Hazard Analysis
Software Engineering

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Table 1: Revision History

Date	Developer(s)	Change
Oct 17 2022	Jeremy	Added 2 FMEA table entries related to web application hazards
Oct 17 2022	Andrew	Added Camera FMEA table entry
Oct 17 2022	Jeremy	Added 2 more FMEA table entries related to web application
Oct 17 2022	Stanley	Rearranged some FMEA table entries, added computer vision table entries
Oct 18 2023	Edward	Added sections 1, 2, 3, 4
Oct 19 2023	Everyone	Finished Section 6 and 7
Jan 23 2024	Cassidy	Addressed git issue #35 and #38 regarding system boundaries and typo

Contents

1 Introduction

This document aims to outline and analyze the potential hazards of ASLingo. A hazard can be defined as a system state or set of conditions, often arising from inherent risks or software anomalies, that, when coupled with particular worst-case environmental conditions or unexpected interactions, can lead to a loss or adverse outcomes. This embodies potential sources of harm due to software failures, bugs, or undesired system behavior, emphasizing proactive identification and mitigation to ensure software safety and functionality.

2 Scope and Purpose of Hazard Analysis

Hazard analysis is a fundamental aspect of the software development process, crucial for preventing losses or adverse outcomes that are undesirable for any product. It involves identifying areas where hazards may arise and determining steps to either reduce or eliminate their effects, making it an important part of the development journey. This analysis is closely tied to the safety and security requirements of the software. Ensuring these requirements are well met significantly contributes to enhancing the software's reliability, making it a more dependable product in the long run.

3 System Boundaries and Components

ASLingo's system will involve the following components:

1. A camera to allow for user input
2. A web frontend to provide user interface and authenticate user login
3. A backend to process software logic
4. A machine learning model to interpret user hand signs

The system boundaries of ASLingo include our web application with the user's camera input, our machine learning model which is trained to learn hand signs, and our back and front end systems that will allow our model to interact with the user's inputs. Due to the limitations of these parts of our system, these may cause hazards to occur or cause our system to not function as intended, so these components of our system will be explored further in this document.

4 Critical Assumptions

1. Assume users are using ASLingo for its intended purpose
2. Assume users are able and willing to follow safety instructions

5 Failure Mode and Effect Analysis

Table 2: Failure Mode and Effect Analysis

Design Function	Failure Modes	Effects of Failure	Causes of Failure	Recommended Action	SR	Ref.
User authentication	Invalid credentials	User cannot log in to system	User error or improperly saved data	Reset credentials and inform user	WAR1	H1-1
Database Access	Database is inaccessible	User cannot view progress or stored personal data	Database connection failure	Display static error page and await database backup/restoration	WAR2	H2-1
Working Application	Error state	User cannot view any pages, progress, and account	Major system failure due to bugs	Display static error page and await application restoration	WAR3	H3-1
Camera	Visual feed is unable to be captured	User's sign cannot be perceived by the device	Poor Lighting Conditions	Instruct user to adjust their environment lighting or move to environment with sufficient lighting	HR1	H4-1
	Physical defect that impairs operation		Cracked/Filthy camera lenses	Notify user that camera lenses appear to be inoperable	HR2	H4-2
Machine Learning Model	Model fails to process/recognize camera input	User sign input cannot be processed accurately/correctly	Hand sign motions are too fast/slow	Interrupt the user and inform user to adjust hand sign motions accordingly	CVR1	H5-1
		Sign recognition works with group members and stakeholders, but fails when a new user uses the application	Model is trained on a specific set of training data and tested on a specific set of people (developers and stakeholders)	Rigorous testing on multiple testing sets and on users not affiliated with the project to ensure hands with varying qualities can be recognized	CVR2	H5-2

6 Safety and Security Requirements

6.1 Web Application Requirements

WAR1. The system shall send a reset link to a user credientals for a registered email which will reset and allow the user to create a new password

WAR2. The system shall create a daily backup of stored data that will be recreated daily to backup any lost data

WAR3. The system shall notify users of any expected downtimes for upgrades and be locked out of account until complete

6.2 Hardware Requirements

HR1. The system shall inform the user that the camera requires better lighting in their environment if there not enough currently

HR2. The system shall inform the user that the camera is inoperable

6.3 Computer Vision Requirements

CVR1. The model will be trained on multiple sign language data sets from varying sources and characteristics

CVR2. The system will notify the user if it is unable to detect signs due to motions being too fast or slow

7 Roadmap

After careful consideration and reassessment, we see that there are many new requirements for us to take into consideration that weren't initially apparent when writing the Software Requirement Specification. Ideally, we will aim to implement every safety requirement, but realistically when taking into account time constraints, those requirements that are strictly necessary for system functionality may be the only ones that get implemented. Primarily, we will be focusing in on the WA and CV requirements, with a majority of the effort being channeled into the CV requirements since that is the main basis that will be providing the functionality for sign recognition. The hazard analysis will be used as a reference throughout the development process and may be amended when necessary in the future.