

Intelligent Customer Help Desk with Smart Document Understanding

Category : Artificial Intelligence

Skills Required : Node.js, IBM Cloud, IBM Watson

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1. INTRODUCTION

1.1 Purpose

In this project, we walk through a working example of a web app that utilizes multiple Watson services to create a better customer care experience. Using the Watson Discovery Smart Document Understanding (SDU) feature, we will enhance the

Discovery model so that queries will be better focused to only search the most relevant information found in a typical owner's manual.

Using Watson Assistant, we will use a standard customer care dialog to handle a typical conversation between a customer and a company representative. When a customer question involves operation of a product, the Assistant dialog will communicate with the Discovery service using a **webhook**. The webhook will be created by defining a web action using **IBM Cloud Functions**.

1.2 Overview

In summary, this project will :

- Create a customer care dialog skill in Watson Assistant.
- Use Smart Document Understanding to build an enhanced Watson Discovery collection.
- Create an IBM Cloud Functions web action that allows Watson Assistant to post queries to Watson Discovery
- Create a flow in **Node-RED** and test the bot to check whether it is giving accurate results or not.

In this project, we use the typical customer care chatbot experience but instead of relying on predefined responses, our dialog will provide a hook that can call out to other IBM Watson services for additional sources of information. In our case, it will be an owner's manual that has been uploaded into Watson Discovery.

2. LITERATURE SURVEY

2.1 Existing Problem

The typical customer care chatbot can answer simple questions, such as locations and hours, directions, and may be even making appointments. When a question falls outside of the scope of the pre-determined question set, the option is typically to tell the customer the question is not valid or offer to speak to a real person.

2.2 Proposed Solution

In this project, we will provide another option. If the customer question is about the operation of a device, we will use the webhook feature of **Watson Assistant** to pass the question onto our **Watson Discovery Service**, which has been pre-loaded with the device's owner manual. So now, instead of "Would you like to speak to a customer representative?" we can return relevant sections of the owner's manual to help solve the customer's problems.

To take it a step further, we will use the **Smart Document Understanding (SDU)** feature of Watson Discovery to train it on what text in the owner's manual is important and what is not. This will improve the answers returned from the queries.

What is SDU?

SDU trains Watson Discovery to extract custom fields in the documents. Customizing how the documents are indexed into Discovery will improve the answers returned from queries. With SDU, we annotate the fields within the documents to train custom conversion models. As we annotate, Watson is learning and will start predicting annotations. SDU models can also be exported and used on other collections.

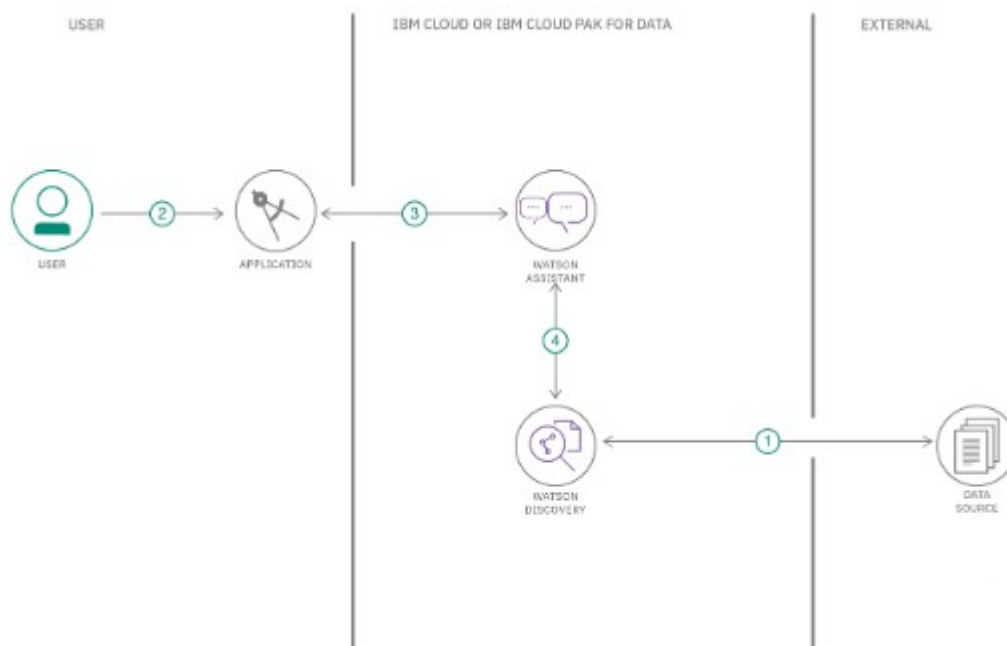
What is a Webhook?

A webhook is a mechanism that allows to call out an external program based on something happening in our program. When used in a Watson Assistant dialog skill, a webhook is triggered when the Assistant processes a node that has a webhook enabled. The webhook collects data that we specify or collect from the user during conversation and save in context variables and sends the data to the Webhook request URL. The URL that receives the webhook is the listener.

It performs a predefined action using the information that is provided by the webhook as specified in the webhook definition, and can optionally return a response. In our example, the webhook will communicate with an IBM Cloud Functions web action, which is connected to the Watson Discovery Service.

3. THEORITICAL ANALYSIS

3.1 Block Diagram



3.2 Hardware / Software Designing

Software Required : IBM Cloud, Node-RED

- IBM Cloud offers the most open and secure public cloud for business, a next-generation hybrid multicloud platform, advanced data and AI capabilities, and deep enterprise expertise across 20 industries.
- Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click. Javascript functions can be created within the editor using a rich text editor. The flows created in Node-RED are stored using JSON which can be easily imported and exported for sharing with others. Node-RED is built on Node.js

4. FLOWCHART

1. The document is annotated using Watson Discovery Smart Document Understanding.
2. The user interacts with the back-end server via the app UI. The front-end app UI is a chatbot that engages the user in a conversation.
3. Dialog between the user and back-end server is coordinated using a Watson Assistant dialog skill.
4. If the user asks a product operation question, a search query is passed to a predefined IBM Cloud Functions action.
5. The IBM Cloud Functions action will query the Watson Discovery Service and return the results.

5.EXPERIMENTAL INVESTIGATIONS

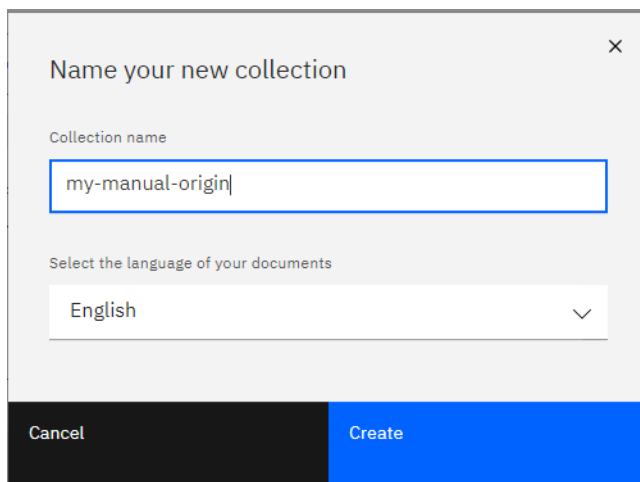
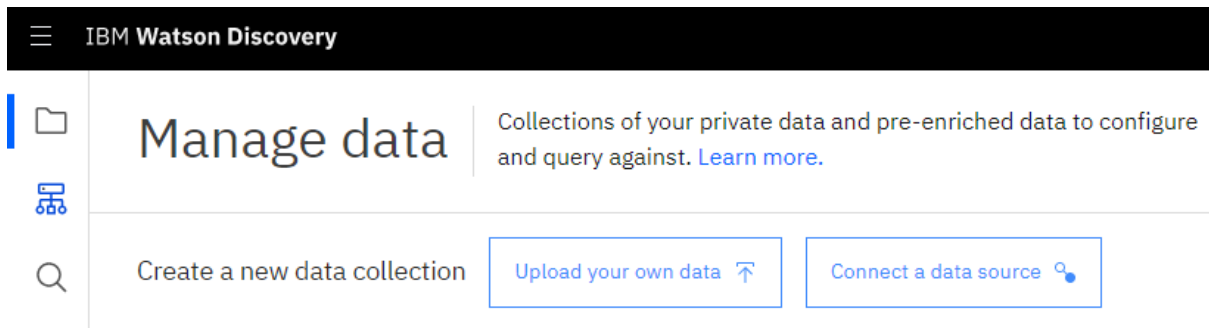
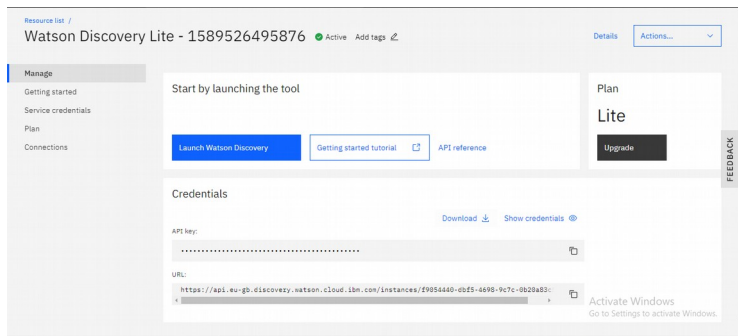
Step – 1 : Create IBM Cloud Services

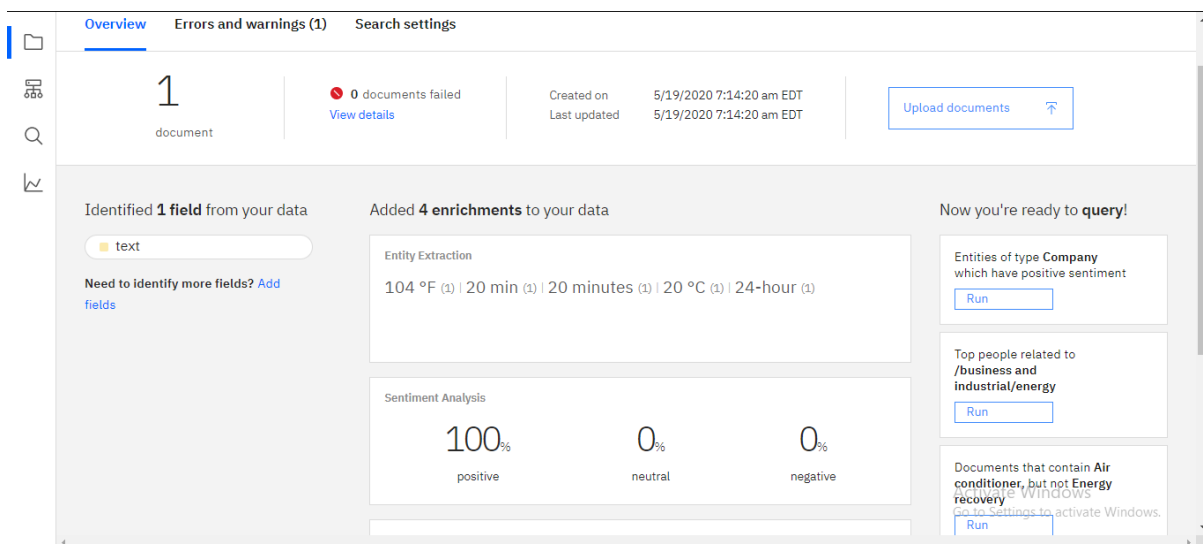
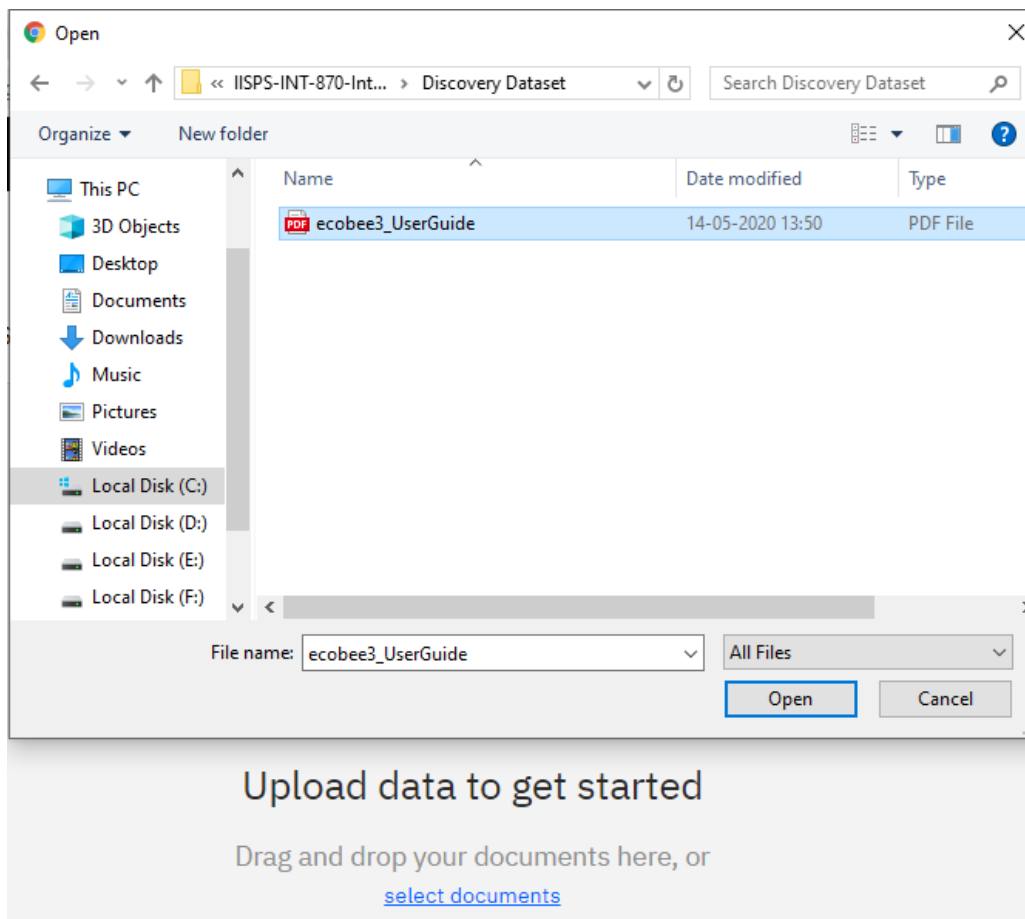
Create the following services : i) Watson Discovery
ii) Watson Assistant

Step – 2 : Configure Watson Discovery

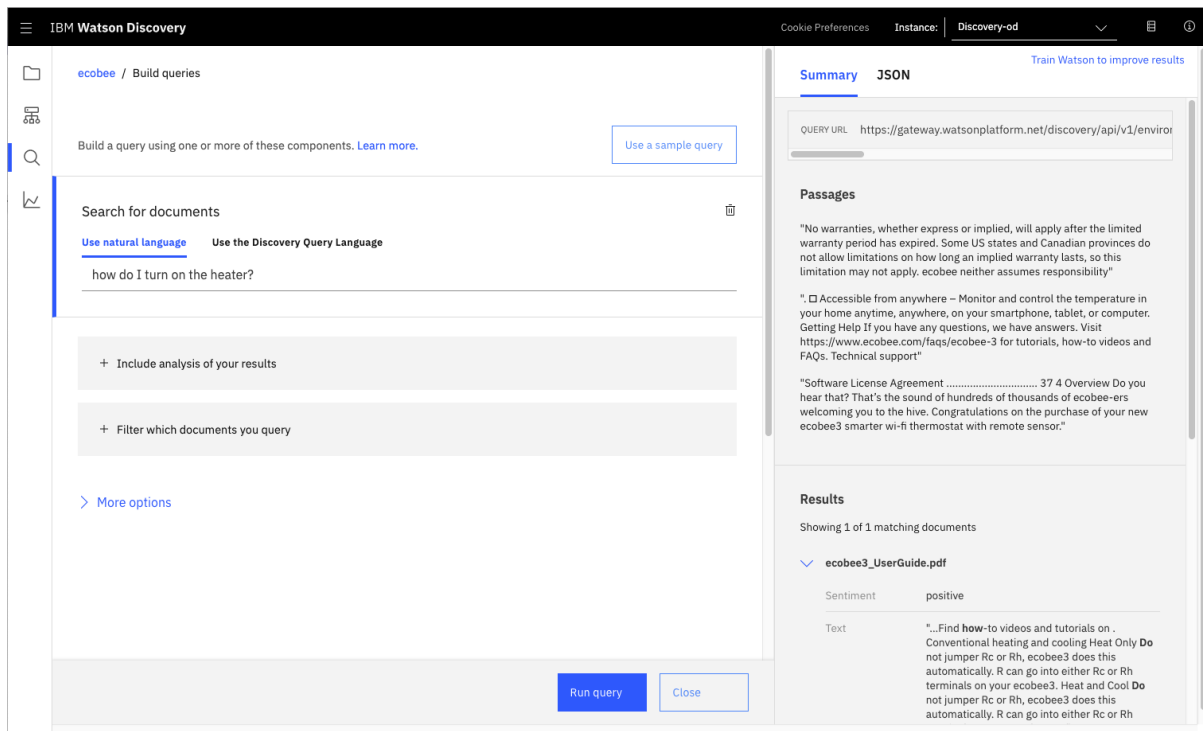
- Import the document

Launch the Watson Discovery tool and create a new data collection by selecting the Upload your own data option. Give the data collection a unique name. When promoted, select and upload the **ecobee3_UserGuide.pdf** file located in the local storage. The Ecobee is a popular residential thermostat that has a wifi interface and multiple configuration options.





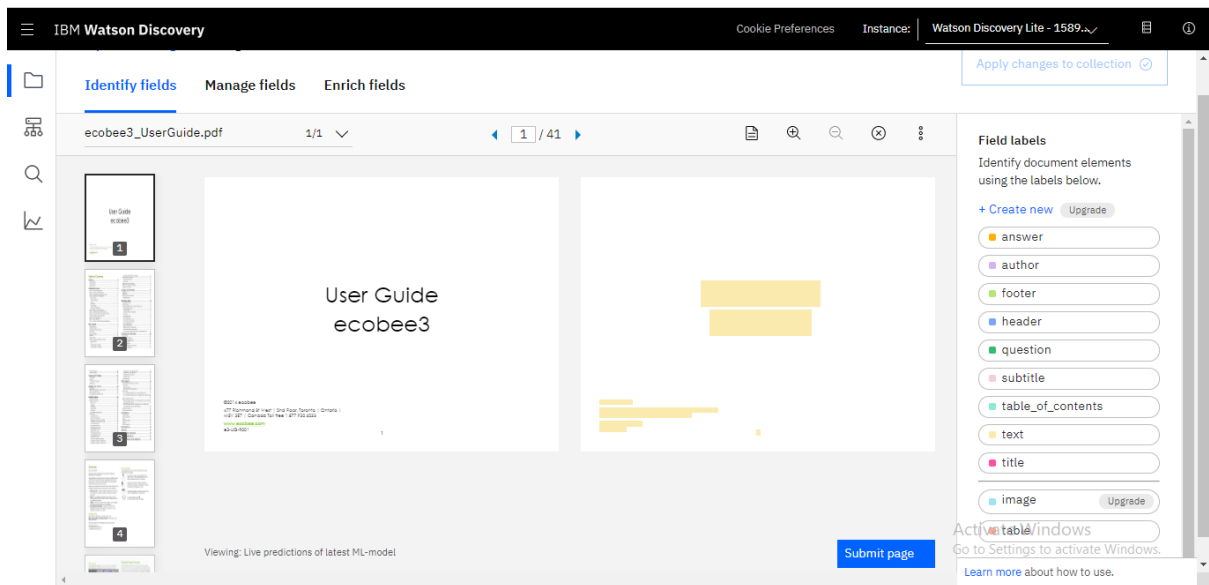
Before applying SDU to our document, let's do some simple queries on the data so that we can compare it to results found after applying SDU. Click the **Build your own query** button. Enter queries related to the operation of the thermostat and view the results. The results are not very useful, and in some cases, not even related to the question.



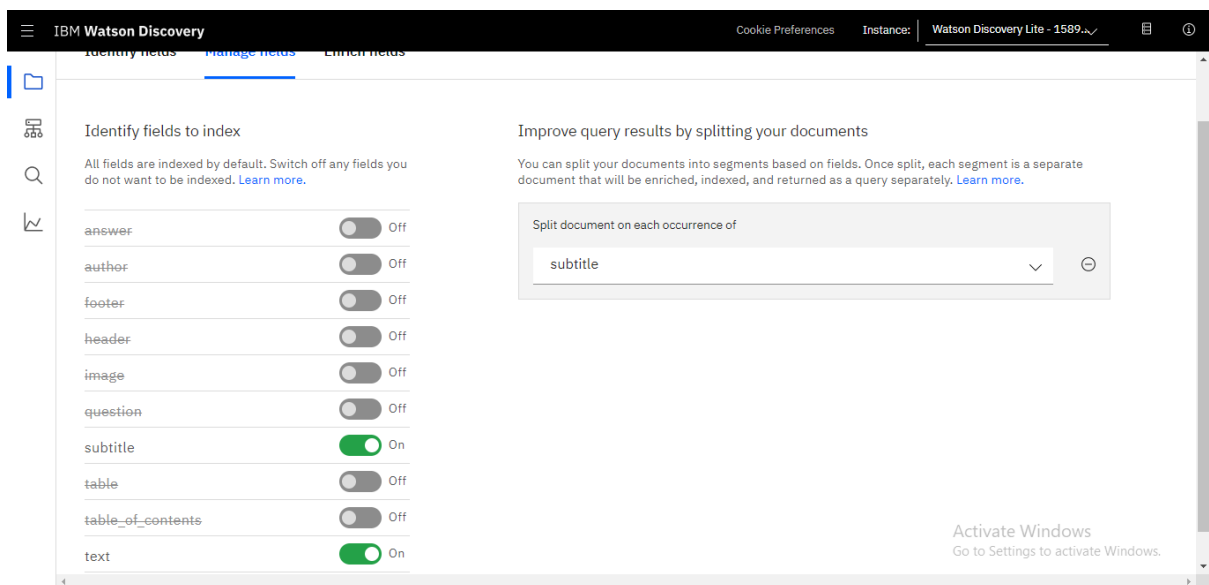
- Annotate with SDU

Now let's apply SDU to our document to see if we can generate some better query responses. From the Discovery collection panel, click the **Configure data** button to start the SDU process. The goal is to annotate all of the pages in the document so Discovery can learn what text is important, and what text can be ignored.

Select the text and assign it a label. For example subtitle, text, footer, table of contents etc., Submit the page to Discovery. As each page is processed, a green check mark will appear on the page. As you go through the annotations one page at a time, Discovery is learning and should start automatically updating the upcoming pages. Once we get to a page that is correctly annotated, we can stop or simply click Submit to acknowledge it is correct. The more pages we annotate, the better the model will be trained. Once we click on the **Apply changes to collection** button, we will be asked to reload the document. Choose the same owner's manual .pdf document as before.



Now, click on the **Manage fields** tab. Tell Discovery which fields to ignore using the on/off buttons, turn off all labels except **subtitles** and **text**. Split the document based on **subtitle**. Submit the changes. Once again, we will be asked to reload the document.



Now as a result of splitting the document apart, our collection will look very different.

IBM Watson Discovery

Overview Errors and warnings (112) Search settings

112 documents

0 documents failed

Created on 5/15/2020 4:22:15 am EDT

Last updated 5/15/2020 4:22:15 am EDT

Upload documents

Identified 4 fields from your data

- subtitle
- table_of_contents
- text
- title

Need to identify more fields? [Add fields](#)

Added 4 enrichments to your data

Entity Extraction

10 °F (4) | 900 seconds (4) | 0.3°C (3) | 0.5°F (3) | 20 min (3)

Sentiment Analysis

53% positive 31% neutral 16% negative

Now you're ready to query!

Documents about **ecobee** as a **Company** with a very negative sentiment

Run

Entities of type **Quantity** which have positive sentiment

Run

Top people related to **technology and computing/operating systems**

Return to the query panel and see how much better the results are :

IBM Watson Discovery

my-manual-orig / Build queries

Build a query using one or more of these components. [Learn more.](#)

Use a sample query

Search for documents

Use natural language Use the Discovery Query Language

How do I turn on the heater?

+ Include analysis of your results

+ Filter which documents you query

Run query Close

Summary JSON

Query URL <https://api.eu-gb.discovery.watson.cloud.ibm>

Passages

"This menu lets you test the wiring and connections of the devices connected to the thermostat by turning them on or off. The equipment will turn off when you exit the menu. Warning: Compressor protection and minimum run-time features are not enforced while in this mode. 30"

"The following pages provide wiring diagrams for common HVAC equipment configurations. Need help with your ecobee3 wiring? Find how-to videos and tutorials on."

"Do not jumper Rc or Rh, ecobee3 does this automatically. R can go into either Rc or Rh terminals on your ecobee3."

"Do not jumper Rc or Rh, ecobee3 does this automatically. R can go into either Rc or Rh terminals on your ecobee3."

Activate Windows

Go to Settings to activate Windows.

"Do not jumper Rc or Rh, ecobee3 does this"

In upcoming steps, we will need to provide the credentials to access Discovery collection. We will be needing **Collection Id, Environment Id**.

Configure data

Collection ID

62541ad0-dfac-4341-ad0a-f1ad987ad1ba

Configuration ID

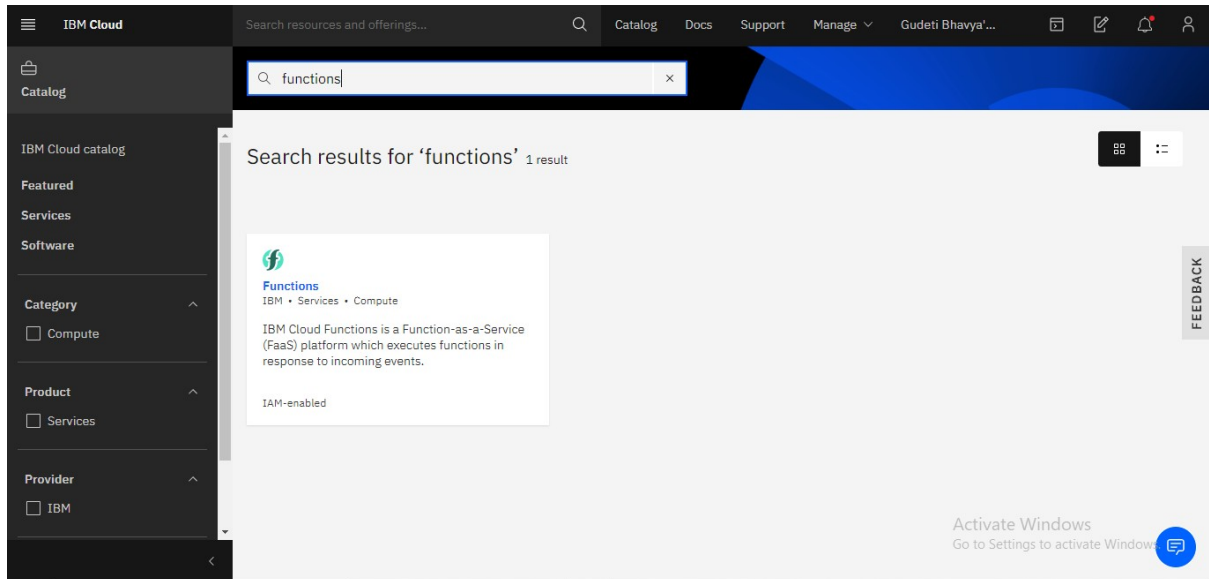
cad33b42-6cdf-4bd7-9cdd-8976148c0bfb

Environment ID

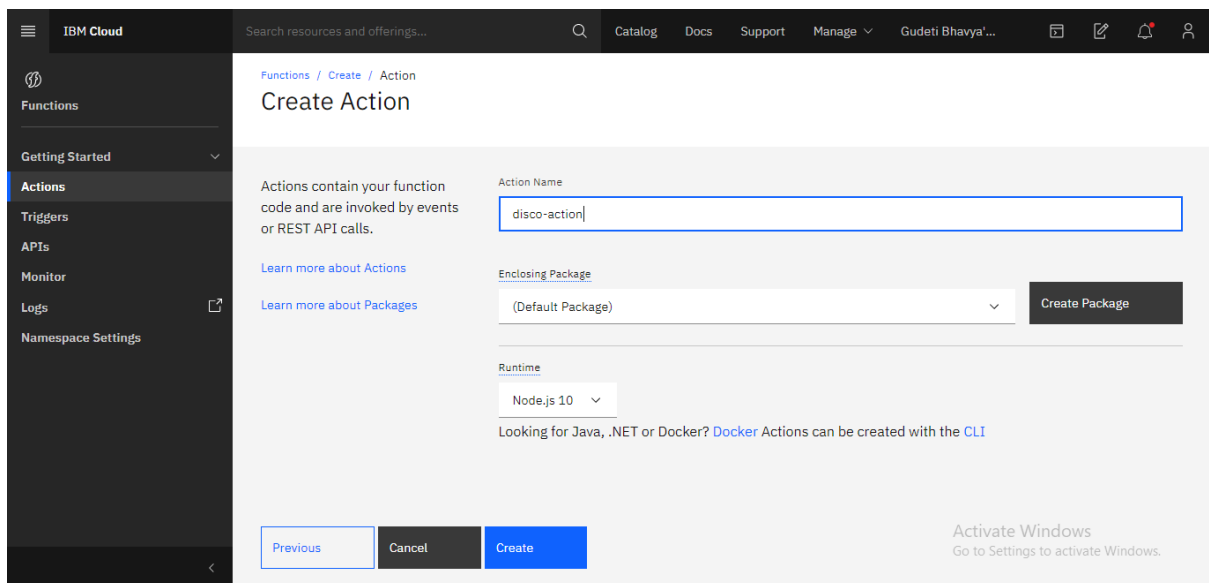
211759ec-3d6c-4d7d-8f72-9e36cc9181f8

Step – 3 : Create IBM Cloud Functions action

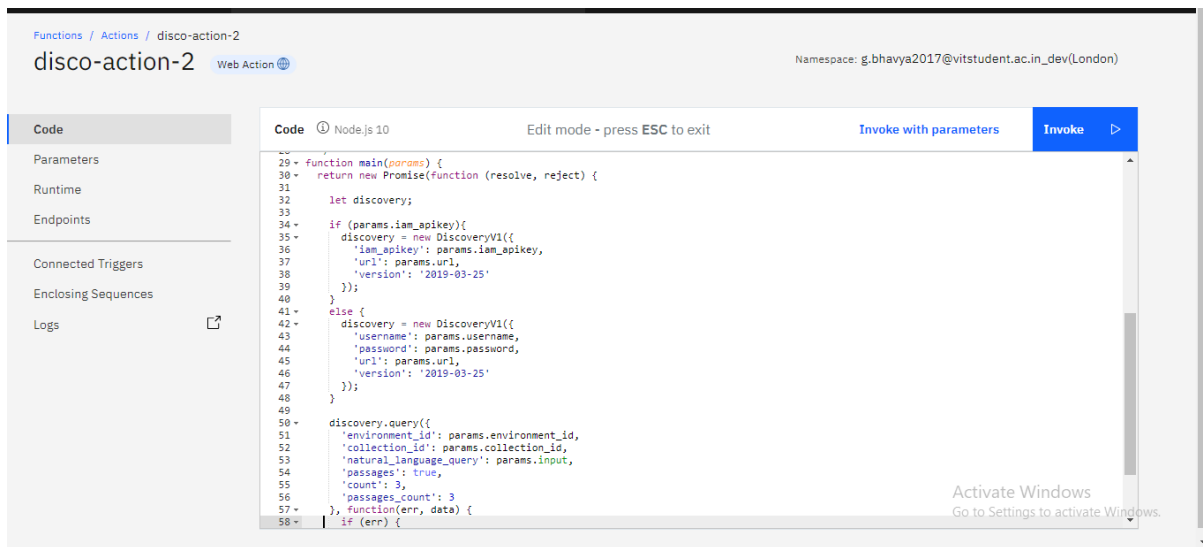
Now let's create the web action that will make queries against our Discovery Collection. Start the IBM Cloud Functions service by selecting **Create Resource** from the IBM Cloud dashboard. Enter functions as the filter then select the **Functions** card.



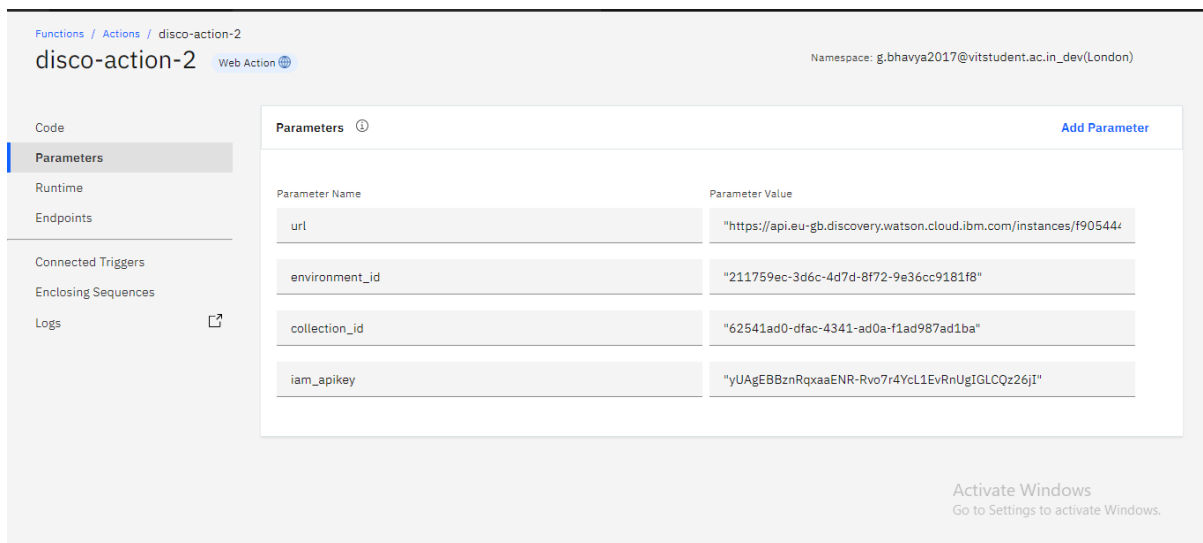
From the **Functions** main panel, click on the **Actions** tab. Then click on **Create**. From the Create panel, select the **Create Action** option. On the create Action panel, provide a unique name, keep the default package and select the **Node.js 10** runtime. Click the **Create** button to create the action.



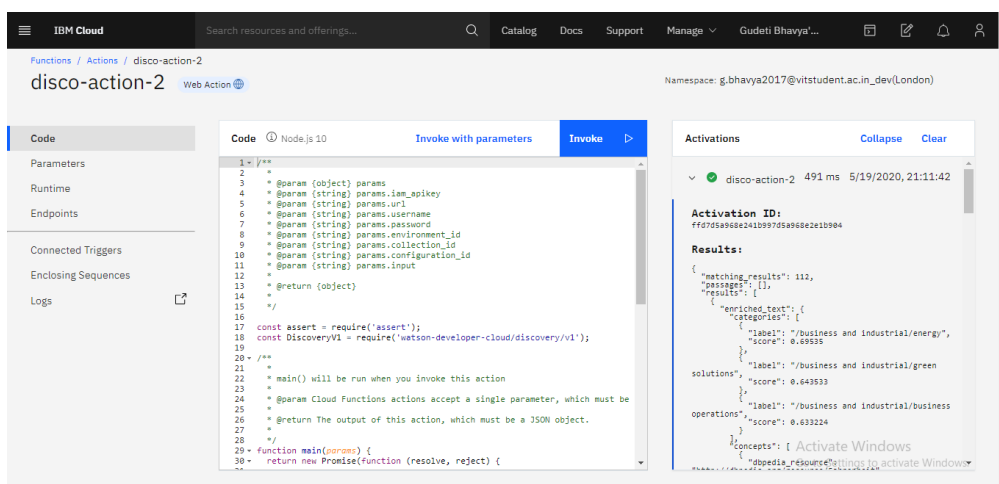
Once the action is created, click on the **Code** tab. Modify the code accordingly to connect to the Discovery service, and to make a query against the collection, then returns the response.



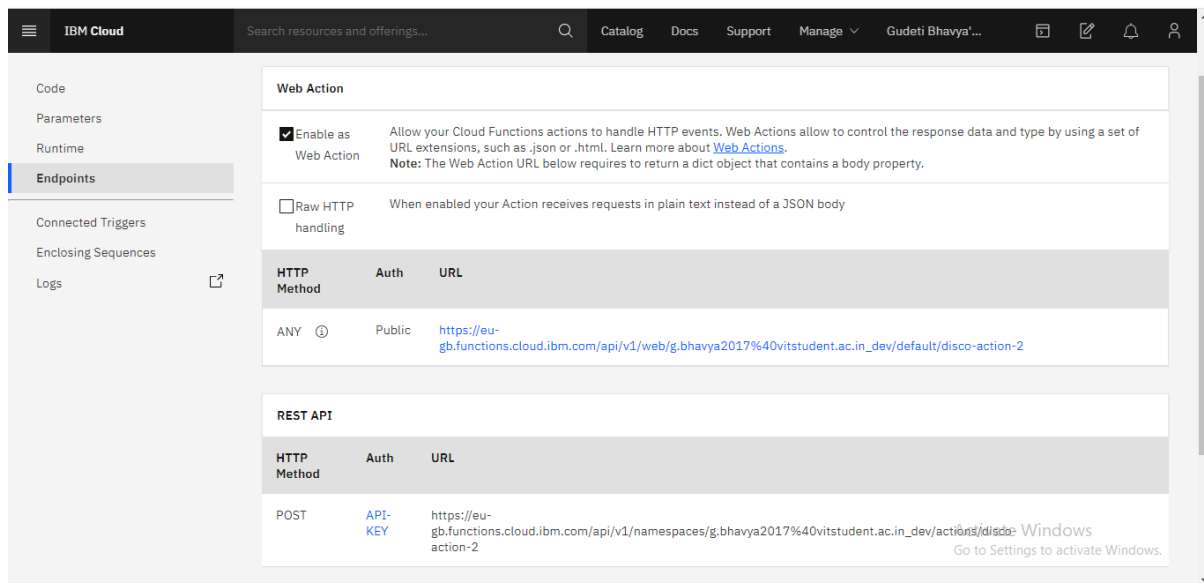
Now select the Parameters tab. Add the following keys : url, environment_id, collection_id, iam_apikey.



Now that the credentials are set, return to the Code panel and press the **Invoke** button. Now we should see actual results returned from the Discovery service.

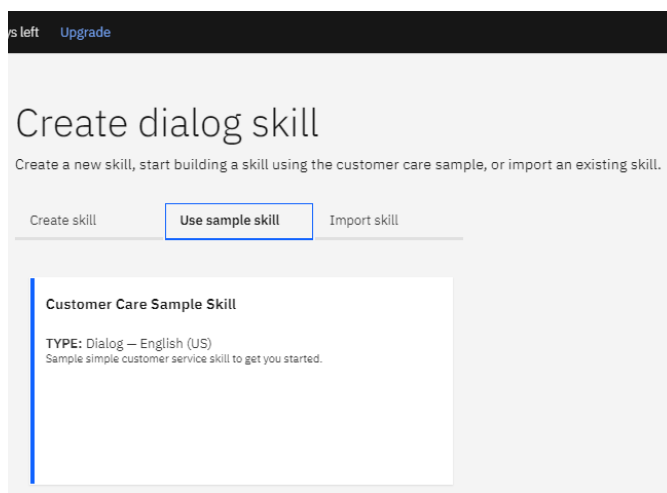


Now, go to the Endpoints panel. Click the checkbox for Enable as Web Action. This will generate a public endpoint URL. Take note of the URL value, as this will be needed by Watson Assistant in future.



Step – 4 : Configure Watson Assistant

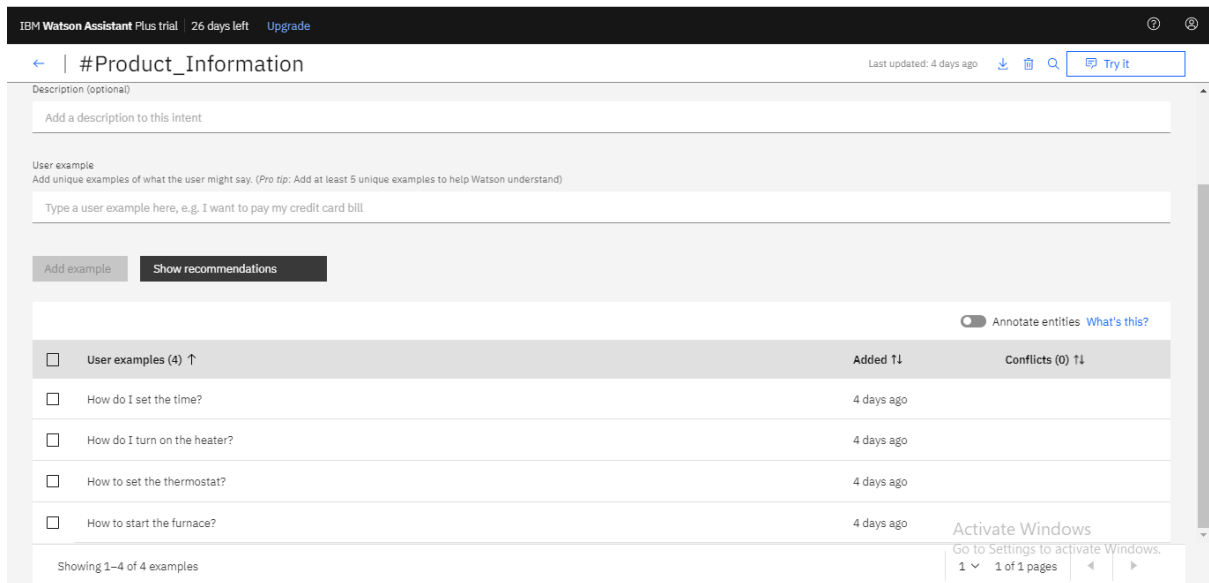
Launch the **Watson Assistant** tool and create a new dialog skill. Select the **Use sample skill** option as the starting point. This dialog skill contains all of the nodes needed to have a typical call centre conversation with a user.



- Add new intent

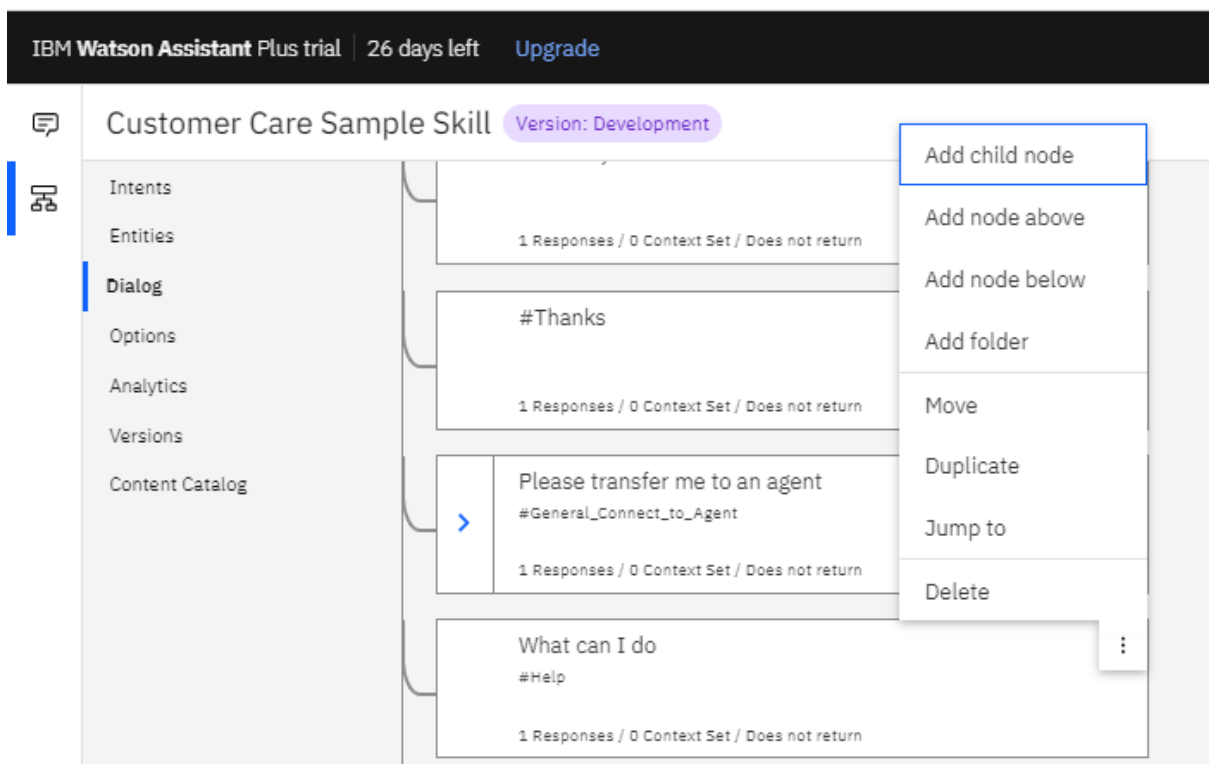
The default customer care dialog does not have a way to deal with any questions involving outside resources, so we will need to create a new intent that can detect when the user is asking about operating the Ecobee thermostat.

From the **Customer Care Sample Skill** panel, select the **Intents** tab. Click the **Create intent** button. Name the intent **#Product_Information** and enter the example questions to be associated with it.



- Create new dialog node

Now we need to add a node. Click on the **Dialog** tab, then search for “**What can I do**” node, and select the **Add node below** option.



Name the node “**Queries about Product**” and assign it our newly created intent. This means that if Watson Assistant recognizes a user input such as “**How do I set the timer?**”, it will direct the conversation to this node.

- Enable webhook from Assistant

Set up access to our WebHook for the IBM Cloud Functions action that we created earlier. Select the **Options** tab. Enter the public URL endpoint for the action. Add **.json** to the end of the URL to specify that the result should be in JSON format.

Now return to the **Dialog** tab and click on the **Queries about Product** node. Click on **Customize**, and enable **Webhooks** for this node. Click **Apply**. The dialog node should have a **Return variable** set automatically to **\$webhook_result_1**. This is the variable name we can use to access the result from the Discovery service query. We will also need to pass in the users question via the parameter input. The key needs to be set to the value “**<?input.text?>**”.

Customize "Queries about Product"

☐ Prompt for everything

Enable this to ask for multiple pieces of information in a single prompt, so your user can provide them all at once and not be prompted for them one at a time.

Webhooks

On

Enable this setting to send a POST request from this dialog node to the webhook URL. The URL and headers are defined in the Webhooks settings of the Options tab. After you enable this setting, the Multiple conditional responses setting is enabled automatically to support adding a response to show when the request is successful and another response to show if the request fails. [Learn more](#)

Multiple conditioned responses

On

Enable multiple responses so that your bot can provide different responses to the same input, based on other conditions.

Cancel
Apply

Customer Care Sample Skill
Version: Development

Intents
Entities
Dialog
Options
Analytics
Versions
Content Catalog

1 Responses / 0 Context Set / Does not return

#Thanks
1 Responses / 0 Context Set / Does not return

Please transfer me to an agent
#General_Connect_to_Agent
1 Responses / 0 Context Set / Does not return

What can I do
#help
1 Responses / 0 Context Set / Does not return

Queries about Product
#Product_Information
2 Responses / 0 Context Set / Does not return

anything_else
1 Responses / 0 Context Set / Returns

Queries about Product

Customize

Node name will be shown to customers for disambiguation so use something descriptive.
Settings

If assistant recognizes

#Product_Information
+

Then callout to my webhook
Learn more

Parameters

Key	Value
Input	"<?input.text?>"

Add parameter +

Return variable

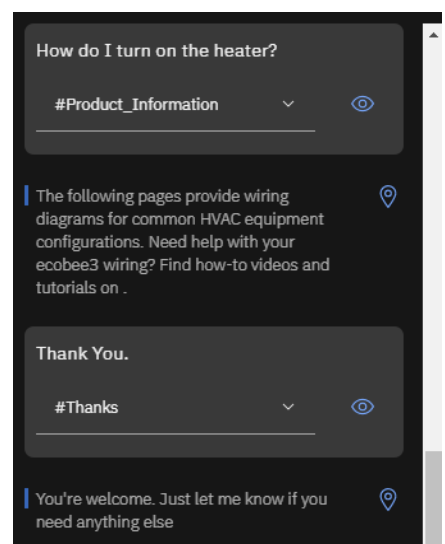
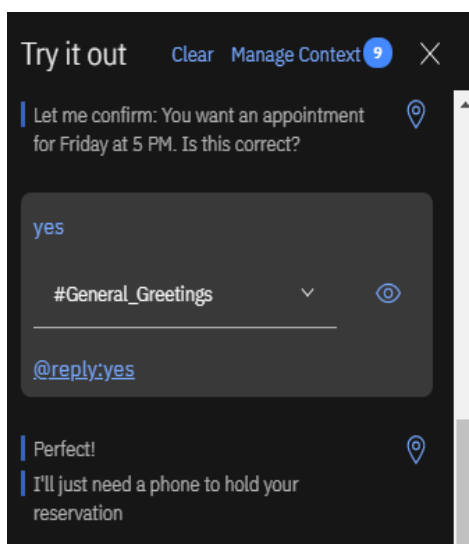
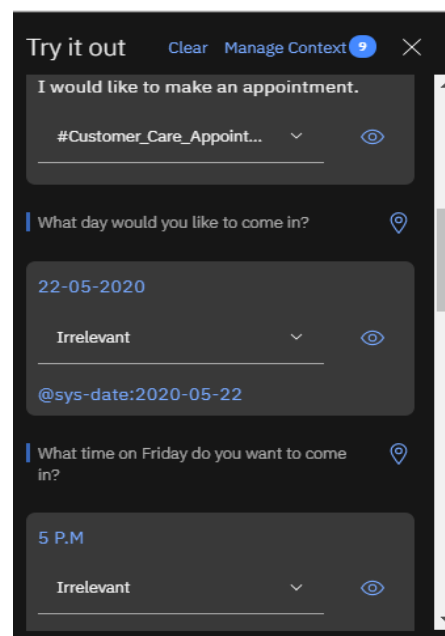
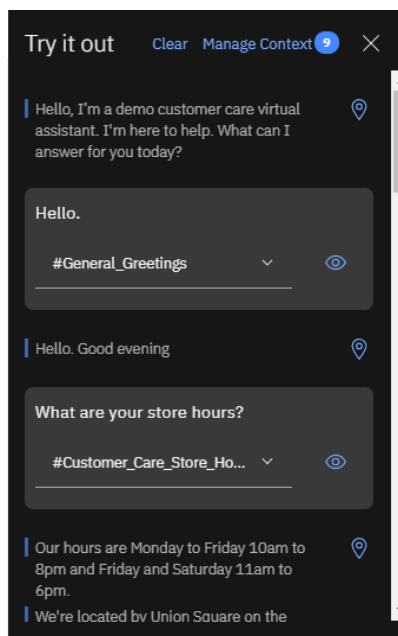
\$webhook_result_1

Optionally we can add the following responses to aid in debugging.

Assistant responds			
	If assistant recognizes	Respond with	
1	\$webhook_result_1	<?\$webhook_result_1.passag	<div> <div> </div> <div> </div> </div>
2	anything_else	Try again later	<div> <div> </div> <div> </div> </div>
Add response +			

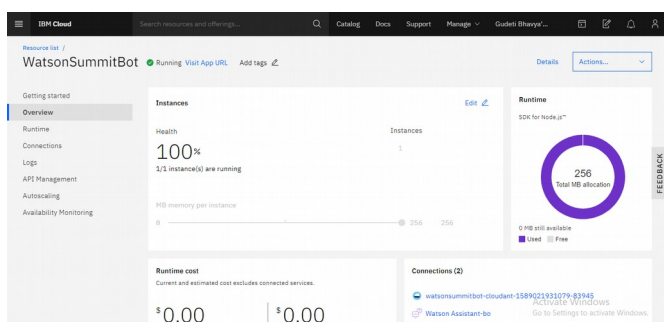
- Test in Assistant Tooling

From the **Dialog** panel, click the **Try it** button. Enter some user input:



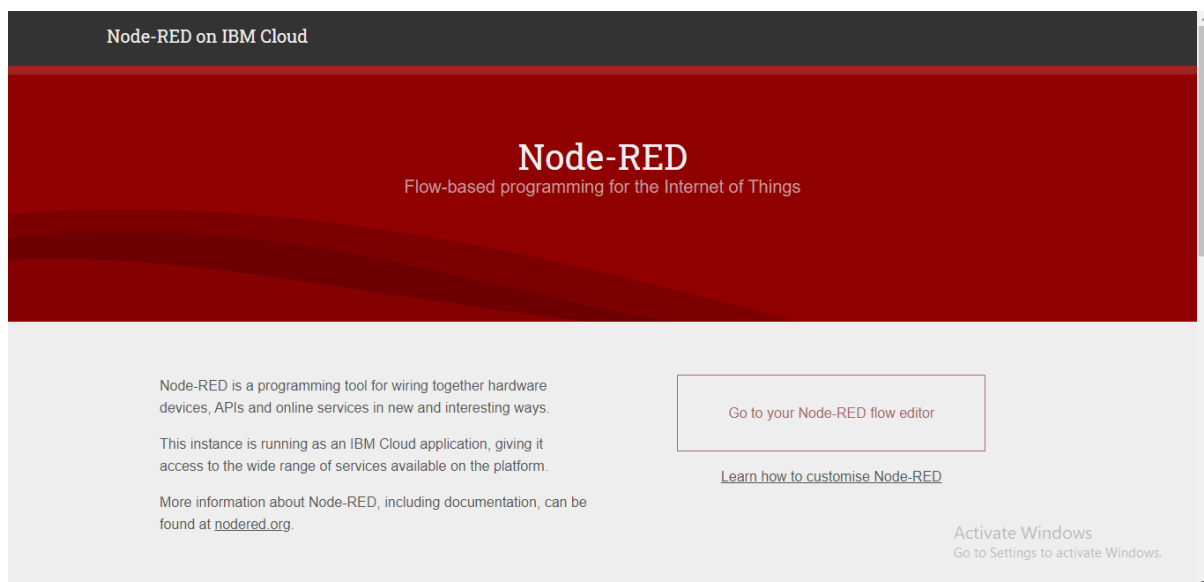
Step – 5 : Create the Node-RED flow

First go to the **IBM Cloud** dashboard and Click on the **Resources list**, Go to **Cloud Foundry apps** and click on the app that we have created earlier. This will direct to the following page. There click on the **Visit App URL**.

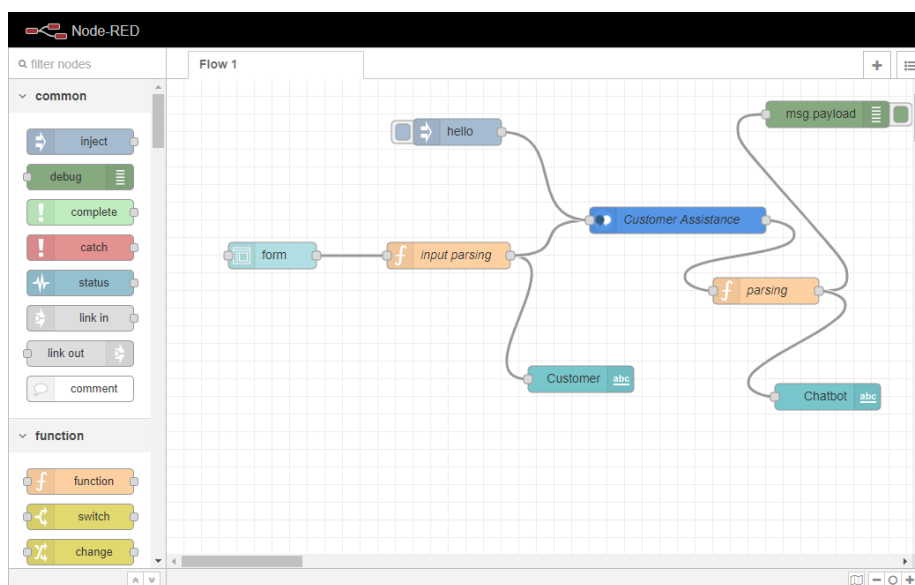


The first time we open the **Node-RED** app, we'll need to configure it and set up security.

1. On the initial screen, click **Next** to continue.
2. Secure the Node-RED editor by providing a **username** and **password**. Click **Next** to continue.
3. The final screen summarizes the options we have made and highlights the environment variables. Click **Finish** to proceed.
4. From here, we can click **Go to your Node-RED flow editor** button to open the editor.



5. Now start creating the flow for this application as shown:



Edit form node

Delete Cancel Done

Properties

Group [customercare] chatbot

Size auto

Label optional label

Label	Name	Type	Required	Rows	Remove
Enter your input	text	Text	<input checked="" type="checkbox"/>		

Edit function node

Delete Cancel Done

Properties

Name input parsing

Function

```

1 msg.payload = msg.payload.text;
2 return msg;

```

Edit inject node

Delete Cancel Done

Properties

Payload hello

Topic

Inject once after 0.1 seconds, then

Repeat none

Name Name

Edit text node

Delete Cancel Done

Properties

Group [customercare] chatbot

Size 6 x 2

Label Customer

Value format {{msg.payload}}

Layout

label value	label value	label value
label value	label value	

Name

Edit text node

Delete Cancel Done

Properties

Group [customercare] Group

Size auto

Label Chatbot

Value format {{msg.payload}}

Layout

label value	label value	label value
label value	label value	

Name

- For **parsing** function write the code as follows :

```

msg.payload.text="";
if(msg.payload.context.webhook_result_1){
    for(var i in msg.payload.context.webhook_result_1.results){

```

```

    msg.payload.text=msg.payload.text+"\n"+msg.payload.context.webhook_result_1.results[i].text;

}

msg.payload=msg.payload.text;

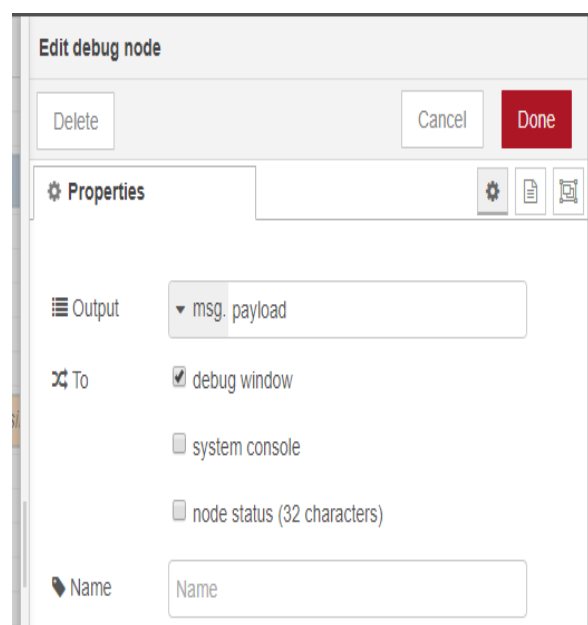
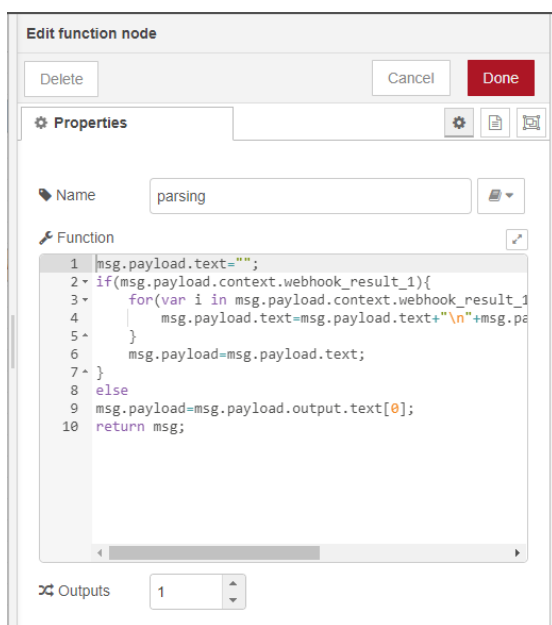
}

else

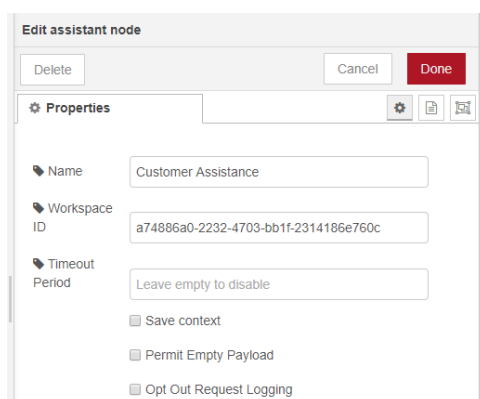
msg.payload=msg.payload.output.text[0];

return msg;

```

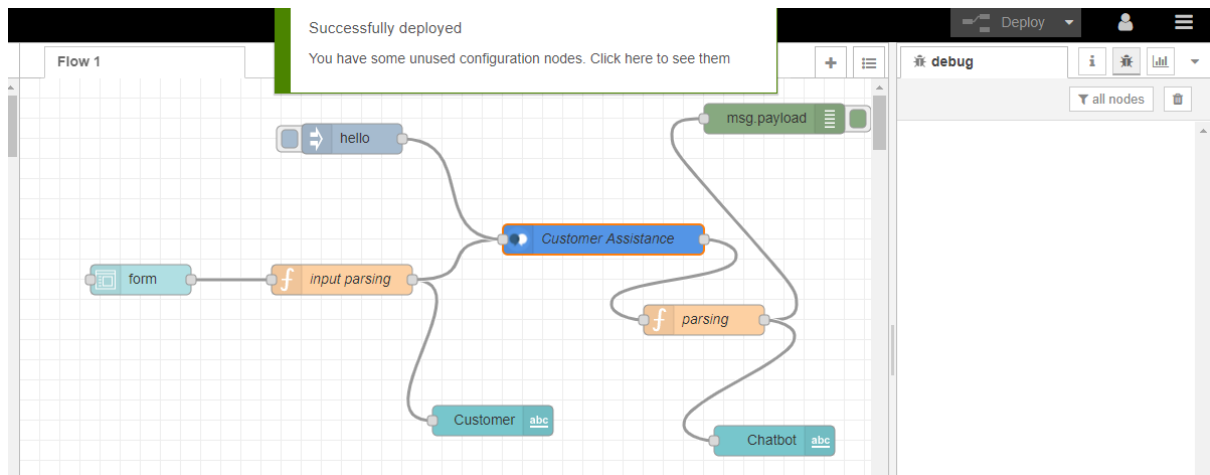


Configure the **Assistant** node with the **Workspace Id** (We get it from **View API details** from Watson Assistant)(**Skill Id**). Make sure that you give the correct credentials. Otherwise it shows an error that “**Resource is not found**”. And make sure to **uncheck the save context** option in Assistance node.

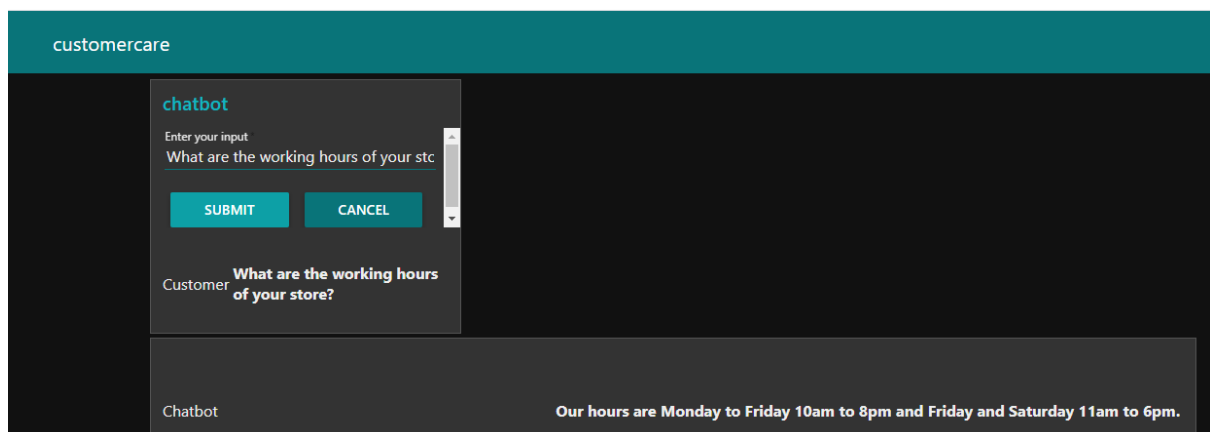
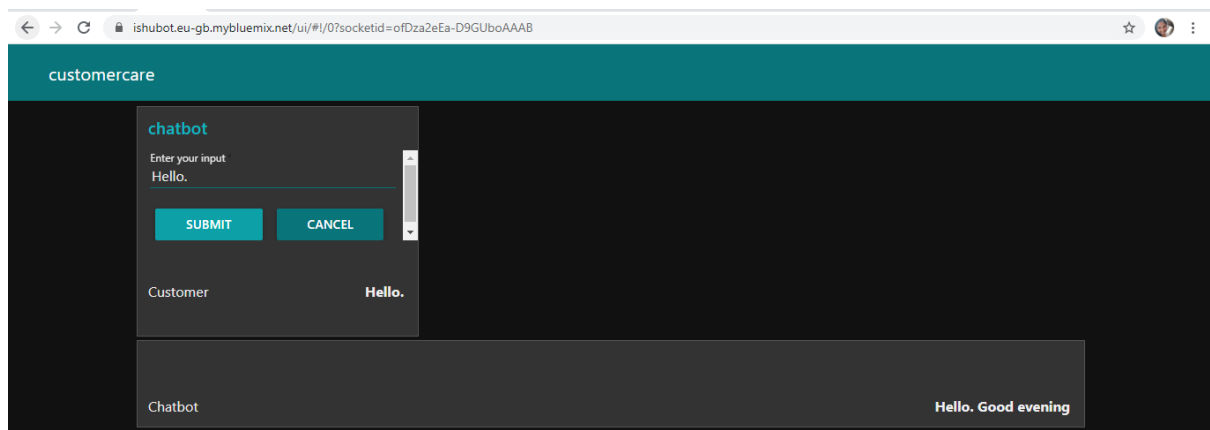


6. RESULT

Now Click on the **Deploy** button. If you configure everything correctly, then you should see the following image saying that “**Successfully deployed**”.



Now copy the URL till **.net/** and go to the new tab in browser and paste the URL and add **ui** at the last of the URL. You should see the following page. Enter some user inputs and test the bot and check whether it is giving accurate results or not.



customercare

chatbot

Enter your input

What is the location of your store?

SUBMIT CANCEL

Customer

What is the location of your store?

Chatbot

We're located by Union Square on the corner of 13th and Broadway

customercare

chatbot

Enter your input

I would like to make an appointment.

SUBMIT CANCEL

Customer

I would like to make an appointment.

Chatbot

What day would you like to come in?

customercare

chatbot

Enter your input

How to set the furnace?

SUBMIT CANCEL

Customer

How to set the furnace?

Chatbot

Generates an alert that indicates it is time to clean or replace the filter on the furnace, if installed. You can set the Last Filter Change date, turn the Reminder On or Off, and set the Frequency of the maintenance interval. If the HVAC system uses a UV lamp for air purification, your ecobee3 can generate an alert indicating that it is time to clean or replace the lamp. You can set the Last Lamp Change date, turn the Reminder On or Off, and set the Frequency of the maintenance interval. If you have a furnace or boiler installed: 1. Select the heating menu. Configure the heater type: Furnace: Optimizes ecobee3 for systems using forced air Boiler: Optimizes your ecobee3 for systems using radiators or in-floor heat. 3. Touch Next. You will be returned to the Equipment configuration menu.

7. ADVANTAGES & DISADVANTAGES

Advantages:

Intelligent document understanding solutions combine search and analytics with Machine Learning(ML) to automatically extract relevant information from unstructured data. Businesses can then access critical insights in real-time, saving significant time and resources that would've been required to manually search through massive data. The benefits include:

- Improve compliance and risk management.

- Increase operational efficiencies.
- Enhance business processes through automation.

Introducing smart document understanding (SDU), a powerful feature now available in Watson Discovery, that can give accurate answers faster. SDU distinguishes text elements and extracts the most valuable content such as key paragraphs, while excluding noise like footers and headers and even identifying text in images. SDU allows to tell AI which data in the document matters, immediately making large data set smaller.

Disadvantages:

The problem isn't with search so much as it is with what information is being searched. That is, traditional search engines are great for crawling, indexing and querying the relatively homogenous information that constitutes web sites and online data. However they're less effective at dealing with the masses of heterogeneous structured and unstructured information that businesses store in various on premises and cloud locations. The more diverse, and dispersed an organization's data resources are, the less likely they can be fully managed or exploited with existing search tools.

8. APPLICATIONS

Consider the time savings – not to mention potential revenue and risk reduction opportunities for a financial institution like U.S. Bank. For businesses today, accepting credit and debit card payments has never been easier. Pricing, on the other hand, remains complex involving multiple parties with varying fee structures based on risk, fraud potential and card-specific rewards. Additionally, pricing can be customised based on the type of customers a merchant sells to. As a result, monthly billing statements breaking down costs and fees is confusing, time consuming and often times frustrating for both merchants and incoming sales reps hoping to win new business.

To solve this problem, U.S. Bank's Innovation team partnered with Elavon, piloted and tested a statement analysis solution capable of analysing a prospect billing statement in real-time and generating an optimized pricing proposal. Using IBM Watson Discovery, with the enhanced smart document understanding capability, what once took 10 days now takes 2 minutes. The solution can analyse dense documents, often dozens of pages along with thousands of relevant pricing codes and other details, and parse relevant information for merchants and sales reps quickly and clearly. As a result, both merchants and sales reps can now spend time doing what they do best, serving their customers and building meaningful, valuable relationships.

9. CONCLUSION

This project explained how to use the Smart Document Understanding feature of Watson Discovery to train the dialog to call out to other IBM Watson Services for additional sources of information. We now should have a fundamental understanding of Watson Discovery and some of its advanced features.

10. FUTURE SCOPE

Within IT, few things are ever really finished or settled. That squares with the fact that technologies are tools that, with evolutionary refinement, can be successfully applied to increasing numbers and other types of problems. A notable point to consider about Watson Discovery with SDU is how it can demonstrably benefit both old school processes like sales proposal creation for U.S. Bank and emerging efforts, including document-based machine learning for AI and searching for valuable “small-data” assets. It is surprising to see that the organizations find new ways to use IBM’s Watson Discovery with SDU in the months and years ahead.

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APPENDIX

Source Code :

1. <https://github.com/SmartPracticeschool/IISPS-INT-870-Intelligent-Customer-Help-Desk-with-Smart-Document-Understanding/tree/master/Assistant%20Skill>
2. <https://github.com/SmartPracticeschool/IISPS-INT-870-Intelligent-Customer-Help-Desk-with-Smart-Document-Understanding/tree/master/Cloud%20Functions%20code>
3. <https://github.com/SmartPracticeschool/IISPS-INT-870-Intelligent-Customer-Help-Desk-with-Smart-Document-Understanding/blob/master/Node-RED-flow.json>

Images : <https://github.com/SmartPracticeschool/IISPS-INT-870-Intelligent-Customer-Help-Desk-with-Smart-Document-Understanding/tree/master/Images>

Discovery Dataset - <https://github.com/SmartPracticeschool/IISPS-INT-870-Intelligent-Customer-Help-Desk-with-Smart-Document-Understanding/tree/master/Discovery%20Dataset>

GitHub Account - <https://github.com/SmartPracticeschool/IISPS-INT-870-Intelligent-Customer-Help-Desk-with-Smart-Document-Understanding>

Node-RED flow link - <https://ishubot.eu-gb.mybluemix.net/red/#flow/7764455e.d3d65c>

Node-RED UI link - <https://ishubot.eu-gb.mybluemix.net/ui/#!/0?socketid=ofDza2eEa-D9GUboAAAB>