

PROJECT REPORT

Name: Akhil Sharma

E-mail : 17ucc009@lnmiit.ac.in

Title : Intelligent Customer Help Desk with
Smart Document Understanding

Category: Artificial Intelligence Internship
at

SMARTINTERNZ

Application ID: SPS_APL_20200000970

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1. INTRODUCTION

1.1 Overview:

A customer care chat bot can answer simple questions, such as store locations and hours, directions, and perhaps even making appointments. In this project, the queries will be handled in a better way. If the customer's question is about the operation of a device, the application shall pass the question onto Watson Discovery Service and we can handle the queries in a better way.

We will build a chat bot that uses various Watson AI Services like Watson Discovery, Watson Assistant, Watson Cloud functions and Node-Red and deliver an effective user friendly Web User Interface.

- **Project Requirements**

IBM Cloud, IBM Watson, Node-Red, NodeJS

- **Functional Requirements**

IBM Cloud

- **Technical Requirements**

Artificial Intelligence, Machine Learning, Watson AI, NodeJS

- **Software Requirements**

Watson Assistant, Watson Discovery, Node-Red

- **Project Deliverables**

Intelligent Chatbot with Smart document understand

- **Project Team**

Akhil Sharma

- **Project Schedule** : 30 days

1.2 Purpose:

The typical customer care chat bot can answer simple questions, such as store locations and hours, directions, and 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.

In this project, there will be an another option. If the customer question is about the operation of a device, the application shall pass the question onto Watson Discovery Service, which has been pre-loaded with the device's owners manual. So now, instead of "Would you like to speak to a customer representative?" we can return relevant sections of the owners manual to help solve our customers' problems.

To take it a step further, the project shall use the Smart Document Understanding feature of Watson Discovery to train it on what text in the owners manual is important and what is not.

This will improve the answers returned from the queries.

1.2.1 Scope of Work

- 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
- Build a web application with integration to all these services and deploy the same on IBM Cloud Platform

2. LITERATURE SURVEY

2.1 Existing problem:

Generally Chatbots means getting input from users and getting only response questions and for some questions the output from bot will be like “try again”, “I don’t understand”, “will you repeat again”, and so on... and directs customer to customer agent but a good customer Chatbot should minimize involvement of customer agent to chat with customer to clarify his/her doubts. So to achieve this we should include an virtual agent in chat bot so that it will take care of real involvement of customer agent and customer can clarifies his doubts with fast chatbots.

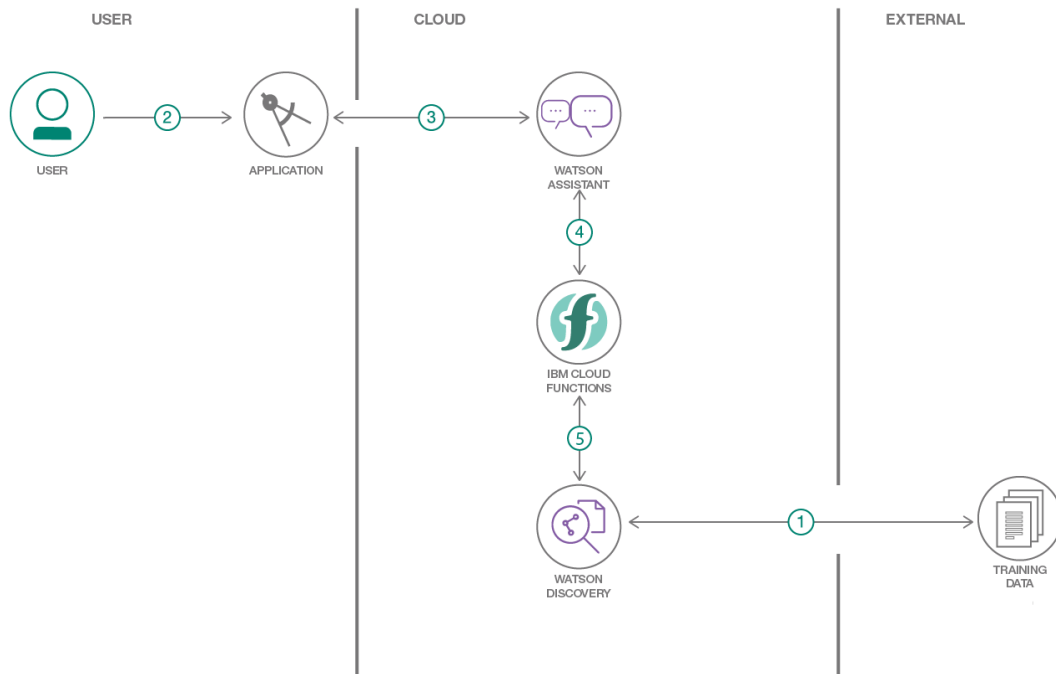
2.2 Proposed solution:

For the above problem to get solved we have to put a virtual agent in chat bot so that it can understand the queries that are posted by customers. The virtual agent should be trained on some modules of records based on the company background so that it can answer the queries related to the product or related to company. In this project I have used Watson Discovery to achieve the above solution, along with Watson Assistant and built an User Interface using Node-RED.

3. THEORITICAL ANALYSIS

3.1 Block/Flow Diagram

The following flow is the basic working flow of the project.



1. The document is annotated using Watson Discovery SDU
2. The user interacts with the backend server via the app UI. The front end app UI is a chat bot that engages the user in a conversation.
3. Dialog between the user and the backend server is coordinated using a Watson Assistant dialog skill.
4. If the user asks a product operation question, a search query is passed to the predefined IBM Cloud Functions action.
5. The Cloud Functions action will pass the query to the Watson Discovery service and returns the result.

3.2 Hardware / Software designing:

1. Create IBM Cloud services
2. Configure Watson Discovery

3. Create IBM Cloud Functions action
4. Configure Watson Assistant
5. Create flow and configure node
6. Deploy and run Node Red app.

4. EXPERIMENTAL INVESTIGATIONS

1. Create IBM Cloud services

Create the following services:

- Watson Discovery
- Watson Assistant
- Node Red

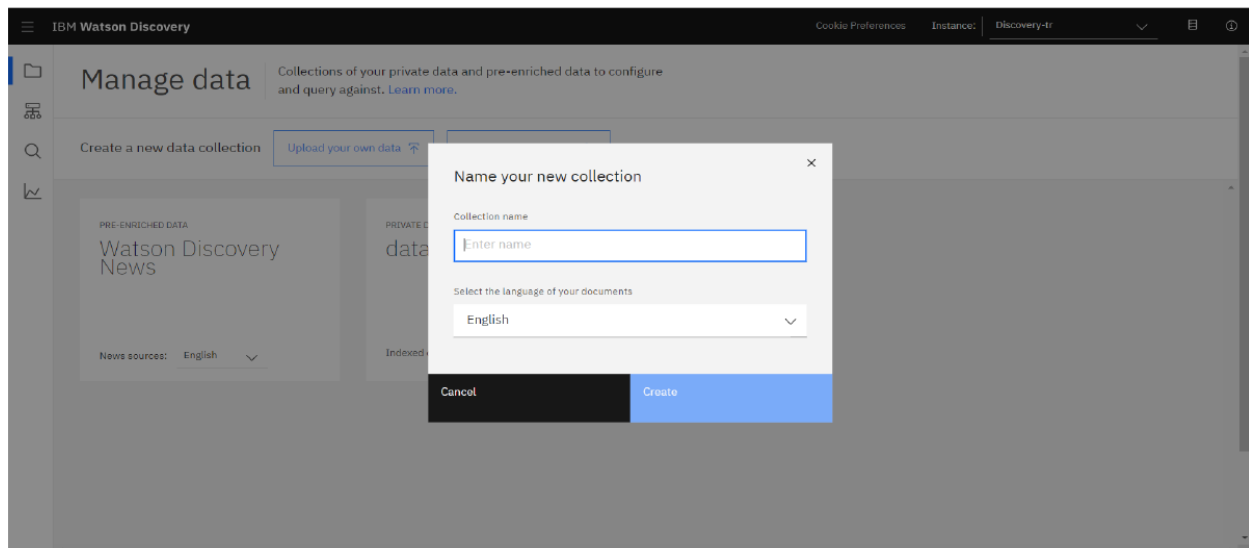
The resources tab of IBM Account will look like this after creation of the above services.

The screenshot shows the IBM Cloud 'Resource list' page. The table lists various resources categorized into Clusters, Cloud Foundry apps, Cloud Foundry services, and Services. The columns are Name, Group, Location, Offering, Status, and Tags. A 'Create resource' button is visible in the top right corner.

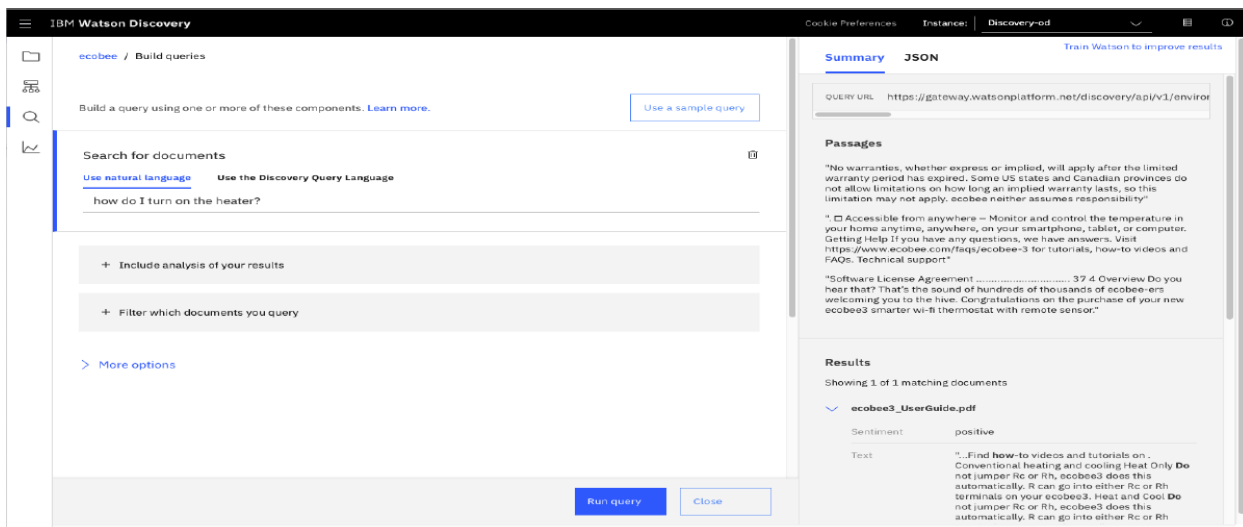
Name	Group	Location	Offering	Status	Tags
Clusters (0)					
Cloud Foundry apps (2)					
Node RED KILKU	17ucc009@lnmit.ac.in / dev	London	SDK for Node.js™	Stopped	—
Node RED NRQZB	17ucc009@lnmit.ac.in / dev	London	SDK for Node.js™	Started	—
Cloud Foundry services (1)					
node-red-nrqzb-cloudant-15908331724...	17ucc009@lnmit.ac.in / dev	London	Cloudant	Provisioned	—
Services (4)					
Continuous Delivery	Default	Dallas	Continuous Delivery	Active	—
Discovery-wp	Default	London	Discovery	Active	—
Watson Assistant-00	Default	London	Watson Assistant	Active	—
node-red-nrqzb-cloudant-15908331724...	Default	London	Cloudant	Active	—
Storage (0)					

2. Configure Watson Discovery

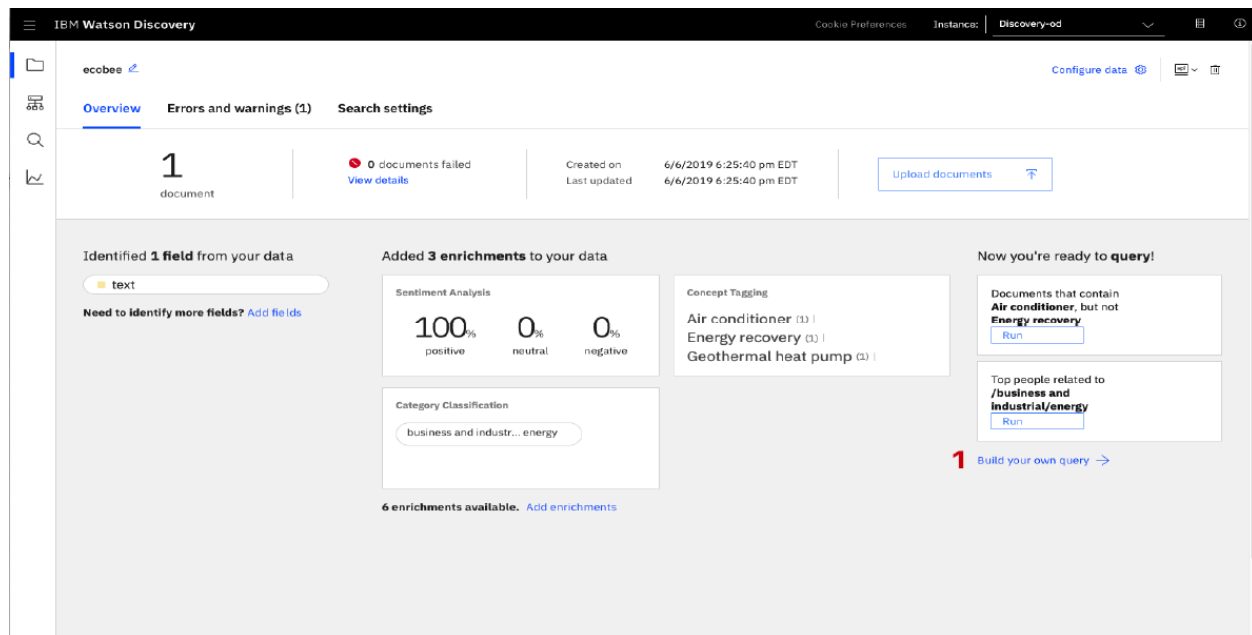
- Import the document
- Launch the Watson Discovery tool and create a new data collection by selecting the Upload your own data option.



- Give the data collection a unique name.
- When prompted, select and upload the ecobee3_UserGuide.pdf file located in the data directory of your local repository.
- 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.
- Enter queries related to the operation of the thermostat and view the results.



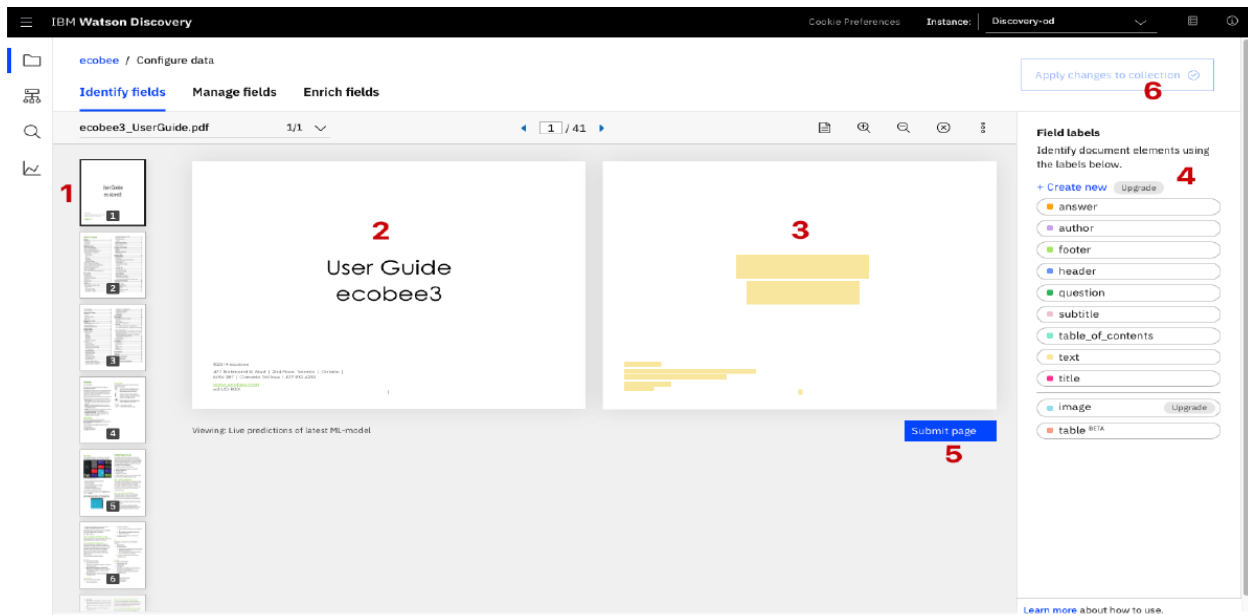
- As you can see in the above image, the results are not beneficial, and in some cases, not even related to the question.
- Annotate with SDU. Now let's apply SDU to our document to see if we can generate some better query responses. From the Discovery collection panel, click the Configure data button (located in the top right corner) to start the SDU process.
- Here is the layout of the Identify fields tab of the SDU annotation panel:



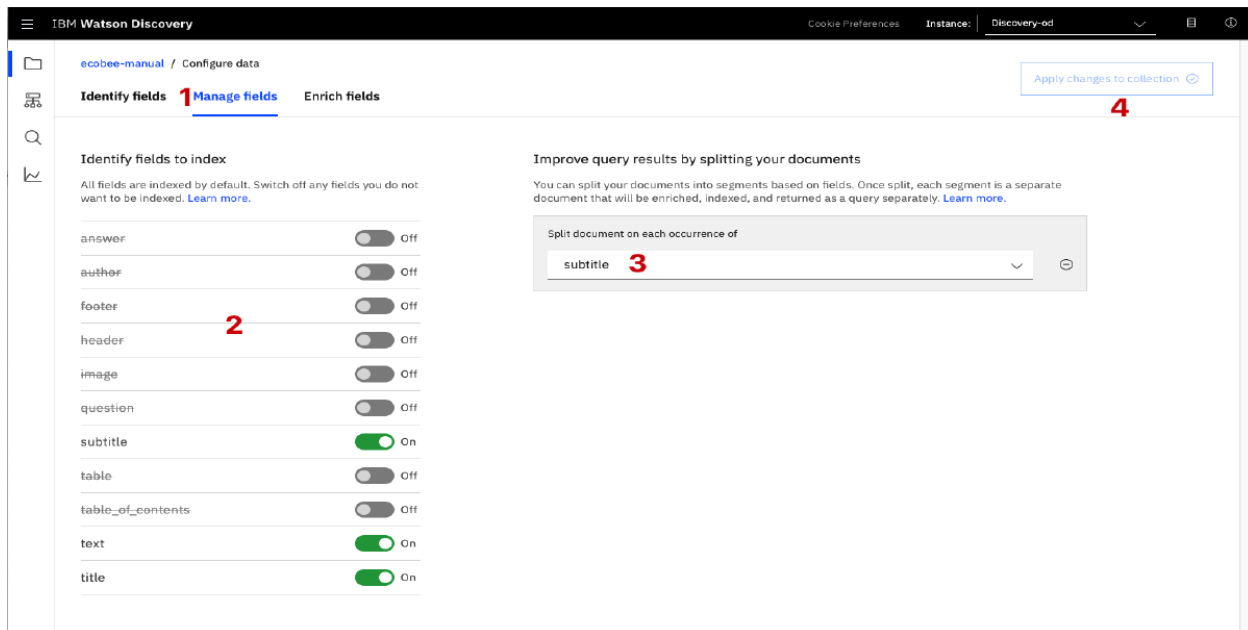
- The goal is to annotate all of the pages in the document so Discovery can learn what text is important, and what text can be ignored.

Follow the following instructions to achieve this task:

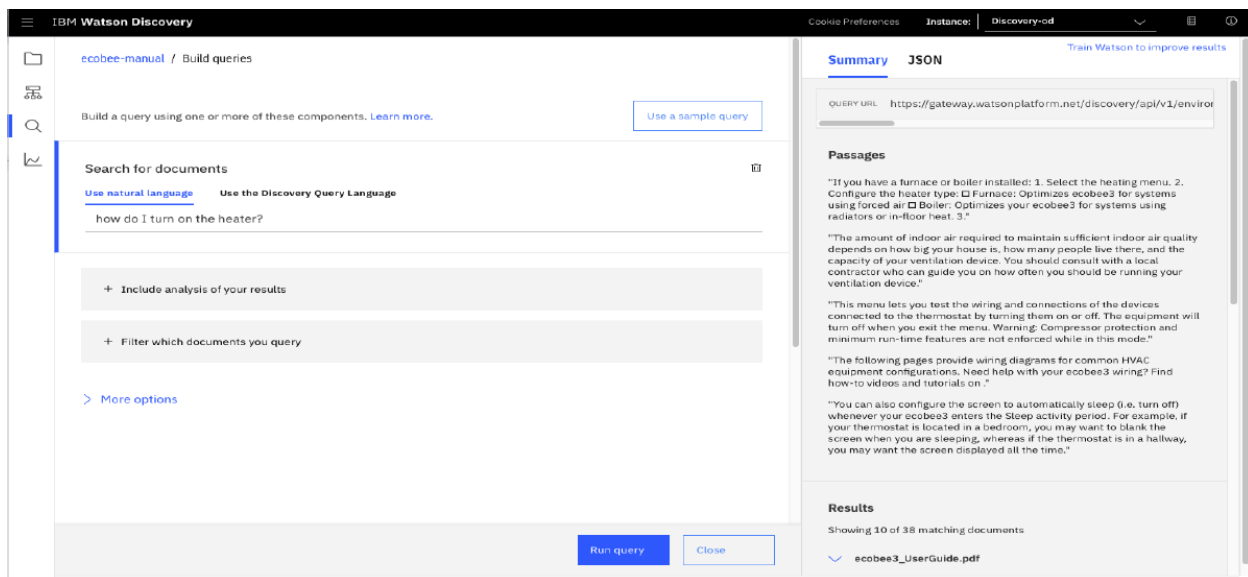
- [1] is the list of pages in the manual. As each is processed, a green check mark will appear on the page.
- [2] is the current page being annotated.
- [3] is where you select text and assign it a label.
- [4] is the list of labels you can assign to the page text.
- Click [5] to submit the page to Discovery.
- Click [6] when you have completed the annotation process.



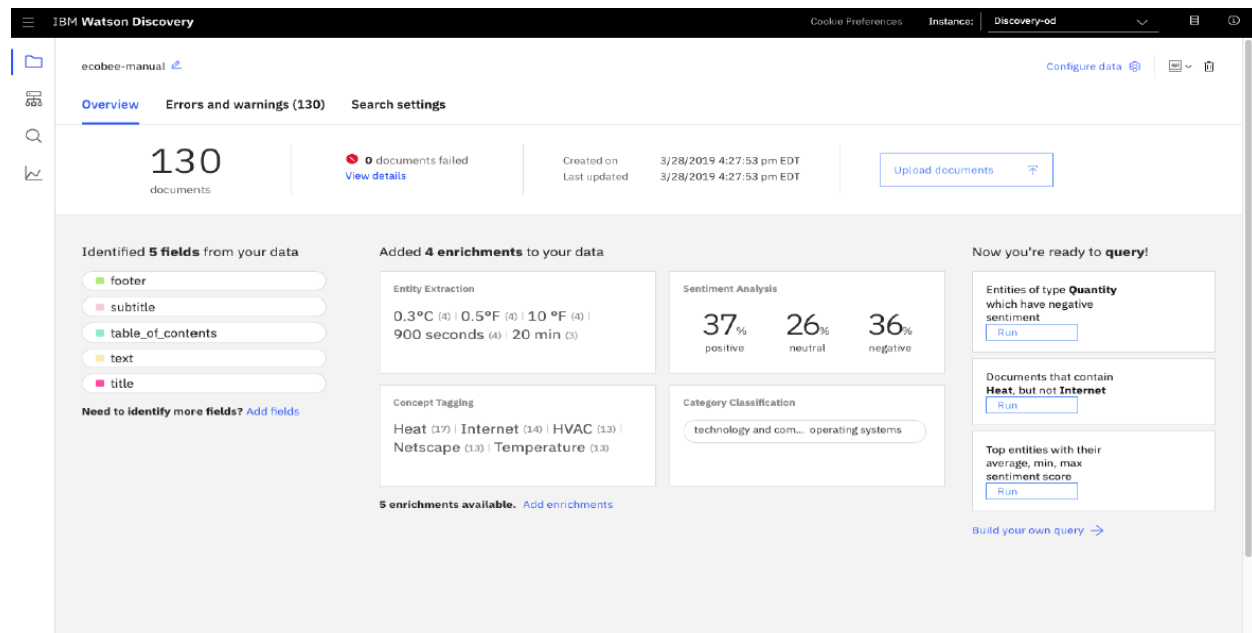
- As you go through the annotations one page at a time, Discovery is learning and should start automatically updating the upcoming pages. Once you get to a page that is already correctly annotated, you can stop, or simply click Submit [5] to acknowledge it is correct. The more pages you annotate, the better the model will be trained.
- For this specific owner's manual, at a minimum, it is suggested to mark the following:
 - The main title page as title
 - The table of contents as table_of_contents
 - All headers and sub-headers (typed in light green text) as a subtitle
 - All page numbers as footers
 - All warranty and licensing information (located in the last few pages) as a footer
 - All other text should be marked as text.
- Once you click the Apply changes to collection button [6], you will be asked to reload the document. Choose the same owner's manual .pdf document as before.
- Next, click on the Manage fields [1] tab.



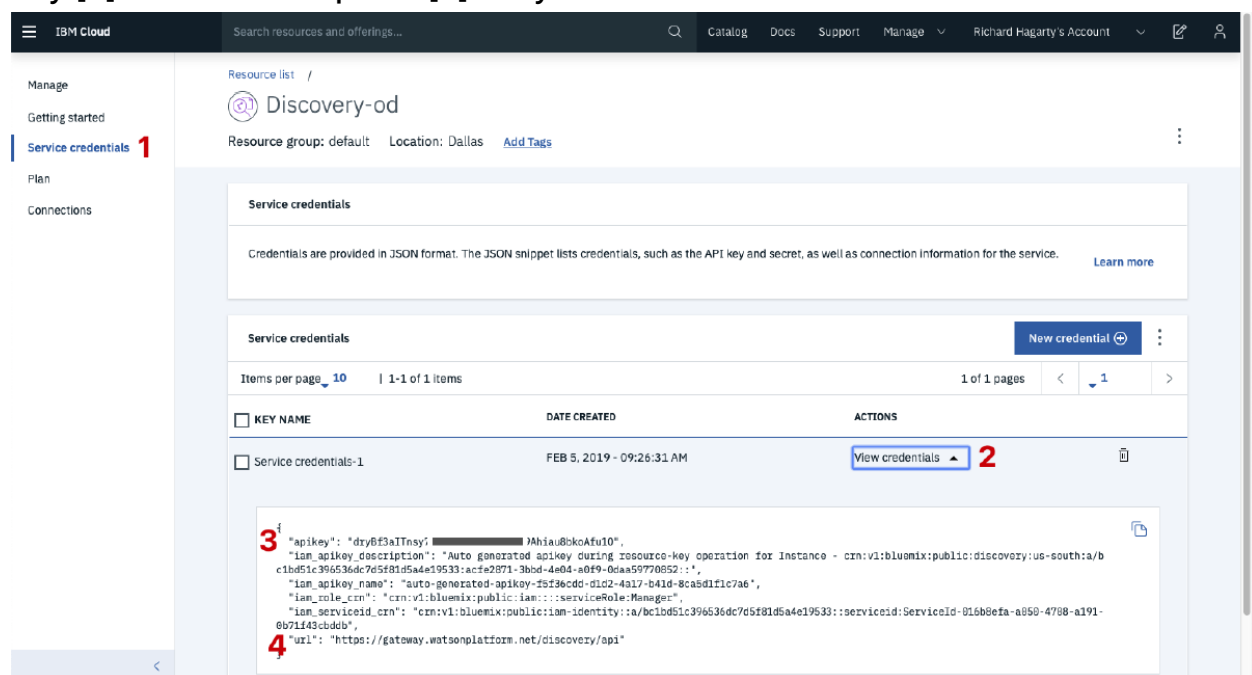
- [2] Here is where you tell Discovery which fields to ignore. Using the on/off buttons, turn off all labels except subtitles and text.
- [3] is telling Discovery to split the document apart, based on subtitle.
- Click [4] to submit your changes.
- Once again, you will be asked to reload the document.
- Now, because of splitting the document apart, your collection will look very different
- Return to the query panel (click Build your own query) and see how much better the results are:



- The results to the queries related to the product are very accurate after annotation of the document.

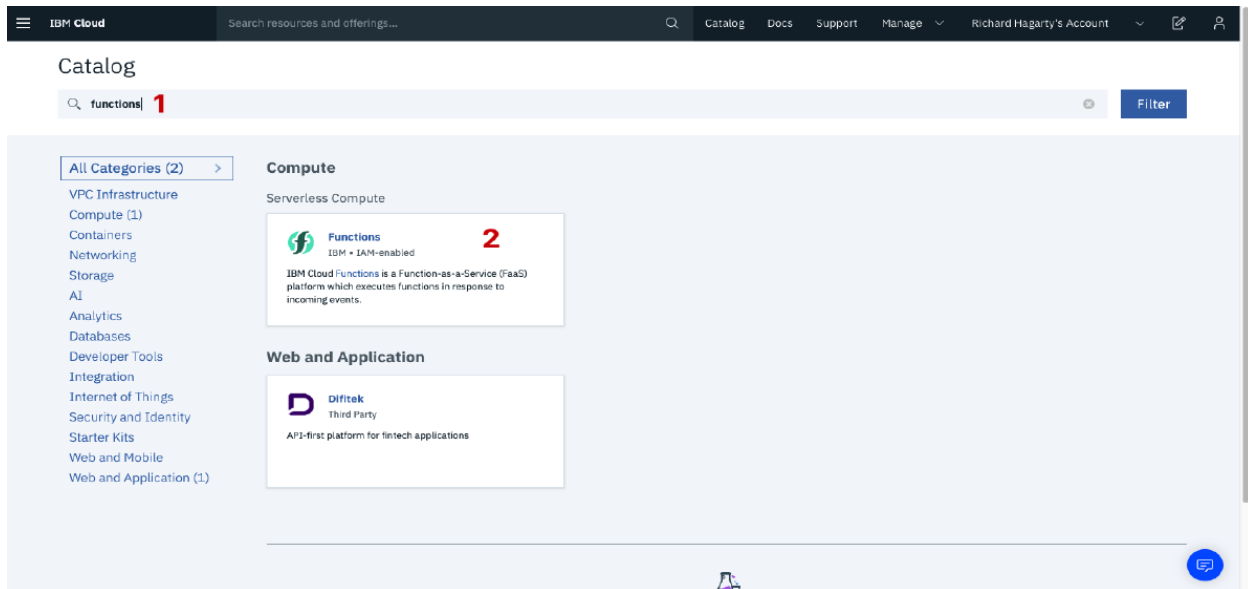


- After annotation we can see the difference, that now no. of documents have increased very much so, we will get accurate response.
- Click the View credentials [2] drop-down menu to view the IAM api key [3] and URL endpoint [4] for your service.

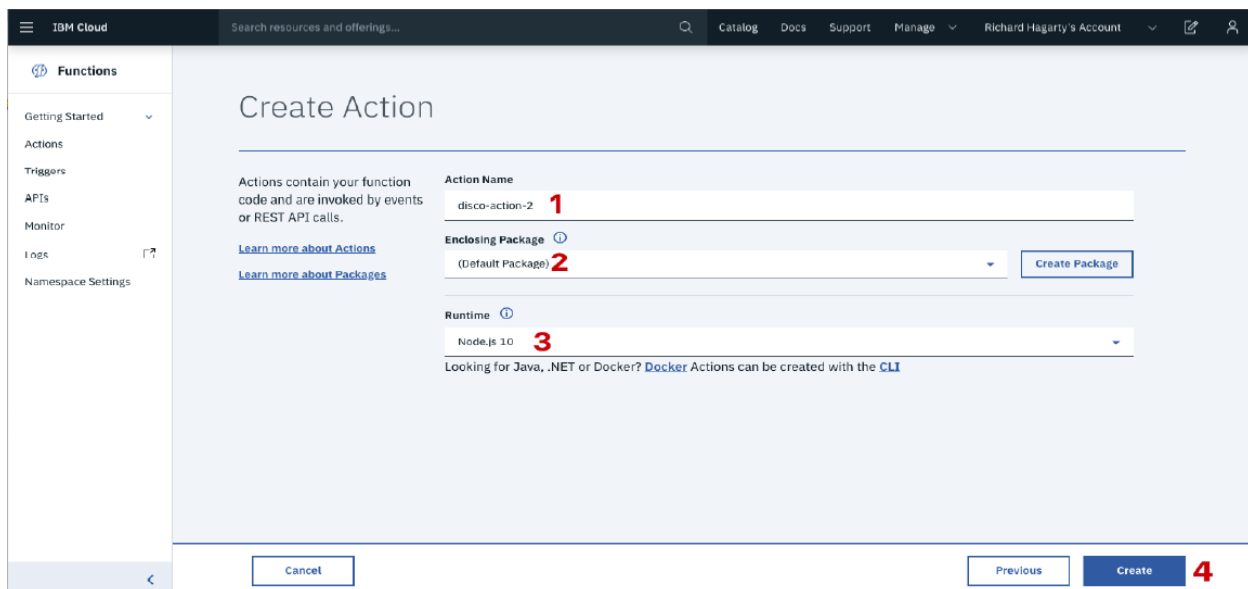


3. Create IBM Cloud Functions action

- Now let us 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 [1], then select the Functions card [2]:

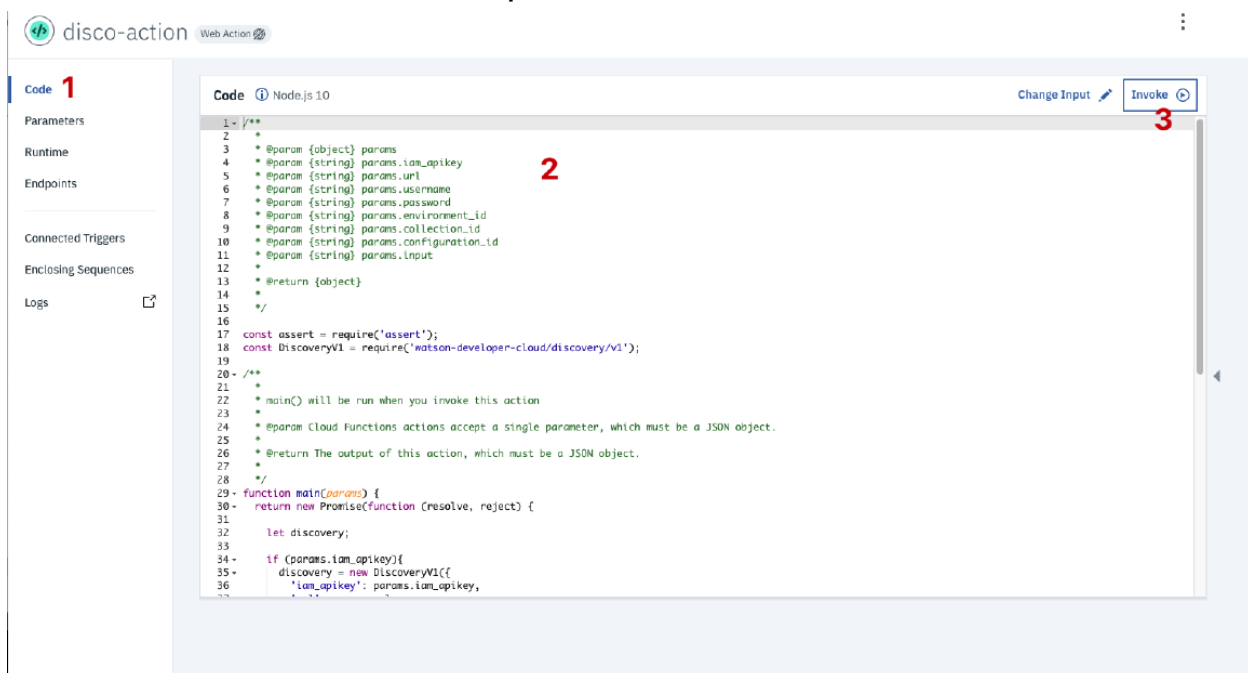


- From the Functions main panel, click on the Actions tab. Then click on Create.



- From the Create panel, select the Create Action option.

- On the Create Action panel, provide a unique Action Name [1], keep the default package [2], and select the Node.js 10 [3] runtime. Click the Create button [4] to create the action.
- Once your action is created, click on the Code tab [1]:
 - In the code editor window [2], cut and paste in the code from the cloud_function.js file found in the actions directory of your local repository. The code is pretty straight-forward - it simply connects to the Discovery service, makes a query against the collection, then returns the response.



- If you press the Invoke button [3], it will fail due to credentials not being defined yet. We will do this next.
- Select the Parameters tab:
 - Add the following keys:
 - url
 - environment_id
 - collection_id
 - iam_apikey

The screenshot shows the IBM Cloud Functions console for a function named 'discovery-function'. The 'Parameters' tab is selected, displaying a table of parameters and their values.

Parameter Name	Parameter Value
url	"https://api.eu-gb.discovery.watson.cloud.ibm.com/instances/c64d1572-6263-4d4"
environment_id	"0fb5ec60-7b43-40c9-99a3-3ba2e1240db8"
collection_id	"c0309df7-e295-4f27-9515-e878e8256036"
iam_apikey	"EjEduOK7vqgZUx6_AiMYZoyDNG5Li0qSpBRf58f7E5q"

- For values, please use the values associated with the Discovery service you created in the previous step.
- Now that the credentials are set, return to the Code panel and press the Invoke button again.
- Now you should see actual results returned from the Discovery service:
 - Next, go to the Endpoints panel [1]:

The screenshot shows the IBM Cloud Functions console for a function named 'disco-action'. The 'Web Action' tab is selected, displaying configuration options and endpoints.

Web Action Configuration:

- ☒ **Enable as Web Action** (2): Allow your Cloud Functions actions to handle HTTP events. Learn more about Web Actions.
- ☐ **Raw HTTP handling**: When enabled your Action receives requests in plain text instead of a JSON body.

Endpoints:

HTTP METHOD	AUTH	URL
ANY	Public	3 https://us-south.functions.cloud.ibm.com/api/v1/web/IBM%20Cloud%20Storage_DSX-journey-2/default/disco-action

REST API:

HTTP METHOD	AUTH	URL
POST	API-KEY	https://us-south.functions.cloud.ibm.com/api/v1/namespaces/IBM%20Cloud%20Storage_DSX-journey-2/actions/disco-action

CURL:

```
4 curl -u API-KEY -X POST https://us-south.functions.cloud.ibm.com/api/v1/namespaces/IBM%20Cloud%20Storage_DSX-journey-2/actions/disco-action?blocking=true
```

- Click the checkbox for Enable as Web Action [2]. This will generate a public endpoint URL.

- [3]. Take note of the URL value [3], as this will be needed by Watson Assistant in a future step.
- To verify you have entered the correct Discovery parameters, execute the provided curl command [4]. If it fails, re-check your parameter values.

4.Configure Watson Assistant

- Launch the Watson Assistant tool and create a new dialog skill. Select the Use sample skill option as your starting point. This dialog skill contains all of the nodes needed to have a typical call center 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 add this.
- 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.

The screenshot shows the Watson Assistant 'Intents' tab for a skill named '#Product_Information'. The interface includes a header with a back arrow, the skill name, and a 'Last modified 2 hours ago' timestamp. Below the header, there are fields for 'Intent name' (pre-filled with '#Product_Information'), 'Description (optional)' (pre-filled with 'User wants help using the thermostat'), and 'Add user example' (with a placeholder 'Type a user example here'). There are buttons for 'Add example' and 'Show recommendations'. At the bottom, a table lists existing user examples:

<input type="checkbox"/> User examples (3) ▼	Added	0 conflicts	Show only conflicts ⓘ
<input type="checkbox"/> How do I access the settings ⓘ	2 hours ago		
<input type="checkbox"/> How do I set the time ⓘ	2 hours ago		
<input type="checkbox"/> How do I turn on the heater ⓘ	2 hours ago		

- Name the intent #Product_Information, and at a minimum, enter the following example questions to be associated with it.
- Create new dialog node

IBM Watson Assistant

[Skills](#) /

Customer Care Sample Skill copy

Sample simple customer service skill to get you started.

Intents Entities **1 Dialog** Analytics Options Versions Content Catalog

> Directions and location
#Customer_Care_Store_Location
3 Responses / 0 Context Set / Skip user input / Returns

Make an appointment
#Customer_Care_Appointments
3 Responses / 7 Context Set / 5 Slots / Does not return

> Transfer to agent
#General_Connect_to_Agent
1 Responses / 0 Context Set / Does not return

Small Talk
3 Dialog nodes / No digressions

anything_else
1 Responses / 0 Context Set / Returns

⋮

⋮

⋮

⋮ **2**

⋮

Add node to folder

Add node above

Add node below **3**

Add folder

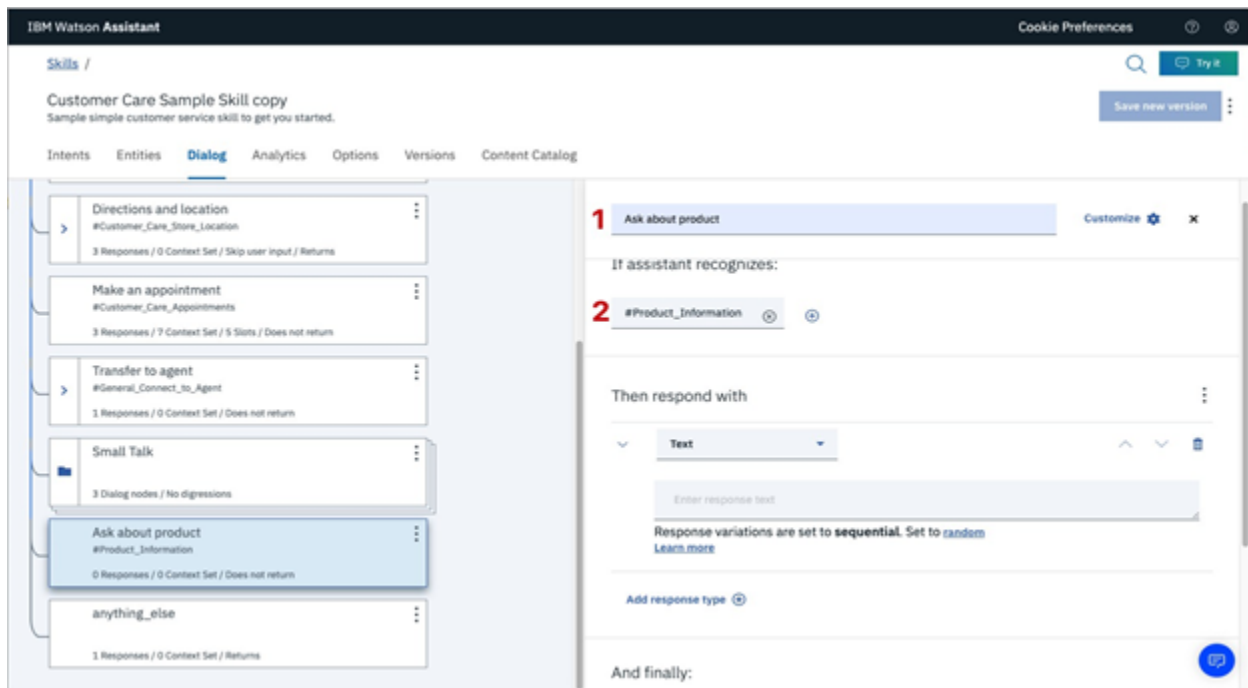
Move

Duplicate

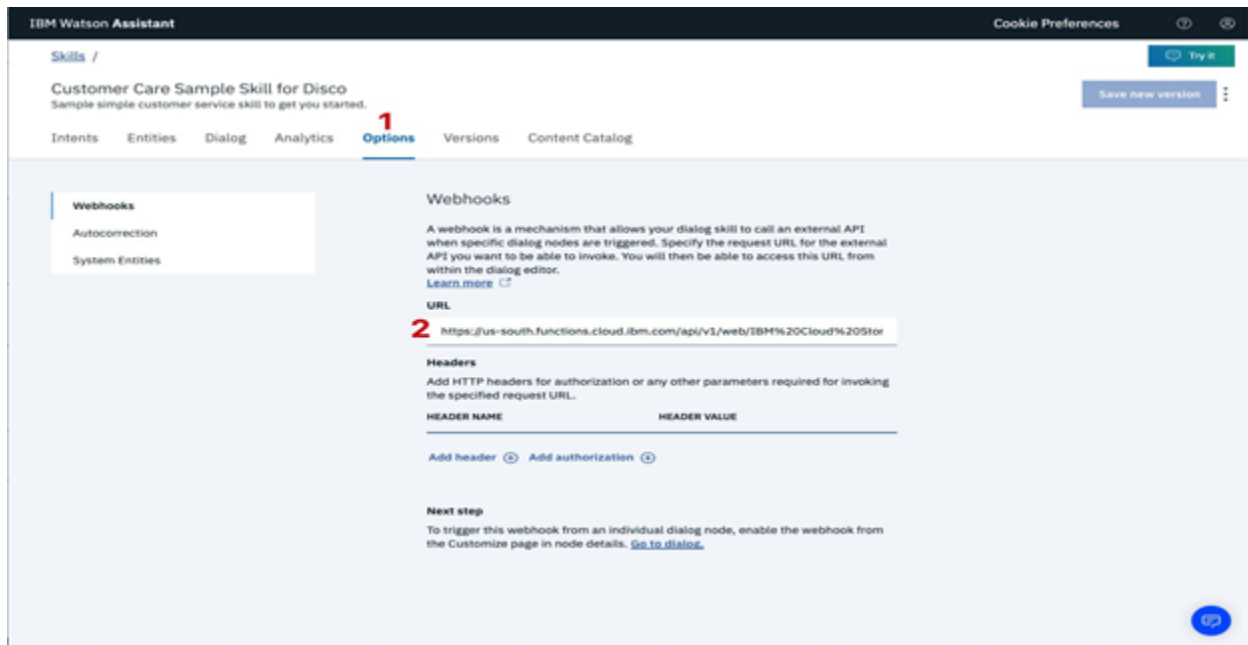
Jump to

Delete

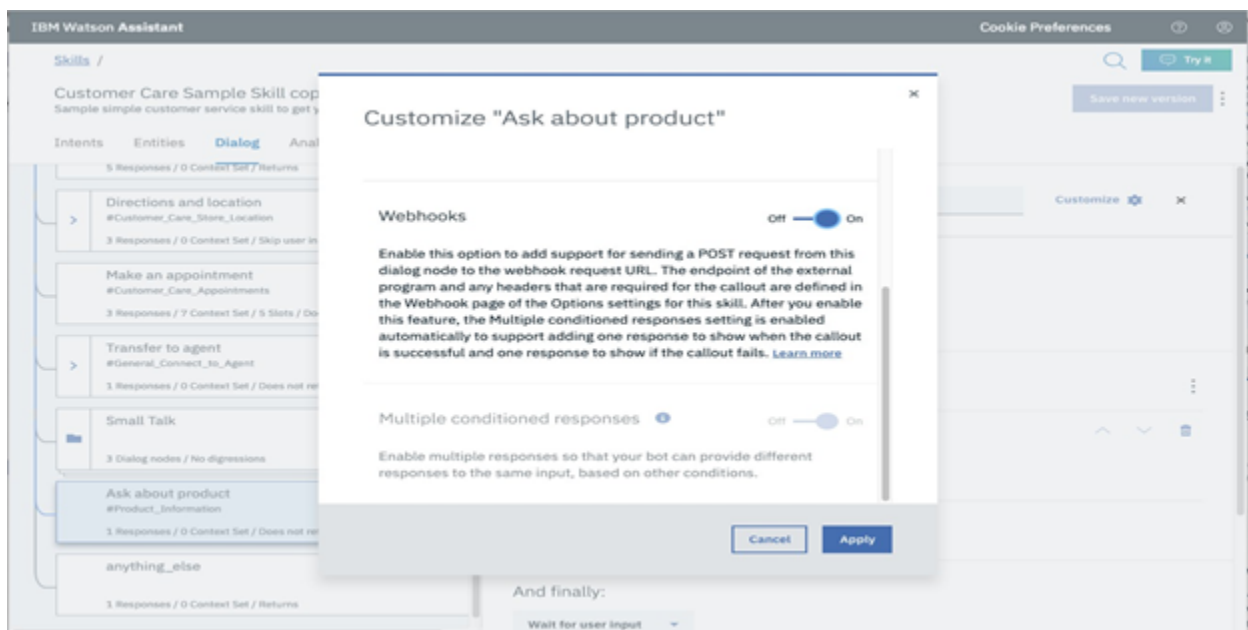
- Now we need to add a node to handle our intent. Click on the Dialog [1] tab, then click on the drop down menu for the Small Talk node [2], and select the Add node below [3] option.



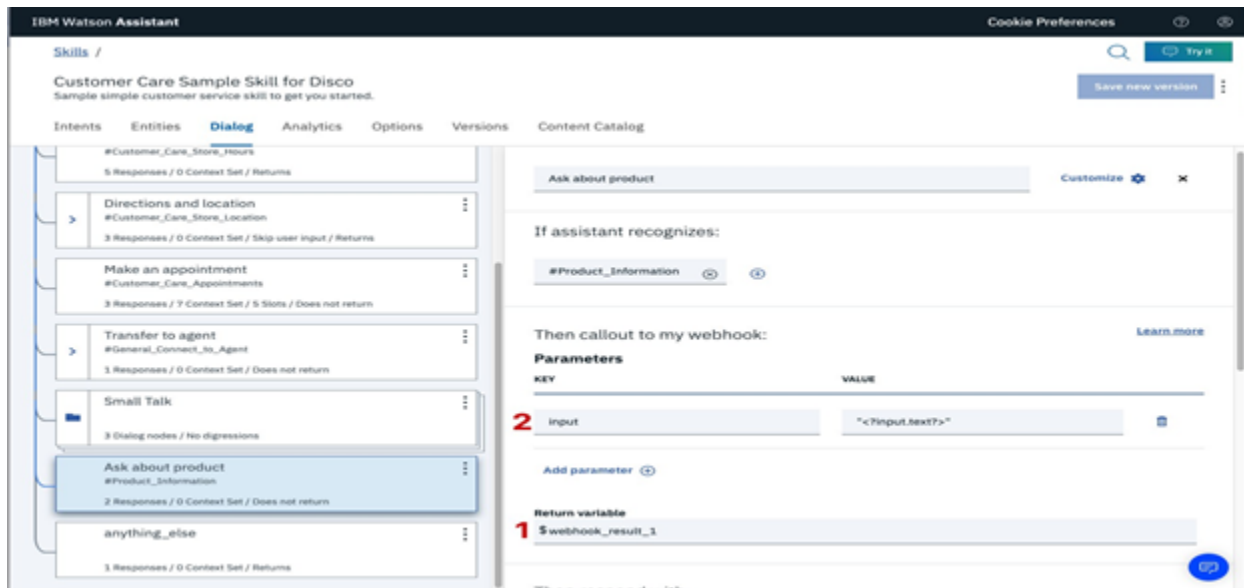
- Name the node "Ask about product" [1] and assign it our new intent [2]. This means that if Watson Assistant recognizes a user input such as "how do I set the time?", it will direct the conversation to this node.
- Enable webhook from Assistant
- Set up access to our WebHook for the IBM Cloud Functions action you created in Step #4(Create IBM Clouds Function).



- Select the Options tab [1]:
- Enter the public URL endpoint for your action [2].
- Return to the Dialog tab, and click on the Ask about product node.
- From the details panel for the node, click on Customize, and enable Webhooks for this node:



- Click Apply.



- The dialog node should have a Return variable [1] set automatically to \$webhook_result_1.
- This is the variable name you can use to access the result from the Discovery service query.
- You will also need to pass in the users question via the parameter input [2]. The key needs to be set to the value: "<?input.text?>"
- If you fail to do this, Discovery will return results based on a blank query.
- Optionally, you can add these responses to aid in debugging:

Return variable

\$webhook_result_1

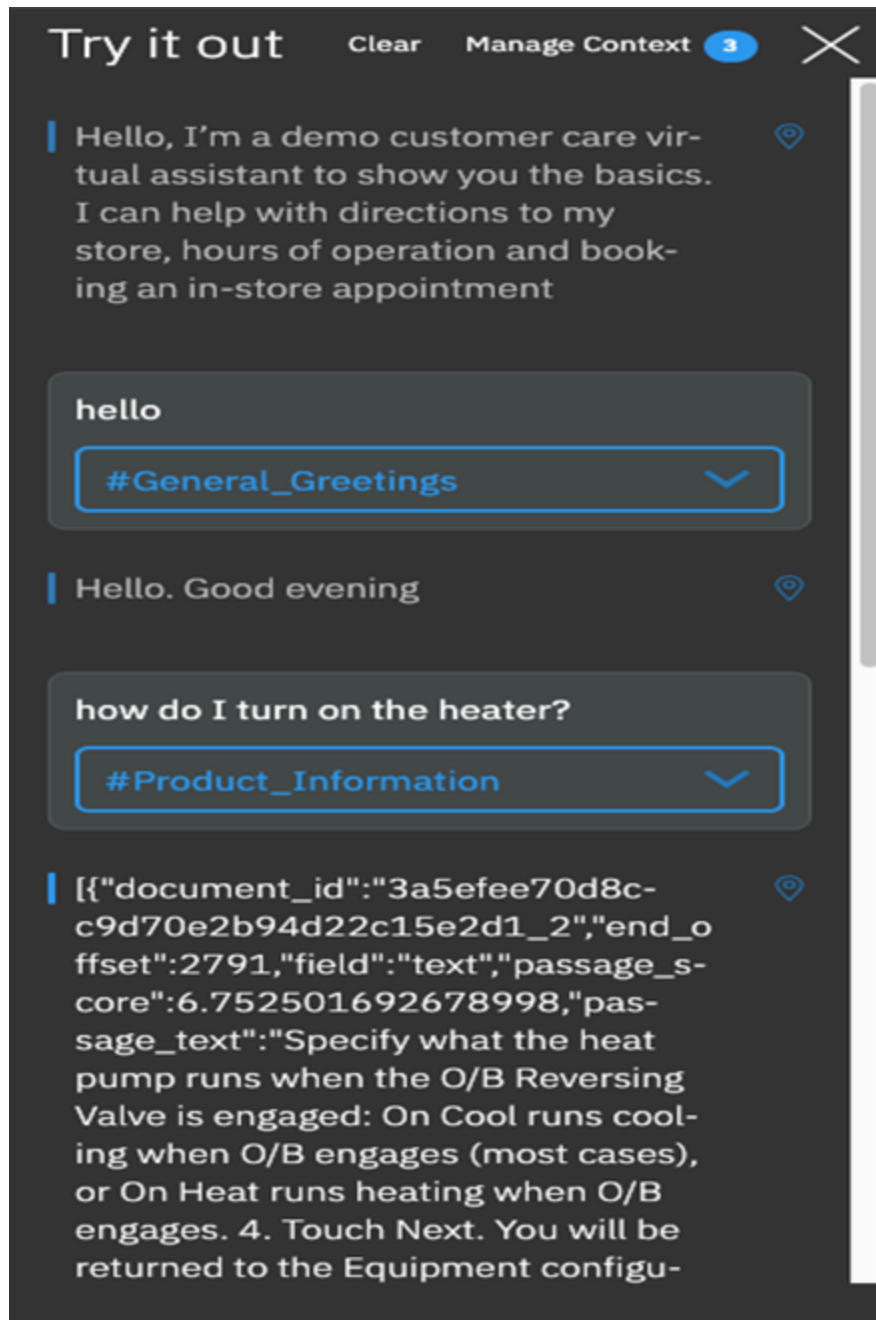
Then respond with

	IF ASSISTANT RECOGNIZES	RESPOND WITH		
1	\$webhook_result_1	\$webhook_result_1	⚙️	🗑️
2	anything_else	Try again later	⚙️	🗑️

Add response ➕

► Test in Assistant Tooling

- From the Dialog panel, click the Try it button located at the top right side of the panel.
- Enter some user input:

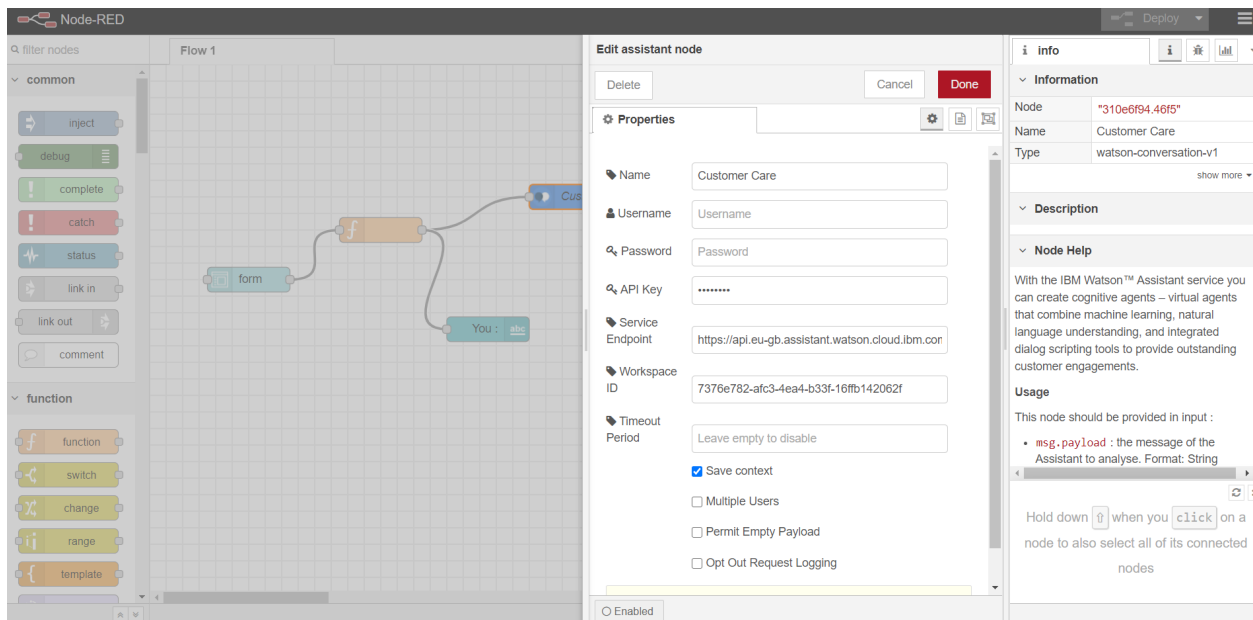


- Note that the input "how do I turn on the heater?" has triggered our Ask about product dialog node, which is indicated by the #Product_Information response.

- So because we specified that `$webhook_result_1.passages` be the response, that value is displayed also.
- You can also verify that the call was successfully completed by clicking on the Manage Context button at the top right. The response from the Discovery query will be stored in the `$webhook_result_1` variable.

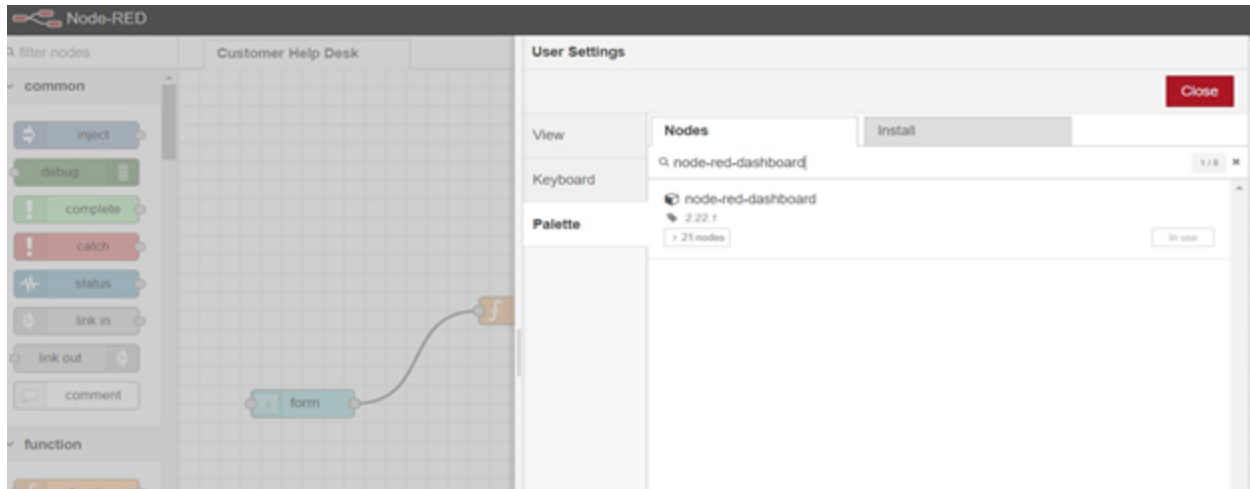
5.Create flow and configure node:

► Integration of Watson assistant in Node-RED:

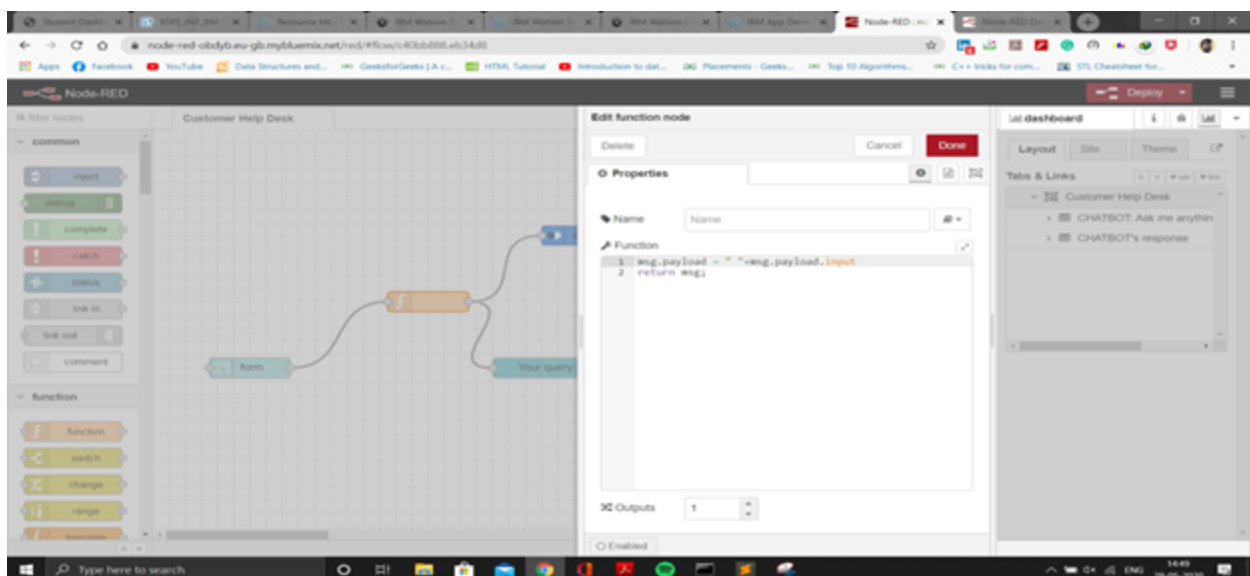


- Double-click on the Watson assistant node
- Give a name to your node and enter the username, password and workspace id of your Watson assistant service
- After entering all the information click on Done
- Drag template node on to the flow from the Input section
- Drag Debug on to the flow from the output section
- For creating a web application UI we need “dashboard” nodes which should be installed manually.
- Go to navigation pane and click on manage palette
- Click on install

- Search for “node-red-dashboard” and click on install and again click on install on the prompt
- The following message indicates dashboard nodes are installed, close the manage palette



- Search for “Form” node and drag on to the flow
- Double click on the “form” node to configure
- Click on the edit button to add the “Group” name and “Tab” name
- Click on the edit button to add tab name to web application
- Give sample tab name and click on add do the same thing for group
- Give the label as “Enter your query”, Name as “text” and click on Done
- Drag a function node, double-click on it and enter the input parsing code as shown below

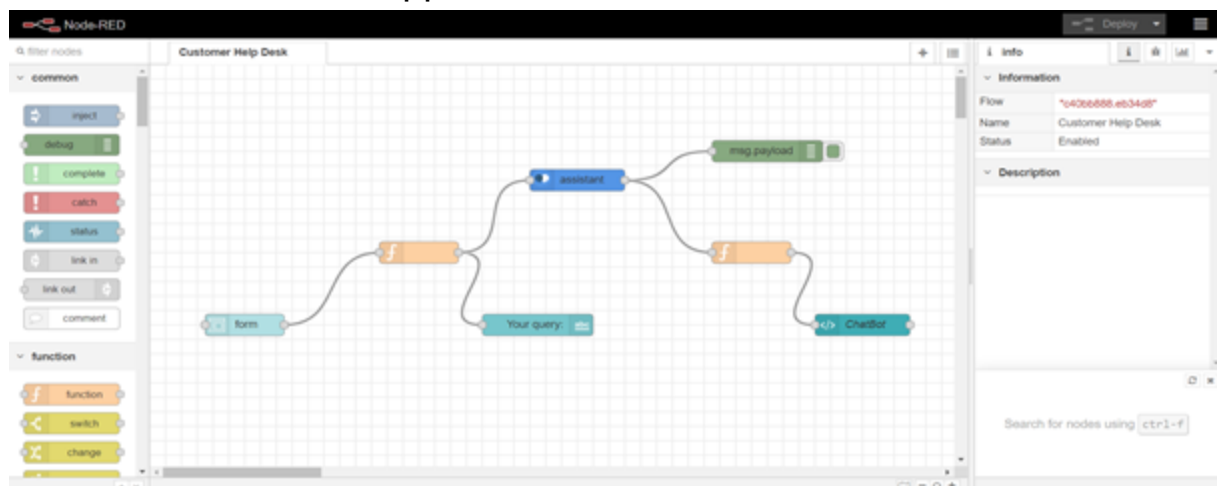


- Click on done
- Connect the form output to the input of the function node and output of the function to input of assistant node
- Search for “text” and “template” node from the “dashboard” section
- Drag these two nodes on to the flow
- Double click on the text node, change the label as “Your query” and click on Done.
- Connect the output of “input parsing” function node to text node and output of “Parsing” function node to the template node.
- Click on Deploy

5. FLOWCHART

- At first go to manage palette and install dashboard.
- Now, Create the flow with the help of following node:
 - Template
 - Assistant
 - Debug
 - Function
 - Ui_Form
 - Ui_Text

Flowchart of node-red app will look like this:



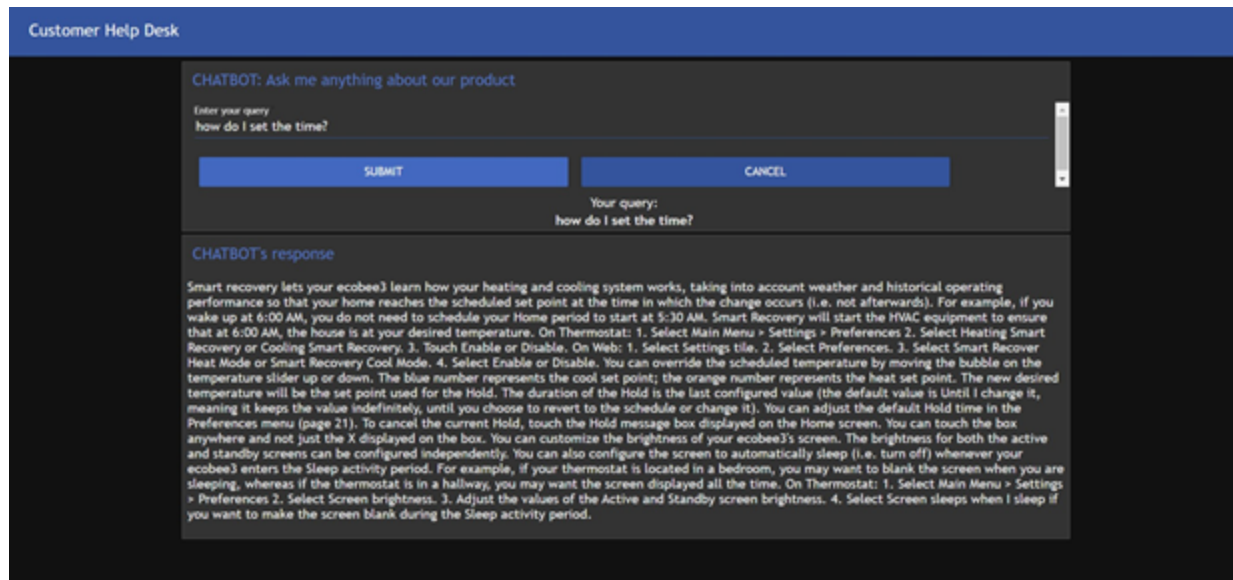
6. RESULTS

- Finally our Node-RED dash board integrates all the components and displayed in the Dashboard UI by typing URL

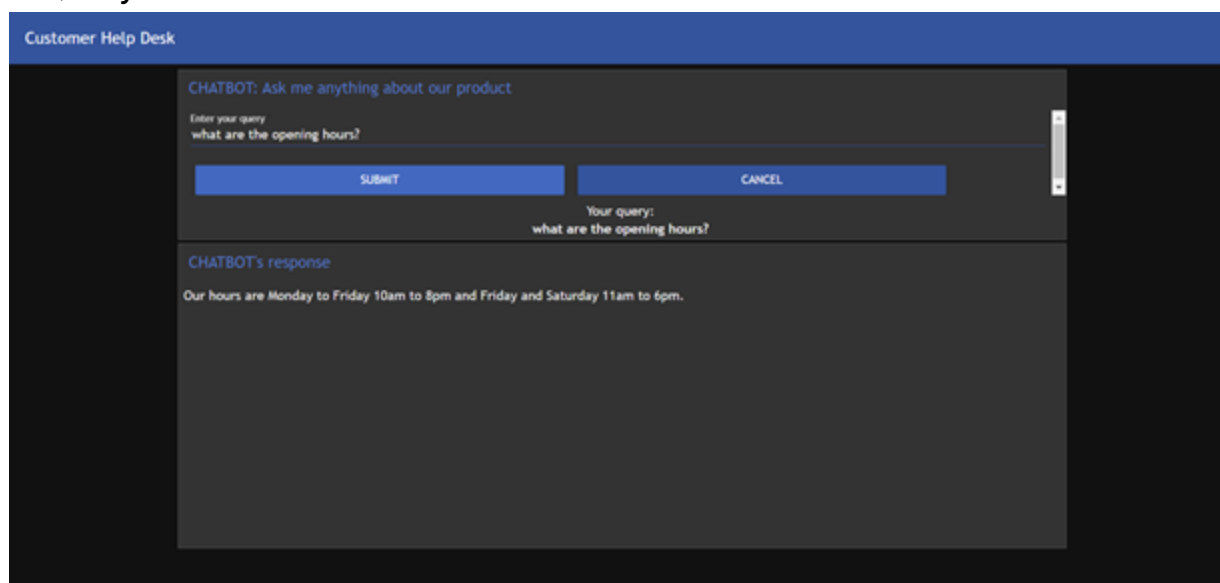
<https://node-red-nrqzb.eu-gb.mybluemix.net/ui/> in browser.

- Here are some pictures showing the responses of our queries by the chat bot :

- Query 1



- Query 2



• Query 3

Customer Help Desk

CHATBOT: Ask me anything about our product

Enter your query
how to turn on the heater?

SUBMITCANCEL

Your query:
how to turn on the heater?

CHATBOT's response

If you have a furnace or boiler installed: 1. Select the heating menu. 2. 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. 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. The HVAC System settings depend on the type of system you have. Depending on your system, one or more of the following options are shown: ☐ Cool: Turn on the air conditioner when the current temperature rises above the set temperature. ☐ Heat: Turn on the heat when the current temperature drops below the set temperature. ☐ Auto: Activate the heating or cooling system as required to keep your home within the configured range of set temperatures. ☐ Aux: Only use the auxiliary or backup heat source to maintain the heat set point temperature. This option only appears if auxiliary heat is configured in the Equipment menu. ☐ Off: Turn the system off. When the system is off, only the current temperature will be displayed on the Home screen. On Thermostat and Mobile: Select Main Menu > System > HVAC System On Web: Select System tile > HVAC

• Query 4

Customer Help Desk

CHATBOT: Ask me anything about our product

Enter your query
how to access the settings?

SUBMITCANCEL

Your query:
how to access the settings?

CHATBOT's response

You can prevent people from making changes your thermostat's schedule, vacation, or system settings by configuring a 4-digit security code. If enabled, the security code will be required to access and change these settings. On Thermostat: To add a security code or change existing settings: 1. Select Main Menu > Settings > Access control 2. If the security code is currently disabled (default setting), touch Enable Security Code, enter a new code and touch Save. Otherwise, enter the existing security code. 3. Select the feature(s) you want to protect: ☐ Temperature & Quick Changes Schedule ☐ Vacation System & Settings To remove an existing security code: 1. Select Main Menu > Settings > Access control 2. Enter the existing security code. 3. Touch Change Security Code. 4. Delete the existing code and touch Save. On Web: 1. Select Settings tile. 2. Select Access Control. 3. If the security code is currently disabled (default setting), select Enable and enter a new code and touch Save. Otherwise, enter the existing security code. 4. Select the feature(s) you want to protect: ☐ Temperature & Quick Changes ☐ Schedule Vacation ☐ System & Settings You can customize the name of your ecobee3 to suit your needs (i.e., Main Floor). This is useful if you have multiple systems or zones and are accessing your thermostat from your personalized web portal. On Thermostat: 1. Select Main Menu > Settings > Preferences 2. Select Thermostat name. 3. Select an existing name from the list or choose Enter your own. 4. Touch Save. 5. If you choose your own name, enter the custom name and touch Save. To access all the features of your ecobee3, register your ecobee3 at ecobee.com. After registration, you can control your ecobee3 from your smartphone, tablet or desktop, and access free online energy management tools.

• Query 5

Customer Help Desk

CHATBOT: Ask me anything about our product

Enter your query
how to access the settings?

SUBMITCANCEL

Your query:
how to access the settings?

CHATBOT's response

You can prevent people from making changes your thermostat's schedule, vacation, or system settings by configuring a 4-digit security code. If enabled, the security code will be required to access and change these settings. On Thermostat: To add a security code or change existing settings: 1. Select Main Menu > Settings > Access control 2. If the security code is currently disabled (default setting), touch Enable Security Code, enter a new code and touch Save. Otherwise, enter the existing security code. 3. Select the feature(s) you want to protect: ☐ Temperature & Quick Changes Schedule ☐ Vacation System & Settings To remove an existing security code: 1. Select Main Menu > Settings > Access control 2. Enter the existing security code. 3. Touch Change Security Code. 4. Delete the existing code and touch Save. On Web: 1. Select Settings tile. 2. Select Access Control. 3. If the security code is currently disabled (default setting), select Enable and enter a new code and touch Save. Otherwise, enter the existing security code. 4. Select the feature(s) you want to protect: ☐ Temperature & Quick Changes ☐ Schedule Vacation ☐ System & Settings You can customize the name of your ecobee3 to suit your needs (i.e., Main Floor). This is useful if you have multiple systems or zones and are accessing your thermostat from your personalized web portal. On Thermostat: 1. Select Main Menu > Settings > Preferences 2. Select Thermostat name. 3. Select an existing name from the list or choose Enter your own. 4. Touch Save. 5. If you choose your own name, enter the custom name and touch Save. To access all the features of your ecobee3, register your ecobee3 at ecobee.com. After registration, you can control your ecobee3 from your smartphone, tablet or desktop, and access free online energy management tools.