

Blazor Simple AI Project

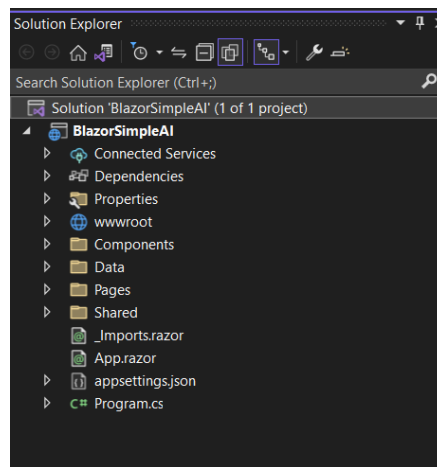
Welcome to the Blazor Simple AI Single Page App, the AI that responds to questions instantly using Microsoft Azure OpenAI Services. This document explains the project in my GitHub repository which is available here: <https://github.com/tejinderrai/public/tree/main/BlazorSimpleAI>.

Technologies

Blazor Simple AI is made up of the following technologies:

- Microsoft .NET Blazor (.NET 6.0 LTS release)
- Microsoft Azure.AI.OpenAI .NET Library
- Microsoft Azure AI Services – OpenAI

It's that simple!



Why Blazor?

Blazor is simply amazing, and I have been developing Blazor projects for over four years. There has been great demand for Blazor over the past few years and as a component framework and use of C# this is exactly what I need to develop solutions and concepts super-fast!

What Blazor Simple AI Does?

Blazor Simple AI is a Blazor server-side single page app which has a single page and a single component. The razor page has two basic user interface controls, a textbox and a submit button for a user to enter the question for Azure OpenAI. The component "AzureOpenAIChat.razor", has a single parameter which receives the question from the main index page. When the parameter is received by the child component, the component has OnParametersSetAsync() method which then retrieves the appsettings.json values in relation to the Azure OpenAI service AI endpoint, Azure OpenAI key and the deployment name which has the associated model, which was deployed with Azure AI Studio, then send the text to the Azure OpenAI service and retrieves and displays the response.

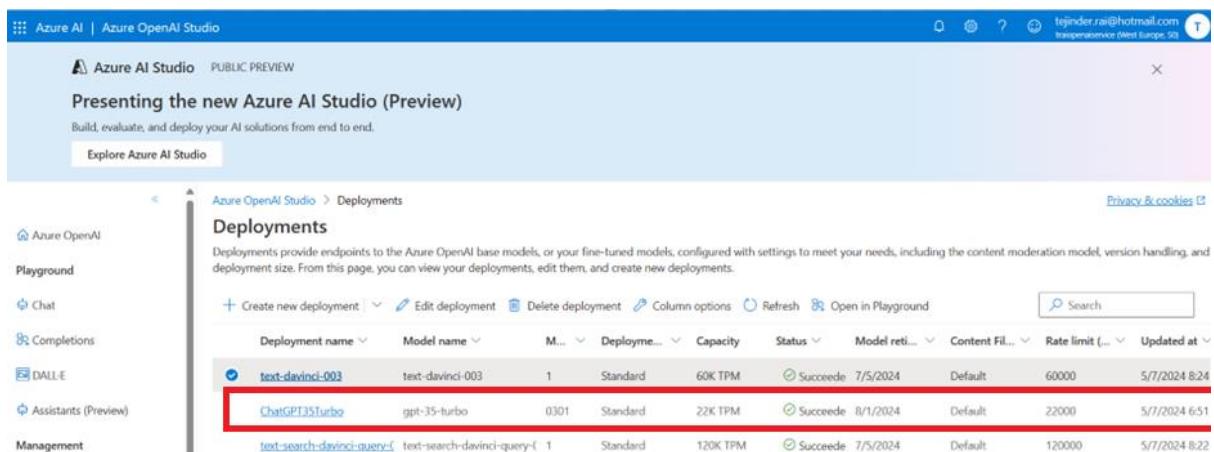
Core Blazor Template Changes

There have been some basic changes to the basic Blazor layout to accommodate the project. These are as follows:

- 1) The sidebar has been removed from the MainLayout.razor page
- 2) A new Index.razor.css style sheet has been added to centre the UI components on the page
- 3) A new Components folder has been added to the project
- 4) A new component named AzureOpenAIChat.razor has been added into the Components folder
- 5) A new configuration section has been added to appsettings.json to include the configuration required for the project to interact with the Azure OpenAI service
- 6) The title and main element have had text changes to represent the project name and description

Steps to Deploy Azure Open AI

- 1) Create an Azure Resource Group
- 2) Deploy the Azure OpenAI service in the resource group, see: [How-to: Create and deploy an Azure OpenAI Service resource - Azure OpenAI | Microsoft Learn](#)
- 3) Manage Deployments in Azure AI Studio and create a deployment using the gpt-35-turbo model



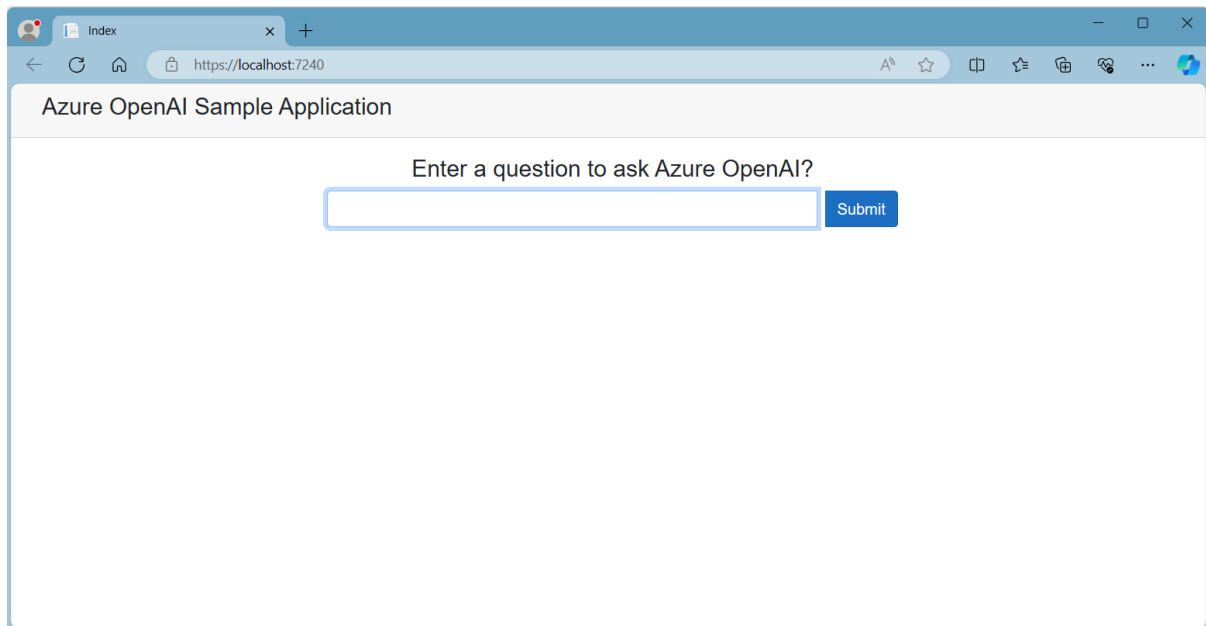
- 4) Update the appsettings.json with the settings

```
"AzureAIConfig": {  
  "OpenAIEndpoint": "https://[You Azure OpenAI Service].openai.azure.com/",  
  "OpenAIKeyCredential": "[Your Azure Open AI Key]",  
  "OpenAIDeploymentName": "[Your Azure Open AI Deployment Name]",  
  "RetroResponse": "true or false"  
}
```

- 5) Build the project and ask Azure OpenAI anything you like.

The UI

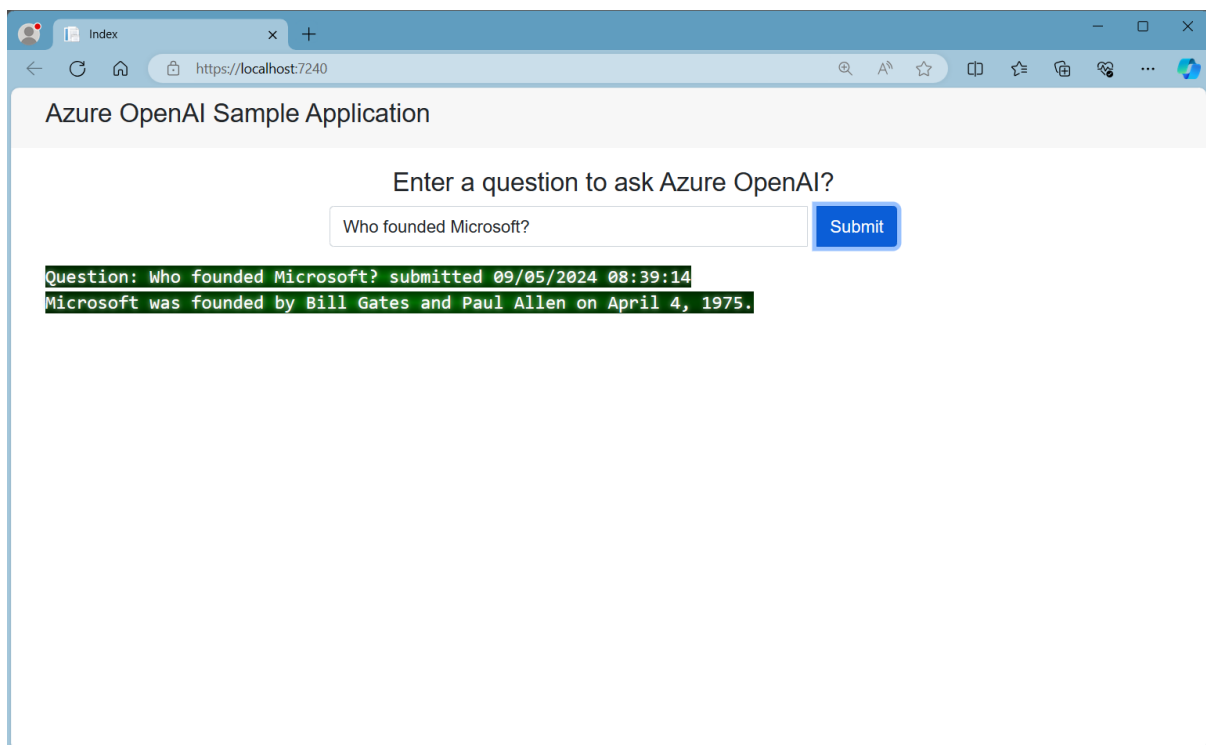
The landing page.



Sample Questions and Responses

Question 1

Who founded Microsoft?



Question 2

Who developed OpenAI?

Azure OpenAI Sample Application

Enter a question to ask Azure OpenAI?

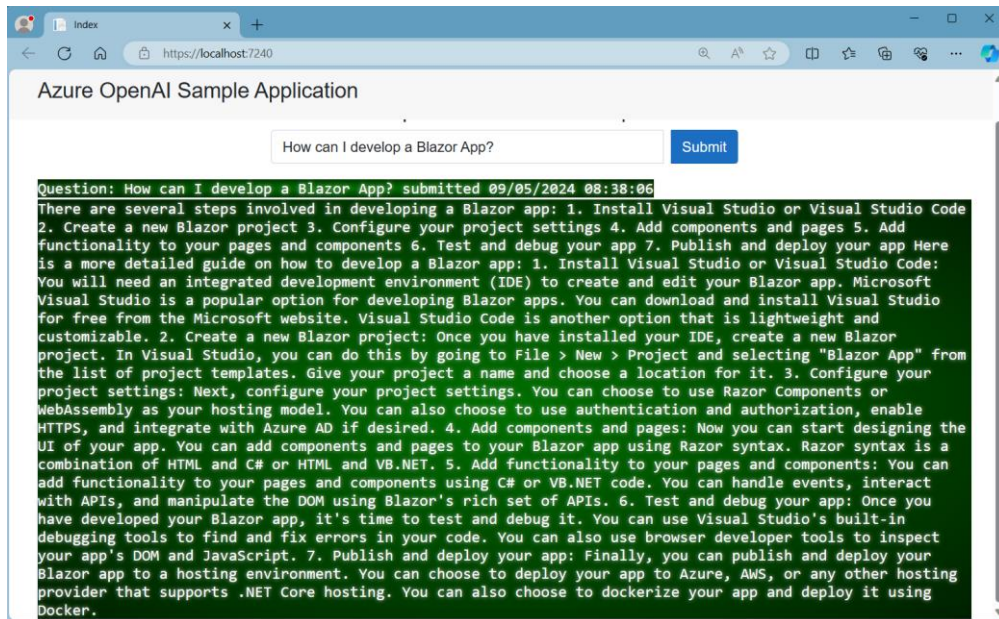
Who developed OpenAI?

Question: Who developed OpenAI? submitted 09/05/2024 08:38:55

OpenAI was developed by a team of researchers and engineers, including well-known individuals in the field of artificial intelligence such as Elon Musk, Sam Altman, Greg Brockman, and Ilya Sutskever.

Question 3

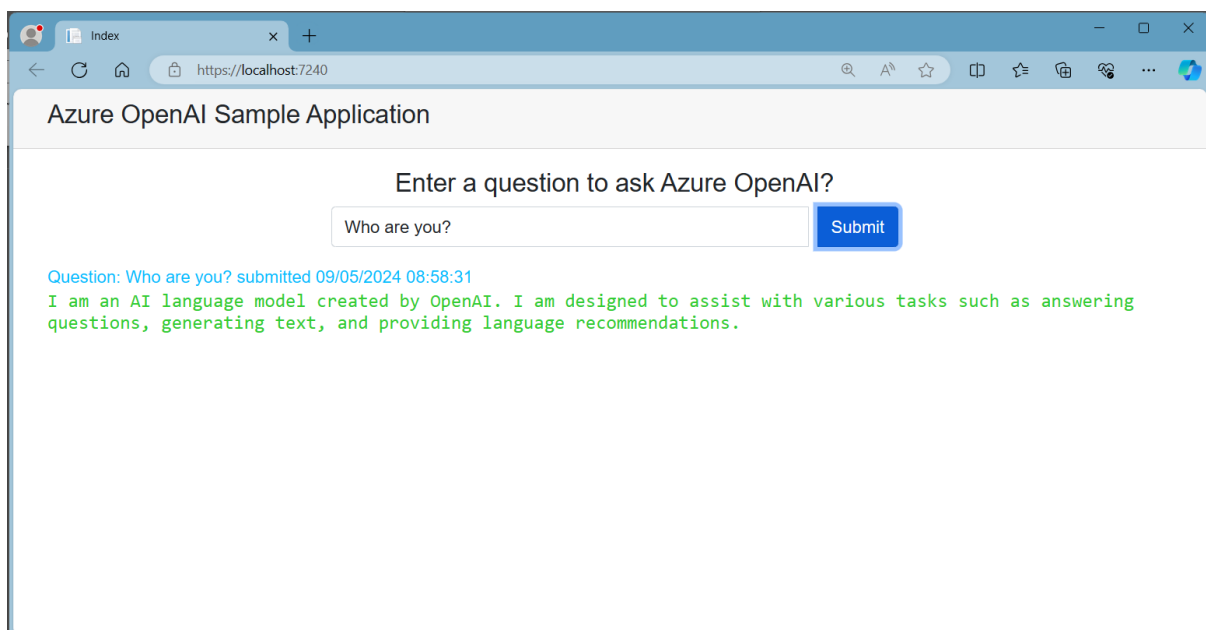
How can I develop a Blazor App?



Basic CSS

The AzureOpenAIChat.razor component has a basic CSS style sheet which allows the deployment to have a retro style response or a basic response text visualization option. If the app setting below is set to true, you will get the retro response as per the sample above. For a standard non-retro style response, you can set the value to false, example below.

```
"AzureAIConfig": {  
  "RetroResponse": "false"  
}
```



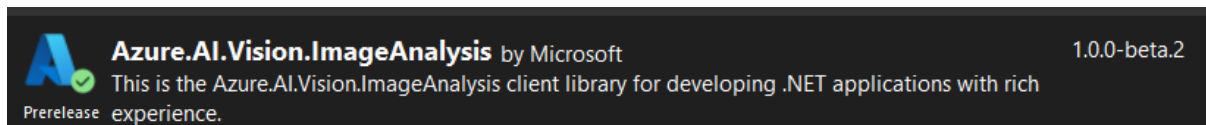
Blazor Simple AI Project (Part 2)

Image Analysis with Azure AI Vision

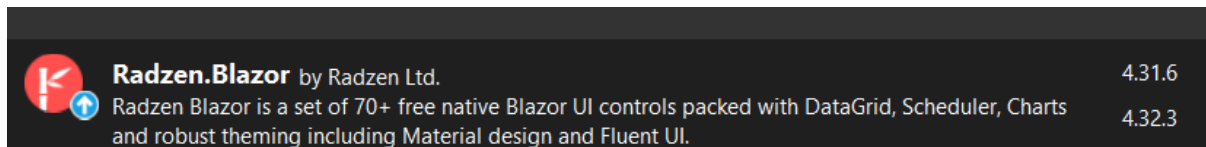
Welcome to the Blazor Simple AI Single Page App, Part 2 of the Microsoft AI services journey, which now includes image analysis utilising Microsoft Azure AI Vision. The Vision Read API is used to extract the text from an image. This document explains the project in my GitHub repository which is available here: <https://github.com/tejinderrai/public/tree/main/BlazorSimpleAI>.

Since part 1, the following nuget packages have been added to the project.

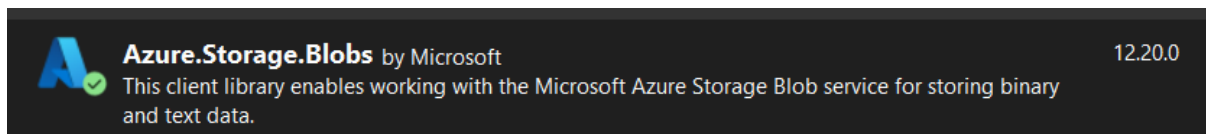
Azure AI Vision Image Analysis – for reading text and metadata from images.



Radzen Blazor – for providing an amazing UI experience.



Azure Storage Blob – for handling interactions with Azure Blob Storage.



Visual Changes

I have made some appealing improvements from the basic Blazor template and styled the UI based on a project from Martin Mogusu available here: [GitHub - martinmogusu/blazor-top-navbar: A top navbar example created in blazor](#). This saved me a lot of time and all I had to do was apply my own visual styles after the top navigation was applied to the project in shared/NavMenu.razor. In addition, I had added a pre-built model for interactive Invoice Analysis and processing, which I will leave the full explanation until Part 3 of this post.

Components

Three components have been developed for the image analysis. These are as follows:

- 1) Vision.razor – The Image Analysis page
- 2) VisionBlobLoader.razor– This includes the capability to upload files to Azure blob storage, which also sets the content type for the blob file.
- 3) VisionBlobFileList.razor – This is a child component embedded into the VisionBlobLoader component, which lists the image files that have been uploaded to Azure blob storage.

Learn about Microsoft AI Vision

To learn more about the capabilities of Microsoft AI Vision, see [What is Azure AI Vision? - Azure AI services | Microsoft Learn](#). Azure AI Vision includes more analysis capabilities, not just specifically image files.

Configuration Settings Changes

The following configuration settings were added to appsettings.json.

```
"AzureVsnConfig": {  
  "AzureAIVisionEndpoint": "https://[Your AI Vision  
Service].cognitiveservices.azure.com/",  
  "AzureAIVisionKeyCredential": "[AI Vision Service Key]"  
},  
"AzureStorageConfig": {  
  "AzureStorageConnectionString": "[Your Storage Account Connection String]",  
  "AzureStorageContainer": "[Your Storage Account Container]",  
  "AzureStorageAccountName": "[Your Storage Account Name]",  
  "AzureStorageAccountKey": "Your Storage Account Key"  
},
```

Note: Whilst this project utilises the service key, in an enterprise environment, you must consider using token based access to the service secured by Microsoft Entra ID, or if you wish to utilise the service key for any reason, utilise Azure Key Vault to protect the key used by the application with a managed identity for the application to access the service key stored in Azure Key Vault.

Components

File Upload Component (VisionBlobLoader)

The file upload component utilises Blazor InputFile for the user to select the file to upload in the application. The component reads the Azure Storage connection string from the configuration, including the container, then uploads the file to the container and also adds a blob http header for the file content type taken from the file properties. The Radzen notification service is used to notify the user of the application activities. I also included a basic spinner as part of the interaction for the upload process.

Blob List Component (VisionBlobFileList.razor)

This component reads the Azure Storage connection string from the configuration, including the container, then displays the blob file names in a Radzen DataGrid. A button is added to Analyse the image, which then calls the Radzen notification service to display the activities being taken by the application.

Data Classes

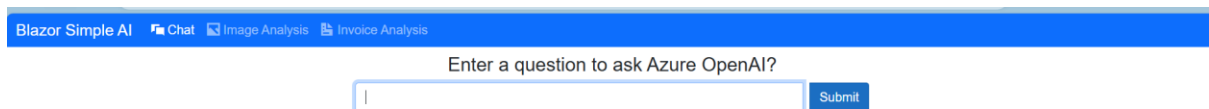
Two data classes have been created as follows:

- AzureBlobFile.cs – Azure blob file properties
- ImageDetails.cs – Image details for extraction from the AI Vision Analysis

The UI

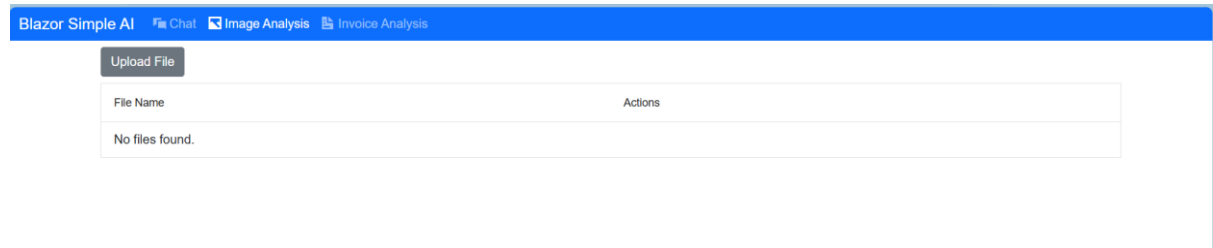
The UI is as follows. Notice the menu control has now changed since Part 1. Invoice Analysis will be formed in Part 3, at the time of writing this blog post, I had already uploaded the code to my GitHub repo.

Home page (Chat)

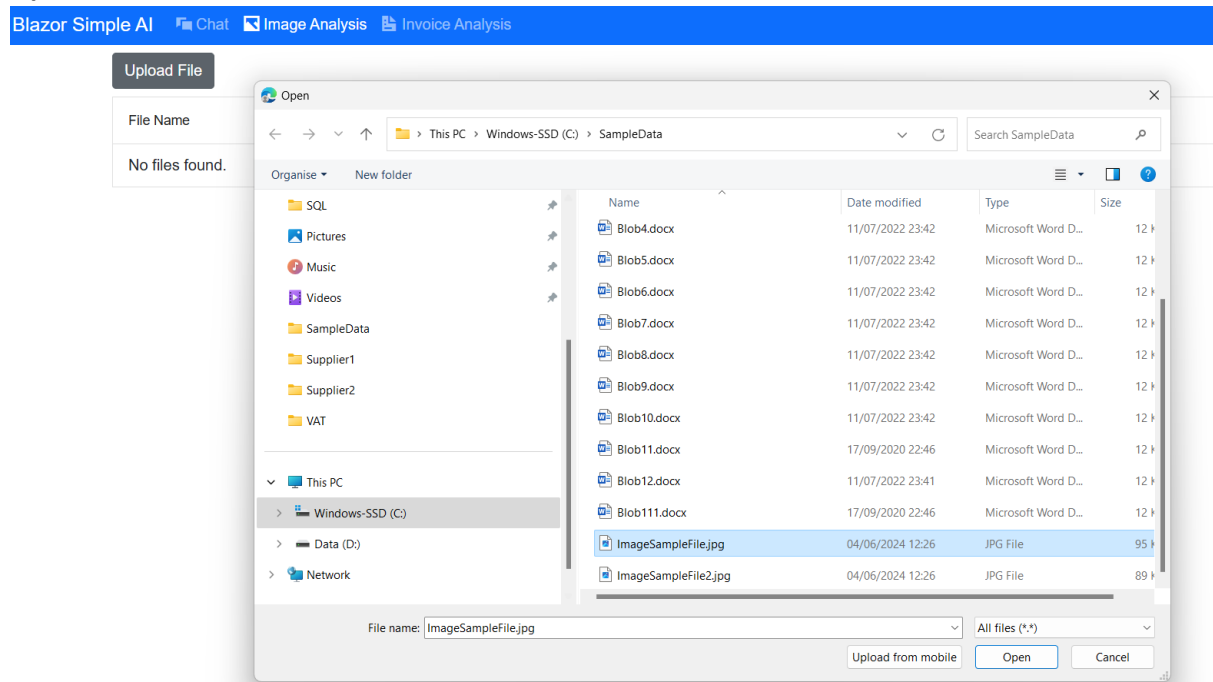


The screenshot shows the 'Home page (Chat)' of the 'Blazor Simple AI' application. At the top, there is a blue navigation bar with the text 'Blazor Simple AI' and three menu items: 'Chat' (active), 'Image Analysis', and 'Invoice Analysis'. Below the navigation bar, the main content area has a light blue background. It features a text input field with the placeholder text 'Enter a question to ask Azure OpenAI?'. To the right of the input field is a blue 'Submit' button.

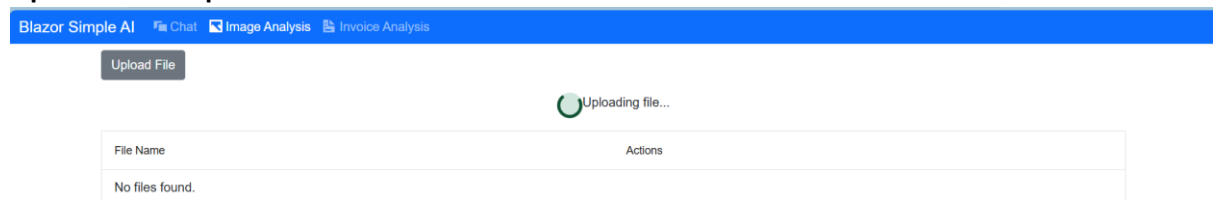
Image Analysis



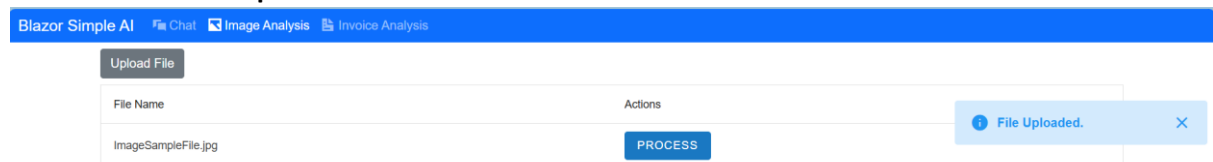
Upload File Control



Upload Action Spinner



Radzen Blazor File Uploaded Notification

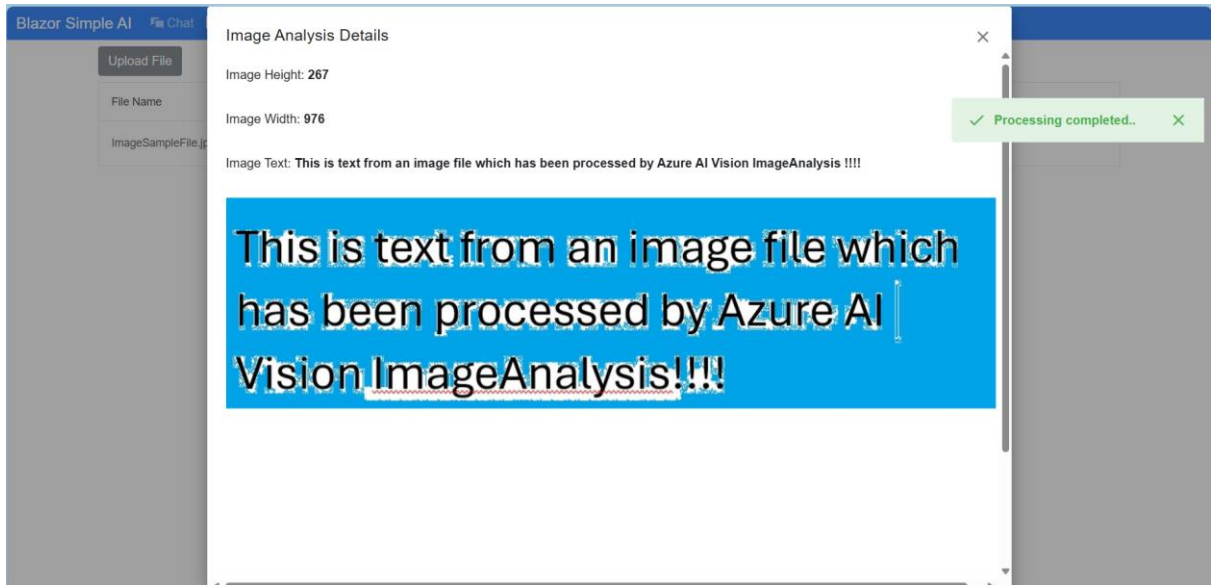


Process Button

The process button reads the application configuration for the Azure AI Vision endpoint and service key, then retrieves a SAS token from Azure for the blob being processed and a URL is generated with the generated SAS token, then this is submitted to Azure AI Vision with the generated URL. The SAS token is generated by the async method `CreateServiceSASBlob(string BlobName)` in the component class. Whilst the method can be defined as a utility class, I have composed this for easier reading of code.

Image Analysis Dialog

When the image processing has completed, a Radzen notification is displayed to the user, with a Radzen dialog popping up to show basic metadata (height and width) of the image, including the text the AI Vision service has extracted as well as the image itself.



That is AI Vision and Image Analysis wrapped up. Part 3 will focus on processing invoices using the pre-built AI model “prebuilt-invoice” part of Microsoft Azure AI Document Intelligence.

Blazor Simple AI Project (Part 3)

Upgrading to GPT-4

Many models in the Azure Open AI service are being deprecated on June 14th 2024. All Microsoft Azure Open AI service model retirement dates can be found on Microsoft learn [here](#). It's time to deploy GPT-4 to Blazor Simple AI and make the minor changes in appsettings.json to utilise the a deployment based on GPT-4. Follow the steps below.

Deploy a new Model with Azure AI Studio

- 1) Launch and authenticate to AI Studio <https://oai.azure.com/>
- 2) Click **Deployments**
- 3) Click **Deploy a new model**
- 4) Set the model version, deployment type, I have chosen standard, enter the name of the deployment and the number of required tokens minute and click **Create**.

Deploy model [Close]

Set up a deployment to make API calls against a provided base model or a custom model. Finished deployments are available for use. Your deployment status will move to succeeded when the deployment is complete and ready for use.

Select a model ⓘ
gpt-4

Model version ⓘ
1106-Preview *

Deployment type ⓘ
Standard *

Deployment name ⓘ
GPT-4 *

⚙️ Advanced options ▾

Content Filter ⓘ
Default

ⓘ 80K tokens per minute quota available for your deployment

Tokens per Minute Rate Limit (thousands) ⓘ
10K

Corresponding requests per minute (RPM) = 60

Your model will be deployed.

Azure OpenAI Studio > Deployments [Privacy & cookies](#)

Deployments

Deployments provide endpoints to the Azure OpenAI base models, or your fine-tuned models, configured with settings to meet your needs, including the content moderation model, version handling, and deployment size. From this page, you can view your deployments, edit them, and create new deployments.

+ Create new deployment Edit deployment Delete deployment Column options Refresh Open in Playground Search

Deployment name	Model name	Model version	Deployme...	Capacity	Status	Model reti...	Content Fil...	Rate limit (...)
GPT-4	gpt-4	1106-Preview	Standard	10K TPM	Succeeded	7/1/2024	Default	10000

Update the configuration settings in the application

In the configuration section below, update the Open AI deployment name setting, in my case the deployment name I had chosen is "GPT-4".

```
"AzureAIConfig": {  
    "OpenAIDeploymentName": "GPT-4",  
}
```

That's all you need to do!

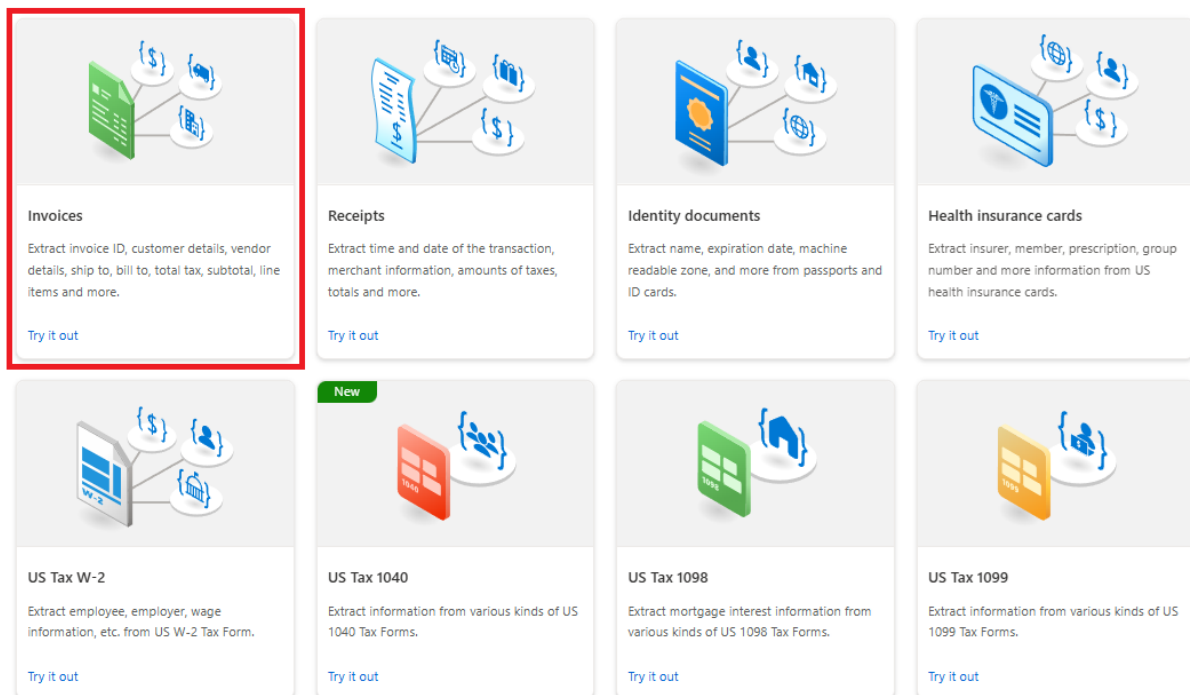
Blazor Simple AI Project (Part 4)

Invoice Analysis

Welcome to the Blazor Simple AI Single Page App, Part 4 of the Microsoft AI services journey, which now includes invoice analysis which utilises Microsoft Azure AI Document Intelligence service. The document Intelligence service is used to extract the text from an invoice using a pre-built model. A sample of some of the models is shown below in document intelligence studio.

Prebuilt models

Extract data from unique document types using the following prebuilt models.



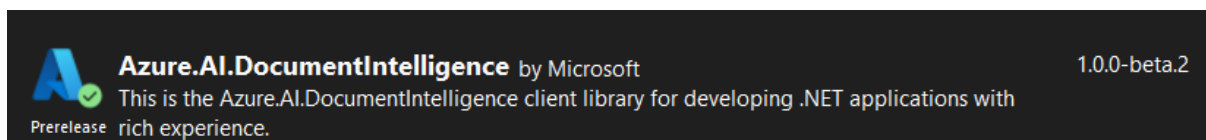
The screenshot displays a grid of prebuilt models for document analysis in the Microsoft Azure AI Document Intelligence studio. The 'Invoices' model is highlighted with a red border. Each model card includes an icon, a title, a description of the data it can extract, and a 'Try it out' link.

Model	Description
Invoices	Extract invoice ID, customer details, vendor details, ship to, bill to, total tax, subtotal, line items and more.
Receipts	Extract time and date of the transaction, merchant information, amounts of taxes, totals and more.
Identity documents	Extract name, expiration date, machine readable zone, and more from passports and ID cards.
Health insurance cards	Extract insurer, member, prescription, group number and more information from US health insurance cards.
US Tax W-2	Extract employee, employer, wage information, etc. from US W-2 Tax Form.
US Tax 1040	Extract information from various kinds of US 1040 Tax Forms.
US Tax 1098	Extract mortgage interest information from various kinds of US 1098 Tax Forms.
US Tax 1099	Extract information from various kinds of US 1099 Tax Forms.

This document explains the project in my GitHub repository which is available here: <https://github.com/tejinderrai/public/tree/main/BlazorSimpleAI>.

Since part 3, the following nuget packages have been added to the project.

Azure.AI.DocumentIntelligence (Pre-release)



New Components

Three components have been developed for the image analysis. These are as follows:

- 1) InvoiceLoader.Razor – A component which includes the child component (InvoiceFileList.Razor), which uploads invoices to Azure blob storage container

- 2) InvoiceFileList.Razor – A component which lists the invoices that are present in the invoice upload container
- 3) InvoiceViewer.Razor – A component which allows the user to view the uploaded invoice in a dialog

Provisioning a Microsoft AI Document Intelligence Service

To provision a Microsoft AI Document Intelligence Service resource, follow the instructions in the article below.

[Create a Document Intelligence \(formerly Form Recognizer\) resource - Azure AI services | Microsoft Learn](#)

Learn about Microsoft AI Document Intelligence

To learn more about the capabilities of Microsoft AI Document Intelligence capabilities, see. [Document Intelligence documentation - Quickstarts, Tutorials, API Reference - Azure AI services | Microsoft Learn](#). Microsoft Azure AI Document Intelligence includes more analysis capabilities, not just specifically an invoice model.

Configuration Settings Changes

The following configuration settings were added to appsettings.json.

```
"AzureDocumentIntelligenceConfig": {  
  "AzureDocumentIntelligenceKey": "[Your Azure Document Intelligence Key]",  
  "AzureDocumentIntelligenceEndpoint": "[Your document intelligence endpoint  
https://[Resource Name].cognitiveservices.azure.com/"  
},  
"AzureStorageConfig": {  
  "AzureStorageInvoiceContainer": "[Your Invoice Upload Container Name]",  
  "AzureStorageInvoiceProcessedContainer": "[Your Invoice Processed Container  
Name]"  
},
```

The invoice processed container is the output interface file that is generated from the text extracted from the original invoice file. It is an output of JSON which utilises the `InvoiceAnalysisData` data type.

Note: Whilst this project utilises the service key, in an enterprise environment, you must consider using token based access to the service secured by Microsoft Entra ID, or if you wish to utilise the service key for any reason, utilise Azure Key Vault to protect the key used by the application with a managed identity for the application to access the service key stored in Azure Key Vault.

Components

Invoice Loader Component (InvoiceLoader.Razor)

The invoice upload component utilises Blazor InputFile for the user to select the file to upload in the application. The component reads the Azure Storage connection string from the configuration, including the container, then uploads the file to the container and also adds a blob http header for the file content type taken from the file properties. The Radzen notification service is used to notify the user of the application activities. I also included a basic spinner as part of the interaction for the upload process.

Invoice File List Component (InvoiceFileList.Razor)

This component reads the Azure Storage connection string from the configuration, including the container, then displays the invoice blob file names in a Radzen DataGrid. A button is added to view the invoice, or process the invoice, which then calls the Radzen notification service to display the activities being taken by the application.

Invoice Viewer Component (InvoiceViewer.Razor)

This component is a child component displayed in a Radzen dialog box which displays the original uploaded invoice directly from the Azure blob storage invoice upload container. A storage SAS key is generated which provides time limited access to the user in order for the invoice to be displayed in the dialog.

Data Classes

InvoiceAnalysisData.cs – The class for the invoice.

InvoiceItem.cs - The class for the invoice items.

Invoice Sample

I have created an invoice samples to test the pre-built invoice model from Microsoft Azure Document Intelligence.

Supplier 1 Invoice (PDF)

INVOICE

DATE
15/05/2024

INVOICE NO.
00001
PO NO.
10001

Car Parts UK Ltd
15 Street Gardens
Poole, Dorset, DS11 333
01872 2828282
Car@parts.co.uk

INVOICE TO
Car Shop
555 Car Street
Manchester
MN1 CAR
01430 303982

SALESPERSON	JOB	PAYMENT TERMS	DUE DATE
John McEnzie	Ferrari 360 Spider Parts	30 Days	15/06/2024

QUANTITY	DESCRIPTION	UNIT PRICE	LINE TOTAL
10	Ferrari 360 Spider Hood	£5,000	£50,000
5	Ferrari 360 Spider Gearbox	£2,500	£12,500

Subtotal

VAT

Total

£62,500

£12,500

£75,000

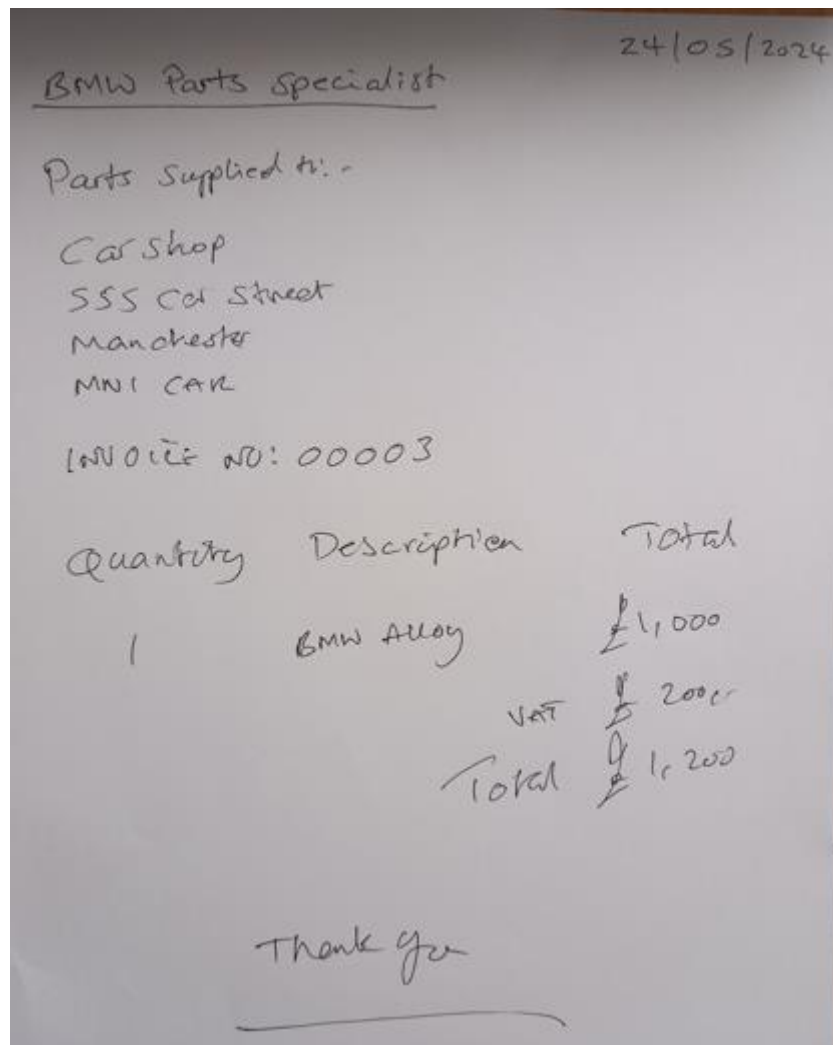
I created two additional sample invoices, both of which were tested and successfully processed. I have not covered the upload of these in my blog post.

Supplier 2 – Jpeg image

(Missing Quantity)

Porsche Parts Specialist <i>The best parts, all the time, on time!</i> 911 Porsche Avenue, Silverstone, SL11 POS Phone 04556 282811 porsche@partsspecialist.com	INVOICE INVOICE NO. 00002 DATE 21/05/2024														
TO: CAR SHOP 555 CAR STREET MANCHESTER MN1 CAR 01430 303982	FOR Porsche 911 Refresh Project PO NO. 10002														
<table><thead><tr><th>Description</th><th>Amount</th></tr></thead><tbody><tr><td>Porsche 911 993 Engine casing</td><td>£3,000</td></tr><tr><td>Porsche 911 993 IMS Bearing</td><td>£2,000</td></tr><tr><td>Porsche 911 993 Rear Spoiler</td><td>£2,000</td></tr><tr><td>Porsche 911 993 Suspension Kit</td><td>£8,000</td></tr><tr><td>VAT 20%</td><td>£3,000</td></tr><tr><td>Total</td><td>£18,000</td></tr></tbody></table>	Description	Amount	Porsche 911 993 Engine casing	£3,000	Porsche 911 993 IMS Bearing	£2,000	Porsche 911 993 Rear Spoiler	£2,000	Porsche 911 993 Suspension Kit	£8,000	VAT 20%	£3,000	Total	£18,000	
Description	Amount														
Porsche 911 993 Engine casing	£3,000														
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Porsche 911 993 Rear Spoiler	£2,000														
Porsche 911 993 Suspension Kit	£8,000														
VAT 20%	£3,000														
Total	£18,000														
Make all cheques payable to Porsche Parts Specialist Payment is due within 30 days. If you have any questions concerning this invoice, contact Rob 04456 282812 rob@porschespecialist.com															
THANK YOU FOR YOUR BUSINESS.															

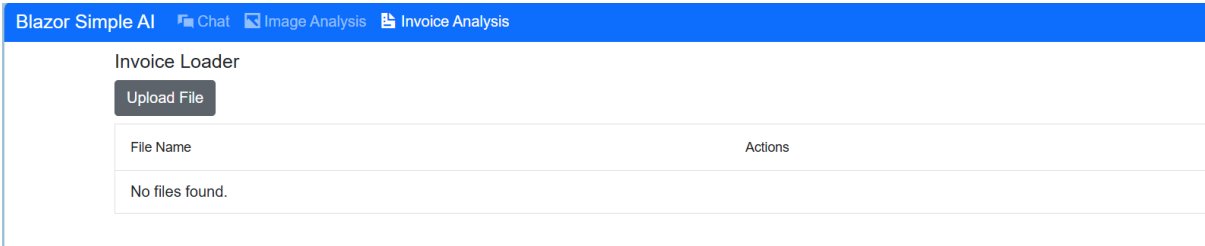
Invoice 3 – Handwritten Invoice – jpeg image



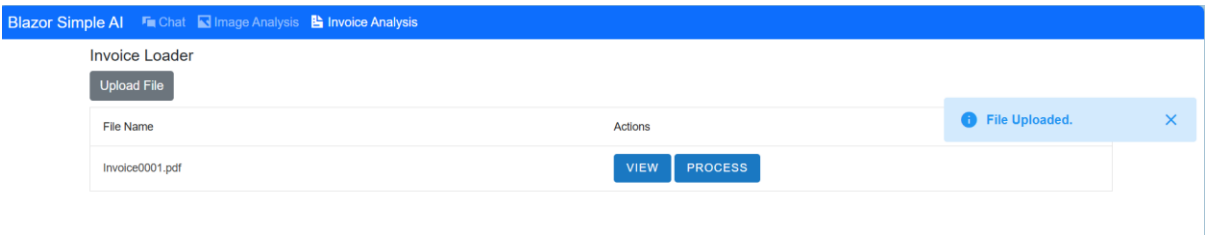
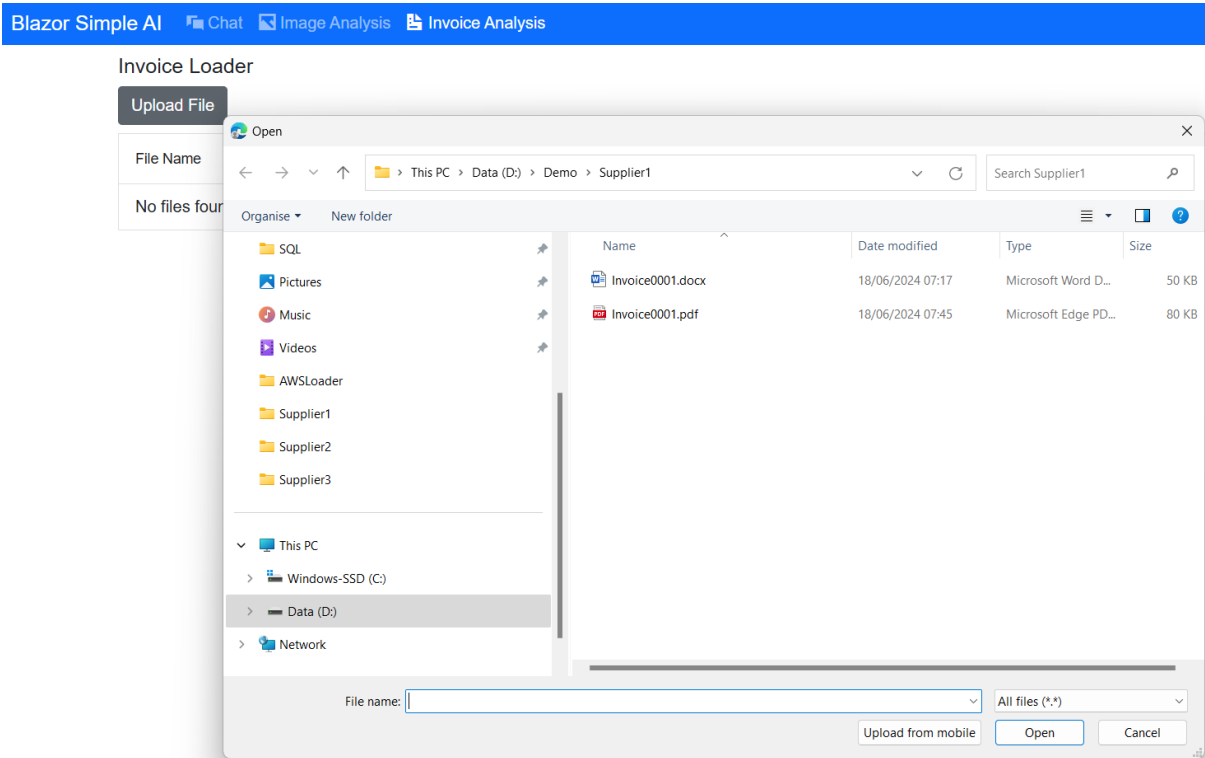
The UI

The UI for invoice analysis is as follows.

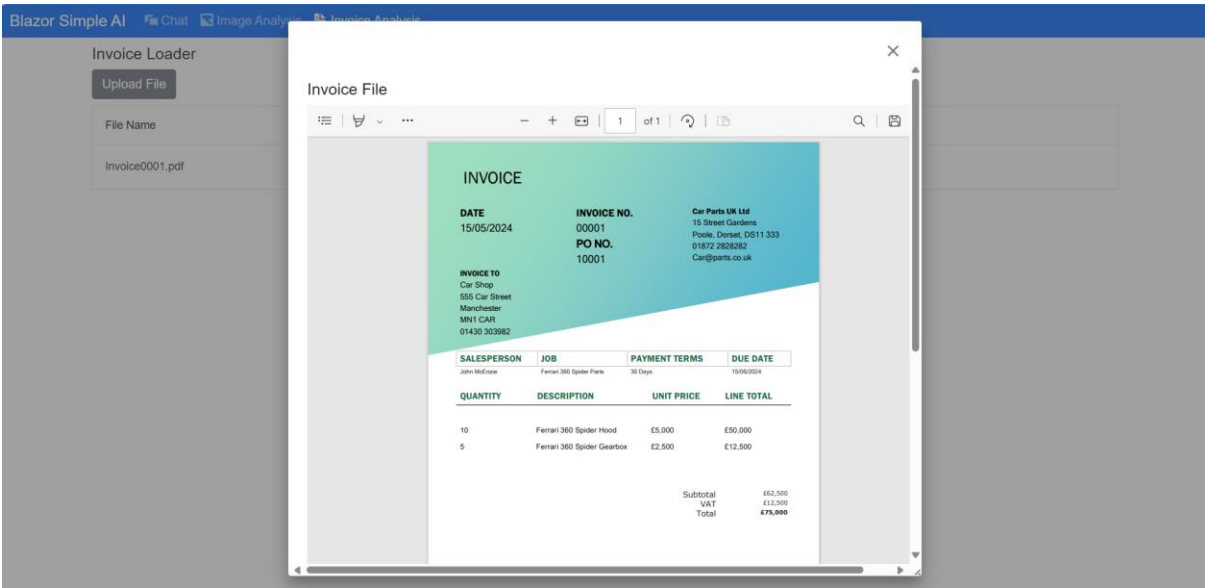
Invoice Analysis



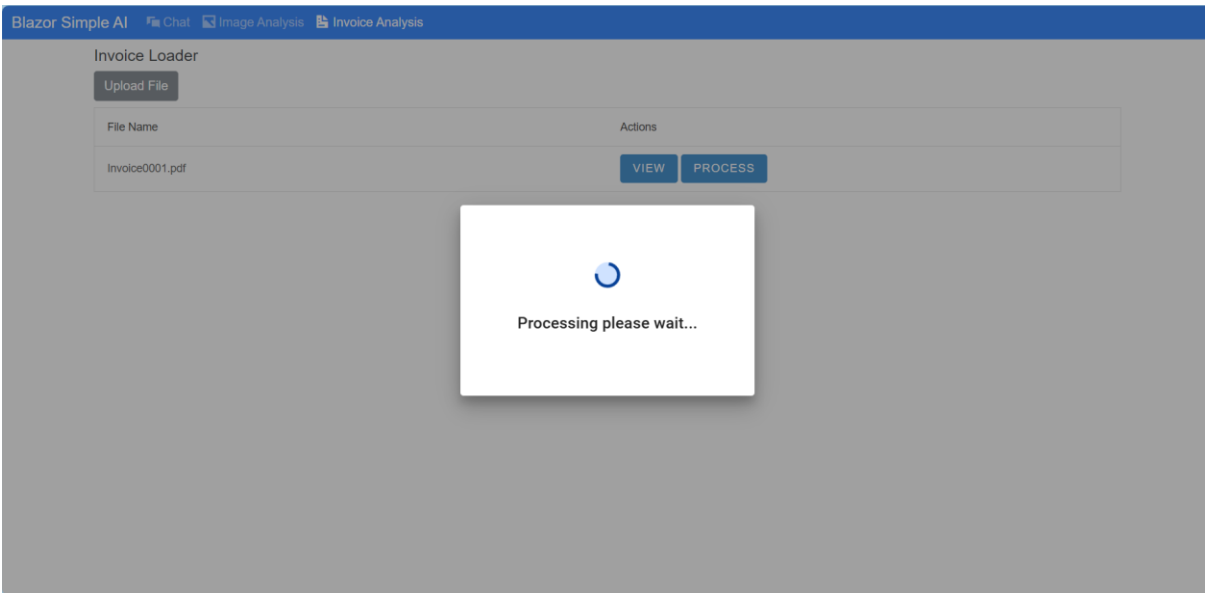
Upload File



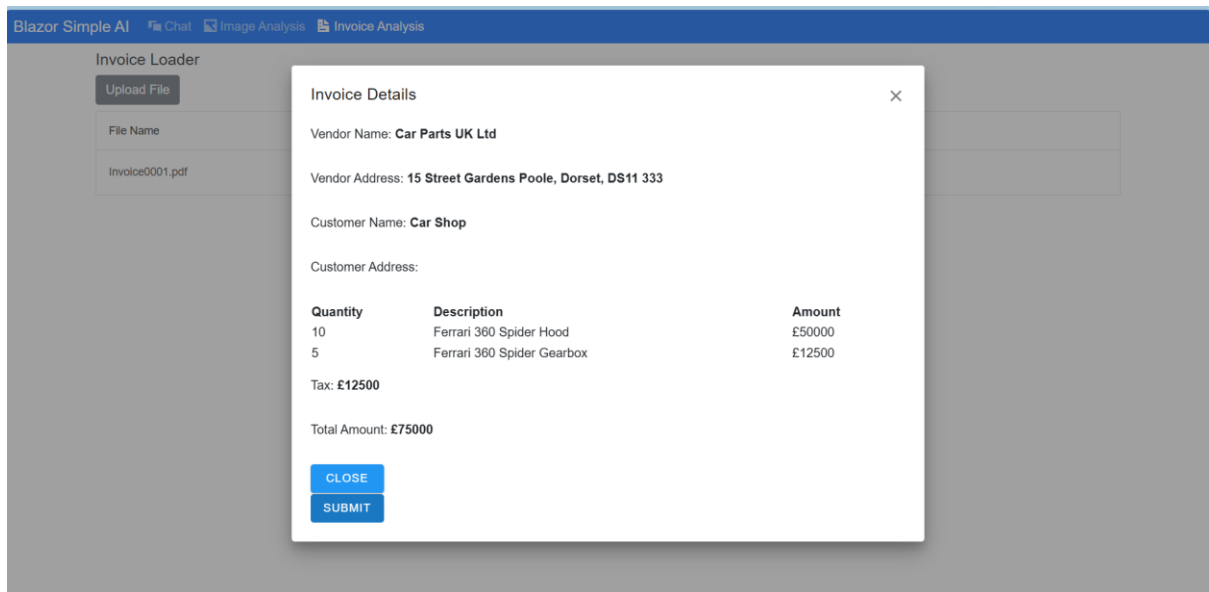
View Button – Opens the PDF in a dialog box



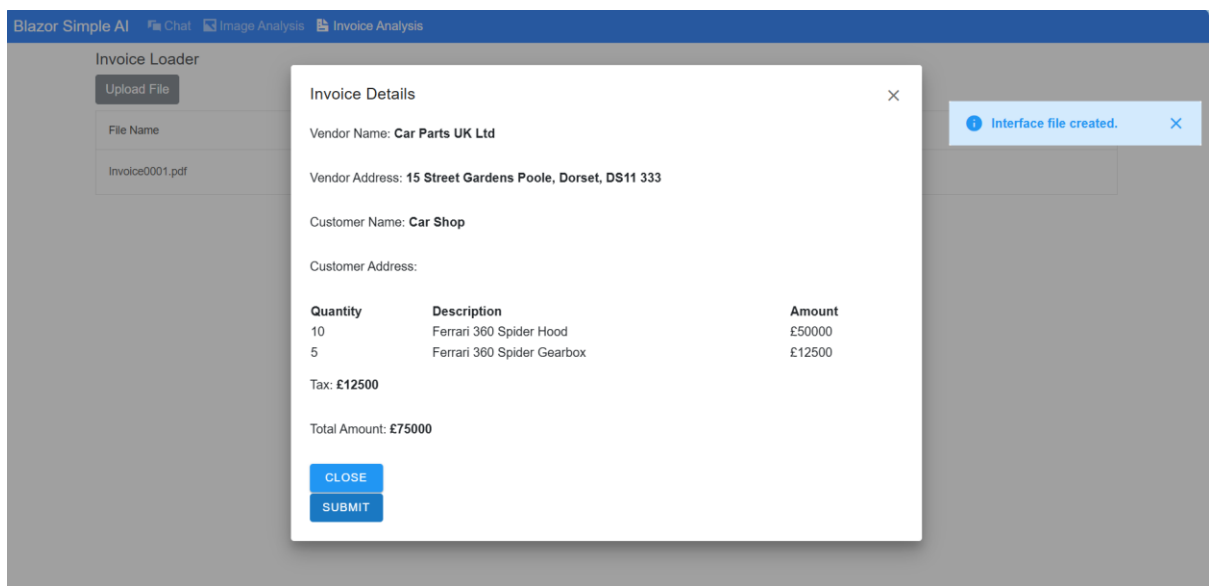
Process Button – Interactive Dialog box



Processing Completed – Invoice details – text extracted into InvoiceAnalysis object.



Submit Button – Create an output interface file in JSON format.



Azure Storage – (invoiceanalysisupload container)

+ Container Change access level Restore containers Refresh Delete Give feedback				
Search containers by prefix				Show deleted containers
Name	Last modified	Anonymous access level	Lease state	
☐ \$logs	21/05/2024, 14:07:18	Private	Available	...
☐ imageanalysisupload	23/05/2024, 08:16:22	Private	Available	...
☐ invoiceanalysisprocessed	30/05/2024, 11:07:01	Private	Available	**
☐ invoiceanalysisupload	29/05/2024, 21:10:26	Private	Available	...
☐ visionupload	16/05/2024, 08:28:20	Private	Available	...

Processed Output file

The screenshot displays the Azure Storage Explorer interface. On the left, a sidebar shows the 'invoiceanalysisprocessed' container. The main pane shows the container's contents, including a table with columns: Name, Modified, Access tier, Archive status, Blob type, and Size. A single blob is listed with the name 'c2456dc4-92d5-411a-afc7-3f63cd401f31', modified on 18/06/2024 at 07:50:28, with an access tier of 'Hot (Inferred)', a blob type of 'Block blob', and a size of 357 B. Below the table, there is a search bar and a 'Show deleted blobs' toggle. On the right, a detailed view of the selected blob is shown, including its name, a 'Save' button, and a 'Preview' button. The preview area shows a JSON file content.

```
{
  "VendorName": "Car Parts UK Ltd",
  "VendorAddress": "15 Street Gardens\nPoole, Dorset, DS11 333",
  "CustomerName": "Car Shop",
  "CustomerAddress": null,
  "InvoiceItems": [
    {
      "Quantity": 10.0,
      "ItemDescription": "Ferrari 360 Spider Hood",
      "Amount": "50000"
    },
    {
      "Quantity": 5.0,
      "ItemDescription": "Ferrari 360 Spider Gearbox",
      "Amount": "12500"
    }
  ],
  "Tax": "12500",
  "InvoiceTotal": "75000"
}
```

File Contents

```
{
  "VendorName": "Car Parts UK Ltd",
  "VendorAddress": "15 Street Gardens\nPoole, Dorset, DS11 333",
  "CustomerName": "Car Shop",
  "CustomerAddress": null,
  "InvoiceItems": [
    {
      "Quantity": 10.0,
      "ItemDescription": "Ferrari 360 Spider Hood",
      "Amount": "50000"
    },
    {
      "Quantity": 5.0,
      "ItemDescription": "Ferrari 360 Spider Gearbox",
      "Amount": "12500"
    }
  ],
  "Tax": "12500",
  "InvoiceTotal": "75000"
}
```

Note: The code does not extract the customer address, but this is in fact possible.

The handwritten jpeg image, the second invoice as a jpeg image and the PDF all proved to have 100% extraction using the Microsoft AI Document Intelligence service. That's just amazing!

It is as simple as that!

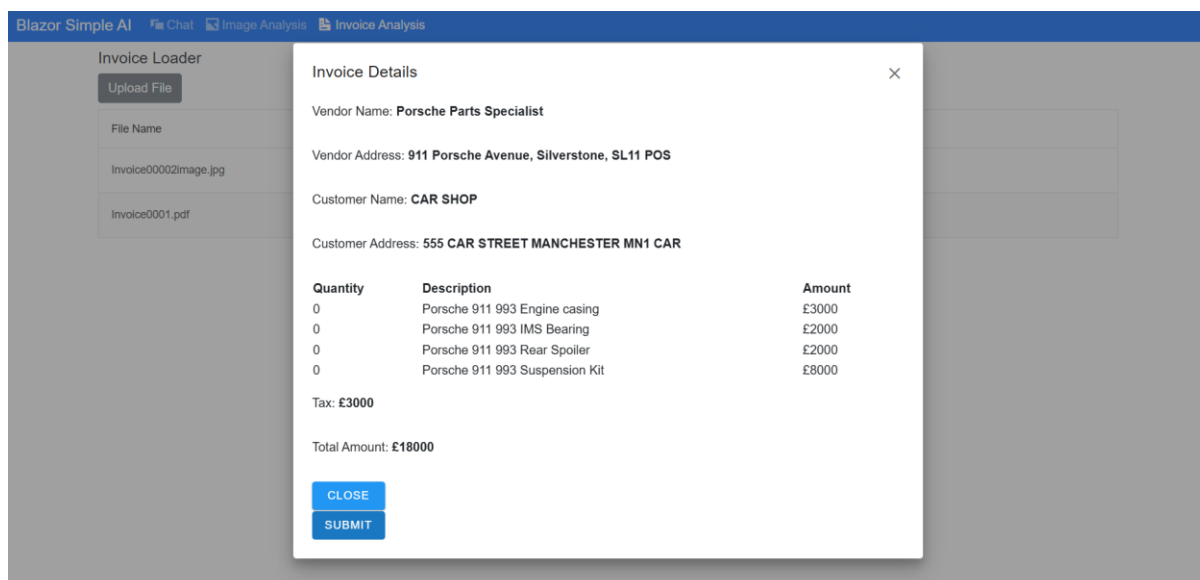
The reason for creating a interactive SPA as a sample app, is to demonstrate the features. The same code can be used in event driven architectures, or scheduled triggers. That will be something I will post next.

Invoice 2 - jpeg output

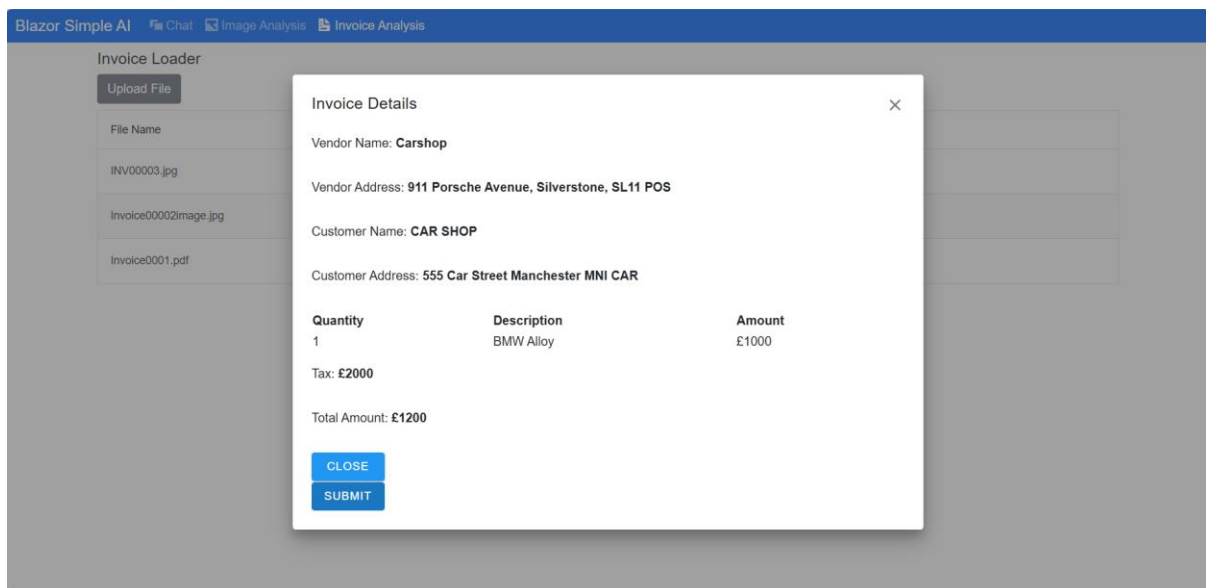
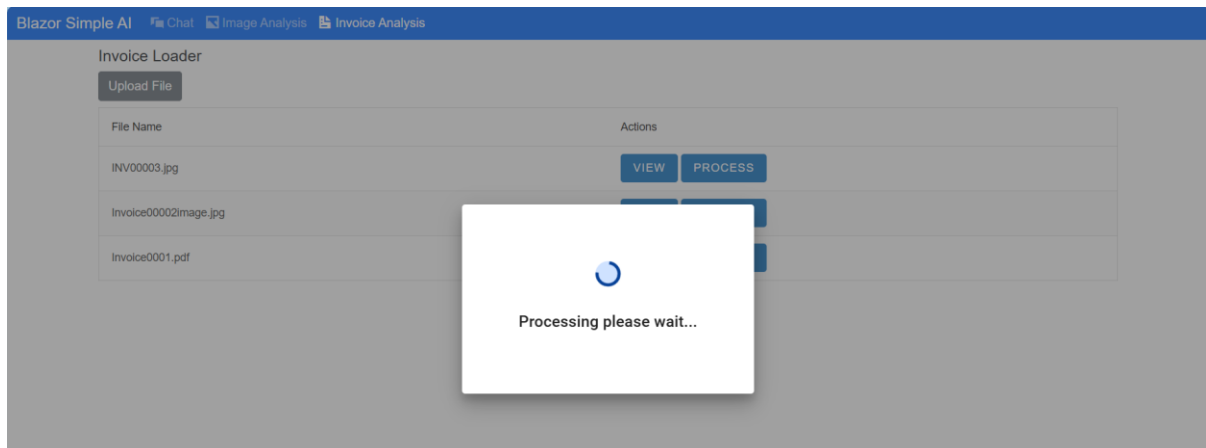


Invoice 2 – Processed

(Note: Missing Quantity in the file)



Invoice 3 – Handwritten jpeg



Blazor Simple AI Project (Part 5)

Azure Open AI Chat Audio Recoding Button

Welcome to the Blazor Simple AI Single Page App, Part 5 of the Microsoft AI services journey, which now includes an audio recording button in the Open AI Chat component.

This document explains the project in my GitHub repository which is available here:

<https://github.com/tejinderrai/public/tree/main/BlazorSimpleAI>

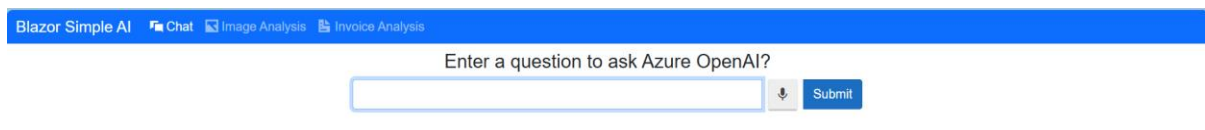
Visual Changes

The audio button has been added to the index.razor page as this is the main landing page. The audio button component is part of Radzen Blazor and simple to interact with which is the `RadzenSpeechToTextButton`. This utilises JavaScript as a component itself, there is an API to get user media.

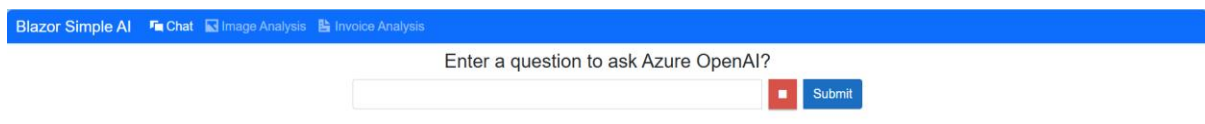
For further information on the Razden Blazor Speech To Text Button, see: [Blazor SpeechToTextButton Component | Free UI Components by Radzen](#).

Landing Page

The new landing page has the audio button added next to the chat text box.

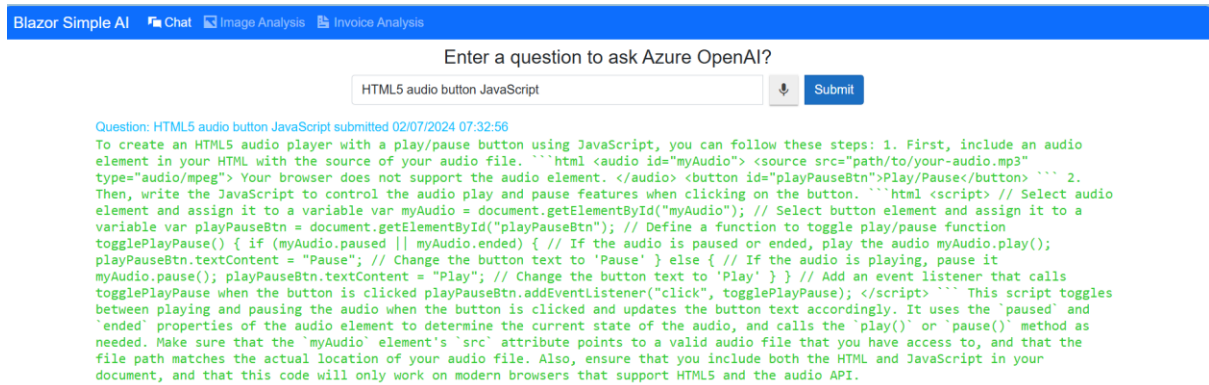


When you click on the audio button, the first instance will provide a prompt requesting access from the site to the devices microphone, then recording has started as shown below.



When you are finished speaking, you click the button to stop recording and the text is submitted to the Question string and a OnChange event occurs and the Question value is set, then the state is changed for the component. Since the Question string is a bound field to the child component, AzureOpenAIChat, which then executes the component code to call the Microsoft Azure Open AI service with the text that was bound to the Question string.

An example of the recorded audio text and Azure Open AI response is shown below.



Code Changes

The following code changes were made in index.razor.

Added audio recording button and spacing.

```
<Radzen.Blazor.RadzenSpeechToTextButton class="padding-right:10px;"
Change="@((args => OnSpeechCaptured(args, "SpeechToTextButton")))" />
<div style="padding-left:10px;" />
```

Added the OnSpeechCaptured method.

Note: I removed the question marks and period from the string return from the Radzen Speech To Text button as the characters were automatically to the returned text string value from the component.

```
private void OnSpeechCaptured(string speechValue, string name)
{
    speechValue = speechValue.Trim(new Char[] { '.', '?' });
    RecordedSpeech = speechValue;
    Question = RecordedSpeech;
    this.StateHasChanged();
}
```

For my next post, I will be utilizing the `RadzenSpeechToTextButton` for a different purpose in the Blazor Simple AI project.