Engineering Design Specification

Document Number	Project Title
0.2	Glasses for the Visually Impaired

Revision History

Revision Level	Description of Revision	Person	Date
0.1	Functional and non-functional specifications for DPR2	Waleed Ahmed	July 16, 2021
0.2	Reduced scope of the project based on Bluetooth constraints, can no longer do everything purely offline. Split requirements up into subsections for better organization. Added a few extra software and hardware requirements.	Waleed Ahmed	August 5, 2021

Intended Application:

The design is intended to perform accurate optical character recognition and convey the results effectively through audio for the visually impaired population

Requirements Specification:

1 General

No.	Characteristic	Relation	Value	Units	Verification Method	Comments
1.1	The design shall extract, decode, and communicate text from an image to a visually impaired user through audio transcription.				Demonstration, Test	Primary function.
1.2	The design shall be inexpensive for users to purchase.	<	200	USD	Analysis	Primary constraint.
1.3	The glasses must be connected to the internet using WiFi.				Demonstration	Functional constraint. Internet connection is required to offload OCR processing.
1.4	The glasses must be connected to the iOS device using Bluetooth.				Demonstration	Functional constraint. Bluetooth connection is required to offload text to speech processing.

1.5	The iOS device needs to be in close proximity to the glasses at all times.	Demonstration	Functional constraint. Necessary for Bluetooth communication.

2.1 Software - General

No.	Characteristic	Relation	Value	Units	Verification Method	Comments
2.1.1	The design's user interface (UI) and user experience (UX) shall be optimized for accessibility.				Demonstration, Test, Expert Opinion	Functional requirement. Expert opinion will come from an assistive technology instructor.
2.1.2	The backend server that performs OCR processing must have sufficiently high uptime.	=	99	%	Test, Analysis	Non-functional requirement.

2.2 Software - iOS

No.	Characteristic	Relation	Value	Units	Verification Method	Comments
2.2.1	The iOS app shall be capable of pairing with the glasses using Bluetooth.				Demonstration, Test	Functional requirement.
2.2.2	The device shall be able to communicate with a locked iOS device using Bluetooth Low Energy (BLE).				Demonstration, Test	Functional requirement.
2.2.3	The iOS device shall perform text to speech synthesis when locked.	<	15	sec	Demonstration, Test	Functional constraint. Enforced by Apple to complete processing in 15 seconds for a background task initiated by a BLE device.

2.3 Software - Artificial Intelligence

No.	Characteristic	Relation	Value	Units	Verification Method	Comments
2.3.1	The machine text OCR algorithm shall have a Word Error Rate (WER) on a custom test set.	<	10	%	Test, Analysis	Non-functional requirement.
2.3.2	The text-in-the-wild OCR algorithm shall have an F-score on a custom test set.	>	60	%	Test, Analysis	Non-functional requirement.
2.3.3	The device shall communicate the OCR model uncertainty about its current prediction.				Demonstration, Test	Non-functional requirement.

3 Hardware

No.	Characteristic	Relation	Value	Units	Verification Method	Comments
3.1	The glasses shall have a physical button that can be pressed to initiate the OCR processing pipeline.				Demonstration, Test	Functional requirement.
3.2	The glasses shall include a small piezoelectric buzzer that can play sounds to give feedback to the user.				Demonstration, Test	Non-functional requirement. The buzzer can be used to indicate an error has occurred, or processing is currently being done.
3.3	The device shall have an operating device voltage.	=	5	Volts	Test	Functional requirement.
3.4	The device shall have a maximum current draw from the battery.	≤	250	mA	Test	Functional requirement.
3.5	The piezoelectric buzzer shall have a maximum current draw.	≤	10	mA	Test	Functional requirement.
3.6	The device shall have a power source that allows it to run for a usable period of time.	≥	4	hours	Analysis, Test	Non-functional requirement.

4 Safety & Regulatory

No.	Characteristic	Relation	Value	Units	Verification Method	Comments
4.1	The device shall not have exposed any electrical components that may harm the user.				Demonstration, Examination	Non-functional constraint.
4.2	The device shall inform the user if any error occurs.				Demonstration, Test	Non-functional requirement.
4.3	The design shall have a fail-safe mechanism that prevents loss of device in the case it falls from the user’s face.				Demonstration, Test	Non-functional requirement.