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Internship Title: Machine Learning Engineer

Project: Intelligent Customer Help Desk with

Title Smart Document Understanding

Internship at smartinternz.com @ 2020

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1. INTRODUCTION

1.1 OVERVIEW

Create a Customer Care - Dialog Skill in Watson Assistant using Smart Document Understanding in order to build an enhanced Watson Discovery Collection.

Ultimately integrate the services with a web application and deploy it on IBM Cloud Platform.

• Project Requirements:

A manual document to upload in discovery, Python, IBM Cloud, IBM Watson

• Functional Requirements:

IBM Cloud

- Technical Requirements: Access to IBM platform, NODE - RED Flow
- Software Requirements:

Watson Assistant, Watson Discovery, Cloud Functions

• Project Deliverable:

The customer-help desk chatbot should be able to provide solutions to the customer queries efficiently.

• Project Team:

1)Aanchal Malhotra

• Project Schedule:

Start Date - 02/05/20

End Date - 17/05/20

1.2 PURPOSE

The typical customer care chatbot can answer simple questions, such as store locations and hours, directions, and maybe even making appointments. When a question falls outside of the scope of the predetermined question set, the option is typically to tell the customer the question isn't valid or offer to speak to a real person.

In this project, there will be 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 owner's manual is important and what is not. This will improve the answers returned from the queries.

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 a virtual agent in chatbot so that it will take care of real involvement of the customer agent and customer can clarify his doubts with fast chatbots.

2.2 PROPOSED SOLUTION

In order to minimize the involvement of customer care agents we use Smart Document Understanding (SDU). We feed the manual which is normally used by the agents to answer queries of the customers to Watson discovery, from where the SDU is brought into use.

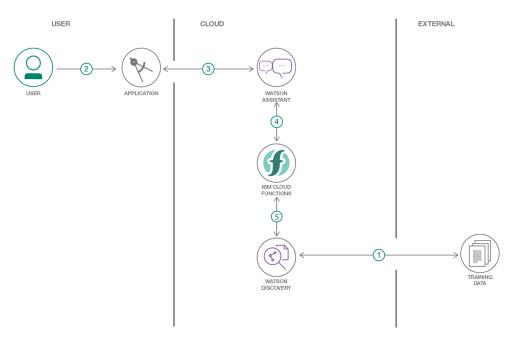
SDU trains Watson Discovery to extract custom fields in your documents. Customizing how your documents are indexed into Discovery will improve the answers returned from queries.

With SDU, you annotate fields within your documents to train custom conversion models. As you annotate, Watson is learning and will start predicting annotations. SDU models can also be exported and used on other collections.

Watson Assistant which acts as the chatbot provided by the IBM platform is connected to the cloud functions which in turn is connected to the Watson Discovery service. All of these instances are integrated in a flow using NODE - RED, where the User interface is created for the chatbot to work.

3. THEORETICAL ANALYSIS

3.1 BLOCK DIAGRAM



- 1. The document is annotated using Watson Discovery SDU
- 2. The user interacts with the backend server via the app UI. The frontend app UI is a chatbot that engages the user in a conversation.
- 3. Dialog between the user and 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 a predefined IBM Cloud Functions action.
- 5. The Cloud Functions action will query the Watson Discovery service and return the results

3.2 HARDWARE / SOFTWARE DESIGNING

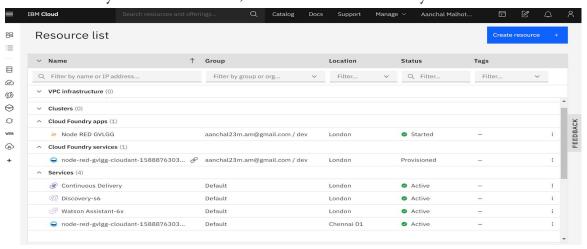
- 1. Create IBM account
- 2. Configure Watson Discovery
- 3. Configure Watson Assistant
- 4. Create Cloud Functions action (code)
- 5. Integrate all instances in NODE RED flow
- 6. Create User Interface in NODE RED flow
- 7. Deploy the final flow

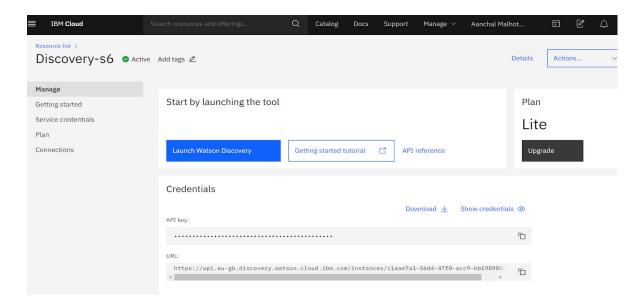
4. EXPERIMENTAL INVESTIGATIONS

- Create IBM Cloud services Create the following services:
 - 1. Watson Discovery
 - 2. Watson Assistant
 - 3. Cloud Functions
 - 4. Node Red

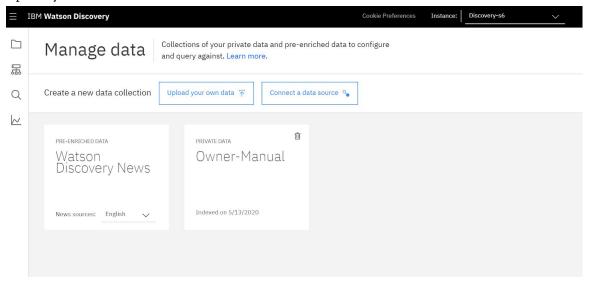
1. Watson Discovery

Create a discovery service in dashboard, then launch watson discovery:



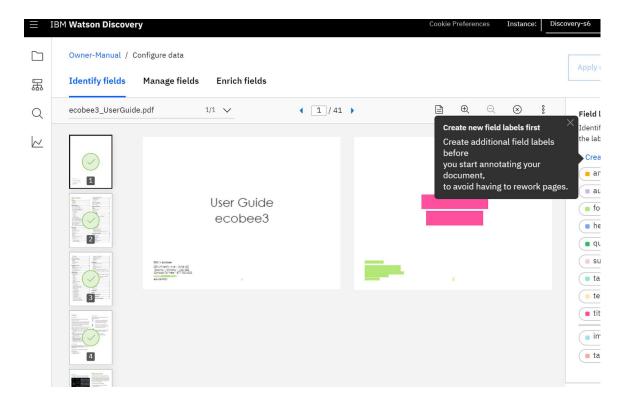


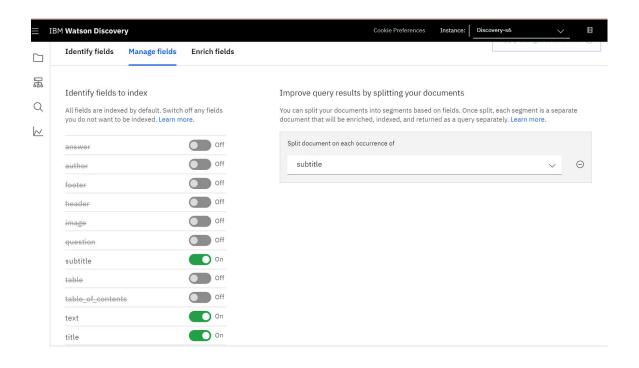
Upload your own data

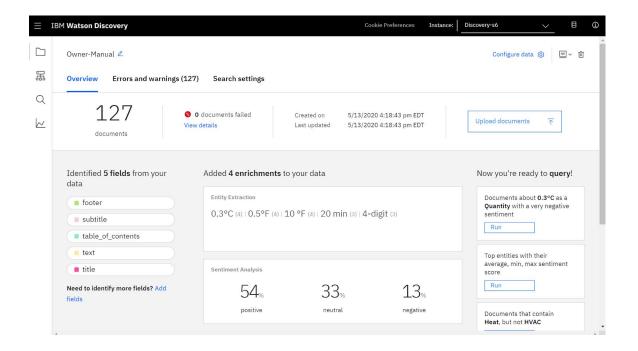


Configure data by identifying and managing fields

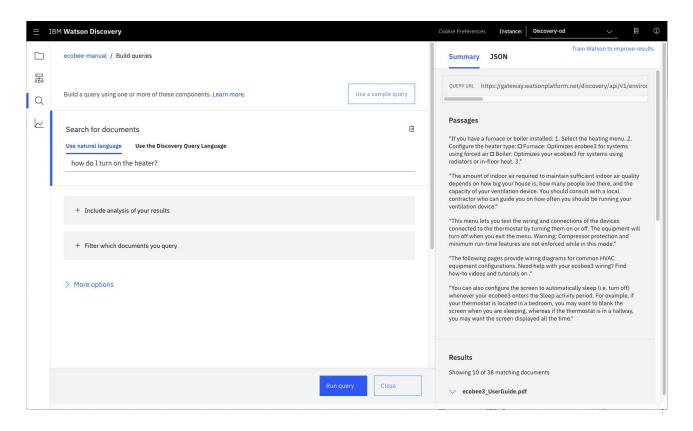
SDU: Highlight the Title, footer, subtitle, and text and submit the initial pages till eventually watson discovery identifies and highlights the different parts on its own







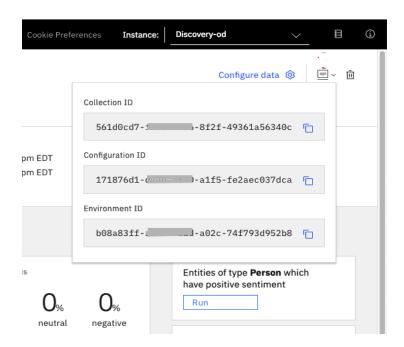
Return to the query panel (click Build your own query) and see how much better the results are.



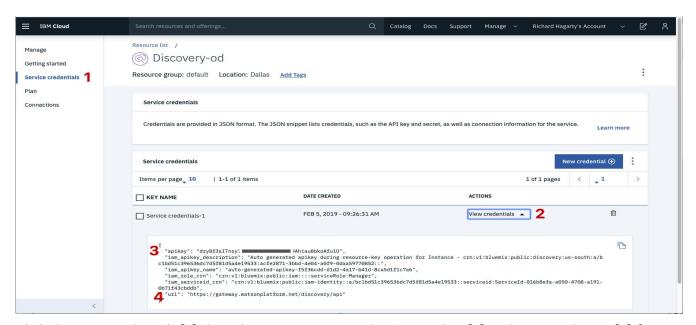
Store credentials for future use

In upcoming steps, you will need to provide the credentials to access your Discovery collection. The values can be found in the following locations.

The Collection ID and Environment ID values can be found by clicking the dropdown button [1] located at the top right side of your collection panel:



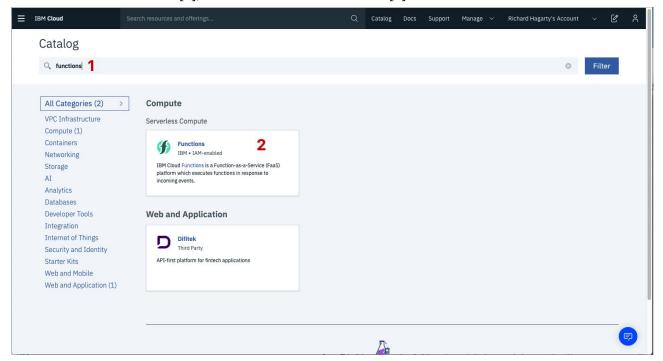
For credentials, return to the main panel of your Discovery service, and click the Service credentials [1]tab:



Click the View credentials [2] drop-down menu to view the IAM apikey [3] and URL endpoint [4] for your service.

2. Cloud Functions

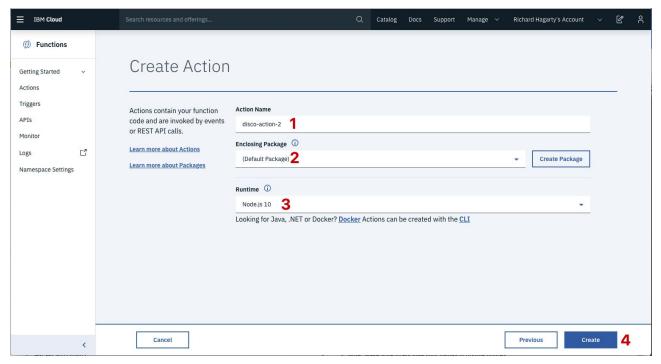
Now let's create the web action that will make queries against our Discovery collection. Start the IBM Cloud Functions service by selecting Create Resource from the IBM Cloud dashboard. Enter functions as the filter [1], then select the Functions card [2]:



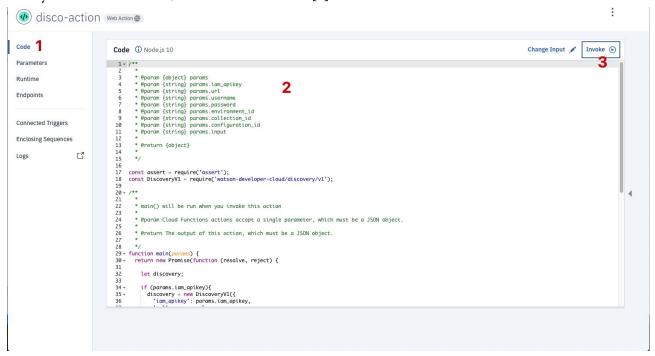
From the Functions main panel, click on the Actions tab. Then click on Create.

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 disco-action.js file found in the actions directory of your local repo. The code is pretty straight-forward - it simply connects to the Discovery service, makes a query against the collection, then returns the response.

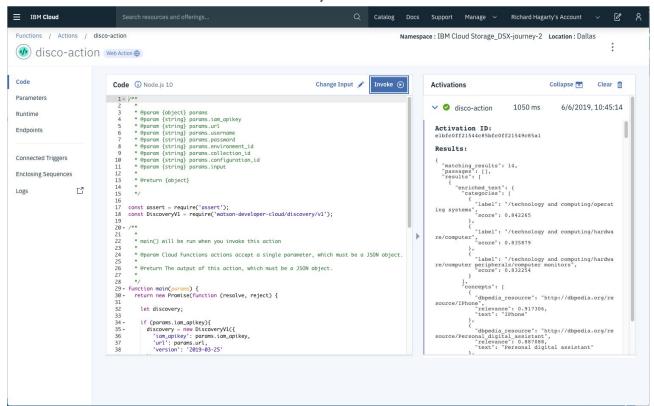
If you press the Invoke button [3], it will fail due to credentials not being defined yet. We'll do this next. Select the Parameters tab [1]:



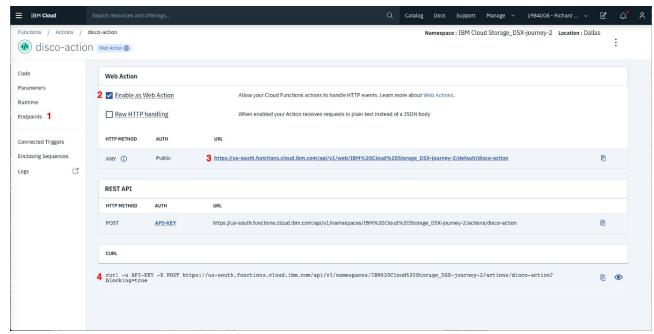
Add the following keys:

url environment_id collection_id iam_apikey

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]:



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 provied curl command [4]. If it fails, re-check your parameter values.

3. 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

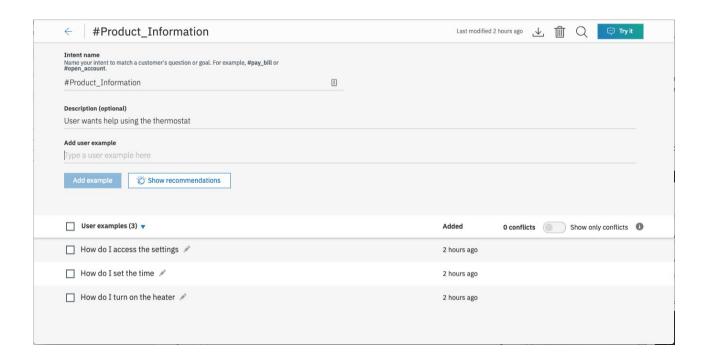
The default customer care dialog does not have a way to deal with any questions involving outside resources, so we will need to add this.

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.

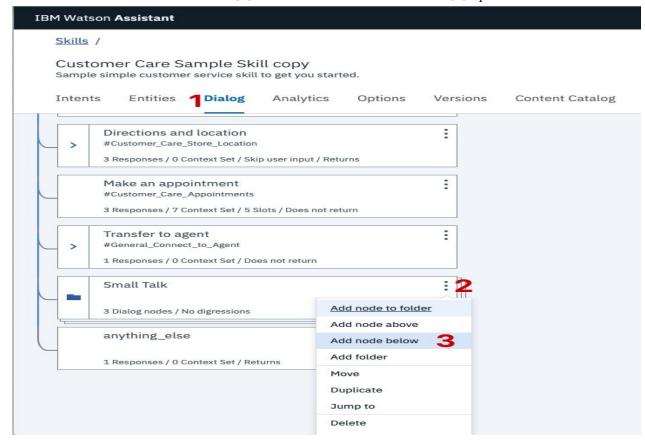
Click the Create intent button.

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

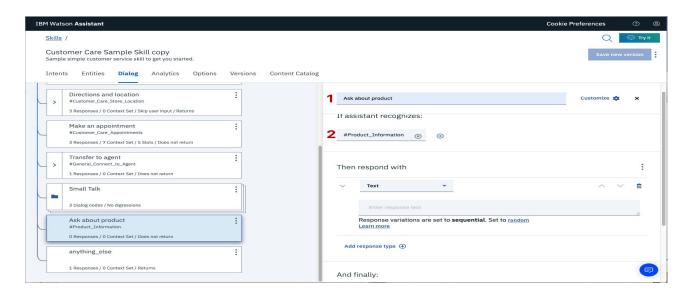


Create new dialog node

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.



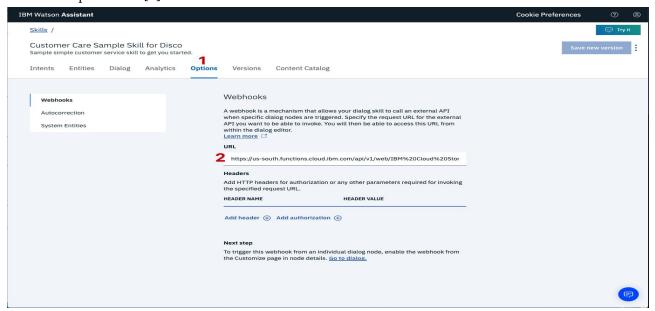
Name the node "Ask about product" [1] and assign it our new intent [2].



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.

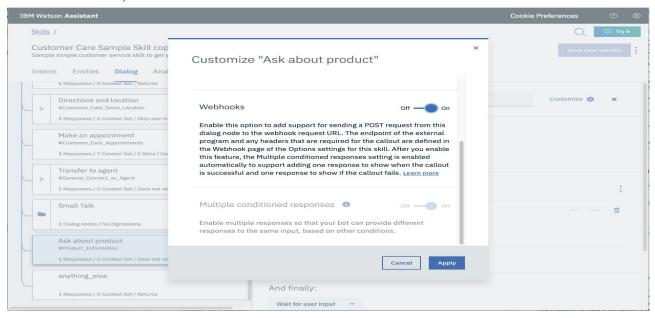
Enable webhook from Assistant

Set up access to our WebHook for the IBM Cloud Functions action you created in Step #4. Select the Options tab [1]:



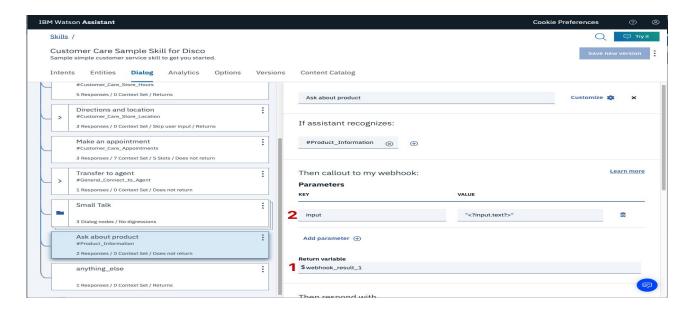
Enter the public URL endpoint for your action [2].

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.

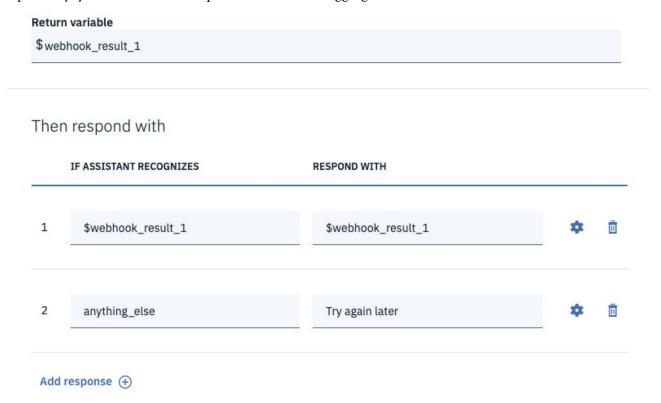
The dialog node should have a Return variable [1] set automatically to \$webhook_result_1. This is the variable name you can use to access the result from the Discovery service query.



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.

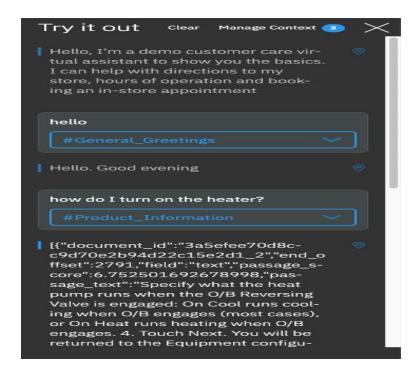
Optionally, you can add these responses to aid in debugging:



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.

And 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:

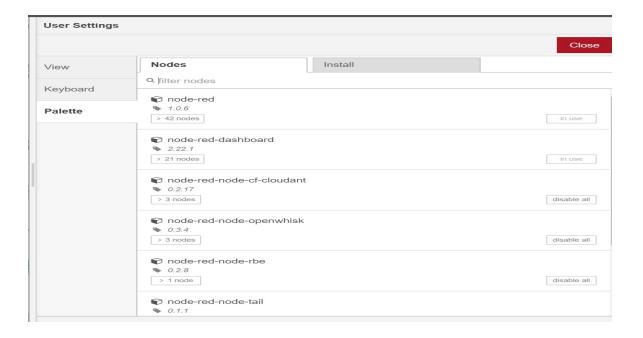


4. NODE-RED

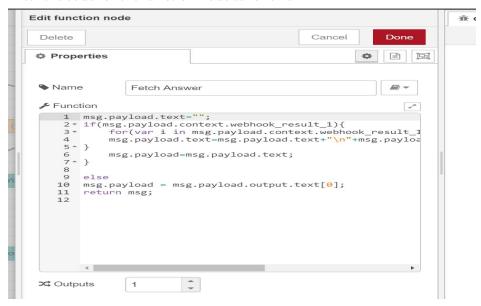
Enter the API Key, Skill Id and the URL in the watson node

Edit assistant node							
Delete	Cancel Done						
* Properties							
Name Name	Name						
≗ Username	Username						
م Password	Password						
م API Key							
Service							
Endpoint	https://api.eu-gb.assistant.watso	on.cloud.ibm.com/i					
◆ Workspace ID	afeeb948-eaed-4f88-aed0-2693	5a34785d					
♣ Timeout							
Period	Leave empty to disable						
☐ Save context							
	■ Permit Empty Payload						
	□ Opt Out Request Logging						
O Enabled							

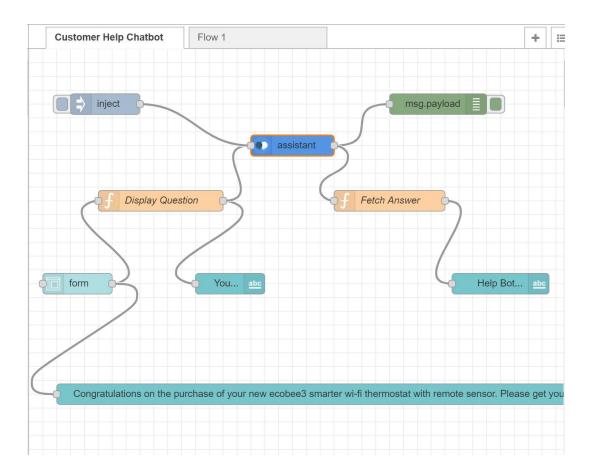
Install the NODE-RED Dashboard form the manage pallet section



Enter the code for the function node as follows



Finally configure the whole flow using different nodes like form, text, function and debug.



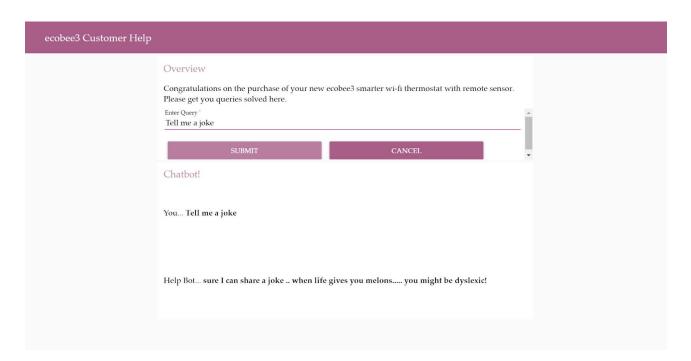
5. FLOW CHART

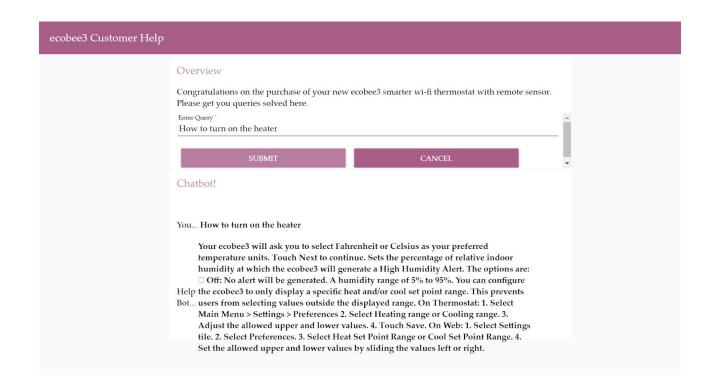
- 1. Configure the Watson Discovery Services
- 2. Configure Watson Assistant Services
- 3. Configure the Cloud Function
- 4. Create Actions in Functions
- 5. Add parameters and connect Assistant and Discovery to it
- 6. Create NODE-RED Flow
- 7. Deploy the flow
- 8. User Interface Chatbot is created successfully!

6. RESULT

NODE-RED Dashboard link after deploying: https://node-red-gvlgg.eu-gb.mybluemix.net/ui

The final output for the project:





7 .ADVANTAGES & DISADVANTAGES

Advantages:

- Saves time for the customer
- Reduces man power
- Cost efficient
- No need to divert calls to customer agents

Disadvantages:

- Chatbot can be misleading sometimes
- May not be able to provide accurate solutions if not configured properly
- Sometimes chatbot can fail to understand customer sentiments and intentions

8.APPLICATIONS

- It can be integrated in popular social media applications like facebook, slack, telegram.
- Chatbot can act as a medium to have casual conversation
- Any website can make use of it to provide solutions to their clients without the involvement of a third party

9.CONCLUSION

This project is a great way to begin learning about the services provided by the IBM platform; using these services we get to understand and implement the concept of Smart Document Understanding

which ultimately helps us build an Intelligent Customer Help-desk Chatbot.

10.FUTURE SCOPE

We can include watson studio text to speech and speech to text services to access the chatbot handsfree. This is one of the future scopes for this project.

11. BIBLIOGRAPHY

APPENDIX

A. Source Code

• Cloud Function (cloudfunction.js)

```
* @param {string} params.collection id
 * @param {string} params.configuration_id
 * @param {string} params.input
* @return {object}
* /
const assert = require('assert');
const DiscoveryV1 = require('watson-developer-cloud/discovery/v1');
/**
* main() will be run when you invoke this action
* @param Cloud Functions actions accept a single parameter, which must be a
JSON object.
* @return The output of this action, which must be a JSON object.
* /
function main(params) {
return new Promise(function (resolve, reject) {
  let discovery;
  if (params.iam_apikey) {
    discovery = new DiscoveryV1({
       'iam_apikey': params.iam_apikey,
```

```
'url': params.url,
      'version': '2019-03-25'
   });
  }
  else {
   discovery = new DiscoveryV1({
      'username': params.username,
      'password': params.password,
      'url': params.url,
      'version': '2019-03-25'
   });
  }
  discovery.query({
    'environment_id': params.environment_id,
    'collection_id': params.collection_id,
    'natural_language_query': params.input,
    'passages': true,
    'count': 3,
    'passages_count': 3
  }, function(err, data) {
   if (err) {
     return reject(err);
    }
   return resolve(data);
 });
});
```

• NODE-RED (flows.json)

```
[
    "id": "428c869.9d44078",
    "type": "tab",
    "label": "Customer Help Chatbot",
    "disabled": false,
    "info": ""
  },
    "id": "f2f2649a.0d0d98",
    "type": "debug",
    "z": "428c869.9d44078",
    "name": "",
    "active": true,
    "tosidebar": true,
    "console": false,
    "tostatus": false,
    "complete": "payload",
    "targetType": "msg",
    "x": 590,
    "y": 80,
    "wires": []
  },
    "id": "33ee0287.4b505e",
    "type": "ui_form",
    "z": "428c869.9d44078",
    "name": "",
    "label": "",
    "group": "b25b0315.a262e",
    "order": 2,
    "width": 0,
    "height": 0,
    "options": [
```

```
"label": "Enter Query",
        "value": "question",
        "type": "text",
        "required": true,
        "rows": null
      }
    ],
    "formValue": {
      "question": ""
    },
    "payload": "",
    "submit": "submit",
    "cancel": "cancel",
    "topic": "",
    "x": 70,
    "y": 340,
    "wires":
        "9af5382.c4eebc8",
        "8b3d873.c439178"
  },
    "id": "8b3d873.c439178",
    "type": "ui_text",
    "z": "428c869.9d44078",
    "group": "b25b0315.a262e",
    "order": 1,
    "width": 0,
    "height": 0,
    "name": "",
    "label": "Congratulations on the purchase of your new ecobee3 smarter wi-fi thermostat with remote
sensor. Please get you queries solved here.",
    "format": "",
    "layout": "row-spread",
    "x": 490,
    "y": 500,
    "wires": []
```

```
},
  "id": "9af5382.c4eebc8",
  "type": "function",
  "z": "428c869.9d44078",
  "name": "Display Question",
  "func": "msg.payload = msg.payload.question;\nreturn msg;",
  "outputs": 1,
  "noerr": 0,
  "x": 190,
  "y": 220,
  "wires": [
      "e72c71f3.cda0f",
      "af6fd9ae.7ba1a8"
},
  "id": "e72c71f3.cda0f",
  "type": "ui_text",
  "z": "428c869.9d44078",
  "group": "69652ad6.2f3994",
  "order": 1,
  "width": 8,
  "height": 2,
  "name": "",
  "label": "You...",
  "format": "{{msg.payload}}",
  "layout": "row-left",
  "x": 290,
  "y": 340,
  "wires": []
},
  "id": "dbbd0f70.3bd49",
  "type": "function",
  "z": "428c869.9d44078",
  "name": "Fetch Answer",
```

```
"func": "msg.payload.text=\"\";\nif(msg.payload.context.webhook_result_1){\n for(var i in
msg.payload.context.webhook_result_1.results){\n
msg.payload.text=msg.payload.text+\"\n\"+msg.payload.context.webhook\_result\_1.results[i].text;\n\}\
n msg.payload=msg.payload.text;\n}\n\nelse\nmsg.payload = msg.payload.output.text[0];\nreturn
msg;\n ",
    "outputs": 1,
    "noerr": 0,
    "x": 520,
    "y": 220,
    "wires": [
        "4c61e88b.977b58"
    "id": "af6fd9ae.7ba1a8",
    "type": "watson-conversation-v1",
    "z": "428c869.9d44078",
    "name": "",
    "workspaceid": "afeeb948-eaed-4f88-aed0-26935a34785d",
    "multiuser": false,
    "context": false,
    "empty-payload": false,
    "service-endpoint":
"https://api.eu-gb.assistant.watson.cloud.ibm.com/instances/6e2e47d9-54f8-4a84-8f1b-e9c533c51e34",
    "timeout": "",
    "optout-learning": false,
    "x": 380,
    "y": 140,
    "wires": [
        "f2f2649a.0d0d98",
        "dbbd0f70.3bd49"
  },
    "id": "4c61e88b.977b58",
```

```
"type": "ui_text",
  "z": "428c869.9d44078",
  "group": "69652ad6.2f3994",
  "order": 4,
  "width": 13,
  "height": 3,
  "name": "",
  "label": "Help Bot...",
  "format": "{{msg.payload}}",
  "layout": "row-left",
  "x": 680,
  "y": 340,
  "wires": []
},
  "id": "75401475.72a5fc",
  "type": "inject",
  "z": "428c869.9d44078",
  "name": "",
  "topic": "",
  "payload": "",
  "payloadType": "str",
  "repeat": "",
  "crontab": "",
  "once": false,
  "onceDelay": 0.1,
  "x": 110,
  "y": 80,
  "wires": [
       "af6fd9ae.7ba1a8"
},
  "id": "b25b0315.a262e",
  "type": "ui_group",
  "z": "",
  "name": "Overview",
```

```
"tab": "cb026f97.c6b13",
  "order": 1,
  "disp": true,
  "width": "14",
  "collapse": false
  "id": "69652ad6.2f3994",
  "type": "ui_group",
  "z": "",
  "name": "Chatbot!",
  "tab": "cb026f97.c6b13",
  "order": 2,
  "disp": true,
  "width": "14",
  "collapse": false
},
  "id": "cb026f97.c6b13",
  "type": "ui_tab",
  "z": "",
  "name": "ecobee3 Customer Help",
  "icon": "dashboard",
  "disabled": false,
  "hidden": false
}
```