DOCUMENT READING SYSTEM FOR BLIND PEOPLE ("READING EYE")

19-20-J 17

Software Requirements Specification

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September 2019

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(SRS documentation submitted in partial fulfilment of the requirement for the Degree of Bachelor of Science Special (honors) In Information Technology)

BSc. Special (Hons) in Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology

Sri Lanka

September
2019

DECLARATION

We declare that this is our own work and this SRS does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The supervisor/s should certify the SRS report with the following declaration.

The above candidate is carrying out research for the undergraduate dissertation under my supervision.

…….. …..…...…….……

Signature of the supervisor Date

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Signature of the co-supervisor Date

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1 Introduction

1.1 Purpose

The purpose of this document is to provide a clear view of the project to all the stakeholders. This document contains details regarding the design and implementation aspects of the project. This gives a clear understanding of the specifications of the project, its technical elements, functions, and requirements. Also, the stakeholders can get a clear understanding of the proposed device's dependencies, limitations, and specialties through this document.

1.2 Scope

This project is proposed with the intention of providing a sophisticated, convenient and practical solution to the problems that visually impaired people face when they are reading printed documents. There are many problems that visually impaired people encounter while reading printed documents. High levelly some of those problems can be pointed out as, not being able to read images, charts, tables and equations in a printed document. Though reading apps for blinds are available in the market nowadays, their focus is mainly on reading text-based content. For other types there are no applications available. Besides, existing applications cannot read printed documents. They can read only documents like PDFs and other electronic formats. Hence, these applications cannot be used to read documents such as books, brochures, booklets, and bills which a person has to read usually.

The proposed device is an all in one solution for all above-mentioned problems and more. It will be capable of reading images, charts, tables, equations, and text-based content. The proposed system utilizes the Cloud Computing technologies along with Deep Learning (DL) techniques to process data and uses cross mobile platform to present the outcome to the end-user. Moreover, the Optical context of character recognition (OCR) will be used with natural language processing (NLP) to identify characters in a digital image and form cohesive descriptions. The final outcome will be an audio file of the generated descriptions which will be created using a text-to-speech API. Furthermore, the security of the mobile application will be enhanced especially through compression and encryption algorithms. Initially before uploading photos to the cloud, they will be compressed to reduce the size of the files. Reduction of the file size will help to transfer the files to the cloud easily and more quickly as small files

get transferred through the network more easily. Other than that, the uploading files will go through an encryption algorithm with the purpose of enhancing security of the files. After enhancing, it will be difficult to read or modify the files in the application.

Since the application will be developed for blind users, the instructions for users to use the app will be given through audio as audio narration is the best way to communicate with the users. Sighted users can use the app as usual as they use any other app. Therefore, the application will be implemented with features to accommodate both types of users.

1.3 Definitions, Acronyms, and Abbreviations

Term	Definition
Reading-Eye	The name of the proposed system
Convolutional Neural Network	A specific type of artificial neural network that used to analyze data
TensorFlow	Open-source machine learning framework by google
Keras	High-level neural networks API which runs on top of TensorFlow
Azure	Microsoft cloud computing services
Tesseract OCR	Open source optical character recognition engine
Natural Language Processing	Artificial Intelligence-based component which makes computers to read the text, hear speech, interpret it, measure sentiment and determine which parts are important.
OpenCV	The library used for Image Processing
LetNet Architecture	A latest convolutional network designed for handwritten and machine-printed character recognition.
SoftMax Identification Function	A function that takes as input a vector of K real numbers, and normalizes it into a probability distribution consisting of K probabilities proportional to the exponentials of the input numbers.

Table 1: Definition for the terms used in this SRS

Acronym/Abbreviation	Definition
SRS	Software Requirement Specification
IP	Image Processing
ML	Machine Learning
DL	Deep Learning
CDAP	Comprehensive Design & Analysis Project
RI	Region Identification
RTBC	Reading of Text-Based Content
CFAO	Creating Final Audio Output
UI	User Interface
UCS	Use Case Scenario

EUI	External User Interface
MTBF	Mean Time Between Failures
CEBCRD	Charts and Equations based contents Reading and Detection
API	Application Programming Interface
OCR	Optical Context of character Recognition

Table 2 : Glossary of Acronyms

1.4 Overview

There are 249 million visually impaired people in the world according to the World Health Organization (WHO). And out of that 39 million are legally blind. According to WHO, the visually impaired people as a ratio is higher in developing countries [1]. Visually impaired communities in countries like Sri Lanka are often ignored and not well looked after by the government bodies. Since Sri Lanka is a developing country, most people who are blind or visually impaired are also not that much wealthy and cannot help themselves too. Therefore, this project is proposed as an action towards helping the visually impaired and as a start for raising awareness about our responsibility towards the visually impaired people.

As mentioned before there are many problems that the visually impaired people encounter while reading printed documents. To read and write they normally use Braille coding system which was introduced a very long-time age. It was the best method for them to achieve literacy. Although many methods were introduced, Braille was the most practical method to use. Because in the Braille method, person has to touch the raised dots in a document in order to read. People have to memorize the specific code for each character or symbol. Since the primary method is touch, it worked well for them so far. While it is a practical and convenient method for reading, it has some certain limitations too which cannot be solved using Braille alone. For example, the average reading speed of a person who uses Braille is about 125 words per minute, but greater speed can be up to 200 words per minute. The average reading speed of most adults (sighted) is around 200 to 250 words per minute. Clearly, there is a significant difference between the two average reading speeds for both types. Not only slow reading time but inaccessibility of the Braille materials is also a major problem. Though there are many software applications and hardware tools available in the market nowadays, they do not solve all the problems these users have. Besides most of these apps and devices are expensive and many people cannot afford them.

The proposed system will be an all-in-one solution to these problems blind users have when reading. They can use the system read any kind of document they find when completing their daily tasks.

1.4.1 Tasks of the system

The main task of the system is to focus the visually impaired user to read contents of various document types and books which contains texts, graphical images, charts, mathematical equations and tables without any impediment. The following components work together to provide this experience to the user.

i) Region Identification, Reading of text-based content & audio generation

ii) Reading and detecting images-based contents and tables-based contents.

iii) Reading and detecting charts-based contents and equations-based contents.

iv) Enhance security and Encryption.

The detailed description of each component will be given in chapter 2 and chapter 3 accordingly with relevant tables and diagrams.

1.4.2 Main Goals

- The main goal of the proposed system is to facilitate visually impaired people to read printed documents that are not written using the braille system and help them to improve their reading capability as normally sighted people.

1.4.3 Specific Goals

The specific goals for each component are as follows:

Region Identification, Reading of text-based content & audio generation

- Analyze captured photos and auto-rotate the image in the actual direction and identify where the captured image should be in the actual position.
- Make the single command to start analyzing and make the option after analyzing the document
- Start the auto play and make the user listen to the audio of the document.
- Identify text, images, charts, tables, and the equations uniquely and create another digital image for different identical matches.
- Identify language patterns and create a detailed description in the text.

Reading and detecting images-based contents and tables-based contents

- Read images and tabular data in any kind of printed document which contains tables.
- Increase the accuracy of reading and reduce the time it takes to identify and analyze the contents of printed documents.

Reading and detecting charts-based contents and equations-based contents

- Identify and detect the chart-based contents separately by chart type, size, color and the resolution of the chart and make a detailed description according to the identified content.
- Identify and detect the mathematical equations-based contents separately by the numbers, variables, and operators contained in the equations and make a detailed description according to the identified content.

Enhance the security and Encryption

- Enforce the security of the system by implementing an algorithm to lightweight the images before sending it to the cloud and make the system efficient in transferring data.

1.4.4 Users

The user segmentation for the proposed mobile application would be mainly based on three categories as psychographic, geographic and demographic. When considering psychographic segmentation, it is mainly considered about the visually impaired people who have partial or complete blindness.

Therefore, system features will be developed to make vision impaired person's reading experience easier and more comfortable. Although it is mainly for vision-impaired people, with its high-quality features and functions it will be suitable for any person who prefers to read documents by listening to the audio. Hence, any person who wishes to read printed documents by listening can be considered to be the user of the proposed product.

The initial target market based on geographic segmentation would be Sri Lanka. The financial statuses of the users are considered under demographic user segmentation. This product mainly

focuses on providing a cross-platform mobile application that would help the user to improve their reading ability in a friendly manner.

1.4.5 Organization of SRS

The flow of the document starts with Introduction, the first part of the SRS, which gives a brief knowledge about the entire software product. This includes the purpose of the document, scope, intended audience and finally the overview of the product which includes the users, objectives and the reading suggestion as well. The Overall description of the document presents a complete idea about the product, which is listed as the second part of the document. Details about user interfaces, hardware interfaces, software interfaces, and communication interfaces can be found in this section. The problem and the solution of identified for the domain are also discussed under this section along with product functions, constraints, user characteristics and assumptions made for this system.

The proposed system's non-functional requirements such as reliability, availability, security and maintainability quality attributes and the detailed description of external interfaces for developers' understanding are illustrated under chapter three, Specific requirements. This chapter includes other requirements that will be considered in future versions of the system.

All the sections in the document are numbered accordingly and framed into partitions of headings and contents for reading conventions. The document is written in Times New Roman font where headings are in bold and font size is set to 14, which gives higher priority and makes map reading easy. The content under each heading is in font 13 size 12 with 1.5 line spacing and aligned justified. The headings under each section are inherited by detailed contents. The document contains diagrams and tables to provide more information with clarity. Additional diagrams can be found in appendixes which have been referred to in the main content area.

2 Overall Descriptions

Vision impaired people use Braille codes when reading and writing. Finding materials that are written in Braille format is quite hard because the majority of the books and other documents typically are not written in Braille. Even if one finds a book written in Braille format that will also only text-based content. The situation is even worse when it comes to mathematical and scientific books as they contain a lot of charts, equations, and tables. Designing a science, mathematics or engineering book is a tedious task because of this reason. Besides, those books are too expensive and take up lot of space. Since mathematics or scientific books are usually around 500-1000 pages or more, Braille format of the same book will get larger than that size. Using that kind of large book is not an easy and practical thing especially for blind users. Therefore, in such a situation, anyone will prefer to have a proper document reading system that acts promptly. Due to the major development of modern technology, there are many existing document reading apps are available for visually impaired people. However, the majority of software applications developed to detect and analyze text contents but most of them cannot detect image-based contents and table-based content or any other type such as charts and equations. Therefore, vision-impaired people cannot use these applications for reading tasks. The proposed system is our solution to the mentioned problem. As it can read any type of content in a printed document. The proposed system is divided based on the content type of the document.

2.1 Product Perspective

Reading-Eye is a comprehensive type of a document reading application which targeted to resolve the impediments of the visually impaired people. Most of the available existing applications provide minimal solutions when compared with the proposed system.

The proposed system will fulfill the major gap in existing solutions in the market. Amazon Kindle, BARD Mobile, KNFB Reader [2],[3],[4], Capti Voice [5], Schmoozer [6] are the some of the existing applications in the market which related to the proposed system.

Below is the identified comparison of the proposed system features and the previous systems features.

Region Identification, Reading of text-based content & audio generation

Features	Schmoozer	Reading-Eye
Smooth Real-Time Analysis	No	Yes
Using CNN for the detect the regions	No	Yes
Voice commands	Yes	Yes
Voice output speed can change	No	Yes
Voice output profile	No	Yes
Recent document saving	No	Yes
Using cross-flatform mobile application	No	Yes

Table 3: Existing products comparison 1

Reading and detecting images-based contents and tables-based contents

Existing Products / Features	Amazon Kindle	BARD Mobile	Capti Voice	KNFB Reader	Schmoozer	Reading Eye
Image based contents identification and reading	✗	✗	✗	✗	✓	✓
Table based contents identification and reading	✗	✗	✗	✗	✗	✓
File size reduction for effective communication	✗	✗	✗	✗	✗	✓
Audio narration	✓	✗	✓	✓	✓	✓

Table 4: Existing products comparison 2

Reading and detecting charts-based contents and equations-based contents

Existing Product / **Features**	Amazon Kindle	BARD Mobile	Capti Voice	KNFB Reader	Schmoozer	**Reading-Eye (Proposed System)**
Equations based contents Identification and Reading	✗	✗	✗	✗	✓	✓
Charts based contents Identification and Reading	✗	✗	✗	✗	✗	✓
Images' size reduction for efficient Communication	✗	✗	✗	✗	✗	✓
Voice output	✓	✗	✓	✓	✓	✓

Table 5: Existing products comparison 3

Enhance the security and Encryption

Product ---------- **Features**	Amazon Kindle	BARD Mobile	Capti Voice	KNFB Reader	Schmoozer	**Reading Eye (Proposed System)**
Text Identification and Reading	✓	✓	✓	✓	✓	✓
Charts Identification and Reading	✗	✗	✗	✗	✗	✓
Voice Input (As Command)	✗	✗	✗	✗	✗	✓
Voice output	✓	✗	✓	✓	✓	✓
Cloud Storage	✗	✗	✗	✗	✓	✓
Client-server communication data security	✗	✗	✗	✗	✗	✓
Images' size reduction for efficient communication	✗	✗	✗	✗	✗	✓

Table 6: Existing products comparison 4

2.1.1 System Interfaces

The mobile application will once communicate with the cloud server whenever the driver enters the destination and preferred route, which will retrieve the appropriate dataset to the mobile device. The data gathered from the real-time detection module will also be stored in the cloud for further processing.

- Azure VMs

  Runs the server which centralizes all communications.

- Azure Storage

  Stores the collected dataset from the users and also for any dataset used for the preparation at the inception of the component.

- Azure Text to Speech

  Convert text to audio in near real time, play it back.

2.1.2 User Interfaces

Figure 1: User Interfaces 1

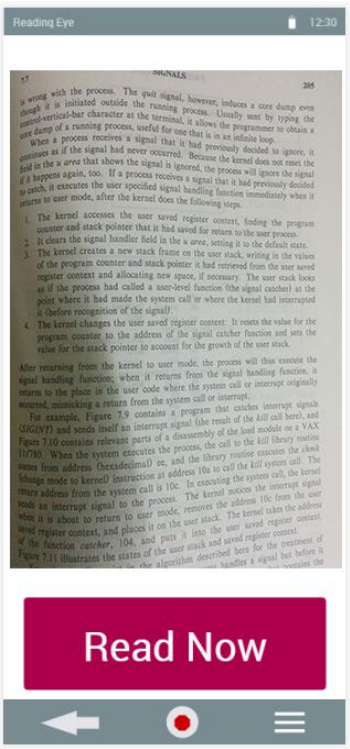

Figure 2: User Interfaces 2

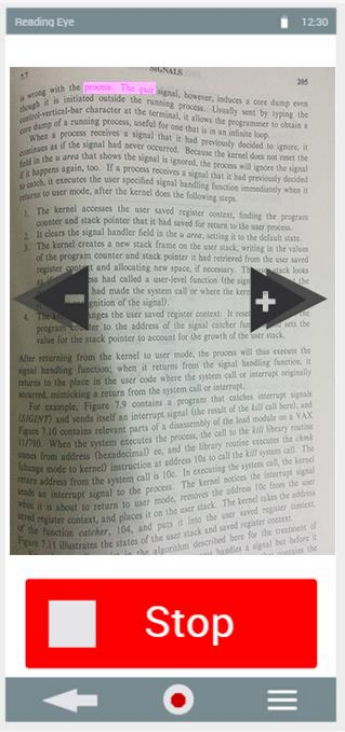

Figure 3: User Interfaces 3

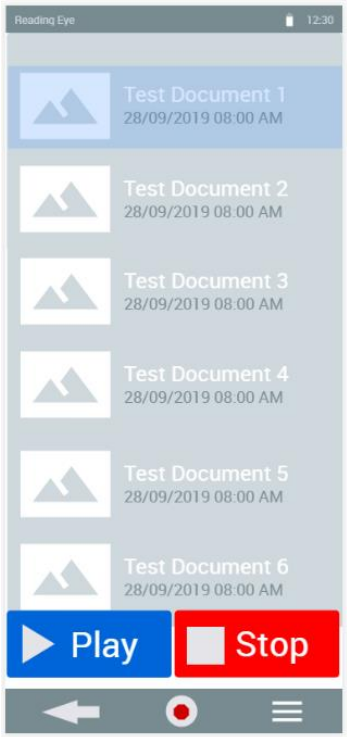

Figure 4: User Interfaces 4

2.1.3 Hardware Interfaces

No special hardware is required for the end-user. A smartphone with a decent 8MP rear-camera is sufficient to get the required information.

2.1.4 Software Interfaces

The mobile app mainly requires an Operating System. There are two option to end-user.

- Android 4.1(API 16) or above version
- IOS 9.0 or above version

Text to Speech SDK Release version 1.3.1 or above.

2.1.5 Communication Interfaces

The application requires an active internet connection as Wi-Fi connection or mobile data connection.

2.1.6 Memory Constraints

350MB of space is required to install the application with 1.5GB of memory to run it effectively to run the all modules in parallel and 250MB of cache memory for all required for all modules.

2.1.7 Operations

- The first step is installing the application to the mobile. Since this is a cross-platform mobile application. It consists two methods as,
    - Android devices – “Reading-Eye” application from Play store
    - iOS devices – “Reading-Eye” application from App store
- User must capture the photo from the smart phone real-camera. If success the capture success massage delivers true the voice.
- Final step is the analyzing document. User can “Analyze now” voice command to start analyze the captured document.
- After the analyzation audio will Play automatically. Therefore, end-user can listen to the audio, at the sometime user can change the audio speed as their preference.

2.1.8 Site Adaptation Requirements

User does not need any configuration to use the application. After installing the mobile application properly, it will detect the mobile phone real-camera automatically and do all the configurations on its own.

2.2 Product Functions

2.2.1 High Level Diagram of overall Module

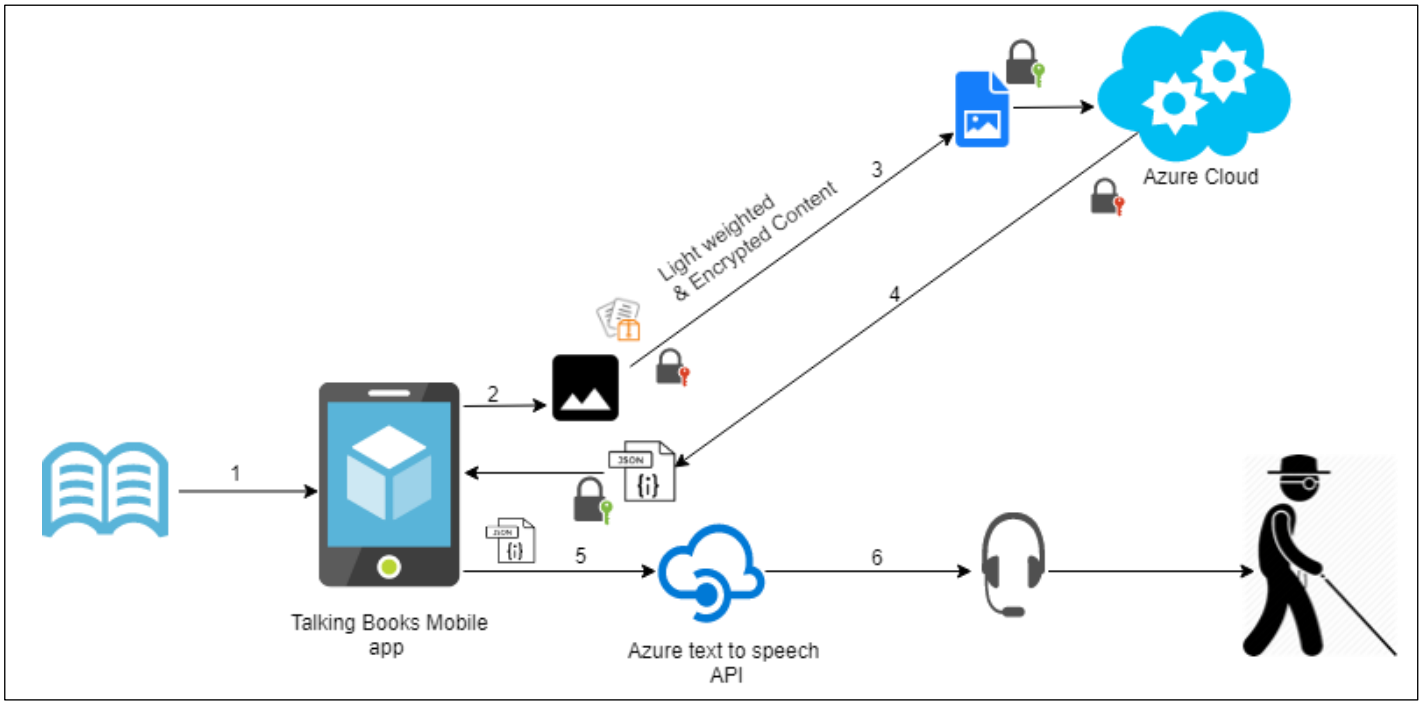

Figure 5: High Level Diagram for overall System

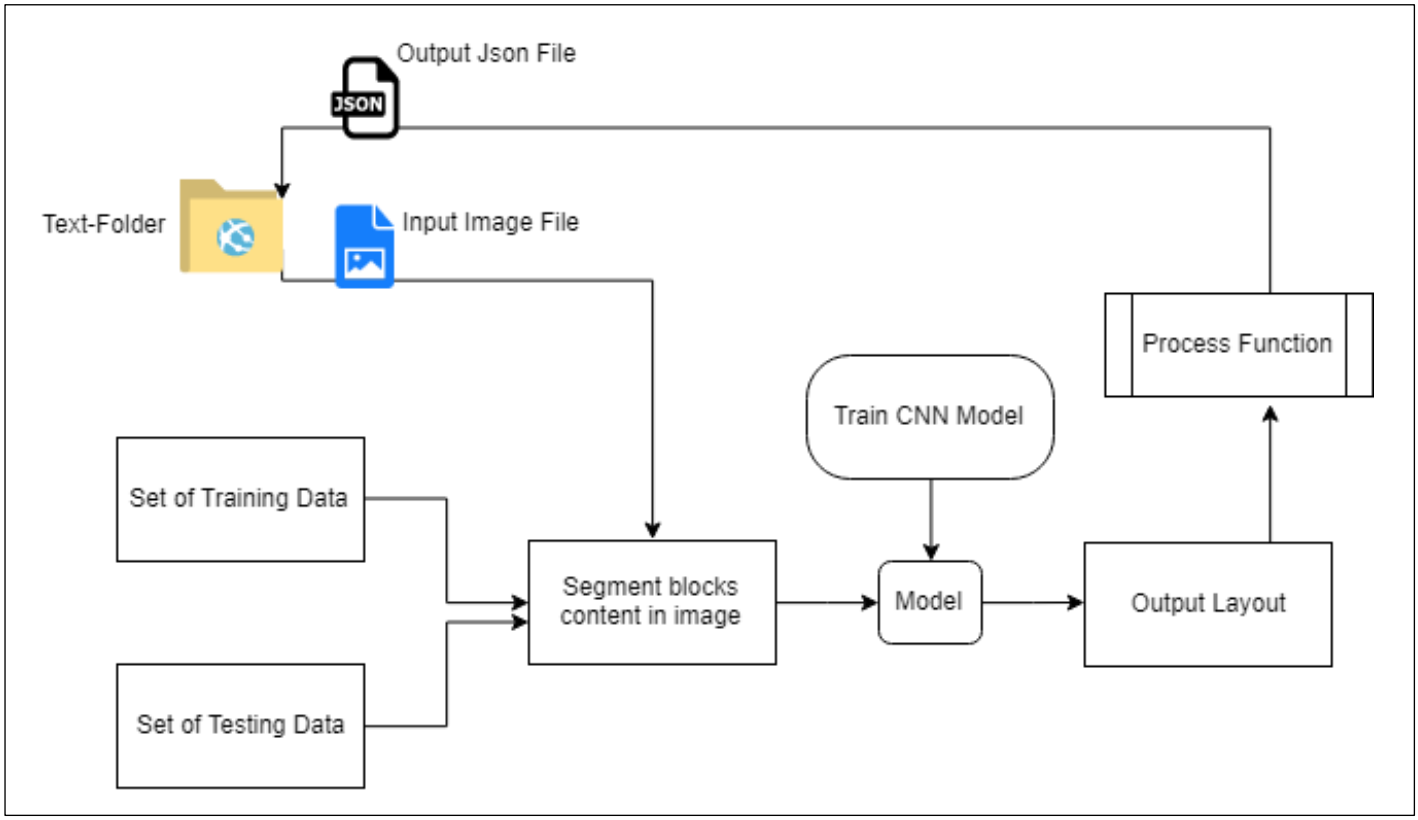

Figure 6: High Level Diagram for RTBC Module

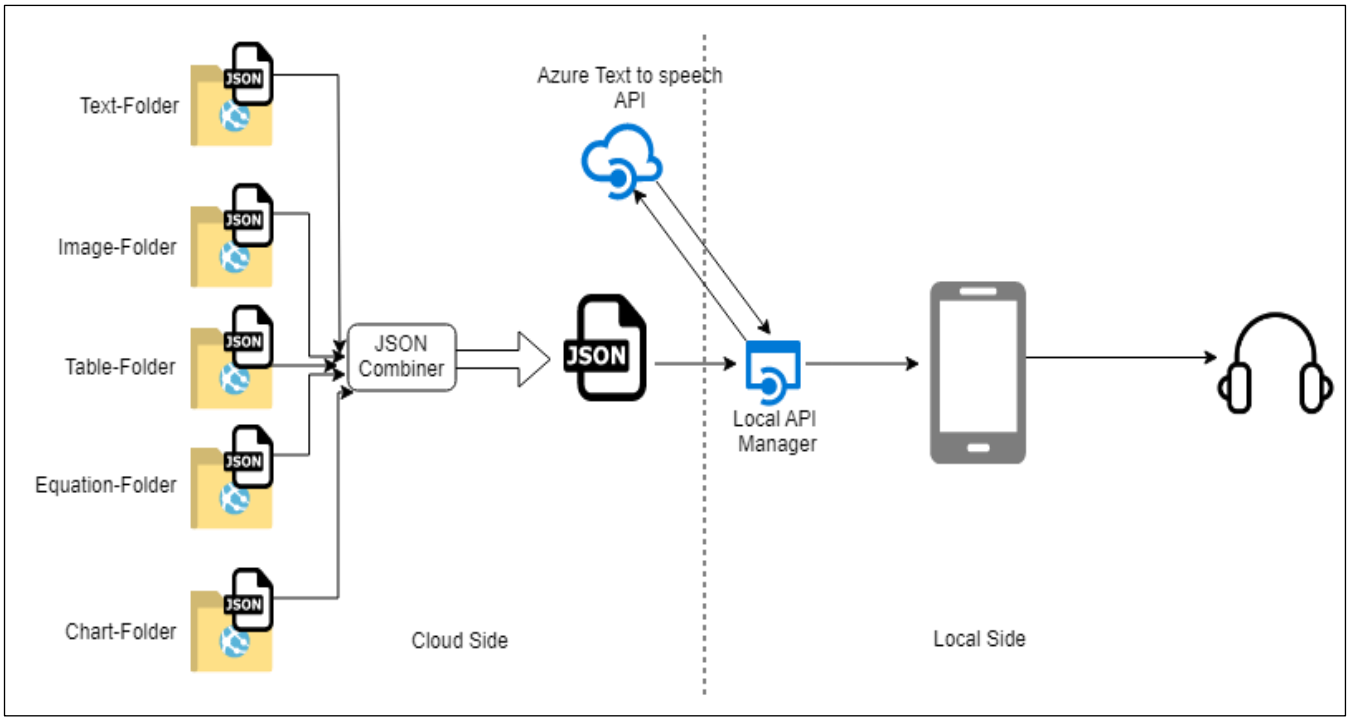

Figure 7: High Level Diagram for RI and CFAO Modules

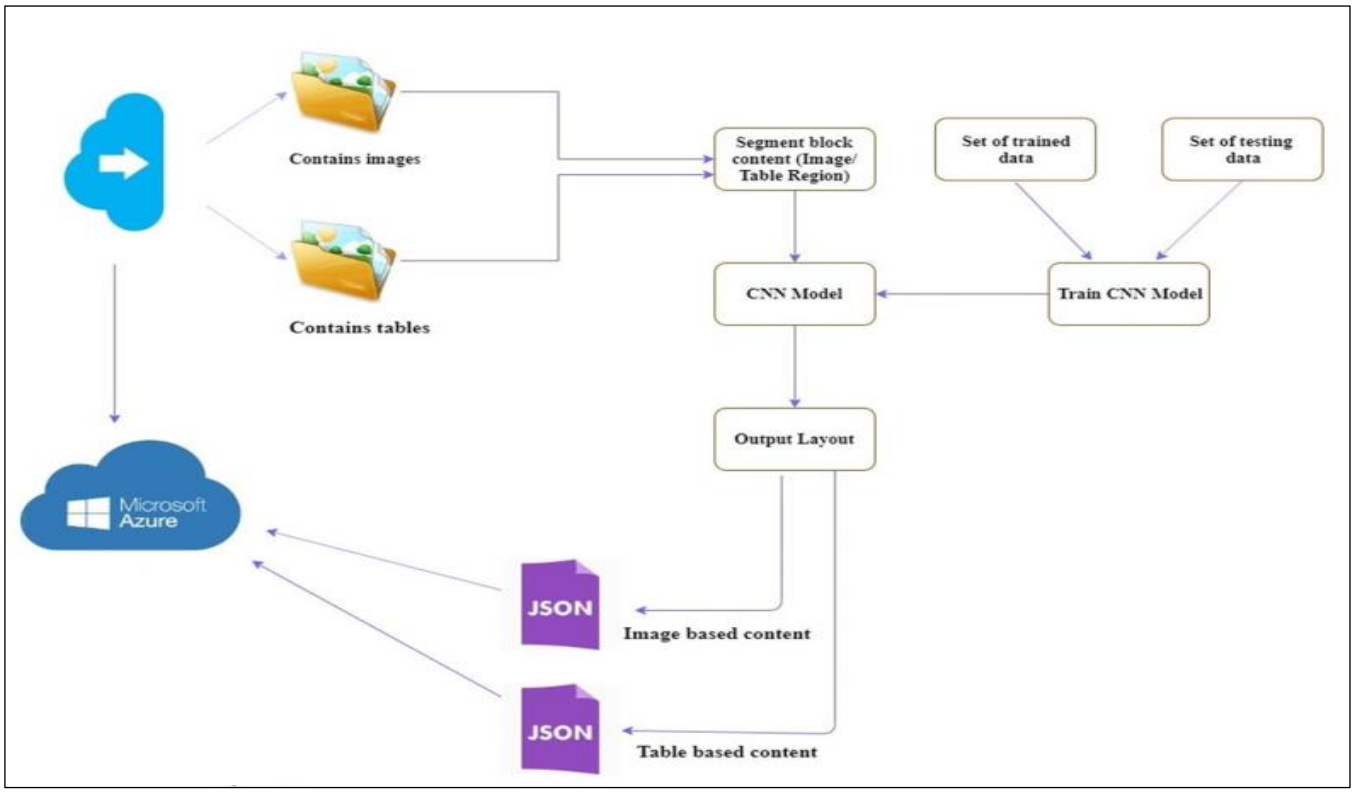

Figure 8: High Level Diagram for ITR Module

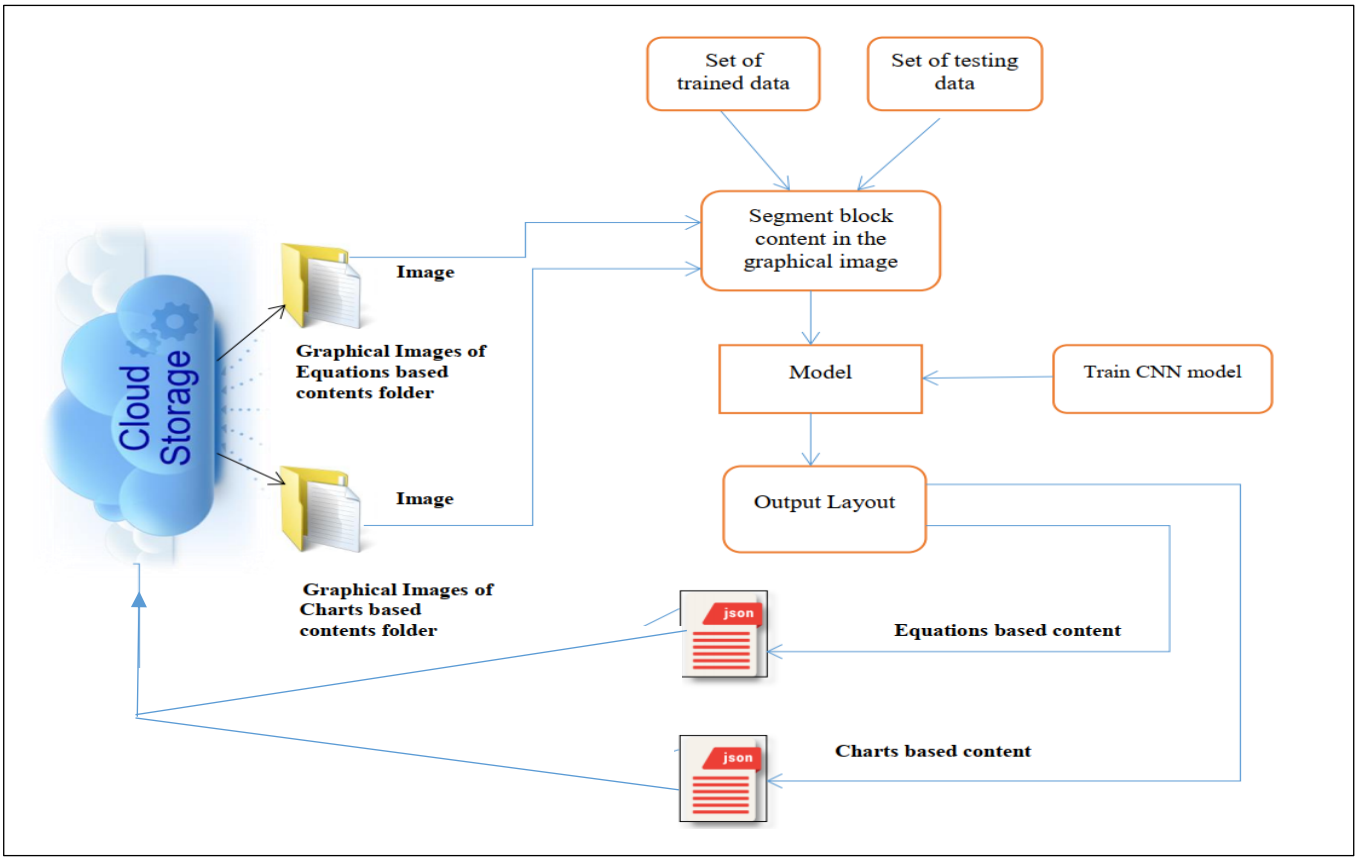

Figure 9: High Level Diagram for CEBCRD Module

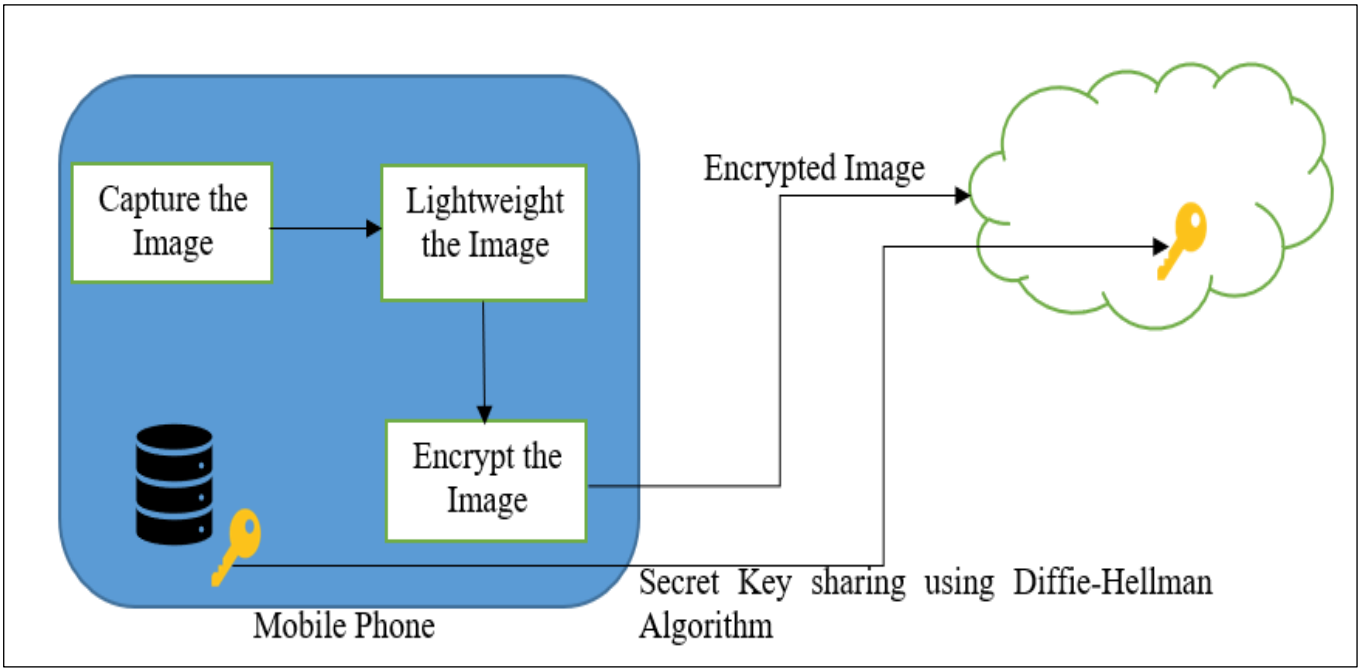

Figure 10: High Level Diagram for Security Module

2.2.2 Use case diagram for RI, RTBC and CFAO Modules

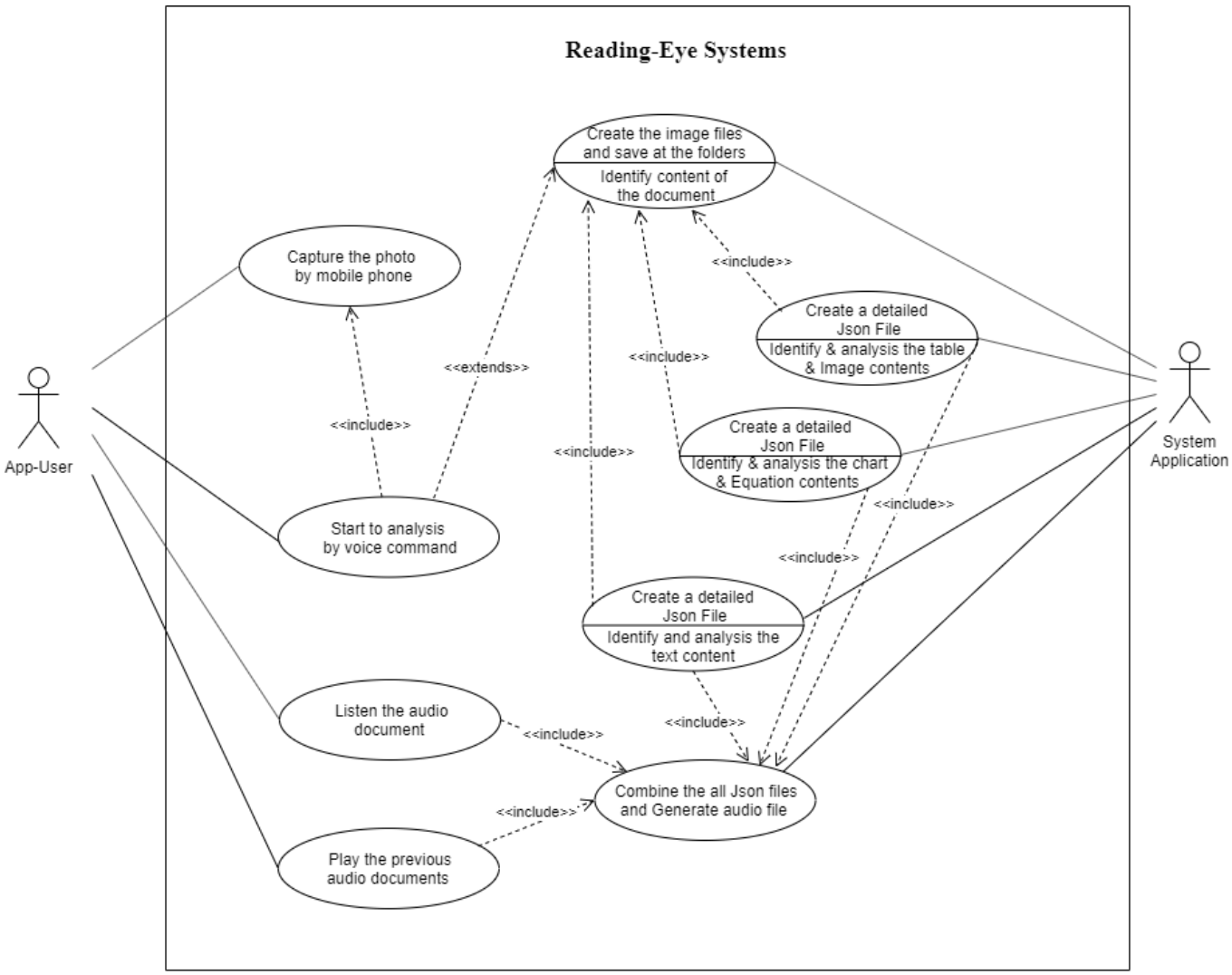

Figure 11: Use case diagram for overall System

2.2.3 Use case Scenarios for RI, RTBC and CFAO Modules

Use case ID	RI_UCS_1	
Use case name	Capture the photo	
Goal in context	Capture the photo on smart phone by the application user	
Pre-condition	None	
Post-condition	Voice command by the application user	
Primary actor	Application user	
Secondary actor	None	
Main flow	**Step**	**Action**

	1	The use case begins when Application user open the application and automatically opened the camera.
	2	Auto detect the document and given commands to the user by the application. (Ex. Move the right, Move the left, Etc.)
	3	When the user touched the mobile phone screen, automatically capture the document image.
	4	If an image captures successfully, notify the user and showing analysis button.

Table 7: Use case Scenario ID - RI_UCS_1

Use case ID	RI_UCS_2	
Use case name	Voice input command	
Goal in context	Voice command by the application user to start analyze	
Pre-condition	"RI_UCS_1" was successes	
Post-condition	Upload the image to cloud	
Primary actor	Application user	
Secondary actor	System application	
Main flow	**Step**	**Action**
	1	Application waiting the user voice input.
	2	When user tell "Analysis Now" command application starts to light weight and upload to cloud.

Table 8: Use case Scenario ID - RI_UCS_2

Use case ID	RI_UCS_3
Use case name	Identify content of the document
Goal in context	Create the image files and save at the cloud folders for the individual analyzing purpose.
Pre-condition	"RI_UCS_2" was successes
Post-condition	Individual analyzing Text, Equations, Images, Tables, Charts concurrently.
Primary actor	System application
Secondary actor	None

Main flow	**Step**	**Action**
	1	Identify content of the cloud uploaded digital image document.
	2	Create the new image files and save in the relevant cloud folders.
	3	Maintained the original document structure in array structure.

Table 9: Use case Scenario ID - RI_UCS_3

Use case ID	RTBC_UCS_1	
Use case name	Identify text contents of the document	
Goal in context	Analyze the texts contents and create a detailed a Json File	
Pre-condition	"RI_UCS_3" was successes	
Post-condition	Combine all Json files	
Primary actor	System application	
Secondary actor	None	
Main flow	**Step**	**Action**
	1	Identify text contents of the cloud digital image document.
	2	Analysis the identified texts.
	3	Create the detailed Json file and save in the "Text-folder".

Table 10: Use case Scenario ID - RTBC_UCS_1

Use case ID	CE_UCS_1	
Use case name	Charts based on contents detection	
Goal in context	The system detects objects and areas in the chart-based image content.	
Pre-condition	"RI_UCS_3" was successes	
Post-condition	The chart-based content output will be saved as a .txt file format for text generation	
Primary actor	System application	
Secondary actor	None	
Main flow	**Step**	**Action**

	1	The system analyzes the chart-based image content.
	2	The system compares the chart-based image content with the data sets for object detection.
	3	The system detects objects (size, type, etc.) and areas separately.
	4	The system saves the identified objects and areas temporary.

Table 11: Use case Scenario ID - CE_UCS_1

Use case ID	CE_UCS_2	
Use case name	Equations based on contents detection	
Goal in context	The system detects objects and areas in the equations-based image content	
Pre-condition	"RI_UCS_3" was successes	
Post-condition	The equations-based content output will be saved as a .txt file format for text generation.	
Primary actor	System application	
Secondary actor	None	
Main flow	**Step**	**Action**
	1	The system analyzes the equation-based image content.
	2	The system compares the equation-based image content with the data sets for object detection.
	3	The system detects objects (numbers, operators, characters, etc.) and areas separately.
	4	The system saves the identified objects and areas temporary.

Table 12: Use case Scenario ID - CE_UCS_2

Use case ID	ITR_UCS_1
Use case name	Detect data from the table
Goal in context	System detects data from the table
Pre-condition	"RI_UCS_3" was successes
Post-condition	Output will be saved as a .txt file for text generation

Primary actor	System application	
Secondary actor	None	
Main flow	**Step**	**Action**
	1	System analyzes the table.
	2	System identifies the rows in the table separately.
	3	Then it reads row data individually and according to the order.
	4	Then saves the read data temporarily as string.

Table 13: Use case Scenario ID - ITR _UCS_1

Use case ID	CFAO_UCS_1	
Use case name	Combine all Json files	
Goal in context	Combine the all Json files and Generate audio file to be listing purpose	
Pre-condition	Analyze the individual contents and create detailed Json Files	
Post-condition	Listening audio document	
Primary actor	System application	
Secondary actor	None	
Main flow	**Step**	**Action**
	1	Get Json files from the relevant cloud folders.
	2	Compare with document structure and arrange the Json file accordingly.

Table 14: Use case Scenario ID - CFAO_UCS_1

Use case ID	CFAO_UCS_2	
Use case name	Listening the document	
Goal in context	Listening the audio describe the document	
Pre-condition	“CFAO_UCS_1” complete successfully	
Post-condition	Save the audio file in the device storage	
Primary actor	Application user	
Secondary actor	System Application	
Main flow	**Step**	**Action**

	1	Get Json file and pass to text to speech API.
	2	Play the audio file and save it in local device storage.

Table 15: Use case Scenario ID - CFAO_UCS_2

2.3 User Characteristics

Basically, the application user should have the ability to understand the English language and should need a proper listing and hearing ability without disabilities.

User can be arrangeable of using a smartphone.

2.4 Constraints

- Proposed application modules will be provided in the English language.
- Since the application runs three main real-time modules which use the camera, as in initial state captured photograph rotation, voice commands, upload the light weighted image. it requires more free memory to run effectively and might have slight latency depending on the device.
- The module requires a fairly adequate rear-camera.
- The CFAO module requires internet access once for every route entry to retrieve route information.

2.5 Assumptions and Dependencies

- The result of each component and any voice assisted applications on the device will not overlap.
- The back-end server will not crash or go down.
- Network connection is actively connected to internet.
- Mobile phone rear-camera is no any errors and photo capturing environment having good lightning condition.

2.6 Apportioning of Requirements

The requirements mentioned in sections One and Two of this SRS documents are primary specifications. Requirements mentioned in section Three are referred to as requirements (or functional) specifications. The two levels of requirements are intended to be consistent.

The proposed product will be the outcome of a research project, therefore the procedure to attain the goals might differ. The major components and their outcomes mentioned here will not change. In spite of that, the technologies and the methodologies mentioned are likely to change in order to make the results more feasible and accurate.

3 Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

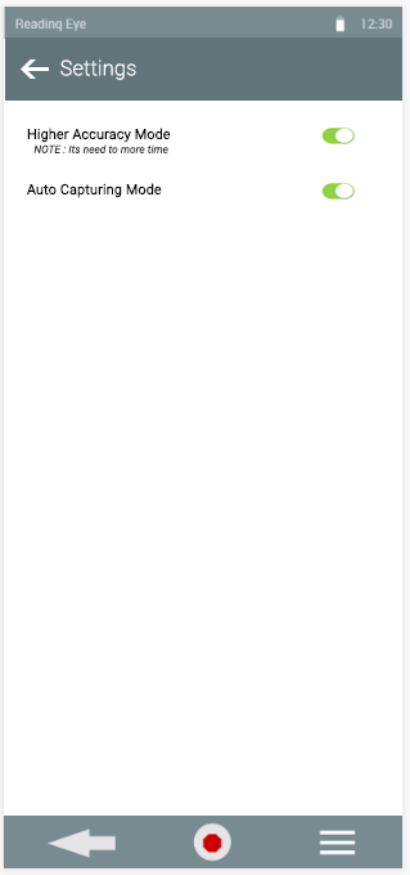

Figure 12: External User Interface 1

This application module having only one external user interface. Figure 8 is mention that the EUI.

If the “Auto Capturing Mode” enable means, not needed to capture photo to user. Document image will be captured by application automatically.

If the “Higher Accuracy Mode” enable means, application always connect to the cloud server and always data transfer by the network. Therefore, application accuracy is higher. But the network delay should be adding to process time. Therefore, the document analyzing time is higher.

3.1.2 Hardware Interfaces

The mobile device's in-built real camera will be taken use of for the photo capturing in "Reading-Eye" application. Therefore, no any other advanced hardware interfaces are required.

3.1.3 Software Interfaces

The backend of the "Reading-Eye" application will be on in the Azure cloud space. The Training of the CNN model will use Python 3.6, Keras 2.0.8 and TensorFlow 2.0 which will run in an Azure VMs.

3.1.4 Communication Interfaces

The software application requires an internet connection (mobile data/ Wi-Fi) to analysis the document image. Mainly used for the Natural language processing.

3.2 Classes/Objects

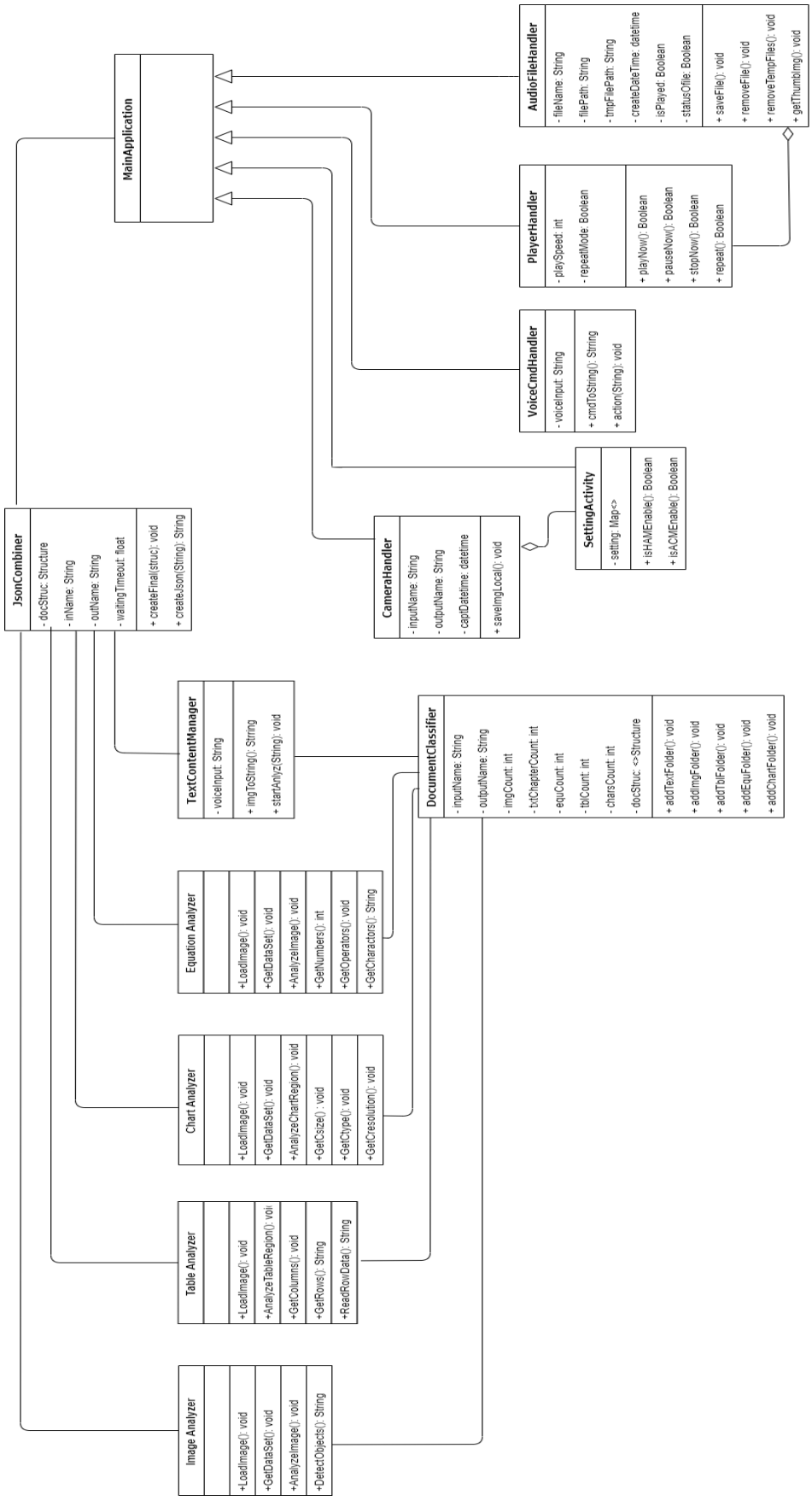

Figure 13: Class Diagram For overall system

3.3 Performance Requirements

All three modules except for the “Reading-Eye” application, require higher computational power from the mobile device, but efficient ways of handling and reusing objects could minimize future bottlenecks in the Android and iOS operating systems at runtime.

Minimum requirements would include at least 1.5GB of free RAM, 1.4GHz CPU and 8MP primary camera for effective detection without any slack in performance. Higher internet connection required for the analyzing progress.

3.4 Design Constraints

The “Reading-Eye” application mainly focus the vison impaired community. Therefore, UI are very simple and easy to use their community.

Moreover, the users should be given the ability to turn the module on or off. Except these, there are no known limitations imposed by external factors on this module.

3.5 Software System Attributes

3.5.1 Reliability

The proposed system use the CNN model. The training model should be trained for large number of datasets and should process the result in a short period of time. When, providing result on appropriate time is equally important as providing an accurate result. No matter how accurate the result is if it is not delivered at appropriate time. Through these strategies, the reliability of the system can be achieved.

3.5.2 Availability

The product should have a very nominal mean time between failures (MTBF), with 99.9999% uptime to serve the back-end services. The service back-end plays the vital role of providing

with the detailed digital audio document to the android and iOS mobile devices, thus should have the very same MTBF.

3.5.3 Security

Proposed system having additional security mechanisms must be imposed on the dataset like encryption and data validation. Moreover, using the cloud computing, having more security. Minimum server downtime and proposed system used server crash alert manger.

3.5.4 Maintainability

- Proposed system using micro services architecture. Therefore, a one of service has stopped but application works normally.
- System may use logger services. It helps remotely errors and bug checkups.

3.6 Other Requirements

The requirements mentioned here will not be considered in the current release of the software product but rather will be implemented in later versions for better performance and feasibility. Therefore, no having other reequipments.

4 Supporting Information

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