

ChatBot and Coding

A chatbot is a computer program that simulates and processes human conversation - written or spoken - allowing humans to interact with digital devices as if they were communicating with a real person. [CHATBOT English Definition and Meaning | Lexico.com](https://www.lexico.com/define/chatbot)



Project Focus:

When most people think of web navigation, they refer to menus and search bars. These options often require sifting through numerous pages to locate the correct content. A chatbot provides a direct portal to the desired information instead.

[Chatbots: History, technology, and applications - ScienceDirect](#) (Eleni Adamopoulou Dec 2020).

With a bot at hand, it's possible to streamline website navigation, and vastly reduce the number of clicks needed to locate answers. A user can simply ask a related question and receive an instant reply. [Chatbots: History, technology, and applications - ScienceDirect](#) (15 December 2020 Eleni Adamopoulou)

The aim of my project:

Chatbots work by analyzing and identifying the intent of the user's request to extract relevant entities, which is the most important task of a chatbot. My chatbot uses the language service which includes a question answering capability that enable me to create a knowledge base of question and answer pairs by using natural language input, so my chatbot can look up answers to questions submitted by users.

Problem

One of the most common web interaction conversational scenarios is providing support through a knowledge base of frequently asked questions (FAQs). Currently Webber Academy publish FAQs on their webpage, which works well for a small set of question-and-answer pairs, but specific information can be difficult as well as time-consuming to search. Chatbots can help the school's website users by quickly resolving their questions and providing an automating information-based answers.

Question: How ChatBots make navigating through websites more convenient?

Background Research

Traditionally, computers are used for mathematical calculations or reparative tasks. However, due to the advancements made in the field of AI, today, computers can be used for complicated cognitive services such as compute vision, language processing, and bots.

Driven by AIML, automated rules, natural-language processing (NLP), and machine learning (ML), chatbots process data to deliver responses to requests of all kinds.

Developers created the Artificial Intelligence Markup Language (AIML), to build the Knowledge Base of the chatbots that adopt the Pattern Matching approach.

https://www.researchgate.net/publication/323279398_ANALYSIS_OF_THE_CHATBOT_OPEN_SOURCE_LANGUAGES_AIML_AND_CHATSCRIPT_A_Review?channel=doi&linkId=5a8bd203aca272017e63f2c7&showFulltext=true (February 2017 Idris Muniro).

Background Research - Continue

Machine learning ML: Chatbots adopt Machine Learning Approaches extract the content from the user input using Natural Language Processing (NLP), and dispose of the ability to learn from conversations. They consider the whole dialog context, not just the current turn, and do not require a predefined response for each possible user input. Typically, they need an extensive training set, the finding of which may constitute a crucial difficulty as available datasets may be inadequate.

[A Web-based Platform for Collection of Human-Chatbot Interactions](#) (Lue Lin October 2016)

```
<category>
  <pattern>HELLO </pattern>
  <template>
    <random>
      <li> Hi! What's your name? </li>
      <li> Hello, How are you? </li>
      <li> Hello! </li>
    </random>
  </template>
</category>

<category>
  <pattern>MYNAMEIS * </pattern>
  <template>Nice to meet you <set name="nameUser"> <star/> </set></template>
</category>

<category>
  <pattern>NIGHT </pattern>
  <template>Good night <get name="nameUser"/> </template>
</category>

<category>
  <pattern>_ NIGHT </pattern>
  <template><srai> NIGHT </srai> </template>
</category>

<category>
  <pattern>NIGHT * </pattern>
  <template><srai> NIGHT </srai> </template>
</category>

<category>
  <pattern>_ NIGHT * </pattern>
  <template><srai> NIGHT </srai> </template>
</category>
```

Figure 1: Apart of a Knowledge Base written in AIML.

Background Research - Continue

Natural Language Processing (NLP) is an Artificial Intelligence field that examines how computer systems can interpret and control the natural language regarding text or speech. Information is collected on the comprehension and usage of human language to create the appropriate techniques for computer systems to manage human language and carry out a variety of tasks . Most NLP techniques rely on machine learning. They consist of Natural Language Understanding, which evolves the mission to understand a text.

[\[1708.05148\] Natural Language Processing: State of The Art, Current Trends and Challenges](#)
(August 17 2017 Diksha Khurana)

Natural language understanding (NLU) is a subfield of NLP which focuses on understanding the meaning of human speech by recognizing patterns in unstructured speech input. NLU solutions have 3 components:

- 1- Dictionary to determine the meaning of a word.
 - 2- Parser to determines if the syntax of the text conforms to the rules of the language.
 - 3- Grammar rules to break down the input based on sentence structure and punctuation.
- NLU enables chatbots to classify users' intents and generate a response based on training data.

[What is natural language understanding \(NLU\)?](#) (Tech Target Contributor).

Background Research - Continue

There are two main types of chatbots, task oriented and data driven.

Task-oriented (declarative) chatbots are single-purpose programs that focus on performing one function. Using rules, NLP, and very little ML, they generate automated but conversational responses to user inquiries. Interactions with these chatbots are highly specific and structured and are most applicable to support and service functions—think robust, interactive FAQs. Task-oriented chatbots can handle common questions, such as queries about hours of business or simple transactions that don't involve a variety of variables. The user formulates requests, the chatbot responds in a conversational fashion. For each subject, possible continuations of conversation are identified. The result is representing the possible evolution of the conversation. Data are accessed when needed by the conversation. A negative effect is that for each different problem, the conversation must be modeled and implemented. Though they do use NLP so end users can experience them in a conversational way, their capabilities are fairly basic. These are currently the most commonly used chatbots.

[Natural Language Understanding for Task Oriented Chatbots | by Bernardt Duvenhage | Feersum Engine | Medium](#)
(Bernardt Duvenhage Sep 9, 2018)

Data-driven and predictive (conversational) chatbots are often referred to as virtual assistants or digital assistants, and they are much more sophisticated, interactive, and personalized than task-oriented chatbots. These chatbots are contextually aware and leverage natural-language understanding (NLU), NLP, and ML to learn as they go. They apply predictive intelligence and analytics to enable personalization based on user profiles and past user behavior. Digital assistants can learn a user's preferences over time, provide recommendations, and even anticipate needs. In addition to monitoring data and intent, they can initiate conversations. A conversation goes on as a sequence of "turns" by the chatbot and the user. The turns are not necessarily alternated. A data driven Chatbots are quite proactive, they help the user to go through a set of content items Apple's Siri and Amazon's Alexa are examples of consumer-oriented, data-driven, predictive chatbots.

[Survey on Chatbot Design Techniques in Speech Conversation Systems](#) (John Woods 2015)

The process of creating a Chatbot:

The creation of a task oriented chatbot starts with planning the aims, procedures, and user requirements of it. Developing the chatbot using a programming language or a chatbot development platform follows, and afterward, the chatbot functionalities are tested locally. The chatbot is then published on an online website or a data center, and it is connected to one or more channels to send and receive messages. Proper integration of a chatbot in an application is crucial at this stage, and there are three methodologies to do this: integration using API, manual integration, or third-party integration. Finally, evaluation is conducted by gathering data during a fixed time after deployment so that developers can detect errors and use the input to enhance the chatbot performance and capabilities.

[Chatbot generation and integration-International Journal of Advance Research, Ideas and Innovations in Technology](#). pp. 1308-1311.

The selection of algorithms or platforms to build chatbots depends on what the chatbot should provide to the users. A chatbot can be developed using programming languages like Java and Python or a chatbot development platform that may be commercial or open-source. Proper context management is critical for intent classification. For example, if the user utterance is "In Calgary, today?" it is most likely that the response will come as the result of an unclassified intent. However, if a context like "weather forecasting" is activated, a successful answer will report the weather forecast in Calgary on the day of the conversation. [Contexts | Dialog Flow ES | Google Cloud](#)

Implementing and Training a Chatbot:

Machine learning approaches are used to generate the AIML rules and therefore train Rule-based chatbots. Chatbot developers must keep files from conversations after the chatbot is deployed, in order to help understand the user requests better and improve the chatbot, which is continuously learning through the analysis of these conversations. New training examples are extracted from the conversations a chatbot takes part in when the conversation goes on well, or feedback is requested. The software will be measuring the user experience so that, based on the measurements, I will be able to make appropriate improvements.

website based chatbots provide developers with full control. On the website, one can say precisely how the chatbot works, including its purpose, user interface, and experience. Moreover, the users can engage in conversation without leaving the current page, having an easy way to ask questions.

[What Are the Key Considerations When Implementing a Chatbot? - Engage Hub](#) Karen Waters 18 September 2018

My Analysis of My Research

Behind the scene: How ChatBot works.

There are two different tasks at the core of a ChatBot:

1- user request analysis: The ability to identify the user's intent and extract data and relevant entities contained in the user's request is the first condition and the most relevant step at the core of a chatbot. Users ask the chatBot a series of simple questions, in return, predefined responses according to questions asked or keywords typed will be provided instantly..

2- returning the response: a chatbot returns a response based on input from a user. This process may look simple; however, in practice, things are quite complex.

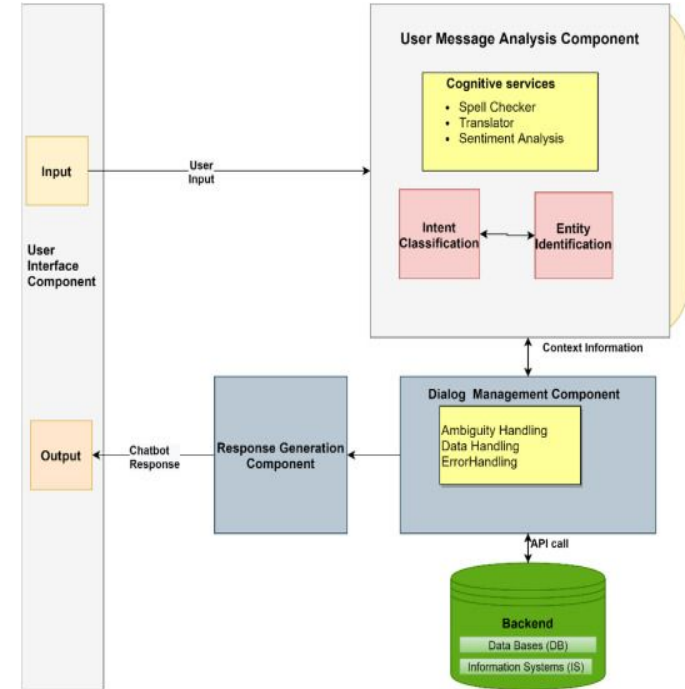


Figure 2: General Chatbot architecture

Analysis

Benefits of ChatBot:

Chatbots boost operational efficiency, in addition, chatbots allow businesses to engage with an unlimited number of customers in a personal way. By using a ChatBot, a business can provide humanlike, personalized, proactive service to millions of people at the same time.

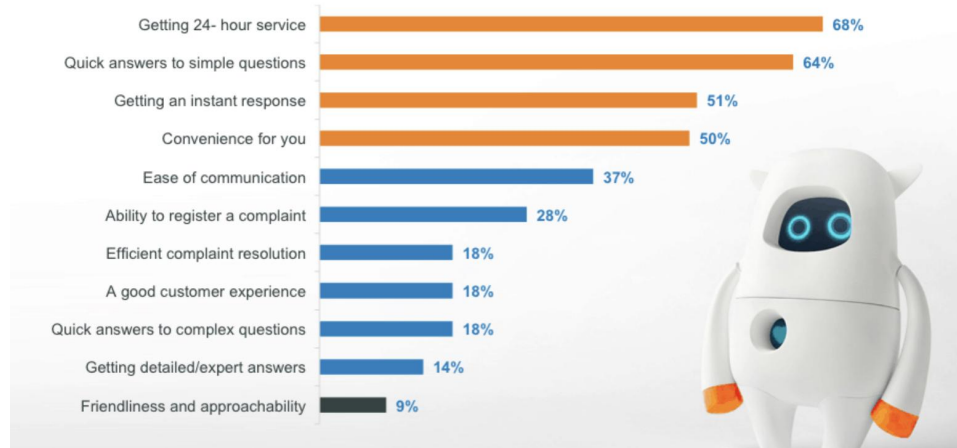


Figure 3: benefits of ChatBots in services



Intelligent

Advanced software learns from past interactions, improving responses over time



Engaging

Enables human-like interaction delivered through a channel that is easily scalable



Effective

Let users perform tasks efficiently and accurately through conversational self-service

Figure 4: benefits of ChatBots

Variables

Manipulated Variable	Responding Variable	Controlled Variable
The variation of each question asked. Multi-turn conversation probabilistic model is used based on the confidence score, or if the answer is not found in the provided database, ChatBot, uses multi-turn conversation to improve the statistics and provide a more accurate answer.	The answer to the question that is being asked.	The textual and lexical properties of the dialogue and the appearance of it, which can generate as suitable responses as possible.

Method

When designing a chatbot, I must first determine the goals that it will serve. Based on the objectives, I will evaluate the primary character of my chatbot.

[https://docs.microsoft.com/en-us/azure/cognitive-services/qnamaker/tutorials/create-faq-bot-with-azure-bot-service\](https://docs.microsoft.com/en-us/azure/cognitive-services/qnamaker/tutorials/create-faq-bot-with-azure-bot-service)

Logic and structure of building a Chatbot:

1- I Created a Language resource: to create and host a knowledge base for question answering, I needed a Language service resource which is a cognitive service in Microsoft azure cloud; however, a subscription is required. To subscribe I:

Opened the Azure portal at <https://portal.azure.com>, and signed in using the Microsoft account associated with my Azure subscription.

- Selected the +Create a resource button, search for *Language*, and create a Language service resource.
- Clicked Select on the Custom question answering block. Then clicked Continue to create my resource.

2- I Created a question answering project: to create a knowledge base for question answering in my Language resource, I will use the Language Studio portal to create a question answering project. In this project, I will create a knowledge base containing questions and answers about Webber Academy. I will create this knowledge base from scratch, but I will also import questions and answers from Webber Academy FAQ page:

<https://www.webberacademy.ca/newfamiliesoverview/faq-overview.cfm>

1. I log in to Language Studio portal at <https://language.azure.com>.
2. I Chose the language resource you created previously.
3. At the top of the page, I clicked Language Studio to return to the Language Studio home page.
4. At the top of the portal, in the Create new menu, I selected Custom question answering, then I selected English as the language. Then I clicked Next.
5. On the Enter basic information page, I entered the following details and then click Next:
 - o Name LearnFAQ
 - o Description: FAQ for Webber Academy
 - o Default answer when no answer is returned: Sorry, I don't understand the question.
6. On the Review and finish page, I clicked Create project.



Figure 5: Webber Academy FAQ page

3- I created some “chitchats” questions and answers to support conversational exchanges. This knowledge base can be extended by adding additional questions and answer pairs.

- On the Manage sources page for your question answering project, in the “+ Add source list”, I selected Chitchat. Then, in the “Add chat” dialog box, I selected “Friendly” and clicked “Add chat”.

4- I edited the knowledge base:

I will extend the knowledge base by adding additional question and answer pairs. I will add the next question (including alternative phrasing) and answer to the knowledge base.

1. In the LearnFAQ project in Language Studio, I selected the Edit knowledge base page
2. In the knowledge base, I selected “+ Add question pair”.
3. In the Question box, I typed questions about Webber academy and press Enter**.
4. I Selected “+ Add alternative phrasing” and press Enter.

5- I added follow-up prompts,

In some cases, it makes sense to enable the user to follow up on answers, or to create a multi-turn conversation that enables the user to iteratively refine the question to get to the answer they need. To do that, I will create a follow-up Prompt dialog box.

- I clicked on “Add prompt”: I Selected Create link to new pairs, and entered follow up questions

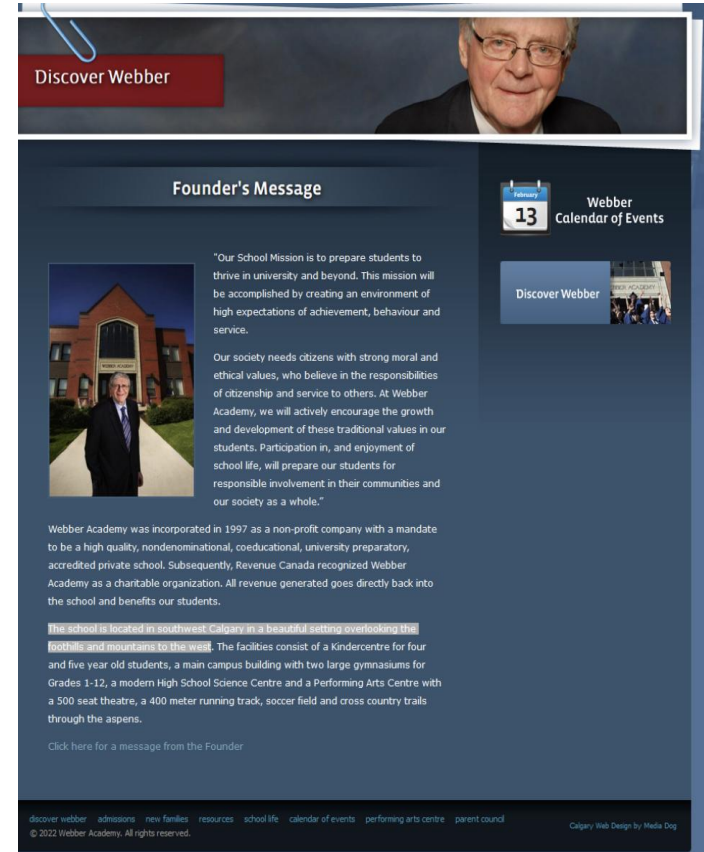


Figure 6: Webber Academy website details

6- I trained and test the knowledge base.

1. At the top right of the page, I clicked "Save changes".
2. Next, I clicked "Test" to open the test pane.
3. In the test pane, at the top, I *deselect* the option to display short answers. Then at the bottom I entered the message "Hi". A suitable response was returned.
4. In the test pane, at the bottom enter the message Where is Webber Academy Located?. An appropriate response from the FAQ was returned.
5. I entered the message "Thanks!". An appropriate chit-chat response was returned.
6. I entered the message "Tell me about Webber Academy tuition fees". The answer I created was returned along with a follow-up prompt question.
7. I selected the Learn more about Webber Academy follow-up link. The follow-up answer with a link to the Webber Academy page should be returned.
8. When I was done testing the knowledge base, I closed the test pane.

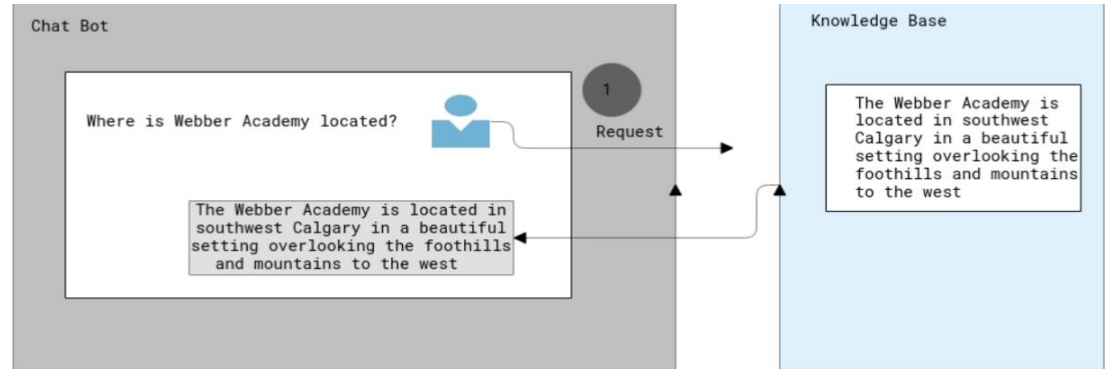


Figure 7: Demo testing my Chatbot knowledge base

7- I deployed and tested the knowledge base:

1. In the LearnFAQ project in Language Studio, I selected the "Deploy knowledge base" page.
2. At the top of the page, I clicked "Deploy" to confirm deploying the knowledge base.
3. When deployment is complete, I clicked "Get prediction URL" to view the REST endpoint for my knowledge base.
4. I returned to the browser and in the "Get prediction URL" dialog box, I copied it to the clipboard, and then clicked "Got it" to close the dialog box.
5. I returned to Visual Studio Code, and in the "ask-question" I replaced *YOUR_KEY* with the key I copied.
6. I saved the file.

8- I created a Chatbot for the knowledge base and test it to ensure that my Chatbot answers questions as expected. I used Azure cognitive service to create the Chatbot.

1. I returned to Language Studio in the browser, and in the Deploy knowledge base page, I selected "Create Bot".
2. I waited for my Chatbot to be created . Then I clicked "Go to resource"
3. I used the test chat interface to ensure that my Chatbot answers questions from my knowledge base as expected.

My Webber Academy Chat-Bot DEMO

https://webchat.botframework.com/embed/webber-academy-bot/gemini?b=webber-academy-bot&s=OpMsgHWT61I.FV0P5JZVY_B2fNBkk-c_j9vWqwpNh6fMimchXUOW3mQ&username=You

Sample questions to test Webber Academy Chatbot :

- Hi
- How are you?
- What are some programs provided in Senior High?
- What programs are provided in Junior High?
- Tell me about the founder of the school.
- What is the annual admission fee?
- Does the school sell uniforms?
- What languages does Webber teach?
- Tell me about Webber Academy's Recreation facility.

Conclusion

In this project, my scientific question was "How Chatbots make navigating through websites more convenient" I asked this question because I realized that surfing websites requires sifting through numerous pages to locate the correct content. Whereas with a chatbot, a direct portal to the desired information could be provided instead.

[Chatbots: History, technology, and applications - ScienceDirect](#)

I built a demo Chatbot for Webber Academy school where first I created a language resource, then I created a question answering project. My next step was adding sources to the knowledge base where I imported data from an existing FAQ file from Webber academy website. The next steps were about editing the knowledge base, training and testing the knowledge base, deploying and test the knowledge base. The final step was creating a bot for the knowledge base and testing it to ensure that my Chatbot answers questions as expected.

[https://docs.microsoft.com/en-us/azure/cognitive-services/qnamaker/tutorials/create-faq-bot-with-azure-bot-service\](https://docs.microsoft.com/en-us/azure/cognitive-services/qnamaker/tutorials/create-faq-bot-with-azure-bot-service)

After building and training my Webber Academy ChatBot, I have asked my family to test it by typing various questions that help them learn more about our school. I learned that the Chatbot provided accurate answers as long as clear keyword of the requested information was typed in the question. To improve the answers statistics, I implemented a multi-turn conversation which allow my Chatbot to request further details (which help by widening the database search to obtain more accurate answer) if necessary.

The application of Chatbot is very effective to various industries such as education, healthcare, hospitality, E-commerce and many more. where Chatbot can help these businesses by providing the real-time on-demand approach that customers are seeking out, as well as providing users with quick and convenient support responding specifically to their questions.

[51 Amazing Chatbot Use Cases By Industry and Function](#)

In conclusion, I believe that using chatbots or smart assistants with artificial intelligence personalizes people's experience and increases their research knowledge, which leads to positive outcomes and help provide better customized support through this digital platform. Chatbots that work in context know who we are, know what we want to do, and can provide instant intelligent answers.

Real Life Application

Chatbots can help all kind of businesses by leveraging messaging platforms as well as providing customer services and customer engagement.

[51 Amazing Chatbot Use Cases By Industry and Function](#)

Example of using ChatBots in different industries:

Health care chat-Bots: hospitals and clinics can leverage Chatbots for booking appointments, sending medical information, and answering patients common questions.

Hospitality ChatBots: can seamlessly assist customers with their bookings by helping gain more information about hotels and their services, restaurants booking, travel packages, and inquiries about offers and deal.

HR. chatBots: HR Chatbots can provide consistency to employee communication and reduce the confusion for the end-user while delivering an instant response.

E- Commerce ChatBots: E-commerce Chatbots can guide customers in their purchase decisions by helping them obtain detailed information about the product they are looking for.

Further Questions

What are the security considerations when implementing QnA Bot?

How to maintain and support the QnA solution during its life cycle?

How can the QnA service be extended to all the schools in Alberta?

Can the QnA Bot support Multi concurrency?

How much does production deployments cost?

Suggested Improvements

There are four things I would like to improve on my project which I believe would contribute to a more detailed product.:

1- Create a prebuilt domain entity.

2- Add more display features to my Chat-Bot such as Webber Academy's mascot for an icon.

3- Monitor the performance of the model in real life time.

4- Integrate my Chatbot on Webber Academy's website to enable me to collect users feedback in real life time.

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[A Web-based Platform for Collection of Human-Chatbot Interactions](#)

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[51 Amazing Chatbot Use Cases By Industry and Function](#)

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Contact Reference

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Project Log

Date	Summary of Activity Performed	Time Spent
Oct 21, 2021	Finding the topic for my SF project: ChatBot and Coding.	2hrs
Oct 26, 2021	Topic scientific question: How ChatBots make navigating through websites more convenient?	30 minutes
Nov 23, 2021	Background research. Researching about AIML, natural-language processing (NLP), and machine learning (ML), and how chatbots process data to deliver responses to requests of all kinds.	2hrs
Dec 1, 2021	Background research: researching and learning about the two main types of chatbots, task oriented and data driven.	2hrs
Dec 8, 2021	Building knowledge base: I use the Language Studio portal to create a knowledge base for question answering in my Language resource.	2hrs

Project Log

Date	Summary of Activity Performed	Time Spent
Dec 9, 2021	Building knowledge base: I create a knowledge base containing questions and answers about Webber Academy.	2hrs and 30 minutes
Dec 10, 2021	Building knowledge base: I create a knowledge base containing questions and answers about Webber Academy.	2hrs
Dec 11, 2021	Building knowledge base: I import questions and answers from Webber Academy FAQ page.	2hrs
Jan 12, 2022	Training the QnA bot: I tested the files from conversations after my chatbot was built, in order to help me understand the user requests better and improve the chatbot.	2hrs and 30 minutes
Jan 13, 2022	Adding relevant alternative questions: I extend the knowledge base by adding additional question and answer pairs. I add the next question (including alternative phrasing) and answer to the knowledge base.	1hr
Jan 14, 2022	Testing the QnA bot model: to test my chatbot I enter various messages and questions and make sure that a suitable response was returned.	2hrs and 30 minutes

Project Log

Date	Summary of Activity Performed	Time Spent
Jan 15, 2022	Inspecting & Improving the QnA bot answer statistics for question outside knowledge base.	2hrs
Jan 16, 2022	Inspecting & Improving the QnA bot answer statistics for question outside knowledge base.	2hrs
Jan 19, 2022	Adding chit-chat with questions and answers to support conversational exchanges. This knowledge base can be extended by adding additional questions and answer pairs.	1hr
Jan 20, 2022	Choosing a threshold for confidence score of the answers.	1hr
Jan 22, 2022	Configuring multi-turn conversation: with follow up question when confident score below threshold.	2hrs
Jan 25, 2022	Testing the QnA bot model to see what my chatbot learned through the analysis of previous conversations.	2hrs
Jan 28, 2022	Publishing my QnA bot to be accessible via internet, it took few trials to have the link activated.	1hr

Project Log

Date	Summary of Activity Performed	Time Spent
Feb 1, 2022	Analysis: I worked on the different tasks at the core of a Chatbot and the benefits of a Chatbot.	2hrs
Feb 5, 2022	Variables: I figured out the multivariable, controlled variable, and the responding variable of my Chatbot.	1hr
Feb 7, 2022	Conclusion: I went through all the aspects of my project and summarized in the conclusion.	1hr and 20 minutes
Feb 15, 2022	Further questions and project improvements: I worked on the four things I would like to improve on my project which I believe would contribute to more detailed product, and the further questions that comes to mind when thinking of a Chatbot.	2hrs
Feb 26, 2022	Real life application: The application of a Chatbot is very effective to various industries such as education, healthcare, hospitality, E-commerce, and many more.	1hr
Feb 27, 2022	Bibliography and final review: I put all the online resources I gather information from throughout the research and building of my project.	2hrs

Thank
You