Chatbot Development:

CareerBud

DSA_202101_ 25:

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1. Introduction:

For many people, looking for a job may be an intimidating and difficult process. Frequently, it entails sifting through a plethora of job advertisements, customizing resumes and cover letters, going to interviews, and embracing the possibility of being rejected. Feelings of irritation, fear, and self-doubt might arise from the emotionally exhausting nature of the trip. To make matters worse, there are many competent applicants fighting for a small number of positions, making the labor market very competitive. The job search process is also made more difficult by elements including industry developments, personal situations, and economic conditions. Job searchers show perseverance, adaptability, and persistence in the face of these obstacles as they search for fulfilling work options that fit their interests, talents, and career goals.

Our goal is to provide a ray of efficiency and optimism among the complications of job searching with our Chatbot Job Recommender. Acknowledging the difficulties encountered by prospective employees and employers alike, we aim to create a job recommender chatbot. Our goal is to develop a dynamic conversational interface that allows users to streamline the job search process. As a customized helper, our chatbot leads users with precision and simplicity through a web of job possibilities.

The report is divided into the following sections:

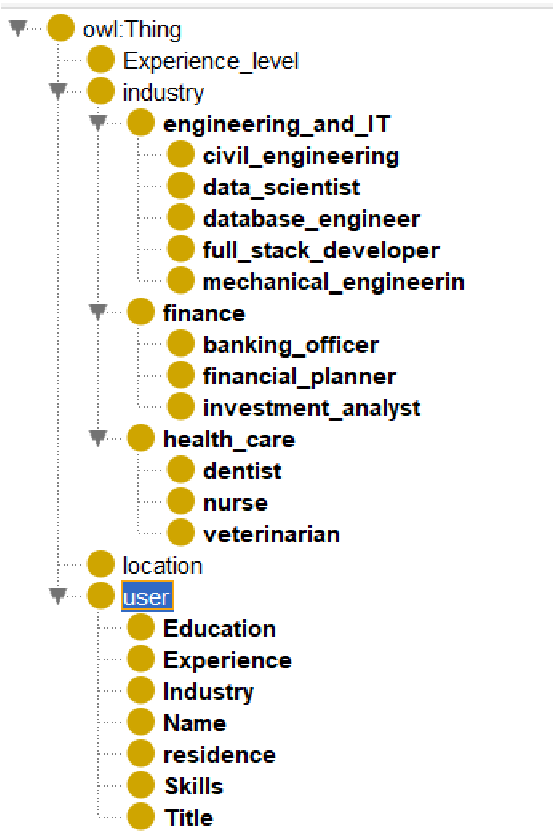
- Ontology development
- Chatbot Development
- Chatbot Implementation
- Challenges and Weaknesses

2. Ontology Development

A key component in guaranteeing the efficacy and precision of our job recommender chatbot is the creation of its ontology. It is a formal explicit description of classes in a domain of discourse, properties of each class describing various features and attributes of the class - slots (sometimes called roles or properties)), and restrictions on slots - facets (sometimes called role restrictions)). By carefully classifying and categorizing job positions, abilities, credentials, and other pertinent characteristics, we build an organized knowledge framework that serves as the basis for our chatbot's intelligence. Through the establishment of hierarchies and the definition of links between entities, we empower the chatbot to comprehend the nuances of the employment market.

2.1. Class

Classes are the focus of most ontologies. Classes describe concepts in the domain. A class can have subclasses that represent concepts that are more specific than the superclass.



We have four main classes in our job recommendation system: - **Experience_level, industry, location and user.**

1. **Experience_level** is connected to each subclass of engineering_and_it, finance, and health_care to consider work experience as search criteria and it has three instances:
    a. entry level
    b. intermediate
    c. senior
2. **Industry** is divided into three subclasses: engineering_and_it, finance, and healthcare.
    a. engineering_and_it - It is further divided into five subclasses:
        i. civil_engineering
        ii. data_scientist
        iii. database_engineer
        iv. full_stack_developer

        v. mechanical_engineer

    b. finance - it - It is further divided into three subclasses:

        i. banking officer

        ii. financial_planner

        iii. investment_analyst

    c. health_care - It is further divided into three subclasses:

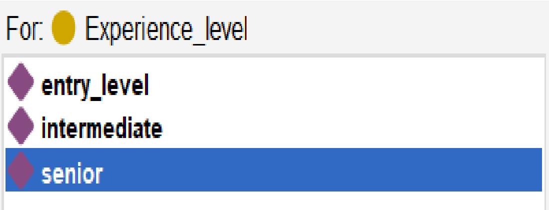
        i. dentist

        ii. nurse

        iii. veterinarian

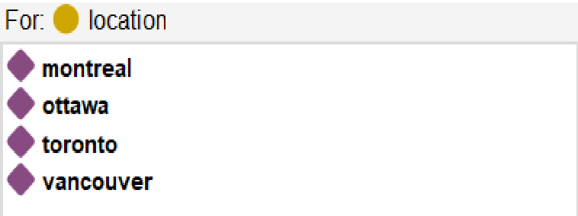
3. **location** is connected to engineering_and_it, finance, and health_care to help the user find jobs in a specific location and it has four instances:
    a. Montreal
    b. Ottawa
    c. Toronto
    d. Vancouver
4. **user** is divided into seven subclasses:
    a. Education - is a string
    b. Experience - related to class ‘Experience_level’ as hasExperience
    c. Industry - related to class as preferredIndustry
    d. Name
    e. Residence - related to class ‘location’ as preferredLocation
    f. Skills - is a string
    g. Title - It is connected to engineering_and_it, finance, and health_care to help the user find his desired position.

Experience_level and location are categorized into the following instances shown in the diagram below



For: ● Experience_level

◆ entry_level
◆ intermediate
◆ senior



For: ● location

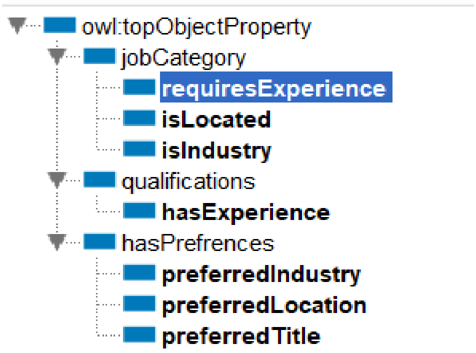
◆ montreal
◆ ottawa
◆ toronto
◆ vancouver

For simplicity purposes we have restricted the location to having only 4 values.

2.2. Data and Object Properties

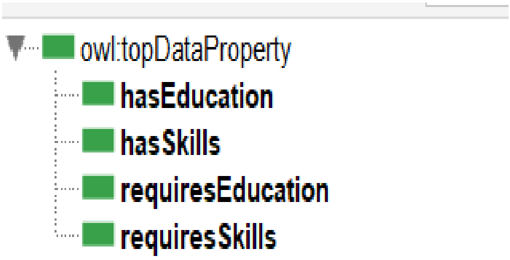
The development of object and data properties involves establishing connections between individual instances of classes within an ontology.

Object Properties



Object properties delineate relationships between different entities, facilitating the representation of intricate connections and enhancing querying and inference capabilities. In the provided diagram, object properties depict relationships between users, industries, experience levels, and locations. For instance, "preferredIndustry" and "preferredTitle" establish associations between users and their preferred industry or job title, "hasExperience" relates users to their experience levels, and "preferredLocation" links users to their desired locations. Similarly, "isLocated" and "requiresExperience" connect each job to its respective location and experience level requirements.

Data properties



Data properties, on the other hand, furnish classes with attributes, such as "hasEducation" and "hasSkills," which capture information about a user's educational background and skills. Conversely, "requiresEducation" and "requiresSkills" provide details about the educational and skill prerequisites for each job.

This systematic approach delineates relationships between user subclasses and class entities, encompassing the following 6 properties:

1. Preferred industry
2. Preferred job title
3. Preferred location
4. User's education
5. User's skills
6. User's experience level

The job properties defining relationship with class entities include the following:

1. requiresExperience
2. isLocated
3. isIndustry
4. requiresEducation
5. requiresSkills

The following figures shows the complete schematic view between each entity interacts with other:

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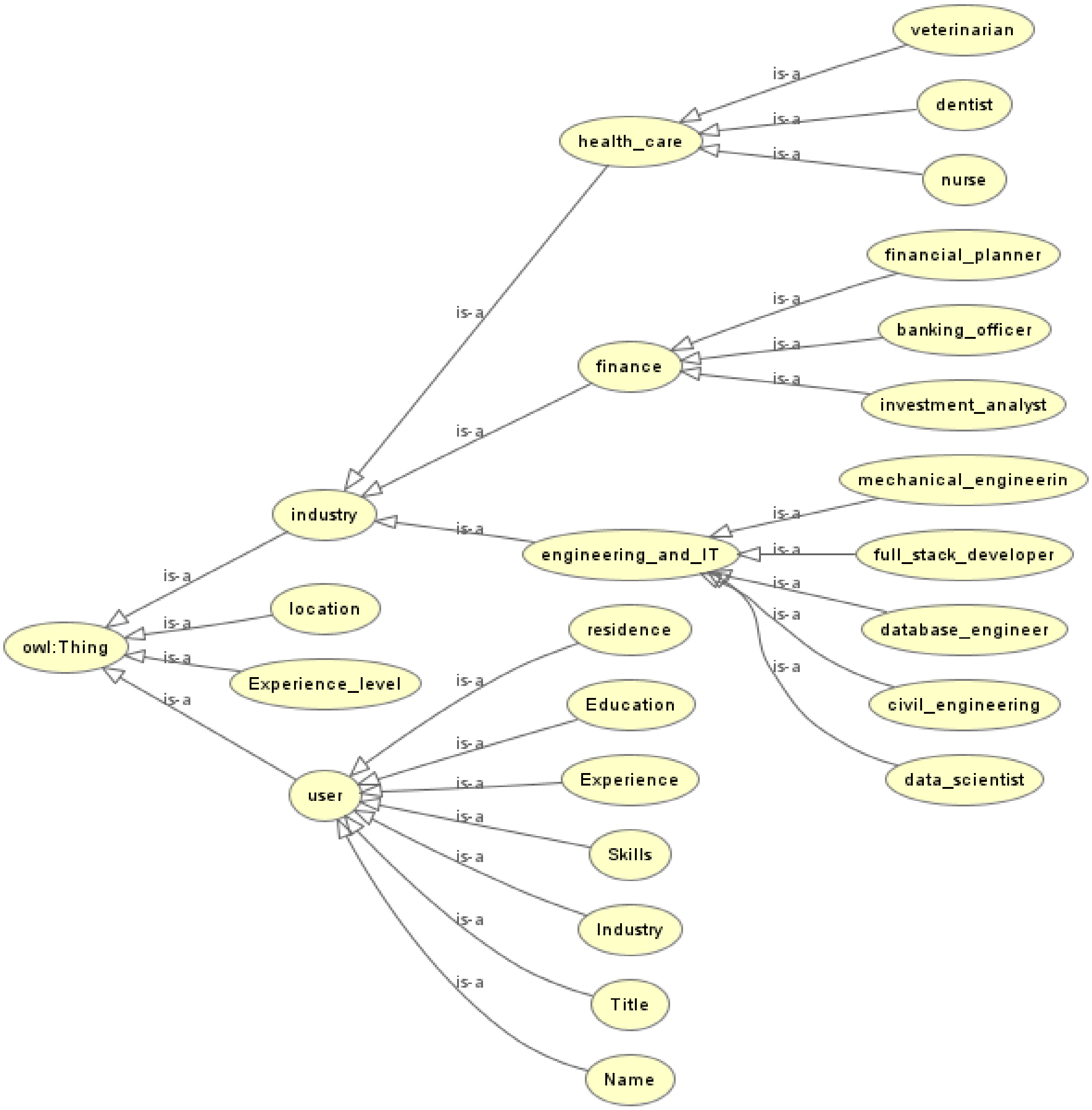
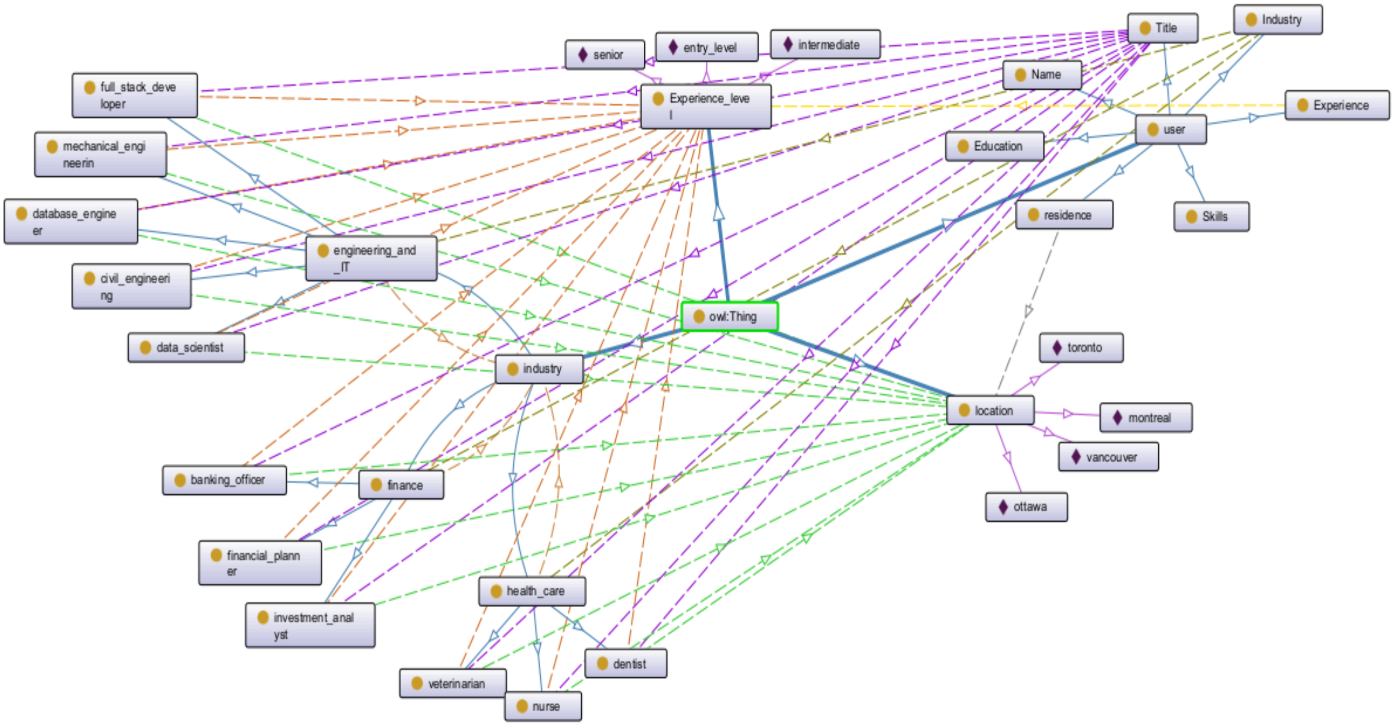
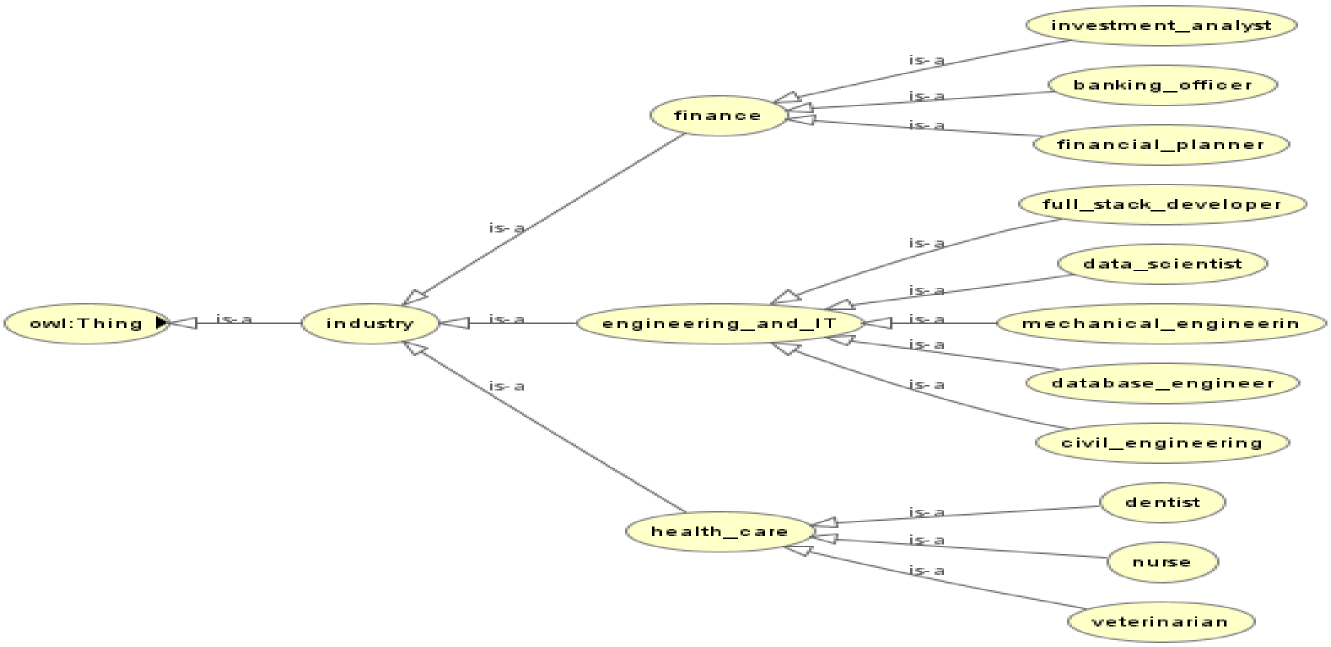
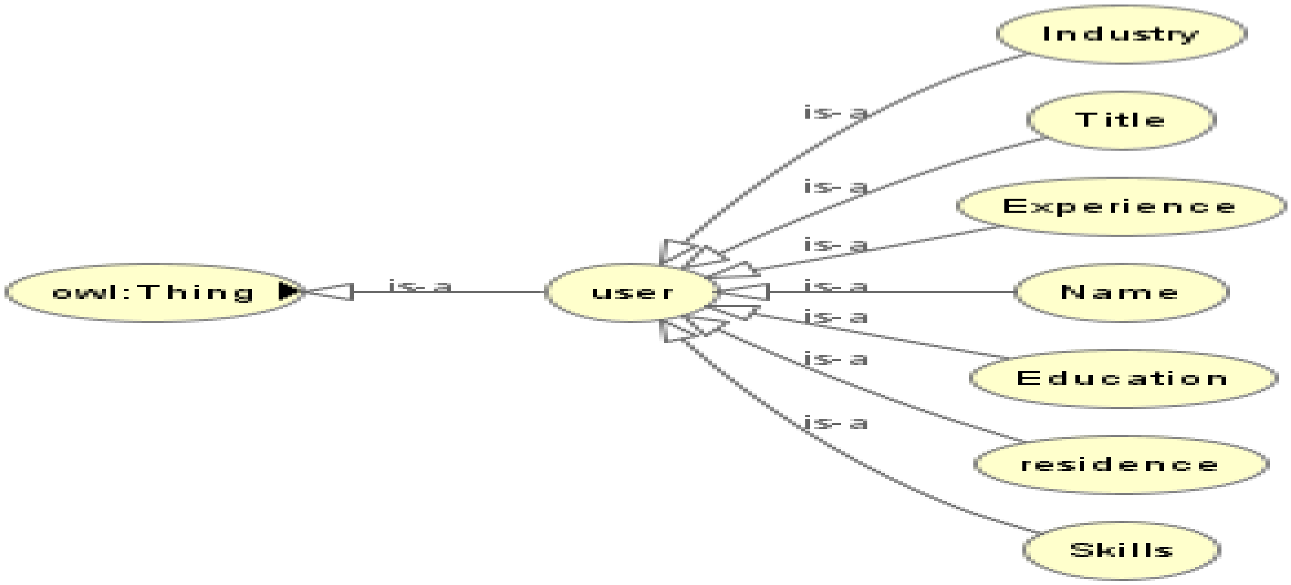




The following diagrams shows a graphical representation with its subclasses



Industry class with its subclasses



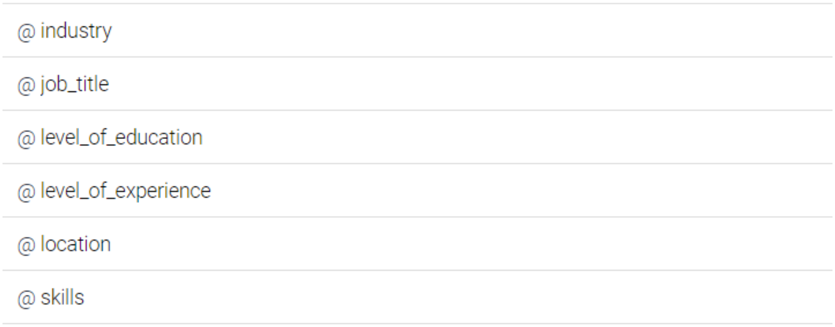
User class with its subclasses

3. Chatbot Development

Our chatbot's main goal is to tailor job recommendations to users by gathering information such as their industry preference, job title preference, location preference, education level, skills, and experience level. This personalized approach ensures that our chatbot recommends relevant job postings to the users which align with their preferences and qualifications. To bring this vision to life, we used Google Dialogflow Essentials. It allowed us to design entities that extract key details from user inputs and intents that guide our chatbot's actions and responses. Below, we offer a detailed breakdown of our chatbot's entity and intent design.

3.1. Entity Design

Entities in Google Dialogflow represent concepts or categories of user input. They are used to extract specific information from user messages. For the chatbot job recommender, we designed the entities to capture the user's industry preference, job title preference, location preference, education level, skills, and experience level.



@ industry

@ job_title

@ level_of_education

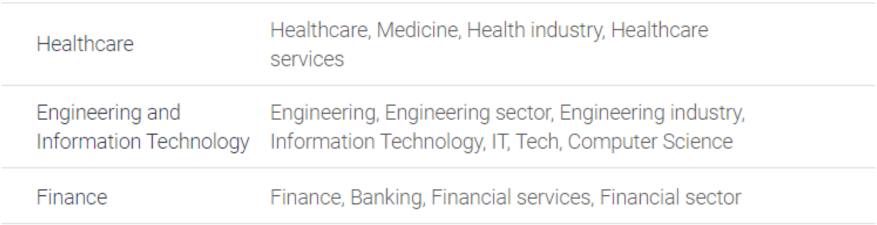
@ level_of_experience

@ location

@ skills

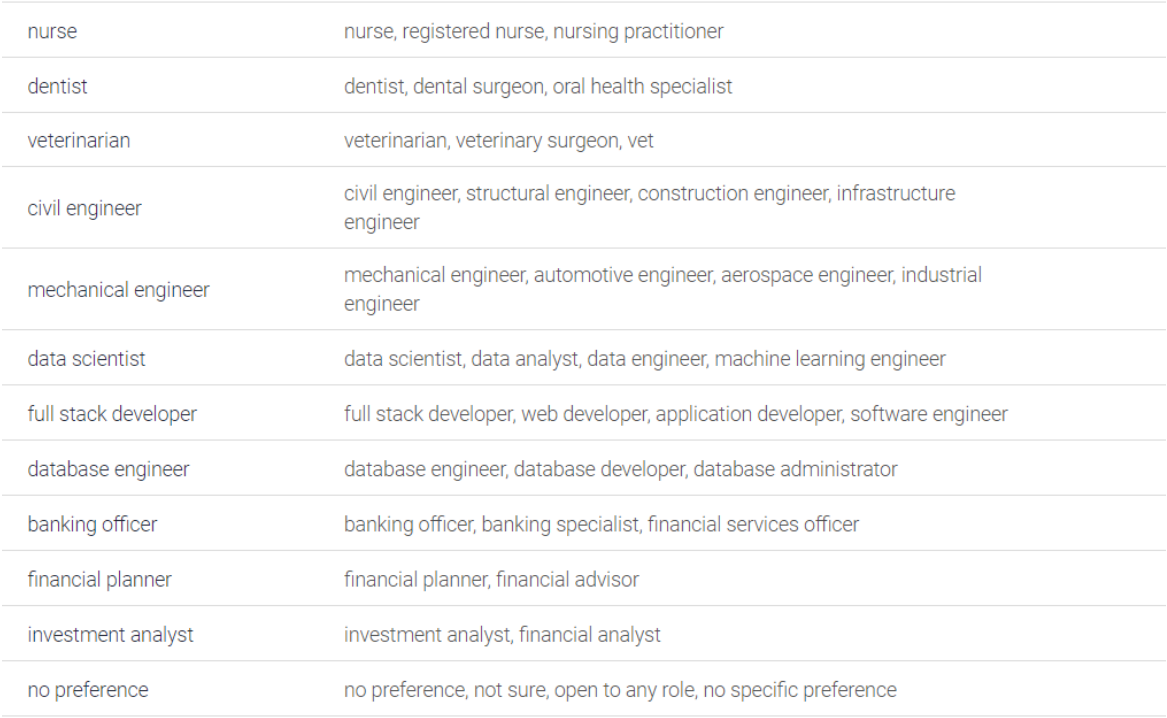
For each entity, we defined several reference values, which are a standard set of terms that the chatbot recognizes, along with synonyms for each reference value, which account for variations in how users may express the same concept. This approach improves the chatbot's ability to accurately understand and interpret user input. In what follows, we list the entities we designed along with the reference values and synonyms we defined for each:

- **@ industry:**



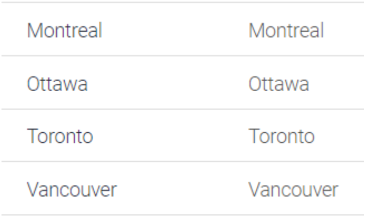
Healthcare	Healthcare, Medicine, Health industry, Healthcare services
Engineering and Information Technology	Engineering, Engineering sector, Engineering industry, Information Technology, IT, Tech, Computer Science
Finance	Finance, Banking, Financial services, Financial sector

- **@ job_title:**



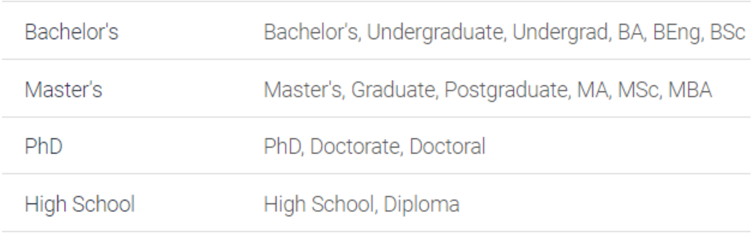
nurse	nurse, registered nurse, nursing practitioner
dentist	dentist, dental surgeon, oral health specialist
veterinarian	veterinarian, veterinary surgeon, vet
civil engineer	civil engineer, structural engineer, construction engineer, infrastructure engineer
mechanical engineer	mechanical engineer, automotive engineer, aerospace engineer, industrial engineer
data scientist	data scientist, data analyst, data engineer, machine learning engineer
full stack developer	full stack developer, web developer, application developer, software engineer
database engineer	database engineer, database developer, database administrator
banking officer	banking officer, banking specialist, financial services officer
financial planner	financial planner, financial advisor
investment analyst	investment analyst, financial analyst
no preference	no preference, not sure, open to any role, no specific preference

- **@ location:**



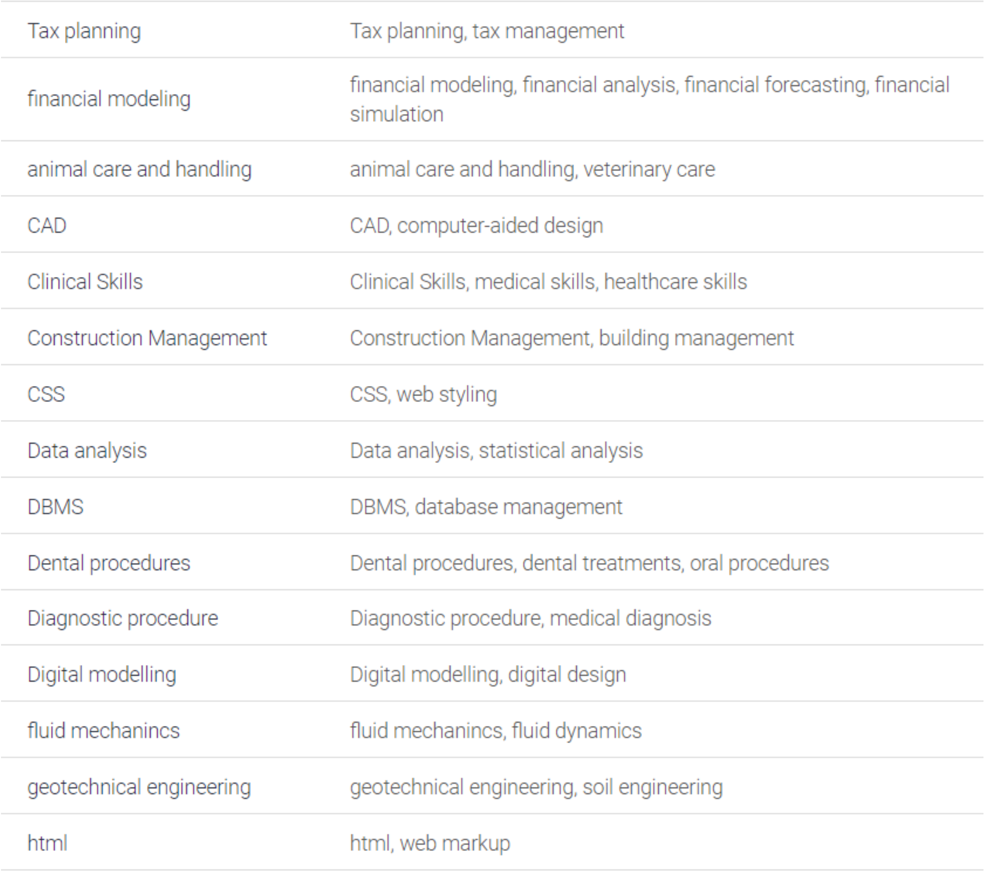
Montreal	Montreal
Ottawa	Ottawa
Toronto	Toronto
Vancouver	Vancouver

- **@ level_of_education:**

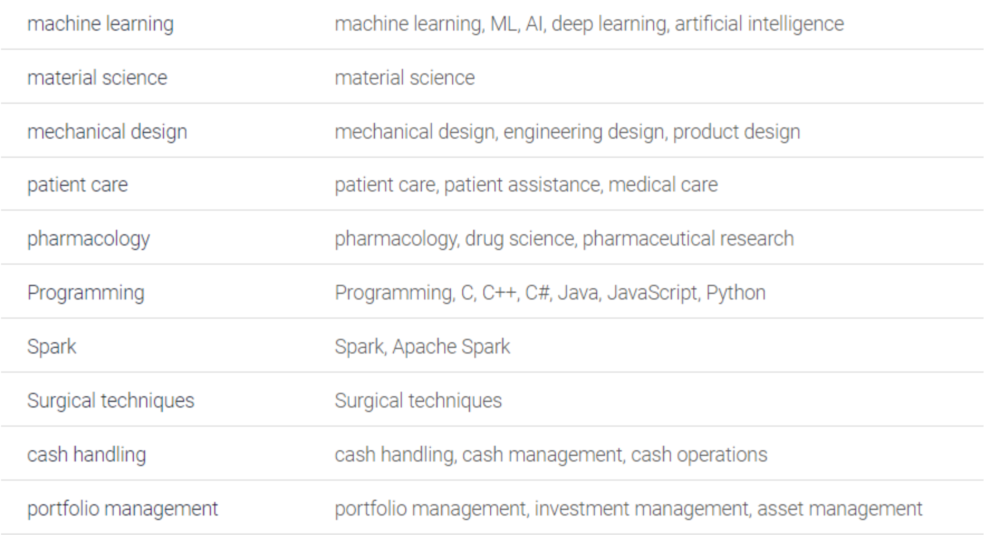


Bachelor's	Bachelor's, Undergraduate, Undergrad, BA, BEng, BSc
Master's	Master's, Graduate, Postgraduate, MA, MSc, MBA
PhD	PhD, Doctorate, Doctoral
High School	High School, Diploma

- **@ skills:**

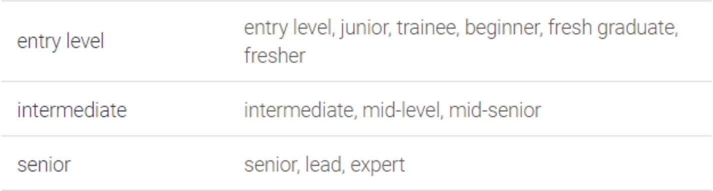


Tax planning	Tax planning, tax management
financial modeling	financial modeling, financial analysis, financial forecasting, financial simulation
animal care and handling	animal care and handling, veterinary care
CAD	CAD, computer-aided design
Clinical Skills	Clinical Skills, medical skills, healthcare skills
Construction Management	Construction Management, building management
CSS	CSS, web styling
Data analysis	Data analysis, statistical analysis
DBMS	DBMS, database management
Dental procedures	Dental procedures, dental treatments, oral procedures
Diagnostic procedure	Diagnostic procedure, medical diagnosis
Digital modelling	Digital modelling, digital design
fluid mechanincs	fluid mechanincs, fluid dynamics
geotechnical engineering	geotechnical engineering, soil engineering
html	html, web markup



machine learning	machine learning, ML, AI, deep learning, artificial intelligence
material science	material science
mechanical design	mechanical design, engineering design, product design
patient care	patient care, patient assistance, medical care
pharmacology	pharmacology, drug science, pharmaceutical research
Programming	Programming, C, C++, C#, Java, JavaScript, Python
Spark	Spark, Apache Spark
Surgical techniques	Surgical techniques
cash handling	cash handling, cash management, cash operations
portfolio management	portfolio management, investment management, asset management

- **@ level_of_experience:**



entry level	entry level, junior, trainee, beginner, fresh graduate, fresher
intermediate	intermediate, mid-level, mid-senior
senior	senior, lead, expert

3.2. Intent Design

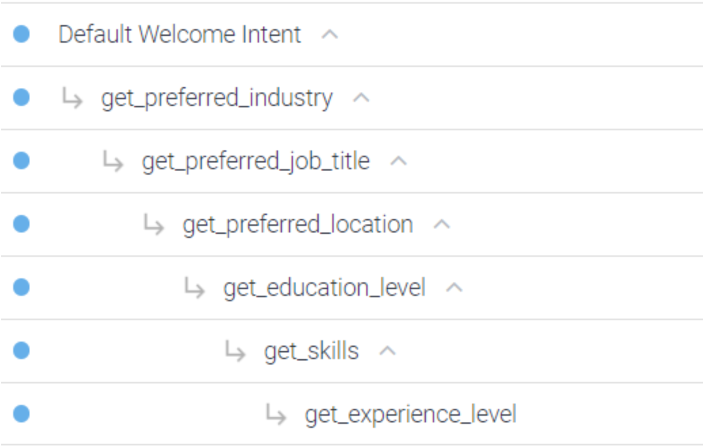
Intents in Google Dialogflow are mappings between what a user says and what actions should be taken by the chatbot. Essentially, it's a way to define how the chatbot should respond to different user inputs or queries. The key components of an intent are the following:

- **Training Phrases:** These are examples of what users might say to trigger the intent. Dialogflow uses these training phrases to understand the variations of how users might express the same request.
- **Action:** An action is a string that identifies the intent's purpose. It's typically used to trigger a specific action in the backend system or fulfillment logic.
- **Parameters:** Parameters are pieces of information extracted from the user's input that are relevant to the intent. For example, if the intent is to get the user's industry preference, the parameter would be the industry entity.
- **Responses:** These are the messages that the chatbot sends back to the user when the intent is triggered. Responses can act as triggers to other intents.
- **Fulfillment:** Fulfillment is the logic that you implement to handle the intent's action. It could involve querying a database, calling an API, or performing any other necessary task to provide a meaningful response to the user.

To design intents and their training phrases and responses, the Competency Questions approach can be used. In this approach, competency questions, i.e. different questions that the user might ask, would be defined, and an intent would be triggered for each competency question. The training phrases of each intent would be different ways the user might ask the competency question, and the responses of each intent would be the agent's response to the specific competency question.

However, in our case, the user won't be asking questions. The chatbot does the question-asking to gather information from the user, and the user will be responding with the required information. Therefore, in our case, we have Competency Statements instead of Questions, and they are the user's responses which consist of one of the following: industry preference, job title preference, location preference, education level, skills, and experience level. Thus, each competency statement consists of a different piece of information, and an intent would be triggered for each competency statement. While it may not be framed as a question, the underlying goal remains similar—to trigger a certain action by the chatbot, i.e. gathering a certain piece of information from the user. The responses for each triggered intent will be questions that prompt the user to provide more information relevant to their preferences and qualifications. In this manner, the chatbot collects all relevant information from the users to generate tailored job recommendations.

For our chatbot, we used the Default Welcome Intent and designed get_preferred_industry, get_preferred_job_title, get_preferred_location, get_education_level, get_skills, and get_experience_level to gather the user's industry preference, job title preference, location preference, education level, skills, and experience level respectively. It is important to note that we used a hierarchy structure in building our intents. In other words, get_preferred_industry intent is a follow-up intent of Default Welcome Intent, get_preferred_job_title intent is a follow-up intent of get_preferred_industry intent, get_preferred_location_intent is a follow up of get_preferred_job_title intent, and so on. This hierarchical structure helps in maintaining a logical flow of conversation. It guides the users through a step-by-step process, making it easier for them to provide necessary information without feeling overwhelmed.



● Default Welcome Intent ^

● ↳ get_preferred_industry ^

● ↳ get_preferred_job_title ^

● ↳ get_preferred_location ^

● ↳ get_education_level ^

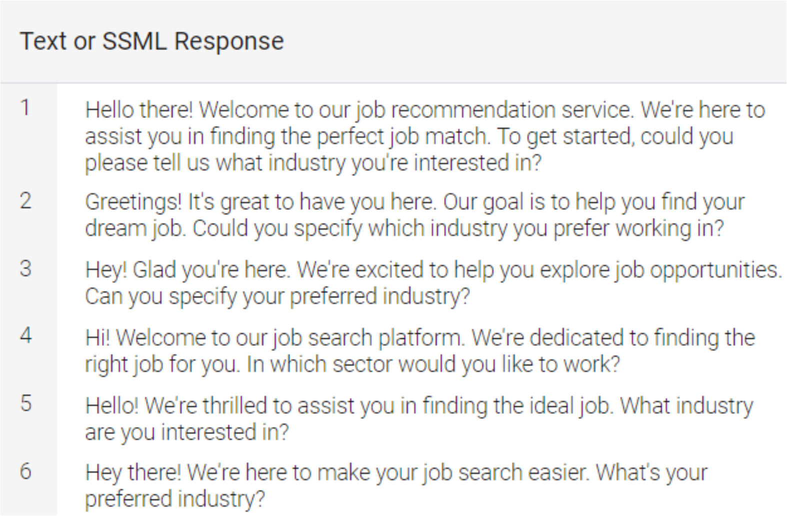
● ↳ get_skills ^

● ↳ get_experience_level

In what follows, we will delve deeper into each intent, its corresponding competency statement, its training phrases, its actions and parameters, and its responses.

3.2.1. Default Welcome Intent

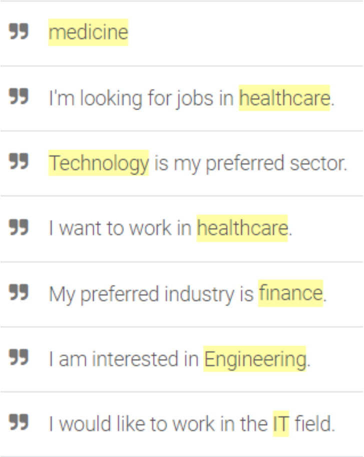
This intent is predefined by Dialogflow. It is triggered when the user says hi, hello, etc. We used its predefined training phrases and modified its responses so that they trigger the following get_preferred_industry intent. In other words, we modified the chatbot responses so that it replies by saluting the user, introducing itself, and asking the user about his preferred industry to begin with. The following are the modified responses:



	Text or SSML Response
1	Hello there! Welcome to our job recommendation service. We're here to assist you in finding the perfect job match. To get started, could you please tell us what industry you're interested in?
2	Greetings! It's great to have you here. Our goal is to help you find your dream job. Could you specify which industry you prefer working in?
3	Hey! Glad you're here. We're excited to help you explore job opportunities. Can you specify your preferred industry?
4	Hi! Welcome to our job search platform. We're dedicated to finding the right job for you. In which sector would you like to work?
5	Hello! We're thrilled to assist you in finding the ideal job. What industry are you interested in?
6	Hey there! We're here to make your job search easier. What's your preferred industry?

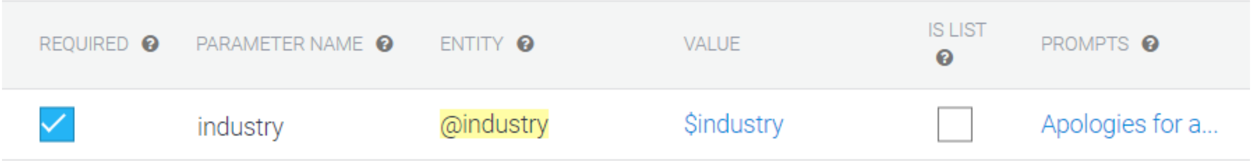
3.2.2. get_preferred_industry intent

- **Corresponding Competency Statement:** This intent is triggered when the user states his preferred industry (as a response to chatbot's question from the parent intent).
- **Training Phrases (Test-Cases):** The user can state his preferred industry in different ways. He can either answer with a short phrase or a full sentence:



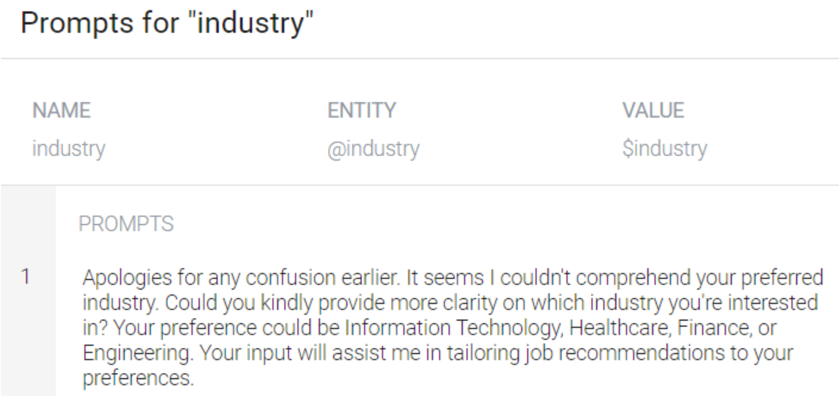
- medicine
- I'm looking for jobs in healthcare.
- Technology is my preferred sector.
- I want to work in healthcare.
- My preferred industry is finance.
- I am interested in Engineering.
- I would like to work in the IT field.

- **Action and parameters:** As we can see in the training phrases, Dialogflow is able to detect values of the @industry entity (highlighted) in the user's statement. Consequently, it automatically adds the industry parameter to the parameter table. This parameter is required, i.e. intent can't be complete if the user doesn't provide this parameter, so we indicated that in the table:



REQUIRED	PARAMETER NAME	ENTITY	VALUE	IS LIST	PROMPTS
☑	industry	@industry	$industry	□	Apologies for a...

We added a prompt, i.e. a question that the chatbot will ask the user if it was not able to detect the required parameter (industry) in his statement:



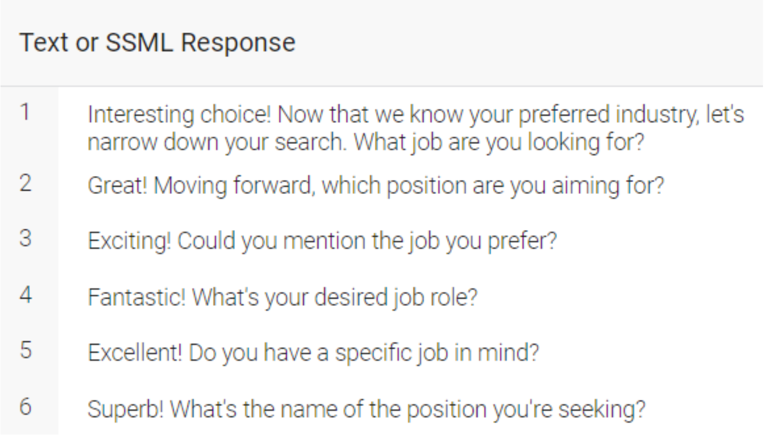
Prompts for "industry"

NAME	ENTITY	VALUE
industry	@industry	$industry

PROMPTS

1 Apologies for any confusion earlier. It seems I couldn't comprehend your preferred industry. Could you kindly provide more clarity on which industry you're interested in? Your preference could be Information Technology, Healthcare, Finance, or Engineering. Your input will assist me in tailoring job recommendations to your preferences.

- **Responses:** We designed the responses in such a way that they trigger the following get_preferred_job_title intent. In other words, we designed the chatbot responses so that it asks the user about his preferred job title:



Text or SSML Response

1 Interesting choice! Now that we know your preferred industry, let's narrow down your search. What job are you looking for?

2 Great! Moving forward, which position are you aiming for?

3 Exciting! Could you mention the job you prefer?

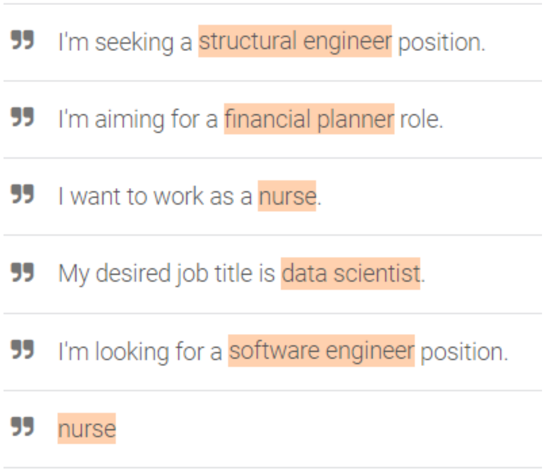
4 Fantastic! What's your desired job role?

5 Excellent! Do you have a specific job in mind?

6 Superb! What's the name of the position you're seeking?

3.2.3. get_preferred_job_title intent

- **Corresponding Competency Statement:** This intent is triggered when the user states his preferred job title (as a response to chatbot's question from the parent intent).
- **Training Phrases (Test-Cases):** The user can state his preferred job title in different ways. He can either answer with a short phrase or a full sentence:



I'm seeking a structural engineer position.

I'm aiming for a financial planner role.

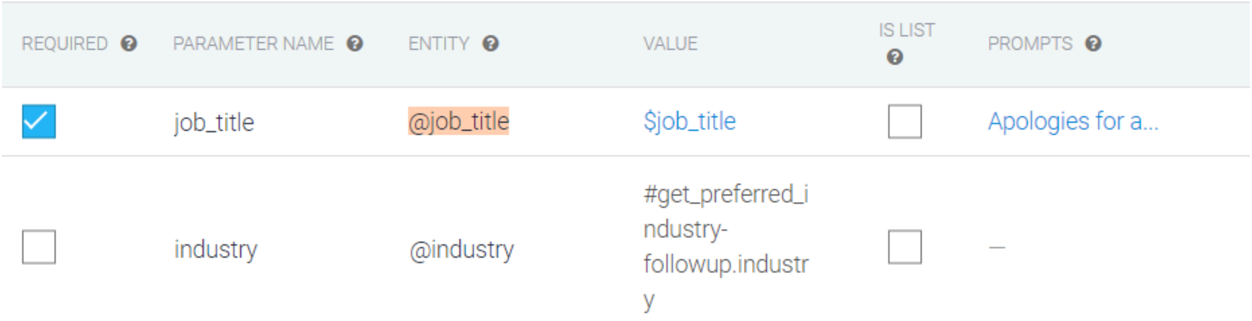
I want to work as a nurse.

My desired job title is data scientist.

I'm looking for a software engineer position.

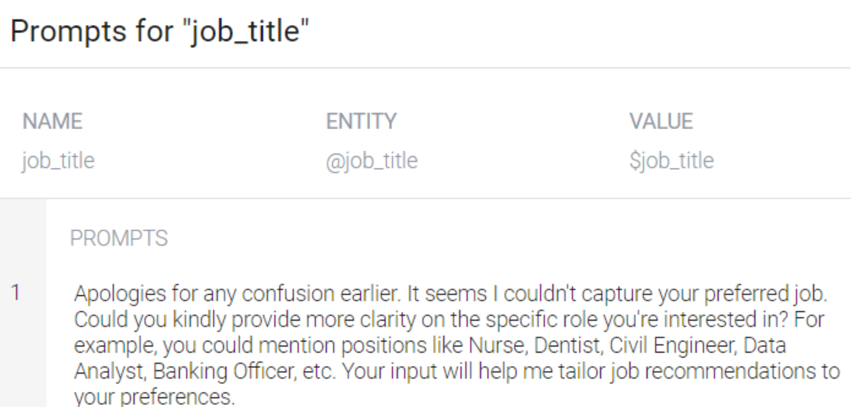
nurse

- **Action and parameters:** As we can see in the training phrases, Dialogflow is able to detect values of the @job_title entity (highlighted) in the user's statement. Consequently, it automatically adds the job_title parameter to the parameter table. This parameter is required, i.e. intent can't be complete if the user doesn't provide this parameter, so we indicated that in the table. Also, we want the chatbot to carry the parameter of its previous parent intent get_preferred_industry, which is industry, to this intent, so we also added it to the table:



REQUIRED	PARAMETER NAME	ENTITY	VALUE	IS LIST	PROMPTS
☑	job_title	@job_title	$job_title	□	Apologies for a...
□	industry	@industry	#get_preferred_industry-followup.industry	□	–

We added a prompt, i.e. a question that the chatbot will ask the user if it was not able to detect the required parameter (job_title) in his statement:



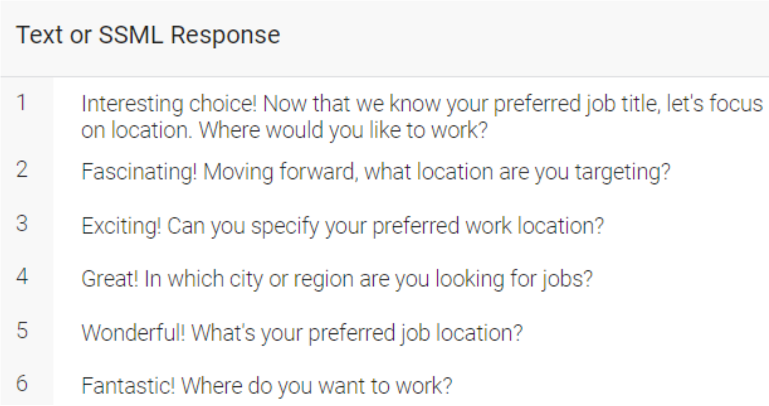
Prompts for "job_title"

NAME	ENTITY	VALUE
job_title	@job_title	$job_title

PROMPTS

1 Apologies for any confusion earlier. It seems I couldn't capture your preferred job. Could you kindly provide more clarity on the specific role you're interested in? For example, you could mention positions like Nurse, Dentist, Civil Engineer, Data Analyst, Banking Officer, etc. Your input will help me tailor job recommendations to your preferences.

- **Responses:** We designed the responses in such a way that they trigger the following get_preferred_location intent. In other words, we designed the chatbot responses so that it asks the user about his preferred location:



Text or SSML Response

1 Interesting choice! Now that we know your preferred job title, let's focus on location. Where would you like to work?

2 Fascinating! Moving forward, what location are you targeting?

3 Exciting! Can you specify your preferred work location?

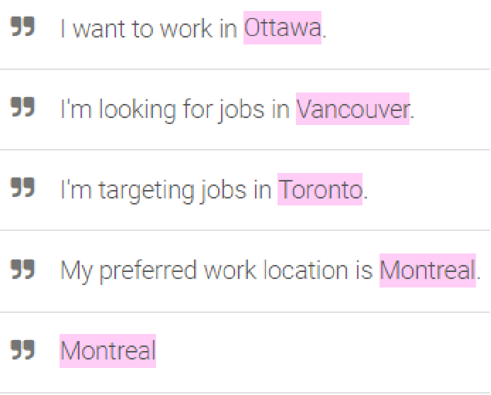
4 Great! In which city or region are you looking for jobs?

5 Wonderful! What's your preferred job location?

6 Fantastic! Where do you want to work?

3.2.4. get_preferred_location intent

- **Corresponding Competency Statement:** This intent is triggered when the user states his preferred location (as a response to chatbot's question from the parent intent).
- **Training Phrases (Test-Cases):** The user can state his preferred location in different ways. He can either answer with a short phrase or a full sentence:



I want to work in Ottawa.

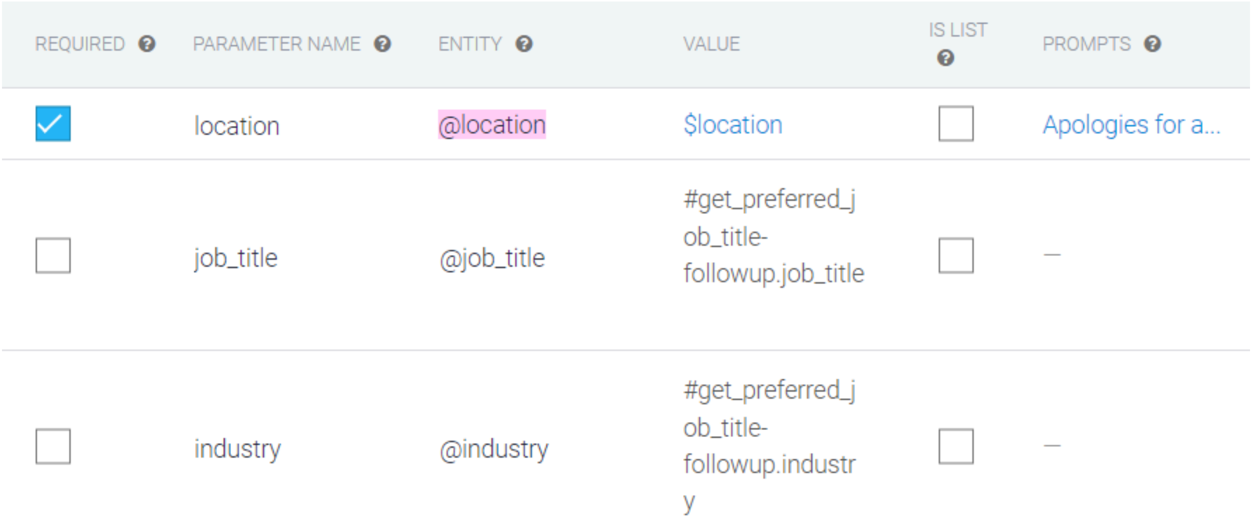
I'm looking for jobs in Vancouver.

I'm targeting jobs in Toronto.

My preferred work location is Montreal.

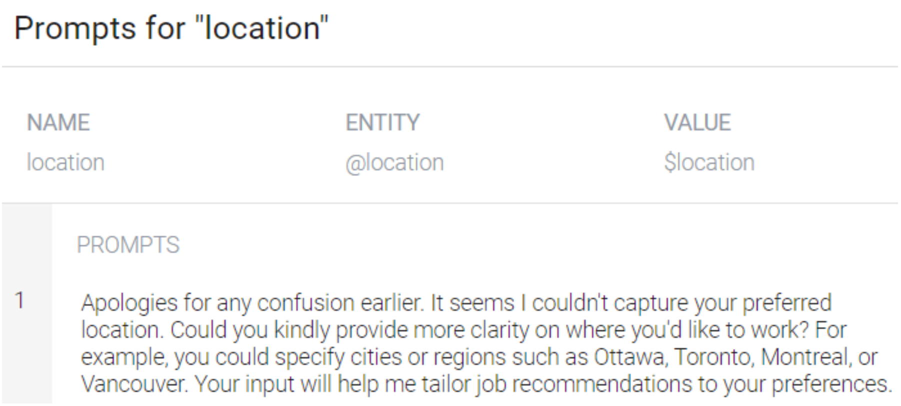
Montreal

- **Action and parameters:** As we can see in the training phrases, Dialogflow is able to detect values of the @location entity (highlighted) in the user's statement. Consequently, it automatically adds the location parameter to the parameter table. This parameter is required, i.e. intent can't be complete if the user doesn't provide this parameter, so we indicated that in the table. Also, we want the chatbot to carry the parameters of its previous parent intent get_preferred_job_title, which are job_title and industry, to this intent, so we also added it to the table:



REQUIRED	PARAMETER NAME	ENTITY	VALUE	IS LIST	PROMPTS
☑	location	@location	$location	□	Apologies for a...
□	job_title	@job_title	#get_preferred_job_title-followup.job_title	□	–
□	industry	@industry	#get_preferred_job_title-followup.industry	□	–

We added a prompt, i.e. a question that the chatbot will ask the user if it was not able to detect the required parameter (location) in his statement:



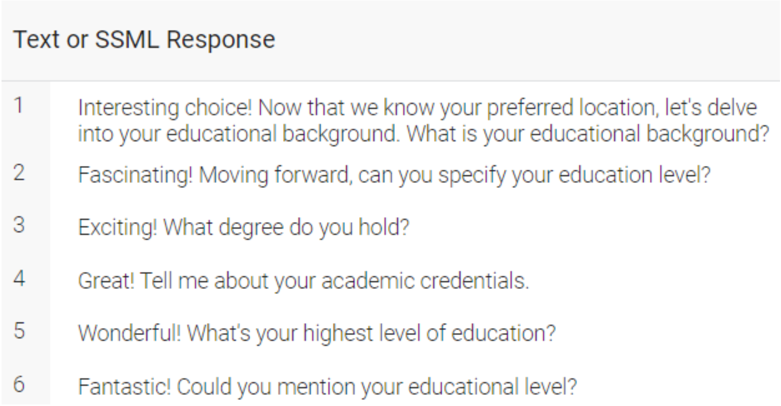
Prompts for "location"

NAME	ENTITY	VALUE
location	@location	$location

PROMPTS

1 Apologies for any confusion earlier. It seems I couldn't capture your preferred location. Could you kindly provide more clarity on where you'd like to work? For example, you could specify cities or regions such as Ottawa, Toronto, Montreal, or Vancouver. Your input will help me tailor job recommendations to your preferences.

- **Responses:** We designed the responses in such a way that they trigger the following get_education_level intent. In other words, we designed the chatbot responses so that it asks the user about his education level:



Text or SSML Response

1 Interesting choice! Now that we know your preferred location, let's delve into your educational background. What is your educational background?

2 Fascinating! Moving forward, can you specify your education level?

3 Exciting! What degree do you hold?

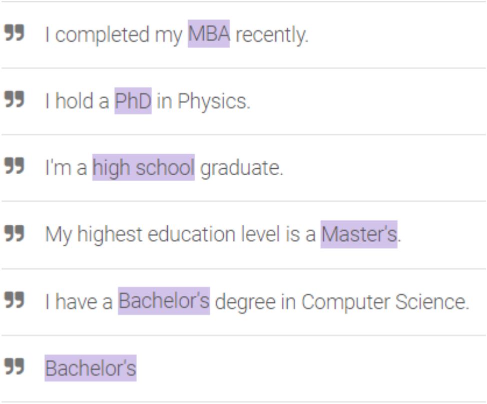
4 Great! Tell me about your academic credentials.

5 Wonderful! What's your highest level of education?

6 Fantastic! Could you mention your educational level?

3.2.5. get_education_level intent

- **Corresponding Competency Statement:** This intent is triggered when the user states his education level (as a response to chatbot's question from the parent intent).
- **Training Phrases (Test-Cases):** The user can state his education level in different ways. He can either answer with a short phrase or a full sentence:



I completed my MBA recently.

I hold a PhD in Physics.

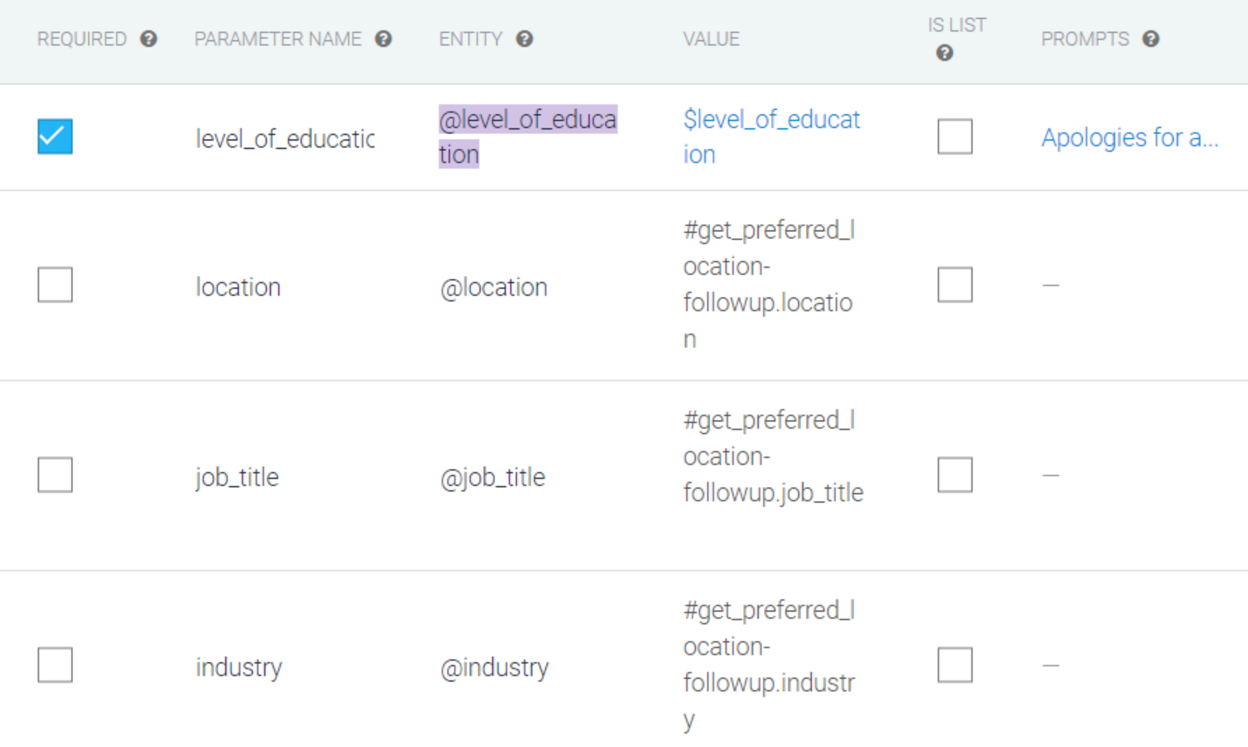
I'm a high school graduate.

My highest education level is a Master's.

I have a Bachelor's degree in Computer Science.

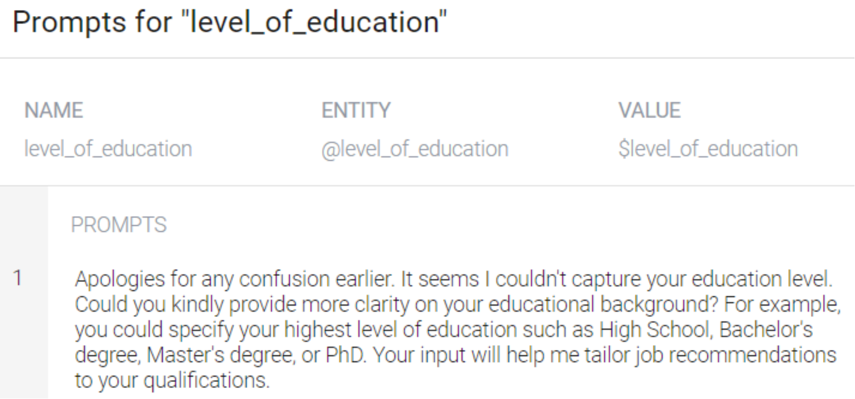
Bachelor's

- **Action and parameters:** As we can see in the training phrases, Dialogflow is able to detect values of the @level_of_education entity (highlighted) in the user's statement. Consequently, it automatically adds the level_of_education parameter to the parameter table. This parameter is required, i.e. intent can't be complete if the user doesn't provide this parameter, so we indicated that in the table. Also, we want the chatbot to carry the parameters of its previous parent intent get_preferred_location, which are location, job_title, and industry, to this intent, so we also added it to the table:



REQUIRED	PARAMETER NAME	ENTITY	VALUE	IS LIST	PROMPTS
☑	level_of_educatic	@level_of_education	$level_of_education	☐	Apologies for a...
☐	location	@location	#get_preferred_location-followup.location	☐	—
☐	job_title	@job_title	#get_preferred_location-followup.job_title	☐	—
☐	industry	@industry	#get_preferred_location-followup.industry	☐	—

We added a prompt, i.e. a question that the chatbot will ask the user if it was not able to detect the required parameter (level_of_education) in his statement:



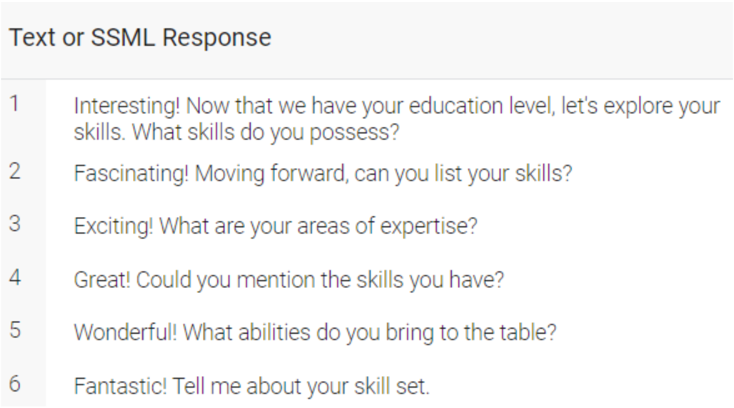
Prompts for "level_of_education"

NAME	ENTITY	VALUE
level_of_education	@level_of_education	$level_of_education

PROMPTS

1 Apologies for any confusion earlier. It seems I couldn't capture your education level. Could you kindly provide more clarity on your educational background? For example, you could specify your highest level of education such as High School, Bachelor's degree, Master's degree, or PhD. Your input will help me tailor job recommendations to your qualifications.

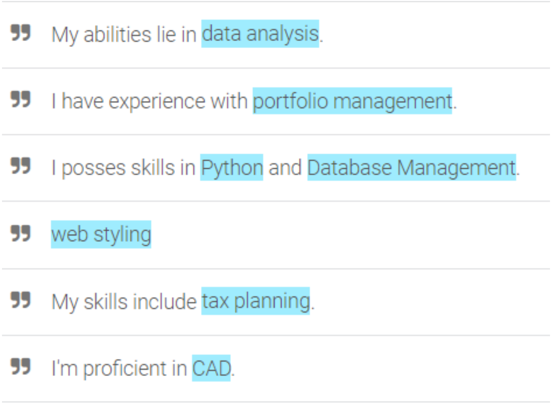
- **Responses:** We designed the responses in such a way that they trigger the following get_skills intent. In other words, we designed the chatbot responses so that it asks the user about his skills:



	Text or SSML Response
1	Interesting! Now that we have your education level, let's explore your skills. What skills do you possess?
2	Fascinating! Moving forward, can you list your skills?
3	Exciting! What are your areas of expertise?
4	Great! Could you mention the skills you have?
5	Wonderful! What abilities do you bring to the table?
6	Fantastic! Tell me about your skill set.

3.2.6. get_skills intent

- **Corresponding Competency Statement:** This intent is triggered when the user states his skills (as a response to chatbot's question from the parent intent).
- **Training Phrases (Test-Cases):** The user can state his skills in different ways. He can either answer with a short phrase or a full sentence:



My abilities lie in data analysis.

I have experience with portfolio management.

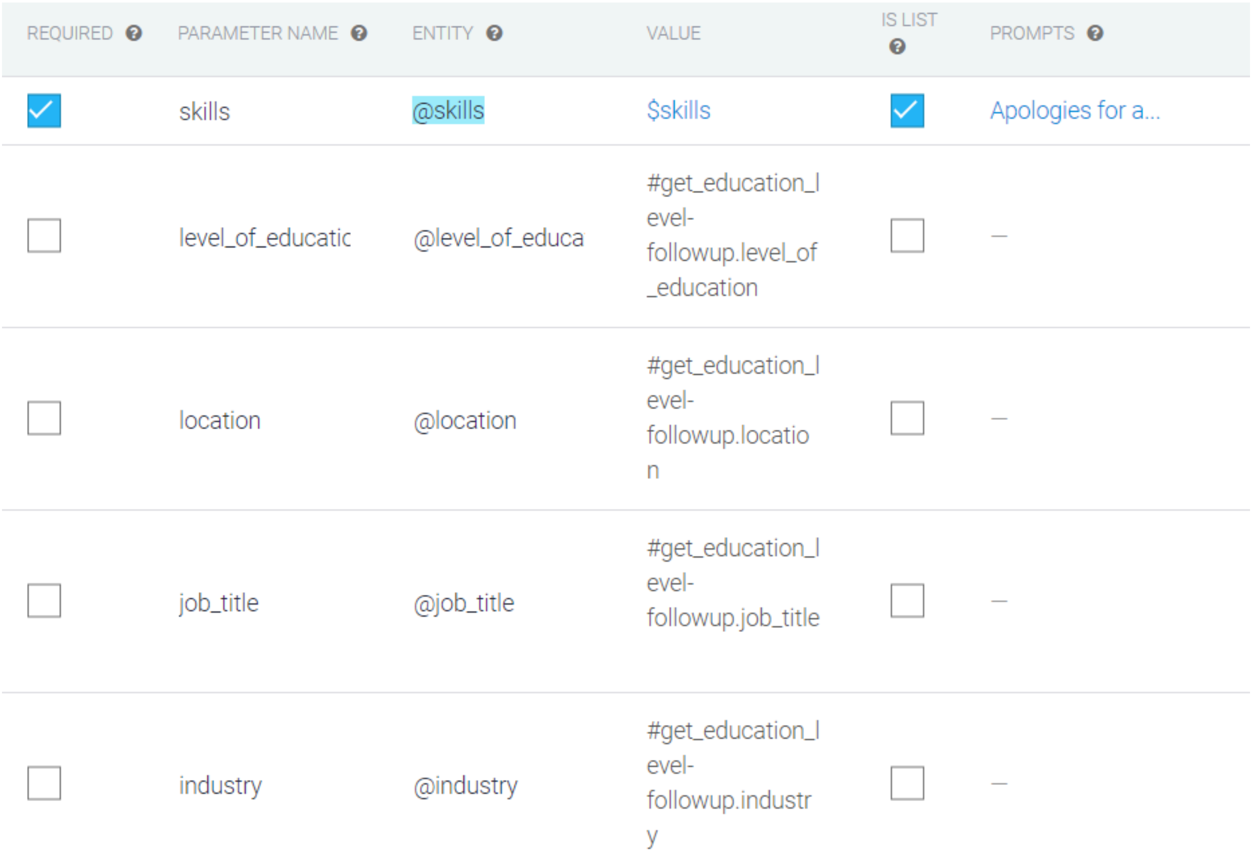
I posses skills in Python and Database Management.

web styling

My skills include tax planning.

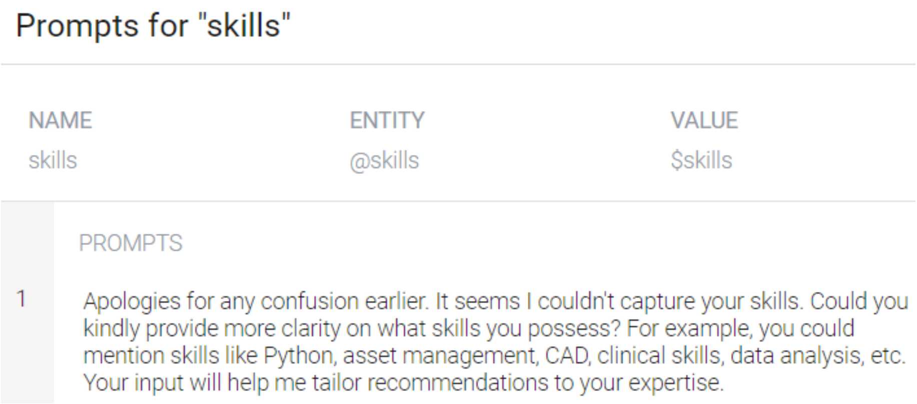
I'm proficient in CAD.

- **Action and parameters:** As we can see in the training phrases, Dialogflow is able to detect values of the @skills entity (highlighted) in the user's statement. Consequently, it automatically adds the skills parameter to the parameter table. This parameter is required, i.e. intent can't be complete if the user doesn't provide this parameter, so we indicated that in the table. Also, we want the chatbot to carry the parameters of its previous parent intent get_education_level, which are level_of_education, location, job_title, and industry, to this intent, so we also added it to the table:



REQUIRED ❓	PARAMETER NAME ❓	ENTITY ❓	VALUE	IS LIST ❓	PROMPTS ❓
☑	skills	@skills	$skills	☑	Apologies for a...
☐	level_of_educatic	@level_of_educa	#get_education_level-followup.level_of_education	☐	–
☐	location	@location	#get_education_level-followup.location	☐	–
☐	job_title	@job_title	#get_education_level-followup.job_title	☐	–
☐	industry	@industry	#get_education_level-followup.industry	☐	–

We added a prompt, i.e. a question that the chatbot will ask the user if it was not able to detect the required parameter (skills) in his statement:



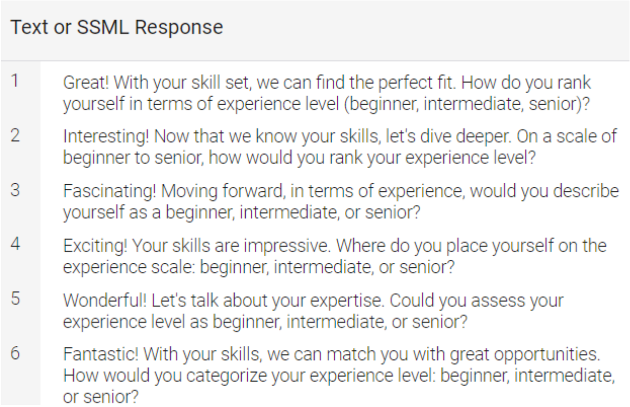
Prompts for "skills"

NAME	ENTITY	VALUE
skills	@skills	$skills

PROMPTS

1 Apologies for any confusion earlier. It seems I couldn't capture your skills. Could you kindly provide more clarity on what skills you possess? For example, you could mention skills like Python, asset management, CAD, clinical skills, data analysis, etc. Your input will help me tailor recommendations to your expertise.

- **Responses:** We designed the responses in such a way that they trigger the following get_experience_level intent. In other words, we designed the chatbot responses so that it asks the user about his experience:



Text or SSML Response

1 Great! With your skill set, we can find the perfect fit. How do you rank yourself in terms of experience level (beginner, intermediate, senior)?

2 Interesting! Now that we know your skills, let's dive deeper. On a scale of beginner to senior, how would you rank your experience level?

3 Fascinating! Moving forward, in terms of experience, would you describe yourself as a beginner, intermediate, or senior?

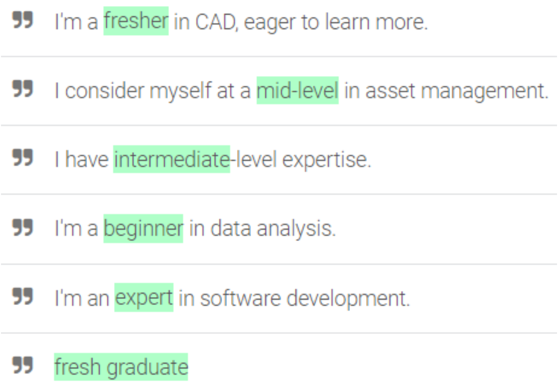
4 Exciting! Your skills are impressive. Where do you place yourself on the experience scale: beginner, intermediate, or senior?

5 Wonderful! Let's talk about your expertise. Could you assess your experience level as beginner, intermediate, or senior?

6 Fantastic! With your skills, we can match you with great opportunities. How would you categorize your experience level: beginner, intermediate, or senior?

3.2.7. get_experience_level intent

- **Corresponding Competency Statement:** This intent is triggered when the user states his experience level (as a response to chatbot's question from the parent intent).
- **Training Phrases (Test-Cases):** The user can state his experience level in different ways. He can either answer with a short phrase or a full sentence:



I'm a fresher in CAD, eager to learn more.

I consider myself at a mid-level in asset management.

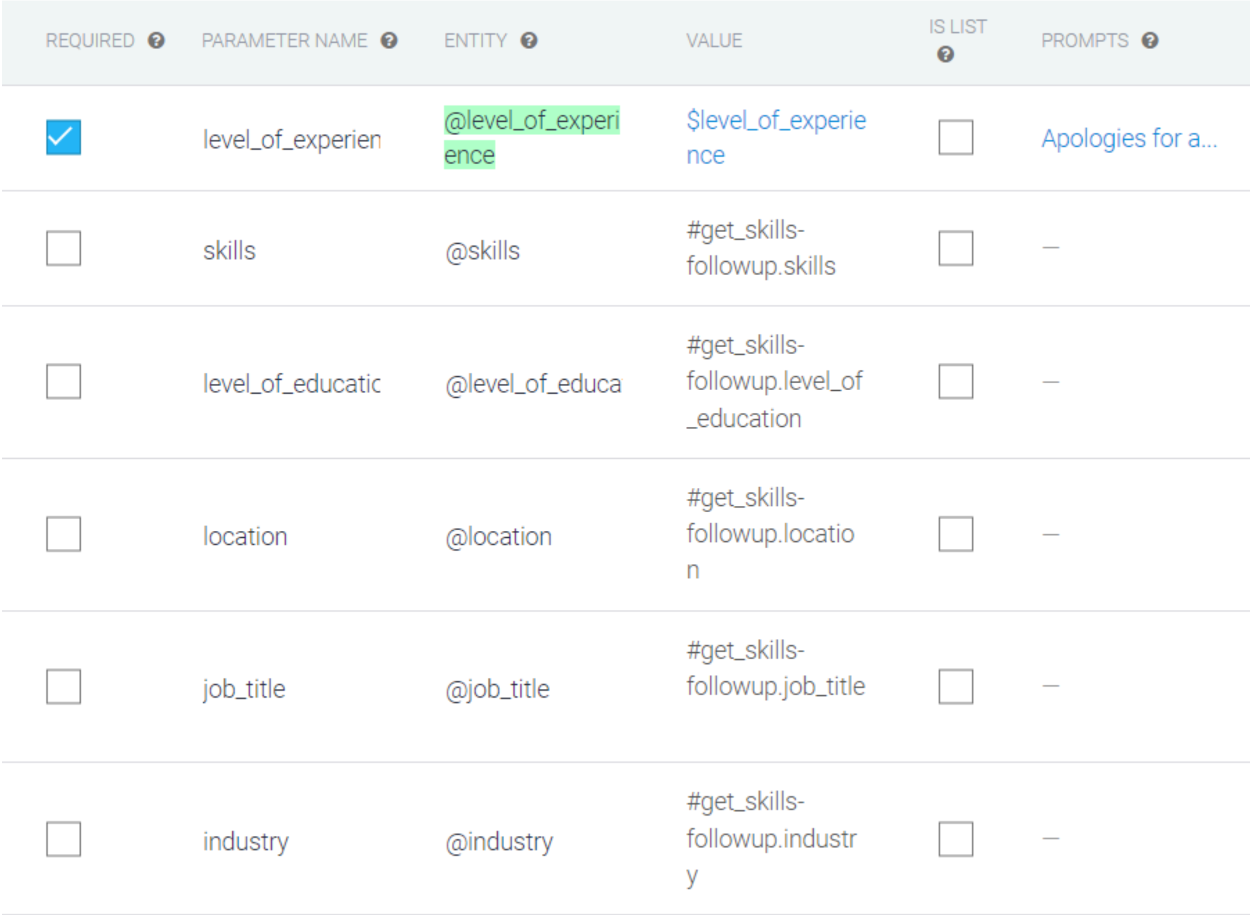
I have intermediate-level expertise.

I'm a beginner in data analysis.

I'm an expert in software development.

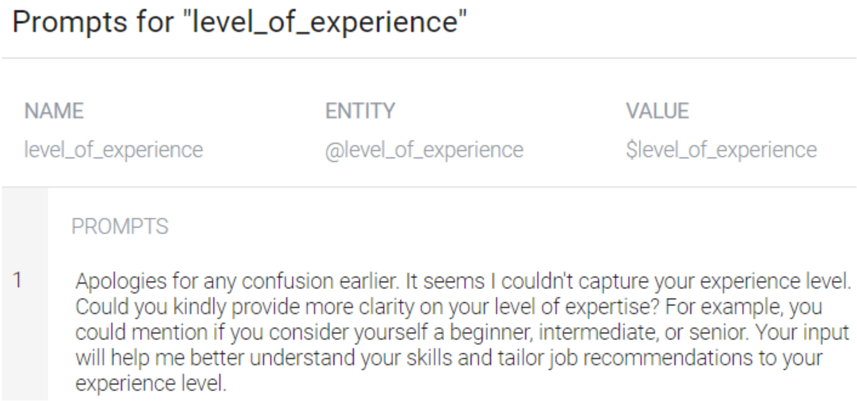
fresh graduate

- **Action and parameters:** As we can see in the training phrases, Dialogflow is able to detect values of the @level_of_experience entity (highlighted) in the user's statement. Consequently, it automatically adds the level_of_experience parameter to the parameter table. This parameter is required, i.e. intent can't be complete if the user doesn't provide this parameter, so we indicated that in the table. Also, we want the chatbot to carry the parameters of its previous parent intent get_skills, which are skills, level_of_education, location, job_title, and industry, to this intent, so we also added it to the table:



REQUIRED	PARAMETER NAME	ENTITY	VALUE	IS LIST	PROMPTS
☑	level_of_experien	@level_of_experience	$level_of_experience	□	Apologies for a...
□	skills	@skills	#get_skills-followup.skills	□	—
□	level_of_educatic	@level_of_educa	#get_skills-followup.level_of_education	□	—
□	location	@location	#get_skills-followup.location	□	—
□	job_title	@job_title	#get_skills-followup.job_title	□	—
□	industry	@industry	#get_skills-followup.industry	□	—

We added a prompt, i.e. a question that the chatbot will ask the user if it was not able to detect the required parameter (skills) in his statement:



Prompts for "level_of_experience"

NAME	ENTITY	VALUE
level_of_experience	@level_of_experience	$level_of_experience

PROMPTS

1 Apologies for any confusion earlier. It seems I couldn't capture your experience level. Could you kindly provide more clarity on your level of expertise? For example, you could mention if you consider yourself a beginner, intermediate, or senior. Your input will help me better understand your skills and tailor job recommendations to your experience level.

- **Responses:** This is set as the end of conversation. After the chatbot gathers all the parameters it needs from the user, it will recommend a job that is tailored to the user's preferences and qualifications. This will be done through Fulfillment and not text responses.

- **Fulfillment:** We enabled the webhook call for this intent as we need the chatbot to have a dynamic response rather than a static text response. This is essential because the chatbot should respond with a job posting that meets the user's preferences and qualifications.

3.3. Fulfillment

We used the inline editor index.js file and hard coded some job postings. We then defined some functions which retrieve the parameters given by the user (industry, job_title, location, level_of_education, skills, and level_of_experience) and recommend the most appropriate job posting based on them. Note that the jobs have been hard coded for the purpose of this assignment. For the project, we will be having a dataset of job postings from which we will extract recommendations that are most similar to the user preferences and qualifications. Also, the fulfillment will be further developed for the project to handle feedback from the user.

3.4. Chatbot Instance

https://bot.dialogflow.com/4a92b649-6135-4486-aac9-a58f1f94a6b4

4. Chatbot Implementation

Due to insufficient window the below images have been clipped to best represent the final output message by the chatbot.

Scenario 1:

user preferences:

industry: IT sector

job title: data scientist

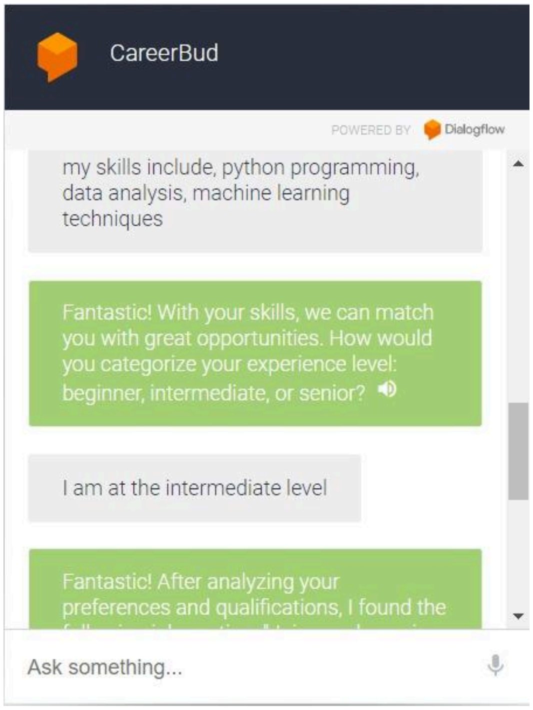
location: ottawa

user qualifications:

education: masters

skills: python, data analysis, machine learning modelling

work experience: intermediate

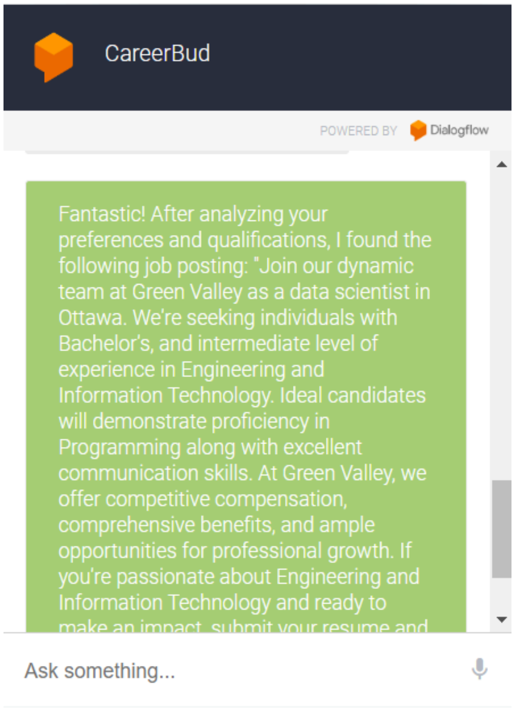


my skills include, python programming, data analysis, machine learning techniques

Fantastic! With your skills, we can match you with great opportunities. How would you categorize your experience level: beginner, intermediate, or senior?

I am at the intermediate level

Fantastic! After analyzing your preferences and qualifications, I found the



Fantastic! After analyzing your preferences and qualifications, I found the following job posting: "Join our dynamic team at Green Valley as a data scientist in Ottawa. We're seeking individuals with Bachelor's, and intermediate level of experience in Engineering and Information Technology. Ideal candidates will demonstrate proficiency in Programming along with excellent communication skills. At Green Valley, we offer competitive compensation, comprehensive benefits, and ample opportunities for professional growth. If you're passionate about Engineering and Information Technology and ready to make an impact, submit your resume and

Scenario 2:

user preferences:

industry: heathcare sector

job title: nurse

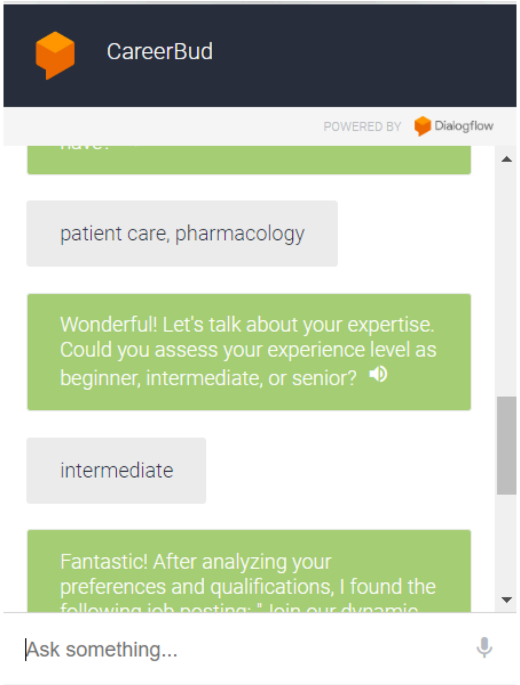
location: montreal

user qualification:

education: diploma

skills: patient care, pharmacology

work experience: intermediate



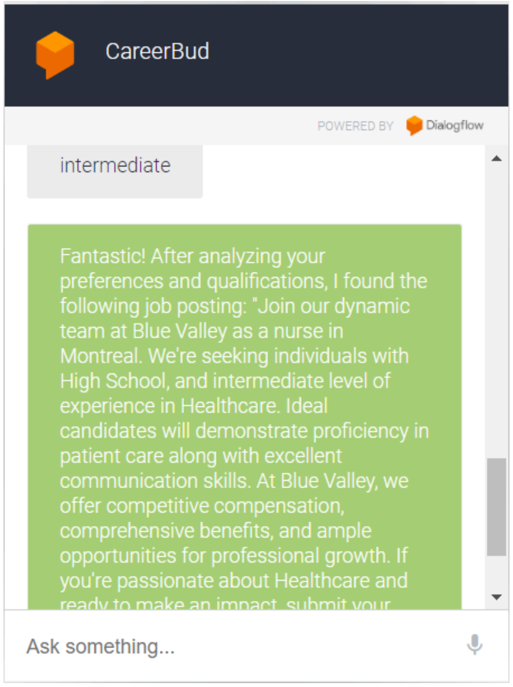
have:

patient care, pharmacology

Wonderful! Let's talk about your expertise. Could you assess your experience level as beginner, intermediate, or senior?

intermediate

Fantastic! After analyzing your preferences and qualifications, I found the following job posting: " Join our dynamic

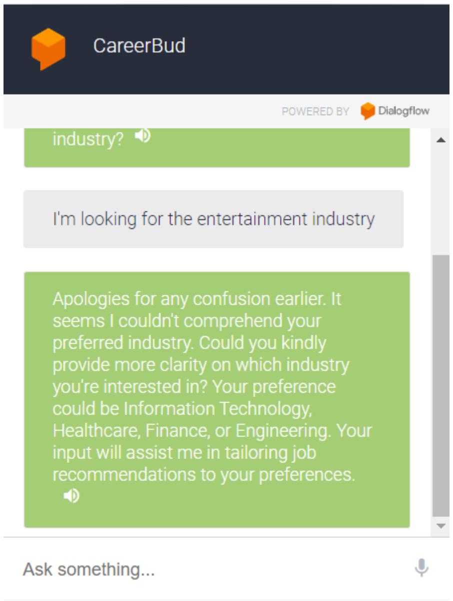


intermediate

Fantastic! After analyzing your preferences and qualifications, I found the following job posting: "Join our dynamic team at Blue Valley as a nurse in Montreal. We're seeking individuals with High School, and intermediate level of experience in Healthcare. Ideal candidates will demonstrate proficiency in patient care along with excellent communication skills. At Blue Valley, we offer competitive compensation, comprehensive benefits, and ample opportunities for professional growth. If you're passionate about Healthcare and ready to make an impact, submit your

Scenario 3:

user gives an out-of-scope preference to industry, so the chatbot prompts him about it.



industry?

I'm looking for the entertainment industry

Apologies for any confusion earlier. It seems I couldn't comprehend your preferred industry. Could you kindly provide more clarity on which industry you're interested in? Your preference could be Information Technology, Healthcare, Finance, or Engineering. Your input will assist me in tailoring job recommendations to your preferences.

5. Challenges and Weaknesses

The chatbot has few shortcomings some of which are mentioned below:

- **Limited Domain Knowledge:** Dialogflow's reliance on predefined intents and entities restricts the chatbot's understanding to a predefined scope of knowledge. For instance, the classification of industry sectors into a limited number of subclasses may not sufficiently cover niche fields, resulting in inaccurate or incomplete job recommendations. This limitation becomes apparent when users inquire about specialized roles or industries beyond the predefined categories.
- **Inability to Handle Ambiguity:** The chatbot's ability to comprehend user inputs is constrained by the predefined synonyms and variations defined for each class. Consequently, the chatbot may struggle to interpret ambiguous or varied user queries effectively. For example, while a user may express interest in a 'database engineer' position, the chatbot's rigid structure may fail to recognize all synonymous terms outside the scope of the predefined ones like 'data administrator' or 'database specialist,' leading to user frustration and potentially inaccurate recommendations.
- **Limited Natural Language Understanding**: Despite Dialogflow's natural language understanding capabilities, the chatbot operates within a constrained framework of predefined questions and responses. This one-sided interaction model inhibits users from seeking additional information or clarifications beyond the scripted prompts provided by the chatbot. As a result, users are unable to engage in open-ended dialogue or pose their own questions, hindering the depth and flexibility of the interaction. For Example, the user cannot ask queries to the chatbot such as "What kind of work culture is expected from this company for this role."
- **Inability to Handle User Feedback:** The chatbot lacks the functionality to adapt or respond to user feedback effectively. Without a mechanism to incorporate user feedback into its recommendation process, the chatbot may continue to provide suboptimal suggestions, failing to address user preferences or refine its recommendations over time. For instance, if a user expresses dissatisfaction with a recommended job, the chatbot lacks the capability to adjust its approach or offer alternative suggestions based on the user's feedback.
- **Lack of Flexibility:** In scenarios where users express uncertainty or hesitation in providing specific preferences, such as preferred location or industry sector, the chatbot's inability to accommodate such ambiguity may impede the flow of conversation and limit the user's ability to navigate the interaction seamlessly. As a result, users may feel constrained by the chatbot's rigid structure, diminishing the overall user experience and effectiveness of the recommendation process. For example: if the user is confused about his preferred location then the conversation will not progress unless this information is provided by the user.