PROJECT REPORT

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TITLE :	Intelligent Customer Help Desk With Smart Document Understanding.
CATEGORY :	Artificial Intelligence

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CONTENT

INTRODUCTION

1.1 *Overview*

The project is focused on creating a customer care chatbot whose dialog will provide a hook that can call out to other Watson services for additional source of information unlike the typical chatbot which rely on predefined responses. In this case, an users manual has been uploaded in Watson Discovery service. This project utilizes different IBM services like Watson Discovery, Cloud Functions, Watson Assistant and Node-Red.

1. Project Requirements: Intelligent customer care chatbot with smart document understanding feature given by Watson Discovery which will lick to appropriate help context from the user manual. Watson Assistant to store all the dialogs, Node-Red tool to connect all the above mentioned services.
Functional Requirements: Each IBM services utilized have purpose in completing the project. Watson Discovery uses data analysis to take unstructured data and enrich it so you can query it for the information needed. Watson Assistant acts as the Chatbot which gives response to the customer's query. Cloud Functions is used to integrate cloud services. Node-Red is a programming tool which will wire together all the services mentioned above.
2. Technical Requirements: This includes Artificial Intelligence, Machine Learning, Python, IBM Watson Services.

3. Software Requirements: IBM Watson services like Watson Discovery, Watson Assistant.

4. Project Deliverables: This chatbot is created to improve customer experience and to show how various services are involved to get a an accurate and desired result.

5. Project Team: Individual project work [Preeti Nair].

6. Project Duration: 29 days.

1.2 ***Purpose***

Chatbots aren't just for customer. They can provide useful support throughtout a business, including service desk. From organisation to simplication to satisfcation, there are many purposes of creating chatbot with smarter service desk.

With feature like Smart Document Understanding (SDU), the customer won't have to undergo the tedious procedure of connecting with customer care representative. Instead the answer of his query will be displayed through the chatbot. The solution provided will be accurate and handy as it is straight from a owner's manual which has been pre-loaded in Watson Discovery. It can direct the user to relevant available content. By taking in

keywords and understanding syntax, bots are then able to suggest useful help rescources.
The response will be lightnening fast and the users can implement on the advice provided by the bot and get on with their day.

To summarize, the purpose of this chatbot is to enhance customer experience by integrating services provided by IBM like Watson Discovery, Watson Assistant, Node-Red and Cloud Functions.

LITERATURE SURVEY

2.1 ***Existing Problem***

A standard chatbot will provide solution for basic queries like "location of store" or "when does the store open". But when the query is something related to the operation of a device, instead of displaying the solution it will direct the customer to a customer representative.
Due to this, the customer has to wait until the representative gets back to them. Sometimes they don't provide useful solution to the query.
Another problem is these chatbots have limited responses for customers.
This overall deteriorates the customer experinece.

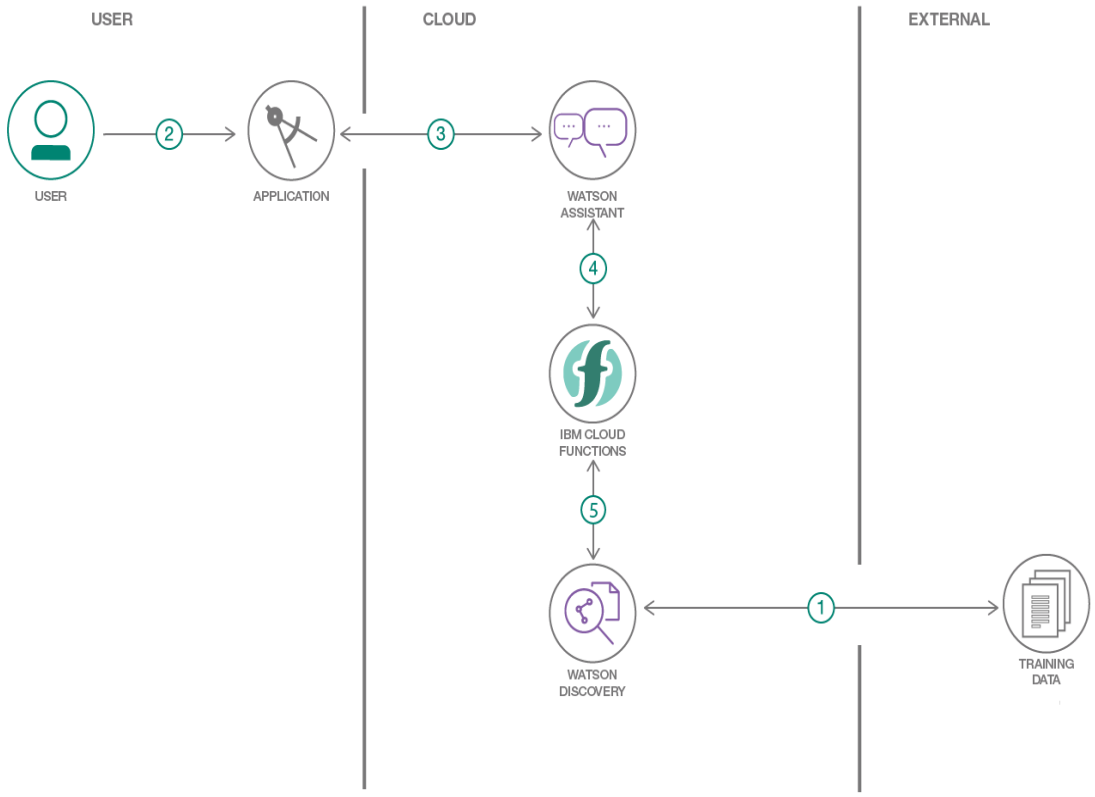
2.1 ***Proposed Solution***

The proposed solution is to create a chatbot that will display the appropriate solution instead of involving any human interaction.

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?" it will return relevant sections of the owners manual to help solve our customers' problems.
In this way the customer won't have to undergo the tedious process of connecting with the representative and the customer will get lightnening fast response. This will thereby enhance customer service experience.

THEORETICAL ANALYSIS

3.1 *BLOCK DIAGRAM*



- **Step 1** : The document in this case the owner's manual is indexed and annotated by the Smart Document Understanding feature of Watson Discovery.
- **Step 2** : The user interacts with the app UI. The frontend server is the chatbot which engages with the customer with small talk.
- **Step 3** : The interaction is coordinated by Watson Assistant service.
- **Step 4** : When a technical query comes into picture, the assistant invokes the Cloud Functions action.
- **Step 5** : The action then queries the Discovery and returns with the result relevant to the query.

3.2 ***Hardware/Software Designing***

The softwares utilized are Watson Discovery, Watson Assistant and Node-Red.

1] Watson Discovery : Discovery makes it possible to rapidly build cognitive, cloud-based exploration applications that unlock actionable insights hidden in unstructured data. It applies latest breakthroughs in machine learning, including natural language processing capabilities, and is easily trained on the language of your domain.
It breaks open the data silos and retrieves specific answers to user's questions while analysing trends and relationships buried in the uploaded data. With Smart Document Understanding (SDU) feature you can train IBM Watson Discovery to extract custom fields in your documents.

2] Watson Assistant : It is conservation AI platform that provides customer fast, straightforward and accurate answers to their question, across any application, device or channel. By addressing common customer inquiries, Watson Assistant reduces the cost of customer interactions.
It uses Watson AI machine learning (ML) and natural language understanding (NLU). The user input is recieved by the assistant and routes it to a dialog skill. The dialog skill interprets the input further, then directs the flow of the conservatio. The dialog gathers any information needs to respond on user's behalf.

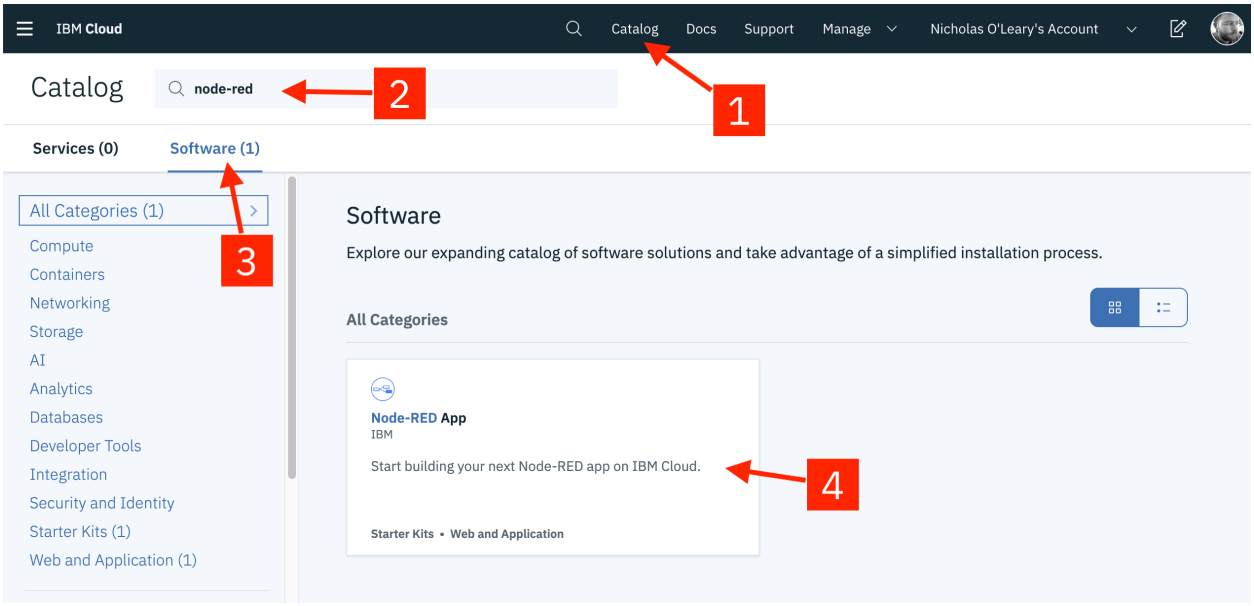
3] Node-Red : It is a prototyping tool that builds applications easily. Applications are developed by building data flows through a series of connected nodes. Intricate apllications can be built that allows Watson services to interact with range of capabilities and services exposed as Node-Red nodes.
It helps in wiring together hardware devices, APIs and online services without writing any code. It provides web based flow editor, which can be used to connect these services and also create UI.

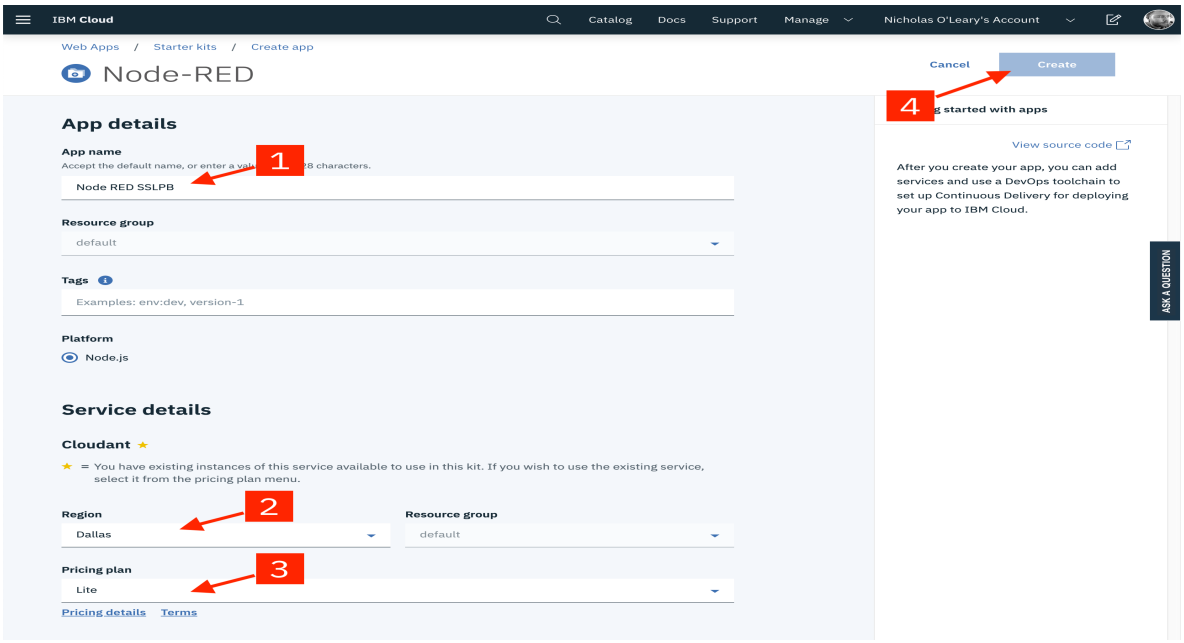
EXPERIMENTAL INVESTIGATIONS

Following services are to be created :

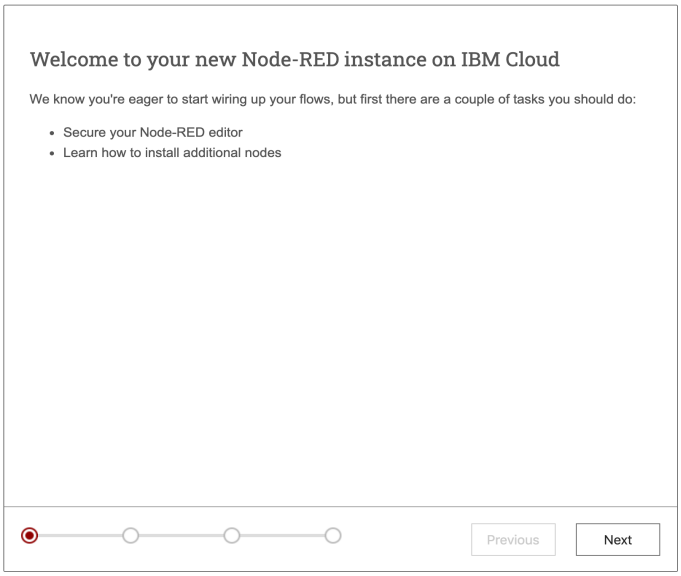
4.1 ***Node-Red Application***

1. Search for Node-Red in catalog and create an application by filling in details like the cloudant region and a unique name.

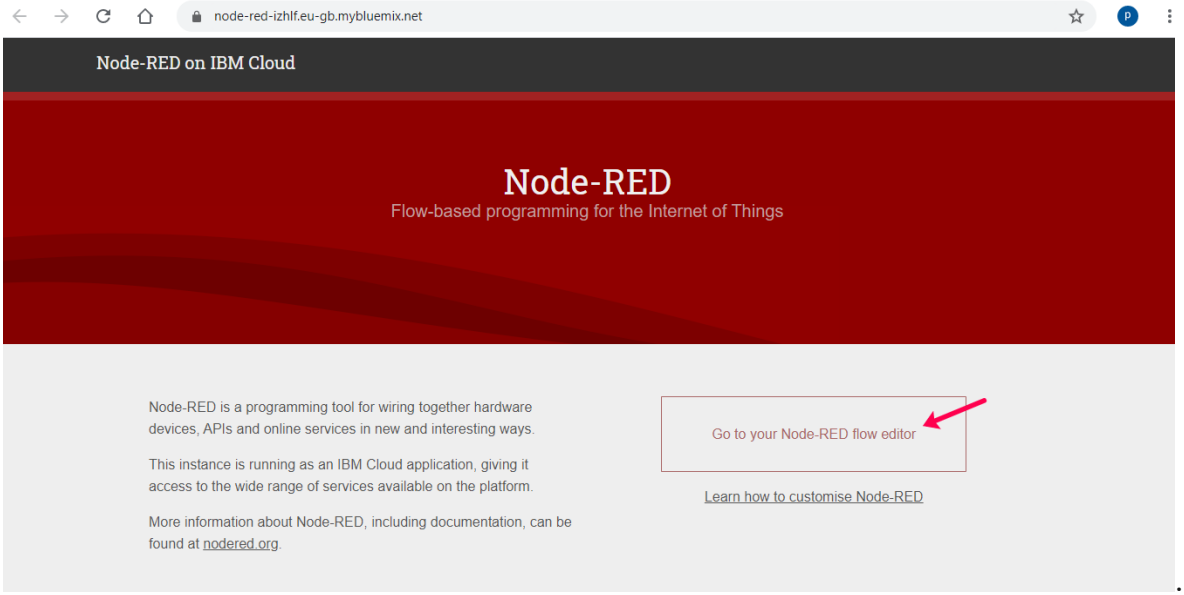




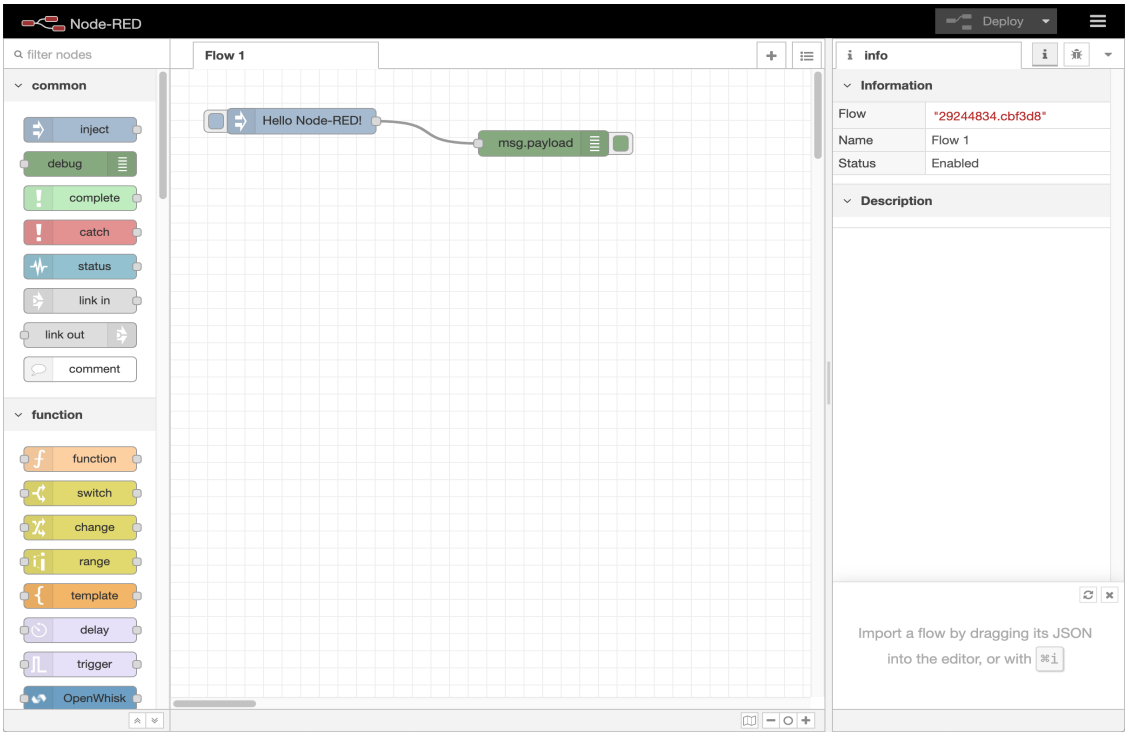
2. Setup Continous Delivery feature to deploy the application created into the Cloud foundary apps in IBM Cloud.
After deploying stage is completed, the application is now running.
3. In the details page, click on Visit App URL to configure it and set up security.



4. Click on Next. Now it will ask for username and password for security reasons. Enter them.
5. The final screen summarizes the options you've made and highlights the environment variables you can use to change the options in the future. Click Finish to proceed.
6. Node-RED will save your changes and then load the main application. From here you can click the Go to your Node-RED flow editor button to open the editor

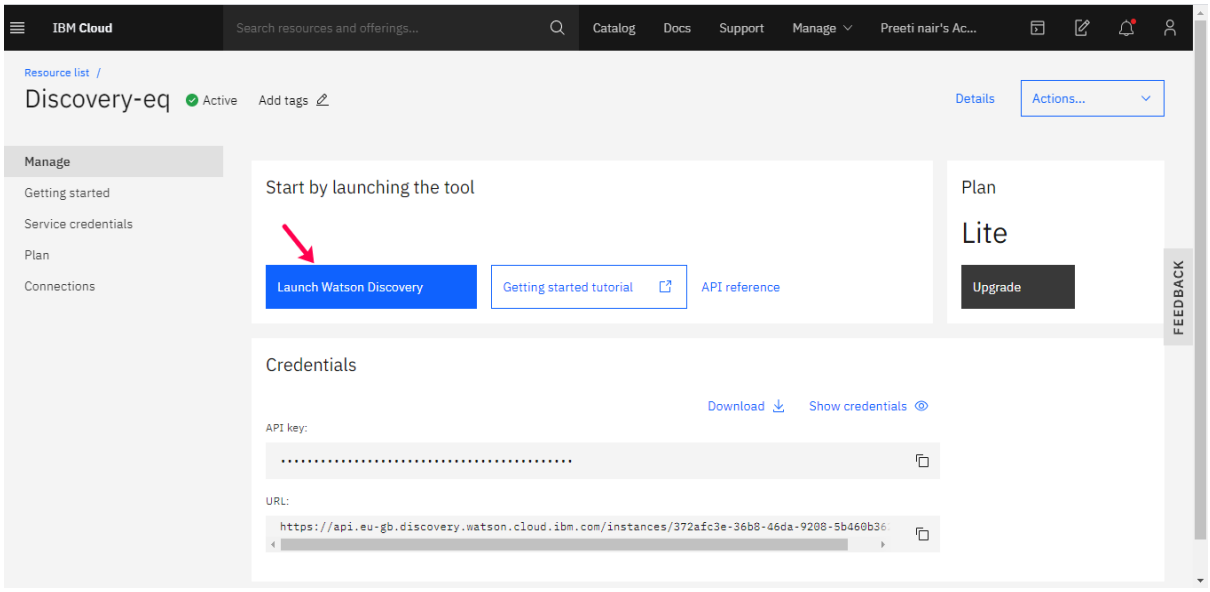


7. This is the place where you will create flow to wire all the services utilized to function the chatbot.

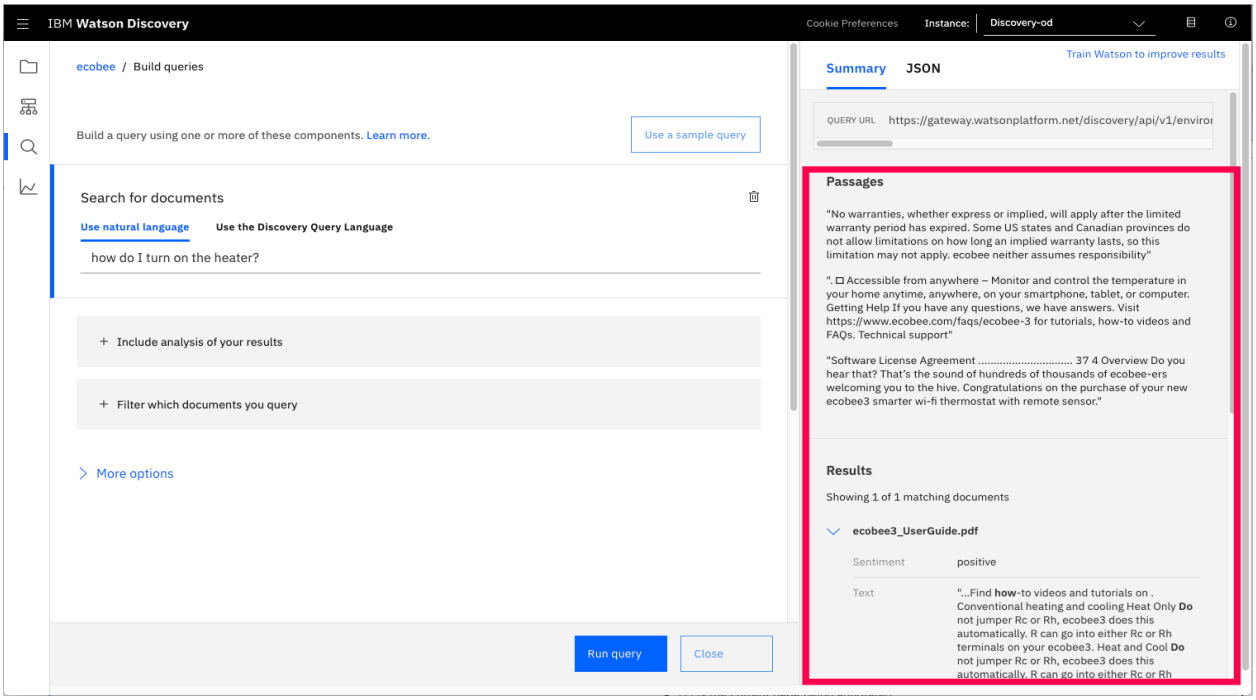


4.2 ***Watson Discovery***

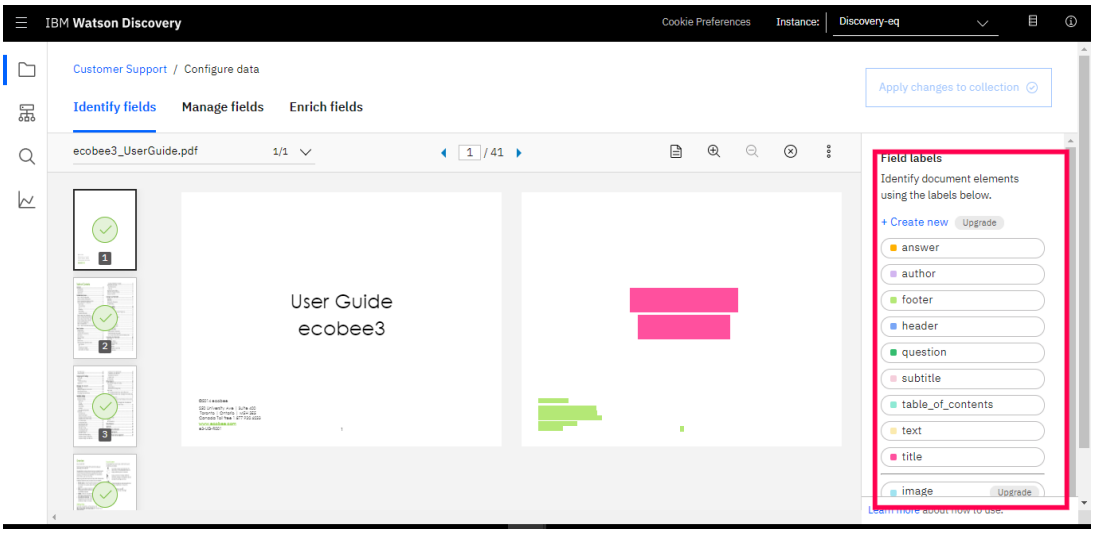
1. Search for Discovery from Catalog and create an instance of the service.
2. After creating, launch the service by clicking on Launch Watson Discovery.



3. Upload the ecobee3 owner's manual by clicking on Upload your own data.
4. Now before setting up the SDU feature, try few queries. Click on the Build your own query.
5. When ask a query, it will display you many sections from the manual. To improve query result, setup SDU feature.

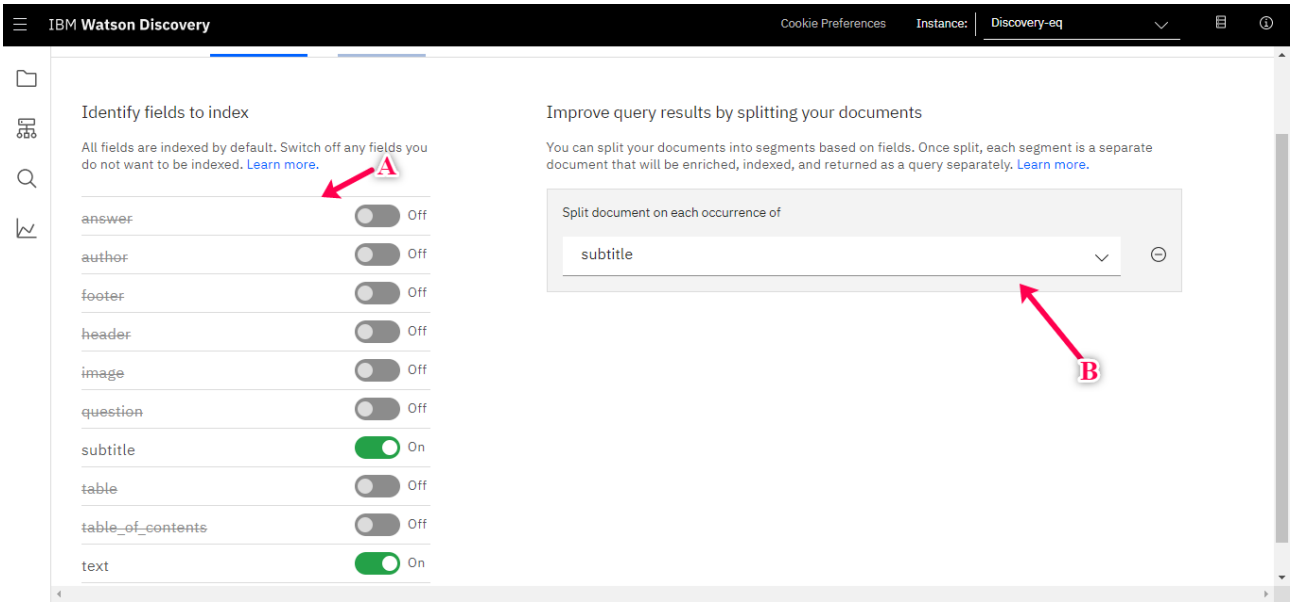


6. Go to Configure data. You will see SDU layout. There are three fields : **Identify fields, Manage fields** and **Enrich fields.**
7. In Identify field, here you will identify the elements in the document by labelling them as **title , subtitle** or **text** which you will see on the right side of the layout page.



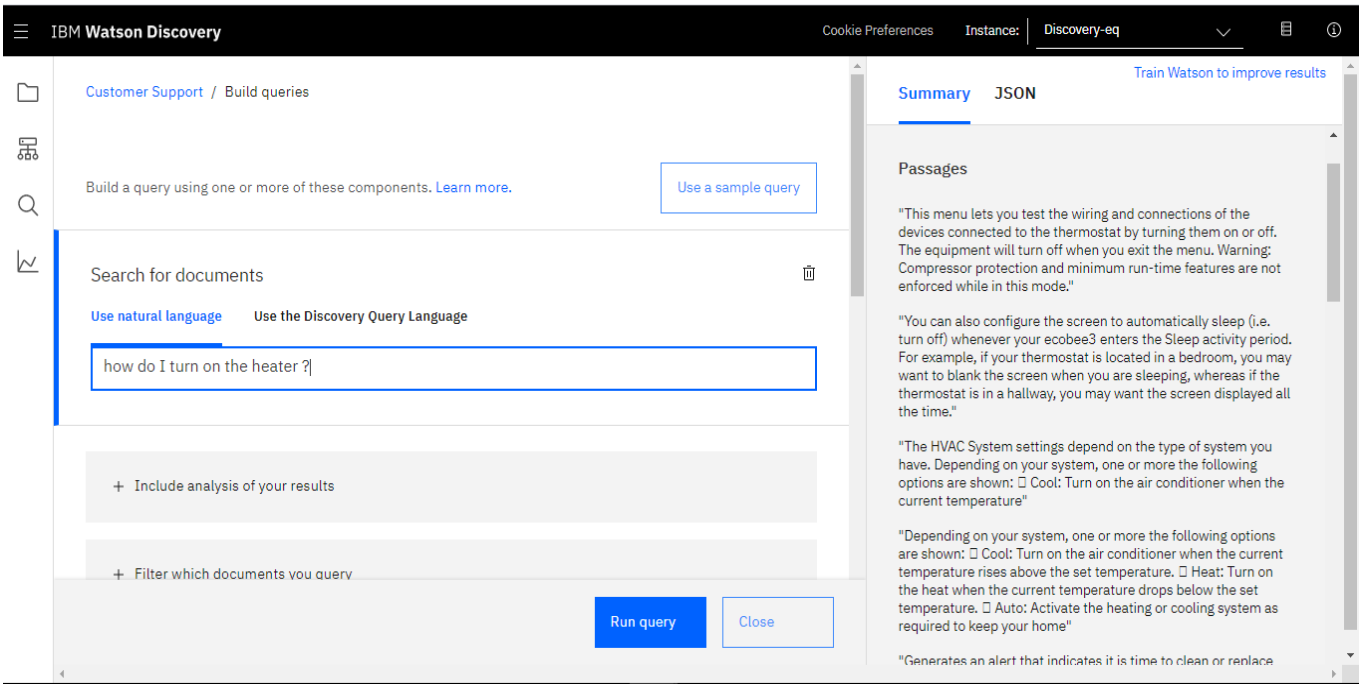
8. Assign relevant labels for 10-11 pages and click on Submit Page accordingly. After few pages, Discovery starts to recognize the element automatically. This means the service is trained.

9. Now go to Manage Fields tab, select the items you want to be indexed (A). After that, split the document by subtitle (B). Click the **Apply to changes button**.



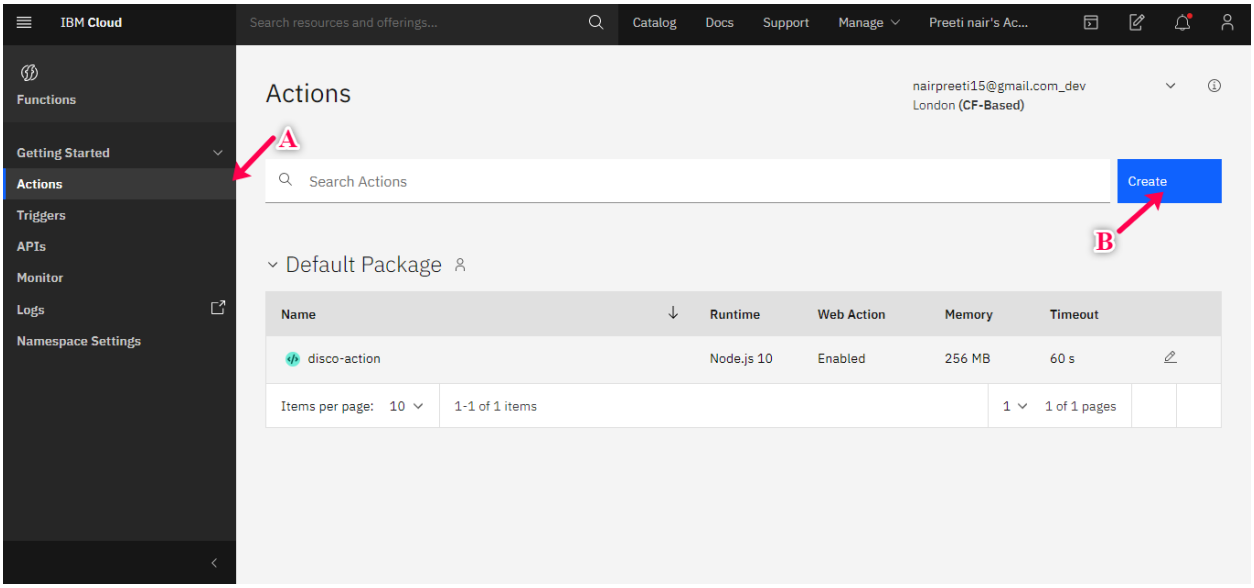
9. It will ask you to upload the document, upload it. You will see all the annotations applied to your index.

10. Again click on **Build your own query.** Ask the same query. This time you will see the most relevant answer from the manual being displayed.

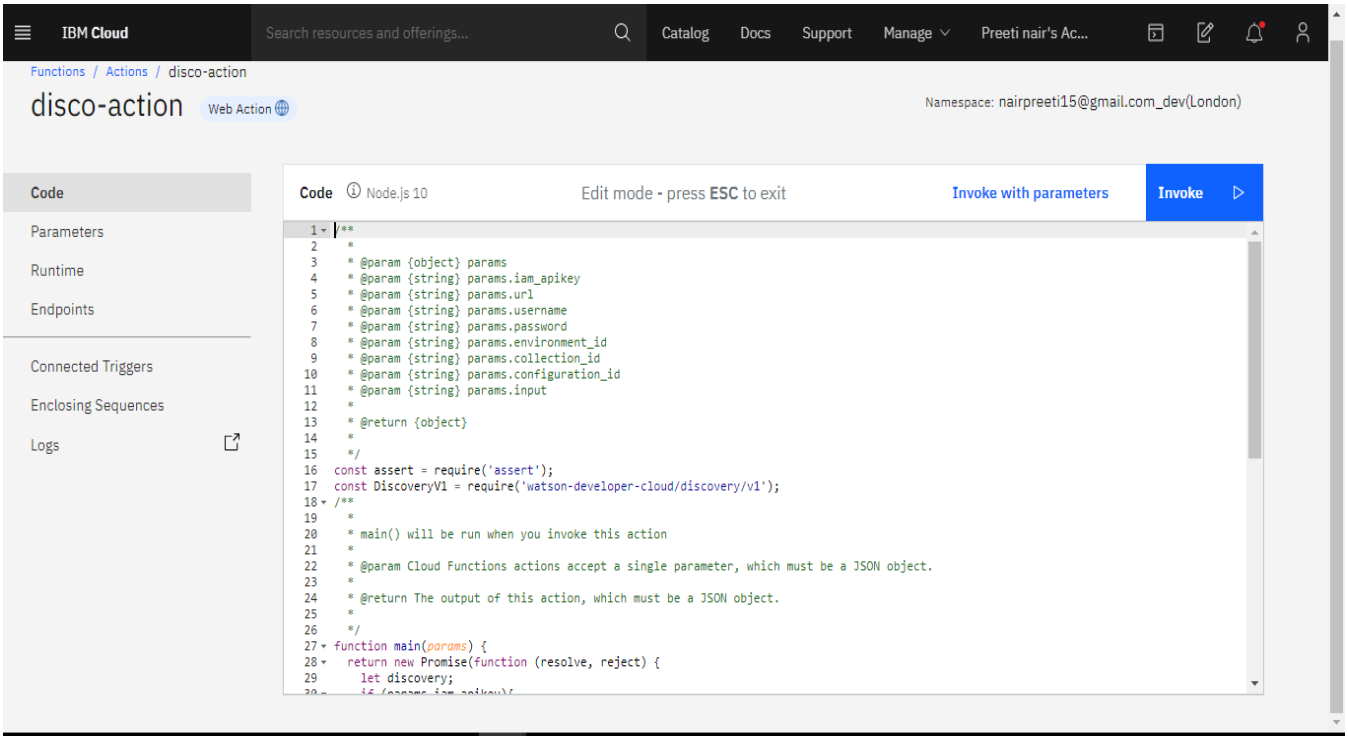


4.3 ***Cloud Functions***

1. Search for Functions in catalog and click on Functions.
2. Opening Functions, in the left tab click on **Actions** (A) and select create (B).

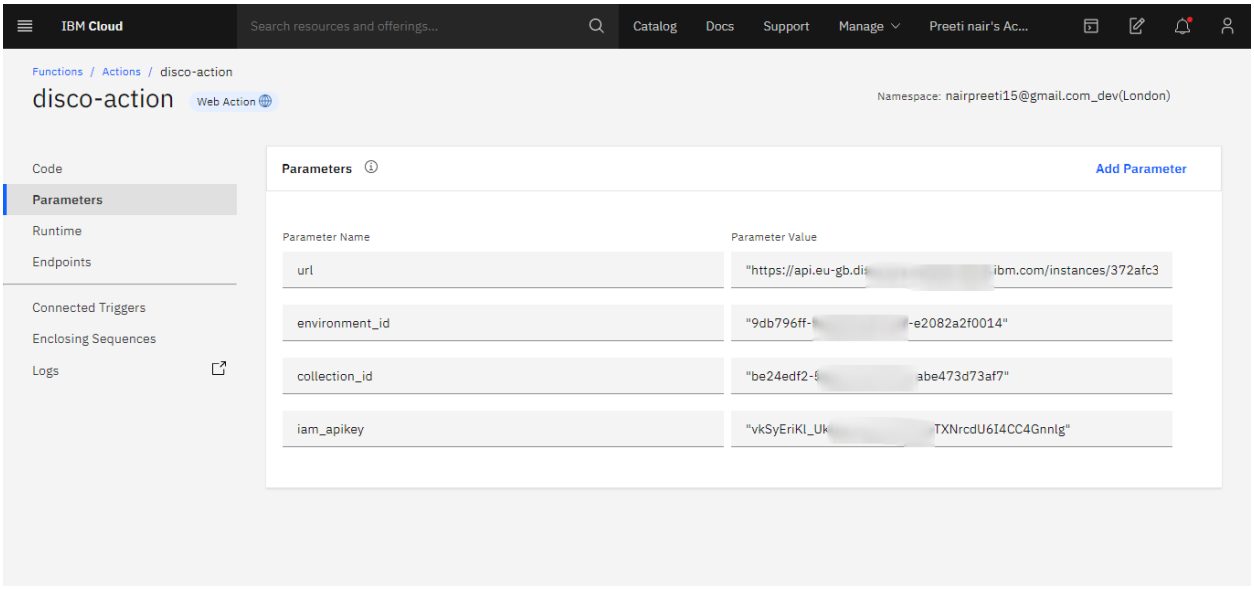


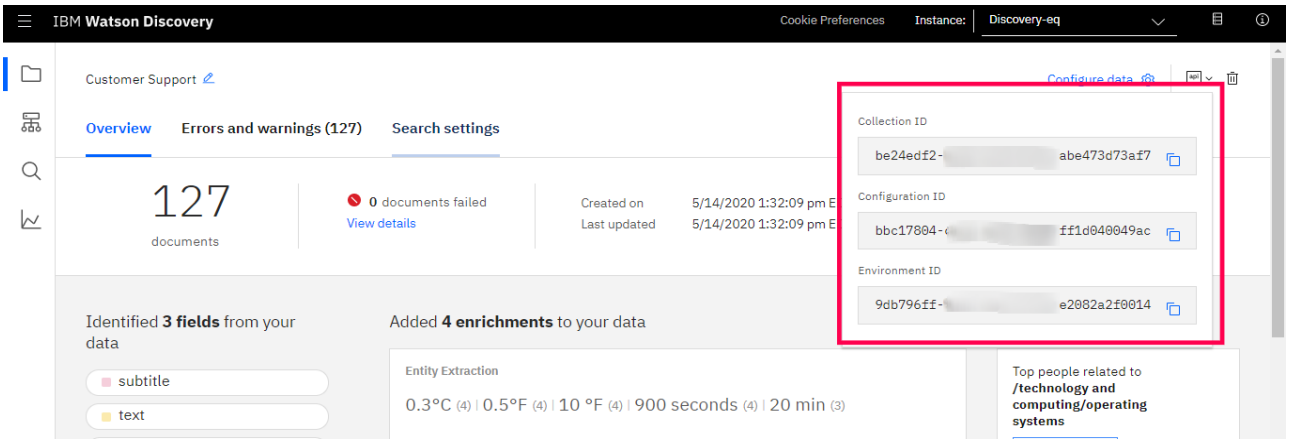
3. Once the action is being created, go to code tab. Paste the code which will revoke the Discovery service.

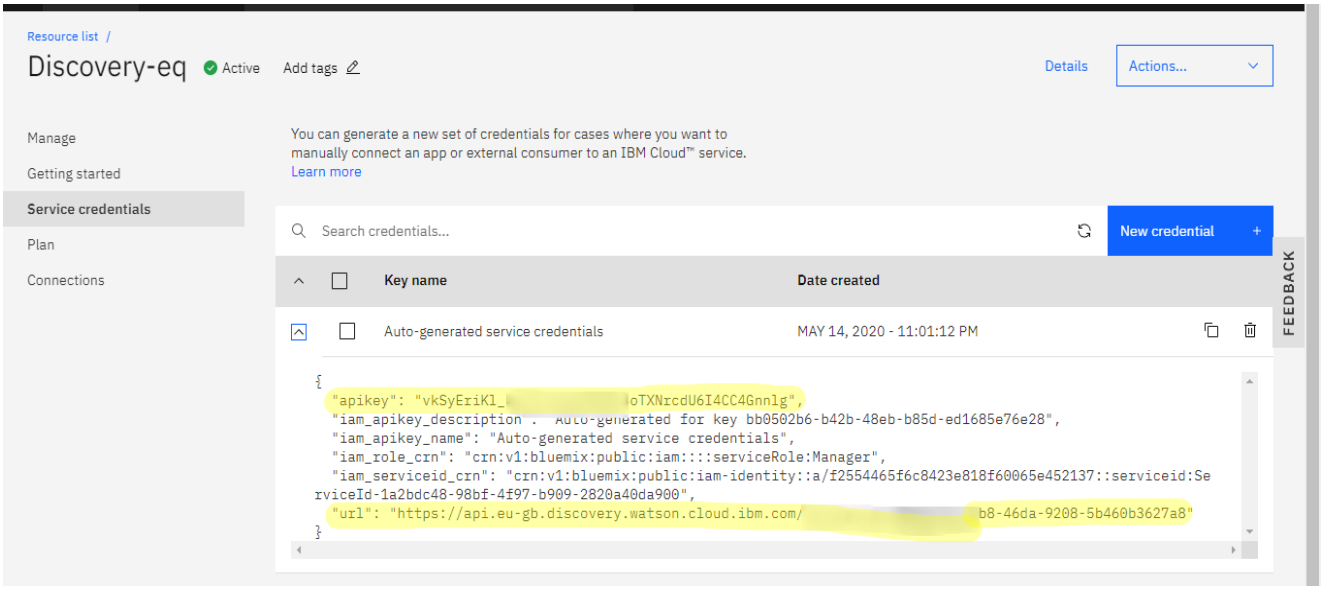


4. Before clicking on **Invoke** button, click on Parameters tab and add all necessary

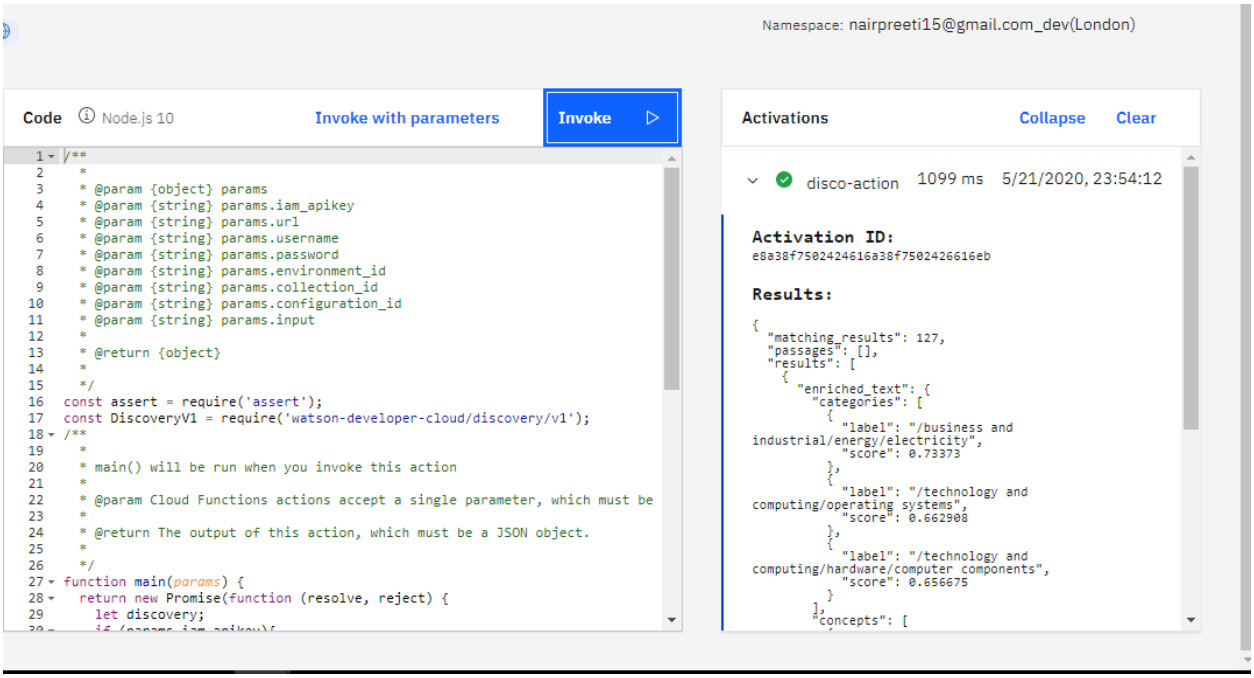
parameters of Discovery service which you will find on following pages.



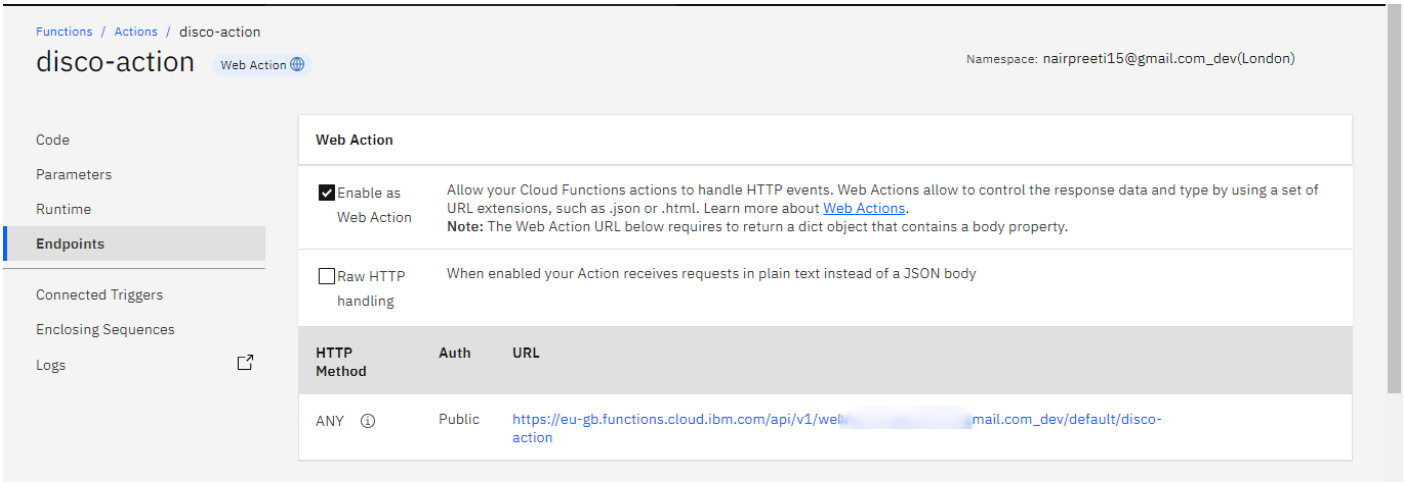




5. After adding parameters, go back to code page and click on **Invoke**. You will see the actual results returned from the Discovery service.



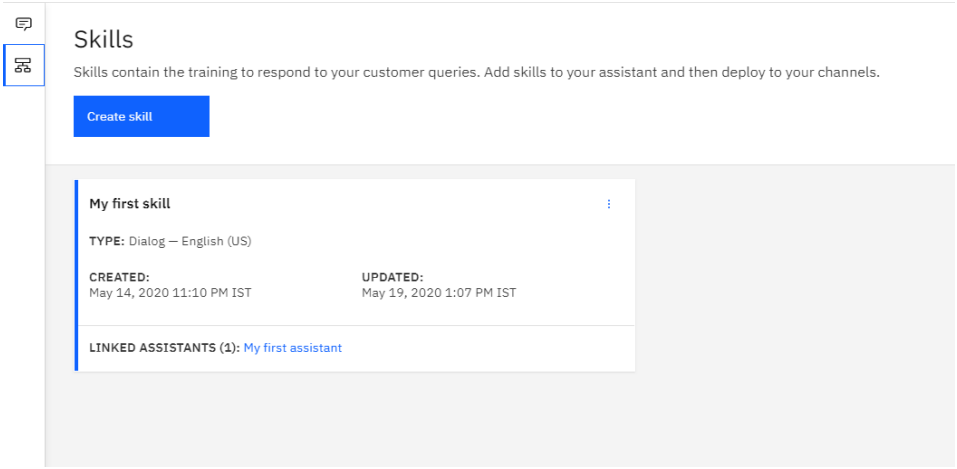
6. In Cloud Functions, click on Endpoints tab, and select **Enable as Web Action**. This will create a url which will be used to setup Webhook in Watson Assistant.



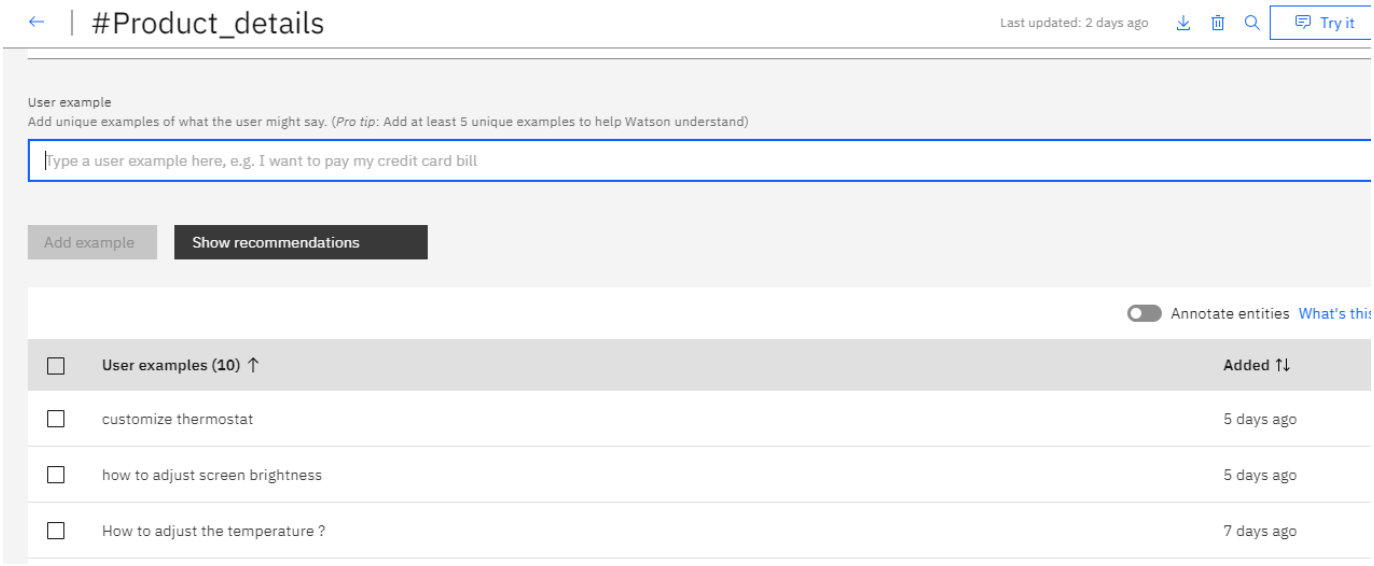
4.4 *Watson Assistant*

1. Create Watson Assistant service in similar fashion as Watson Discovery. Launch the service.
2. When you open the service, you will see a dialog skill named Customer Care skill automatically provided by the service. Either choose that and remodify it or

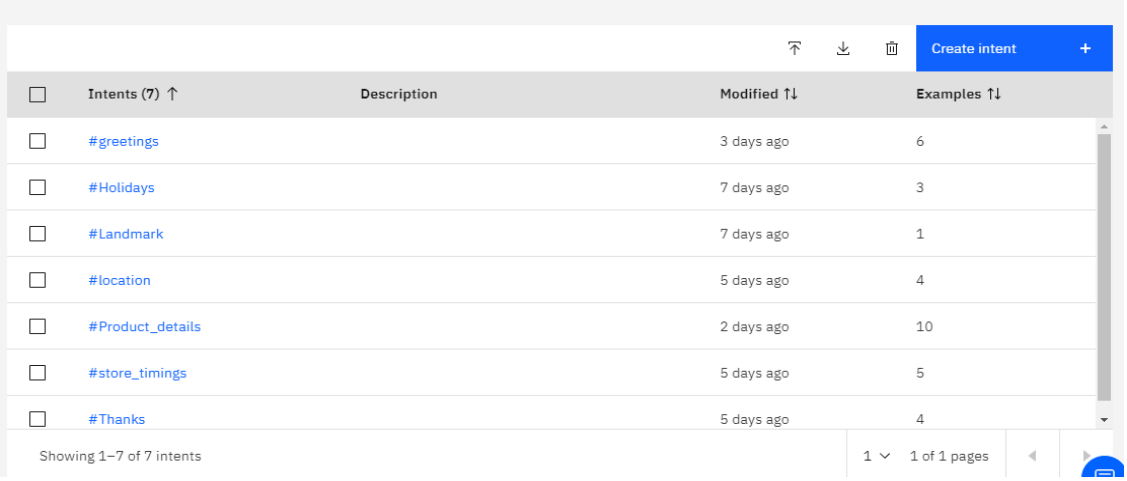
create new skill.



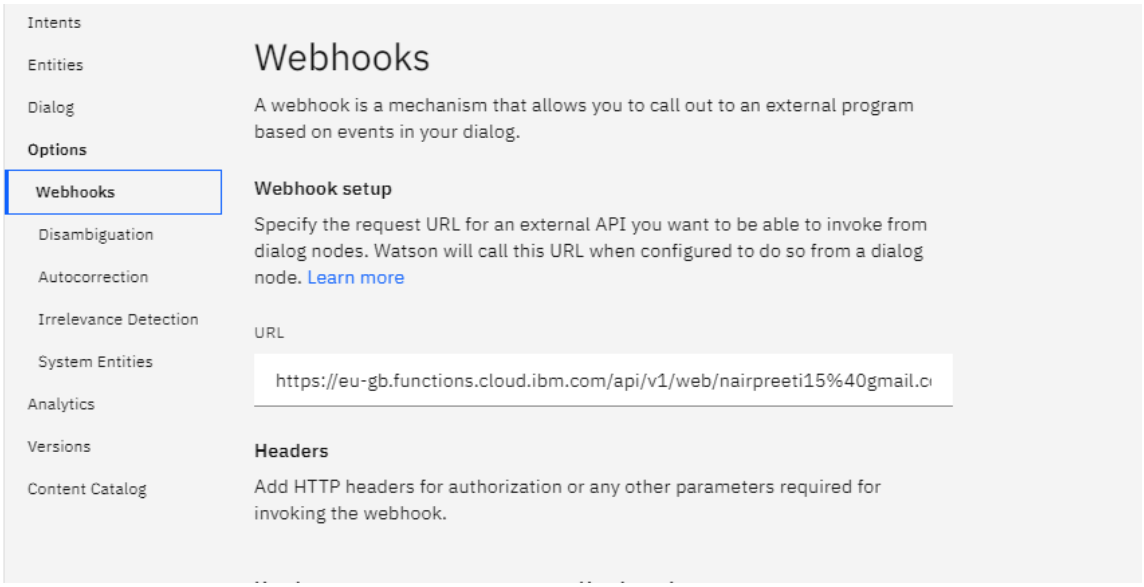
3. Firstly create intent which we will detect if the customer is asking about the operation of the product. Given down below is an intent about Product_details. Provide few sample examples of queries for the assistant to detect.



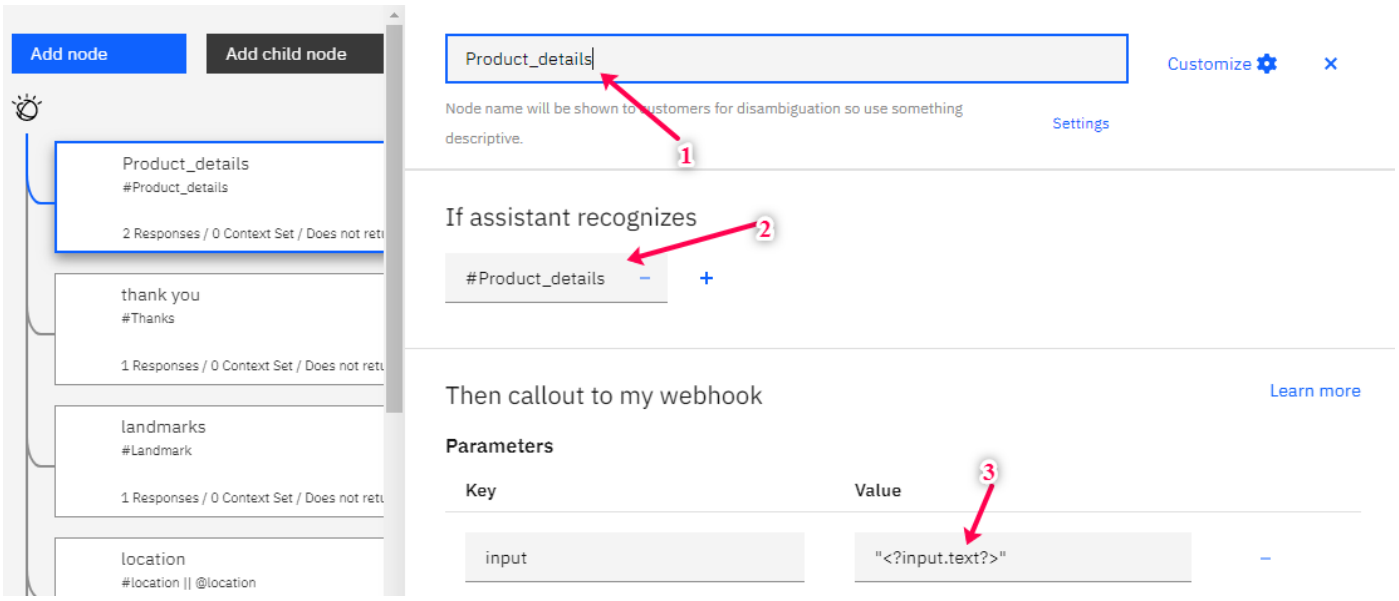
Similarly you can give intents for location, landmarks or timings.



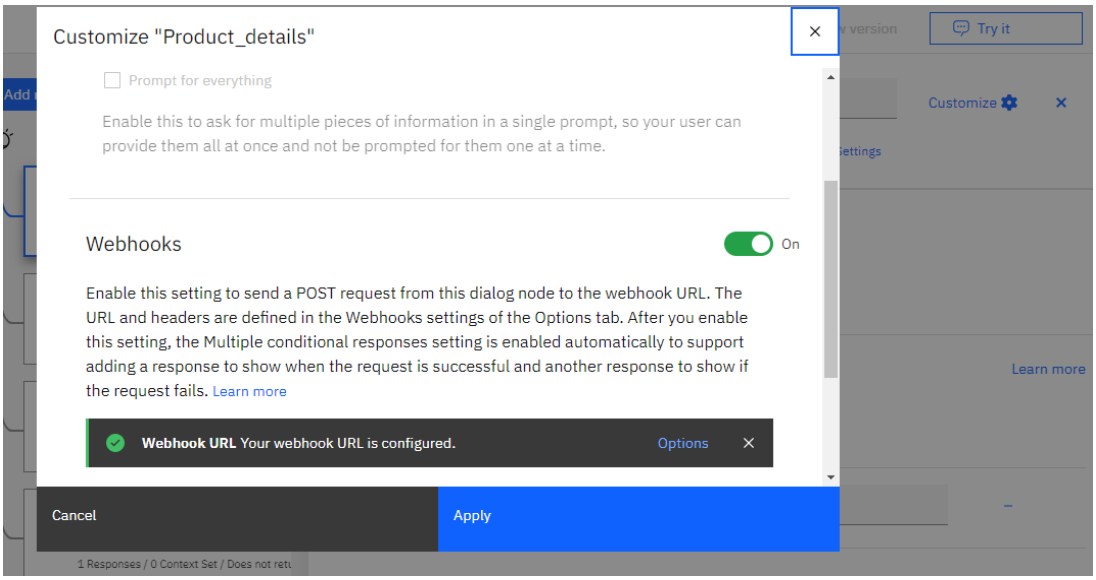
4. Click on Options. Here you will setup Webhook. Use the url from the Web action of Cloud functions in Endpoints tab.



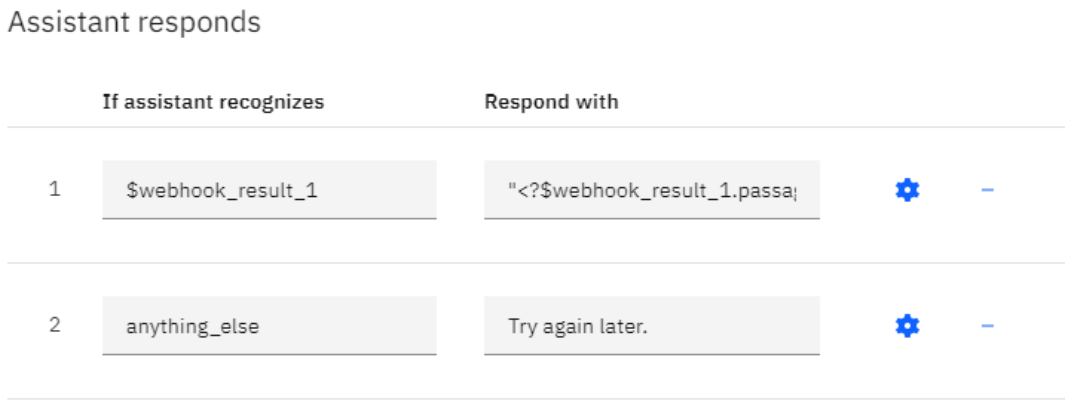
5. Move onto Dialog tab. Here, add nodes to handle intents.
6. Create a node for Product_details (1) and accordingly assign its intent (2).
7. Enter syntax (3) which will pass on the query via **input** parameter to discovery.



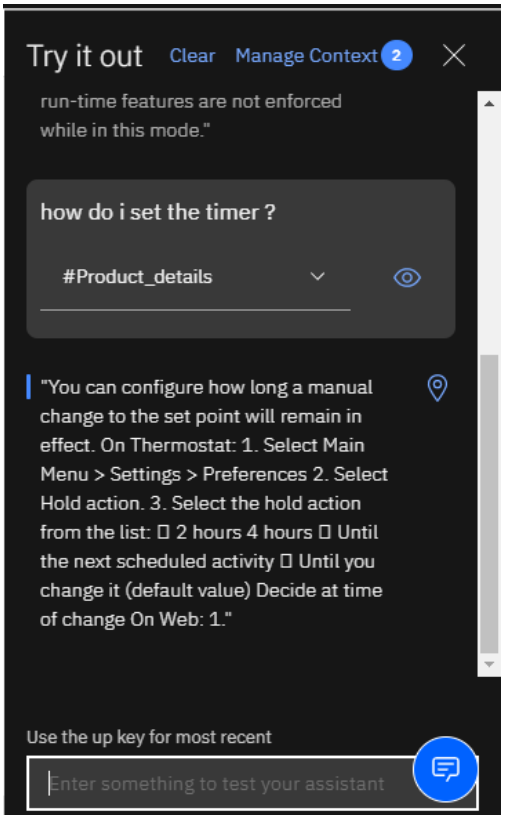
8. Click on Customize and enable the Webhook.

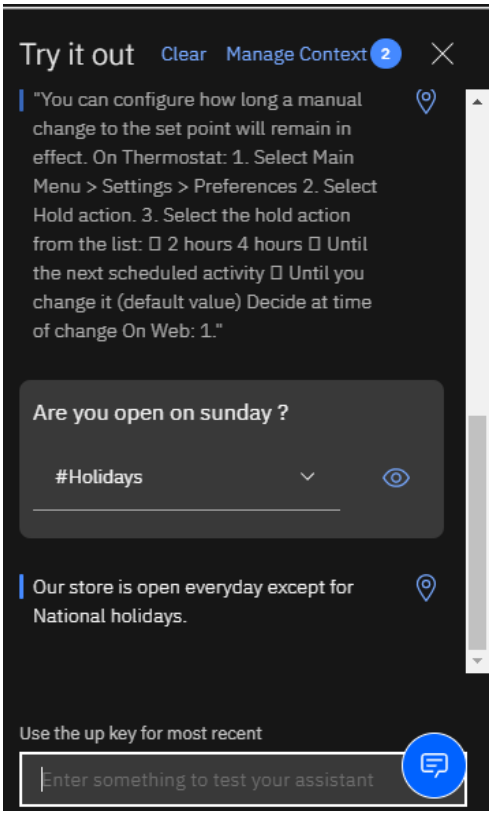


9. Now add the reponses to aid in debugging.



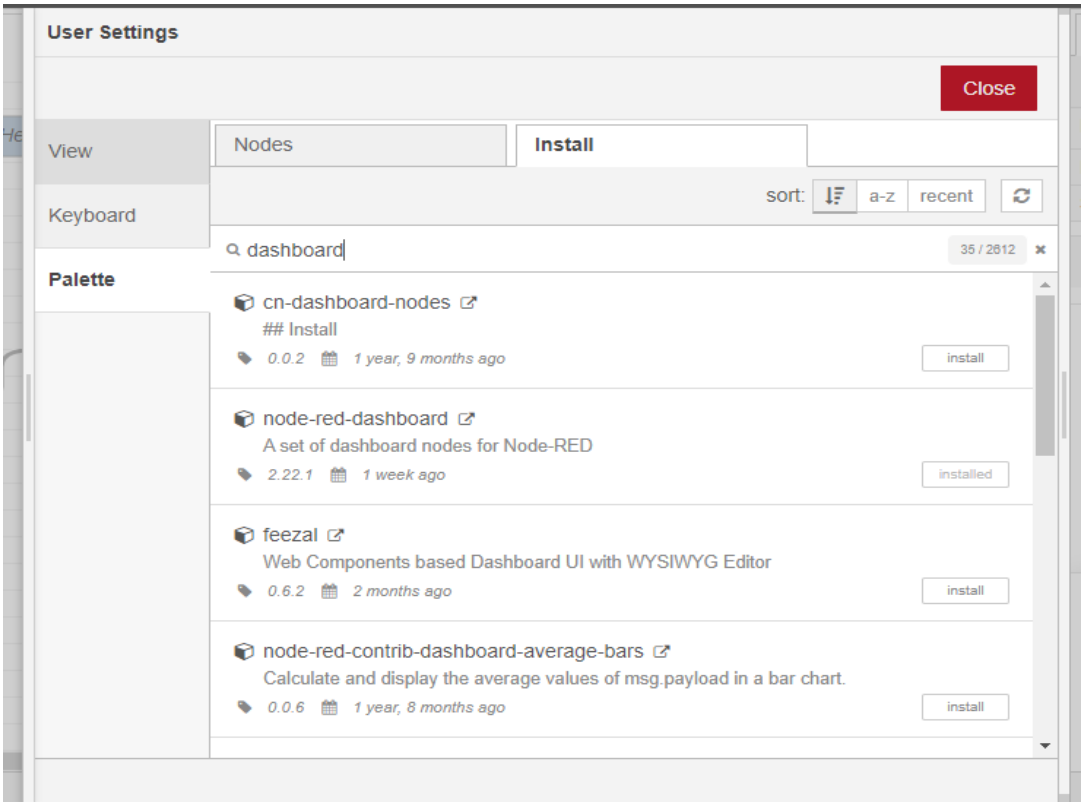
10. Try out the assistant.



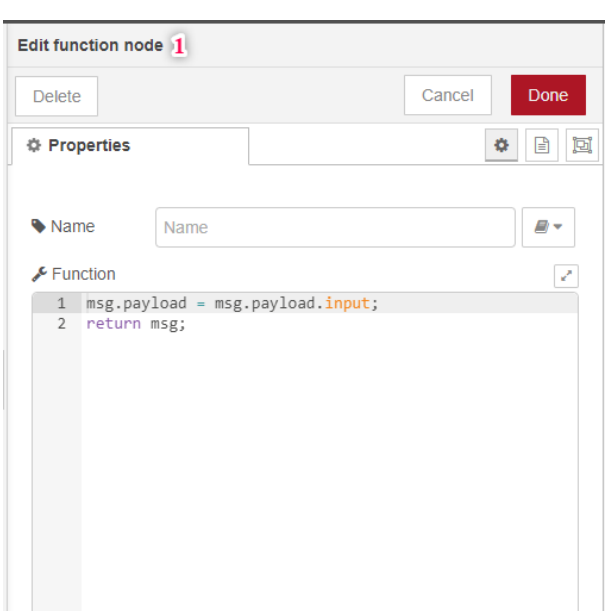


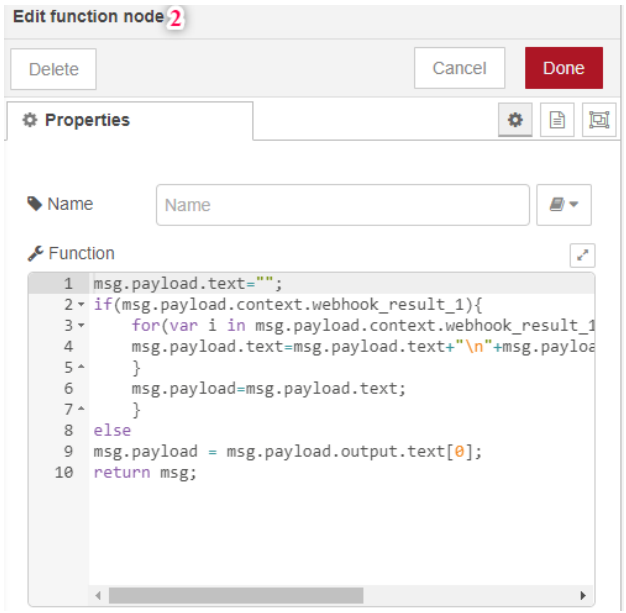
Integration of all the above services in NODE-RED

1. Open the Node-Red Flow editor. Before beginning, download dashboard nodes used for creating chatbot UI. Click on **Manage Palette.** Go to install tab and search for node-red-dashboard. Then click on install.

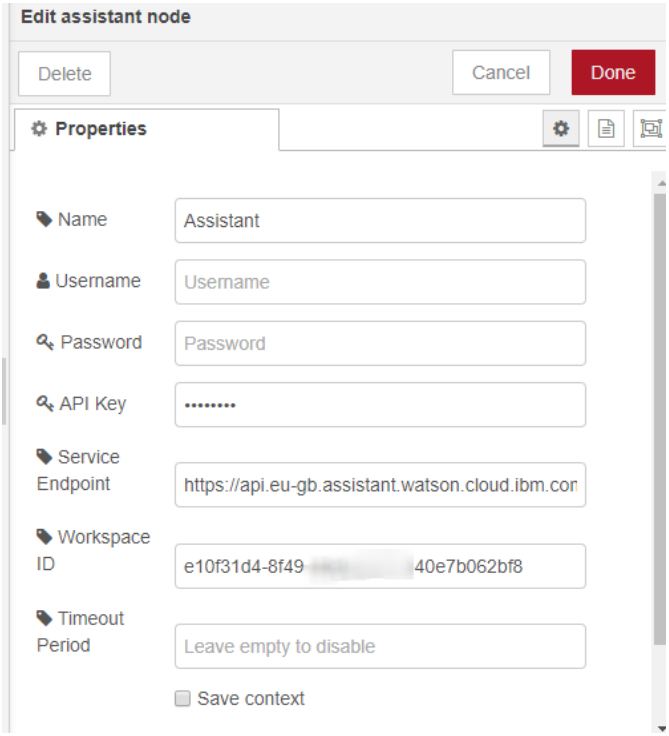


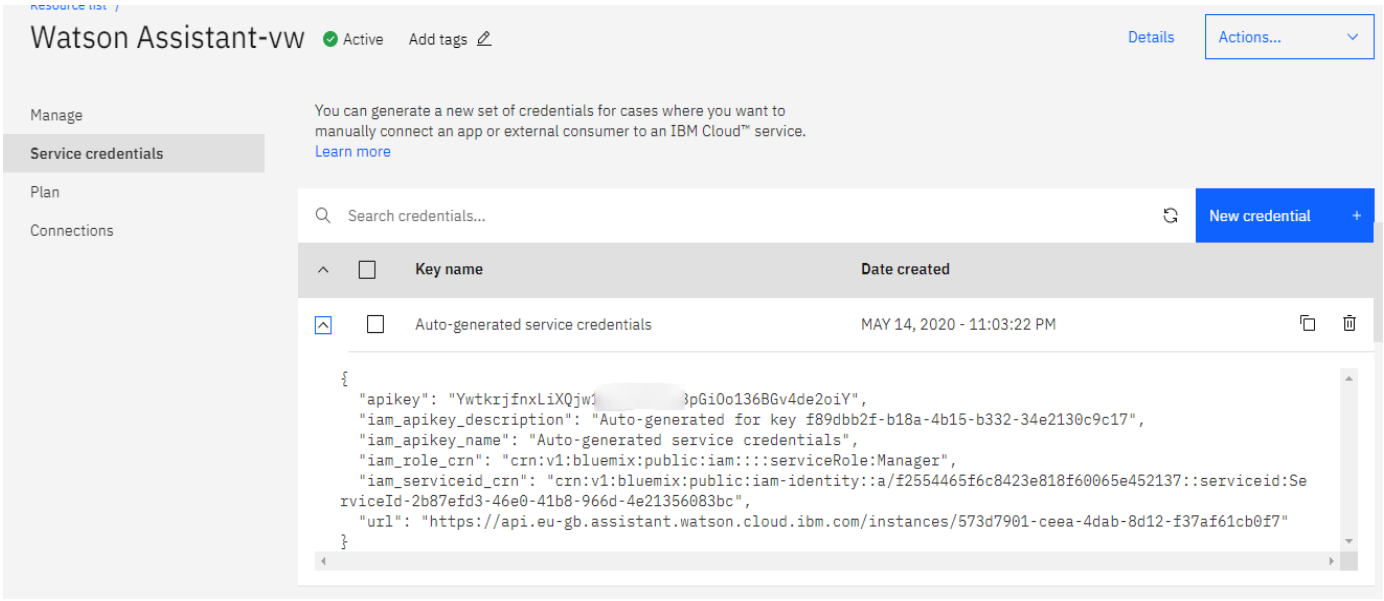
2. Add **Form** node. Double click on it and add the Group name and Tab name. Also select the size of form.
3. Add **Inject** node. Double click it and name it as Hello.
4. Add two **Text** nodes. Double click the first one and name it as Query and the second one as the Response.
5. Drag two **Debug** nodes.
6. Drag two **Functions** nodes. Add in the codes for both the nodes.



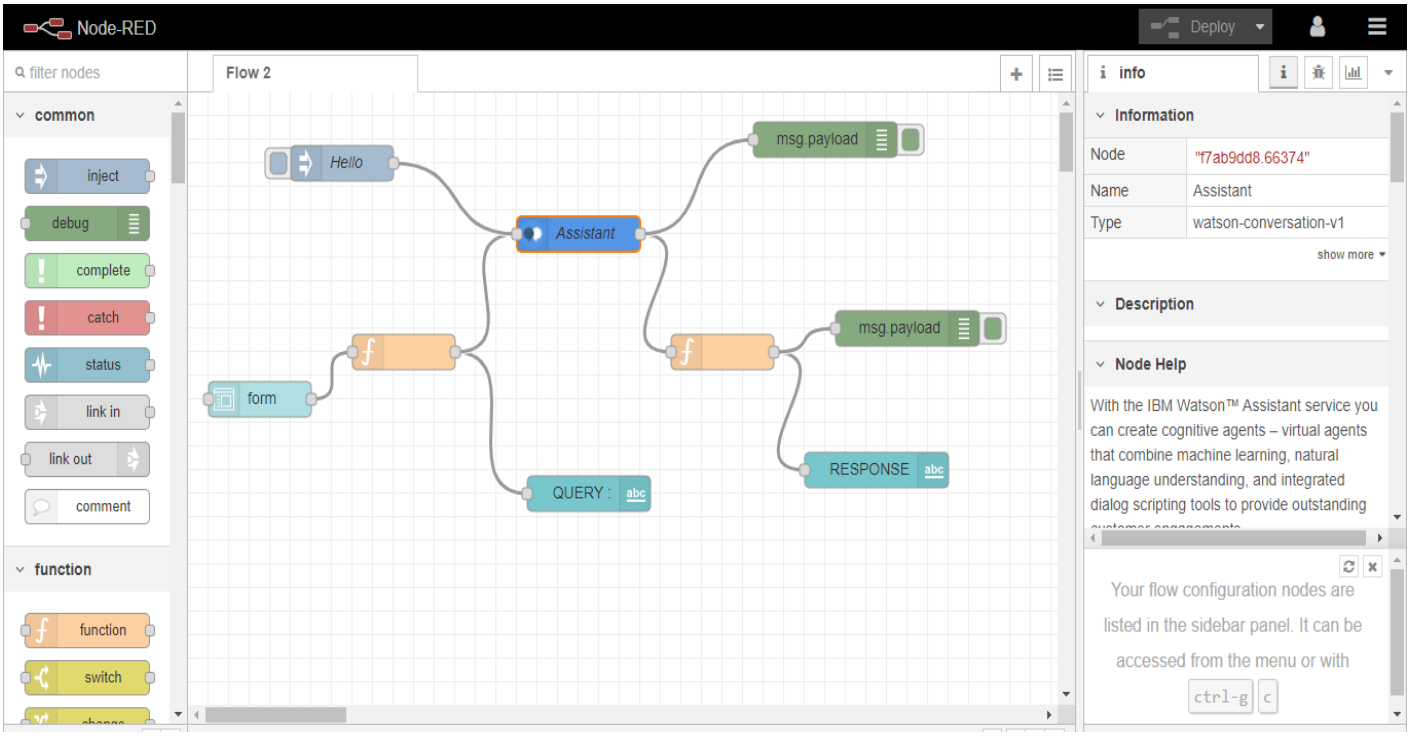


7. Drag **Assistant** node. Double click on it and it will ask credentials like API key, Workspace ID and Service Endpoint which you will get from Watson Assistant service page. Get the details and enter them and click on Done.

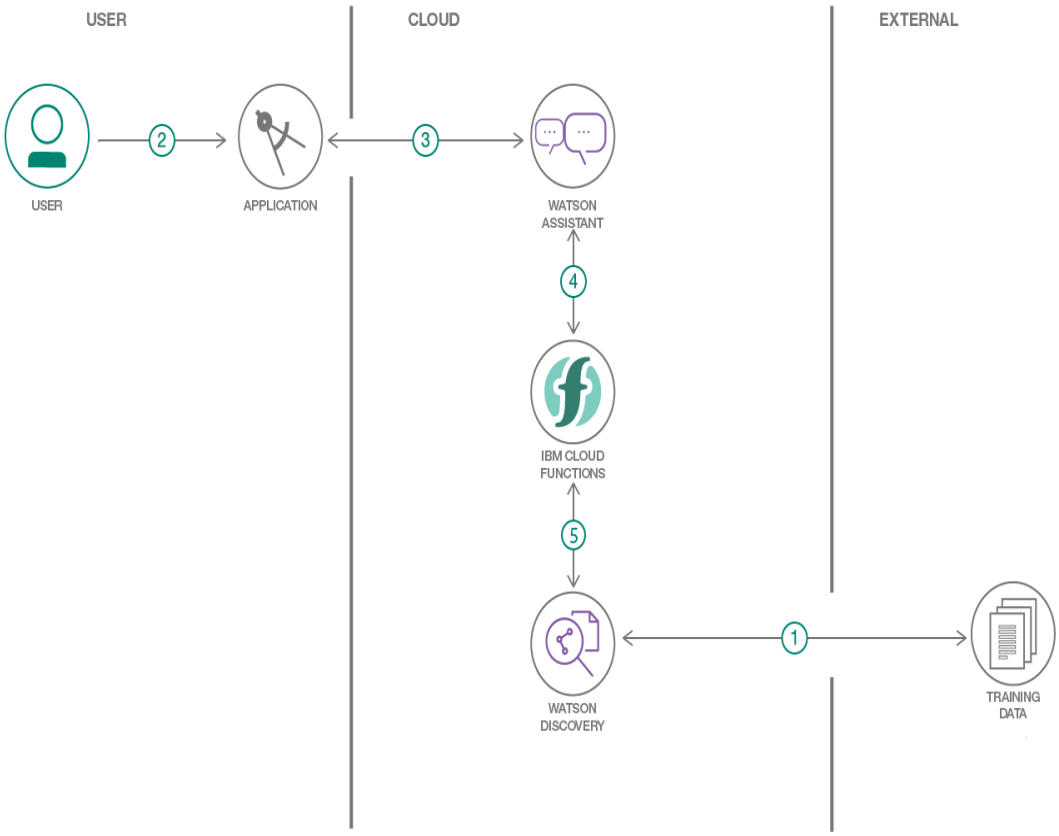




8. Connect the form node to input of function node 1 and its output to input of Assistant node. Connect output of function node 1 to "Query" text node. Connect the output of Assistant node to input of function node 2 and its output to "Response" text node.
9. Click on Deploy.



FLOWCHART



The flow summarizes the functionality of the Chatbot.

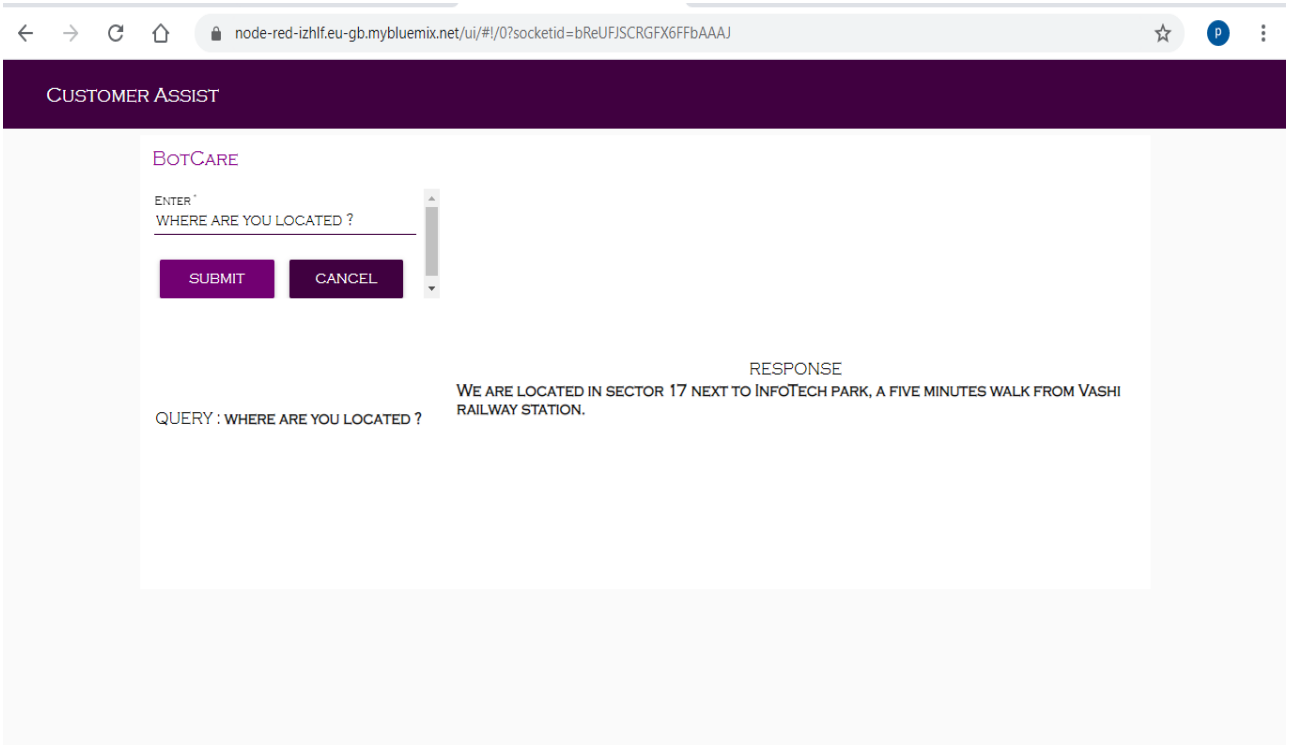
The document preloaded in Discovery is being annotated by Smart Document Understanding feature. This trains the Discovery to improve the query result. The user inetracts with frontend ui of the chatbot and it keeps them engaged in conversation with small talk. This interaction between the user and the UI is being coordinated by Watson Assistant.

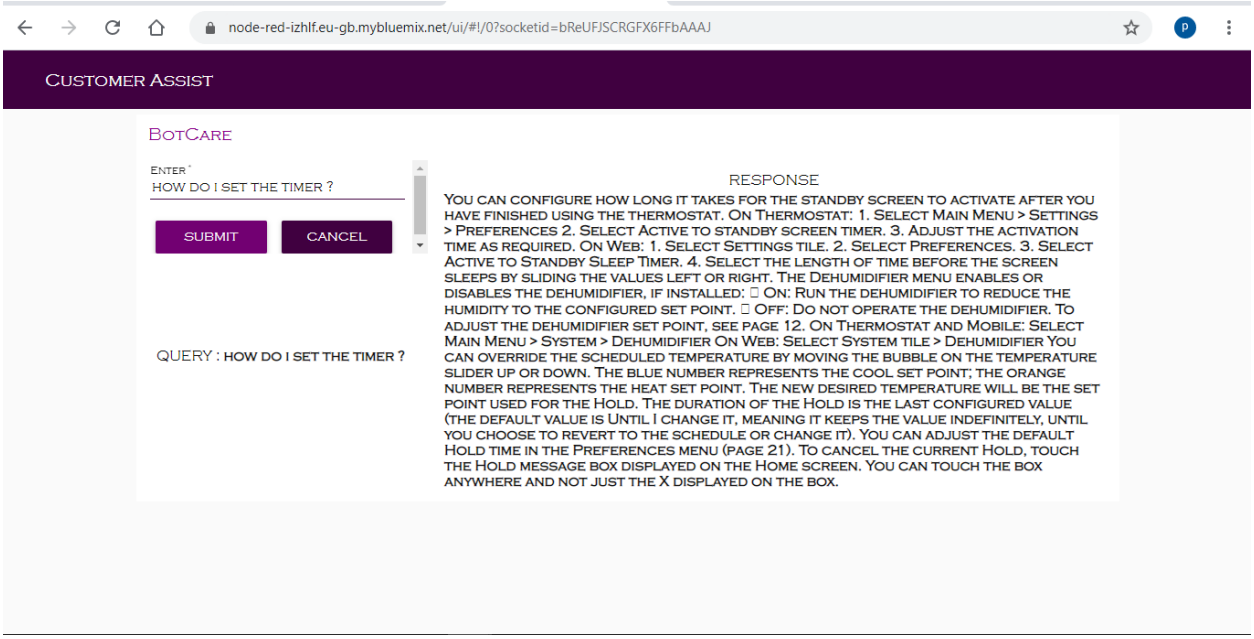
When user asks a technical query, the Assistant invokes the Cloud Function action. This action then queries Watson Discovery and returns with relevant result from the pre-loaded owner's manual.

Watson Assistant, Discovery and Cloud Functions are IBM services. The Training Data is the owner's manual which is external section. The user and applications comes under User section because the application is accessed by the user.

RESULT

After deploying the flow in Node-Red, open the UI by typing https://node-red-izhlf.eu-gb.mybluemix.net/ui in the browser. You will see the Help Desk created. The layout of the page can also be customized.





ADVANTAGES / DISADVANTAGES

Advantages

- They are available 24/7 which maintain continous communication between the customer and the seller.
- An operator can concentrate on one customer at a time. A chatbot can however, answer thousands of questions at the same time.
- This reduces the cost of manpower.
- Actions like changing or querying records are almost instantaneous for bots which can significantly improve customer experience.
- Since bots are on digital platforms where people spend majority of their time, bots can be used to automate common tasks such as providing adavanced search functionality.

Disadvantages

- Chatbots are installed in the aim of getting fast response and improving customer interaction. However, due to limited availability of data and the time needed for self updation, the process can be slow and costly.
- For better outcome, more complex designing is required and need of skilled developers.
- At times they can mislead customer if the query doesn't match with the pre loaded dialog. Bots get confused and respond with same answer for different questions. This leads to frustrated customers.
- Unlike humans, each bot needs to be programmed differently for each business, which increases the initial installation cost.

APPLICATIONS

Integration of chatbots with social media platforms like Facebook Messenger, LINE, WeChat, and WhatsApp make it easier for businesses to provide 24/7 customer service to the user.

- For travel industry, such customer service chatbot proved to be a boon. Apart from benefit of booking and scheduling flights, they help to integrate additional services via social media platforms. Services like Airbnb, Uber can be integrated for enhancement of customer experience.
- One of the most useful application of these bots is in healthcare department. An average patient spends 30 minutes trying to get to the right service in a local hospital. But deploying conversational chatbots in the healthcare sector can significantly reduce long waits. From registration to coverage and claims, chatbots are in popular demand in this industry.
- The use of chatbots in any appliance website is a very common thing today. Earlier, chatbots would tranfer any function related query onto an agent. But with growing technology, that is also eliminated. The bot will the give accurate result without any human interaction.

CONCLUSION

In conclusion, we have created a chatbot which not only engage the customer with small talk but will also provide user with accurate and smart solution. The response will be fast and customer will be satisfied with the service.
By integrating all the above mentioned services, a smarter and efficiently working Customer Help Desk has been developed.

FUTURE SCOPE

While most businesses will have chatbot for customer services, many will develop bots for their internal processing.
One such thing will be Bots handling first stage interviews to find promsing candidates. The bots can process resumes to find highly qualified candidates and fasten the otherwise slow recruiting process and managing cost.
Customer service is increasingly an automated one. Many companies are adopting AI tools to build a better way of handling and expanding the service.
Chatbots have a long way to go to realize their full potential. Still, the chatbots will ultimately generate significant future value in both corporate and customer settings.

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APPENDIX

A. ***Source Code***

Code to invoke action :

```
/**
 *
 * @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);
  });
 });
}
```

Code for Watson Assistant :

https://github.com/SmartPracticeschool/llSPS-INT-619-Intelligent-Customer-Help-Desk-with-Smart-Document-Understanding/blob/master/WATSON-ASSISTANT/skill-My-first-skill.json