PROJECT REPORT

Topic:	Intelligent Customer Help Desk With Smart Document Understanding
Category:	Artificial Intelligence
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Internship:	SmartBridge (Remote Summer Internship Program 2020)

CONTENTS

1. Introduction

1.1 Overview

A chatbot using various IBM Cloud Services (Watson Discovery, Watson Assistant, IBM Cloud Functions and Node-Red) was built to act as an intelligent web based customer support chatbot for after sales service and customer queries.

- **Project Requirements :** Node-RED, IBM Cloud Account, IBM Watson Services
- **Functional Requirements :** IBM Cloud Services
- **Technical Requirements :** Watson AI, ML, Node JS
- **Software Requirements :** Watson Assistant, Watson Discovery, IBM Cloud Functions, Node-RED
- **Project Deliverables :** Intelligent Chatbot with Smart Document Understanding
- **Project Team :** Adithya Ganesan
- **Project Duration :** 1month

1.2 Purpose

The typical customer care chatbot can answer simple questions, such as store locations and hours, directions, and perhaps 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 is another option. If the customers' question is about the operation of a device, the application passes the question onto the IBM 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 return relevant sections of the owners manual to help solve our customers' problems.

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

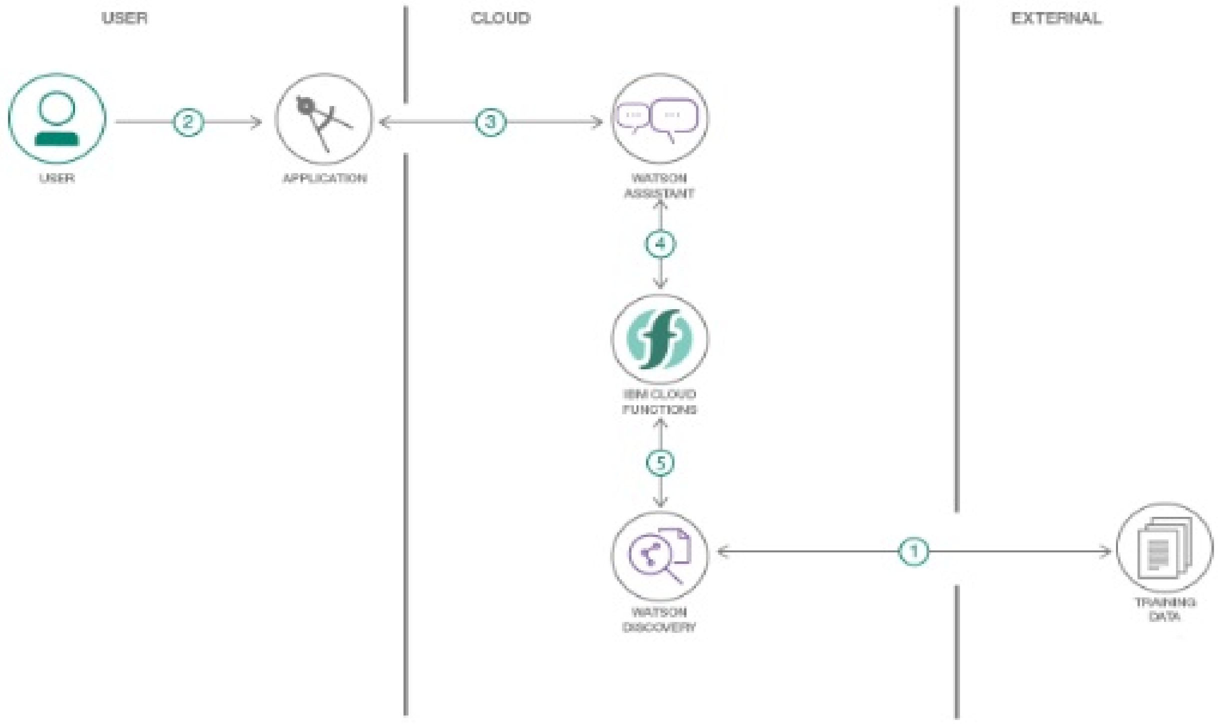
Generally chatbots are equipped with a certain set of questions such as store locations and operating hours, directions and booking appointments. If the question or the user input lies out of the scope of the pre-existing question set, the chatbot returns an error message asking the user to rephrase the question or ask the user if they would like to speak to a customer support executive. An efficient chatbot should minimise the volume of customer support redirections to the representatives.

2.2. Proposed Solution

In order to solve the above-mentioned problem to minimise the number of customer support query redirections to the support team, a smart chatbot has been built that is trained with data in the product user manual using the IBM Watson Discovery Services' Smart Document Understanding feature and implemented so that the chatbot can answer queries based on the working of the product. So, if a customer asks a question based on the working of a product, the chatbot returns relevant sections of the user manual rather than redirecting the user to a customer service representative. This reduces the strain on the company's customer support team and enables easy solution to the customers' queries.

3. Theoretical Analysis

3.1. Block Diagram



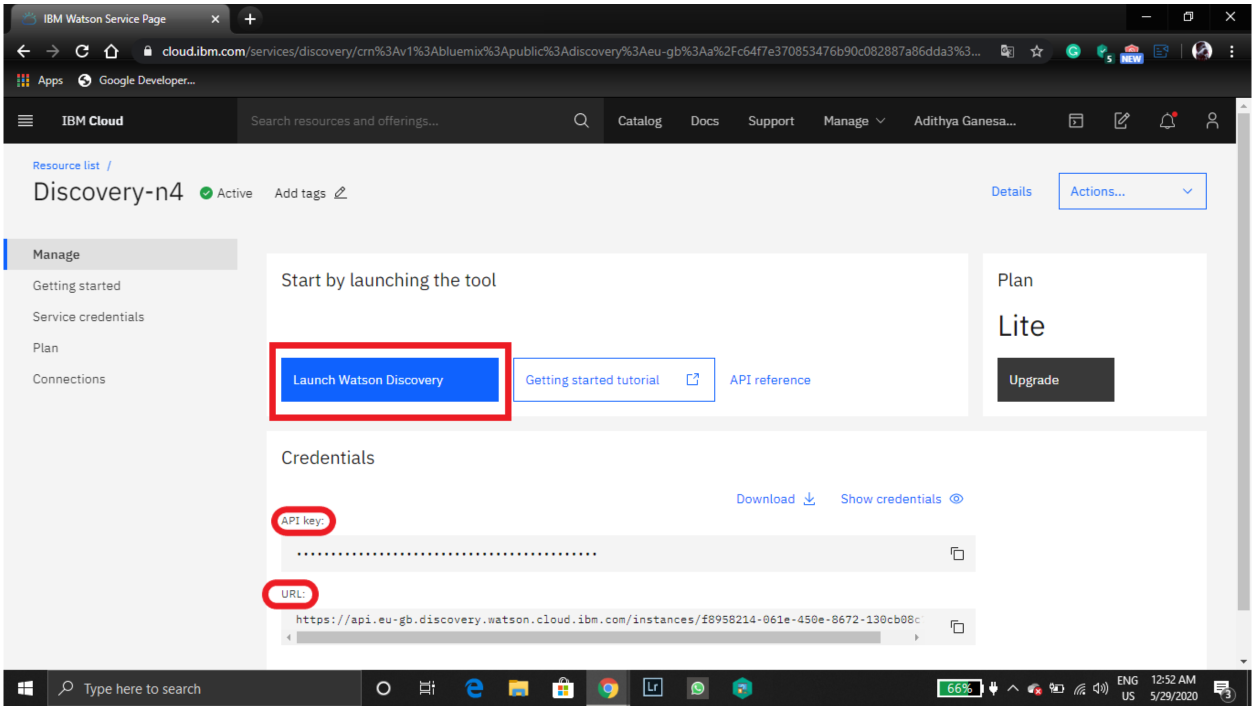
3.2. Hardware/Software Designing

- Create necessary IBM Cloud services.
- Configure IBM Watson Discovery
- Create IBM Cloud Function action
- Configure IBM Watson Assistant
- Create Node-RED flow and configure node
- Deploy and run node red app

4. Experimental Investigation

1. **Create required IBM Cloud Services**
   a. IBM Watson Assistant
   b. IBM Watson Discovery
   c. Node-RED

2. **Configure IBM Watson Discovery**
   a. Launch Watson Discovery service.

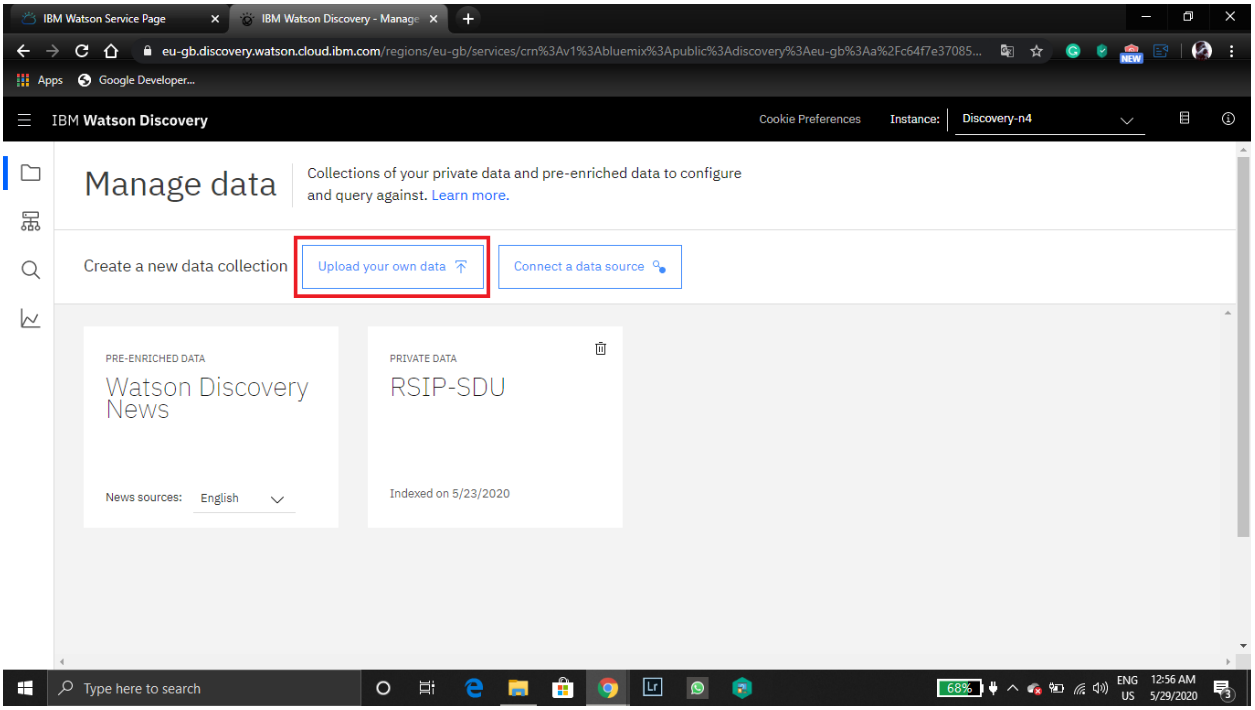


API key:

URL:

```
https://api.eu-gb.discovery.watson.cloud.ibm.com/instances/f8958214-061e-450e-8672-130cb08c
```

b. Upload documents for Smart Document Understanding (I have used the Ecobee3 Smart Thermostat User Manual).

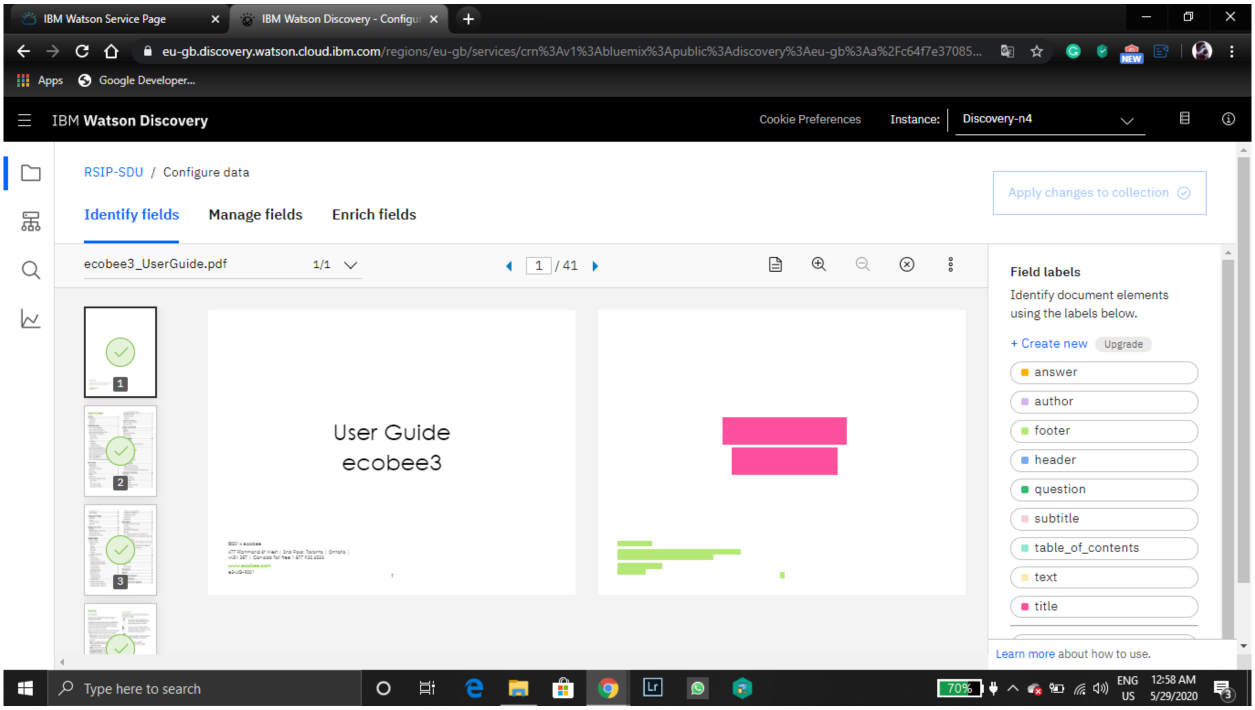


Collections of your private data and pre-enriched data to configure and query against. Learn more.

Create a new data collection

Indexed on 5/23/2020

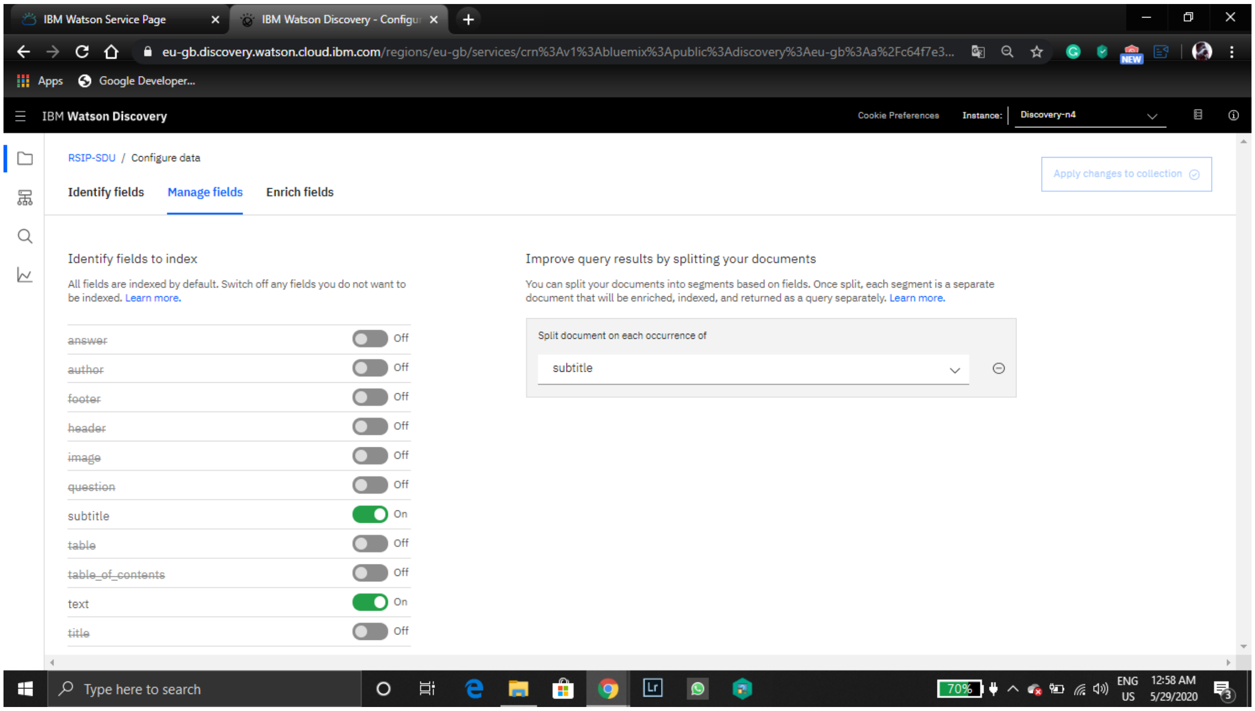
c. Annotate data for Smart Document Understanding.



Identify document elements using the labels below.

Learn more about how to use.

d. Select the fields to be indexed and split document for improved results (I have selected only *subtitles* and *text* for indexing and split the document using *subtitles*).



IBM Watson Discovery

RSIP-SDU / Configure data

Identify fields | Manage fields | Enrich fields

Apply changes to collection

Identify fields to index

All fields are indexed by default. Switch off any fields you do not want to be indexed. Learn more.

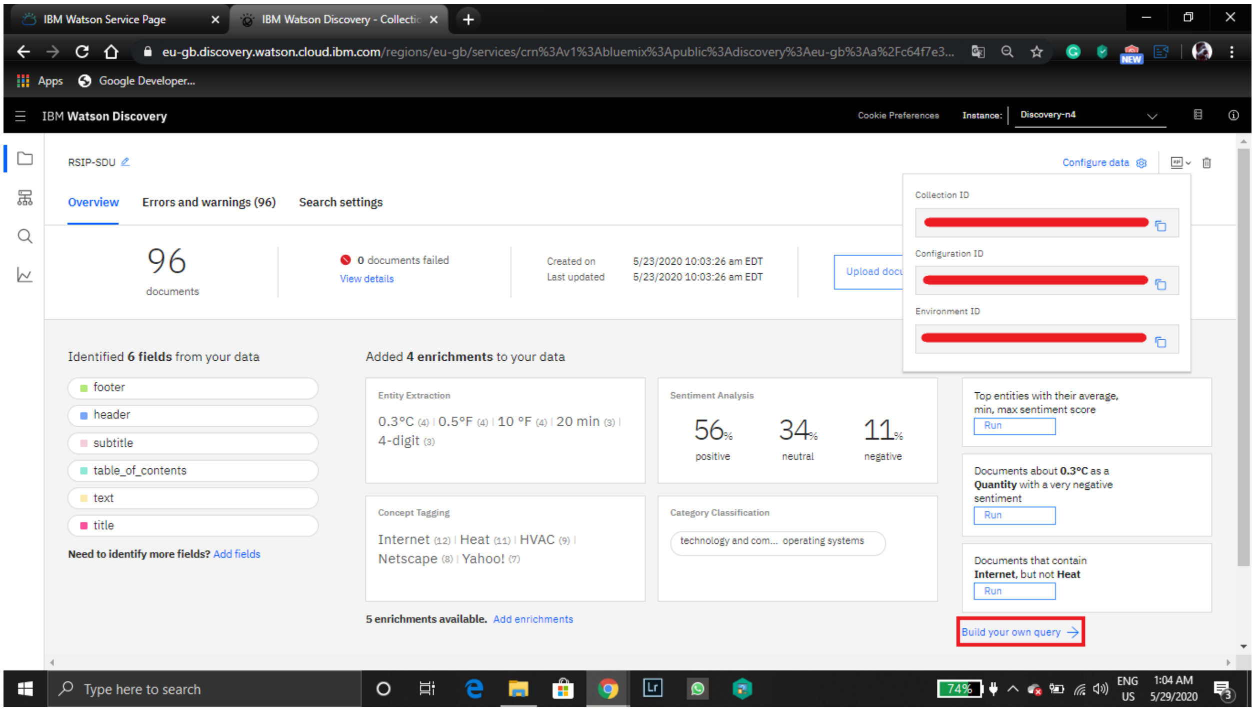
~~answer~~	Off
~~author~~	Off
~~footer~~	Off
~~header~~	Off
~~image~~	Off
~~question~~	Off
subtitle	On
~~table~~	Off
~~table_of_contents~~	Off
text	On
~~title~~	Off

Improve query results by splitting your documents

You can split your documents into segments based on fields. Once split, each segment is a separate document that will be enriched, indexed, and returned as a query separately. Learn more.

Split document on each occurrence of: subtitle

e. Run a query to check accuracy of discovery, store Discovery credentials and also the API key and URL shown step 2(a).



IBM Watson Discovery

RSIP-SDU

Overview | Errors and warnings (96) | Search settings

96 documents

0 documents failed
View details

Created on 5/23/2020 10:03:26 am EDT
Last updated 5/23/2020 10:03:26 am EDT

Collection ID
[redacted]

Configuration ID
[redacted]

Environment ID
[redacted]

Identified **6 fields** from your data

- footer
- header
- subtitle
- table_of_contents
- text
- title

Need to identify more fields? Add fields

Added **4 enrichments** to your data

Entity Extraction
0.3°C (4) | 0.5°F (4) | 10 °F (4) | 20 min (3) | 4-digit (3)

Sentiment Analysis
56% positive | 34% neutral | 11% negative

Concept Tagging
Internet (12) | Heat (11) | HVAC (9) | Netscape (8) | Yahoo! (7)

Category Classification
technology and com... operating systems

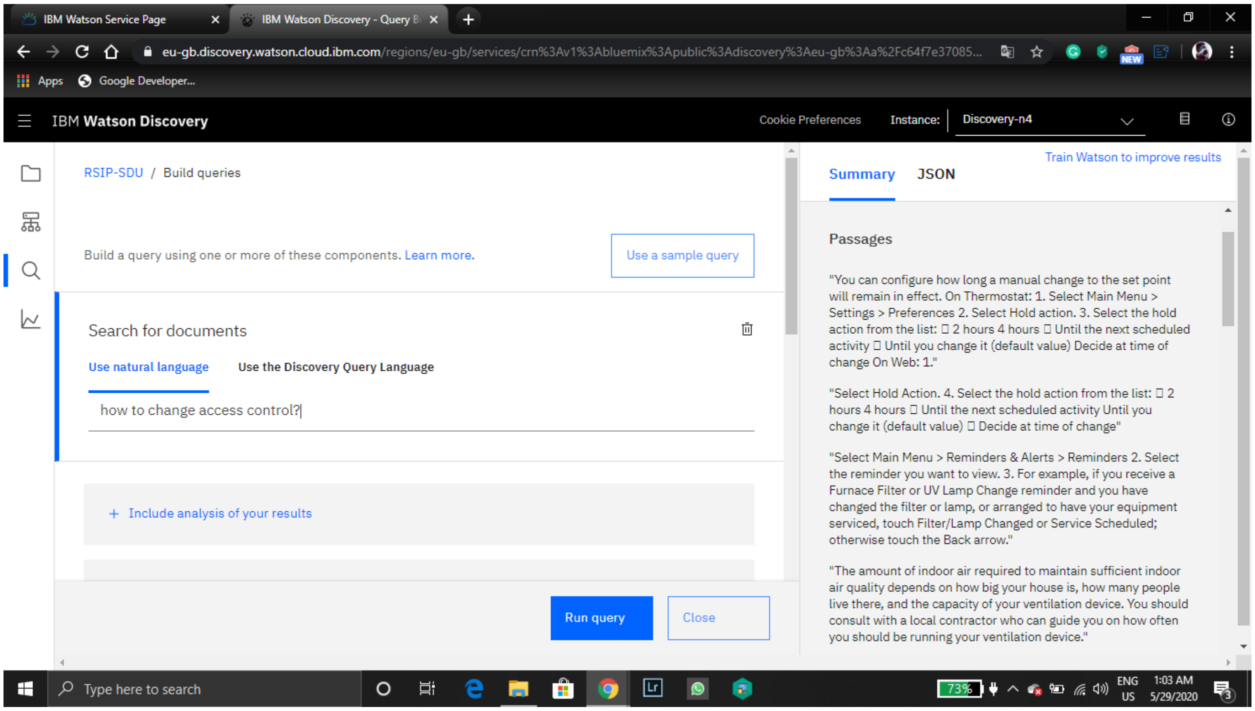
5 enrichments available. Add enrichments

Top entities with their average, min, max sentiment score — Run

Documents about **0.3°C** as a **Quantity** with a very negative sentiment — Run

Documents that contain **Internet**, but not **Heat** — Run

Build your own query →


IBM Watson Service Page
IBM Watson Discovery - Query B
eu-gb.discovery.watson.cloud.ibm.com/regions/eu-gb/services/crn%3Av1%3Abluemix%3Apublic%3Adiscovery%3Aeu-gb%3Aa%2Fc64f7e37085...
Apps
Google Developer...
IBM Watson Discovery
Cookie Preferences
Instance:
Discovery-n4
RSIP-SDU / 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
+ Include analysis of your results
Run query
Close
Train Watson to improve results
Summary
JSON
Passages
Type here to search
73%
ENG US
1:03 AM 5/29/2020

how to change access control?

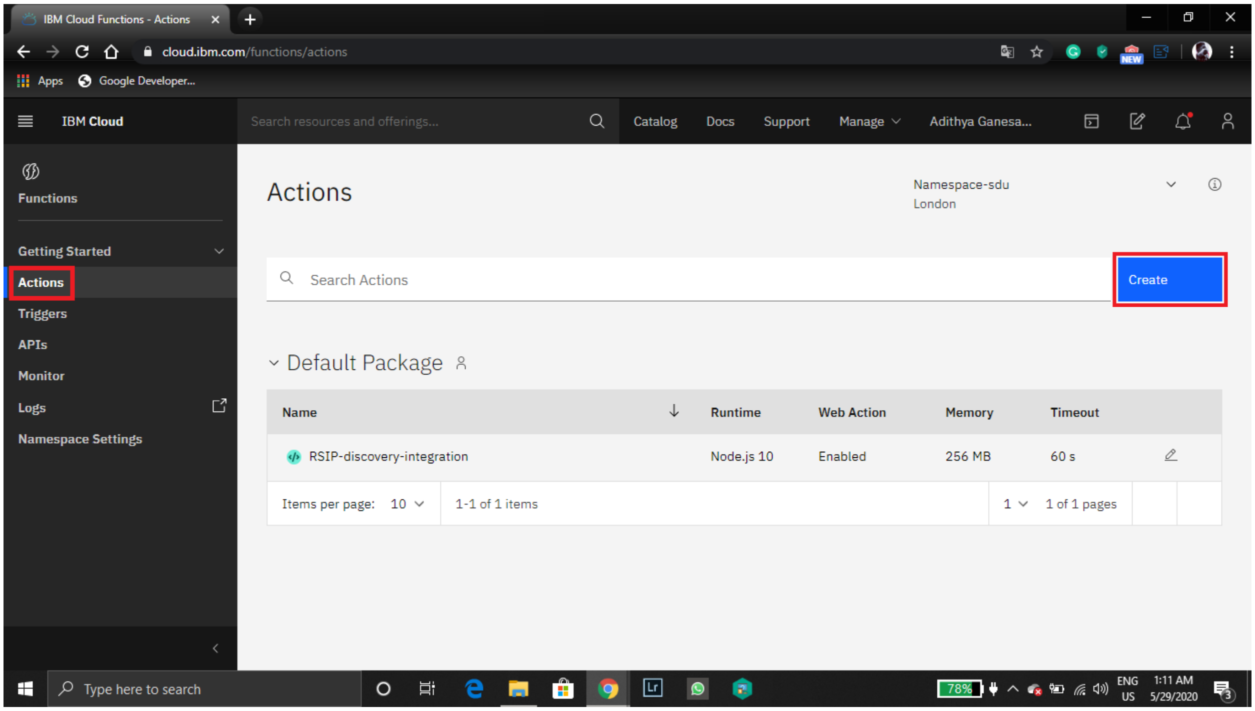
"You can configure how long a manual change to the set point will remain in effect. On Thermostat: 1. Select Main Menu > Settings > Preferences 2. Select Hold action. 3. Select the hold action from the list: □ 2 hours 4 hours □ Until the next scheduled activity □ Until you change it (default value) Decide at time of change On Web: 1."

"Select Hold Action. 4. Select the hold action from the list: □ 2 hours 4 hours □ Until the next scheduled activity Until you change it (default value) □ Decide at time of change"

"Select Main Menu > Reminders & Alerts > Reminders 2. Select the reminder you want to view. 3. For example, if you receive a Furnace Filter or UV Lamp Change reminder and you have changed the filter or lamp, or arranged to have your equipment serviced, touch Filter/Lamp Changed or Service Scheduled; otherwise touch the Back arrow."

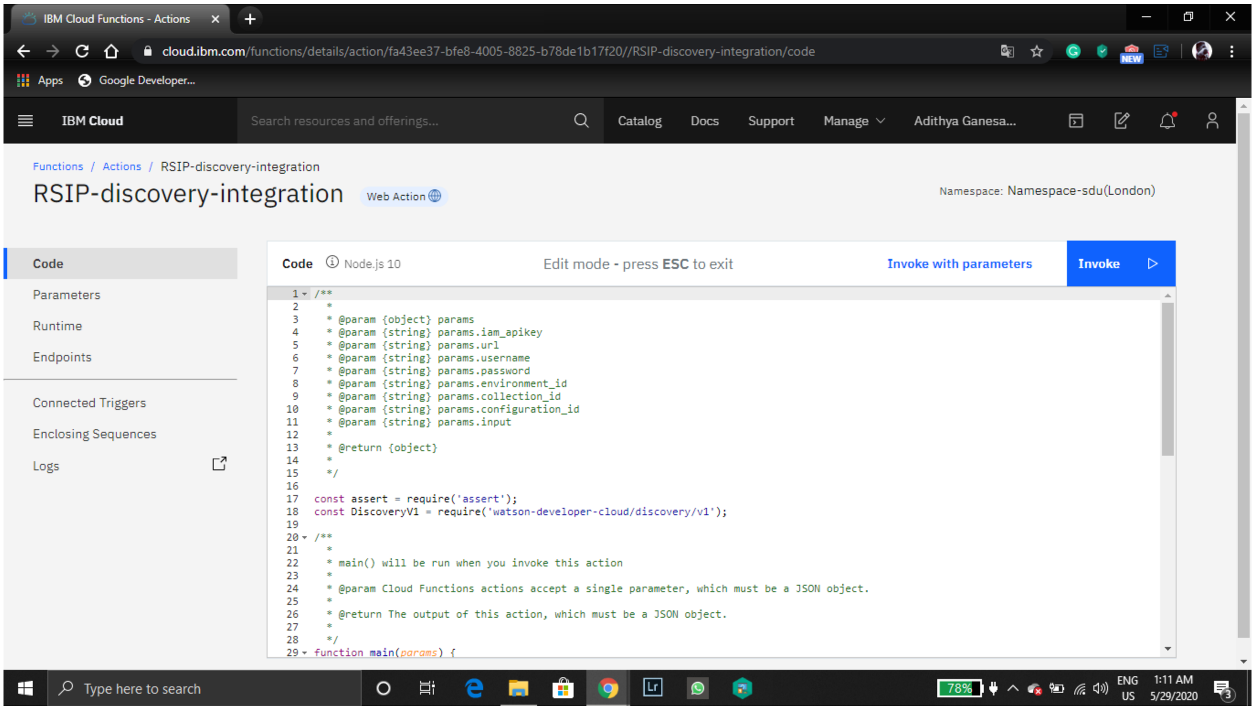
"The amount of indoor air required to maintain sufficient indoor air quality depends on how big your house is, how many people live there, and the capacity of your ventilation device. You should consult with a local contractor who can guide you on how often you should be running your ventilation device."

3. **Create a webhook using IBM Cloud Functions Action**
    a. This is used to integrate IBM Discovery Service with IBM Watson Assistant using a webhook.
    b. Create an IBM Cloud Functions Action (Source code is given in appendix).



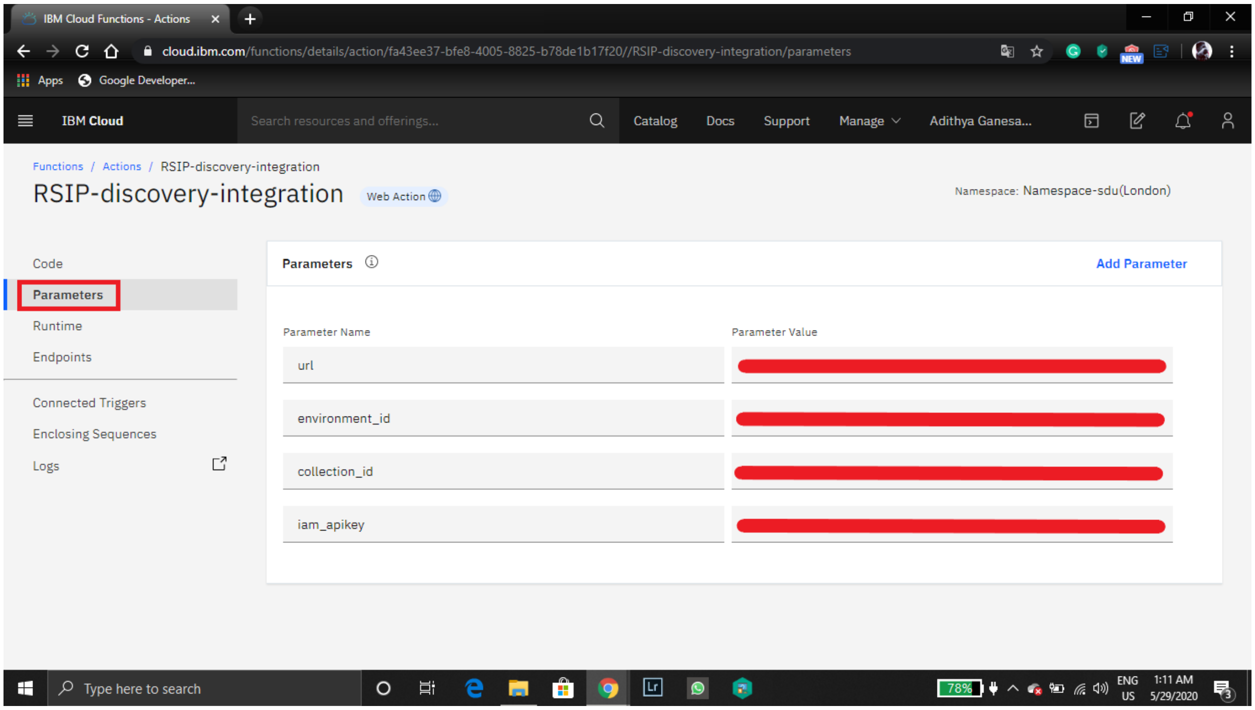
Name	Runtime	Web Action	Memory	Timeout
RSIP-discovery-integration	Node.js 10	Enabled	256 MB	60 s

Items per page: 10 1-1 of 1 items 1 1 of 1 pages


IBM Cloud Functions - Actions
cloud.ibm.com/functions/details/action/fa43ee37-bfe8-4005-8825-b78de1b17f20//RSIP-discovery-integration/code
Apps
Google Developer...
IBM Cloud
Search resources and offerings...
Catalog
Docs
Support
Manage
Adithya Ganesa...
Functions / Actions / RSIP-discovery-integration
RSIP-discovery-integration
Web Action
Namespace: Namespace-sdu(London)
Code
Parameters
Runtime
Endpoints
Connected Triggers
Enclosing Sequences
Logs
Code
Node.js 10
Edit mode - press ESC to exit
Invoke with parameters
Invoke
Type here to search
78%
ENG
US
1:11 AM
5/29/2020

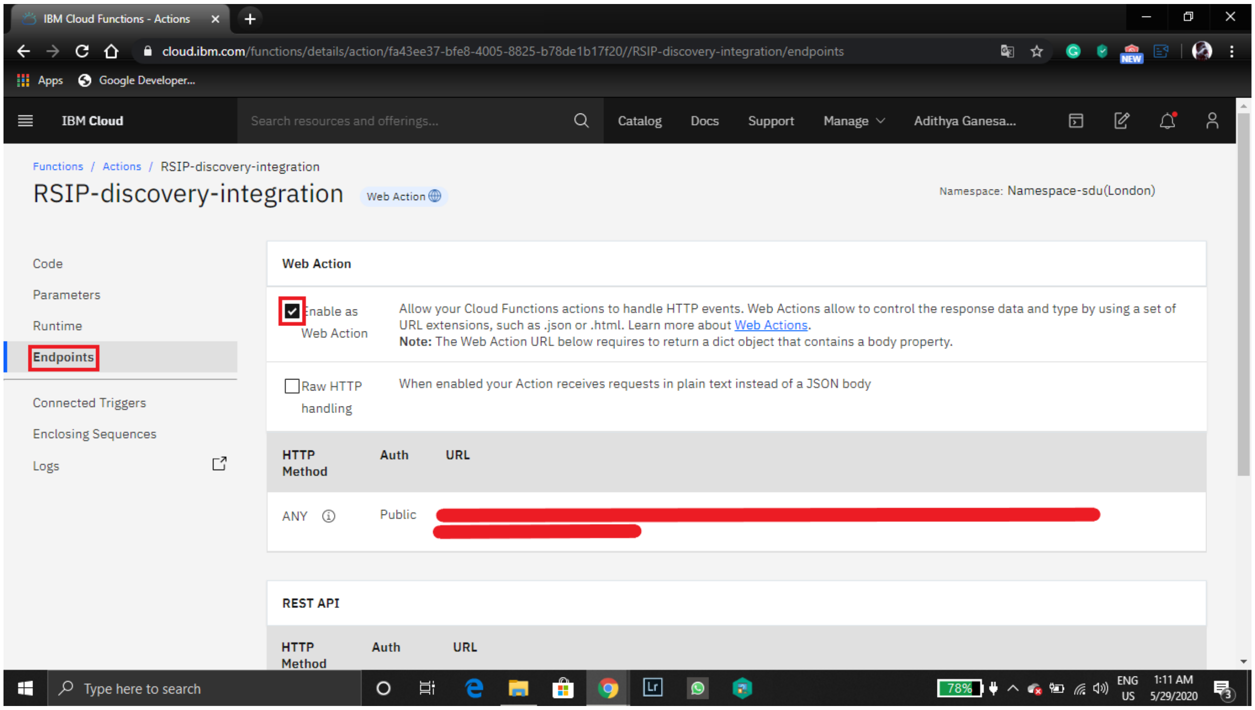
```
/**
  *
  * @param {object} params
  * @param {string} params.iam_apikey
  * @param {string} params.url
  * @param {string} params.username
  * @param {string} params.password
  * @param {string} params.environment_id
  * @param {string} params.collection_id
  * @param {string} params.configuration_id
  * @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) {
```

c. Click on *parameters,* create required parameters and use the Discovery credentials for parameter values.


IBM Cloud Functions - Actions
cloud.ibm.com/functions/details/action/fa43ee37-bfe8-4005-8825-b78de1b17f20//RSIP-discovery-integration/parameters
Apps
Google Developer...
IBM Cloud
Search resources and offerings...
Catalog
Docs
Support
Manage
Adithya Ganesa...
Functions / Actions / RSIP-discovery-integration
RSIP-discovery-integration
Web Action
Namespace: Namespace-sdu(London)
Code
Parameters
Runtime
Endpoints
Connected Triggers
Enclosing Sequences
Logs
Parameters
Add Parameter
Type here to search
78%
ENG
US
1:11 AM
5/29/2020

Parameter Name	Parameter Value
url	[redacted]
environment_id	[redacted]
collection_id	[redacted]
iam_apikey	[redacted]

d. Go to *Endpoints* tab and click on the *Enable as web action* checkbox and store the URL.



Functions / Actions / RSIP-discovery-integration

RSIP-discovery-integration   Web Action

Namespace: Namespace-sdu(London)

Web Action

☑ Enable as Web Action — Allow your Cloud Functions actions to handle HTTP events. Web Actions allow to control the response data and type by using a set of URL extensions, such as .json or .html. Learn more about Web Actions.
Note: The Web Action URL below requires to return a dict object that contains a body property.

□ Raw HTTP handling — When enabled your Action receives requests in plain text instead of a JSON body

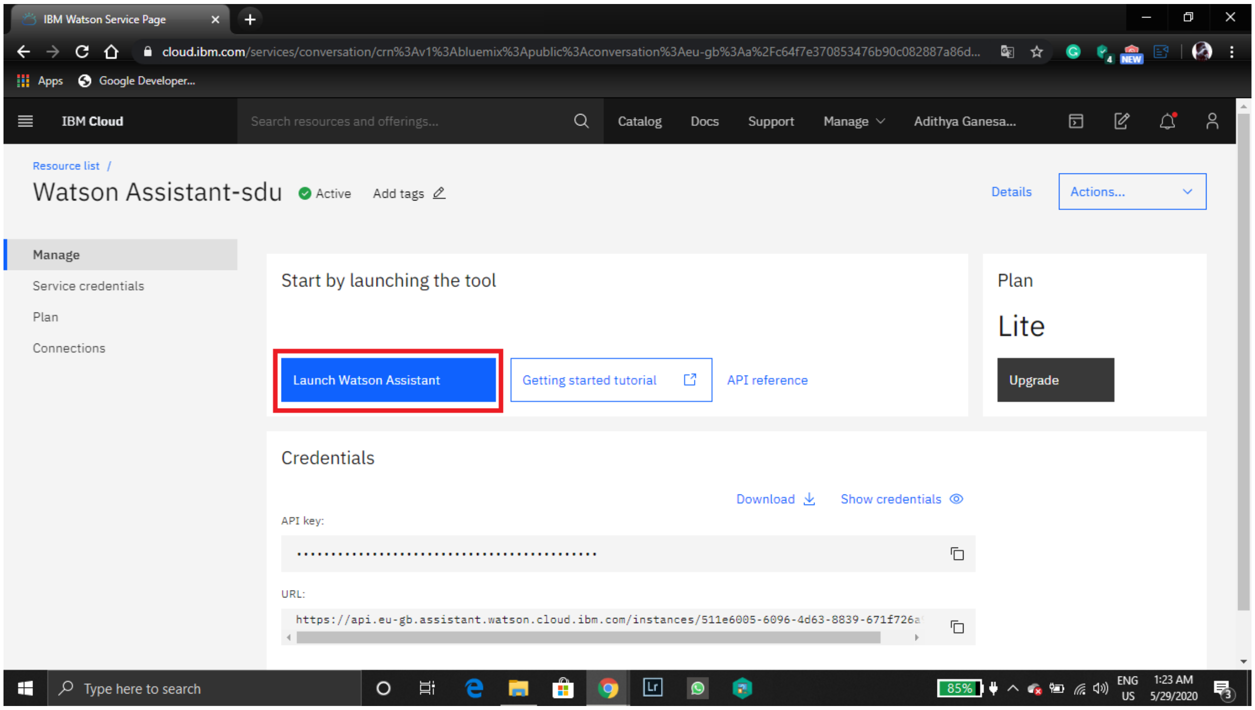
HTTP Method	Auth	URL
ANY	Public	[redacted]

REST API

HTTP Method	Auth	URL

4. Configure IBM Watson Assitant

a. Launch IBM Watson Assistant and use the *Customer Care Sample Skill* to create an assistant with pre-loaded queries related to customer support.



Resource list /

Watson Assistant-sdu   Active   Add tags

Start by launching the tool

Plan

Lite

Credentials

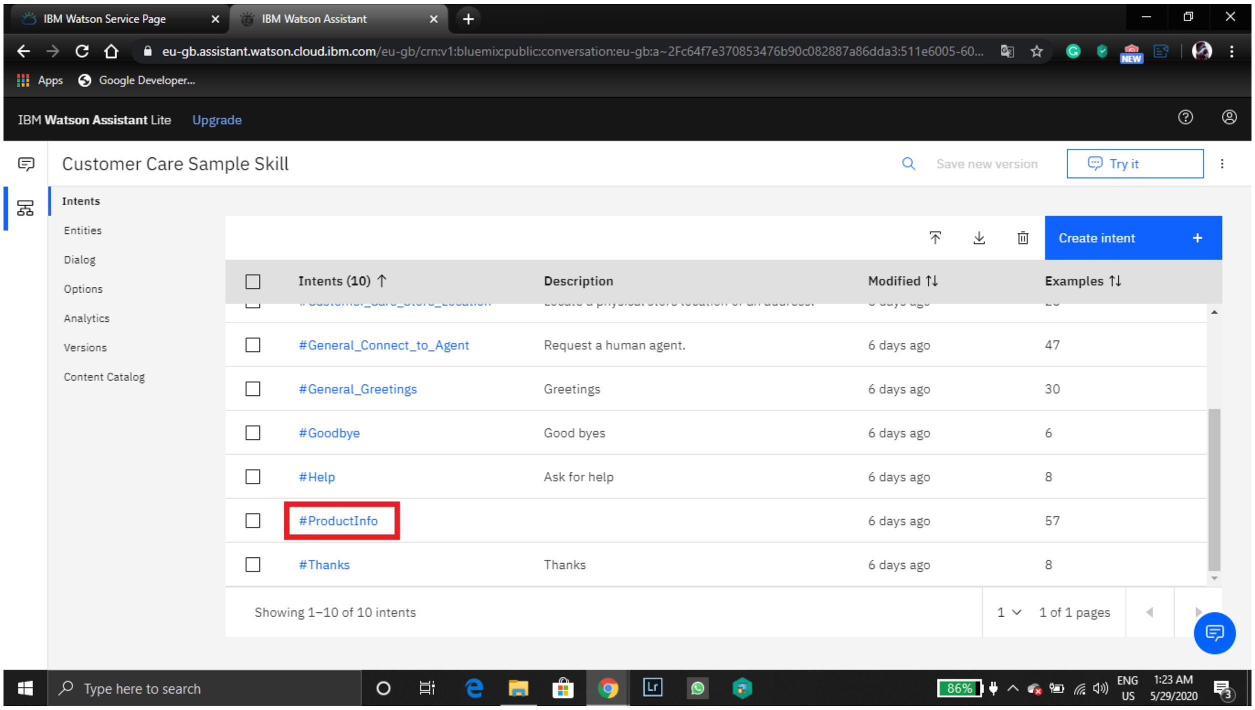
API key:

```
............................................
```

URL:

```
https://api.eu-gb.assistant.watson.cloud.ibm.com/instances/511e6005-6096-4d63-8839-671f726a
```

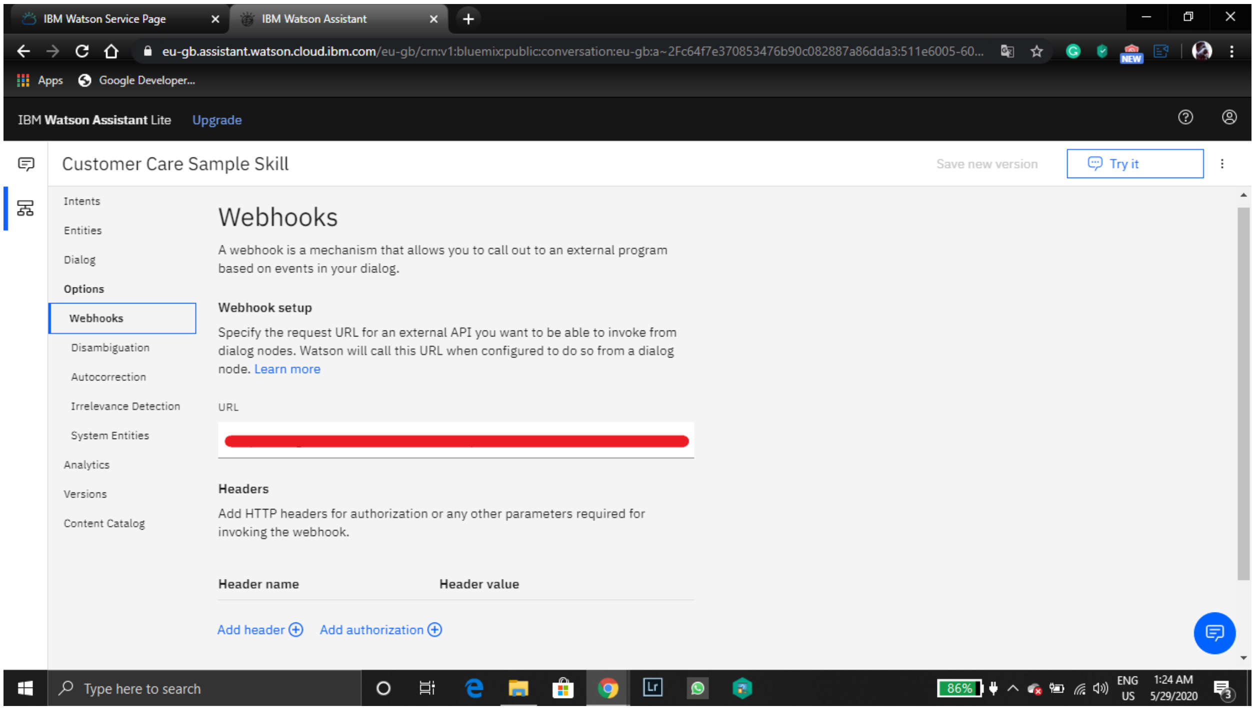
b. Create an intent for product related queries (I have created the *ProductInfo* intent) and add to dialog.



☐	Intents (10) ↑	Description	Modified ⇅	Examples ⇅
☐	#General_Connect_to_Agent	Request a human agent.	6 days ago	47
☐	#General_Greetings	Greetings	6 days ago	30
☐	#Goodbye	Good byes	6 days ago	6
☐	#Help	Ask for help	6 days ago	8
☐	#ProductInfo		6 days ago	57
☐	#Thanks	Thanks	6 days ago	8

Showing 1–10 of 10 intents   1 ∨   1 of 1 pages

c. Go to options tab and under webhooks, paste the URL we stored in step 3(d).



Webhooks

A webhook is a mechanism that allows you to call out to an external program based on events in your dialog.

Webhook setup

Specify the request URL for an external API you want to be able to invoke from dialog nodes. Watson will call this URL when configured to do so from a dialog node. Learn more

URL

[redacted]

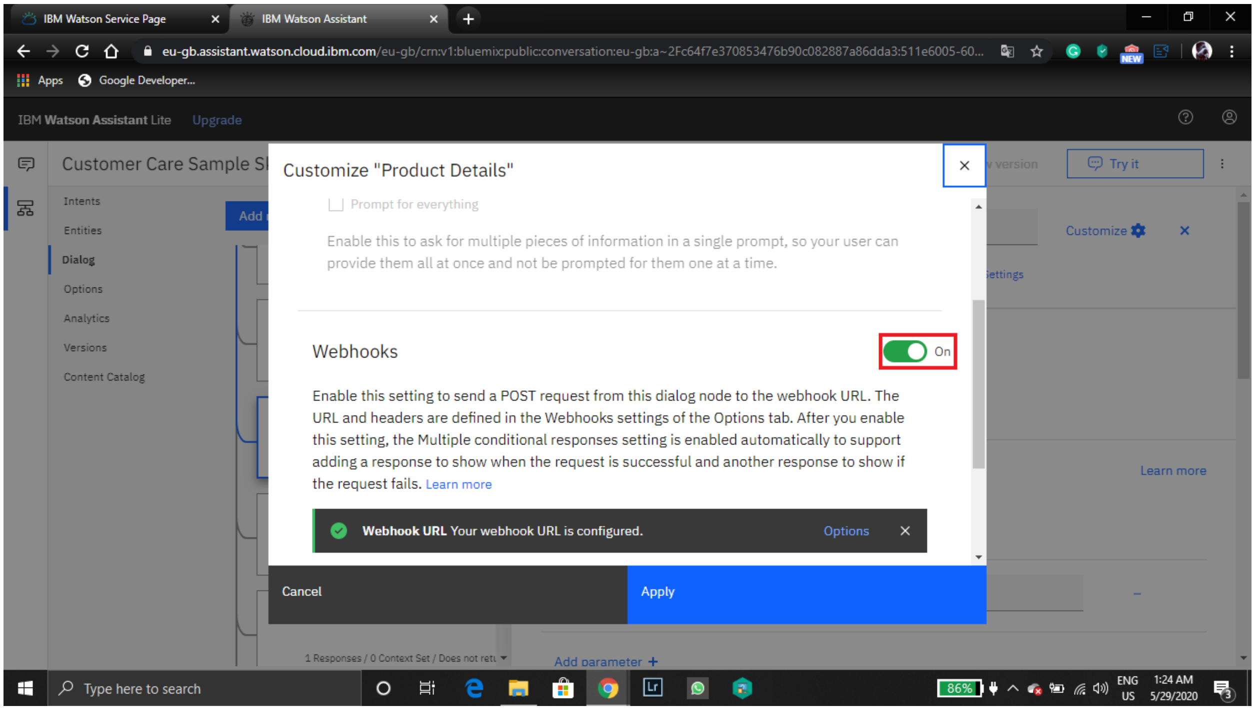
Headers

Add HTTP headers for authorization or any other parameters required for invoking the webhook.

Header name   Header value

Add header ⊕   Add authorization ⊕

d. In dialog tab enable webhooks.



Customize "Product Details"

□ 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

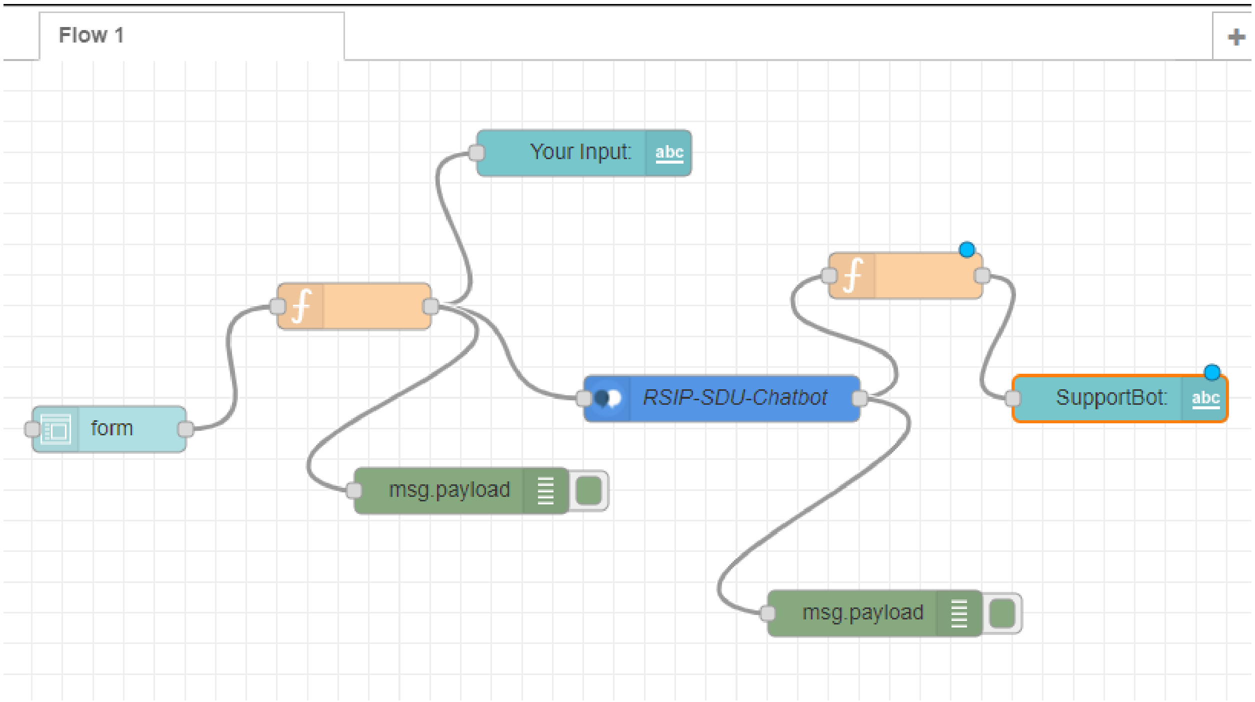
Enable this setting to send a POST request from this dialog node to the webhook URL. The URL and headers are defined in the Webhooks settings of the Options tab. After you enable this setting, the Multiple conditional responses setting is enabled automatically to support adding a response to show when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

Webhook URL Your webhook URL is configured. Options

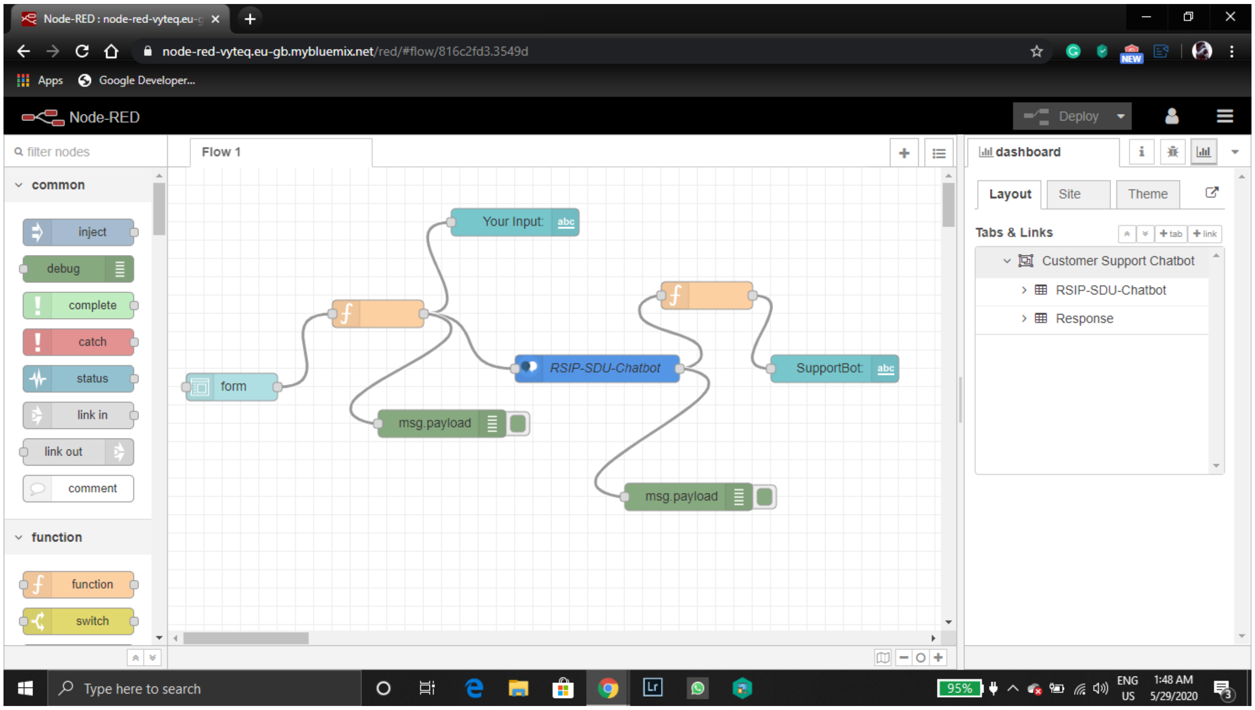
Cancel | Apply

5. Create a Node-RED flow

a. Use Node-RED to create a UI and to link all the services.

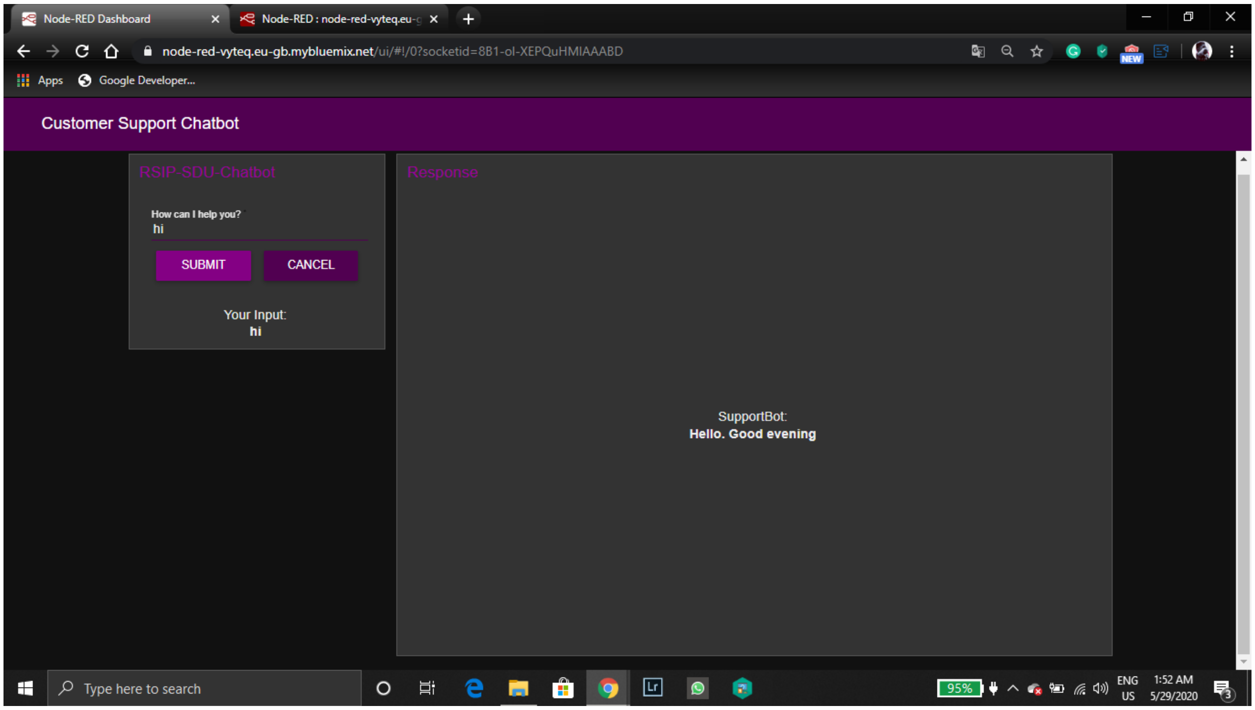


5. Flowchart



Node-RED : node-red-vyteq.eu-
node-red-vyteq.eu-gb.mybluemix.net/red/#flow/816c2fd3.3549d
Apps
Google Developer...
Node-RED
Deploy
filter nodes
common
inject
debug
complete
catch
status
link in
link out
comment
function
function
switch
Flow 1
Your Input:
abc
form
msg.payload
RSIP-SDU-Chatbot
SupportBot:
abc
msg.payload
dashboard
Layout
Site
Theme
Tabs & Links
+ tab
+ link
Customer Support Chatbot
RSIP-SDU-Chatbot
Response
Type here to search
95%
ENG
US
1:48 AM
5/29/2020

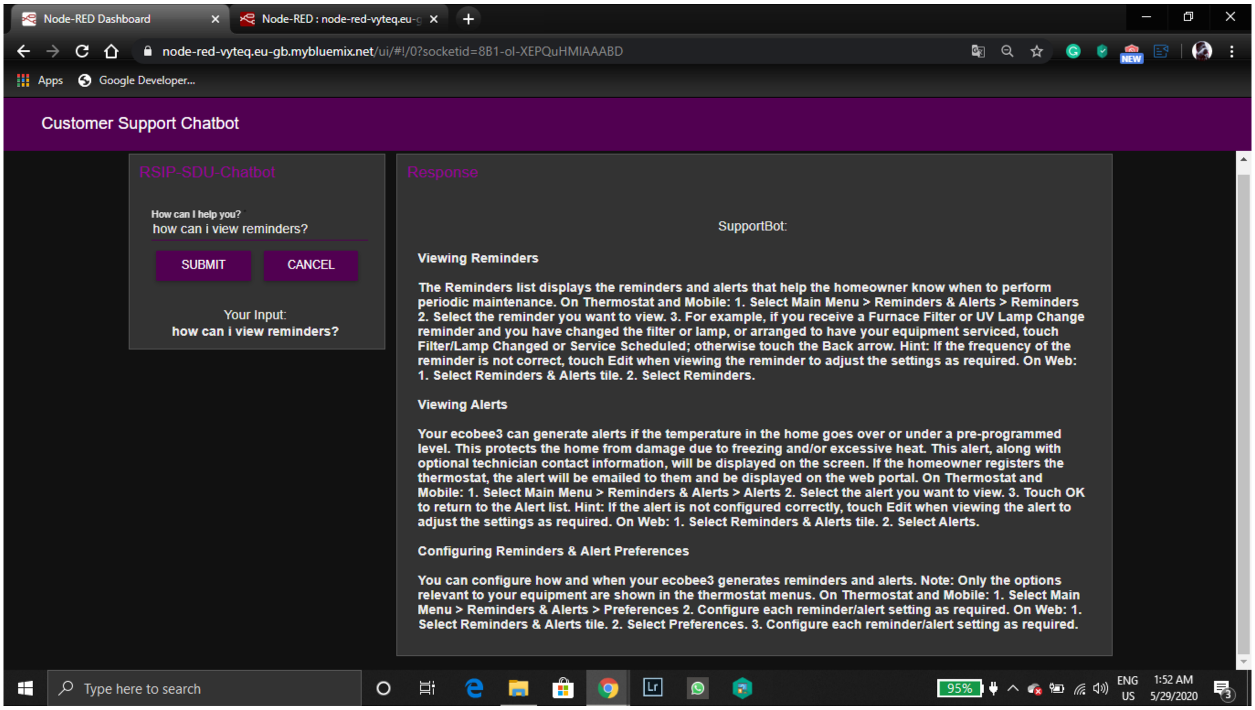
6. Results



How can I help you?
hi

Your Input:
hi

SupportBot:
Hello. Good evening



How can I help you?
how can i view reminders?

Your Input:
how can i view reminders?

SupportBot:

Viewing Reminders

The Reminders list displays the reminders and alerts that help the homeowner know when to perform periodic maintenance. On Thermostat and Mobile: 1. Select Main Menu > Reminders & Alerts > Reminders 2. Select the reminder you want to view. 3. For example, if you receive a Furnace Filter or UV Lamp Change reminder and you have changed the filter or lamp, or arranged to have your equipment serviced, touch Filter/Lamp Changed or Service Scheduled; otherwise touch the Back arrow. Hint: If the frequency of the reminder is not correct, touch Edit when viewing the reminder to adjust the settings as required. On Web: 1. Select Reminders & Alerts tile. 2. Select Reminders.

Viewing Alerts

Your ecobee3 can generate alerts if the temperature in the home goes over or under a pre-programmed level. This protects the home from damage due to freezing and/or excessive heat. This alert, along with optional technician contact information, will be displayed on the screen. If the homeowner registers the thermostat, the alert will be emailed to them and be displayed on the web portal. On Thermostat and Mobile: 1. Select Main Menu > Reminders & Alerts > Alerts 2. Select the alert you want to view. 3. Touch OK to return to the Alert list. Hint: If the alert is not configured correctly, touch Edit when viewing the alert to adjust the settings as required. On Web: 1. Select Reminders & Alerts tile. 2. Select Alerts.

Configuring Reminders & Alert Preferences

You can configure how and when your ecobee3 generates reminders and alerts. Note: Only the options relevant to your equipment are shown in the thermostat menus. On Thermostat and Mobile: 1. Select Main Menu > Reminders & Alerts > Preferences 2. Configure each reminder/alert setting as required. On Web: 1. Select Reminders & Alerts tile. 2. Select Preferences. 3. Configure each reminder/alert setting as required.

Thus the Intelligent Customer Help Desk With Smart Document Understanding was successfully built and deployed. https://node-red-vyteq.eu-gb.mybluemix.net/ui/

7. Merits & Demerits

Merits

- Small sized customer support team is enough as only a low volume of queries are redirected.
- Cost efficient.
- Only a small amount of queries need representatives, hence the customer is also satisfied with quick and easy solution.

Demerits

- The IBM Watson Discovery service returns wrong results if not properly configured.
- Same answers might be given for different queries.

8. Application

- It can be deployed in popular social media applications like Facebook, Slack and Telegram because of the pre-existing integrations with IBM Cloud Services.
- The chatbot can be deployed in any website to clear the basic doubts of the customer.
- It can be used as a Customer Helpdesk for small scale products as their manual usually has the solution for the user's problems.

9. Conclusion

By following the above-mentioned steps, we create a basic chatbot which can help us to answer the basic questions of the customer or user related to location of the office, working hours and the information about the product. We have successfully created the intelligent help desk smart chatbot using IBM Watson Assistant, IBM Cloud Function, IBM Watson Discovery and Node-Red.

Chatbot Link: https://node-red-vyteq.eu-gb.mybluemix.net/ui/

10. Future Scope

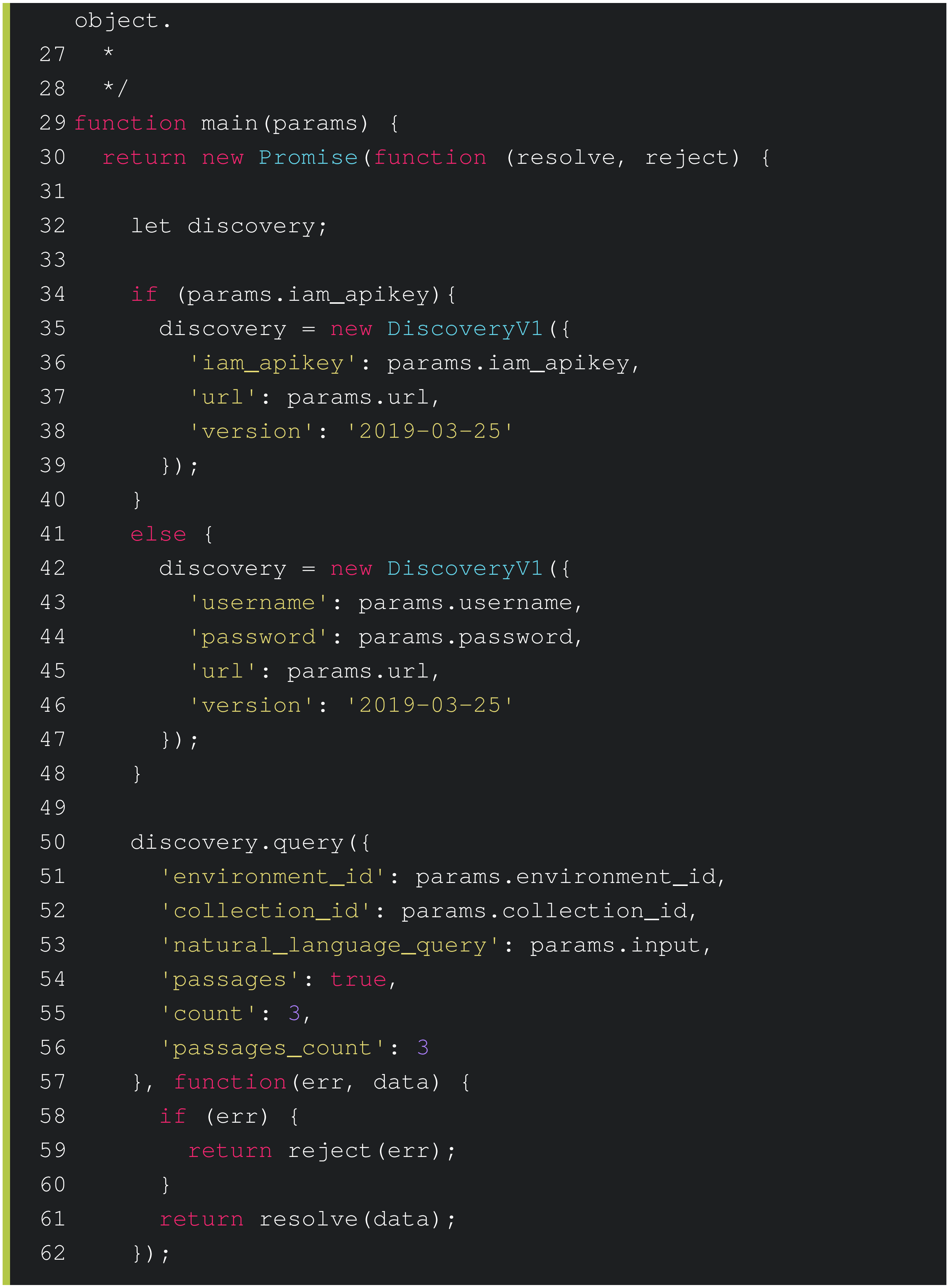
- Improve UI.
- Text-toSpeech and Speech-to-Text capabilities can be added.
- Annotate manual more accurately with more fields for increased precision in IBM Watson Discovery Service responses.

11. Appendix

11.1. Source Code

11.1.1. IBM Cloud Functions Action (Node.js 10)

```
/**
  *
  * @param {object} params
  * @param {string} params.iam_apikey
  * @param {string} params.url
  * @param {string} params.username
  * @param {string} params.password
  * @param {string} params.environment_id
  * @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);
    });
  });
}
```

11.1.2. Node-RED Flow (json)

```
[{"id":"816c2fd3.3549d","type":"tab","label":"Flow
1","disabled":false,"info":""},{"id":"dfba7f3f.d9fb3","type
":"ui_form","z":"816c2fd3.3549d","name":"","label":"","grou
p":"cb07b1b4.19ff7","order":1,"width":0,"height":0,"options"
:[{"label":"How can I help
you?","value":"text","type":"text","required":true,"rows":n
ull}],"formValue":{"text":""},"payload":"","submit":"submit
","cancel":"cancel","topic":"","x":70,"y":240,"wires":[["9f
84d064.22692"]]},{"id":"9f84d064.22692","type":"function","
z":"816c2fd3.3549d","name":"","func":"msg.payload =
msg.payload.text;\nreturn
msg;","outputs":1,"noerr":0,"x":230,"y":160,"wires":[["8da4
2c74.5462a","bc0c3d79.7667a","80080676.04caf8"]]},{"id":"56
d4f596.0db11c","type":"function","z":"816c2fd3.3549d","name
":"","func":"msg.payload.text=\"\";
\nif(msg.payload.context.webhook_result_1)\n{ \n    for(var
i in msg.payload.context.webhook_result_1.results)\n    {
\n
msg.payload.text=msg.payload.text+\"<br>\"+msg.payload.cont
ext.webhook_result_1.results[i].subtitle;\n
msg.payload.text=msg.payload.text+\"<br><br>\"+msg.payload.
context.webhook_result_1.results[i].text+\"<br>\";\n    }
\n    msg.payload=msg.payload.text; \n    \n} \nelse
\nmsg.payload = msg.payload.output.text[0];\nreturn msg;
","outputs":1,"noerr":0,"x":590,"y":140,"wires":[["5100ed9f
.b34914"]]},{"id":"bc0c3d79.7667a","type":"watson-conversat
ion-v1","z":"816c2fd3.3549d","name":"RSIP-SDU-Chatbot","wor
kspaceid":"e810ddf1-ad64-4035-9d44-fd496dea8623","multiuser
":false,"context":false,"empty-payload":false,"service-endp
oint":"https://api.eu-gb.assistant.watson.cloud.ibm.com/ins
tances/511e6005-6096-4d63-8839-671f726a98a1","timeout":"","optout-learning":false,"x":470,"y":220,"wires":[["56d4f596.0db11c","9d87dde1.c9d6f"]]},{"id":"8da42c74.5462a","type":"ui_text","z":"816c2fd3.3549d","group":"cb07b1b4.19ff7","order":2,"width":0,"height":0,"name":"","label":"Your Input:","format":"{{msg.payload}}","layout":"col-center","x":380,"y":60,"wires":[]},{"id":"9d87dde1.c9d6f","type":"debug","z":"816c2fd3.3549d","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"false","x":570,"y":360,"wires":[]},{"id":"5100ed9f.b34914","type":"ui_text","z":"816c2fd3.3549d","group":"8a38f208.6ef13","order":1,"width":14,"height":9,"name":"","label":"SupportBot:","format":"{{msg.payload}}","layout":"col-center","x":730,"y":220,"wires":[]},{"id":"80080676.04caf8","type":"debug","z":"816c2fd3.3549d","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"false","x":300,"y":280,"wires":[]},{"id":"cb07b1b4.19ff7","type":"ui_group","z":"","name":"RSIP-SDU-Chatbot","tab":"5bece7a3.cdda68","order":1,"disp":true,"width":5,"collapse":false},{"id":"8a38f208.6ef13","type":"ui_group","z":"","name":"Response","tab":"5bece7a3.cdda68","order":2,"disp":true,"width":14,"collapse":false},{"id":"5bece7a3.cdda68","type":"ui_tab","z":"","name":"Customer Support Chatbot","icon":"dashboard","disabled":false,"hidden":false}]
```

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