1. Abstract

IBM wants to use "natural language processing and machine learning to reveal insights from large amounts of unstructured data." (http://www.ibm.com/watson/what-is-watson.html) IBM Watson is the technology that IBM uses to achieve this goal.

Our project seeks to help guide first year students and their advisors by using their questions about the CSSE majors at Behrend as input and providing a structured analysis of possible academic careers built from Watson's insights.

We will increase Watson's domain to include insight related to the CSSE majors at Penn State Behrend. This will reveal more insights about majors in Penn State Behrend for Watson, achieving a small portion of IBM's goal. In addition, this will assist advisors with giving advice to new students to Penn State Behrend as well as being able to answer some questions for students without them having to go hunting for information.

In this report, we breakdown our goals into user and system requirements showing the engineering process of this project. UML Diagrams are also provided for further detail and explanation of this process.

3. Problem Statement

3.1. Business Background

IBM Watson's services, including Bluemix's APIs and other services from 3rd parties or developers, can be utilized to conduct textual analysis and output a numerical scale of performance factor. Web Experience Management (WEM) can be trained to answer many open-ended questions. The question we are trying to answer is whether we can create a system to assist with the enrollment process, through use of Bluemix and WEM.

3.2. Needs

To increase the effectiveness of the IBM Watson services, a larger domain is needed. Additionally, students are often unsure of which fields would coincide with their interests and talents.

3.3. Objectives

The objective of this project is to increase Watson's domain to include Penn State Behrend's academic information related to the CSSE majors, such as recommended courses, FAQs, and advisor information. The project will enable students to make a better decision as to which careers they might be interested in pursuing and what each path would entail. It will also help advisors to accurately guide the students.

4. Requirements

4.1. User Requirement

4.1.1. Glossary of Relevant Domain Terminology

4.1.1.1. Watson - An IBM supercomputer that combines artificial intelligence (AI) and sophisticated analytical software for optimal performance as a "question answering" machine.

4.1.1.2. Big Data Analysis - The process of examining large datasets to uncover hidden patterns, unknown correlations, customer preferences

4.1.1.3. Textual Analysis - A research method that requires the researcher to closely analyze the content of communication rather than the structure of the content.

4.1.1.4. Web Experience Management - A process of managing the all-round experience of the web user across various touch points in the journey through an organization's web presence.

4.1.2. User Groups

4.1.2.1. Visitors

4.1.2.2. Students

4.1.2.3. Advisors

4.1.2.4. System Developers

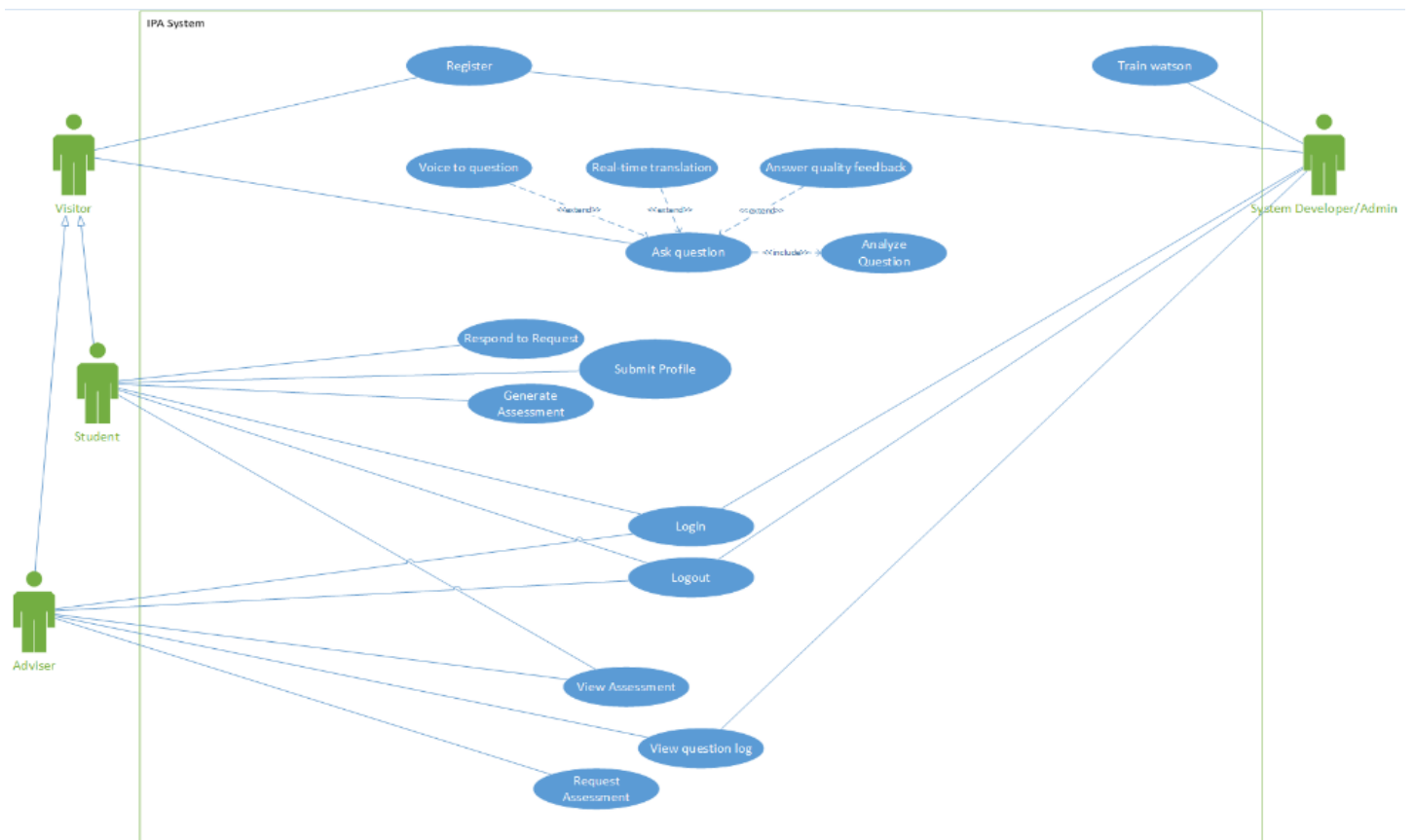### 4.1.3. Functional Requirements

4.1.3.1. Project Scope

Figure 1: Use Case Diagram version 1 (subject to change)

4.1.3.2. User Scenarios

Project Name:	Intelligent Academic Planner		
Use Case ID:	UC-001		
Use Case Name:	Respond to Request		
User Goal:	User approves of advisor viewing assessment		
Scope:	IPA System		
Level:	Primary task		
Relevant User Reqs:	UF-E		
Relevant System Reqs:	SF-E-05		
Primary Actor:	Student		
Precondition:	User has a request awaiting approval		
Minimal Guarantee:	User's assessment are non-view-able		
Success Guarantee:	User's assessment becomes view-able for advisor that requested		
Trigger:	User requests to respond to request		
Success Scenario:	**Step**	**Actions**	
	1	The user requests to respond to request	
	2	The system asks for user's response	
	3	The user responds	
Extensions:	**Branching Scenarios**		
3A	Condition: If request is declined		
	Step	**Actions**	
	1	The system sends notification to advisor	
	2	Exit out of functionality	
3B	Condition: If request is accepted		
	Step	**Actions**	
	1	The system sends notification to advisor	
	2	The system allows advisor to view assessment of student	
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Figure 2: Description of Use Case "Respond to Request", which is related to requirements UF-E and SF-E-05

Project Name:	Intelligent Academic Planner		
Use Case ID:	UC-005		
Use Case Name:	View assessment		
User Goal:	User is able to view assessment		
Scope:	IPA System		
Level:	Subfunction		
Relevant User Reqs:	UF-E		
Relevant System Reqs:	SF-E-03		
Primary Actor:	student, advisor		
Precondition:	The user is logged in		
Minimal Guarantee:	System does not display student's assessment		
Success Guarantee:	system display student's assessment		
Trigger:	User requests to view assessments		
Success Scenario:	**Step**	**Actions**	
	1	The user requests to view assessments	
	2	The system displays assessments that can be viewed	
Extensions:	Branching Scenarios		
Acknowledgment: Generated from the CapStone process management system ©2015			

Figure 4: Description of Use Case "View Assessment", which is related to requirements UF-E and SF-E-03

Project Name:	Intelligent Academic Planner		
Use Case ID:	UC-004		
Use Case Name:	Register		
User Goal:	To be recognized by the system.		
Scope:	IPA System		
Level:	Primary task		
Relevant User Reqs:	UF-F		
Relevant System Reqs:	SF-F-01		
Primary Actor:	Visitor, System Devleoper		
Precondition:	User is viewing program		
Minimal Guarantee:	User is not recognized by system		
Success Guarantee:	User is recognized by system		
Trigger:	User requests to register		
Success Scenario:	**Step**	**Actions**	
	1	The user requests to register	
	2	The system asks for registration information	
	3	The user inputs registration information	
	4	The system validates information	
	5	The system accepts user registration	
Extensions:	Branching Scenarios		
4A	Condition: Information is invalid		
	Step	**Actions**	
	1	The system notifies user of invalid information	
	2	Return to step 2	
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Figure 3: Description of Use Case "Register", which is related to requirements UF-F and SF-F-01

Project Name:	Intelligent Academic Planner
Use Case ID:	UC-007
Use Case Name:	Train Watson
User Goal:	User be able to train watson with new questions that user asked but hasn't been answered
Scope:	IPA System
Level:	Primary task
Relevant User Reqs:	UF-H
Relevant System Reqs:	SF-A-01
Primary Actor:	System Developer
Precondition:	User is logged in
Minimal Guarantee:	Watson is not further trained
Success Guarantee:	Watson is further trained
Trigger:	User requests to train Watson

	Step	Actions
	1	The user request system export new questions
	2	The system export new question list as a text file
	3	The user request system export incorrect answered questions
	4	The system export downvotes answered questions
Success Scenario:	5	The user request view answer quality
	6	The system display the statistical analysis of the answer for each of the questions
	7	The user request view the feedback of answer from user
	8	The system display the most up voted help feedback for the answer
	9	The user request the analysis of a specific question
	10	The system display analysis of a question by keyterm

Extensions:		Branching Scenarios
1A		Condition: User request system export all new questions from last time export
	Step	Actions
	1	The system export question list that is new from last time
1B		Condition: User request system export all new questions by major
	Step	Actions
1C		Condition: User request system export all new questions other condition
	Step	Actions
	1	The system export top 10 unanswered FAQ
	2	The system export top 10% unanswered FAQ

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Figure 6: Description of Use Case "Train Watson", which is related to requirements UF-H and SF-A-01

Project Name:	Intelligent Academic Planner
Use Case ID:	UC-006
Use Case Name:	View question log
User Goal:	User is able to view the question log
Scope:	IPA System
Level:	Primary task
Relevant User Reqs:	UF-G
Relevant System Reqs:	SF-G-01
Primary Actor:	Adviser, System Developer
Precondition:	User is logged in
Minimal Guarantee:	System does not display question log
Success Guarantee:	System displays question log
Trigger:	User requests to view question log

	Step	Actions
	1	The user requests to view question log
Success Scenario:	2	The system asks for filter information
	3	The user enters filter information
	4	The system displays all questions based on filter information

Extensions:	Branching Scenarios

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Figure 5: Description of Use Case "View Question Log", which is related to requirements UF-G and SF-G-01

Project Name:	Intelligent Academic Planner		
Use Case ID:	UC-010		
Use Case Name:	Answer quality feedback		
User Goal:	User is able to provide feedback on question response.		
Scope:	IPA System		
Level:	Primary task		
Relevant User Reqs:	UF-H		
Relevant System Reqs:	SF-H-01		
Primary Actor:	Visitor, Student, Advisor		
Precondition:	User is asking a question		
Minimal Guarantee:	Feedback is not stored		
Success Guarantee:	Feedback is stored		
Trigger:	User requests to submit feedback		
Success Scenario:	**Step**	**Actions**	
	1	The user requests to submit feedback	
	2	The system allows user to enter feedback	
	3	The user submits feedback	
	4	The system stores feedback	
Extensions:	**Branching Scenarios**		
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Figure 7: Description of Use Case "Answer Quality Feedback", which is related to requirements UF-H and SF-H-01

Project Name:	Intelligent Academic Planner		
Use Case ID:	UC-008		
Use Case Name:	Voice to question		
User Goal:	User receives text based on voice input		
Scope:	IPA System		
Level:	Subfunction		
Relevant User Reqs:	UF-C		
Relevant System Reqs:	SF-C-07		
Primary Actor:	Visitor, Student, and Advisor		
Precondition:	User is asking a question		
Minimal Guarantee:	System does not convert voice to text		
Success Guarantee:	System converts voice to text		
Trigger:	User requests to convert voice to text		
Success Scenario:	**Step**	**Actions**	
	1	The user request voice to text function	
	2	The system start listening user's voice	
	3	The user stop recording voice	
	4	The system upload voice to server	
	5	The system return translated text to user	
Extensions:	**Branching Scenarios**		
3A	**Condition:** user recording more than 30 seconds		
	Step	**Actions**	
	1	The system prompts over time recording and start converting previous 30 seconds' voice	
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Figure 8: Description of Use Case "Voice To Question", which is related to requirements UF-C and SF-C-07

Project Name:	Intelligent Academic Planner					
Use Case ID:	UC-011					
Use Case Name:	Ask question					
User Goal:	User is able to ask questions					
Scope:	IPA System					
Level:	Primary task					
Relevant User Reqs:	UF-C					
Relevant System Reqs:	SF-C-01,SF-C-02,SF-C-03,SF-C-04,SF-C-05,SF-C-07					
Primary Actor:	Visitor, Student, Advisor					
Precondition:	User is viewing program					
Minimal Guarantee:	Question is not logged					
Success Guarantee:	Question is logged					
Trigger:	The user requests to ask a question					

	Step	Actions
Success Scenario:	1	The user requests to ask a question
	2	The system requests user's question
	3	The user enters question and requests answer
	4	The system analyzes question <<Analyze Question>>
	5	The system displays answer
	6	The system logs question to question log
	7	The system asks user if they would like to submit feedback on answer quality

Extensions:	Branching Scenarios
3A	Condition: If user requests to enter question by voice

	Step	Actions
	1	The system converts voice to question <<Voice to Question>>

3B	Condition: If user requests translation

	Step	Actions
	1	The system translates text <<Realtime Translation>>

7A	Condition: If user requests to provide feedback

	Step	Actions
	1	The system requests feedback information <<Answer Quality Feedback>>

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Figure 9: Description of Use Case "Ask Question", which is related to requirements UF-C, SF-C-01, SF-C-02, SF-C-03, SF-C-04, SF-C-05, and SF-C-07

Project Name:	Intelligent Academic Planner			
Use Case ID:	UC-009			
Use Case Name:	Real-time translation			
User Goal:	User is able to see input/output in english			
Scope:	IPA System			
Level:	Subfunction			
Relevant User Reqs:	UF-C			
Relevant System Reqs:	SF-C-02			
Primary Actor:	Visitor, Student, Advisor			
Precondition:	User is asking a question			
Minimal Guarantee:	Input/output is not translated			
Success Guarantee:	System displays translated text			
Trigger:	User requests translation			

	Step	Actions
Success Scenario:	1	The user input non-english input
	2	The system determines what language is being used
	3	The system translates text to english
	4	The system displays english answer

Extensions:	Branching Scenarios

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Figure 10: Description of Use Case "Real-time Translation", which is related to requirements UF-C and SF-C-02

Project Name:	Intelligent Academic Planner
Use Case ID:	UC-015
Use Case Name:	Generate Assessment
User Goal:	User receives assessment of profile information
Scope:	IPA System
Level:	Primary task
Relevant User Reqs:	UF-E
Relevant System Reqs:	SF-E-04,SF-E-05
Primary Actor:	Student
Precondition:	User has submitted information to profile
Minimal Guarantee:	No assessment generated
Success Guarantee:	System generate assessment and display to user
Trigger:	User requests to generate assessment

Success Scenario:	Step	Actions
	1	The user requests to generate assessment
	2	The system analyzes profile and generates assessment
	3	The system displays assessment

Extensions:	Branching Scenarios	
3A	Condition: keep assessment on user's record	

	Step	Actions
	1	The user request system save the assessment
	2	The system upload assessment to server and relate to user account

3B	Condition: The user request assessment to be viewable by advisers	

	Step	Actions
	1	The user request assessment to be viewable by advisers
	2	The system mark user's assessment as public and save to user's account

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Figure 11: Description of Use Case "Generate Assessment", which is related to requirements UF-E, SF-E-04, and SF-E-05

Use Case Name:	Submit Profile
User Goal:	User can create profile
Scope:	IPA System
Level:	Primary task
Relevant User Reqs:	UF-E
Relevant System Reqs:	SF-E-01,SF-E-02,SF-E-03,SF-E-04,SF-E-05
Primary Actor:	student
Precondition:	User is logged in
Minimal Guarantee:	Profile is not stored
Success Guarantee:	Profile is stored
Trigger:	User requests to update profile

Success Scenario:	Step	Actions
	1	The user requests to update profile
	2	The system verify the profile
	3	The system upload the profile to server

Extensions:	Branching Scenarios	
2A	Condition: If system detect invalid format of the profile	

	Step	Actions
	1	The system notify user of problem
	2	Return to step 1

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Figure 12: Description of Use Case "Submit Profile", which is related to requirements UF-E, SF-E-01, SF-E-02, SF-E-03, SF-E-04, and SF-E-04

Project Name:	Intelligent Academic Planner
Use Case ID:	UC-012
Use Case Name:	Analyze Question
User Goal:	System determines answer for user
Scope:	IPA System
Level:	Primary task
Relevant User Reqs:	UF-C,UF-D
Relevant System Reqs:	SF-C-01,SF-C-03,SF-C-04,SF-C-05,SF-D-01
Primary Actor:	N/A
Precondition:	User asks a question
Minimal Guarantee:	Question is not analyzed
Success Guarantee:	Question is analyzed
Trigger:	User submits a question

Success Scenario:	Step	Actions
	1	The user submits a question
	2	The system performs textual analysis on the question
	3	The system determines if another question could be asked to clarify answer
	4	The system displays answer

Extensions:	Branching Scenarios
1A	Condition: If another question could be asked

	Step	Actions
	1	The system asks user the question
	2	The user responds to question
	3	Return to step 2 in main scenario using response given

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Figure 13: Description of Use Case "Analyze Question", which is related to requirements UF-C, UF-D, SF-C-01, SF-C-03, SF-C-04, SF-C-05, and SF-D-01

Use Case Name:	Login
User Goal:	User is able to log in
Scope:	IPA System
Level:	Primary task
Relevant User Reqs:	UF-A
Relevant System Reqs:	SF-A-01
Primary Actor:	Student, Advisor, System Devel
Precondition:	User is registered
Minimal Guarantee:	User is not logged in
Success Guarantee:	User is logged in
Trigger:	User requests to log in

Success Scenario:	Step	Actions
	1	The user request to login to the system
	2	The system verifies user's login credential
	3	The system logs in user

Extensions:	Branching Scenarios
2A	Condition: login credential doesn't match account info

	Step	Actions
	1	The system notifies user of problem
	2	Return to step 1

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Figure 14: Description of Use Case "Login", which is related to requirements UF-A and SF-A-01

Project Name:	Intelligent Academic Planner		
Use Case ID:	UC-019		
Use Case Name:	Request Assessment		
User Goal:	System notify student that an adviser wants to see his assessment		
Scope:	IPA System		
Level:	Primary task		
Relevant User Reqs:	UF-E		
Relevant System Reqs:	SF-E-05		
Primary Actor:	Advisor		
Precondition:	User is logged in		
Minimal Guarantee:	No request is sent		
Success Guarantee:	Request is sent		
Trigger:	User requests to send request to student		
Success Scenario:	**Step**	**Actions**	
	1	The user requests to send request to student	
	2	The system asks for student information	
	3	The user inputs student information	
	4	The system validates student information	
	5	The system sends request to student	
Extensions:	**Branching Scenarios**		
4A	**Condition:** If invalid student information		
	Step	**Actions**	
	1	The system notifies user of problem	
	2	Return to step 2	
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Figure 15: Description of Use Case "Request Assessment", which is related to requirements UF-E and SF-E-05

Project Name:	Intelligent Academic Planner		
Use Case ID:	UC-018		
Use Case Name:	Logout		
User Goal:	User is able to log out		
Scope:	IPA System		
Level:	Primary task		
Relevant User Reqs:	UF-B		
Relevant System Reqs:	SF-B-01		
Primary Actor:	Student, Advisor, System Devel		
Precondition:	User is logged in		
Minimal Guarantee:	User is not logged out		
Success Guarantee:	User is logged out		
Trigger:	User requests to log out		
Success Scenario:	**Step**	**Actions**	
	1	The user requests to logout	
	2	The system verifies all information is saved	
	3	The system logs users out	
Extensions:	**Branching Scenarios**		
2A	**Condition:** If some information is unsaved		
	Step	**Actions**	
	1	The system checks if user still wants to log out	
	2	The user responds	
	3	BRANCH - If user responds no exit functionality. Else - Continue on.	
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Figure 16: Description of Use Case "Logout", which is related to requirements UF-B and SF-B-01

4.1.3.3. List of User Functional Requirements

Project Name:	Intelligent Academic Planner					
Requirement ID:	UF-B			Type	Functional	Non-Functional
Creation:	Sep 20 2016 04:17 PM			User	⊠	☐
Modification:	Oct 05 2016 01:50 AM			System	☐	☐
Description:	A user can log out.					
Priority:	Highest	✓ High	Medium	Low		Lowest
This Req. is Refined Into:		SF-B-01				
Justify why UF-B can be completely covered by SF-B-01		If a user can log out within 5 seconds, they can log out properly				
Traceability:	Use cases cf.	UC-018				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	Generated from the CapStone Process Management System ©2015					

Figure 18: Description of user functional requirement UF-B, which is related to requirements SF-B-01 and use cases UC-018

Project Name:	Intelligent Academic Planner					
Requirement ID:	UF-A			Type	Functional	Non-Functional
Creation:	Sep 20 2016 01:25 PM			User	⊠	☐
Modification:	Oct 05 2016 01:50 AM			System	☐	☐
Description:	A user can log in.					
Priority:	Highest	✓ High	Medium	Low		Lowest
This Req. is Refined Into:		SF-A-01				
Justify why UF-A can be completely covered by SF-A-01		If a user can login within 5 seconds, they can log in properly.				
Traceability:	Use cases cf.	UC-016				

Figure 17: Description of user functional requirement UF-A, which is related to requirements SF-A-01 and use cases UC-016

Project Name:	Intelligent Academic Planner					
Requirement ID:	UF-C			Type	Functional	Non-Functional
Creation:	Sep 20 2016 04:18 PM			User	☒	☐
Modification:	Sep 20 2016 04:58 PM			System	☐	☐
Description:	A user can ask the system questions.					
Priority:	✔ Highest	High	Medium	Low		Lowest
This Req. is Refined Into:		SF-C-01, SF-C-02, SF-C-03, SF-C-04, SF-C-05, SF-C-07				
Justify why UF-C can be completely covered by SF-C-01, SF-C-02, SF-C-03, SF-C-04, SF-C-05, SF-C-07		If the system is able to perform the functionality in SF-C-01 through SF-C-06 then a user will undoubtedly have been able to ask the system questions. The system would not be able to perform these functions without a user first asking it a question.				
Traceability:	Use cases cf.	UC-008, UC-009, UC-011, UC-012				
	Test cases cf.	Yet to be completed in test case worksheet!				
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Figure 19: Description of user functional requirement UF-C which is related to requirements SF-C-01, SF-C-02, SF-C-03, SF-C-04, SF-C-04, SF-C-05, and SF-C-07 and use cases UC-008, UC-009, UC-011, and UC-012

Requirement ID:	UF-E			Type	Functional	Non-Functional
Creation:	Oct 04 2016 11:51 PM			User	☒	☐
Modification:	Oct 05 2016 12:06 AM			System	☐	☐
Description:	A user can create a profile					
Priority:	Highest	High	✔ Medium	Low		Lowest
This Req. is Refined Into:		SF-E-01, SF-E-02, SF-E-03, SF-E-04, SF-E-05				
Justify why UF-E can be completely covered by SF-E-01, SF-E-02, SF-E-03, SF-E-04, SF-E-05		All of the system requirements associated with this cover what can be put into their profile.				
Traceability:	Use cases cf.	UC-001, UC-005, UC-013, UC-015, UC-019				
	Test cases cf.	Yet to be completed in test case worksheet!				
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Figure 20: Description of user functional requirement UF-E which is related to requirements SF-E-01, SF-E-02, SF-E-03, SF-E-04, and SF-E-05 and use cases UC-001, UC-005, UC-013, UC-015, and UC-019

Project Name:	Intelligent Academic Planner					
Requirement ID:	UF-F			Type	Functional	Non-Functional
Creation:	Oct 05 2016 12:15 AM			User	☒	☐
Modification:	Oct 05 2016 01:51 AM			System	☐	☐
Description:	A user can register					
Priority:	Highest	✓ High	Medium	Low		Lowest
This Req. is Refined Into:		SF-F-01				
Justify why UF-F can be completely covered by SF-F-01		If a user can register within 5 seconds, they can register properly.				
Traceability:	Use cases cf.	UC-004				

Figure 21: Description of user functional requirement UF-F which is related to requirements SF-F-01 and use cases UC-004

Project Name:	Intelligent Academic Planner					
Requirement ID:	UF-D			Type	Functional	Non-Functional
Creation:	Sep 23 2016 12:52 PM			User	☒	☐
Modification:	Oct 05 2016 01:51 AM			System	☐	☐
Description:	A user should receive multiple responses to a question.					
Priority:	Highest	High	Medium	✓ Low		Lowest
This Req. is Refined Into:		SF-D-01				
Justify why UF-D can be completely covered by SF-D-01		By requiring a minimum of 1 response to be given, it is a given that multiple responses are given to a question.				
Traceability:	Use cases cf.	UC-012				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	Generated from the CapStone Process Management System ©2015					

Figure 22: Description of user functional requirement UF-D which is related to requirements SF-D-01 and use cases UC-012

Project Name:	Intelligent Academic Planner					
Requirement ID:	UF-G			Type	Functional	Non-Functional
Creation:	Oct 05 2016 12:36 AM			User	☒	☐
Modification:	Oct 05 2016 01:52 AM			System	☐	☐
Description:	A user can view a log of asked questions.					
Priority:	Highest	High	✓ Medium	Low		Lowest
This Req. is Refined Into:		SF-G-01				
Justify why UF-G can be completely covered by SF-G-01		If advisors and system developers can view the question log, then users can view the question log.				
Traceability:	Use cases cf.	UC-006				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	Generated from the CapStone Process Management System ©2015					

Figure 24: Description of user functional requirement UF-G, which is related to requirements SF-G-01 and use cases UC-006

Project Name:	Intelligent Academic Planner					
Requirement ID:	UF-H			Type	Functional	Non-Functional
Creation:	Oct 05 2016 02:12 AM			User	☒	☐
Modification:	Oct 05 2016 02:16 AM			System	☐	☐
Description:	A user can provide information to improve accuracy of the system.					
Priority:	Highest	High	✓ Medium	Low		Lowest
This Req. is Refined Into:		SF-H-01				
Justify why UF-H can be completely covered by SF-H-01		If answer quality feedback is submitted, accuracy of responses can be increased.				
Traceability:	Use cases cf.	UC-007, UC-010				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	Generated from the CapStone Process Management System ©2015					

Figure 23: Description of user functional requirement UF-H, which is related to requirements SF-H-01 and use cases UC-007 and UC-010

4.1.4. Non-functional Requirements

4.1.4.1. Product: Performance Requirements

Project Name:	Intelligent Academic Planner				
Requirement ID:	UP-03			**Type**	**Functional**	**Non-Functional**
Creation:	Oct 05 2016 01:36 AM			User	☐	☒
Modification:	Oct 05 2016 01:54 AM			System	☐	☐
Description:	A user should receive a quick response after asking a question			Product (sub-type below)		
				Performance Requirements		
Priority:	Highest	High	Medium	✓ Low	Lowest
This Req. is Refined Into:	SP-03-01					
Justify why UP-03 can be completely covered by SP-03-01	By specifying performance requirements, it is ensured that the question will be answered in a quick manner.					
Traceability:	Use cases cf.	N/A				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	Generated from the CapStone Process Management System ©2015					

Figure 25: Description of user non-functional performance requirement UP-03 which is related to requirement SP-03-01

4.1.4.2. Product: Dependability/Reliability/Security

Project Name:	Intelligent Academic Planner				
Requirement ID:	UP-01			**Type**	**Functional**	**Non-Functional**
Creation:	Oct 05 2016 12:10 AM			User	☐	☒
Modification:	Oct 05 2016 01:53 AM			System	☐	☐
Description:	A user's profile should be secure.			Product (sub-type below)		
				Dependability/Reliability/Security		
Priority:	Highest	✓ High	Medium	Low	Lowest
This Req. is Refined Into:	SP-01-01					
Justify why UP-01 can be completely covered by SP-01-01	Ensures only specific people can view a user's profile, making it secure.					
Traceability:	Use cases cf.	N/A				
	Test cases cf.	Yet to be completed in test case worksheet!				

Figure 26: Description of user non-functional security requirement UP-01, which is related to requirement SP-01-01

Project Name:	Intelligent Academic Planner						
Requirement ID:	UO-01				**Type**	**Functional**	**Non-Functional**
Creation:	Sep 23 2016 12:42 PM				**User**	☐	☒
Modification:	Oct 05 2016 01:53 AM				**System**	☐	☐
Description:	A user's session should be managed.				Organizational (sub-type below)		
					Development Requirements		
Priority:	Highest	✓ High	Medium	Low		Lowest	
This Req. is Refined Into:		SO-01-01					
Justify why UO-01 can be completely covered by SO-01-01		Ensures that a user can only be logged in for 1 hour, managing their session.					
Traceability:	Use cases cf.	N/A					
	Test cases cf.	Yet to be completed in test case worksheet!					
Acknowledgment	Generated from the CapStone Process Management System ©2015						

Figure 27: Description of user non-functional developmental requirement UO-01, which is related to requirement SO-01-01

4.2. System Requirements

4.2.1. Functional Requirements

4.2.1.1. List of System Functional Requirements

Project Name:	Intelligent Academic Planner						
Requirement ID:	SF-A-01				**Type**	**Functional**	**Non-Functional**
Creation:	Sep 23 2016 12:22 PM				**User**	☐	☐
Modification:	Oct 05 2016 01:41 AM				**System**	☒	☐
Description:	The system should log-in a user within 5 seconds.						
Priority:	Highest	High	Medium	✓ Low		Lowest	
This Req. is Engineered From:		UF-A					
Justify why meeting SF-A-01 can contribute to the fulfilment of UF-A		Provides performance requirement for logging in.					
Traceability:	Use cases cf.	UC-007, UC-016					
	Test cases cf.	Yet to be completed in test case worksheet!					
Acknowledgment	Generated from the CapStone Process Management System ©2015						

Figure 28: Description of system functional requirement SF-A-01 which is related to requirements UF-A and use cases UC-007 and UC-016

Project Name:	Intelligent Academic Planner					
Requirement ID:	SF-B-01			Type	Functional	Non-Functional
Creation:	Sep 23 2016 12:32 PM			User	☐	☐
Modification:	Oct 05 2016 01:41 AM			System	☒	☐
Description:	The system should log-out a user within 5 seconds.					
Priority:	Highest	High	Medium	✔ Low		Lowest
This Req. is Engineered From:		UF-B				
Justify why meeting SF-B-01 can contribute to the fulfilment of UF-B		Explains performance requirement.				
Traceability:	Use cases cf.	UC-018				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	Generated from the CapStone Process Management System ©2015					

Figure 29: Description of system functional requirement SF-B-01, which is related to requirements UF-B and use cases UC-018

Requirement ID:	SF-C-01			Type	Functional	Non-Functional
Creation:	Sep 20 2016 04:22 PM			User	☐	☐
Modification:	Oct 05 2016 01:42 AM			System	☒	☐
Description:	The system should conduct textual analyses.					
Priority:	Highest	✔ High	Medium	Low		Lowest
This Req. is Engineered From:		UF-C				
Justify why meeting SF-C-01 can contribute to the fulfilment of UF-C		In order to provide an answer to questions asked, system must be able to perform this function.				
Traceability:	Use cases cf.	UC-011, UC-012				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	Generated from the CapStone Process Management System ©2015					

Figure 30: Description of system functional requirement SF-C-01, which is related to requirements UF-C and use cases UC-011 and UC-012

Project Name:	Intelligent Academic Planner				
Requirement ID:	SF-C-03		Type	Functional	Non-Functional
Creation:	Sep 20 2016 04:31 PM		User	☐	☐
Modification:	Oct 05 2016 01:44 AM		System	☒	☐
Description:	The system should recommend majors suitable for the user based on the personality assessment.				
Priority:	Highest	High	✓ Medium	Low	Lowest
This Req. is Engineered From:	UF-C				
Justify why meeting SF-C-03 can contribute to the fulfilment of UF-C	This allows questions to be answered more accurately.				
Traceability:	Use cases cf.	UC-011, UC-012			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	Generated from the CapStone Process Management System ©2015				

Figure 32: Description of system functional requirement SF-C-03, which is related to requirements UF-C and use cases UC-011 and UC-012

Project Name:	Intelligent Academic Planner				
Requirement ID:	SF-C-02		Type	Functional	Non-Functional
Creation:	Oct 05 2016 01:59 AM		User	☐	☐
Modification:	Oct 05 2016 02:00 AM		System	☒	☐
Description:	The system should be able to handle input from multiple well-known languages.				
Priority:	Highest	High	Medium	Low	✓ Lowest
This Req. is Engineered From:	UF-C				
Justify why meeting SF-C-02 can contribute to the fulfilment of UF-C	Allows users to ask a question in a variety of ways.				
Traceability:	Use cases cf.	UC-009, UC-011			

Figure 31: Description of system functional requirement SF-C-02, which is related to requirements UF-C and use cases UC-009 and UC-011

Project Name:	Intelligent Academic Planner					
Requirement ID:	SF-C-04			Type	Functional	Non-Functional
Creation:	Sep 20 2016 04:34 PM			User	☐	☐
Modification:	Oct 05 2016 01:44 AM			System	☒	☐
Description:	The system should gather data unique to each user.					
Priority:	Highest	High	✔ Medium	Low		Lowest
This Req. is Engineered From:		UF-C				
Justify why meeting SF-C-04 can contribute to the fulfilment of UF-C		This allows questions to be answered more accurately.				
Traceability:	Use cases cf.	UC-011, UC-012				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	Generated from the CapStone Process Management System ©2015					

Figure 34: Description of system functional requirement SF-C-04 which is related to requirements UF-C and use cases UC-011 and UC-012

Project Name:	Intelligent Academic Planner					
Requirement ID:	SF-C-05			Type	Functional	Non-Functional
Creation:	Sep 20 2016 04:35 PM			User	☐	☐
Modification:	Oct 05 2016 01:44 AM			System	☒	☐
Description:	The system should recommend courses based on the recommended majors.					
Priority:	Highest	High	✔ Medium	Low		Lowest
This Req. is Engineered From:		UF-C				
Justify why meeting SF-C-05 can contribute to the fulfilment of UF-C		This allows questions to be answered more accurately.				
Traceability:	Use cases cf.	UC-011, UC-012				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	Generated from the CapStone Process Management System ©2015					

Figure 33: Description of system functional requirement SF-C-05, which is related to requirements UF-C and use cases UC-011 and UC-012

Project Name:	Intelligent Academic Planner						
Requirement ID:	SF-D-01				Type	Functional	Non-Functional
Creation:	Sep 23 2016 12:54 PM				User	☐	☐
Modification:	Oct 05 2016 01:46 AM				System	☒	☐
Description:	The system should show a minimum of 1 related search/question.						
Priority:	Highest	High	Medium		✓ Low		Lowest
This Req. is Engineered From:		UF-D					
Justify why meeting SF-D-01 can contribute to the fulfilment of UF-D		This allows responses to be structured and more accurate.					
Traceability:	Use cases cf.	UC-012					
	Test cases cf.	Yet to be completed in test case worksheet!					
Acknowledgment	Generated from the CapStone Process Management System ©2015						

Figure 36: Description of system functional requirement SF-D-01, which is related to requirements UF-D and use cases UC-012

Project Name:	Intelligent Academic Planner						
Requirement ID:	SF-C-07				Type	Functional	Non-Functional
Creation:	Oct 05 2016 01:20 AM				User	☐	☐
Modification:	Oct 05 2016 01:39 AM				System	☒	☐
Description:	The system should be able to handle both text and voice input.						
Priority:	Highest	High	Medium		✓ Low		Lowest
This Req. is Engineered From:		UF-C					
Justify why meeting SF-C-07 can contribute to the fulfilment of UF-C		Allows user to ask questions in multiple ways					
Traceability:	Use cases cf.	UC-008, UC-011					
	Test cases cf.	Yet to be completed in test case worksheet!					
Acknowledgment	Generated from the CapStone Process Management System ©2015						

Figure 35: Description of system functional requirement SF-C-07 which is related to requirements UF-C and use cases UC-008 and UC-011

Project Name:	Intelligent Academic Planner				
Requirement ID:	SF-E-01		Type	Functional	Non-Functional
Creation:	Oct 04 2016 11:56 PM		User	☐	☐
Modification:	Oct 05 2016 01:46 AM		System	☒	☐
Description:	The system should allow between 100 and 600 words to describe a user's academic and professional interests.				
Priority:	✓ Highest	High	Medium	Low	Lowest
This Req. is Engineered From:	UF-E				
Justify why meeting SF-E-01 can contribute to the fulfilment of UF-E	Allows user to enter information about themselves to their profile				
Traceability:	Use cases cf.	UC-013			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	Generated from the CapStone Process Management System ©2015				

Figure 38: Description of system functional requirement SF-E-01, which is related to requirements UF-E and use cases UC-013

Project Name:	Intelligent Academic Planner				
Requirement ID:	SF-E-02		Type	Functional	Non-Functional
Creation:	Oct 04 2016 11:56 PM		User	☐	☐
Modification:	Oct 05 2016 01:47 AM		System	☒	☐
Description:	The system should allow a user to submit 100 words of self-description about their personality.				
Priority:	Highest	High	✓ Medium	Low	Lowest
This Req. is Engineered From:	UF-E				
Justify why meeting SF-E-02 can contribute to the fulfilment of UF-E	Allows user to enter personality information on their profile				
Traceability:	Use cases cf.	UC-013			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	Generated from the CapStone Process Management System ©2015				

Figure 37: Description of system functional requirements SF-E-02, which is related to requirements UF-E and use cases UC-013

Project Name:	Intelligent Academic Planner					
Requirement ID:	SF-E-04			Type	Functional	Non-Functional
Creation:	Oct 05 2016 01:43 AM			User	☐	☐
Modification:	Oct 05 2016 01:48 AM			System	☒	☐
Description:	The system should create a personality assessment unique to each user based on the data gathered.					
Priority:	Highest	High	✔ Medium	Low		Lowest
This Req. is Engineered From:		UF-E				
Justify why meeting SF-E-04 can contribute to the fulfilment of UF-E		Allows user to view information about themselves on their profile that they did not input.				
Traceability:	Use cases cf.	UC-013, UC-015				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	Generated from the CapStone Process Management System ©2015					

Figure 40: Description of system functional requirement SF-E-04, which is related to requirements UF-E and use cases UC-013 and UC-015

Project Name:	Intelligent Academic Planner					
Requirement ID:	SF-E-03			Type	Functional	Non-Functional
Creation:	Oct 05 2016 12:00 AM			User	☐	☐
Modification:	Oct 05 2016 01:47 AM			System	☒	☐
Description:	The system should allow a user to view their personality assessments.					
Priority:	Highest	✔ High	Medium	Low		Lowest
This Req. is Engineered From:		UF-E				
Justify why meeting SF-E-03 can contribute to the fulfilment of UF-E		Allows a user to learn about themselves based on profile information.				
Traceability:	Use cases cf.	UC-005, UC-013				

Figure 39: Description of system functional requirement SF-E-03, which is related to requirements UF-E and use cases UC-005 and UC-013

Project Name:	Intelligent Academic Planner						
Requirement ID:	SF-E-05				Type	Functional	Non-Functional
Creation:	Oct 05 2016 01:45 AM				User	☐	☐
Modification:	Oct 05 2016 01:45 AM				System	☒	☐
Description:	The system should summarize this data to be used by an advisor directing the student.						
Priority:	Highest	High	✓ Medium		Low		Lowest
This Req. is Engineered From:		UF-E					
Justify why meeting SF-E-05 can contribute to the fulfilment of UF-E		Allows user to get assistance from advisors based on their profile.					
Traceability:	Use cases cf.	UC-001, UC-013, UC-015, UC-019					
	Test cases cf.	Yet to be completed in test case worksheet!					
Acknowledgment	Generated from the CapStone Process Management System ©2015						

Figure 42: Description of system functional requirement SF-E-05, which is related to requirements UF-E and use cases UC-001, UC-013, UC-015, and UC-019

Project Name:	Intelligent Academic Planner						
Requirement ID:	SF-F-01				Type	Functional	Non-Functional
Creation:	Oct 05 2016 12:16 AM				User	☐	☐
Modification:	Oct 05 2016 01:49 AM				System	☒	☐
Description:	The system should register the user within 5 seconds.						
Priority:	Highest	High	✓ Medium		Low		Lowest
This Req. is Engineered From:		UF-F					
Justify why meeting SF-F-01 can contribute to the fulfilment of UF-F		Places a performance requirement on registration.					
Traceability:	Use cases cf.	UC-004					
	Test cases cf.	Yet to be completed in test case worksheet!					
Acknowledgment	Generated from the CapStone Process Management System ©2015						

Figure 41: Description of system functional requirement SF-F-01, which is related to requirements UF-F and use cases UC-004

Project Name:	Intelligent Academic Planner						
Requirement ID:	SF-H-01				Type	Functional	Non-Functional
Creation:	Oct 05 2016 02:15 AM				User	☐	☐
Modification:	Oct 05 2016 02:15 AM				System	☒	☐
Description:	A user can provide answer quality feedback after asking a question.						
Priority:	Highest	High	✓ Medium	Low		Lowest	
This Req. is Engineered From:		UF-H					
Justify why meeting SF-H-01 can contribute to the fulfilment of UF-H		Allows feedback to be submitted.					
Traceability:	Use cases cf.	UC-010					
	Test cases cf.	Yet to be completed in test case worksheet!					
Acknowledgment	Generated from the CapStone Process Management System ©2015						

Figure 44: Description of system functional requirement SF-H-01, which is related to requirements UF-H and use cases UC-010

Project Name:	Intelligent Academic Planner						
Requirement ID:	SF-G-01				Type	Functional	Non-Functional
Creation:	Oct 05 2016 12:37 AM				User	☐	☐
Modification:	Oct 05 2016 12:37 AM				System	☒	☐
Description:	The system should only allow Advisors and System Developers to view the question log.						
Priority:	Highest	High	✓ Medium	Low		Lowest	
This Req. is Engineered From:		UF-G					
Justify why meeting SF-G-01 can contribute to the fulfilment of UF-G		Adds security to the question log.					
Traceability:	Use cases cf.	UC-006					
	Test cases cf.	Yet to be completed in test case worksheet!					
Acknowledgment	Generated from the CapStone Process Management System ©2015						

Figure 43: Description of system functional requirement SF-G-01, which is related to requirement UF-G and use cases UC-006
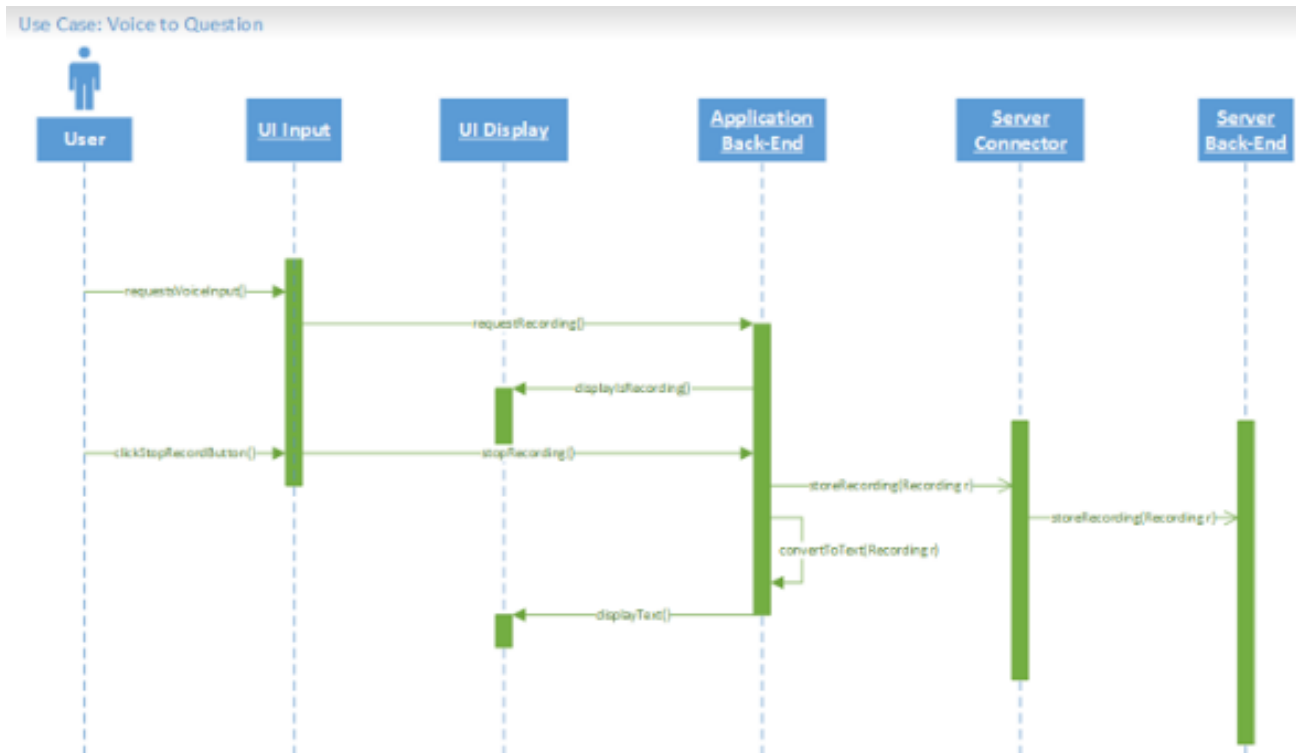
4.2.1.2. System Behavior

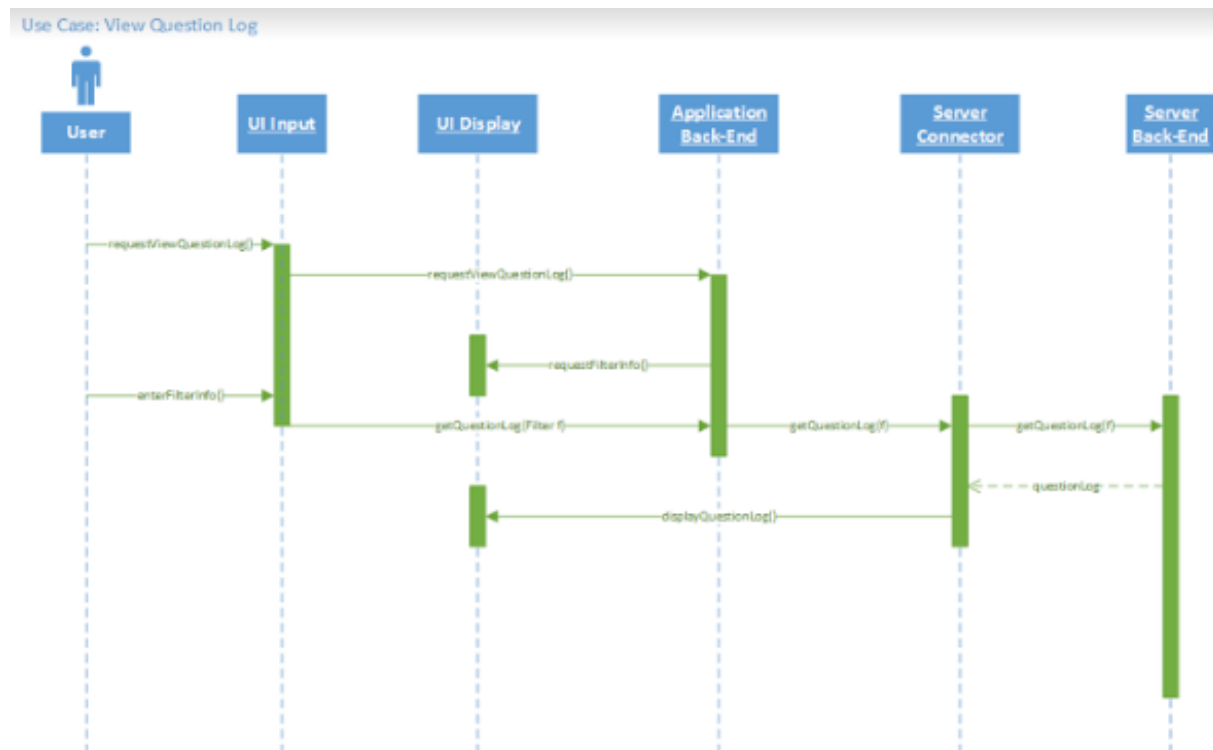*Figure 46: Sequence diagram for "View Question Log", related to UC-006*

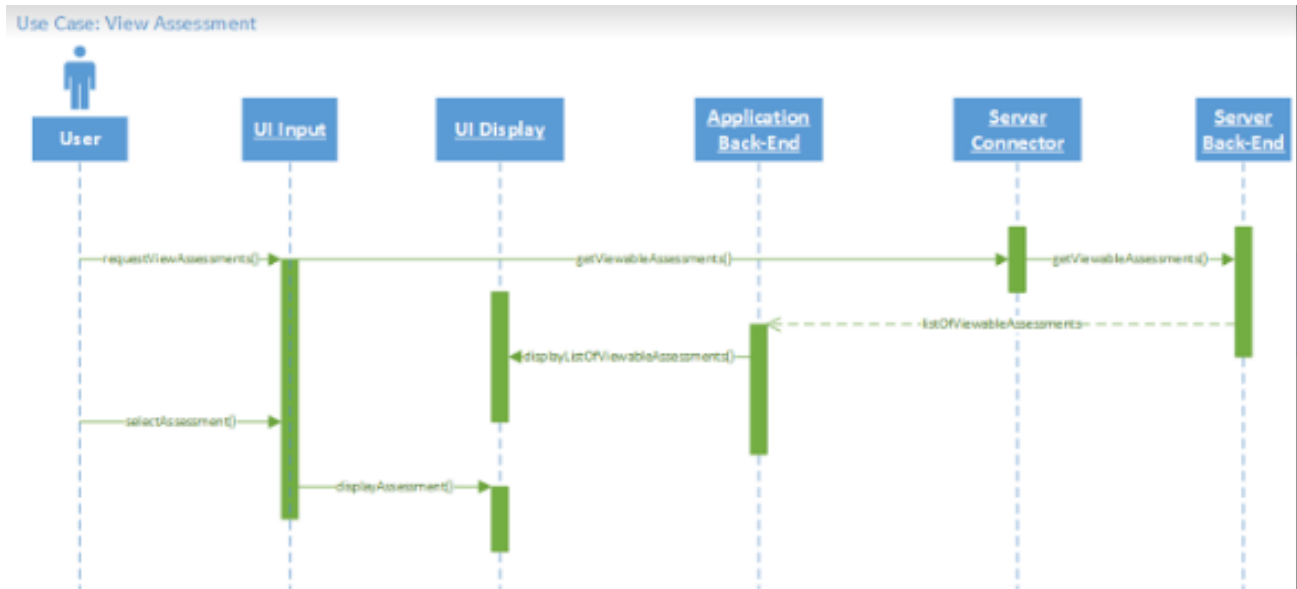*Figure 45: Sequence diagram for "Voice to Question", related to UC-008*

Figure 47: Sequence diagram for "View Assessment", related to UC-005
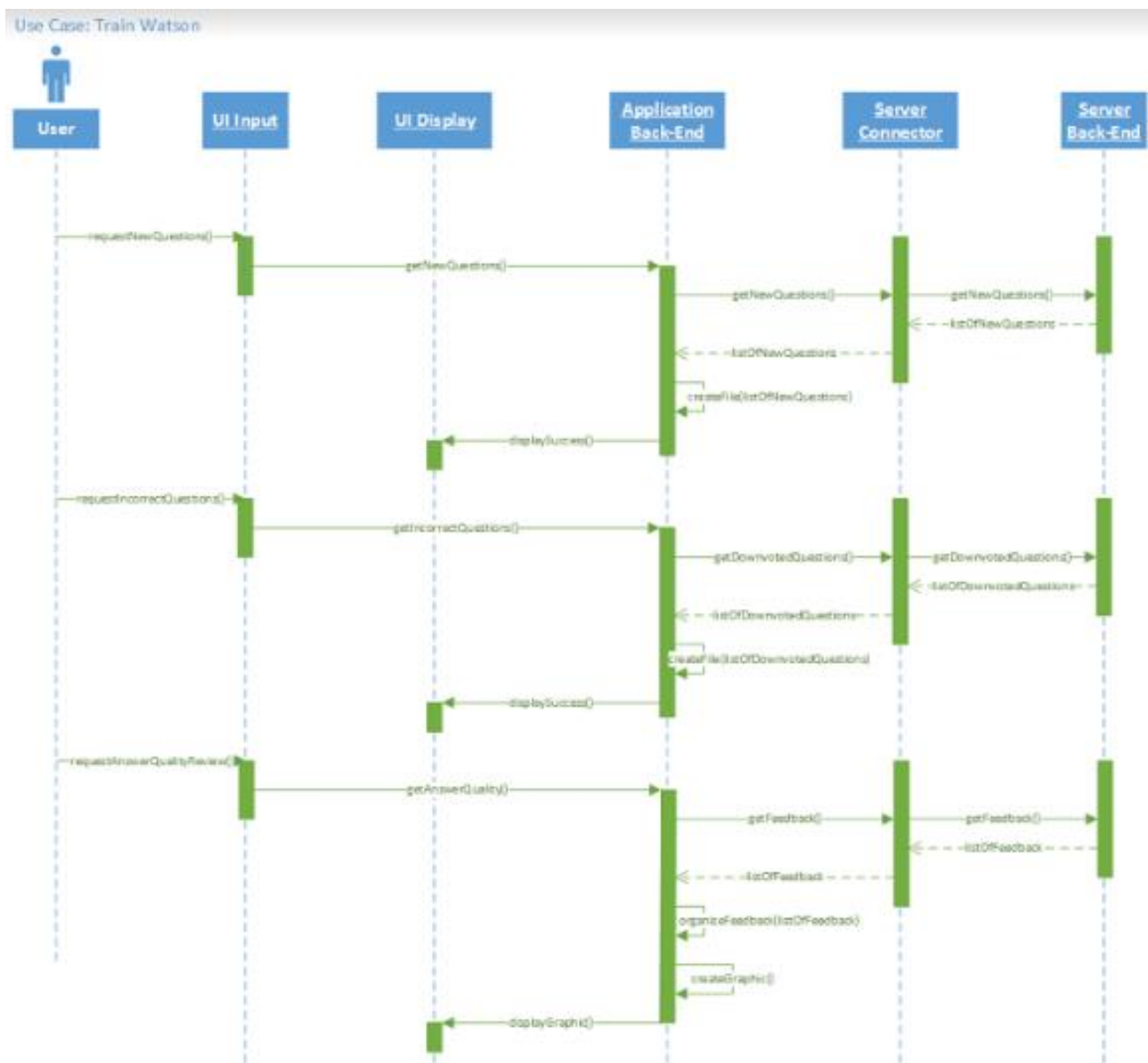

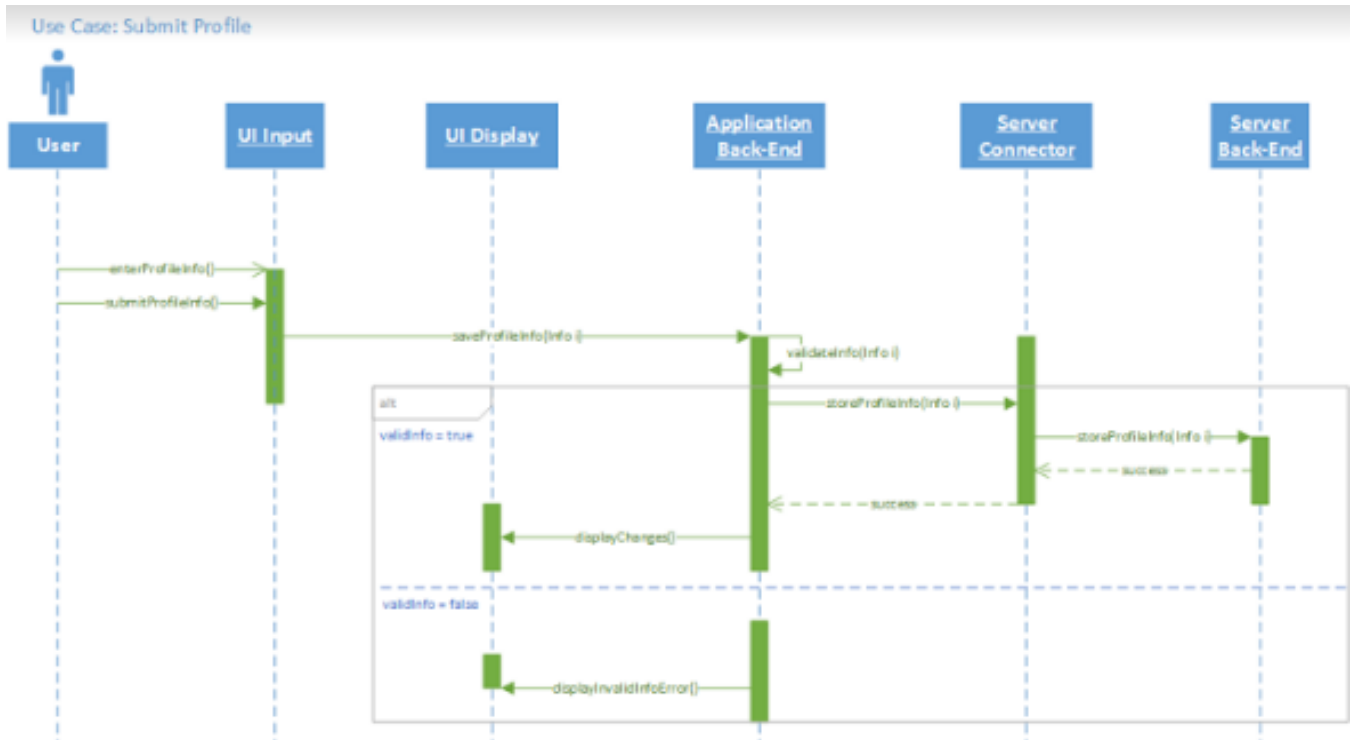*Figure 48: Sequence diagram for "Train Watson", related to UC-007*

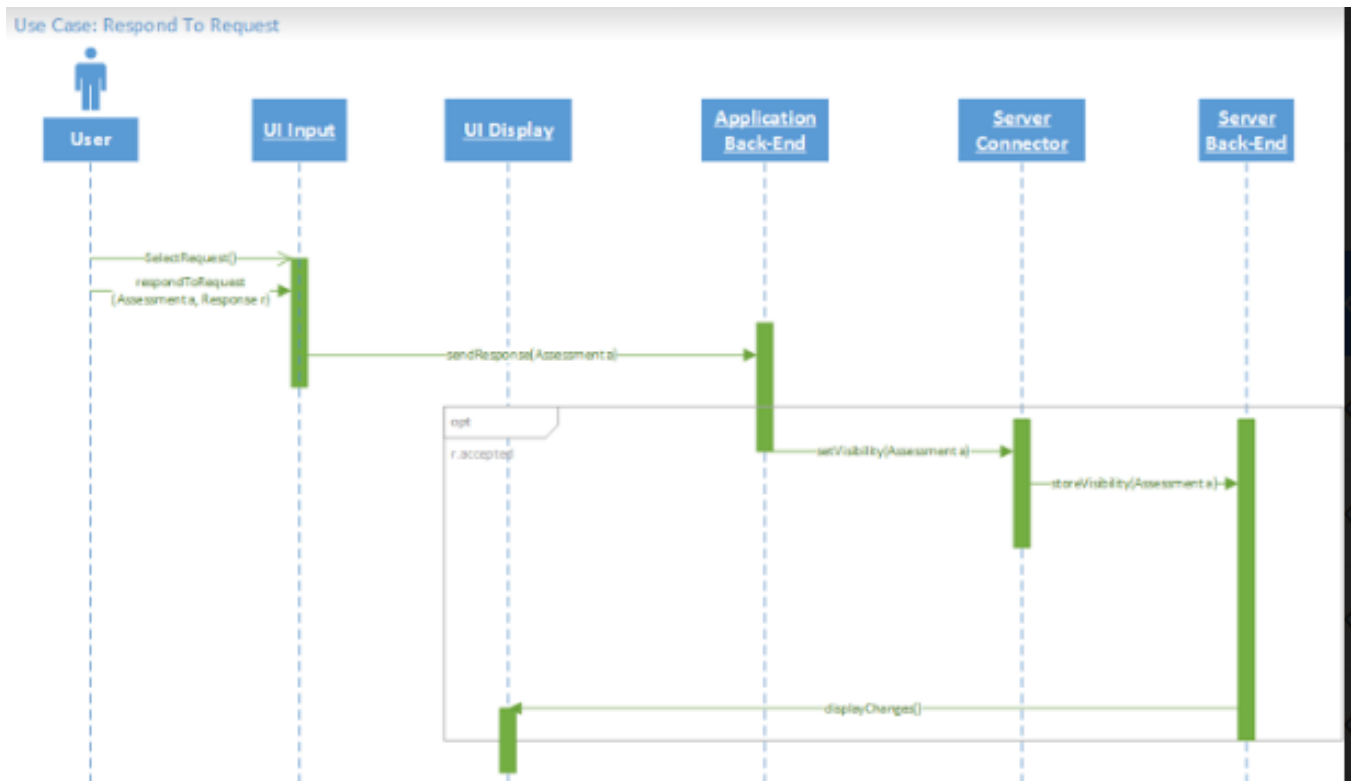*Figure 50: Sequence diagram for "Submit Profile", related to UC-013*

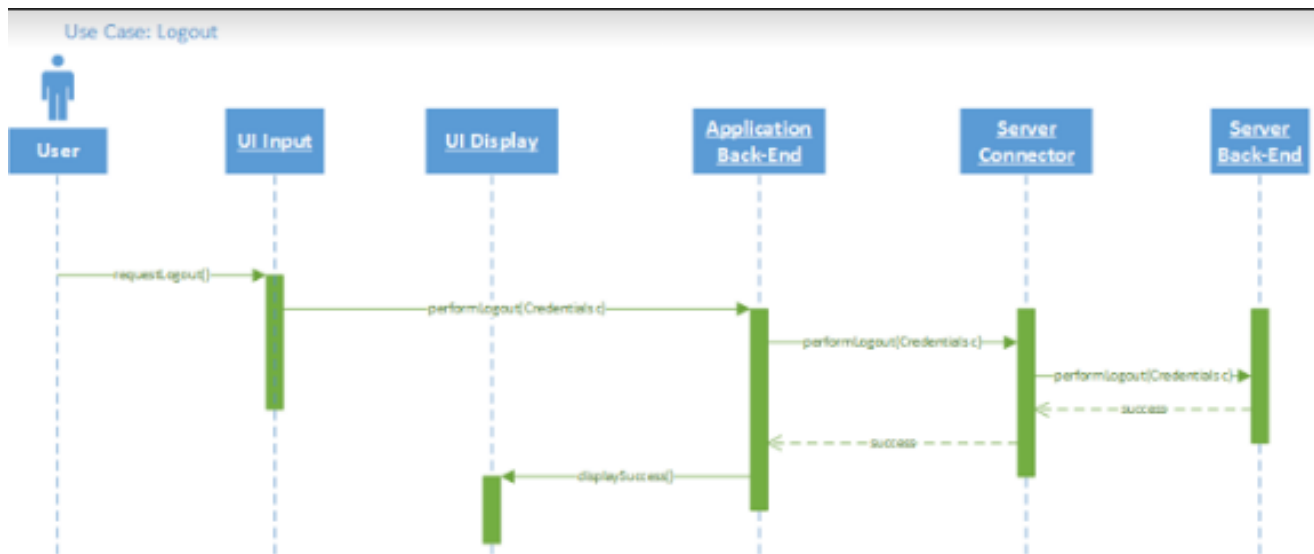*Figure 49: Sequence diagram for "Respond to Request", related to UC-001*

Figure 51: Sequence diagram for "Logout", related to UC-018
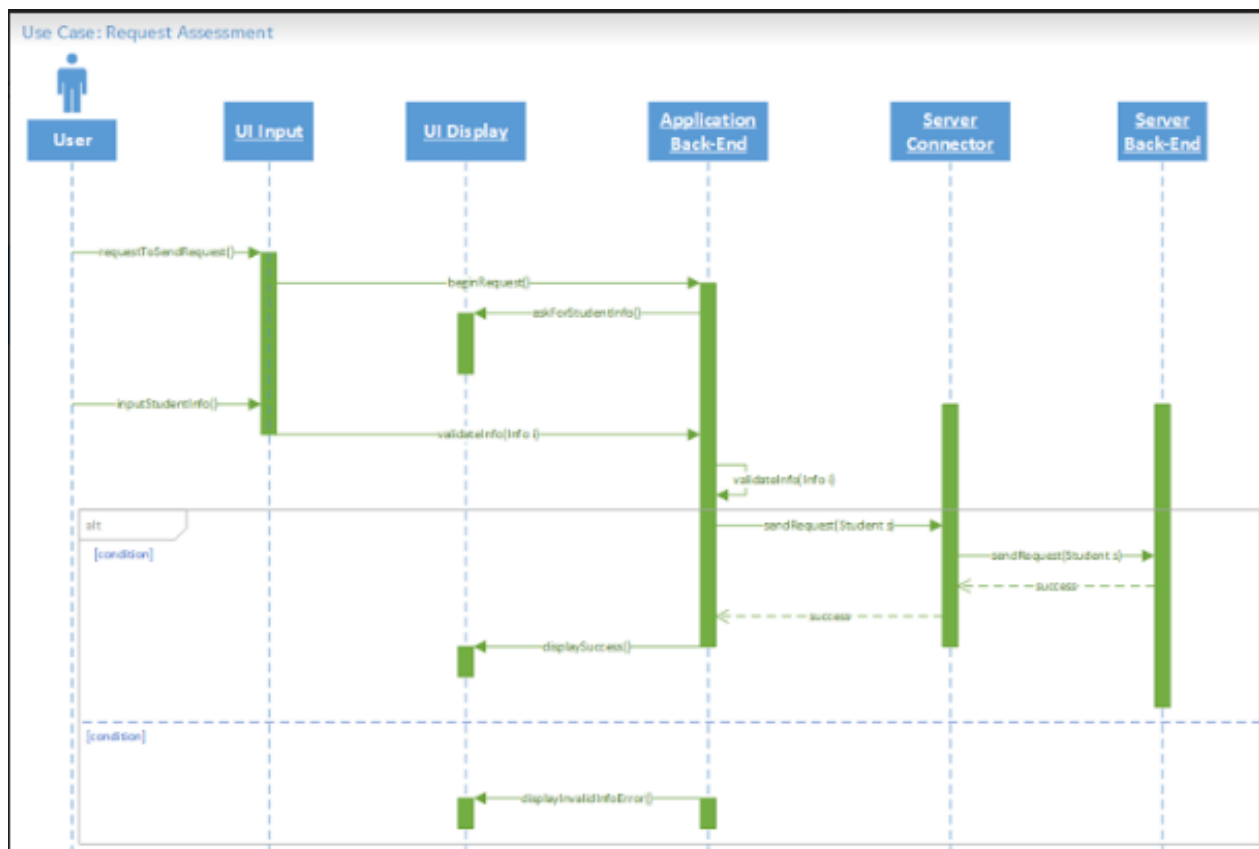
Figure 52: Sequence Diagram for "Request Assessment", related to UC-019
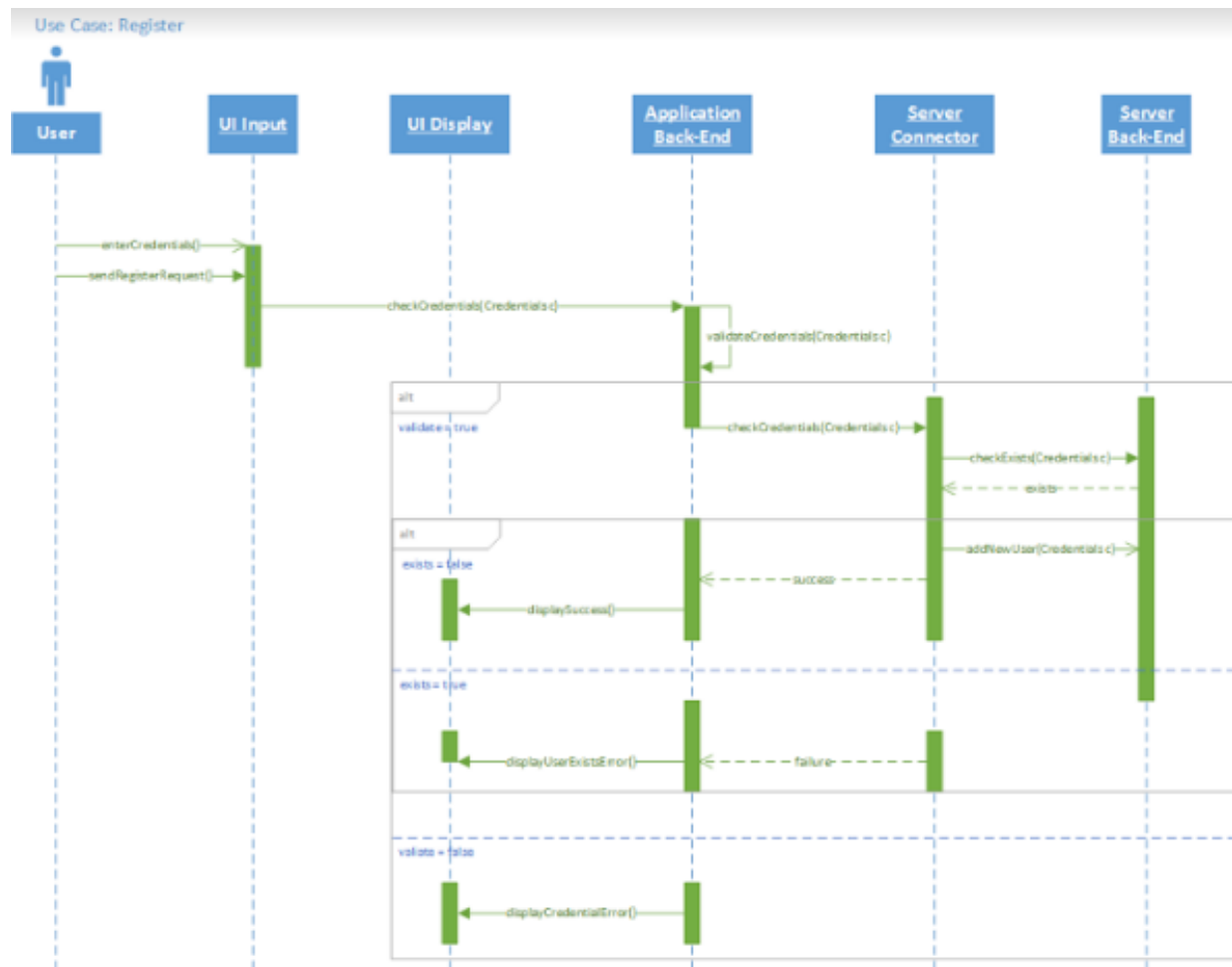
Figure 53: Sequence diagram for "Register", related to UC-004

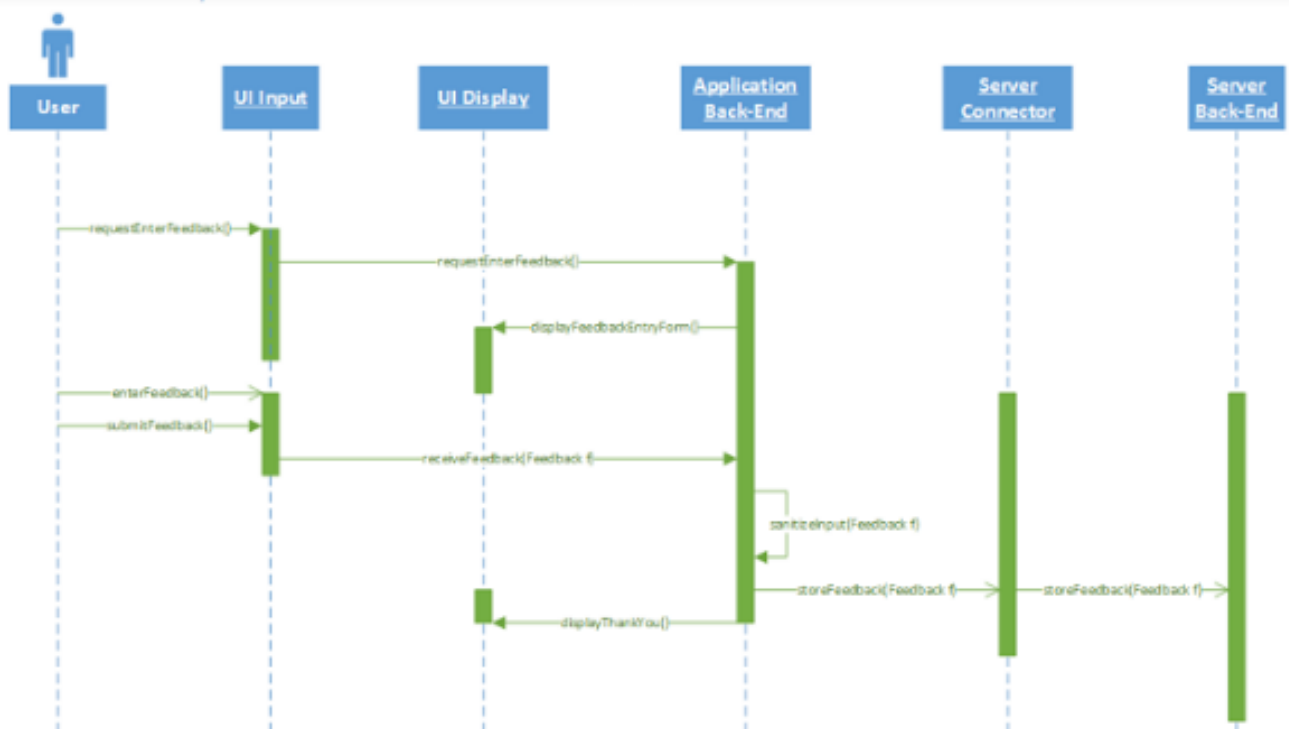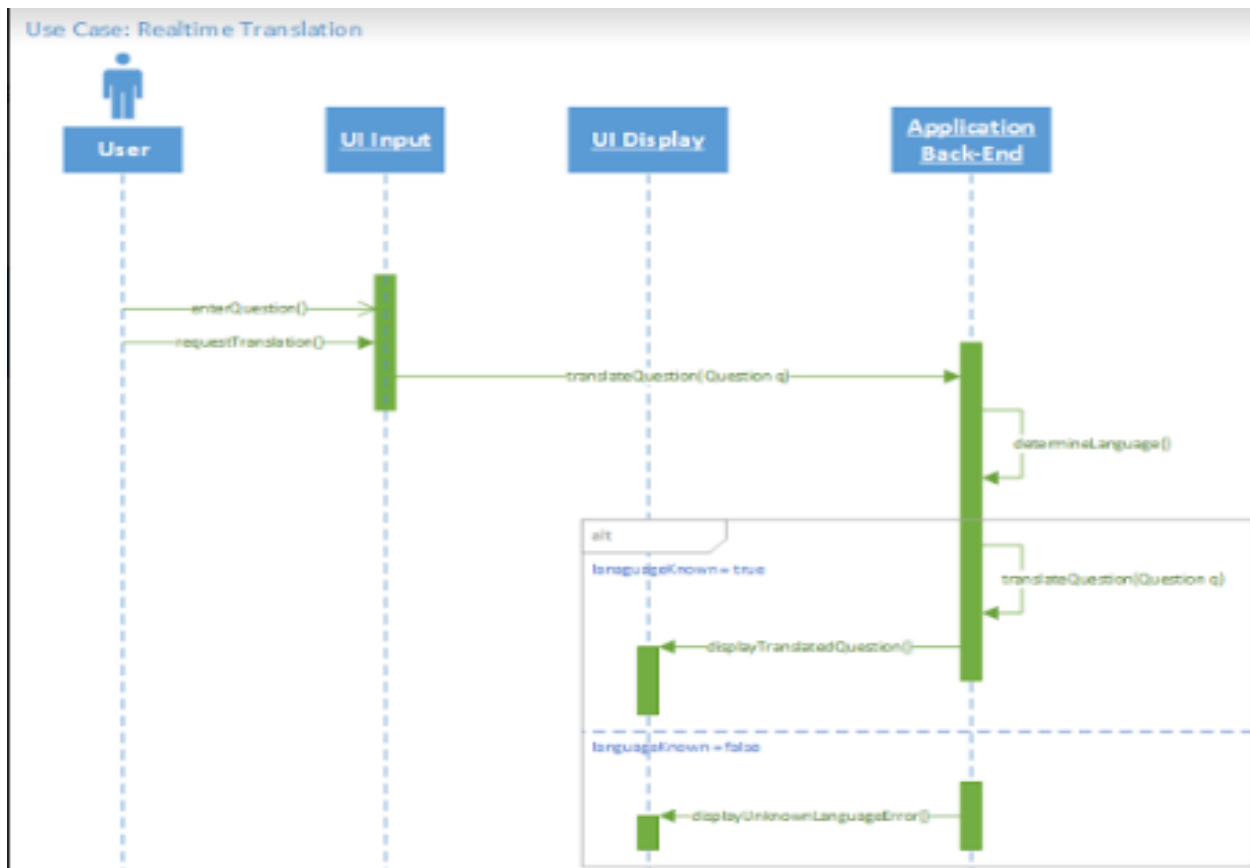*Figure 54: Sequence diagram for "Answer Quality Feedback", related to UC-010*

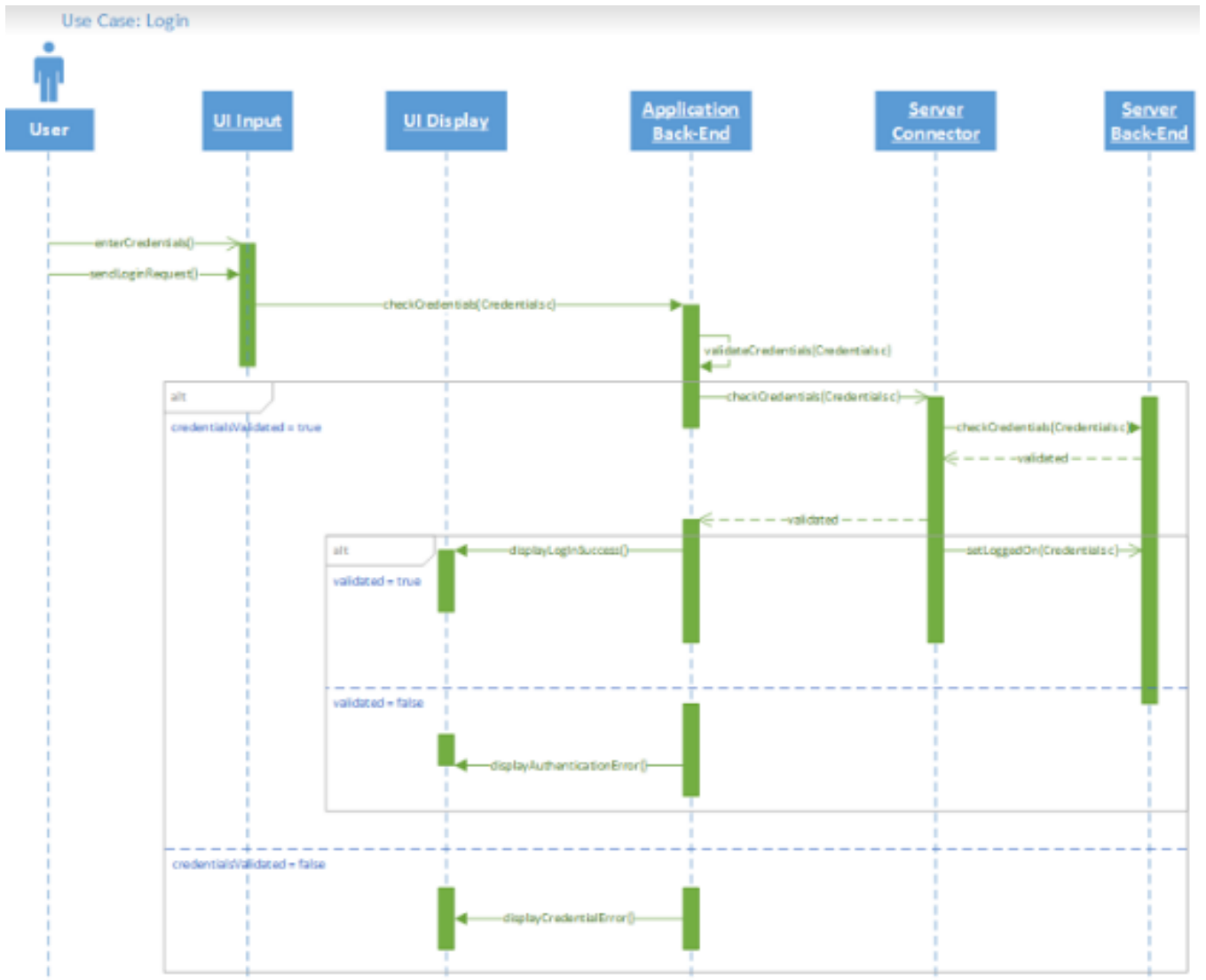*Figure 55: Sequence diagram for "Real-time Translation", related to UC-009*

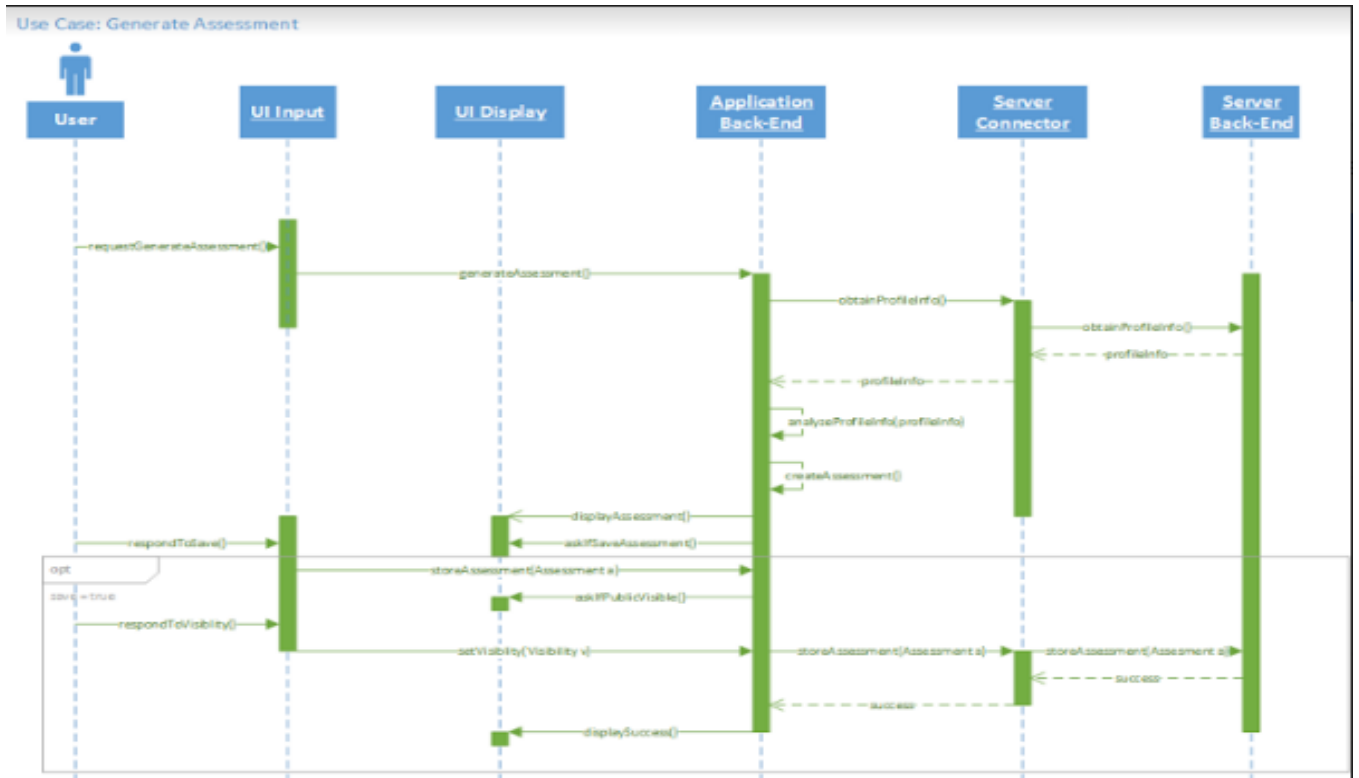*Figure 56: Sequence diagram for "Login", related to UC-016*

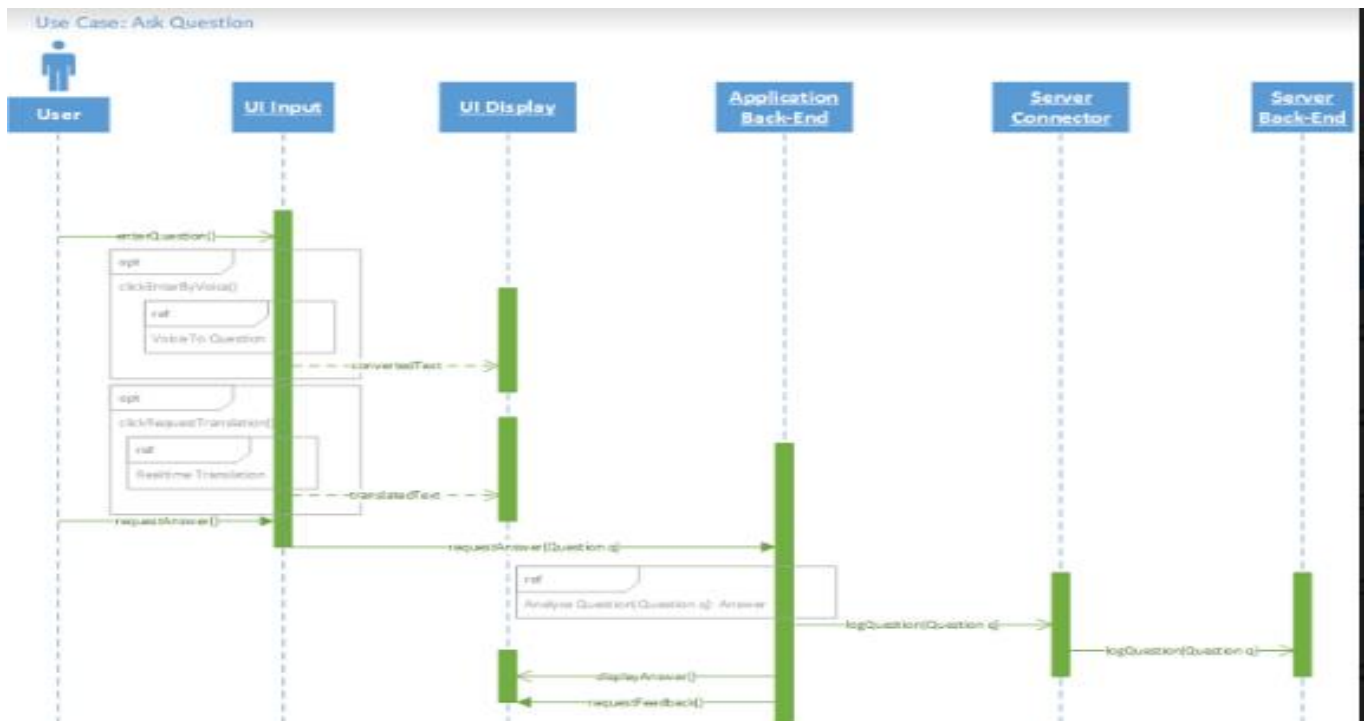*Figure 58: Sequence diagram for "Generate Assessment", related to UC-015*

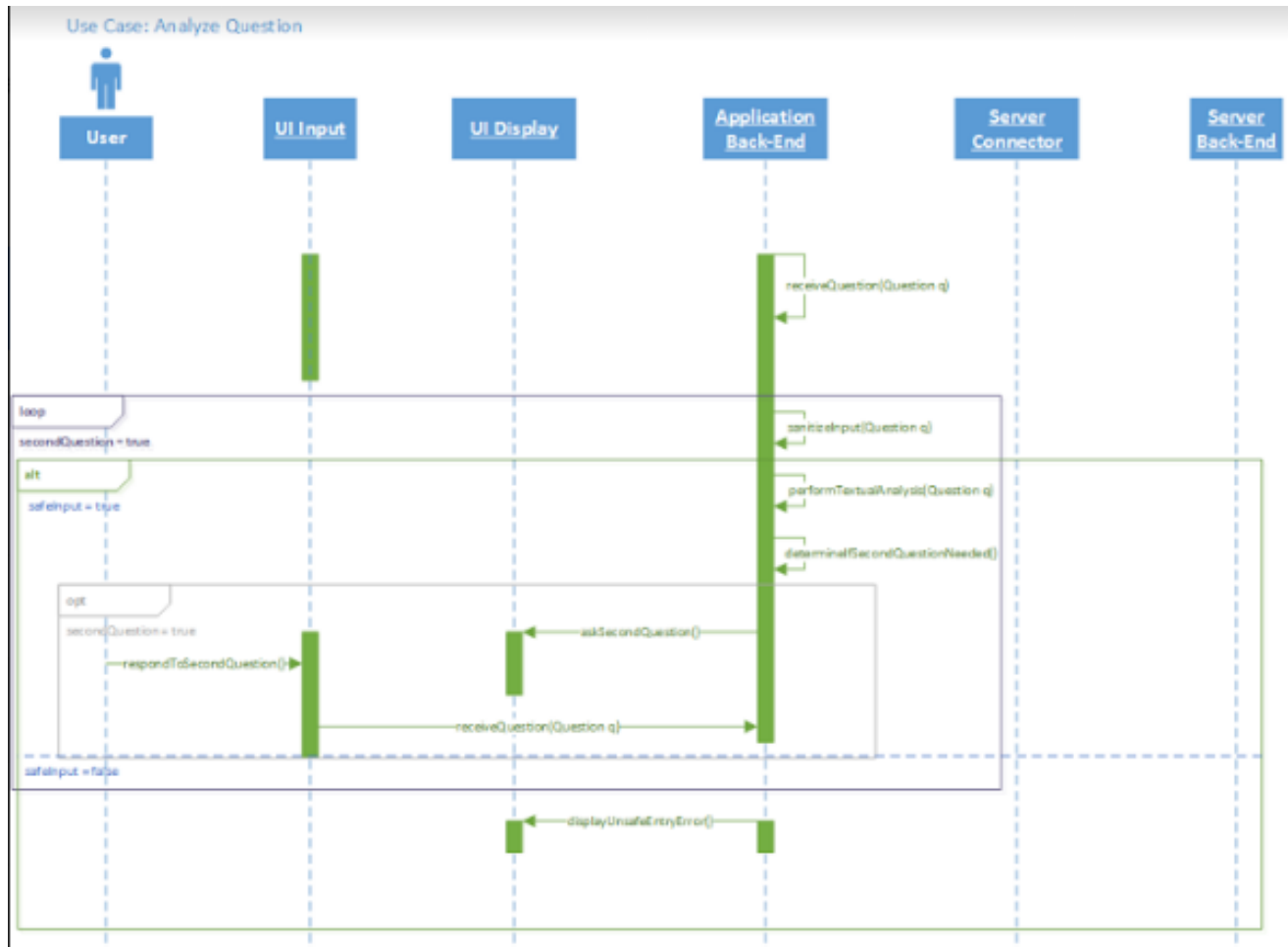*Figure 57: Sequence diagram for "Ask Question", related to UC-011*

Figure 59: Sequence diagram for "Analyze Question", related to UC-012

4.2.1.3. Data Requirements

UC001 - Input: User whose assessment is being requested.

UC004 - Input: User email address and real name for registration and login.

UC004 - Input: User password for registration and login.

UC006 - Input: Filter information for useful question log (eg. major, minor, courses).

UC007 - Output: List of newly generated questions exported to a text file.

UC007 - Output: List of unanswered frequently asked questions.

UC008 - Input: Questions submitted in the form of voice recordings.

UC008 - Output: The voice recording is converted to text and displayed to the user.

UC009 - Input: Untranslated text.

UC009 - Output: Translated text.

UC010 - Input: User feedback pertaining to the relevance of the responses to their questions.

UC011 - Input: User questions.

UC011 - Output: Responses to user questions.

UC013 - Input: User profile.

UC015 - Output: User assessment based on their profile and search history.

UC019 - Input: The advisor who is requesting the student's assessment.

4.2.2. Non-functional Requirements

4.2.2.1. Product: Performance Requirements

Project Name:	Intelligent Academic Planner					
Requirement ID:	SP-03-01			Type	Functional	Non-Functional
Creation:	Oct 05 2016 01:36 AM			User	☐	☐
Modification:	Oct 05 2016 01:49 AM			System	☐	☒
Description:	The system's voice-to-text service should process within 5 seconds of voice submission.			Product (sub-type below)		
				Performance Requirements		
Priority:	Highest	High	Medium	✓ Low		Lowest
This Req. is Engineered From:		UP-03				
Justify why meeting SP-03-01 can contribute to the fulfilment of UP-03		Ensures an answer is given quickly by adding a performance requirement.				
Traceability:	Use cases cf.	N/A				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	Generated from the CapStone Process Management System ©2015					

Figure 60: Description of system non-functional performance requirement SP-03-01, related to requirement UP-03

4.2.2.2. Product: Dependability/Reliability/Security

Project Name:	Intelligent Academic Planner						
Requirement ID:	SP-01-01				**Type**	**Functional**	**Non-Functional**
Creation:	Oct 05 2016 12:12 AM				**User**	☐	☐
Modification:	Oct 05 2016 12:14 AM				**System**	☐	☒
Description:	The system should only display information that the user knows is being displayed.				Product (sub-type below)		
					Dependability/Reliability/Security		
Priority:	Highest	✓ High	Medium		Low		Lowest
This Req. is Engineered From:		UP-01					
Justify why meeting SP-01-01 can contribute to the fulfilment of UP-01		Makes the user's profile more secure by allowing the user to specify which information is visible.					
Traceability:	Use cases cf.	N/A					
	Test cases cf.	Yet to be completed in test case worksheet!					
Acknowledgment	Generated from the CapStone Process Management System ©2015						

Figure 61: Description of system non-functional security requirement SP-01-01, which is related to requirement UP-01

4.2.2.3. Organizational: Development Requirements

Project Name:	Intelligent Academic Planner						
Requirement ID:	SO-01-01				**Type**	**Functional**	**Non-Functional**
Creation:	Sep 23 2016 12:42 PM				**User**	☐	☐
Modification:	Oct 05 2016 01:49 AM				**System**	☐	☒
Description:	The system should log the user out after 1 hour of inactivity.				Organizational (sub-type below)		
					Development Requirements		
Priority:	✓ Highest	High	Medium		Low		Lowest
This Req. is Engineered From:		UO-01					
Justify why meeting SO-01-01 can contribute to the fulfilment of UO-01		Ensures a user is not logged on for too long, managing their session.					
Traceability:	Use cases cf.	N/A					
	Test cases cf.	Yet to be completed in test case worksheet!					

Figure 62: Description of system non-functional development requirement SO-01-01, which is related to requirement UO-01

4.3. Requirements Trace Table

Project Name: Intelligent Academic Planner

User Requirements		System Requirements	
Req ID	Description	Req ID	Description
UF-A	A user can log in.	SF-A-01	The system should log-in a user within 5 seconds.
UF-B	A user can log out.	SF-B-01	The system should log-out a user within 5 seconds.
UF-C	A user can ask the system questions.	SF-C-01	The system should conduct textual analyses.
		SF-C-02	The system should be able to handle input from multiple well-known languages.
		SF-C-03	The system should recommend majors suitable for the user based on the personality assessment.
		SF-C-04	The system should gather data unique to each user.
		SF-C-05	The system should recommend courses based on the recommended majors.
		SF-C-07	The system should be able to handle both text and voice input.
UF-D	A user should receive multiple responses to a question.	SF-D-01	The system should show a minimum of 1 related search/question.
UF-E	A user can create a profile	SF-E-01	The system should allow between 100 and 600 words to describe a user's academic and professional interests.
		SF-E-02	The system should allow a user to submit 100 words of self-description about their personality.
		SF-E-03	The system should allow a user to view their personality assessments.
		SF-E-04	The system should create a personality assessment unique to each user based on the data gathered.
		SF-E-05	The system should summarize this data to be used by an advisor directing the student.
UF-F	A user can register	SF-F-01	The system should register the user within 5 seconds.
UF-G	A user can view a log of asked questions.	SF-G-01	The system should only allow Advisors and System Developers to view the question log.
UF-H	A user can provide information to improve accuracy of the system.	SF-H-01	A user can provide answer quality feedback after asking a question.
UO-01	A user's session should be managed.	SO-01-01	The system should log the user out after 1 hour of inactivity.
UP-01	A user's profile should be secure.	SP-01-01	The system should only display information that the user knows is being displayed.
UP-03	A user should receive a quick response after asking a question	SP-03-01	The system's voice-to-text service should process within 5 seconds of voice submission.

Acknowledgment: Generated from the CapStone process management system ©2015

Figure 63: Overall view of all user and system requirements

5. Exploratory Studies

5.1. Relevant Techniques

Surveys

5.2. Relevant Packages/Products

N/A

5.3. Broader Impacts

This project can be expanded to include other majors within Behrend or branches of Penn State University. On a grand scale, this type of tool would be a beneficial tool for high school juniors and seniors, as well as college freshman.

6. System Design

6.1. Architectural Design

Layered Architecture

7. System Implementation

7.1. Programming Languages & Tools

Bluemix (conversation, retrieve and rank, alchemyAPI,…)
MongoDB
Node.js

7.2. Coding Conventions

N/A

7.3. Code Version Control

GitHub

9. Challenges & Open Issues

9.1. Challenges Faced in Requirements Engineering

9.1.1. Initially, we struggled to determine the scope of the project. Watson has many features, therefore we had to be very specific about which of these features would make the most sense for our project's initial development.

9.1.2. Understanding the domain, or what sort of questions we wanted Watson to answer.

9.1.3. Be able to benchmark the accuracy of answering system.

9.1.4. Be able to automate the training/learning system.

10. System Manuals

10.1. Instructions for System Development

10.1.1. How to setup the development environment

10.1.1.1. The Intelligent Academic Planner project is a web application, that will be accessible publicly on Heroku, a Node.JS environment host platform. The source code will be stored by GitHub, for version control purposes. And the master version will always be automatically deployed and run on Heroku. There is no restriction on what IDE will be used by each group member.

10.1.2. Notes on system further extension

10.1.2.1. Automate question and feedback log DB

10.1.2.2. Natural language extension

10.1.2.3. Analytical library

10.1.2.4. Visual recognition on building

10.1.2.5. Attitude analysis on question

10.1.2.6. Campus direction utility

10.1.2.7. Course info helper (location, material, etc…)

10.1.2.8. News/feeds utility

12. References

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