal with when an event occurs. This analysis helps to clarify the most critical aspects of the system.

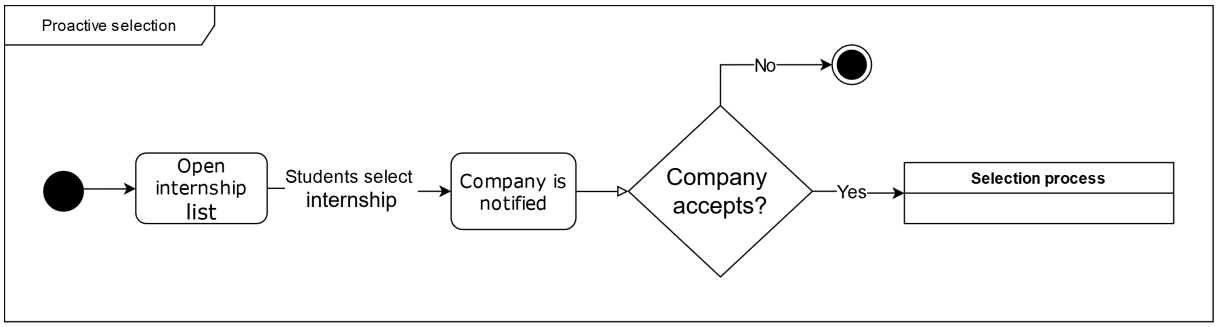

Figure 2: Proactive selection

This state diagram describes the process of manual selection of the internship by the student. In the initial state, the "Open internship list" the system is displaying some internship, and the student can

select one of them, when is selected the system goes into the "Company is notified" state and notify the company interested, that can accept or not the request, in case of acceptance, the selection process start.

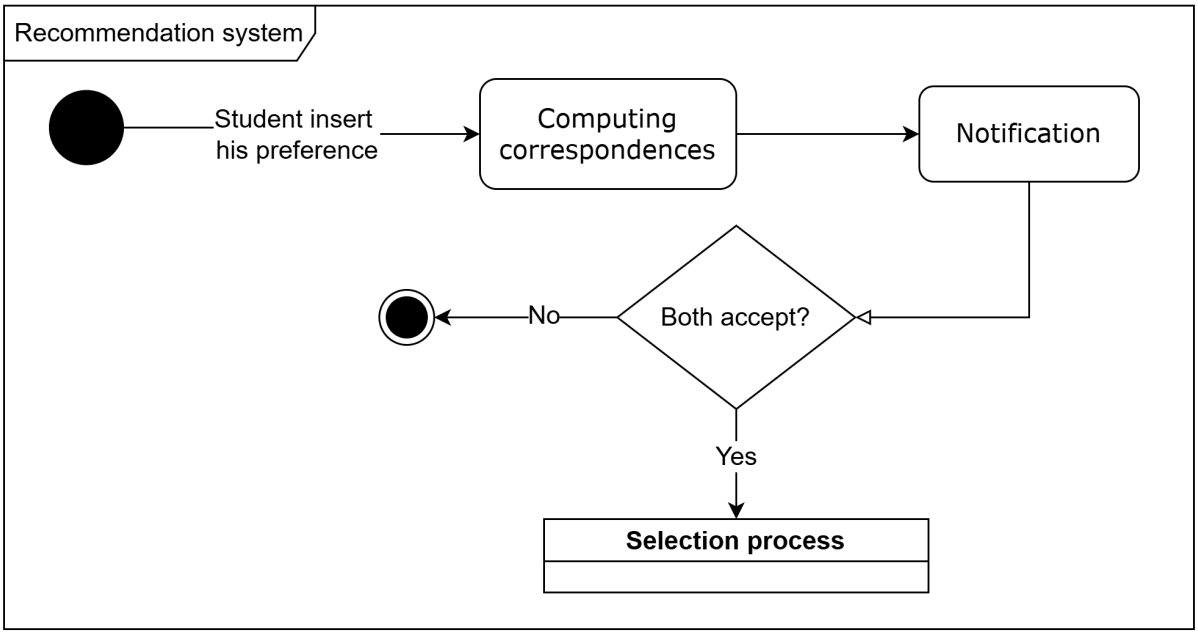

Figure 3: Recommendation process

After the insertion of the preferences by the student, the system goes to the state of "computing correspondences" where it actually search for an internship that can match with the preferences of a company, through a keyword search of the preferences through the CVs' content or a statistical analysis of the internships. The system always found the best match, then proceed to the state of "notification" where it notify both the counterparts, if both of them accept, then the system proceed with the selection process, else the selection process never start.

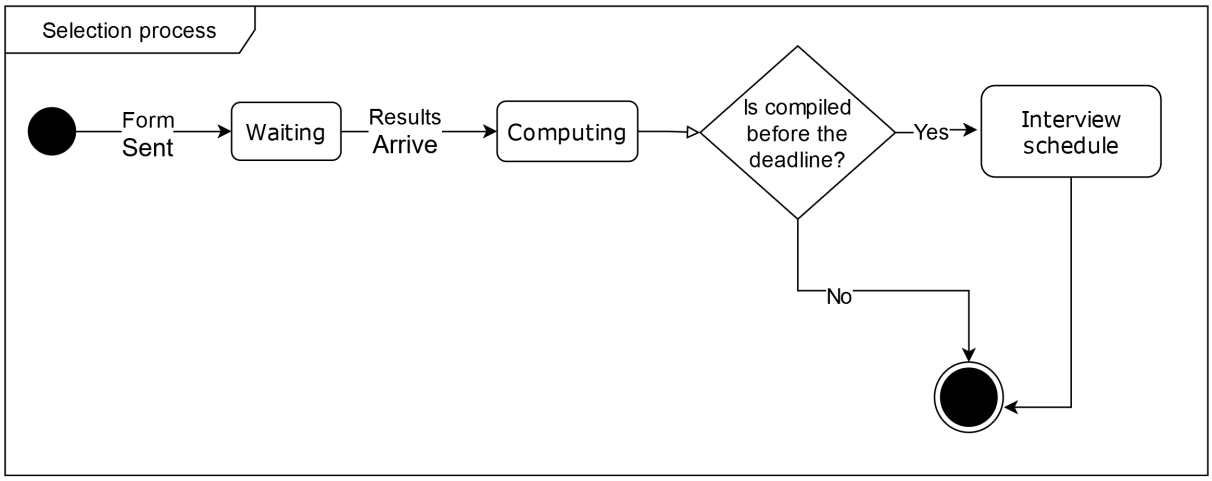

Figure 4: Selection process

This state diagram describe the selection process, once it starts, the system sent a form and goes to the "Waiting" state, where it waits until the student compile the form and send back the results, Then when they arrive, it goes to the "Computing" state and elaborate the form result and if the date of compiling is before the deadline, the system proceeds with the scheduling of the interview in the "Interview schedule" state, where it also produce the link for the video interview.

2.2 Product functions

The following sections contains the main product function of S&C.

- **Sign and Login**
  These functions will be available to all the users. The sign-up functionality allows users to create an account to register themselves to the platform. Each user will be asked to select if he/she is a student or a company and provide own data such as name, email and password; for the student will also be asked surname, his/her description and CV, for the company the VAT number and a description of itself. The login functionality allows users to access an existing account using the credentials (email and password) chosen at registration.

- **Managing internships and data**
  This function allows companies to insert their offers into the platform, it requires a name, a start and an end date, if there is one, a salary, the qualification required and a description. Also a company can modify the existent one and its data.

- **Managing student data**
  This function allows a student to insert his/her updated data.

- **Autonomous research**
  This function allows a student to search throughout all the internships available and find what suits him better and he/she ask the company to start the selection process. He/She can search through the list with a keyword or through the application of some filter.

- **Recommendation system**
  This function search for a correspondence between the student and the companies, taking in consideration the CV of the student, the preferences and the description of both. If this search fails, it takes in consideration a statistical analysis approach that produce the most suitable match from the list of internships.

- **Selection process**
  This function handle the selection process, once all the parts have accepted to collaborate, S&C sends a form to the student, and when the student send it back, it check if it has done in time, if yes, schedules an interview for the first spot available for both the student and the company, else it ends the process. The function will end after the acceptance or not by the company of the student after the interview.

2.3 User characteristics

Here it is provided a more detailed characterization of the two different types of users of the platform, also specifying the roles they can assume in different contexts.

- **Student**
  A student can be whoever wants to search for an internship and his/her is a real university student. After his/her registration, he/she gets the functionalities which are reserved for student such as managing data and autonomously searching for an internship.

- **Company**
  A company can be whoever wants to offer an internship. After its registration, it gets the functionalities which are reserved for companies such as managing data and offers for an internship.

2.4 Assumptions, dependencies, and constraints

[A1]: The user always selects the correct option about his/her/its position (student/company)
[A2]: All users have an active email address.
[A3]: All users have access to an internet connection
[A4]: A student is a real student, subscribed to a University.
[A5]: All users have a Zoom account.
[A6]: All Companies are real companies, and the inserted VAT number can be verified.
[A7]: The internship should start from a valid date, which is later from the interview date

Here is the command to refer to another element (section, figure, table, ...) in the document: *As discussed in Section* **??** *and as shown in Figure* **??**, ... Here is how to introduce a bibliographic citation [1]. Bibliographic references should be included in a `.bib` file.

3 Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

The platform is featured with several Graphic User Interfaces such to allow all the different kinds of users to interact with all its functionalities. The most important ones are presented below:

- **Registration/Login Interface**
  This interface provides for two different forms to fill in personal data, either to register to the platform or to access the personalized Home Page.

- **Home Page**
  In this page the student visualizes key information about the upcoming internship, and also inserts a keyword to search on them. If it is a company, it has the possibility to see its internship and notifications.

- **Profile page**
  With this interface, the user can review his/her personal data set during registration.

- **Internships management**
  With this interface, a company can manage his own published internships and add new ones.

- **Internships feedback**
  With this interface, users can give feedback after completion of an internship and visualize all the given ones.

3.1.2 Hardware Interfaces

The platform does not provide any hardware interface since it is primarily a platform to find a internship: it does not require any external component or device other than the one it runs on.

3.1.3 Software Interfaces

The software, through an appropriate API, communicates with Zoom to manage the interview call.

3.1.4 Communication Interfaces

The platform exploits the internet connection for communication to the main server, whose role is to manage all back-end functions such as storing data, responding to deadlines, and so on.

3.2 Functional Requirements

3.2.1 Use case diagrams

In this section, some of the most significant Use Cases for S&C platform have been represented, dividing them into two groups, one for each category of user.

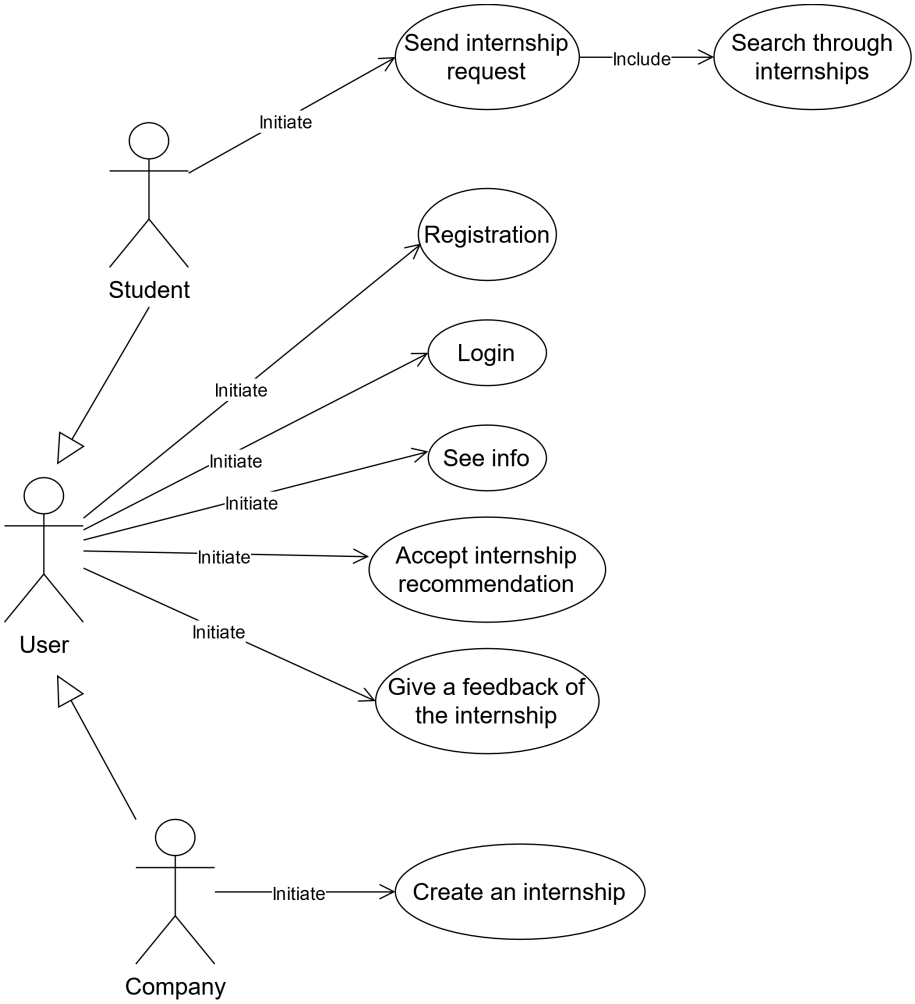

Figure 5: Use Cases Diagram

3.2.2 Use cases and related diagrams

Name	Register user
Actors	User
Entry conditions	User has opened the platform
Event flow	1. The User requests to register. 2. The system asks the user to choose if it is a Student or a Company and to provide relative data. 3. User submits all necessary information. 4. The system checks if email has been already used by another user to register. 5. System updates the database with the User's information and displays a message of confirmed registration.
Exit conditions	User has successfully registered
Exception	User provides an email already registered in the database. The system displays an error.

Table 2: UC1

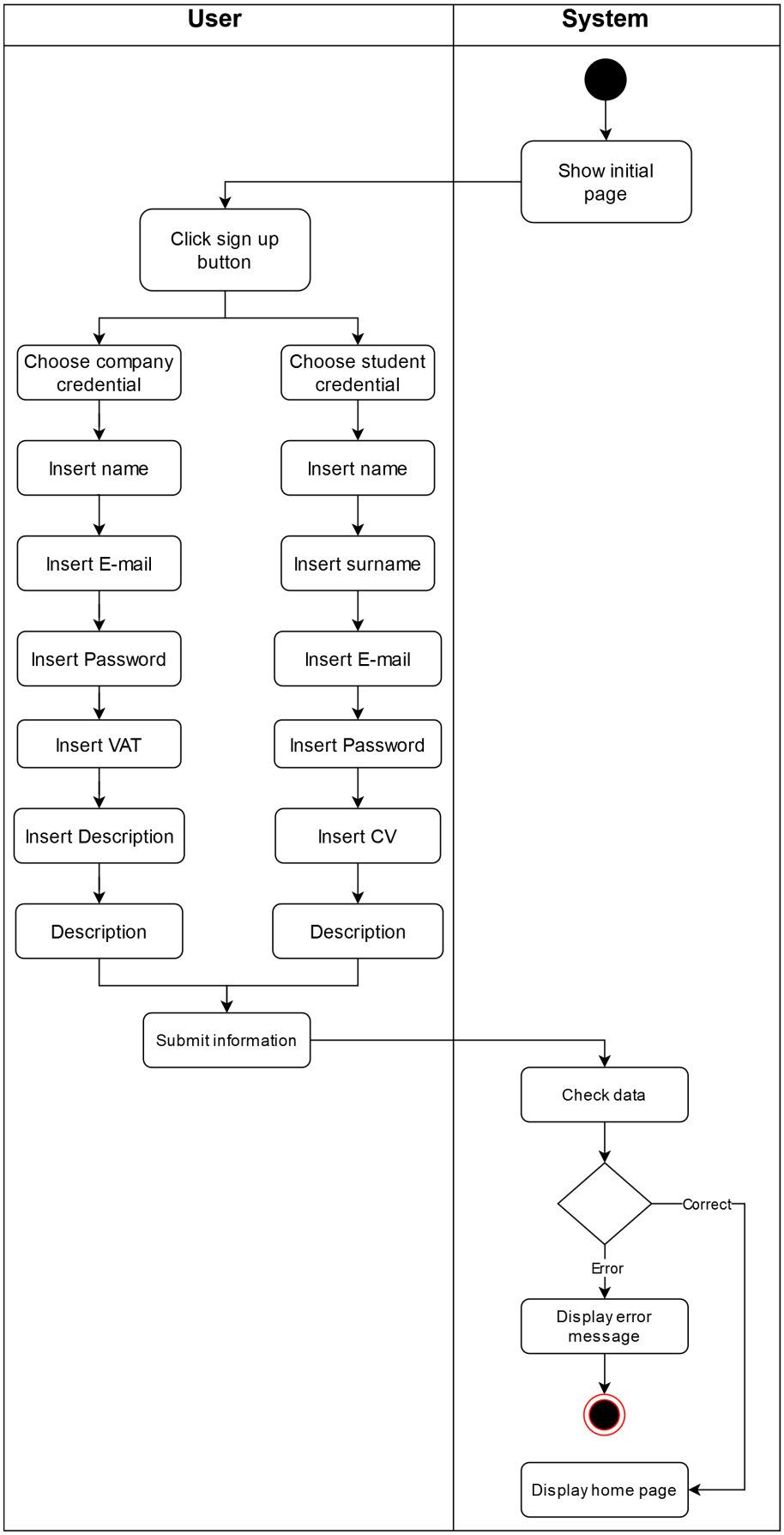

Figure 6: AD1

Name	Login user
Actors	User
Entry conditions	User has registered to the platform
Events flow	1. User inserts in apposite fields the credentials for logging in (username and password) and presses the “Login” button 2. The system checks the correctness of the credentials inserted 3. The system displays the home page
Exit conditions	User is logged in
Exception	User inserts wrong combina tion of credentials and presses Login button. In this case, the application displays the Login page with an error

Table 3: UC2

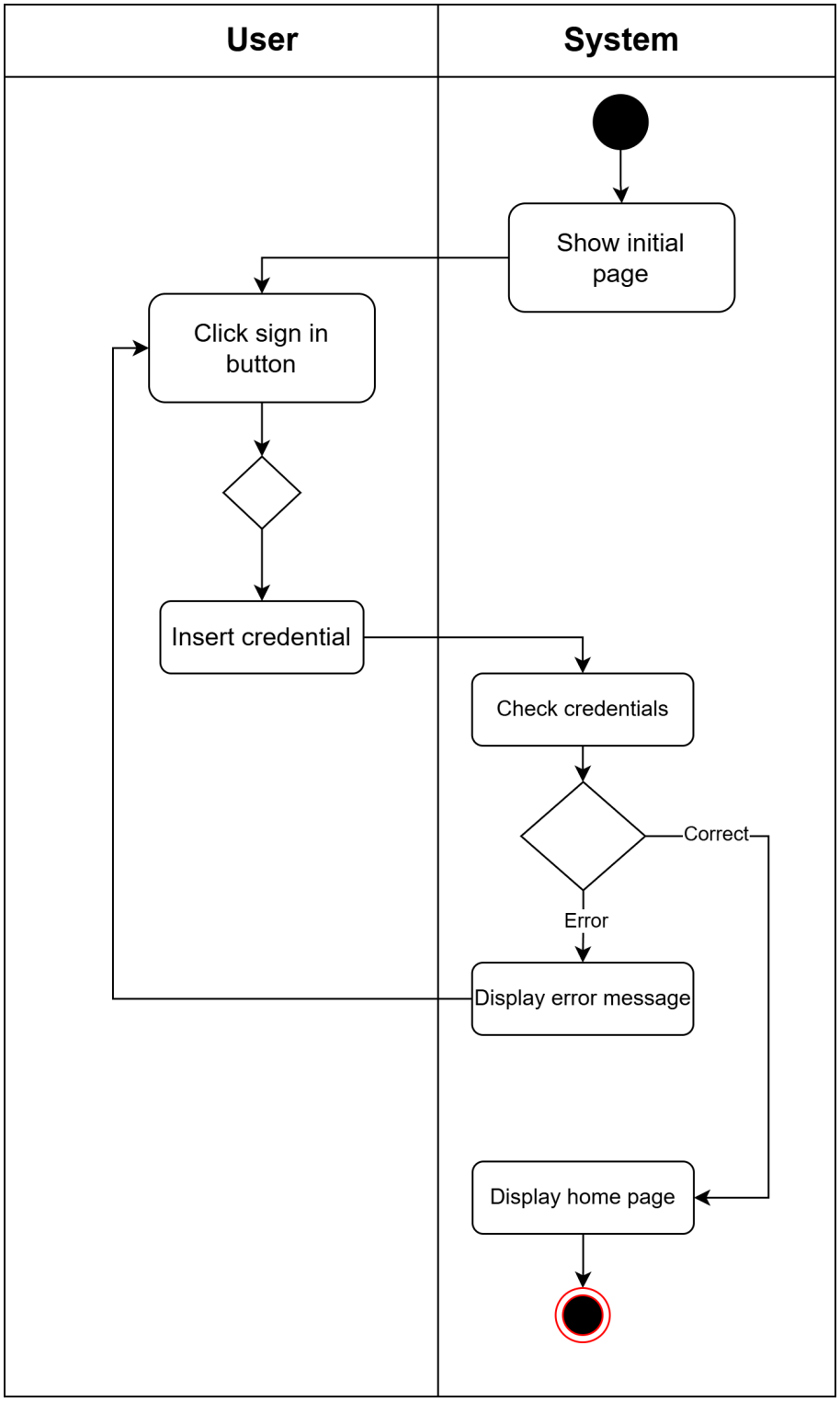

Figure 7: AD2

Name	User data management
Actors	User
Entry conditions	User has logged in to the platform
Events flow	1. System show home page. 2. User click on button "My data". 3. System show user data. 4. User click on button "Modify data". 5. User can modify its information. 6. User click on button "insert". 7. System check validity. 8. System shows the data updated.
Exit conditions	Company insert a valid internship
Exception	User change e-mail, inserts a not valid one and presses insert button. In this case, the application displays the Home page with an error

Table 4: UC3

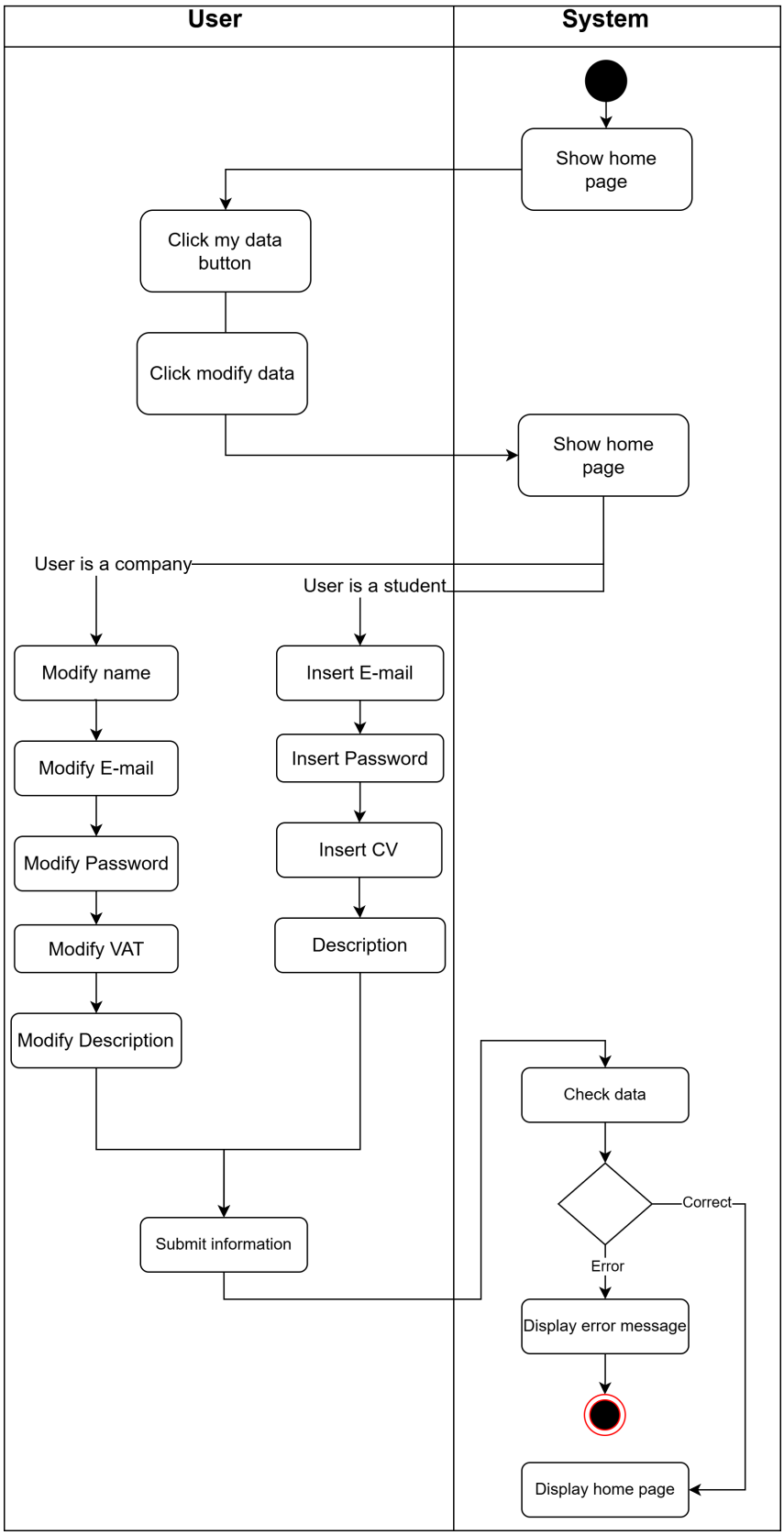

Figure 8: AD3

Name	Internship insertion
Actors	Company
Entry conditions	Company has registered/logged in to the platform
Events flow	1. System show the home page. 2. Company click on button insert "new internship". 3. Company insert valid information of an "internship", such as name, start date, end date, salary, qualification required and a description. 4. Company click on button "insert". 5. System check validity. 6. System shows the inserted internship list updated.
Exit conditions	Company insert a valid internship
Exception	Company inserts a not valid date and presses insert button. In this case, the application displays the Home page with an error

Table 5: UC4

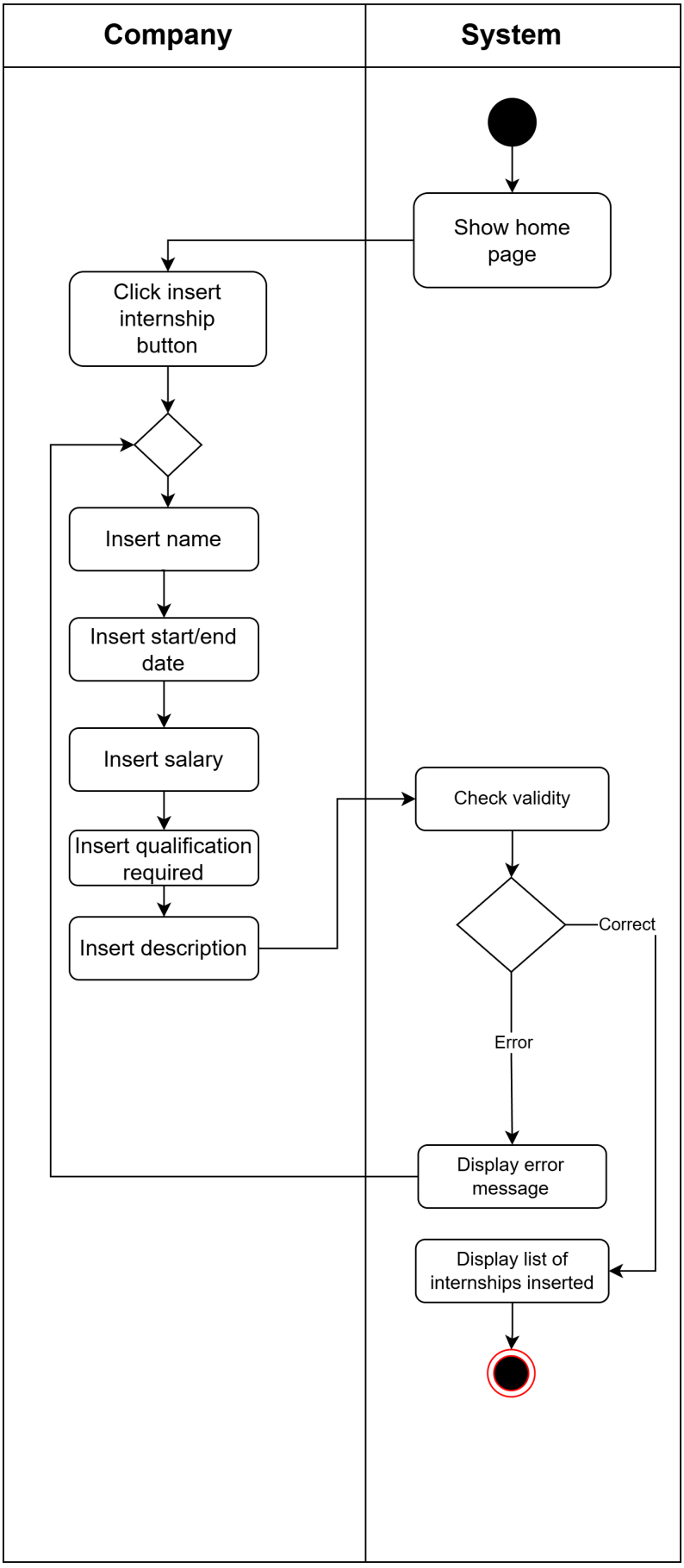

Figure 9: AD4

Name	Internship modification
Actors	Company
Entry conditions	Company has logged in to the platform
Events flow	1. System shows home page. 2. Company click on button "My internship". 3. Company click on button "Modify internship". 4. Company can modify information of an "internship", such as name, start date, end date, salary, qualification required and a description. 5. Company click on button "insert". 6. System check validity. 7. System shows the inserted internship list updated.
Exit conditions	Company insert a valid internship
Exception	Company inserts a not valid date and presses insert button. In this case, the application displays the Home page with an error

Table 6: UC5

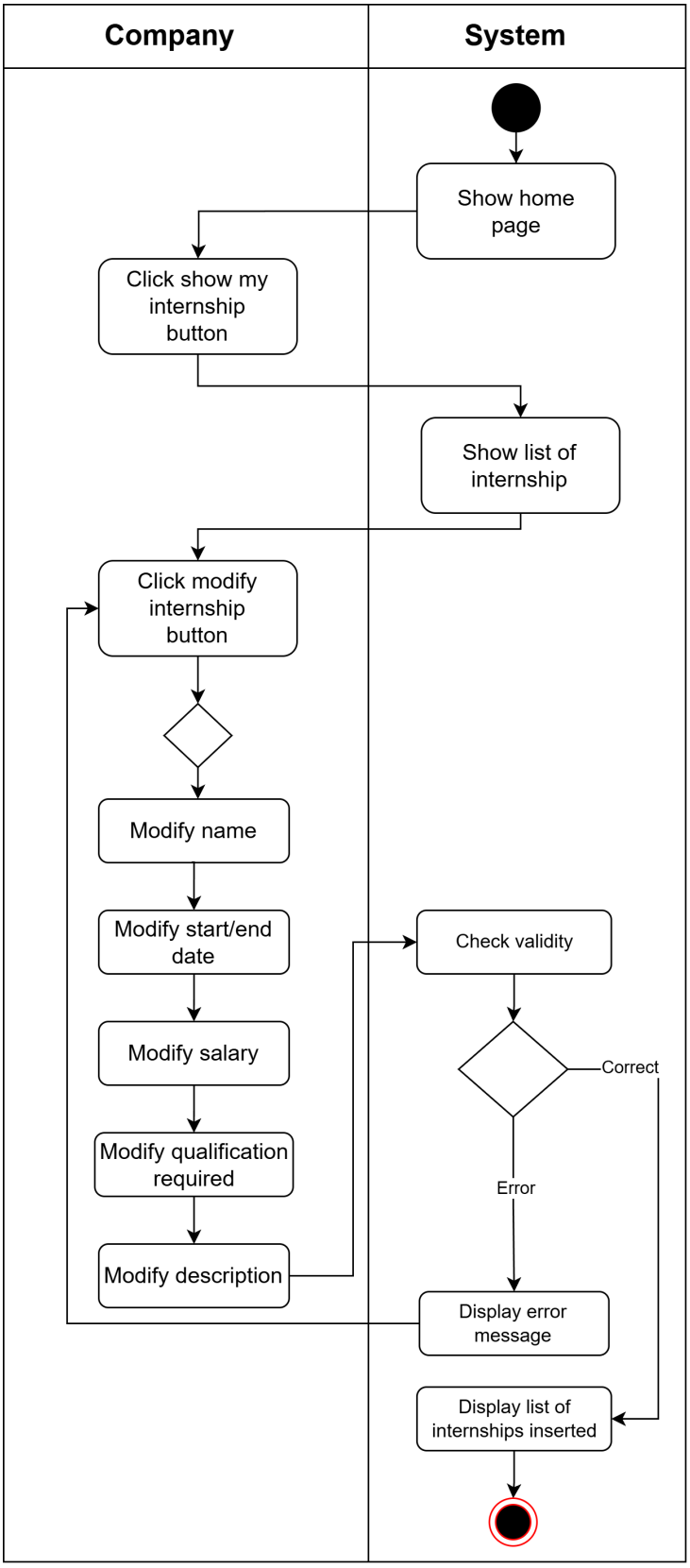

Figure 10: AD5

Name	Student proactive search
Actors	Student
Entry conditions	Student has logged in to the platform
Events flow	1. System shows the list of available internship in home page and a search bar. 2. Student search through the list. (a) Student scroll and click button "show details". (b) Student write a keyword on the search bar and press the button "search". i. System produce some results ii. Student scroll the list of result and click button "show details". 3. System shows the selected internship information.
Exit conditions	(a) Student click on button "Ask for an internship". (b) Student click on button "Close the research"
Exception	Search does not produce results, the application produce an error message and goes back to the full list

Table 7: UC6

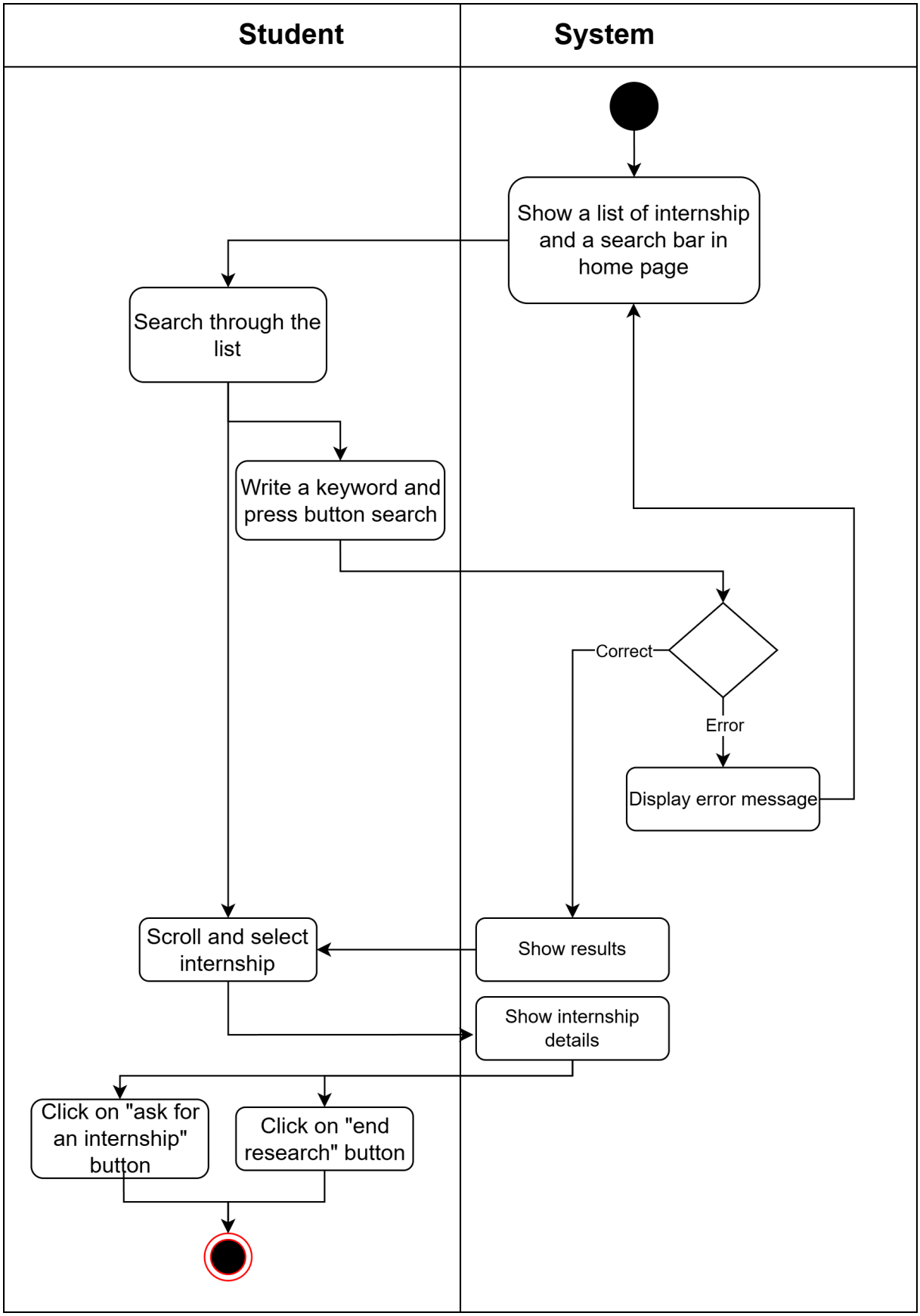

Figure 11: AD6

Name	Student notification
Actors	Student
Entry conditions	Recommendation system find a match.
Events flow	The notification appears on the main page of the student.
Exit conditions	(a) The student decides to accept the internship. (b) The student decides to reject the internship.

Table 8: UC7

Name	Company notification
Actors	Company
Entry conditions	(a) A student click the button "Ask for an internship". (b) Recommendation system find a match.
Events flow	The notification appears on the main page of the company.
Exit conditions	(a) The company decides to accept the internship. (b) The company decides to reject the internship.

Table 9: UC8

Name	User schedule the interview
Actors	Student and company
Entry conditions	(a) Company accepts the request of the student. (b) Student and company accept the notification of the recommendation system.
Events flow	1. User clicks on accepted internship. 2. User clicks on the calendar icon. 3. The system shows the calendar. 4. User the user indicates which days he has free.
Exit conditions	(a) User click the button "save". (b) User click out the calendar.
Exception	User click the button "save" without indicate the free days

Table 10: UC9

Name	User leave a feedback
Actors	Student and company
Entry conditions	The internship is over
Events flow	1. User clicks on finished internship. 2. The system shows a box where you can write it. 3. User write the feedback.
Exit conditions	User click the button "save"

Table 11: UC11

Name	Zoom call
Actors	Student and company
Entry conditions	S&C finds a free slot for both of them
Events flow	1. The system communicates with Zoom to create a link for the video-call. 2. Zoom successfully creates the link. 3. Zoom sends the link to the system that saves it in the database. 4. The system show the link on the users page.
Exit conditions	On the day the internship starts the link is deleted

Table 12: UC12

3.2.3 Requirements

R1	The S&C platform allows users to register.
R2	The S&C platform allows users to register filling mandatory fields.
R3	The S&C platform allows users to login using their credential.
R4	The S&C platform allows users to manage their data and modify them.
R5	The S&C platform allows companies to insert an internship.
R6	The S&C platform allows company to modify their internships data.
R7	The S&C platform should provide the "search internship" functionality to students.
R8	The S&C platform should notify users when a match is found.
R9	The S&C platform should notify companies when a match is found.
R10	The S&C platform should notify companies when a student request to be contacted.
R11	The S&C platform should allows users to accept or not the match made by the platform.
R12	The S&C platform should send to the students a form related to the chosen internship
R13	The user should fill the mandatory form by the deadline
R14	The S&C platform check that the form has been compiled by the deadline
R15	The S&C platform allows user to insert their free slots
R16	The S&C platform should provide a match for a free slot between the users schedules
R17	The S&C platform should be able to request zoom to create a call room and receive back the corresponding link.
R18	The S&C platform should allows users to leave feedback.

Table 13: Requirements

3.2.4 Mapping on requirements

Goal	Requirements	Assumptions
[G1]: All unregistered students and Companies must be able to subscribe and login to the S&C platform.	R1,R2,R3	A1,A2,A4,A6
[G2]: Companies must be able to create internship offers.	R5, R6	
[G3]: Students must be able to complete their CV and preferences.	R4	
[G4]: Students must be able to search for an internship.	R7	
[G5]: Student and Company are informed when there is a match between them.	R8,R9	
[G6]: Monitoring of the execution of the internships.		
[G7]: Statistics collection.		
[G8]: Feedbacks collection.		
[G9]: Companies rank based on Feedback.		

Table 14: Mapping on requirements

3.3 Performance Requirements

The main performance indicator for this application should be scalability because a large number of users is expected.

3.4 Design Constraint

3.4.1 Standard Compliance

- The platform includes the full adherence to **GDPR**, which stands as one of the most significant and internationally recognized standards for the protection of personal data and the ensuring of user privacy. The system is committed to handling user data in **GDPR** compliant ways, ensuring transparency in data collection and processing, and adopting appropriate security measures to protect such data.
- To obtain data correctness and protection even at the communication level, the platform should adopt the use of **TCP/IP** together with the application of the **TLS** security protocol.
- The purpose of **S&C** is to gather students and companies from all over the world. So, it is very important to use a time standard, such as UTC, to achieve the synchronization of all the users, the correct unfolding of Battles, and the handling of deadlines.

3.4.2 Easy to use

The application should be very user-friendly to allow the vast majority of people to use it.

3.4.3 Hardware limitations

In order to enable an effective use of the platform for as many users as possible, the platform should not require high-level hardware and should work on almost all types of machine.

3.4.4 Any other constraint

S&C platform is intended to welcome students from all over the world. So, it should be necessarily designed completely in English, allowing every student to understand its pages, interfaces, commands, etc.

3.5 Software system attributes

3.5.1 Reliability

The system should prevent downtime, even when the system is stressed with a great number of simultaneous requests, to let users always start and end research and to prevent problems in the selection process.

3.5.2 Availability

The system must be available as much as possible to allow the user to benefit from the services when they need them. The system should be available with a minimum value of 99% of time. Who will be more affected by lack of availability are users. In this case, students may not be able to search the internship list and cannot participate in the selection process.

3.5.3 Modularity

The system must be designed in a modular way, both for the client-side and for the server-side. The two kinds of actors will have different interfaces that permit the execution of different functionalities. From the server side, traffic is distributed among several servers and managed through a load balancer server. This solution will also allow the user to use the application during the downtime period needed to maintain the server.

3.5.4 Maintainability

It is very important to ensure that the source code of the system can be easily understood, modified, and improved over time. To achieve this goal, the code should be clear and well documented, making it easy for developers to understand and facilitating maintenance.

3.5.5 Security

To match the **GDPR** compliance, the platform should achieve protection of personal data through an authentication system that involves unique usernames and strong passwords.
There are some aspects of the platform that are private (updating PDF, inserting internships), i.e. they are reserved only for a specific group of users. For this purpose, the platform should provide a keyword-based protection system, capable of generating and managing unique keywords: users are asked to submit the correct keyword to access private contexts.

3.5.6 Portability

Given S&C's scale and reach, it is crucial to ensure its compatibility with a wide range of operating systems, including Windows, MacOS, and Linux, for an effortless deployment.

4 Formal Analysis Using Alloy

Organize this section according to the rules defined in the project description.

5 Effort Spent

Provide here information about how much effort each group member spent in working at this document. We would appreciate details here.

References

[1] S. Bernardi, J. Merseguer, and D. C. Petriu. A dependability profile within MARTE. *Software and Systems Modeling*, 10(3):313–336, 2011.

