Software Requirements Specification

For

Natural Language Understanding Module

Version 1.1

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September 17th, 2021

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Revision History

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| --- | --- | --- | --- |
| **Name** | **Date** | **Reason for Changes** | **Version** |
| Joseph Kalfus | 8/24/21 | Initial draft | 1.0 |
| Tongue Twisters | 9/10/21 | Updated system features list | 1.1 |

# Introduction

## Purpose

This document will describe the high level functional and nonfunctional requirements for release 1.0 of the Natural Language Understanding (NLU) Module features specifically for the Linux server platform.

## Document Conventions

Each feature that is documented will specify the priority that each requirement is considered. Some command line interface (CLI) windows will be provided of the features described. Some margins will have to be minimized (less than one inch) to accommodate screen shots but will still be able to print on 8.5-inch by 11-inch paper. Menu commands will be separated by a > symbol.

## Intended Audience and Reading Suggestions

This document is intended to be read from start to finish by the testers of this software. The validation of these features will be documented in a separate log.

## Product Scope

The Triple T Corporation is the newcomer in the consumer Natural Language Understanding (NLU) market. We must innovate in this sector to ensure that it holds onto the market share of their NLU software. The NLU Module will allow back-end processing of language patterns spoken into an internet connected device. We will focus on the Application Programming Interface (API) section of the software. This Software Requirements Specification (SRS) will include the introduction, description, system features, external interface requirements, system features, and nonfunctional requirements.

## References

* Mesmerize Team Channel Software Requirements Specification Memory Magic App dated August 28, 2021
* Mesmerize Team Channel Project Plan for the Memory Magic App dated August 28, 2021
* NLU 2021 Testing and Validation Log by various testing personnel
* NLU Project Plan dated August 29, 2021

# Overall Description

## Product Perspective

The NLU Module for the Linux platform combines some features from previous speech-to-text smartphone applications to give the user a more responsive *understanding* of previous notes taken. In the initial version of the speech-to-text smartphone application, it allowed for someone to speak into their device, and have it transcribed what was said. This version will add a speech to intent feature.

## Product Features

Below is a list of system features that will be present in the initial release of the NLU Module. These features are listed in the order by which they appear in this SRS and are described in detail in sections 3 and 5 of this document.

* Identify Sentence Type of Input Text
* Tokenize Input Text
* Instruct App to Make a Note
* Identify Intent of Question
* Instruct App to Provide User Assistance
* Return Last Valid Input Text
* Return User’s Location
* Search User’s Notes to Find Answer to Question
* Search for Answer to Miscellaneous Question
* Identify Language Localization of Input Text
* Return Grammatically Correct Output Text

## User Classes and Characteristics

Memory Magic App (favored) The Memory Magic smartphone application will the primary user of the NLU Module. It will query the NLU API to allow for the understanding of a note taken.

Extension Developers Extension developers will be allowed to make various *add-ons* to interface with the API.

End User Testers Although not intended for direct use by end-users, some will be able to interface directly with the NLU module by using a browser to query a parsing phrase. This will allow of testing of the current code base.

## Operating Environment

The operating environment includes any modern operating systems that meets the minimum operating requirements described on NLU Module minimum system requirements technical document. The NLU Module also operates on Apache based web platforms (for temporary testing). The focus of this SRS will be on the Linux Ubuntu platform.

**COMPONENT** **REQUIREMENT**

Computer and processor A server with minimum quad-core 64-bit processor

Memory 4 GB of RAM

Hard disk 100 GB of available hard disk space

Display None, will use secure shell (SSH)

Operating system Linux Ubuntu 20.04 LTS

## Design and Implementation Constraints

Java code style guide found at <https://google.github.io/styleguide/javaguide.html>

Python code style guide found at <https://docs.python-guide.org/writing/style/>

## User Documentation

Various sources of support and documentation are included with the NLU Module. The primary source of support will be in the command line interface (CLI) with the --help command. This command will bring up a command output of the various commands with the module.

## Assumptions and Dependencies

The NLU Module will assume that it is interfacing with a front-end device (like a smartphone application or website).

Dependencies will include relying on a third party NLU parser like PicoVoice’s *Rhino Speech to Intent* engine or Rasa Technology Incorporated *Rasa Open Source*. These third parties will have their own dependencies like the Python programming language support.

Finally, the module must be trained with sample training date to allow it to learn.

# System Features

## Identify Sentence Type of Input Text

Given the Memory Magic App provides input text to the NLU Module, the NLU module shall identify the text’s sentence type including: a question, a statement, or is invalid.

## Tokenize Input Text

Given the sentence type of the input text provided by the Memory Magic App has been identified as anything other than invalid, the NLU module shall parse input text provided by the Memory Magic App into “tokens” with implied meaning. These tokens include: persons, locations, objects, quantities, organizations, events, dates, times, actions, personally-identifiable information (PII), and app features. If input text cannot be tokenized, the NLU Module shall return output text stating so. If input text can be tokenized, the NLU Module shall store tokenized data into a temporary record for further processing.

## Instruct App to Make a Note

Given the sentence type of the input text provided by the Memory Magic App has been identified as a statement and a sufficient number of tokens was parsed to provide value, the NLU module shall instruct the Memory Magic App to create a note that includes the input text and direct the user to the Notes screen.

## Identify Intent of Question

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and a sufficient number of tokens was parsed to provide value, the NLU module shall identify the intent of the question.

## Instruct App to Provide User Assistance

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and the intent of the question has been identified as being about an app feature, the NLU Module shall instruct the Memory Magic App to direct the user to a dedicated support page for that feature with step-by-step instructions.

## Return Last Valid Input Text

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and the intent of the question has been identified as being about the last thing said, the NLU Module shall return the last valid input text as output text.

## Return User’s Location

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and the intent of the question has been identified as being about the user’s location, the NLU Module shall query the GPS to determine the user’s location and return it as output text.

## Search User’s Notes to Find Answer to Question

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and the intent of the question has been identified as being about the user’s notes, the NLU Module shall search the user’s notes to find an answer to the question. The NLU Module shall identify the user note whose tokenized data most closely matches the tokenized input text data and has a confidence interval (CI) of 60% or greater. Once the matching user note has been identified, the “questioning method” (e.g., who, what, when, where, why, how) of the question shall be identified so that the answer can be formulated grammatically to best answer the question.

## Search for Answer to Miscellaneous Question

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and the intent of the question has been identified as being miscellaneous, the NLU Module shall make a web search with the input text and return the first search result as output text.

## Identify Language Localization of Input Text

Given the Memory Magic App provides input text to the NLU Module, the NLU module shall identify the language localization of the input text. If the language localization is not U.S. English, it shall be translated to U.S. English for internal NLU processing. Before the output text is returned to the Memory Magic App, it shall be translated from U.S. English to the identified language localization.

## Return Grammatically Correct Output Text

Given the NLU Module has determined the output text that shall be returned to the Memory Magic App, the NLU Module shall verify the output text is grammatically correct before returning it.

# External Interface Requirements

## User Interfaces Overview

The system user interface (UI) shall be an Android UI to be installed on Android smartphone. The system function shall be easily accessible, consistent and users friendly. The NLU module should understand the text enquiry, to search for solutions and respond back by text.

## Hardware Interfaces

No hardware interface needed; the application shall install on the Android mobile devices. All external communication will be with a cloud service provider system.

## Software Interfaces

SI-1: The application shall be developed as an Android and iOS mobile application and shall be able running on all Android 8.0, iOS 10 and up.

SI-2: The application shall use flutter, a free and open-source mobile framework and Dart language for development.

SI-3: The Android studio integrated development environment shall be for application development as it is the best for app development.

SI-4: The Android emulators shall be used to test the application.

SI-5: The GitHub repository will be used to track changes in code and to update the version of the application.

## Communication Interface

CI-1: The application shall connect with the microphone of the device to enable the device to capture when user spoken.

CI-2: The application shall connect with the speaker of the device to allow user to communicate with audio.

CI-3: The application shall use internet connection through the device component.

# System Features/Modules

## Identify Sentence Type of Input Text

5.1.1 Description and Priority

Given the Memory Magic App provides input text to the NLU Module, the NLU module shall identify the text’s sentence type including: a question, a statement, or is invalid. Priority = High.

5.1.2 Stimulus/Response Sequences

Stimulus: The Memory Magic Application provides input text to the NLU Module.

Response: The NLU module identifies whether the input text is a question, a statement, or is invalid.

5.1.3 Functional Requirements

REQ-1.1: Upon the Memory Magic App providing input text to the NLU Module, the NLU Module shall identify if it is a question (e.g., “Do I need to pick up something?”).

REQ-1.2: Upon the Memory Magic App providing input text to the NLU Module, the NLU Module shall identify if it is a statement (e.g., “I need to pick up eggs today.”).

REQ-1.3: Upon the Memory Magic App providing input text to the NLU Module, the NLU Module shall identify if it is invalid (e.g., “Isfhew ghreuh.”).

REQ-1.4: If the sentence type is identified as invalid, the NLU Module shall return output text stating: “Sorry, I do not understand what you are saying.”

## Tokenize Input Text

5.2.1 Description and Priority

Given the sentence type of the input text provided by the Memory Magic App has been identified as anything other than invalid, the NLU module shall parse input text provided by the Memory Magic App into “tokens” with implied meaning. These tokens include: persons, locations, objects, quantities, organizations, events, dates, times, actions, personally-identifiable information (PII), and app features. If input text cannot be tokenized, the NLU Module shall return output text stating so. If input text can be tokenized, the NLU Module shall store tokenized data into a temporary record for further processing. Priority = High.

5.2.2 Stimulus/Response Sequences

Stimulus: The Memory Magic Application provides input text to the NLU Module and its sentence type has been identified as anything other than invalid.

Response: The NLU Module identifies all persons, locations, objects, quantities, organizations, events, dates, times, actions, PII, and app features present in the input text and stores it in a temporary record for processing. If input text cannot be properly tokenized, output text shall be returned to the Memory Magic App stating the input text could not be understood.

5.2.3 Functional Requirements

REQ-2.1: Upon the Memory Magic App providing valid input text to the NLU Module, the NLU Module shall identify all persons in the text including: names (e.g., John), pronouns (e.g., he, she, I), and occupations (e.g., plumber).

REQ-2.2: Upon the Memory Magic App providing valid input text to the NLU Module, the NLU Module shall identify all locations in the text (e.g., cities, streets, countries, addresses, home, landmarks).

REQ-2.3: Upon the Memory Magic App providing valid input text to the NLU Module, the NLU Module shall identify all objects in the text (e.g., medication, toy, remote, banana).

REQ-2.4: Upon the Memory Magic App providing valid input text to the NLU Module, the NLU Module shall identify all quantities in the text (e.g., 6, six, half a dozen).

REQ-2.5: Upon the Memory Magic App providing valid input text to the NLU Module, the NLU Module shall identify all organizations in the text (e.g., Walmart, Amazon, McDonalds).

REQ-2.6: Upon the Memory Magic App providing valid input text to the NLU Module, the NLU Module shall identify all events in the text (e.g., anniversary, graduation, meeting).

REQ-2.7: Upon the Memory Magic App providing valid input text to the NLU Module, the NLU Module shall identify all dates in the text (e.g., Friday, yesterday, today, tomorrow, January, January 21st, the 23rd).

REQ-2.8: Upon the Memory Magic App providing valid input text to the NLU Module, the NLU Module shall identify all times in the text (e.g., 4:00pm, 3 in the morning, noon, evening, tonight).

REQ-2.9: Upon the Memory Magic App providing valid input text to the NLU Module, the NLU Module shall identify all actions in the text (e.g., pick up, attend, go to, meet).

REQ-2.10: Upon the Memory Magic App providing valid input text to the NLU Module, the NLU Module shall identify all PII in the text (e.g., phone number, email address).

REQ-2.11: Upon the Memory Magic App providing valid input text to the NLU Module, the NLU Module shall identify all app features in the text (e.g., user profile, login, theme).

REQ-2.12: If an insufficient number of tokens can be parsed from input text to provide value, the NLU Module shall return output text to the Memory Magic App stating: “Sorry, I do not understand what you are saying.”

REQ-2.13: If a sufficient number of tokens can be parsed from input text to provide value, the NLU Module shall store tokens into a JSON object for further processing.

## Instruct App to Make a Note

5.3.1 Description and Priority

Given the sentence type of the input text provided by the Memory Magic App has been identified as a statement and a sufficient number of tokens was parsed to provide value, the NLU module shall instruct the Memory Magic App to create a note that includes the input text and direct the user to the Notes screen. Priority = High.

5.3.2 Stimulus/Response Sequences

Stimulus: The Memory Magic Application provides input text to the NLU Module and its sentence type has been identified as a statement and a sufficient number of tokens was parsed to provide value.

Response: The NLU Module instructs the Memory Magic App to create a note that includes the input text. The Memory Magic App shall then direct the user to the Notes screen, displaying the newly created note.

5.3.3 Functional Requirements

REQ-3.1: Upon the sentence type of the input text provided by the Memory Magic App being identified as a statement and a sufficient number of tokens was parsed to provide value, the NLU Module shall instruct the Memory Magic App to create a note that includes the input text.

REQ-3.2: Upon a new note being created, the Memory Magic App shall direct the user to the Notes screen, displaying the newly created note.

## Identify Intent of Question

5.4.1 Description and Priority

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and a sufficient number of tokens was parsed to provide value, the NLU module shall identify the intent of the question. Priority = High.

5.4.2 Stimulus/Response Sequences

Stimulus: The Memory Magic Application provides input text to the NLU Module and its sentence type has been identified as a question and a sufficient number of tokens was parsed to provide value.

Response: The NLU module identifies whether the intent of the question is about an app feature, about the last thing said, about the user’s location, about the user’s notes, or is miscellaneous.

5.4.3 Functional Requirements

REQ-4.1: Upon the sentence type of the input text provided by the Memory Magic App being identified as a question and a sufficient number of tokens was parsed to provide value, the NLU Module shall identify if the intent of the question is about an app feature (e.g., “How do I change my profile picture?”).

REQ-4.2: Upon the sentence type of the input text provided by the Memory Magic App being identified as a question and a sufficient number of tokens was parsed to provide value, the NLU Module shall identify if the intent of the question is about the last thing said (e.g., “What was I talking about?”).

REQ-4.3: Upon the sentence type of the input text provided by the Memory Magic App being identified as a question and a sufficient number of tokens was parsed to provide value, the NLU Module shall identify if the intent of the question is about the user’s location (e.g., “Why am I here?”).

REQ-4.4: Upon the sentence type of the input text provided by the Memory Magic App being identified as a question and a sufficient number of tokens was parsed to provide value, the NLU Module shall identify if the intent of the question is about the user’s notes (e.g., “Do I need to pick up eggs today?”).

REQ-4.5: Upon the sentence type of the input text provided by the Memory Magic App being identified as a question and a sufficient number of tokens was parsed to provide value, the NLU Module shall identify if the intent of the question is miscellaneous (e.g., “What is a baby goose called?”).

## Instruct App to Provide User Assistance

5.5.1 Description and Priority

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and the intent of the question has been identified as being about an app feature, the NLU Module shall instruct the Memory Magic App to direct the user to a dedicated support page for that feature with step-by-step instructions. Priority = High.

5.5.2 Stimulus/Response Sequences

Stimulus: The Memory Magic Application provides input text to the NLU Module and its sentence type has been identified as a question and the intent of the question has been identified as being about an app feature.

Response: The NLU Module instructs the Memory Magic App to direct the user to a dedicated support page for that feature with step-by-step instructions.

5.5.3 Functional Requirements

REQ-5.1: Upon the sentence type of the input text provided by the Memory Magic App being identified as a question and the intent of the question being identified as being about an app feature, the NLU Module shall instruct the Memory Magic App to direct the user to a dedicated support page for that feature with step-by-step instructions.

## Return Last Valid Input Text

5.6.1 Description and Priority

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and the intent of the question has been identified as being about the last thing said, the NLU Module shall return the last valid input text as output text. Priority = Medium.

5.6.2 Stimulus/Response Sequences

Stimulus: The Memory Magic Application provides input text to the NLU Module and its sentence type has been identified as a question and the intent of the question has been identified as being about the last thing said.

Response: The NLU Module returns the last valid input text as output text.

5.6.3 Functional Requirements

REQ-6.1: Upon the sentence type of the input text provided by the Memory Magic App being identified as a question and the intent of the question being identified as being about the last thing said, the NLU Module shall return the last valid input text as output text.

## Return User’s Location

5.7.1 Description and Priority

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and the intent of the question has been identified as being about the user’s location, the NLU Module shall query the GPS to determine the user’s location and return it as output text. Priority = Medium.

5.7.2 Stimulus/Response Sequences

Stimulus: The Memory Magic Application provides input text to the NLU Module and its sentence type has been identified as a question and the intent of the question has been identified as being about the user’s location.

Response: The NLU Module queries the GPS to determine the user’s location and returns it as output text.

5.7.3 Functional Requirements

REQ-7.1: Upon the sentence type of the input text provided by the Memory Magic App being identified as a question and the intent of the question being identified as being about the user’s location, the NLU Module shall query the GPS to determine the user’s location and return it as output text.

## Search User’s Notes to Find Answer to Question

5.8.1 Description and Priority

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and the intent of the question has been identified as being about the user’s notes, the NLU Module shall search the user’s notes to find an answer to the question. The NLU Module shall identify the user note whose tokenized data most closely matches the tokenized input text data and has a confidence interval (CI) of 60% or greater. Once the matching user note has been identified, the “questioning method” (e.g., who, what, when, where, why, how) of the question shall be identified so that the answer can be formulated grammatically to best answer the question. Priority = High.

5.8.2 Stimulus/Response Sequences

Stimulus: The Memory Magic Application provides input text to the NLU Module and its sentence type has been identified as a question and the intent of the question has been identified as being about the user’s notes.

Response: The NLU Module searches the user’s notes to find an answer to the question. To do so, the NLU Module identifies the user note whose tokenized data most closely matches the tokenized input text data and has a confidence interval (CI) of 60% or greater. Once the matching user note has been identified, the “questioning method” (e.g., who, what, when, where, why, how) of the question shall be identified so that the answer can be formulated grammatically to best answer the question.

5.8.3 Functional Requirements

REQ-8.1: Upon the sentence type of the input text provided by the Memory Magic App being identified as a question and the intent of the question being identified as being about the user’s notes, the NLU Module shall identify the user note whose tokenized data most closely matches the tokenized input text data (i.e., highest CI).

REQ-8.2: If no user note is identified whose tokenized data matches the tokenized input text data with a CI of 30% or greater, the NLU Module shall return output text to the Memory Magic App stating: “Sorry, but I could not find anything in your notes that matches your question.”

REQ-8.3: If at least one user note is identified whose tokenized data matches the tokenized input text data with a CI of 30% or greater but less than 60%, the NLU Module shall return output text to the Memory Magic App asking the user for confirmation (e.g., “Are you asking about picking up eggs tomorrow?”).

REQ-8.4: If a user note is identified whose tokenized data matches the tokenized input text with a CI of 60% or greater and has the highest CI overall, the NLU Module shall identify that user note as the source of the answer.

REQ-8.5: If a user note is identified as the source of the answer, NLU Module shall identify the “questioning method” of the question to best formulate the output text before it is returned to the Memory Magic App (e.g., Where? = location)).

## Search for Answer to Miscellaneous Question

5.9.1 Description and Priority

Given the sentence type of the input text provided by the Memory Magic App has been identified as a question and the intent of the question has been identified as being miscellaneous, the NLU Module shall make a web search with the input text and return the first search result as output text. Priority = Low.

5.9.2 Stimulus/Response Sequences

Stimulus: The Memory Magic Application provides input text to the NLU Module and its sentence type has been identified as a question and the intent of the question has been identified as being miscellaneous.

Response: The NLU Module makes a web search with the input text and returns the first search result as output text.

5.9.3 Functional Requirements

REQ-9.1: Upon the sentence type of the input text provided by the Memory Magic App being identified as a question and the intent of the question being identified as being miscellaneous, the NLU Module shall make a web search with the input text and return the first search result as output text.

## Identify Language Localization of Input Text

5.10.1 Description and Priority

Given the Memory Magic App provides input text to the NLU Module, the NLU module shall identify the language localization of the input text. If the language localization is not U.S. English, it shall be translated to U.S. English for internal NLU processing. Before the output text is returned to the Memory Magic App, it shall be translated from U.S. English to the identified language localization. Priority = High.

5.10.2 Stimulus/Response Sequences

Stimulus: The Memory Magic Application provides input text to the NLU Module.

Response: The NLU Module identifies the language localization of the input text and translates it to U.S. English for internal NLU processing. The NLU Module translates the output text from U.S. English to the identified language localization before it is returned to the Memory Magic App.

5.10.3 Functional Requirements

REQ-10.1: Upon the Memory Magic App providing input text to the NLU Module, the NLU Module shall identify the language localization of the input text (e.g., “Brazilian Portuguese”).

REQ-10.2: If the language localization of the input text is not U.S. English, the input text shall be translated to U.S. English for internal NLU processing.

REQ-10.3: If the language localization of the input text is not U.S. English, the output text shall be translated from U.S. English to the identified language localization before it is returned to the Memory Magic App.

## Return Grammatically Correct Output Text

5.11.1 Description and Priority

Given the NLU Module has determined the output text that shall be returned to the Memory Magic App, the NLU Module shall verify the output text is grammatically correct before returning it. Priority = High.

5.11.2 Stimulus/Response Sequences

Stimulus: The NLU Module determines the output text that shall be returned to the Memory Magic App.

Response: The NLU Module verifies the output text is grammatically correct before returning it.

5.11.3 Functional Requirements

REQ-11.1: Upon the NLU Module determining the output text that shall be returned to the Memory Magic App, the NLU Module shall verify the output text is grammatically correct before returning it.

# Nonfunctional Requirements

## 6.1 Performance

|  |  |
| --- | --- |
| NF-1.1: | The prompt for the user to speak shall appear in 1.5 seconds or less. |
| NF-1.2: | Upon confirming what the user said, the system shall only present the top 4 results. |

## 6.2 Safety

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| --- | --- |
| NF-2.1: | The application shall provide the user with an option to block offensive words. |

## 6.3 Security

|  |  |
| --- | --- |
| NF-3.1: | The application shall lock for at 10 minutes after 3 failed spoken passcode attempts. |
| NF-3.2: | The application shall provide users with options to clear or restrict their voice history to a specific timeframe. |
| NF-3.3: | Upon speaking the first voice command, the application shall ask the user whether or not they want their data to be shared with the application developer for analytics purposes. |

## 6.4 Quality

|  |  |
| --- | --- |
| NF-4.1: | The system shall ask the user if they meant to say something else if they misspeak or the system does not understand what they said. |

References:

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