Software Requirements Specifications

for

SIGN LANGUAGE RECOGNITION WITH MACHINE LEARNING (SLRWML)

Version 1.0

Prepared By:

Group ID: 202004

Batuhan BAYRAKTAR 201611007
Bersu OĞUZ 201611042
Numan SÜME 201615047
Öznur ÜSTÜNDAĞ 201611061

Due Date: 01 December 2020

Change History

The first version of this document was prepared on 11 November 2020 according the IEEE Std 830-1998, IEEE Recommended Practice for Software Requirements Specifications.

Preface

This document contains the sign language recognition with machine learning (SLRWML) Software Requirements Specification (SRS), a project that aims to facilitate communication with deaf people in a web-based environment and enable us to understand them better.

SLRWML SRS has been prepared according to IEEE STD 830-1998, Recommended Practice for IEEE Software Requirements Specifications [1]. This document includes product perspective, functions, user features, requirements, system assumptions and restrictions.

Table of Contents

1. Introduction

The following subsections are an overview of the entire Software Requirements Specification (SRS) document.

1.1 Purpose

This document has been prepared to explain briefly what is the "Sign Language Recognition with Machine Learning" and why it will be implemented. The required information will be investigated in subsections.

1.2 Scope

The sign language has been being used by the people who suffer from hearing loss. These people express themselves with a specific type of language which is called "Sign Language".[1] The sign language is like the other languages, each region has its own specific sign language like normal language. The common thing in sign language is that; each expression is stated with fingers and some arm movement.

The interest to sign language has been increasing with growing media. Today each TV series, news and movies have been using sign language to reach the deaf people or people who communicate with sign language. Thus, sign language stuff and similar applications have been being used widely nowadays.

The Sign Language Recognition has been providing to convert sign language to written language faster, safely and without human beings. Since it is not feasible technically to convert all media on the internet to written language from sign language, it will be useful to use an algorithm that does the same thing.

The software that will be prepared may use the dataset that is available on the internet but also it will be needed to generate some dataset. The sign language is used by many people, so it contains small differences for every person, the software should understand the difference and ignore it by machine learning algorithms.

The objectives of the project are:

- To convert the sign language that is perceived by camera to written language.
- To do conversion as much as faster.
- To do conversion truly,namely, it has to ignore expression not related with sign language-gestures-
- To generate meaningful sentences rather than putting all words side by side.
- To store user's type of speaking and understand words easily from personel speaking

1.3 Definitions, Abbreviations, Acronyms

AI	Artificial Intelligence
ML	Machine Learning
SLRWML	Sign Language Recognition with Machine Learning

1.4 References

[1] https://tr.wikipedia.org/wiki/İşaret_dili (Last Access : 30 November 2020)

1.5 Overview

This document had been prepared to give clear information about the software that converts sign language to written language. This document includes all technical detail and required specification for this purpose.

2. Overall Description

This section describes the requirements for SLRWML. To be easy to understand, this part of the SRS provides a basis for requirements. The detail definitions are mentioned in chapter 3.

2.1 Product Perspective

SLRWML is an application that has both a web interface and an app interface.

2.1.1 External System Interfaces

Since SLRWML is an independent system, there is no system interface with any other system.

2.1.2 User Interfaces

 SLRWML has 1 user, but there are 2 different interfaces according to the users' request.

Translation From Image To Sound And Text Interface

The user interface is designed for everyone. Therefore, the interface should be simple and convenient. In this interface, there is a screen at the bottom of the screen that detects and shows the user's movements, and there is a text box that converts these movements into a written text. Next to the text box there is a microphone sign. This sign will also enable you to hear the text aloud.

Translation from Text to Image Interface

The user interface is designed for everyone. There is a text box in this interface where you can enter text. At the top is a screen that translates the entry in this text box into sign language.

2.1.3 Hardware Interfaces

Server Side

The PC will have a 64 bit architecture. The computer will have a hard disk large enough to hold close to 1000 sign language data.

Client Side

Any phone or personal computer that can support any Windows environment with mouse support or run on android devices is acceptable.

2.1.4 Software Interfaces

Server Side

The developed application will be accessed using a web browser or by downloading it from the google play store. Approximately 1000 sign language information will be uploaded to a database.

Client Side

The required software product on the client side is an internet browser that supports at least HTML version 3.2, java enabled, camera enabled and any operating system that can run browsers.

2.1.5 Communication Interfaces

The default communication protocol for data transmission between server and the client is Transmission Control Protocol/ Internet Protocol (TCP/IP). At the upper level Hyper Text Transfer Protocol (HTTP, default port=80) will be used for communication between the web server and client.

2.1.6 Memory Constraints

SLWML will not use any additional resources. User's computer running the web browser or android phone must have enough physical memory to run this program.

2.1.7 Operations

The SLRWML operations that users need are explained below.

• Users will first see 2 different translation options. These are image-to-sound / text translation and image-to-text translation. By choosing one of these options, they will be directed to the relevant page.
• On the image-to-audio and text-to-text translation page, the user shows the words they want to tell in sign language and the computer detects it, then translates the detected word into text and displays it in the text box. Optionally, the texts in the text box can be translated into sound and listened.

• On the text-to-image translation page, users type the word they want to tell in the text box. Then, the sign language equivalent of this word is projected as an animation on the display screen.

2.2 Product Functions

The system has 1 different function for 1 different user group:
User: Chooses what kind of translate he wants to do, then writes or displays the inputs requested by the system.

2.3 User Characteristics

There will be 1 types of users:

User: The user must have a smartphone or web browser with an internet connection in order to use the SLRWML website. It also needs an android phone with internet connection in order to use SLRWML's application.

2.4 Constraints

The size of the hard disk should be close to 1000 data that the system wants to keep in memory.

2.5   Assumptions and Dependencies

Each user will have the appropriate hardware and software configuration specified in sections 2.1.3, 2.1.4, 2.1.5.

2.6   Apportioning of Requirements

Language usage requirements such as server type, communication type and secure connection should be determined. The problems that the user will experience in the application should be determined and appropriate solutions should be produced for them.

3. Specific Requirements

3.1 External Interface Requirements

There are no external interfaces for this system.

3.2 Functional Requirements

Assuming there is a pre-existing database of Turkish word and sign language gestures as animation. Users don't have to sign up or sign in. Applications will be available for everyone.

3.2.1 Image-to-Sound / Text Conversion Functions

Devices must have a camera for detection. The gestures which are detected via camera, will translate to text messages. For voice message, Devices must have a voice assistant such as Google Assistant or Siri. Text messages will be converted to voice via assistants.

3.2.2 Text to Image Conversion Functions

There will be two options for input. Users can write down as a text. Otherwise, the user can use the phone's voice assistant. After translation, output will be shown as animation on the screen.

3.2.3 Common Functions

There is just one type of user. So, all functions are common

3.3 Performance Requirements

We aim that people can use it in daily life. Because of that, translation should take less than 5 second.

3.4 Security Requirements

The security is provided using HTTPS over SSL protocol for secure communication between the client and the server. Also, secure network protocol TCP/IP protocol in SQL Server will be used.

3.5 Design Constraints

No planning was made about that section.

3.6 Software System Attributes

Functionality: Application is designed to translate sign language to human language and human language to sign language.

Reliability: Apllication will work properly for every OS system on mobile phones.

Security: Users are not allowed to reach the database directly, so data will be saved in this way. User information will not share with 3th party applications.

Safety: Safety will be covered by using TCP/IP on the network side.

Performance: Translation should take less than 5 second.

Flexibility: Responsive web design (RWD) will be used in GUI design. RWD is an approach that makes web pages render well on a variety of devices and window or screen sizes.

Scalability: Application is designed to cover the needs of all users.

Portability: The system works on all operating systems.

Availability: As long as there is access to the internet, there will be access to the application without any interrupts.

Usability: GUI will be designed to make users comfortable and familiar with the application. Every type of human can easily use applications. GUI will be mapped according to that.

Maintainability: Application will be updated according to coming feedback from users and improving the word database of application. Database will be backed up monthly in case of data loss.

3.7 Other Requirements

Users must have a mobile device for using the application. Applications must be installed on mobile phones. For database connection, Mobile devices have to have internet connection. Users should know basic phone usage.

4. References

[1]   https://standards.ieee.org/standard/830-1998.html
[2]   https://www.cse.msu.edu/~cse870/IEEEXplore-SRS-template.pdf