

GNG2101
Design Project User and Product Manual

OCR Reading Assistant Project

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Table of Contents

- Table of Contents ii
- List of Figures v
- List of Tables viii
- List of Acronyms and Glossary ix
- 1 Introduction..... 1
- 2 Overview..... 2
- 3 Getting started..... 3
 - 3.1 Set-up Considerations 3
 - 3.2 User Access Considerations..... 3
 - 3.3 Accessing the System..... 4
 - 3.3.1 Signing into Power Apps 4
 - 3.3.2 Installing Power Apps Portals..... 4
 - 3.3.3 Getting to the app..... 5
 - 3.4 System Organization & Navigation 8
 - 3.4.1 Home Page 8
 - 3.4.2 Other features..... 8
 - 3.5 Exiting the System 8
 - 3.6 Getting Access to OCR 3 App 8
- 4 Using the System → Spiridon..... 9
 - 4.1 User Interface 9
 - 4.1.1 Colour Coding..... 9

4.1.2	Icons	10
4.1.3	Font and Font Size	10
4.1.4	Menu Page	11
4.2	Text Recognition	12
4.2.1	Magnifying the Image.....	14
4.3	Selected Text Recognition	14
4.3.1	Magnifying the Image.....	17
4.4	Price Recognition	17
4.4.1	Magnifying the Image.....	20
5	Troubleshooting & Support	21
5.1	Error Messages or Behaviours	21
5.2	Special Considerations	22
5.3	Maintenance	22
5.4	Support	22
6	Product Documentation	23
6.1.1	App Canvas Creation	23
6.1.2	Accessing MS Translates Database	24
6.1.3	Creating New Screen	25
6.1.4	Saving Project	26
6.1.5	Menu	27
6.1.6	Text Recognition.....	31
6.1.7	Selected Text Recognition	37
6.1.8	Price Recognition.....	42

6.2	Testing & Validation.....	48
6.3	BOM → David.....	54
6.4	Equipment List.....	54
7	Conclusions and Recommendations for Future Work.....	55
8	Bibliography.....	57
	APPENDICES.....	58
9	APPENDIX I: Design Files.....	58

List of Figures

Figure 1 Login to Power App 4

Figure 2 Power Apps Portals 5

Figure 3 Power App menu 6

Figure 4 Accessing AI Builder from Menu Page..... 7

Figure 5 Get AI Builder Button 7

Figure 6 Start Free Trial..... 7

Figure 7: Menu OCR 3 app..... 11

Figure 8 Text Recognizer empty..... 12

Figure 9 :Text printed 13

Figure 10 Selected Text Recognition empty..... 15

Figure 11 Selected Text Recognition Printed text 16

Figure 12 Price Recognition 18

Figure 13 Price Recognition with printed price 19

Figure 14 Menu Page Canvas Creation 23

Figure 15 Blank App Phone Layout 24

Figure 16 Data Base Insertion..... 24

Figure 17 MS Translate Database..... 25

Figure 18 New Page Insertion..... 26

Figure 19 File..... 26

Figure 20 Saving File..... 27

Figure 21 Naming Menu Page 28

Figure 22 Creating Label on Menu.....	28
Figure 23 Inserting First Button On Menu Page.....	29
Figure 24 Menu Page Built App.....	30
Figure 25 Inserting Navigation Function.....	30
Figure 26 Changing Background Colour.....	31
Figure 27 Inserting OCR Text Recognizer.....	32
Figure 28 Inserting OCR Function.....	32
Figure 29 Inserting Label.....	33
Figure 30 Inserting Text Printing Function.....	33
Figure 31 Inserting Audio Media.....	34
Figure 32 Formatting Audio Playing Button and Formula.....	35
Figure 33 Inserting Audio Playing Stop Button And Formula.....	36
Figure 34 Changing Background Colour Selected Text Recognition.....	37
Figure 35 Inserting OCR.....	38
Figure 36 Inserting Printing Label.....	39
Figure 37 Inserting Audio Media.....	40
Figure 38 Inserting Formula.....	40
Figure 39 Inserting Play Text Button.....	41
Figure 40 Inserting Exit to Menu Button.....	42
Figure 41 Insertion Of the OCR In the App.....	43
Figure 42 Price Label.....	44
Figure 43 Printed Price Label.....	45
Figure 44 Insertion Of The Audio Media.....	46

Figure 45 Insertion Of The Audio Player Icon 47

Figure 46 Insertion of the Exit To Menu Button 48

List of Tables

Table 1. Acronyms.....	ix
Table 2. Glossary	ix
Table 3 Evaluation of The Prototype Based On Target Specification.....	48
Table 4 Family feedback on the usability	49
Table 5 Family feedback on the Audio Feedback	50
Table 6 Accuracy On Price Tag.....	51
Table 7. Referenced Documents	58

List of Acronyms and Glossary

Provide a list of acronyms and associated literal translations used within the document. List the acronyms in alphabetical order using a tabular format as depicted below.

Table 1. Acronyms

Acronym	Definition
OCR	Optical Character Recognition
AI	Artificial Intelligence

Provide clear and concise definitions for terms used in this document that may be unfamiliar to readers of the document. Terms are to be listed in alphabetical order.

Table 2. Glossary

Term	Acronym	Definition
OCR 3	OCR 3	Name of the app

1 Introduction

This user manual will provide accessibility to the reader of all project documentation and will allow him or her to maintain, integrate, or configure our entire design project. This project focuses on the development of our OCR assistant app. This prototype predominantly involves the usage of components such as the Microsoft PowerApps. We have produced a mobile application. The main objective of this project is to provide visually impaired users the ability to move around in public autonomously. The app uses an AI builder that is powered by Microsoft this is to help the app run optical character recognition. If the user wants something read aloud to them, all they have to do is scan it on the app and the text is printed and read to them.

This User and Product Manual (UPM) provides the information necessary for <types of users> to effectively use the <System Name (Acronym)> and for prototype documentation.

2 Overview

Difficulties in reading text that are a distance away, whether that text is from a sign, poster, price tag or notice board, are prevalent for those whose vision is in such a state beyond the aid of the conventional glasses. Without the aid of a third party, it becomes seemingly herculean for such people to go about on their daily public activities.

To maintain their need for independence and increased self-sufficiency, a device capable of allowing such people to read these written mediums is considered.

This is where the OCR 3 comes into play, as unlike the majority of other text reader apps on the market, OCR 3 with its large and colourful User Interface and Simplistic design was specifically created to be usable by the aforementioned visually impaired.

Spiridon's AI uses the latest OCR technology to efficiently analyze and interpret whatever text is given to it. The app is also powered along with Microsoft PowerApps platform.

3 Getting started

The app is free for all users provided they have active access to a Microsoft PowerApps account which includes the Power Apps application which is available for all systems at https://powerapps.microsoft.com/en-us/?&ef_id=Cj0KCQjwmcWDBhCOARIsALgJ2QfBuLcGaLyhHp_Llaga_QYd1Lsjhr9brn6tTXSr4m8Yvi7CIHIEcEgaAn9cEALw_wcB:G:s&OCID=AID2100431_SEM_Cj0KCQjwmcWDBhCOARIsALgJ2QfBuLcGaLyhHp_Llaga_QYd1Lsjhr9brn6tTXSr4m8Yvi7CIHIEcEgaAn9cEALw_wcB:G:s you would then need to follow the steps provided at the site to gain access to the Microsoft power app account.

With a fully active account one needs only to send the request at samoh074@uottawa.ca and in no more than 3 business days they will be given full access to the app.

Clicking the app will take you immediately to its home screen where using the app will be clearly directed in Section 4 of the guide.

3.1 Set-up Considerations

In line with the application's simple nature the only devices needed are whatever common phone, tablet or laptop with a reasonably up-to-date operating systems and proper functioning peripherals; no more than you would need for any other app.

It should be noted that constant internet connection is required if you choose to use it without the PowerApps portal . The portal is available for all operating systems and can be downloaded from their website as well as Google play store, apple store or Microsoft store

3.2 User Access Considerations.

The app was made to help those with visual disabilities, and as such is targeted towards the impaired as well as help groups and care centres with the same goal.

Though the target demographic when the app was created was people suffering from visual disorders, the app is in fact free for all to use as long as they have a Power app account

3.3 Accessing the System

3.3.1 Signing into Power Apps

Go to the Power Apps home page at <https://powerapps.microsoft.com/en-us> there you will see the 'start for free' button either at the top or bottom of the page. Clicking it will redirect you to the sign in the page where you can follow the instructions available there to create your account and login

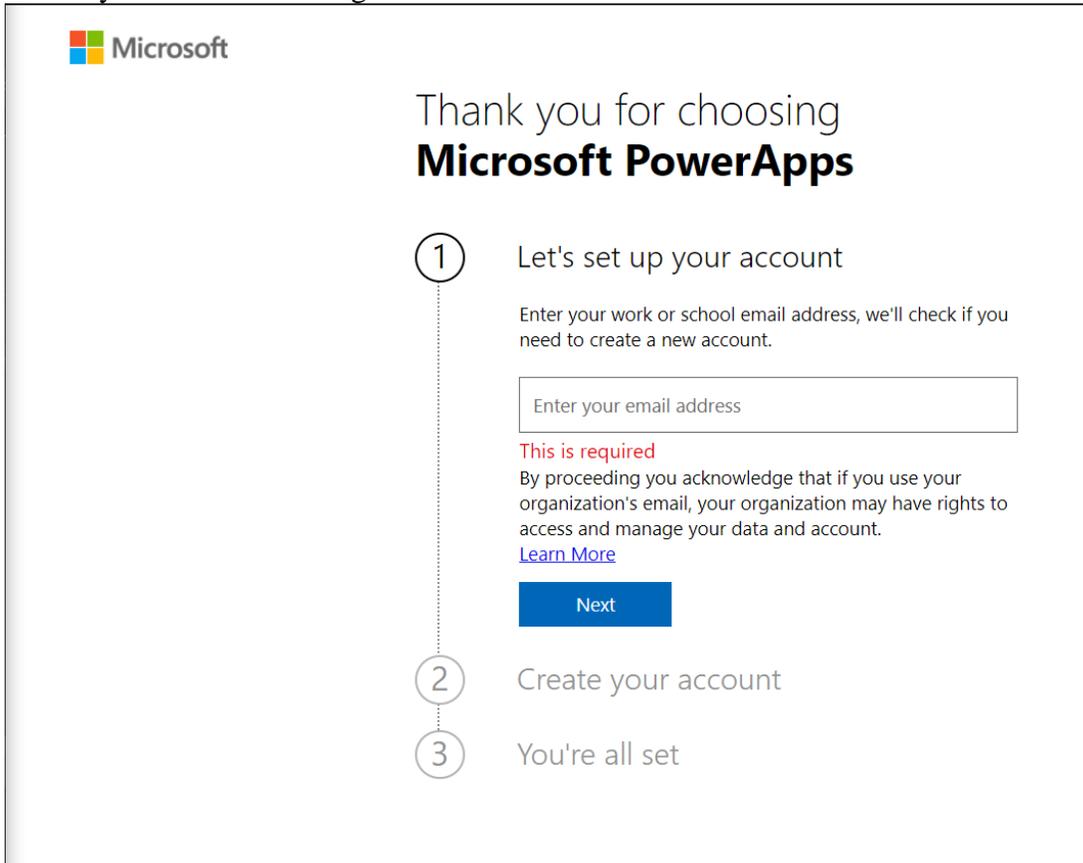


Figure 1 Login to Power App

3.3.2 Installing Power Apps Portals

The portal can be downloaded from their website [here](#) as well as by searching Google play, apple store or wherever you may buy your app. Clicking 'Start free' will take you to the login page where you will need to follow the instructions to activate.



Enable external access with Power Apps portals

Empower anyone—either inside or outside your organization—to interact with Microsoft Dataverse data using portals.

Start free >

Watch overview ▶

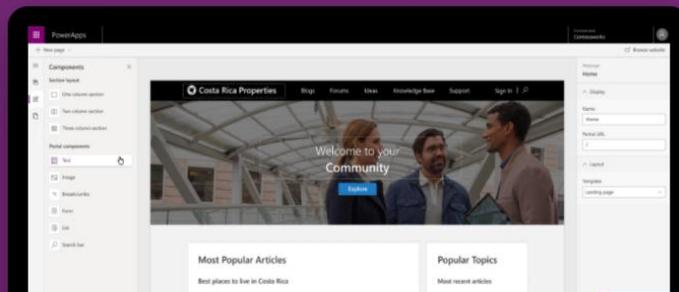


Figure 2 Power Apps Portals

3.3.3 Getting to the app

3.3.3.1 With Portals

Once Portals is installed on your system you need only to open the portals app and choose from the list of apps available to you that will be displayed once you have signed into the portal

3.3.3.2 Via the Website

If you are accessing the app through Office 365 or directly from the site:

Log in following the steps previously iterated in section [], go to Apps ' and there you will see the app included in a list of apps owned by you

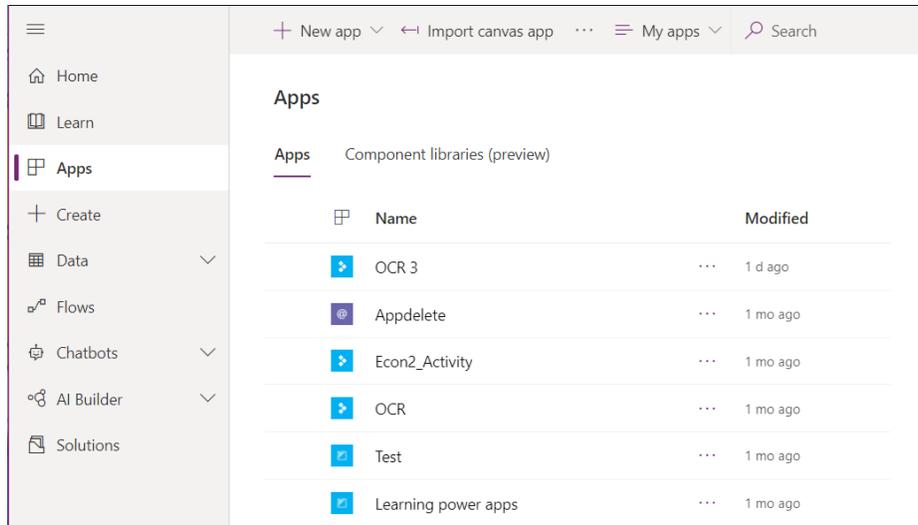


Figure 3 Power App menu

For more information on Power Apps visit the Google docs [here](#).

3.3.3.3 Accessing AI Builder → Spiridon

1. Login in Power App using above instruction
2. Once on the menu page of Power App select “Ai Builder”

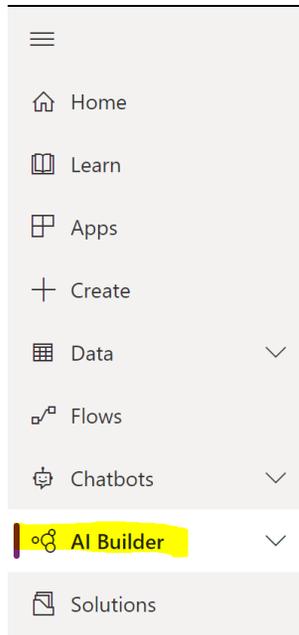


Figure 4 Accessing AI Builder from Menu Page

3. Then on the top right corner select “Get AI Builder”



Figure 5 Get AI Builder Button

4. Then Select “Start Free”

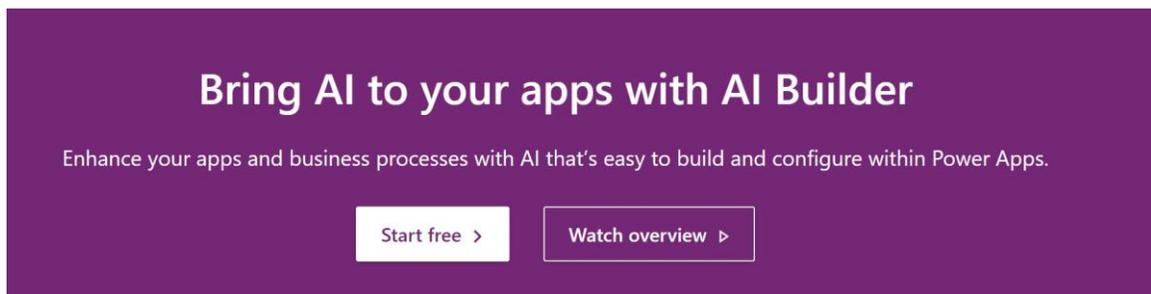


Figure 6 Start Free Trial

5. You should now have access to the 30-day AI Builders free trial. (It is to note that you can extend the trial up to 30 extra days for free once the first trial has ended.)

3.4 System Organization & Navigation

The system follows a simple minimalist design with only one page per functionality and a home page.

3.4.1 Home Page

The home page is bright and distinct green with the three sub functions horizontally laid out with each button a different colour to give a greater sense of separation to each feature.

3.4.2 Other features

The three other features are modelled like the home screen with a single exit button to bring the back to the main menu. Every UI item is arranged horizontally with a clear colour coding to separate each feature.

3.5 Exiting the System

To exit the app completely you either need to click the back button on your respective device or close the website if you had chosen to use it online.

Logging out of your power app account is recommended if the device in use is not yours.

3.6 Getting Access to OCR 3 App

If you want to get access to the OCR 3 app as a user ,please send an email to samoh074@uottawa.ca.

4 Using the System → Spiridon

The solution app built on Microsoft Power App ,includes 3 different features. Each one includes an OCR AI with Text to Speech functionality.

The first feature present in the OCR 3 app is a general Text Recognizer that recognizes all the text present in an image and prints it all out. It then reads the printed text to the user.

The second feature present in the OCR 3 app is a Selected Text Recognizer that recognizes all the text present in an image but only prints the selected text by the user. It then reads the printed text to the user using the TextToSpeech AI.

The third feature present in the OCR 3 app is a price recognizer that prints the price from an image containing a price tag. It then reads the printed price to the user using the TextToSpeech AI.

All three features of the app are accessible via buttons on the menu page of the OCR 3 app.

It is to note that the OCR 3 app has been colour coded. Each button on the menu leads to a feature page of the app that will have the same background colour as their respective master button.

The following subsections provide detailed, step-by-step instructions on how to use the various functions or features of the User Interface.

4.1 User Interface

This section includes relevant information regarding the user interface of the OCR 3 app.

4.1.1 Colour Coding

The OCR 3 app has been coloured coded to facilitate the use. Each button on the menu screen is from a different colour. The button then leads to their feature screen. The background of the feature screen is the same colour as their respective master button.

1st button, *Text Recognition* is green → *Text Recognition* features screen background is same colour.

2nd button, *Selected Text Recognition* is orange → *Selected Text Recognition* features screen background is same colour.

3rd button, *Price Recognition* is purple → *Price Recognition* features screen background is same colour.

4.1.2 Icons

The solution app includes icons. Considering the client being visually impaired , it is critical to include clear and understandable large icons to mimic a certain action. It makes it easier for the client to use and understand the app.

4.1.3 Font and Font Size

The solution app includes varieties of font size. Considering the client being visually impaired , it is critical to consider the use of large fonts to make the printed text larger and so easier to read. The Standard font used in the app is *Open Sans* and 30 as the font size.

(It is to not the font size may vary from a page to another depend on the feature , but the standard font size used is 30)

4.1.4 Menu Page

The menu of the OCR 3 application contains 3 large buttons that permit the user to select the feature he wants to use. A message that prompts the user to select a feature is also present.

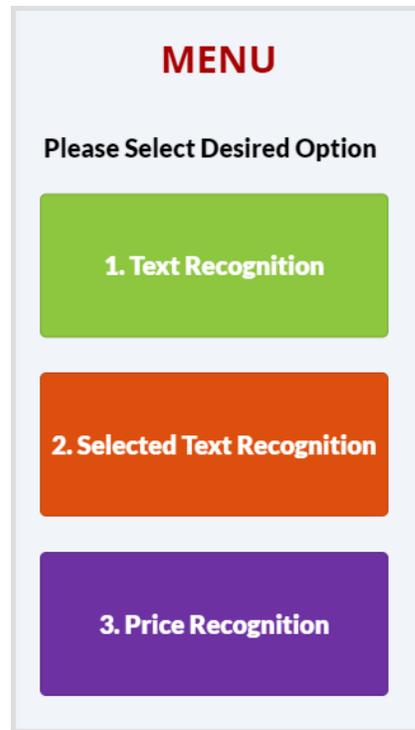


Figure 7: Menu OCR 3 app

The buttons present on the menu page of the app, have been designed to ease the navigation in the app for visual impaired users.

The buttons are large , visible , well identified with the name of the function in a large font. In addition , each button is from a different colour, to ease the distinction between them and their features. It is to note that the menu background is a lighth grey , for creating a contrast between the different buttons present on the page.

The buttons are the only interactive elements on this page. The output of selecting one of them will be a redirection to their respective feature page.

The following sections provide detailed, step-by-step instructions on how to use the various functions or features of the Text Recognition.

4.2 Text Recognition

The first feature of the solution is a general *Text Recognizer*. The user needs to input an image that contains text in the app, and the internal AI will detect characters in the image using and OCR and print as an output, the text from the image in a present label. The second output of the system is a vocal audio of the printed text.

A vocal audio of the printed text is also generated and available for the user to listen to it

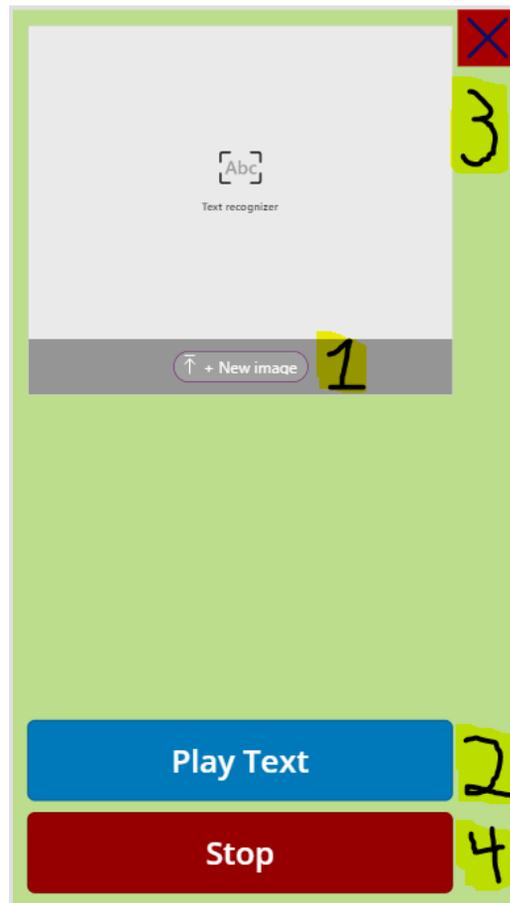


Figure 8 Text Recognizer empty

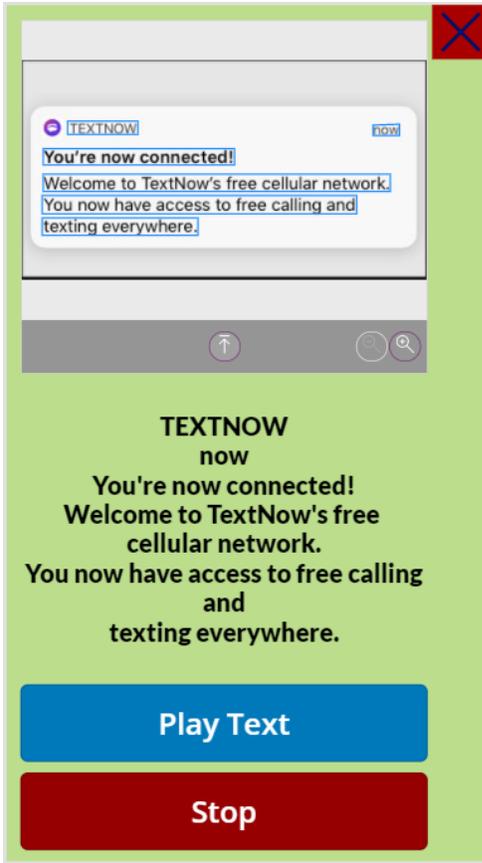


Figure 9 :Text printed

1. To use the general text recognizer feature , the user needs to select “Text Recognition” button from the menu page. (Refer to figure 4.1 for menu page visual representation.)
2. The user then needs to select “ New Image” (Step 1 from figures 4.2.1) and input an image. The user can either select an existing image from the smartphone camera roll or take a picture using the phone camera.
 - 2.1. If no text is present on the image, nothing will get printed. The user will then need to input a new image that contains characters.
 - 2.1.1. The Internal AI OCR will print the recognized text from the imputed image in a present label. (Refer to figure 4.2.2)
3. For getting the printed text from the imputed image read by the internal *TextToSpeech* AI, select “Play Text” button (Step 2 from figures 4.2.1)

4. For interrupting the text lecture while getting read, select “Stop” button (Step 4 from figures 4.2.1)
5. After completing the needed task using the feature, the user can select the “X” red button in the top right corner to be redirected to the Menu page of the OCR 3 app. (Step 3 from figures 4.2.1.)

4.2.1 Magnifying the Image

If you desire to get a closer look at the chosen image click the gray magnifying glass button directly beneath the image frame, to the utmost right to enlarge the image. The button right to its left will negate any enlargement

The following subsections provide detailed, step-by-step instructions on how to use the various functions or features of the Selected Text Recognition.

4.3 Selected Text Recognition

The second feature of the solution OCR 3 app is a *Selected Text Recognizer*. As the text recognizer feature, the user needs to input an image that contains text in the app, and the internal AI will detect characters in the image using and OCR. The user will then be required to select directly on the image he has imputed ,the text he wants to be printed on the label, which is the first output of the system. The second output of the system is a vocal audio of the printed text. The vocal audio of the printed text generated is available for the user to listen to it. The user only requires activating once the text-to-speech feature on the page for the time use. All new text selected generated from the same imputed image will result in an automatic reading of the printed text by the TextToSpeech AI.

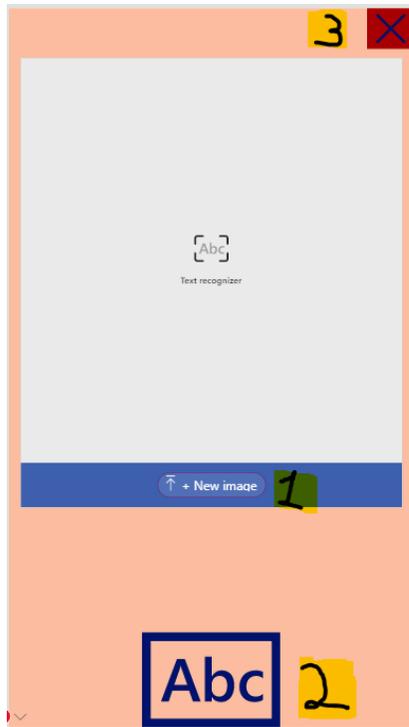


Figure 10 Selected Text Recognition empty

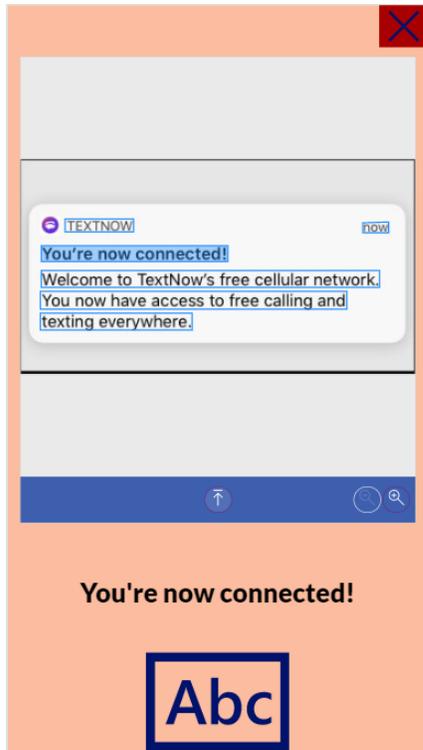


Figure 11 Selected Text Recognition Printed text

1. To use the selected text recognizer feature , the user needs to select “Selected Text Recognition” button from the menu page. (Refer to figure 4.1 for menu page visual representation.)
2. To input an image in the OCR , the user needs to select “ New Image” (Step 1 from figures 4.3.1). The user can either select an existing image from the smartphone camera roll or take a picture using the phone camera.

2.1 If no text is present on the imputed image, nothing will get printed. The user will then need to input a new image that contains characters.

2.2 The Internal AI OCR will print the recognized text from the imputed image in a present label. (Refer to figure 4.3.2)

3. The user is then required to select the text from the imputed image that he wants to be printed and read. (step 2 figures 4.3.1)
4. After completing the needed task using the feature, the user can select the “X” red button in the top right corner to be redirected to the Menu page of the OCR 3 app. (Step 3 from figures 4.3.1.)

4.3.1 Magnifying the Image

If you desire to get a closer look at the chosen image click the gray magnifying glass button directly beneath the image frame, to the utmost right to enlarge the image.

The button right to its left will negate any enlargement

The following subsections provide detailed, step-by-step instructions on how to use the various functions or features of the <Price Recognition>.

4.4 Price Recognition

The third feature present in the OCR 3 app is a price recognizer that prints the price from an image containing a price tag.

As the text recognizer feature, the user needs to input an image that contains a price in the app. The internal AI software will detect all characters from the imputed image using an OCR but will discriminate all character that is not containing a “\$” followed by 5 characters. The OCR will print the price tag in a present label.

A vocal audio of the printed price will also be generated and available for the user to listen to it. The user only requires activating once the text-to-speech feature on the page for the time use.

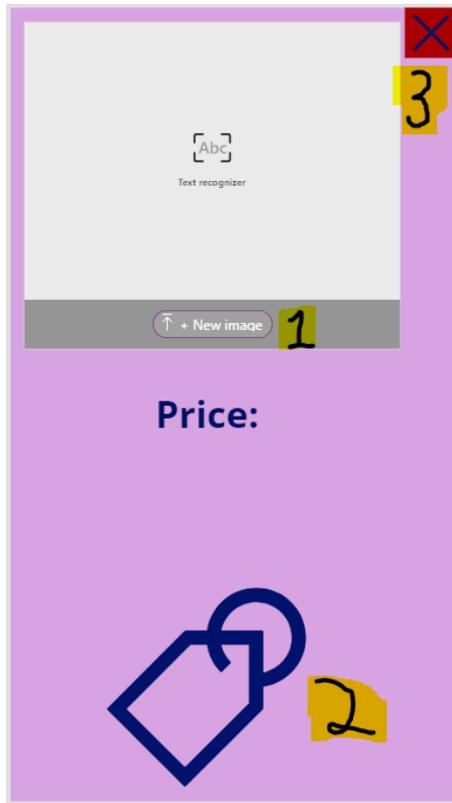


Figure 12 Price Recognition

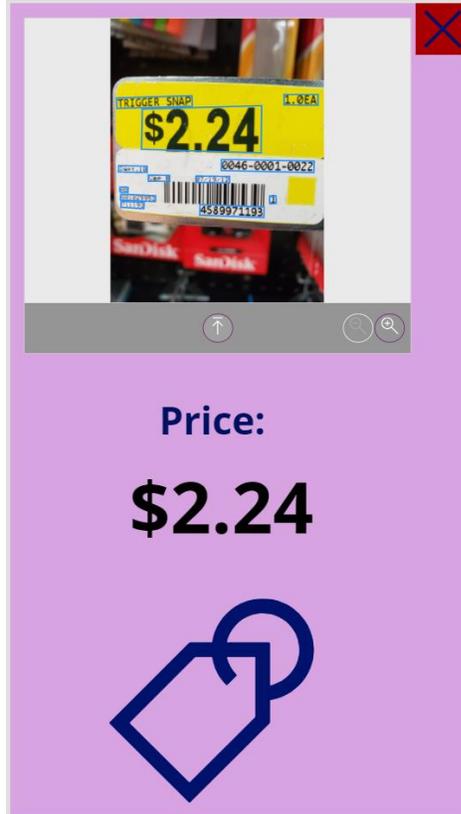


Figure 13 Price Recognition with printed price

2. To use the price recognizer feature , the user needs to select “Price Recognition” button from the menu page. (Refer to figure 4.1 for menu page visual representation.)
3. To input an image in the OCR , the user needs to select “ New Image” (Step 1 from figures 4.4.1). The user can either select an existing image from the smartphone camera roll or take a picture using the phone camera.
 - 3.1.1. 2.1 If no text is present on the imputed image, nothing will get printed. The user will then need to input a new image that contains characters.
 - 3.1.2. 2.2 The Internal AI OCR will print the recognized price from the imputed image in a present label. (Refer to figure 4.4.2)
4. To play the audio of the price, the user will be required to select the price tag button (step 2 figures 4.4.1).

5. After completing the needed task using the feature, the user can select the “X” red button in the top right corner to be redirected to the Menu page of the OCR 3 app. (Step 3 from figures 4.3.1.)

4.4.1 Magnifying the Image

If you desire to get a closer look at the chosen image, click the gray magnifying glass button directly beneath the image frame, to the utmost right to enlarge the image.

The button right to its left will negate any enlargement.

5 Troubleshooting & Support

The solution app OCR 3 is software based. It is therefore critical for the user to understand and know how to properly use the app to avoid any type of failure.

This section covers trouble shooting and support regarding the OCR 3 solution app.

5.1 Error Messages or Behaviours

1. When imputing an image in any one of the 3 features:
 - a. If not, text is present in the image , not text will get printed in the label. If the user tries and select the “Play Text” button to listen the vocal audio, the outputted message will be “ No text identified.”
 - i. The user will then be required to input a new image with text.
 - b. If the image contains text and gets printed in the label but no vocal audio gets generated when selecting the “Play Text” button:
 - i. The user should close the app and open it again.
 - ii. If no vocal audio gets printed , please contact support (refer to section 5.4 supports)
2. If app is not responsive, at any time during the use.
 - a. Close the app and restart it.
 - i. If the app is still not responsive , please contact support (refer to section 5.4 supports)
3. If any error messages that platform related appears that are such
AI in compact , database not installed, formula error license term ended ,
incompatibility with user devices or others.
 - i. Please contact support (refer to section 5.4 supports)

5.2 Special Considerations

Some app failures that arise may not be due to the app itself but as a result of issues with Microsoft PowerApps corporations. Depending on the message received from PowerApps the recovery may vary.

It is also important to consider the compatibility of the app may also vary depending on the phone model used, brand , OS and another external factor.

To anticipate any compatibility issue , the user should make OS of the used phone is to the latest version.

(During the prototyping process, the app has been tested on both iPhone 11 on IOS 14 and a Samsung Galaxy Note 8 on Android Pie.)

5.3 Maintenance

To avoid product failure, regular platform updates are recommended. Make sure you are running a power app on the latest version of the computer operating system. (Mac OS or Widows)

Regarding the app platform itself , make sure you are running the platform on the latest version of the smartphone operating system. Proceed to a regular updating of the power app platform.

5.4 Support

For any kind of support needed regarding Power App platform , bugs , questions ,issues please search on Microsoft Power App support by selecting the following link :
<https://powerapps.microsoft.com/en-us/support/>

For any question regarding the product, functions in the app . layout , functionality, please contact Spiridon Amohnoaie , members of the OCR Engineer Team , by sending an email to the following address:

samoh074@uottawa.ca

6 Product Documentation

The product documentation covers the entirety of the product-building process.

It includes all the instruction for building each section of the app as well as the consideration made on those specific sections. Additional information regarding the OCR AI and TextToSpeech is covered in the documentation.

It is to note the entirety of the solution OCR 3 app, has been built on Microsoft Power platform. Therefore, the *BOM* and *Equipment List* covered in the product documentation, will be listed once and is valid for the entire section. Please refer to corresponding subsection for more information.

While doing research on a platform for building our solution, we were looking for a free , intuitive , easy-to-use platforms that can support different AI and external databases. It became rapidly evident to us that Power App best answers our needs and therefore was our choice.

6.1.1 App Canvas Creation

1. Open this link and login with your uOttawa student account : <https://powerapps.microsoft.com/en-us/>

1. Please refer to respective sections for help.

2. Once login , select “Apps” then” + New app” and “Canvas”

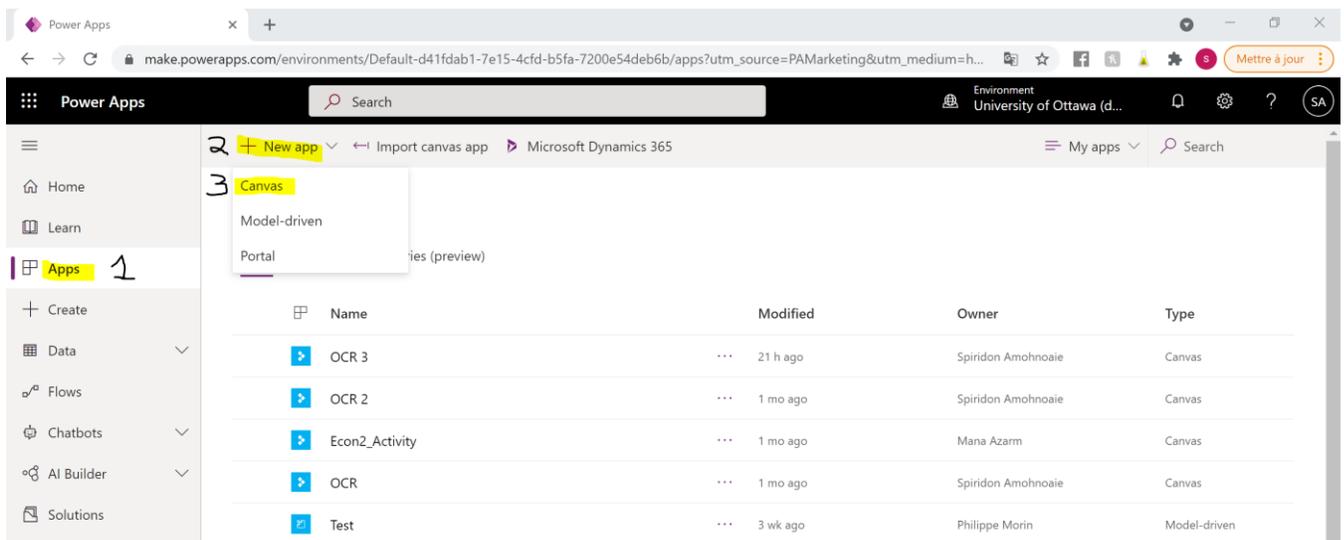


Figure 14 Menu Page Canvas Creation

3. Once you selected “Canvas”, a new page will load. Select “Phone Layout” under “Blank app”

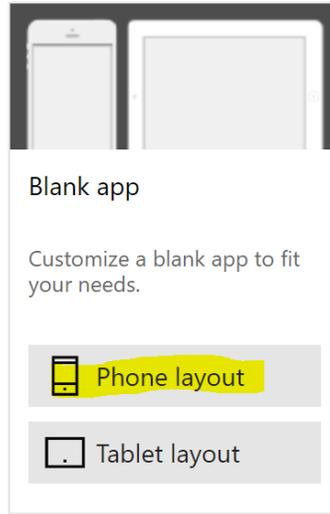


Figure 15 Blank App Phone Layout

4. A new page should load with a blank canvas. Once it's done, you are ready to start building the app.

6.1.2 Accessing MS Translates Database

1. It is now time to include the database that will support the Text to Speech features. After the user has created the canvas, select the cylinder on the left side of the page and then select “+ Add data”

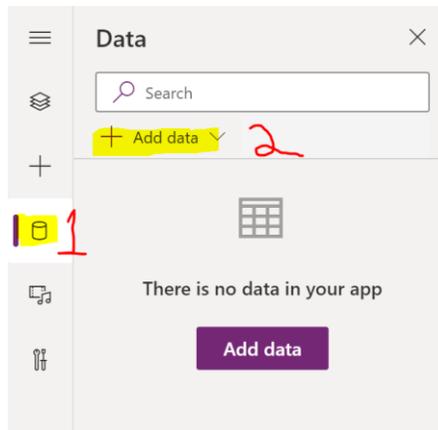


Figure 16 Data Base Insertion

2. Then , in the search bar , type “Translator” and select the first one.

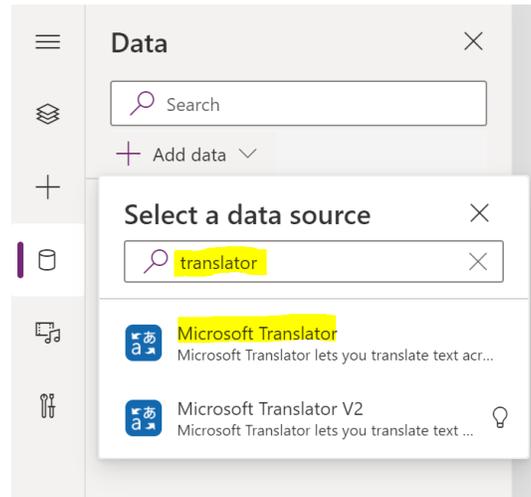


Figure 17 MS Translate Database

3. You should now have the Text to Speech Database installed in the app.

6.1.3 Creating New Screen

1. When creating the solution app, the user will be required to add several new screen pages . To do so , under “Home” , “new screen” then select “Blank”

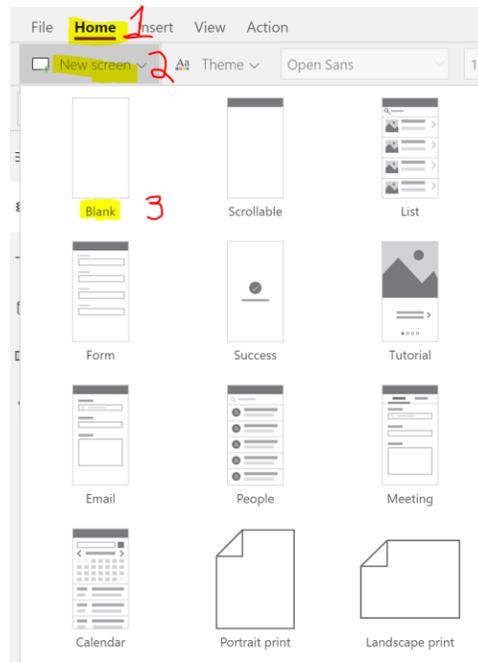


Figure 18 New Page Insertion

2. A new blank page should appear.

6.1.4 Saving Project

1. To avoid losing any progress, it is important to regularly save projects while working on it. To do so, select “File” on the left corner

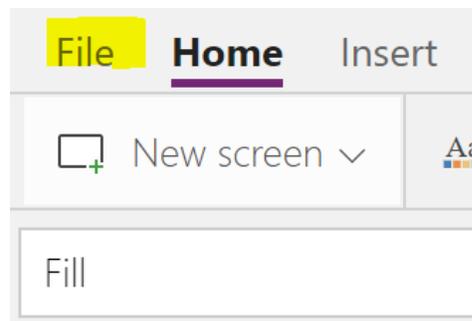


Figure 19 File

2. Then select “Save As” , keep it on the cloud for letting other people have access to it. the user is then required to insert a name , the app will then automatically be saving on power app platform

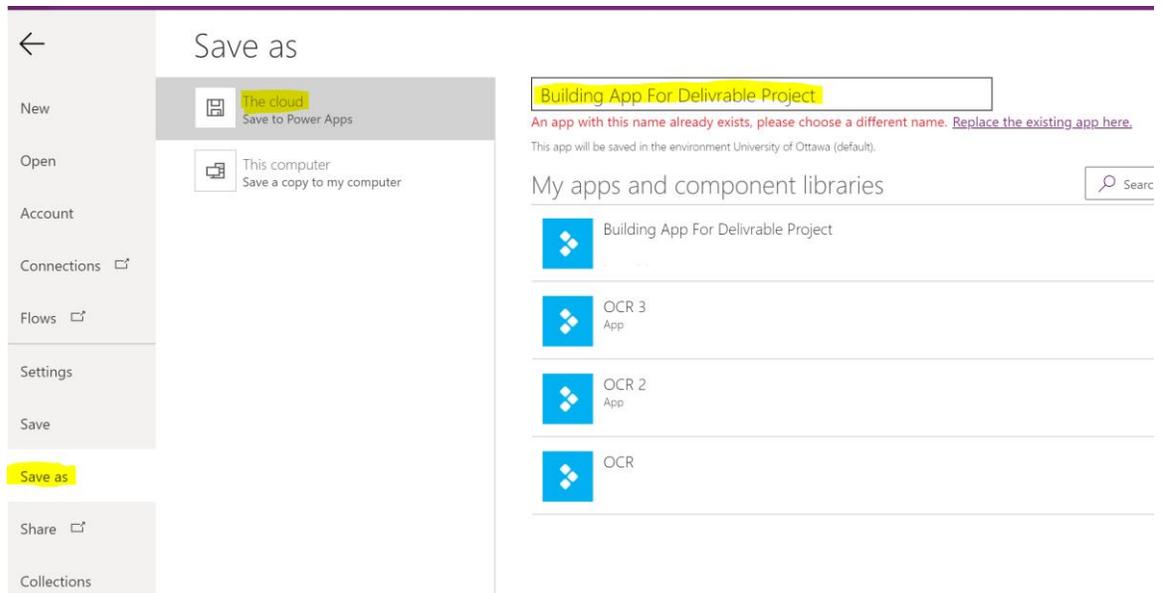


Figure 20 Saving File

3. After proceeding to change and the user needs to save , under “File” select “Save” then”Save”.
 - a. (Optimal)→ the user is also offered to publish the version of the saved app. (publish means to update the app on external servers to be accessed and used)
 - b. It is also critical for the user to save as often as possible the progression of the work!

6.1.5 Menu

1. Under tree view, double click on “Screen 1” and change the name of the page for “Menu”

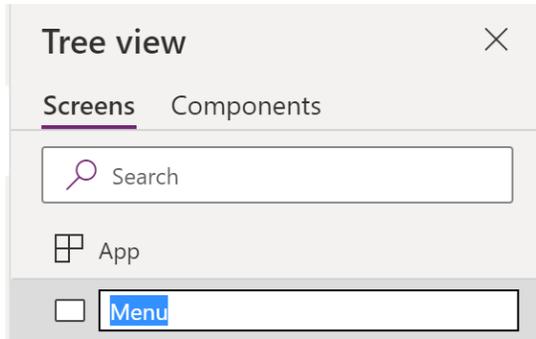


Figure 21 Naming Menu Page

2. Go under “Insert” and select “Label”, change the text in the label for “Menu” then change the font for “45” font weight “Bold”, text alignment “Centre”

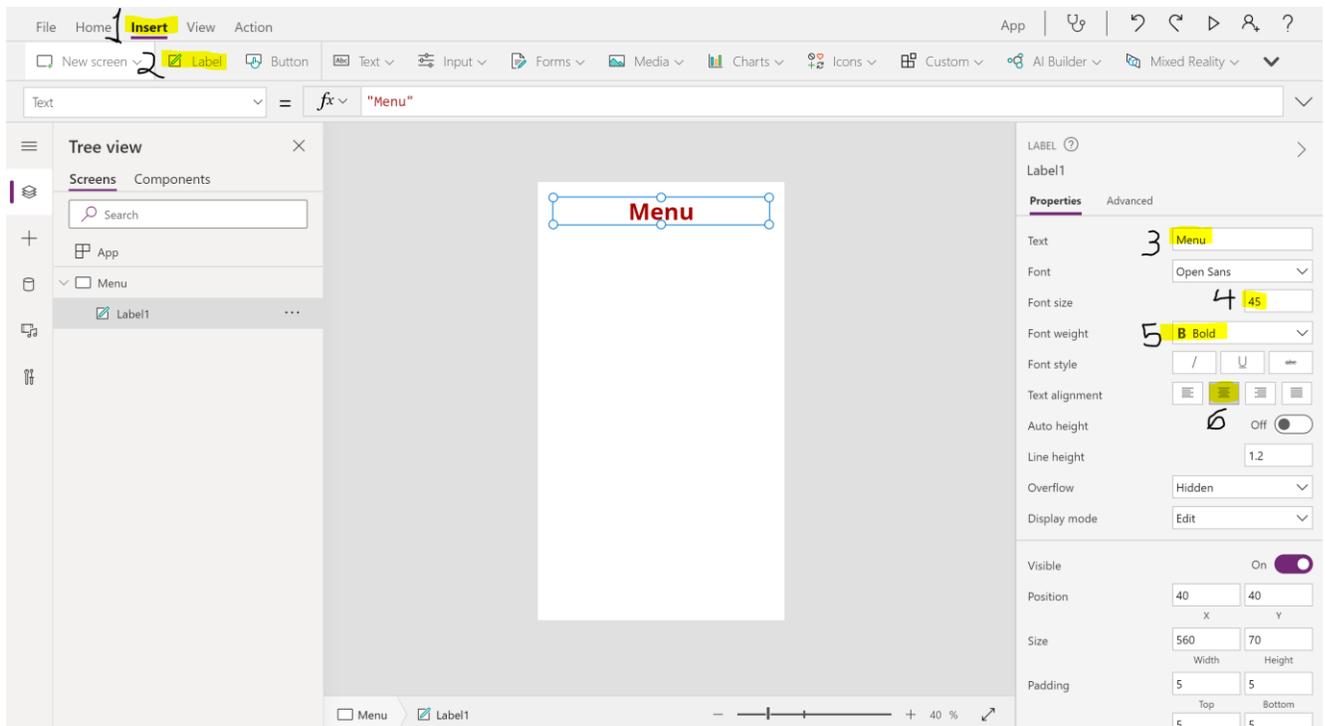


Figure 22 Creating Label on Menu

3. Create a second label following step 2 above. Change the text for “Please Select Desired Option”, font size “30”, font “normal”, Text Alignment “Centre.”
4. Now it is time to create the buttons for navigation in the app. Go under “insert” then “Button”. After you created the button, change the name of the button for “1. Text Recognition” and then change the text of the button for “1. Text Recognition”, then

change the position for 39 in x and 290 in y. size 550 in width and 226 in height , colour select “green”. Then select Font weight “Bold”

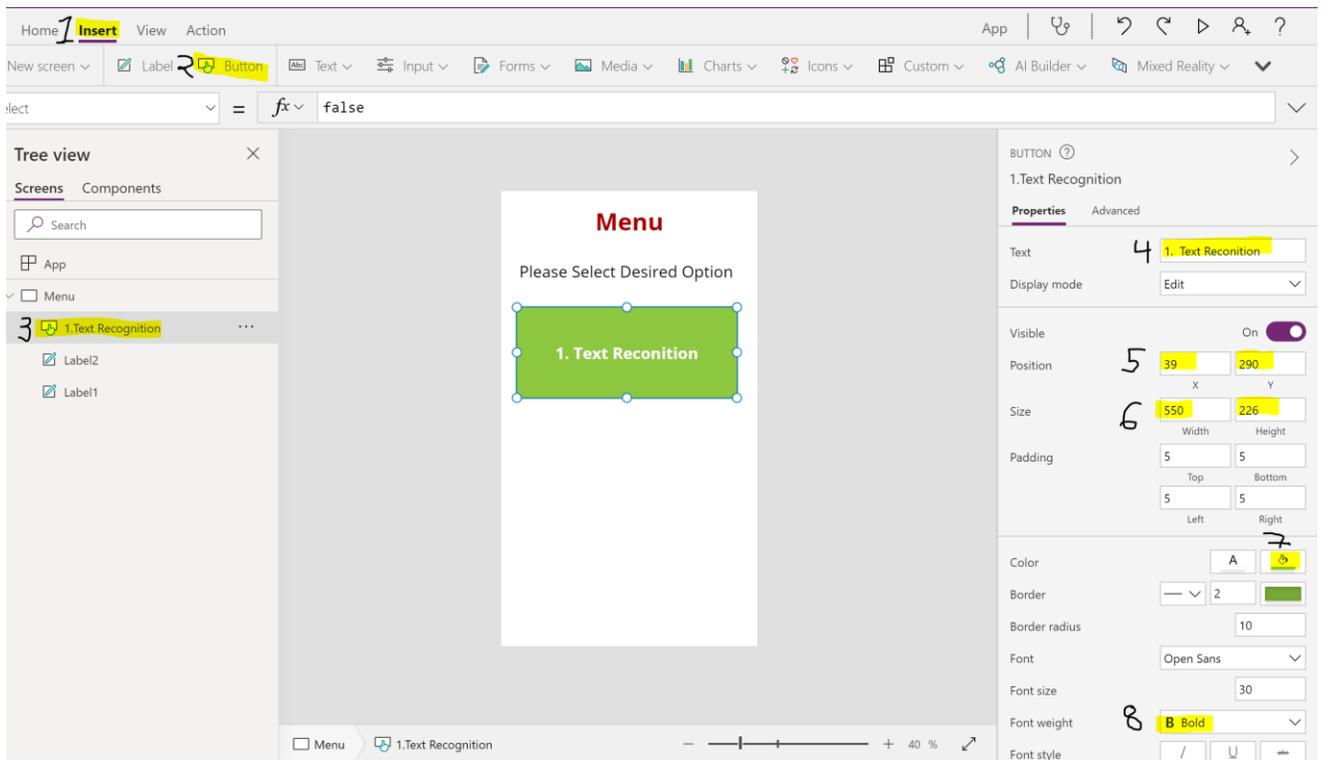


Figure 23 Inserting First Button On Menu Page

5. Repeat sept 4 above for button 2. Change the name of the button for “1. Text Recognition” and then change the text of the button for “2. Selected Text Recognition”, then change the position for 39 in x and 573 in y. size 548 in width and 226 in height , colour select “orange”. Then select font weight “Bold”
6. Repeat sept 4 above for button 2. Change the name of the button for “1. Text Recognition” and then change the text of the button for “2. Selected Text Recognition”, then change the position for 39 in x and 857 in y. size 548 in width and 226 in height , colour select “purple”. Then select font weight “Bold.”
7. Once you finish setting up the button , the menu page should look like below image :

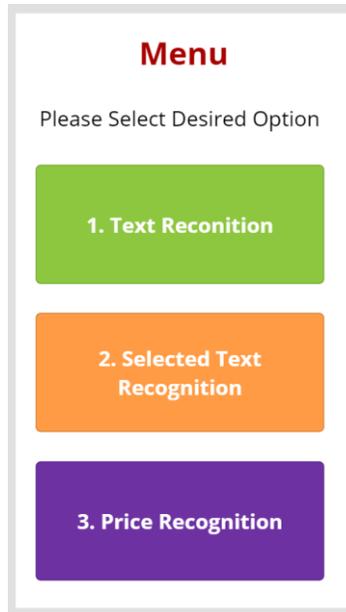


Figure 24 Menu Page Built App

It is now time to add function to navigate between the future coming pages of the app

8. Select button 1 .Text Recognition , and impute the following formula under “onSelect” : [Navigate\('Text Recognition'\)](#)

*Call *Navigate Function* to access the “Text Reconiton” page*

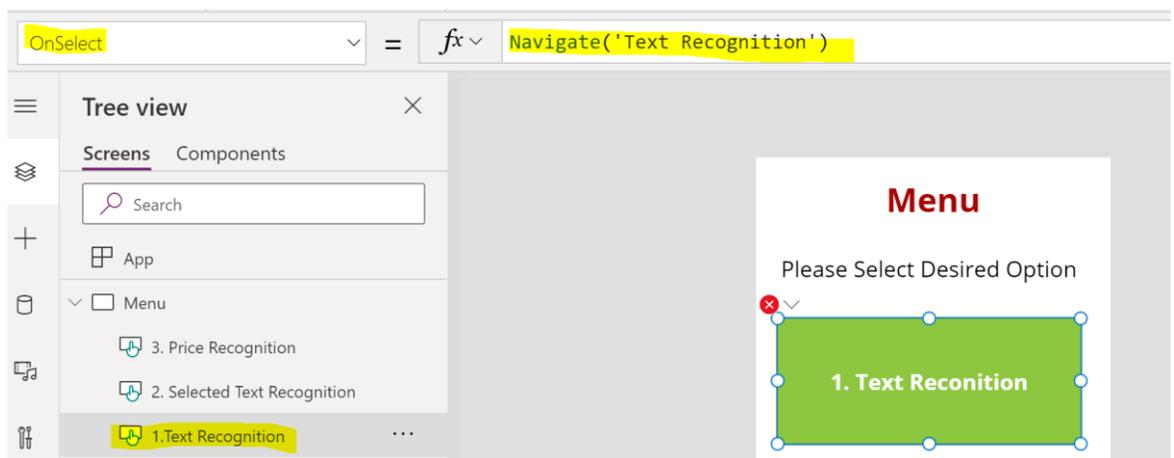


Figure 25 Inserting Navigation Function

- Repeats step 8 for button 2. Selected Text Recognition and 3. Price Recognition. Impute Navigate('Selected Text Recognition') function for button 2 and Navigate('Price Recognition') function for button

6.1.6 Text Recognition.

- Create a new screen page (please refer to section 6.3)
- Change the screen name for “text recognition”.
- Change the colour of the screen for light green by selecting the “fill icon”

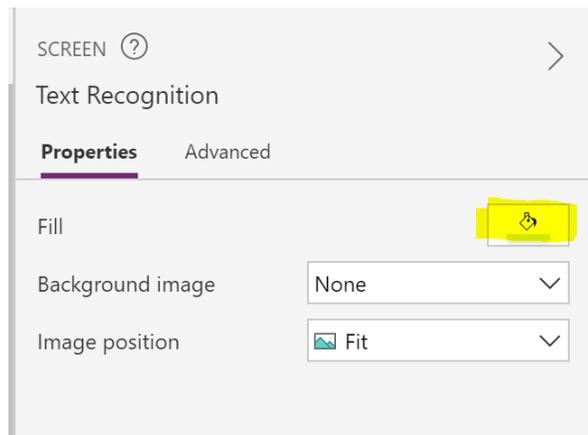


Figure 26 Changing Background Colour

- Add the Text Recognizer OCR AI (to use the Text recognizer you need to have the premium version of Power App, please refer to how to get the premium version of power app) under “Insert” , “AI Builder” →”Text Recognizer” .
 - change the position to 19(X) ,20 (Y)
 - change position for 540 width and 470 Height

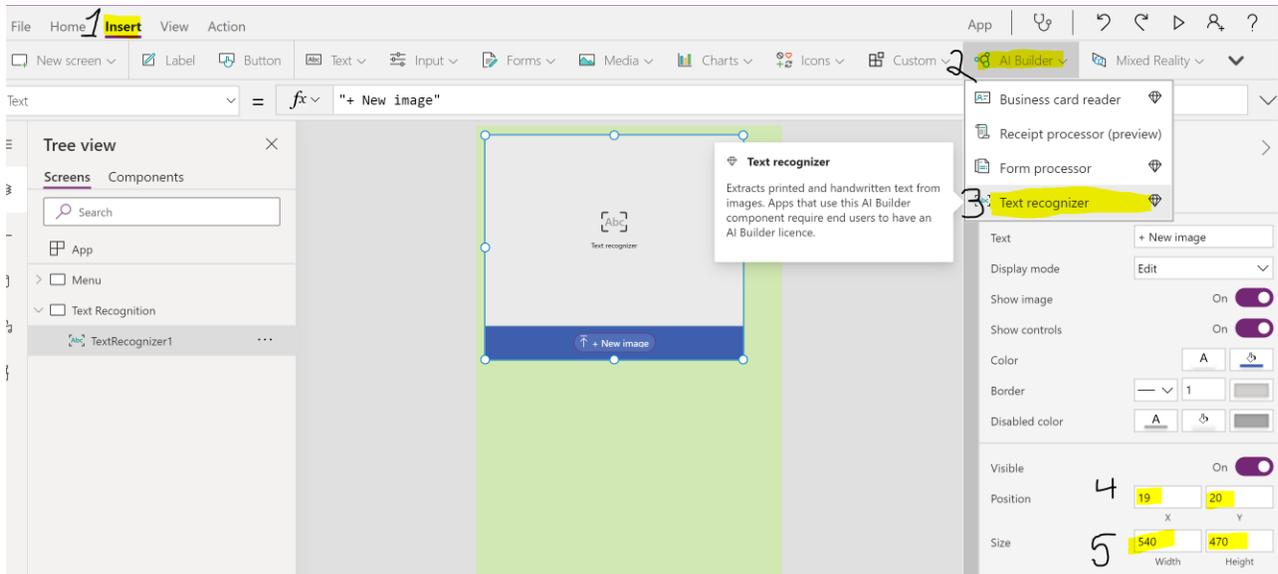


Figure 27 Inserting OCR Text Recognizer

5. Add the following function under OnChange:

`UpdateContext({ varExtractedText:TextRecognizer1.Results.Text})`

*This function create an interaction between the *Text Recognizer* OCR and future label



Figure 28 Inserting OCR Function

6. Create a label where the recognized text from the OCR will be printed. Under “Insert” select “label” and change it name for “Printed Text Label.”
 - 6.1. change font size for 25 and font weight for Bold and select centre text alignment
 - 6.2. Change the position for 19 (X) , 490 (Y)
 - 6.3. Change the size of 538 width and 414 height

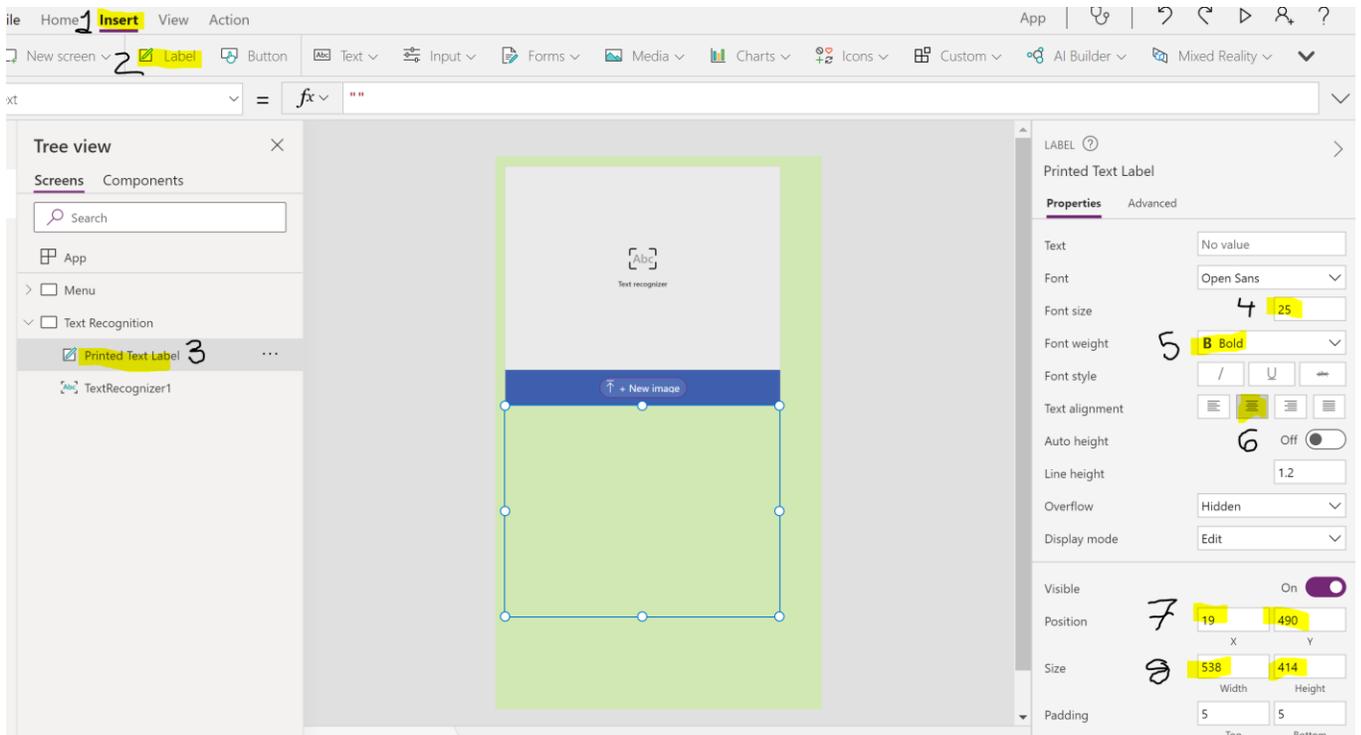


Figure 29 Inserting Label

7. Add following function under “Text”:

`Concat(varExtractedText,Text & Char(13))`

* This function extract the recognized text from the OCR and prints it text in the label *

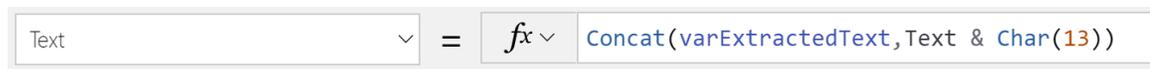


Figure 30 Inserting Text Printing Function

8. Now we need to add a media they will play the vocal audio of the printed text (to make it work you need to have the Translate Database installed , please refer to the appropriate section). Under “insert” , “media” → “audio.”

8.1 Change the name of the audio name for “Audio for Text recognizers.”

8.2 Under visibility , turn it off. (this will make the audio invisible on the page but will still be present to interact with)

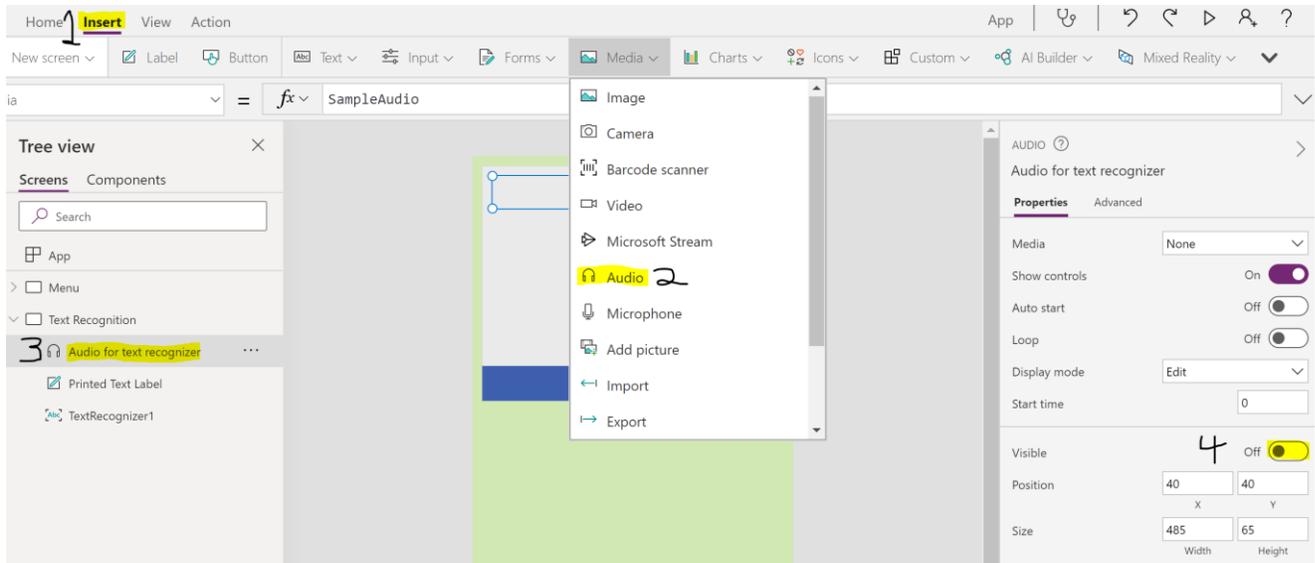


Figure 31 Inserting Audio Media

9. Insert the following function under “media” to make the TextToSpeech function work:

`If(IsBlank(Label1.Text), "No text identified", MicrosoftTranslator.TextToSpeech(Label1.Text,"en-us"))`

This function calls the Microsoft translates AI to generate a vocal audio of the printed text from the label. The language selection is also part of the function and customizable

10. It is now time to create the buttons that will play the vocal audio outputted by the TextToSpeech AI . Under “Insert” select “button”

10.1 change name of the button for “ Play Text” and Text “Play Text”

10.2 change size for 19 (x) 902 (Y)

10.3 change size 538 width and 101 Heights

10.4 change colour for light blue

10.5 change alignment for the centre

10.6 Add following function under OnSelect to make buttons play

`Reset('Audio for text recognizer');Set(varPlay, false);Set(varPlay,true)`

* This function initialize the button to connect with the audio media and play the audio then reset to a value of 0 and restart the process*

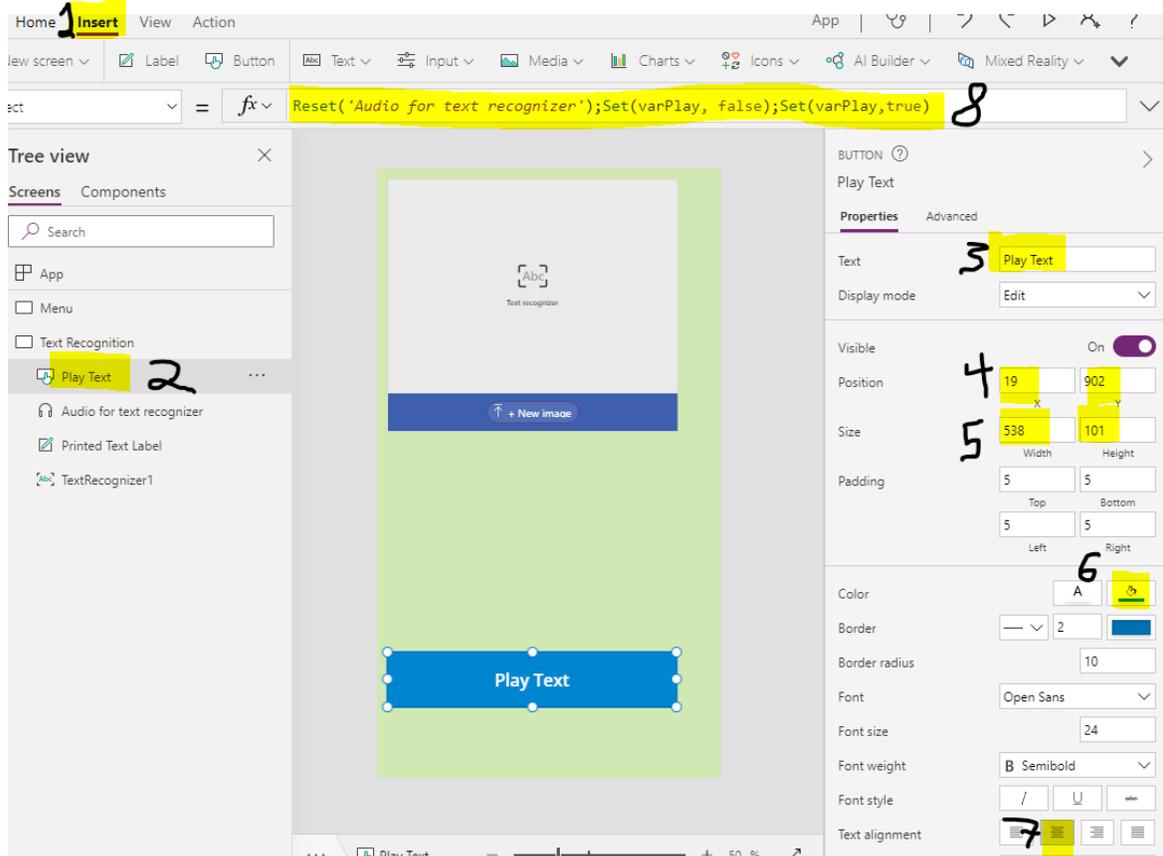


Figure 32 Formatting Audio Playing Button and Formula

11. Insert a second button following the above steps.
 - 11.1 change name of the button for “ Stop” and Text “Stop”
 - 11.2 change size for 19 (x) 1019 (Y)
 - 11.3 change size 538 width and 101 Heights
 - 11.4 change colour for red
 - 11.5 change alignment for the centre
 - 11.6 Add following function under OnSelect to make buttons play
`Reset('Audio for text recognizer');Set(varPlay, false)`

* This function reinitialize the value of the audio media to false and so interrupts it*

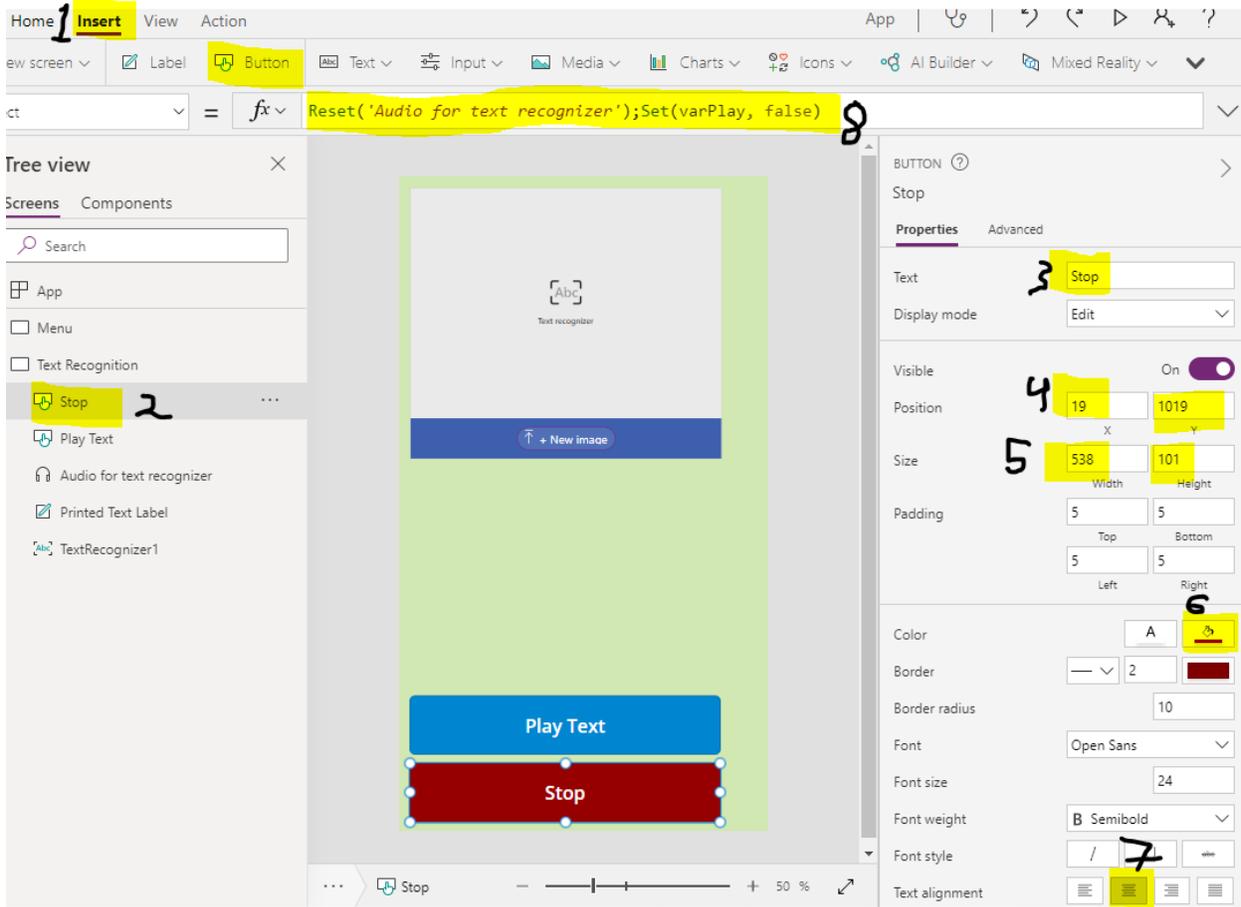


Figure 33 Inserting Audio Playing Stop Button And Formula

12. It is now time to insert the button that will bring the user back to the menu. Under “insert” select ”icons” and select “cancel.”

12.1 change the name of the icon for “Exit to menu”

12.2 change the position for 564 (x), 0 (y)

12.3 change colour for red

12.4 insert the following function to get back to menu:

`Navigate(Menu)`

this function calls the navigate function that brings the user back to the Menu page

6.1.7 Selected Text Recognition

1. Create a new screen page (please refer to section 6.3)
2. Change the screen name for “Selected Text Recognition”.
3. Change the colour of the screen for light orange by selecting the “fill icon”

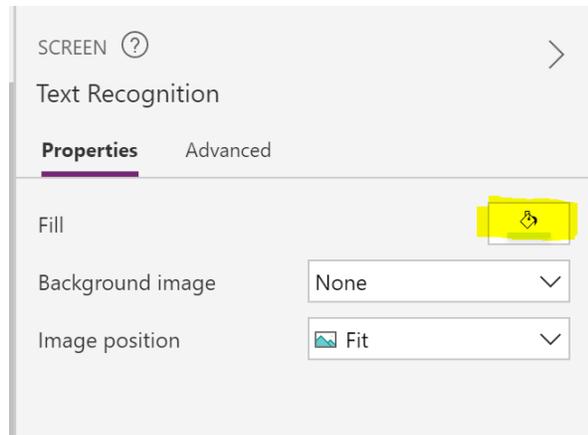


Figure 34 Changing Background Colour Selected Text Recognition

4. Add the Text Recognizer OCR AI (to use the Text recognizer you need to have the premium version of Power App, please refer to how to get the premium version of power app) Under “Insert” , “AI Builder” →”Text Recognizer” .
 - 4.1 change the position to 18(X) ,78 (Y)
 - 4.2 change position for 602 width and 710 Height

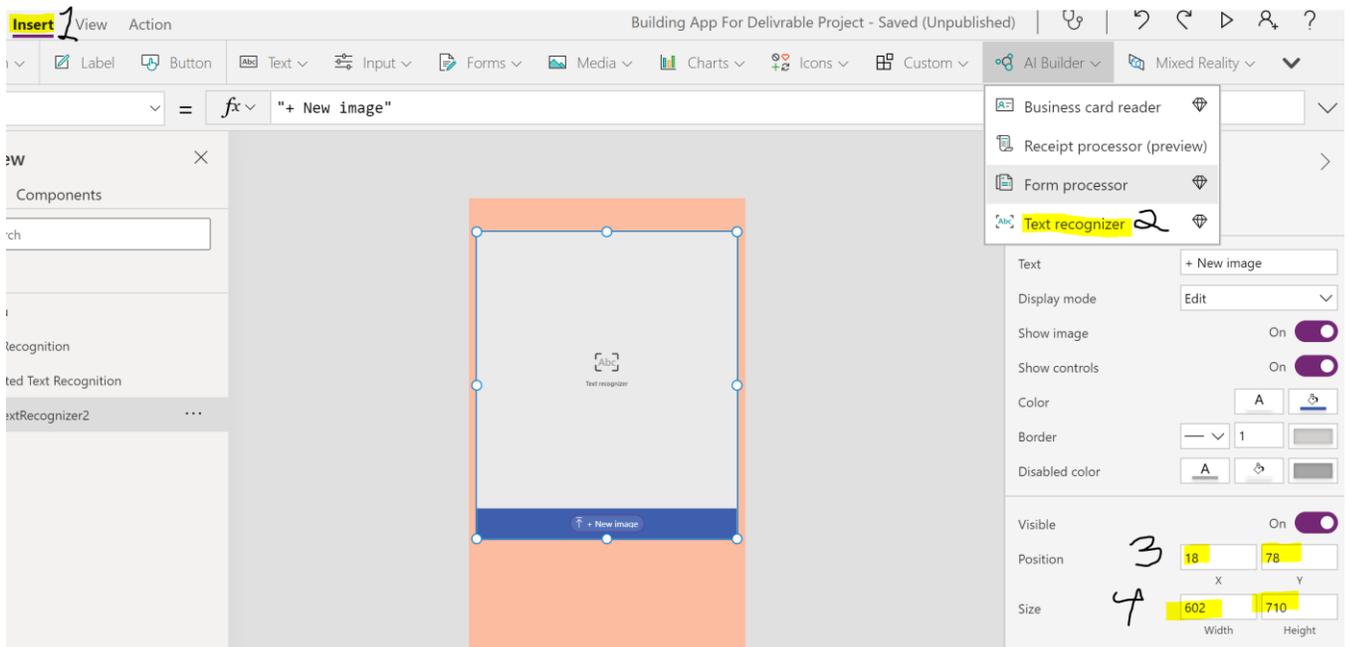


Figure 35 Inserting OCR

5. It is now time to insert the label that will get the selected text printed in. Under “Insert” select “label”
 - 5.1 change the name of the label for “Printed Text label”
 - 5.2 Remove any value in “Text”
 - 5.3 Change the font for “lato Black”
 - 5.4 Change the font size for 30
 - 5.5 change the font weight for “Bold”
 - 5.6 Change text alignment for “centre”
 - 5.7 Change position for 18(x) and 801 (y)
 - 5.8 Change size for 602 Width and 185 Height

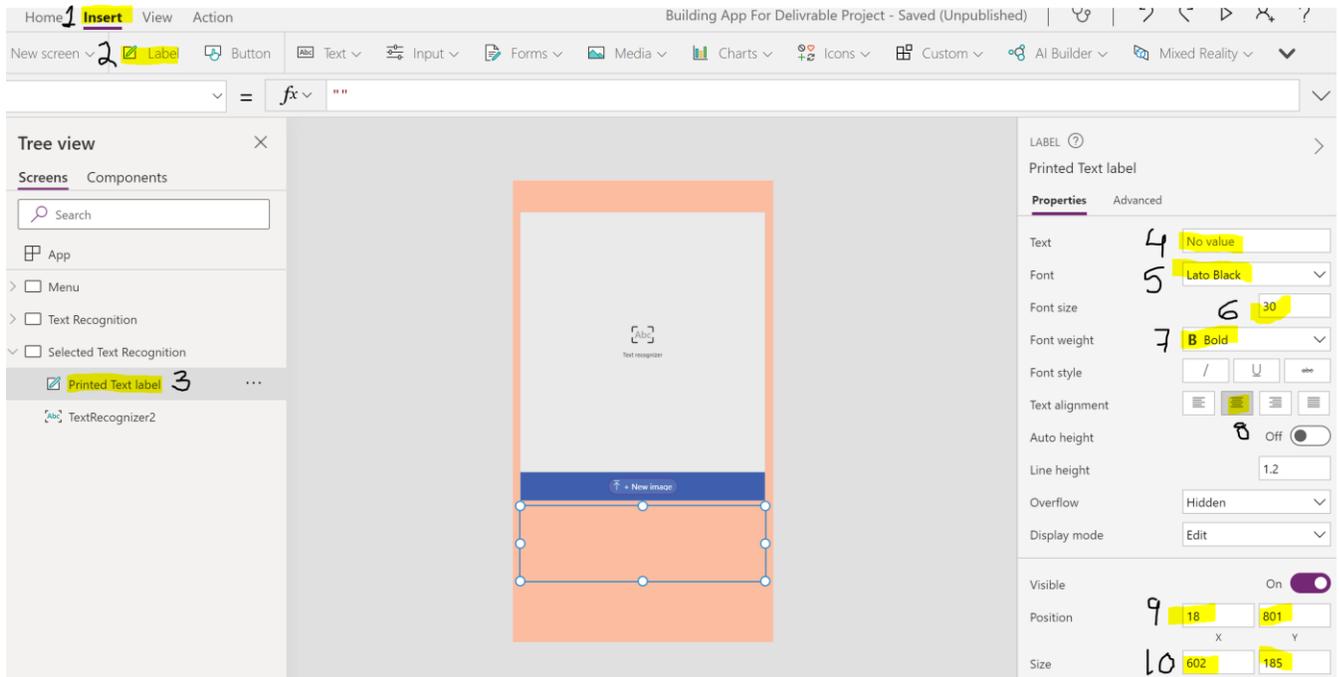


Figure 36 Inserting Printing Label

6. Insert the following function under “Text” to create a link between the OCR and the printing label:

`TextRecognizer2.Selected.Text`

* This function links the OCR to the printing label but only the selected text from the image will be printed *

7. It is now time to add the audio media that will produce the vocal of the printed text. Under “insert” select “Media” then “Audio”

7.1 change the name for” Audio 2 for text recognizers.”

7.2 Under visibility , turn it off. (this will make the audio invisible on the page but will still be present to interact with)

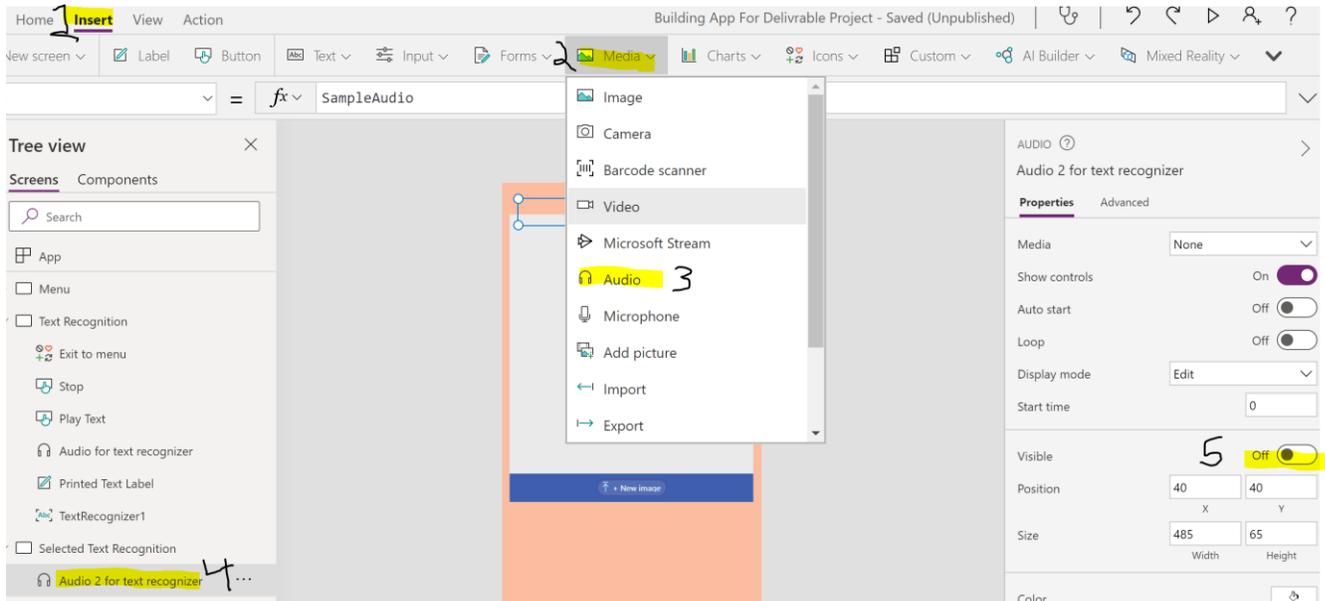


Figure 37 Inserting Audio Media

8. Insert the following function to start the TextToSpeechFeature:

`MicrosoftTranslator.TextToSpeech('Printed Text label'.Text,"en-us")`

. This function calls the Translate TextToSpeech AI to create a vocal audio of the printed text from the label

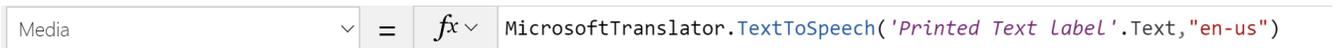


Figure 38 Inserting Formula.

9. It is now time to create a button to start playing the Vocal audio. Under “Insert” selection “button”

9.1 Change the name for “Play Text”

9.2 Change the text for “Play Text”

9.3 Change the position for 18 (x) and 986 in (y)

9.4 Change the size of 602 width and 133 Height

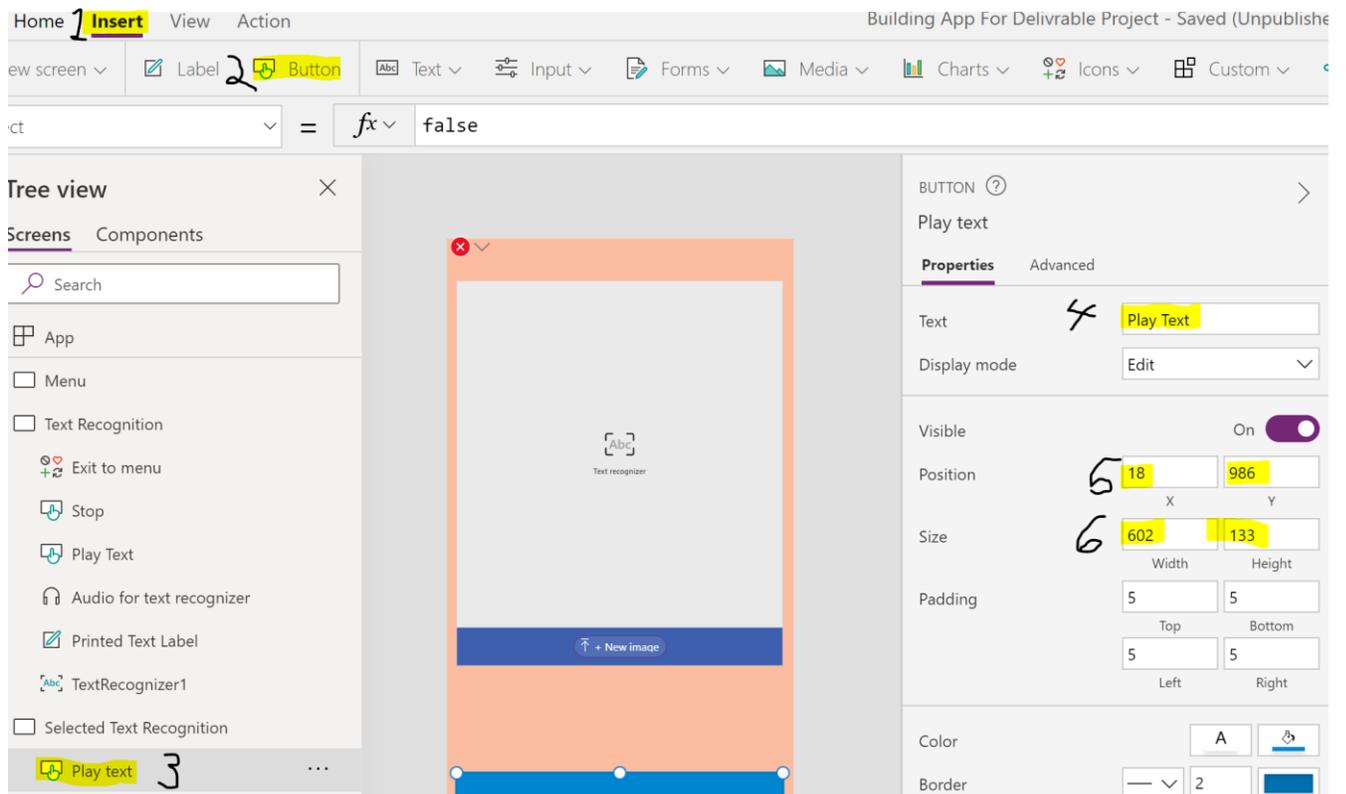


Figure 39 Inserting Play Text Button

10. Insert the following formula to may the button play the sound:

. Reset('Audio 2 for text recognizer');Set(varPlay1, false);Set(varPlay1, true)

* This function takes the value of the audio media, reset it and start it*

11. It is now time to insert the button that will bring the user back to the Menu page. Under “Insert”, select “Icons” and “Cancel.”

11.1 Change the name for “Exit to menu 2”

11.2 Change the colour for red

11.3 Change the position for 565(x) and 0 (y)

11.4 Change the size of 75 width and 64 height

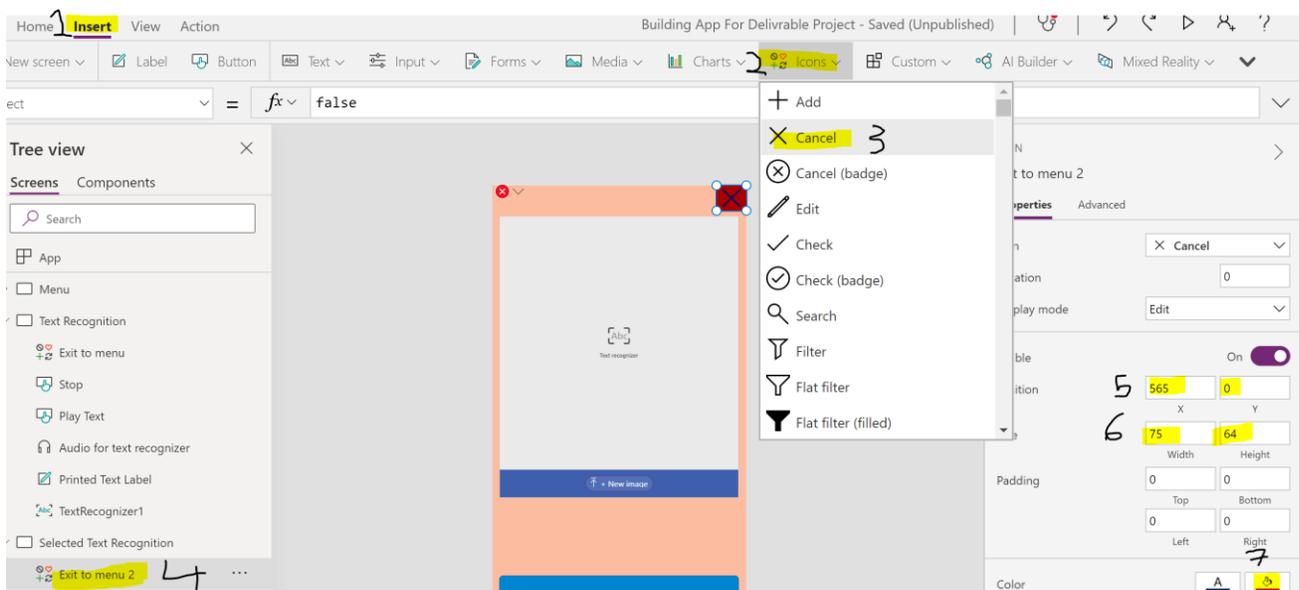


Figure 40 Inserting Exit to Menu Button

12. Insert the following function to navigate back to the menu:

`Navigate(Menu)`

This function calls the navigate function that brings the user back to the Menu page

6.1.8 Price Recognition

1. It is now time to create the third and final feature of the solution app. Create a new screen .change the name of the screen for “Price Recognition” and change the colour of light purple.
2. An OCR is now needed. Add the Text Recognizer OCR AI (to use the Text recognizer you need to have the premium version of Power App, please refer to how to get the premium version of power app) Under “Insert” , “AI Builder” →”Text Recognizer” .

2.1 change the position to 19(X) ,20 (Y)

2.2 change position for 538 width and 468 Height

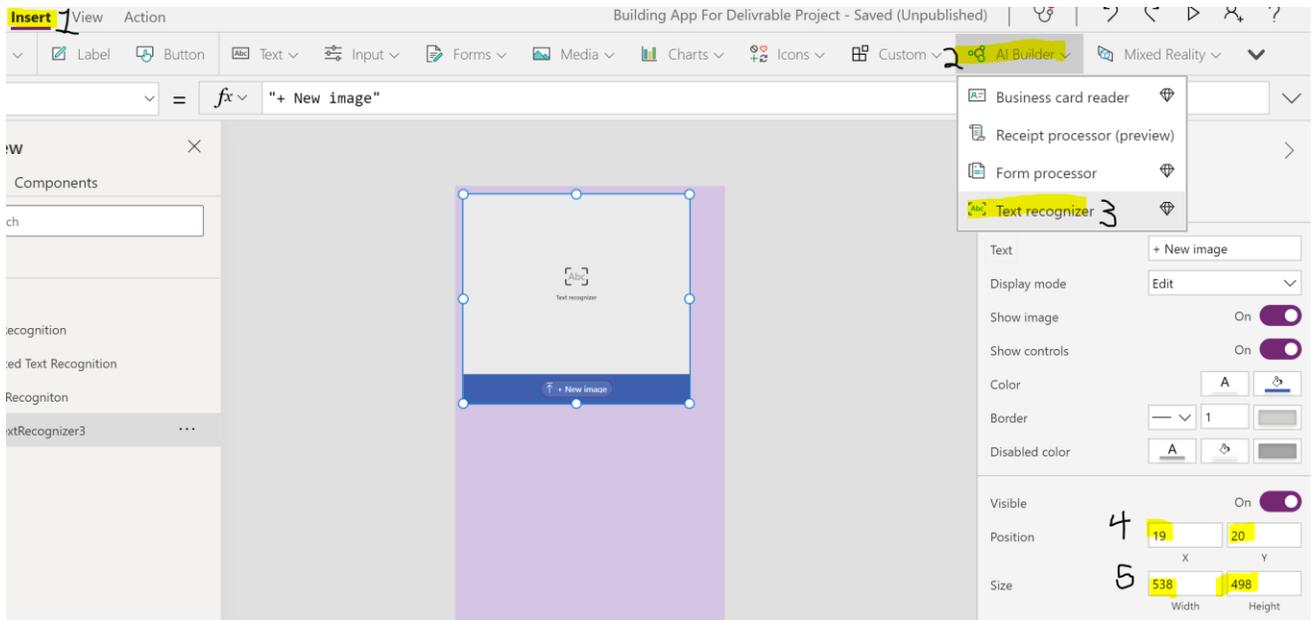


Figure 41 Insertion Of the OCR In the App

3. Under “Insert” insert a label
 - 3.1 change the name for “Price”
 - 3.2 change the text for “Price : “
 - 3.3 change the font size for 30
 - 3.4 Change the font weight for “Bold”
 - 3.5 change text alignment for “centre”
 - 3.6 change the position for 19(x) and 546 (y)
 - 3.7 change the size for 538 width and 70 height

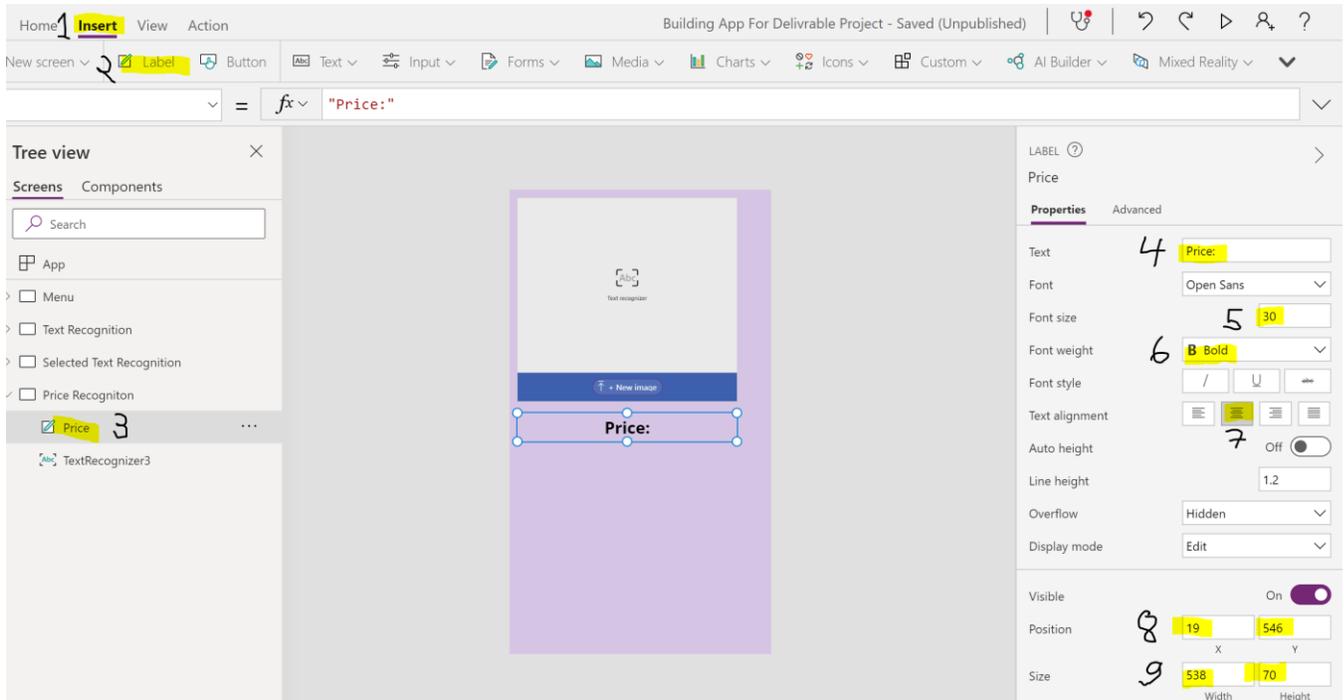


Figure 42 Price Label

4. Insert a second label . Under “Insert” insert a lable

4.1 change the label name for “Invisible Label”

4.2 remove initial value text

4.3 turn the visibility “Off”

4.4 insert the following formula to print the OCR text :

`Concat(varExtractedText,Text & Char(13))`

*. This formula will make the OCR print text in the Lala , but since the label is invisible on the , the user will not see it *

5. It is now time to insert the label that will get the price printed. Under “insert” select “button”

5.1 Change the name for “Printed Price”

5.2 Change the font size for 75

5.3 Change the font weight for “Bold”

5.4 Change text alignment for “center”

5.5 Change the position for 25(x) and 637 (y)

5.6 Change the Size for 538 width and 126 for Height

5.7 Insert following function to get the price printed in the label from the OCR :

`Mid('Invisible label'.Text,Find("$", 'Invisible label'.Text),6)`

*. This function will evaluate the printed text from *Invisible Label* and will discriminate whatever doesn't contain “\$” with 6 numbers following it “

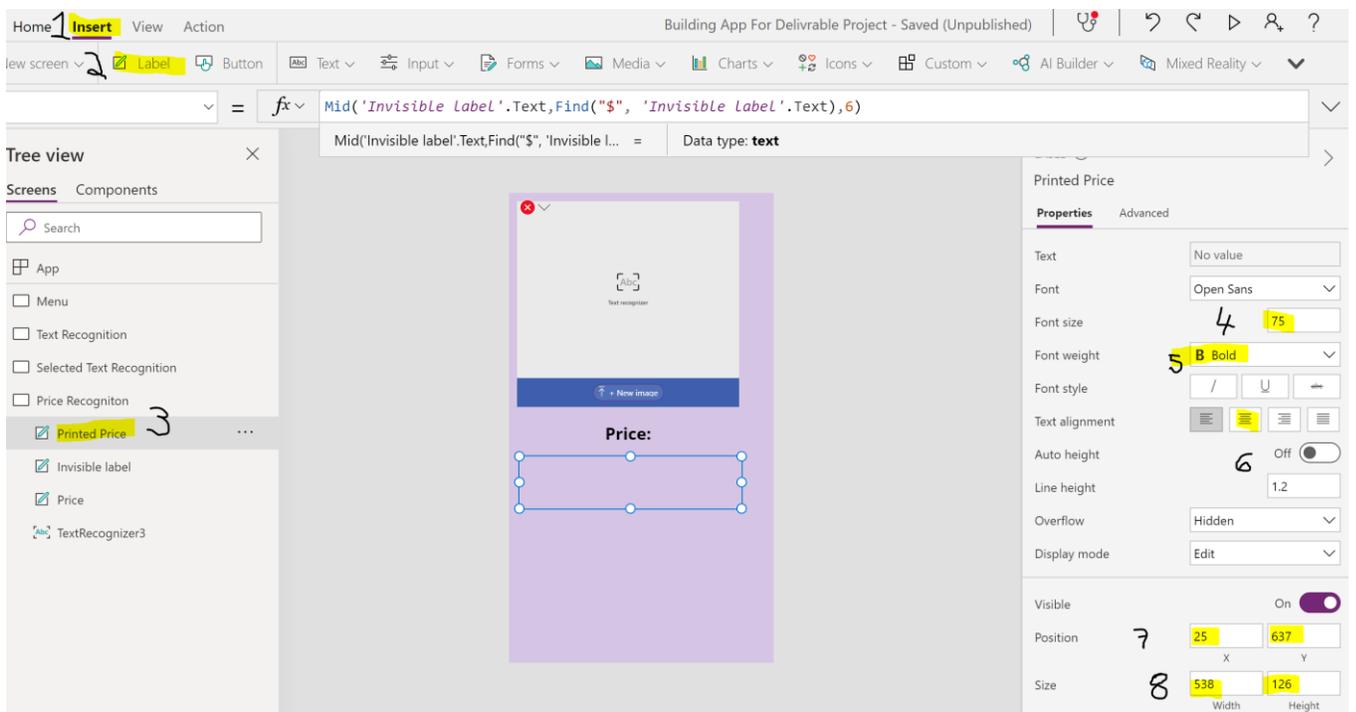


Figure 43 Printed Price Label

6. It is now time to insert the audio media the will store the vocal audio of the printed text. Under “insert” select “Media “ then”Audio”

6.1 Change the name for “ Audio 3 for text recognizer”

6.2 turn of the Off the visibility

6.3 Add the following formula to create the vocal audio of the printed price :

`If(IsBlank('Printed Price'.Text), "No text identified",
MicrosoftTranslator.TextToSpeech('Printed Price'.Text,"en-us"))`

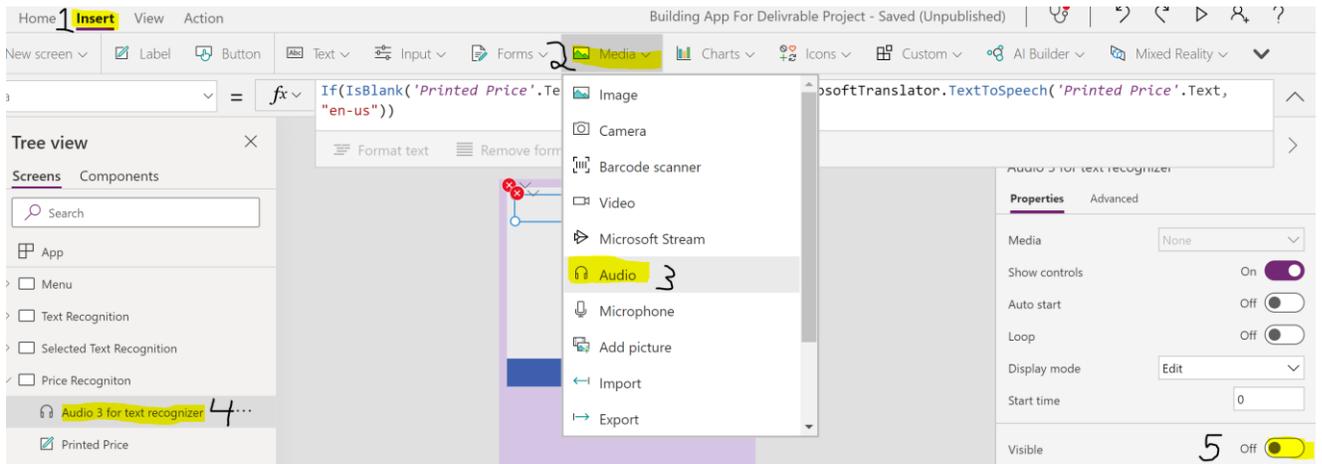


Figure 44 Insertion Of The Audio Media

7. It is now time to create a button that will play the vocal audio of the printed text. Under “insert” select “icons” then “Tag”

7.1 Change the name for “Price Tag Audio Player”

7.2 change the position for 3 (x) and 810 (y)

7.3 Change the Size for 214 width and 169 Height

7.4 insert the following formula to make the button play the vocal audio:

`Reset('Audio 3 for text recognizer');Set(varPlay, false);Set(varPlay, true)`

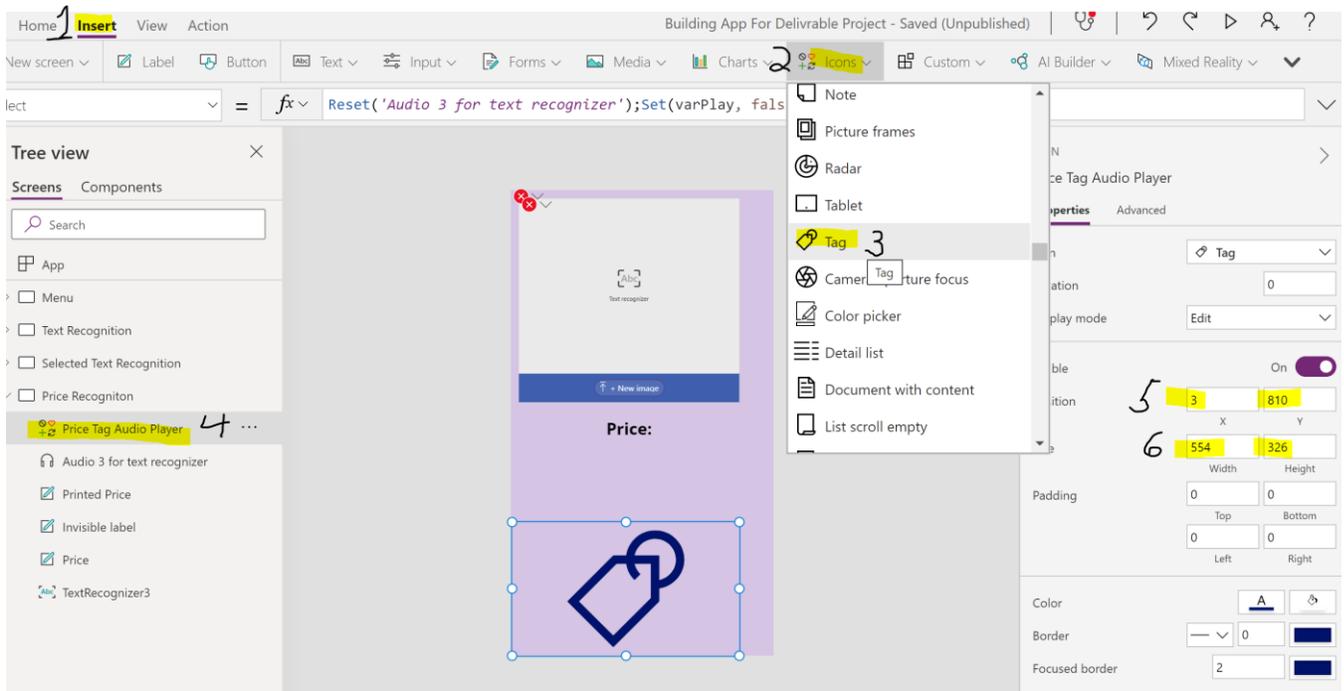


Figure 45 Insertion Of The Audio Player Icon

8. it is now time to create the button that will bring the user back to the menu page. Under “insert”, ”icone” select “cancel”

8.1 change the name for “Exit to menu 3”

8.2 change colour for red

8.3 change position for 564 (x) and 0 (y)

8.4 insert following formulas to navigate back to the menu:

`Navigate(Menu)`

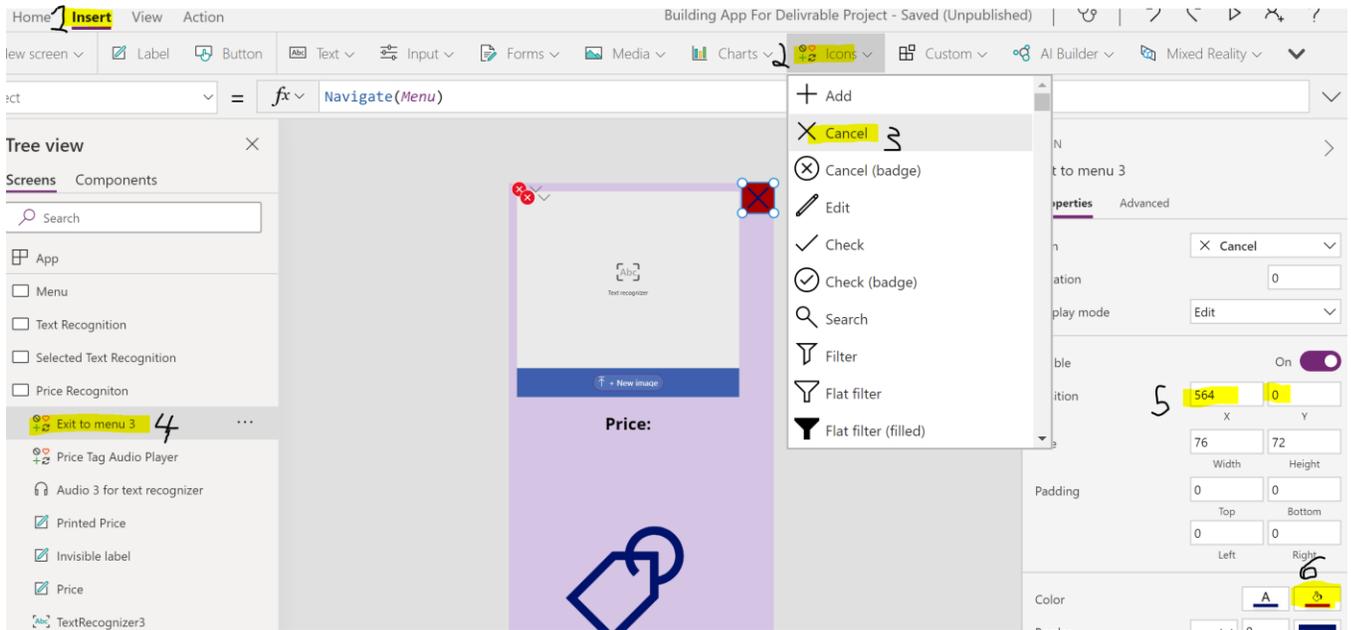


Figure 46 Insertion of the Exit To Menu Button

6.2 Testing & Validation

For testing the solution app, we have asked different family members to try the app and evaluate it under different criterium and assumptions.

(It is important to note that no instruction was given to them before testing app. All following data is raw opinion, and subjective. In , the final OCR 3 solution app is referred as "Prototype 2" during testing phase)

Table 3 Evaluation of The Prototype Based On Target Specification

	Unit	Ideal value	Marginal value	Expected result	Actual result
1. Usability of the solution	Subjectif (scale 1 to 5)	5	4	5	4.3
2. IOS compatible	Binary Yes or no	Yes	Yes	Yes	Yes

3.The solution provides audio feedback.	Binary Yes or no	Yes	Yes	Yes	Yes
4. Accuracy of result (printed text)	%	=100%	>80%	80%	85%
4. # of steps to accomplish task	count	=2	< 4	3	4
5. # Of different colours used in the solution	count	>4	> 3	5	10
6. Cost	\$	< 0	< 50	0\$	0\$

1. Usability of the solution: Based on the testing of our Prototype 2, we conclude the usability of the app to be 4.3 .The app is really intuitive to use and has simple steps to accomplish a needed task. Each button is clearly labelled with their functionality to reduce any possible confusion by the user. ... The internal algorithm is also optimized to proceed the task in the shortest delay possible.

In our target specification , we expected a 5/5. The single down point of the app is the OCR screen being a bit small on some phone screen. It can take a bit of time to get used to it. There for the usability was rated 4.3/5

Test methods : To test the usability of the app , I have asked 3 family members to try the app and provide some feedback about it.

(No instruction and no information were given to them before testing)

Table 4 Family feedback on the usability

Family member	usability?	Rating	Feedback
Mother,	yes	4	“I like the colour code. It makes it easier to recognize the different functions, knowing that the app is for visually impair people.”
Father	Yes	4	“Button can get improved (make them rounder). The app is intuitive enough to use. Functionality of the app is responsive. ”

Sister	Very yes	5	“I really like how you have the option to choose what you want to hear and that is not just only one option. The voice feels pretty normal to me. I’ll be very cool if they’re another option for the voice, like for example a boy’s voice or have it in another language. ”
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2. IOS compatibility: Proptype 2 has been built on Microsoft Power App platform. This platform allows creating apps that can be both IOS and Android compatible without needing to pass by the Appstore to publish the app. Prototype 2 is therefore FULLY compatible with IOS.

Testing procedures and feedback :

I (Spiridon) downloaded and tested OCR 3 Power App on a family member iPhone.

All the pages and features of the app were working on the iPhone .Very few to no bugs were observed during the testing phase. The app was fully working on the iPhone.

3. The solution provides audio feedback: Prototype 2 includes an AI that is capable of producing audio output of a printed text that the OCR detects. This feature allows the user to get audio feedback of the proceeded information by the app

testing procedure and Feedbacks:

I have asked the same 3-family member to test and provide feedback on the audio output of the app

(No instruction and no information were given to them before testing)

Table 5 Family feedback on the Audio Feedback

Family member	feedback
Father	“ The app provides an accurate audio output of the printed text. The voice is a bit fast but still easily understandable “

Mother	“I like the audio feedback feature. It makes it easier to use the different functions, knowing that the app is for visually impair people. The audio feedback is accurate and works automatically when I select the text that I want to be read. ”
Sister	“ The voice feels pretty normal to me. I’ll be very cool if they’re another option for the voice, like for example a boy voice or have it in another language.”

4. Accuracy of results: Prototype 2 contains a well-optimized algorithm that uses AI capable of doing **Object Character Recognition** from an image and printing the output in a label.

Testing the accuracy of the result:

To test the accuracy of the printed text , I have tested 6 different price tags in the app and recorded the data. I only used the price recognizer feature of the app for my testing since it is the main requested feature from the app by the client.

Table 6 Accuracy On Price Tag

Test	Accurate ?
	<p>Yes → (1pts)</p>



Price:

\$56.7

Semi accurate (recognized the price but not the one I was looking for) → (0.5pts)



Price:

\$22.9

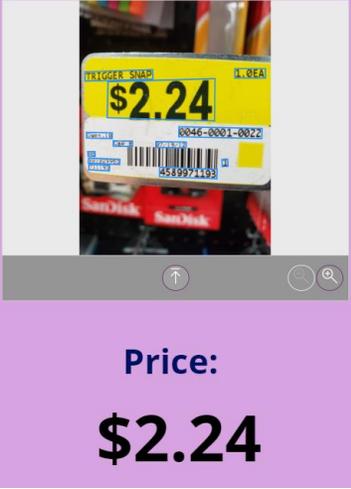
Yes → (1pts)



Price:

\$14.9

Almost (The price didn't get fully printed) → (0.75pts)

	<p>Yes → (1pts)</p>
<p>Result :</p>	<p>4.25/5 = 85%</p>

We then concluded that the accuracy of the OCR is 85% which is satisfactory enough.

5. # Of steps to accomplish a task: Globally , the number of steps to accomplish a task by the use is 4. (open app → select features/ options → take pictures → select the text reader). When building prototype 2 , we have kept in mind to keep as few steps as possible to accomplish a task!

6. # Of different colours used in the solution : The app has a total of four different visible colours used. Each page has a different colour to make it easier for the user to navigate in the app. In addition , on the first page , each button is a different colour. Their respective colour is the same as the background colour from their associated page . (Button 1 is green , page 2 is green. Button 2 is orange , page 3 is orange . Button 3 is purple , page 4 is purple)

7. Cost: Prototype has been built on Microsoft Power app platform which is free using our UO student account. The premium features used in this app are also free when using the UO student account. It is to note that the premium features are free when using the 30-day trial of the premium version.

6.3 BOM → David

Table 8.BOM

Item Number	Part Name	Description	Quantity	Unit Cost (Cad)	Extended cost (Cad)
1	Microsoft Power App https://make.powerapps.com/	WebApp building platform	1	0.00\$ Usually 51.20\$/month but we using Uottawa student accounts so it is free + 620\$/month AI builder access	0.00\$ Usually 51.20\$/month but we using Uottawa student accounts so it is free + 620\$/month AI builder access
					0.00\$

6.4 Equipment List

The equipment needed for building the solution App is the MS power App platform

7 Conclusions and Recommendations for Future Work

Although we encountered challenges and faced unforeseen circumstances that hindered the progression of further work, this project was a very beneficial learning experience. As a team we were able to truly understand the implementation of the design process, each team member learned valuable characteristics of themselves and how they interact with other team members, as well as how they can improve to avoid any problems that may have occurred during the semester. The main lessons our group learned were in areas such as organization, time management, and contingency planning. With Covid and circumstances unpredictable, organization was key to keep the group constantly on task. With members unable to meetup and work together, work had to be divided strategically among members and durations set, keeping in mind dependencies. Furthermore, with changes in circumstances unpredictable, there was a need to be very flexible at times with our plans and consider different scenarios that might unfold. These are lessons which can be applied in the real world of engineering jobs, specifically in the engineering design and entrepreneurship sector.

I believe our team's solutions are a stepping stone for anyone looking to tackle the problem, and can be completed fully or parts of it can be used as inspiration to create other solutions. There are plenty of ways in which our solution can be improved and polished, and we as plan to add some extra features like a voice selection feature with different accents may have been added to provide more familiarity to the user as well as a language

translation and selection feature for the app to be more globally accessible. Improvements to the AI would have also been made to ensure a higher success rate and quicker, more efficient image processing.

8 Bibliography

Concat and Concatenate functions - power apps. (2019, May 23). Retrieved March 1, 2021, from <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/functions/function-concatenate>

Find function - power apps. (2015, November 7). Retrieved March 3, 2021, from <https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/functions/function-find>

R. (Director). (2018, December 02). *Image to text with POWER Apps, Microsoft flow, and COGNITIVE SERVICE* [Video file]. Retrieved February 16, 2021, from <https://www.youtube.com/watch?v=GZZEjIRRLI>

R. (Director). (2018, December 09). *Image to text with POWER Apps, Microsoft flow, and Cognitive Service: Part 2* [Video file]. Retrieved February 16, 2021, from <https://www.youtube.com/watch?v=IOhd1xJmYgM>

Rao, V. (Director). (2020, February 23). *Accessibility: Text to speech in power apps using Microsoft Translator* [Video file]. Retrieved February 16, 2021, from <https://youtube.com/watch?v=zaVf21Rsteg&feature=share>

Technologies, A. (Director). (2020, October 28). *Power apps & AI text recognition BY sameer Mohammed | AQL Technologies* [Video file]. Retrieved February 21, 2021, from <https://www.youtube.com/watch?v=sUB7p5GZ1bM>

Topness, P. (Director). (2020, March 12). *Power apps text recognizer component & ups label to on premise db* [Video file]. Retrieved February 28, 2021, from <https://www.youtube.com/watch?v=eOznJgavHo&t=82s>

Young, S. (Director). (2021, March 2). *QTT - power apps play sound on click* [Video file]. Retrieved April 11, 2021, from <https://www.youtube.com/watch?v=oRMSKfqPUbw>

APPENDICES

9 APPENDIX I: Design Files

Here is the makerRepo link of our project:

<https://makerepo.com/SpiridonAmohnoaie/849.ocr-accessibility-app-engineering-team-c22>

App demonstration Youtube link :

https://www.youtube.com/channel/UC9O5a_Zs2QSsy5_P5iT0g

Table 7. Referenced Documents

Document Name	Document Location and/or URL	Issuance Date
Deliverables H	https://docs.google.com/document/d/1TiOH4zBFt4n3tNzU_TA_XUWTK7Wu4y3IUM8F7vQeA8Gk/edit	none