CHATBOT USING WATSON SERVICES

Report Submitted in Partial Fulfilment of the Requirement for the Degree
of
Bachelor of Technology
By
Sanghamitra Hota
Reg. Number: 1501106521

Under the Guidance of
Dr Subasish Mohapatra

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
COLLEGE OF ENGINEERING AND TECHNOLOGY,
BHUBANESWAR
2019

CERTIFICATION

This is to certify that the report entitled "Chatbot using Watson Services" is submitted by Sanghamitra Hota bearing registration number 1501106521, to the Department of Computer Science and Engineering, College of Engineering and Technology, is a bonafide research work to award partial bachelor's degree in Technology in Computer Science and Engineering under Biju Pattanaik University of Technology, Rourkela, Odisha.

Date:

(Dr. Subasish Mohapatra
HOD, Dept of CSE, CET, BBSR)

(Dr. Subasish Mohapatra
HOD, Dept of CSE, CET, BBSR)

DECLARATION

I certify that the work contained in the report is original and has been done myself under the general supervision of my guide. The work has not been submitted to any other institute for any degree or diploma. I have followed the guidelines provided by the Institution in writing the report. Whenever I used material from other sources, I have given due credit to them by citing them in the report and giving their details. Whenever I used quotation I have used quotation marks and detailed reference.

(Sanghamitra Hota)

ACKNOWLEDGEMENT

I wish to express my sincere gratitude to Dr Subasish Mohapatra for his guidance and constant motivation in my seminar topic “Chatbot using Watson Services”. I would like to thank all the teachers of Department, Computer Science and Engineering, College of Engineering and Technology for giving us this opportunity to work on the recent topics of Computer Science.
I would like to thank my parents for their constant support and motivation. Last but not least I want to thank my friends for providing me with the information required for my report.

Sanghamitra Hota
Regd. No: 1501106521
Branch: CSE

LIST OF CONTENTS

LIST OF FIGURES

ABSTRACT

A Chatbot (also known as a talkbot, chatterbot, Bot, interactive agent, or Artificial Conversational Entity) is a computer program which conducts a conversation via auditory or textual methods. Such programs are often designed to simulate how a human would behave as a conversational partner, thereby passing the Turing Test. Chatbots are used in dialogue systems for various practical purposes including customer service or information acquisition. Some chatter bots use sophisticated natural language processing (NLP)systems, but many simpler systems scan for keywords within the input, then pull a reply with the most matching keywords, or the most similar wording pattern, from a database or Bag Of Words(BoW).

Interface designers have come to appreciate that humans' readiness to interpret computer output as genuinely conversational—even when it is actually based on rather simple pattern-matching—can be exploited for useful purposes by adding it with better technologies and IBM Watson Assistant came with a platform to build chatbots by aggregating all the technologies needed at one place.

Keywords: Chatbot, Dialog Systems, Natural Language Processing, Bag Of Words, IBM Watson Assistant.

1. INTRODUCTION

Anyone who has ever tried to contact a company through a representative at a call centre knows how slow and frustrating the process can be. Even with upgrades and best practices in customer experience, there isn't much that can be done to improve the situation because in most cases the agent is looking through multiple CRMs and is limited by the speed of the programs they can Access. However, new developments in technology have opened doors to a faster, easier solution: "Chatbots".

A Chatbot is a service, powered by rules and sometimes artificial intelligence, that you interact with via a chat interface. The service could be any number of things, ranging from functional to fun, and it could live in any major chat product (Facebook Messenger, Slack, Telegram, Text Messages, etc.).

According to Borisov's definition, "A chatbot is a computer program that is capable of having a human-like conversation with a user by receiving and sending text messages for the purpose of automating a business process." A chatbot can have a conversation with a customer but isn't limited by technology because the AI technology is built into the software. In most cases, chatbots use messenger apps to communicate with customers. A person can type or ask a question and the chatbot responds with the right information. Depending on the situation, many chatbots can learn from what a customer says to personalize the interaction and build off previous interaction.

For example, if a customer talks with a chatbot and asks for movie recommendations, the chatbot can remember which movie the customer saw and follow up with it later when providing a recommendation for a restaurant or another movie. Chatbots have the ability to dig through huge amounts of data to pick out the best nugget for a customer, whether it is a troubleshooting solution or a recommendation for a new product to try.

Here are a couple of examples:

• *Weather Bot* - Get the weather whenever you ask.
• *Grocery bot* - Help me pick out and order groceries for the week.
• *News Bot* - Ask it to tell you whenever something interesting happens.
• *Life advice bot* - I'll tell it my problems and it helps me think of solutions.
• *Personal finance bot* - It helps me manage my money better.
• *Scheduling Bot* - Get me a meeting with someone on the Messenger team at Facebook.
• *A bot that's your friend* - In China, there is a bot called **Xiaoice**, built by Microsoft, that over 20 million people talk to.

2. USES OF CHATBOTS

Depending on the programming of chatbots, Chatbots can be of two types:
1.*Simple rule-based chatbots:* that can handle specific messages from users. They require a specific input and are programmed to generate a specific output, so there's not much room for different conversational styles.
2. *Advanced chatbots:* (and the one's businesses will benefit most from) are grounded in AI, are capable of understanding conversational phrasing, and are programmed to actively learn from previous conversations so they're constantly able to grow and develop.

Depending on this classification, Chatbots have varying use cases.

- *Customer Service*
  Chatbots can be useful in many aspects of the customer experience, including providing customer service, presenting product recommendations and engaging customers through targeted marketing campaigns. If a customer has an issue with a product, she can connect with a chatbot to explain the situation and the chatbot can input that information to provide a recommendation of how to fix the product.
- *Product Recommendation*
  On the recommendation side, chatbots can be used to share popular products with customers that they might find useful and can act as a sort of personal shopper or concierge service to find the perfect gift, meal or night out for a customer with just a few basic questions.
- *Branding Purposes*
  Brands are also using chatbots to connect their customers with thought leaders and add personality to their products. In all cases, brands seem to be having great success and experiencing increased engagement and revenue.
- *Personal Financial Assistance*
  They can also save money for companies and are easy to set up. Because most chatbots use messenger apps that are already on billions of phones around the world, chances are your customers are already plugged in and ready for your bot.
- *Sending Money*
  Chatbots can easily send payment to your team of friends through slack or PayPal.
- *News*
  Chatbots help you to stay up to date with the news headlines. Latest headlines from mainstream media sources like CNN, Fox News, or the Guardian. Or you can get the latest tech headlines from TechCrunch or Engadget.

3. HISTORY OF CHATBOTS

Over the years, Chatbots have been there in different forms. These are as follows:

• Alan Turing and Joseph Weizenbaum imagined computers talking like humans and, in 1950, had the foresight to develop a test to see if a person could distinguish human from the machine: the "Turing Test".

• In 1966 a computer program called "ELIZA" was invented by Weizenbaum. It imitated the language of a psychotherapist from only 200 lines of code. Mimicked human conversation by matching user prompts to scripted responses- it was able, at least for a time, to pass the Turing artificial intelligence test.

• 1972 Parry: Inexplicably simulated a person with paranoid schizophrenia. Parry was more serious and advanced than ELIZA- it was described as 'ELIZA with attitude'.

• The first move away from text chatbots occurred in 1988 when Rollo Carpenter started the Jabberwacky project – a voice-operated entertainment AI chatbot. One of the earliest attempts at creating an AI through human interaction. Mainly a form of entertainment, it had the ultimate goal of moving from a text-based system to one wholly voice-operated.

• In 1995, "A.L.I.C.E" (Artificial Linguistic Internet Computer Entity), was a natural language processing bot. She could apply heuristic pattern matching rules to human input- in other words, have a conversation.

• In 1992 Dr Sbaitso, an AI speech synthesis program created for MS-DOS-based Pcs. Designed to showcase a digitized voice, the Doc was far from lifelike-despite assuming the role of a psychologist when interacting with users.

• In the year 2000, Robert Hoffer from ActiveBuddy Inc. co-created the SmarterChild chatbot that used AOL Instant Messenger and MSN Messenger to build a relationship with over 30 million users. The chatbot provided access to news, weather, movie times and acted as a personal assistant using natural language comprehension.

• In 2001 Smarterchild, an Intelligent bot widely distributed across SMS networks. With features such as quick data access and fun personalized conversation. It was considered a precursor to Apple's Siri and Samsung's S Voice.

• 2006 IBM's Watson: "Watson" was designed to compete in Jeopardy!, which he won in 2011 against two of the show's former champions. Now Watson uses natural language processing and machine learning to reveal insights from large amounts of data.

• 2010 -2015: Over the next decade or so, bots became very popular among big tech companies, starting within Siri (2010), Google Now (2012), Alexa (2015), and Cortana in (2015). These bots are able to respond to voice commands, play music, and perform internet searches, among other tasks.

• 2016 Bots for Messenger: In April 2016, Facebook launched a Messenger platform which allows the developer to create bots that interact with FB users.

4. TYPES OF CHATBOT

Chatbots are mainly classified by the input it takes or by the task it is going to perform. The resulting categories are no coincidence: each one represents a hypothesis on how the use of the messaging canvas could disrupt traditional offerings. A lot of people are betting their hats on these implicit assumptions. Bots increase their disruptive potential if they provide value in several ways, but without confusing users.

Traditionally, there are two types of chatbots:

1. *AI-based:*
   These chatbots thrive on dynamic learning and constantly update themselves using various customer interactions. They are intelligent, of superior design, and offer better user experience.
2. *Fixed chatbots:*
   These are programs with fixed information and hence offer limited help. They are used for segments with limited customer access or to resolve back-end queries. However, fixed chatbots are not-so-popular due to their inability to understand perplexed human behaviour. Also, they may not be able to handle all the queries and hence come across as a challenge while interacting.

According to Watson Services, there are three types of chatbots, which are given below:

1. *Support Chatbots*:
   Support chatbots are built to master a single domain, like knowledge about a company. Support chatbots need to have personality, multi-turn capability, and context awareness. They should be able to walk a user through any major business processes and answer a wide range of FAQ-type questions. In IBM Watson, the Watson Conversation service is used for the short-tail, common questions and processes, and Watson Discovery service for the long-tail, but there are many potential solutions for this.

2. *Skills Chatbots:*
   Skills chatbots are typically more single-turn-type bots that do not require a lot of contextual awareness. They have set commands that are intended to make life easier: "Turn on my living room lights," for example. Speech functionality is usually used for this type of chatbot so the user does not need to turn on a device or click any buttons. It follows the commands quickly so that users can multitask while engaging with the bot. These chatbots do not worry too much about contextual awareness.

3. *Assistant Chatbots:*

Assistant chatbots are more or less a middle ground between the two bots above. They work best when they know a little bit about a variety of topics. Assistant chatbots need to be "conversational and respond" to just about anything while being as entertaining as possible.

Siri is a good, current example – while she only does so much, people continually ask her for things simply because even when she cannot perform the command, the response she gives tends to be amusing. These chatbots take huge training dataset to tackle every situation possible.

5. CHATBOT ARCHITECTURE

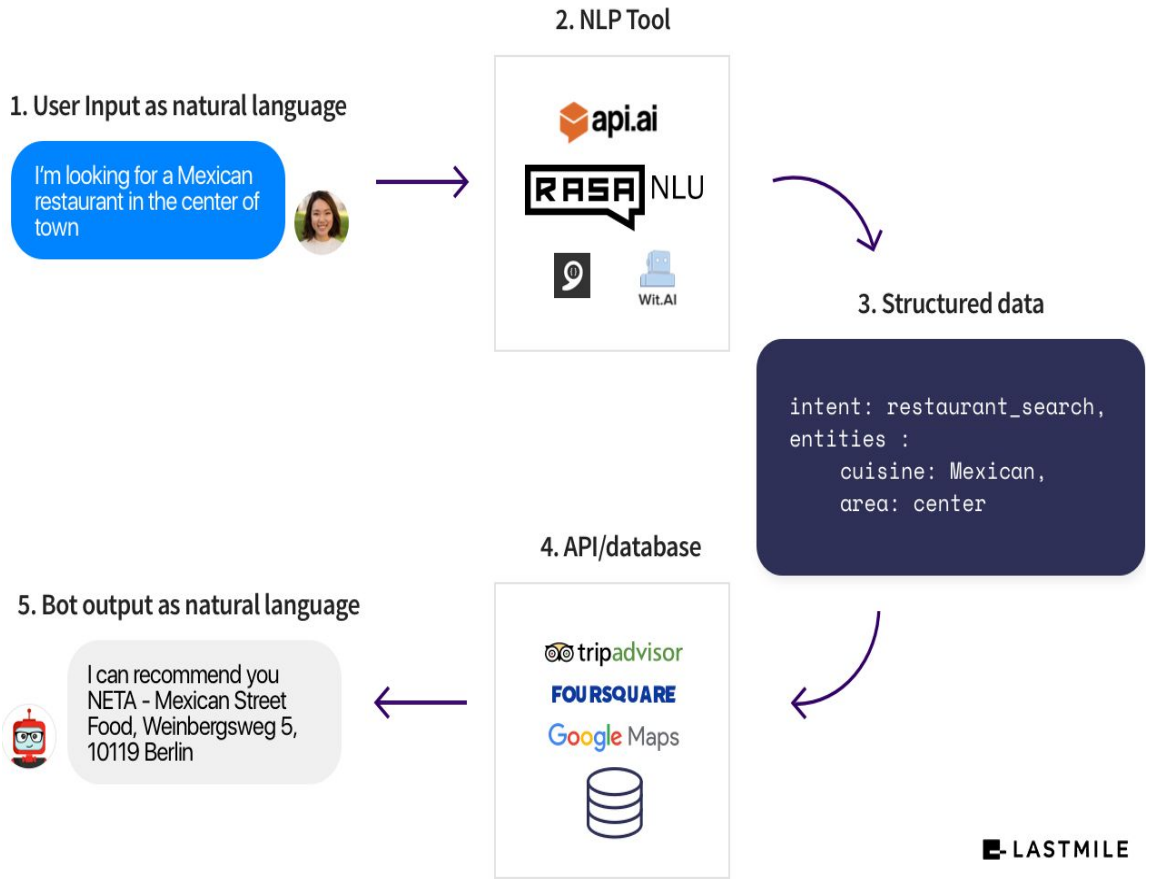

Fig 1: Architecture of chatbots

The architecture of chatbots is quite similar to that of web architecture. The starting step of the process is giving input to the program. The input is taken by the NLU platforms. The data is then converted to structured data. It searches for the response from the database or APIs and at the end, the output is given to the user through the user interface.
The architecture lies on the basic principle "client-server" model. The only difference is in the data. The data is "unstructured" in case of chatbots. In a web application, we are asked to feed particular inputs to the page, so the data are generally structured, but in chatbots, the raw data is given, so the data needs parsing and cleaning before searching for suitable outputs from the database.

6. STEPS OF MAKING A CHATBOT (USING WATSON SERVICES)

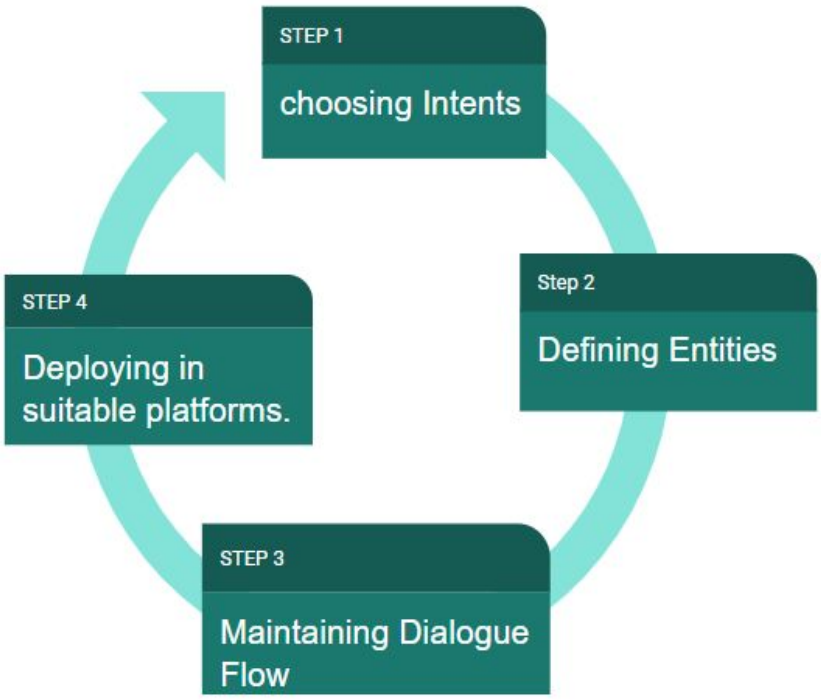

Fig 2: Steps of making a chatbot

6.1. CHOOSING INTENTS :

An Intent is a collection of expressions(what the user says) that mean the same thing but are constructed differently. Each intent corresponds to one action your user wants to perform.

For example, An intent “greet” will have the following expressions “hi,” hello,” hey,” all meaning the same thing as a greeting or conversation initiator.

Fig 3: Phrases under greeting intent.

6.2. DEFINING ENTITIES :

An Entity is a piece of information extracted from what a user says. These are the details you want the bot engine to capture in order to perform the action.

For example, When you look for a famous place in a city you would need to capture information like *the kind of place, the city* and the personal preferences like *timings etc.*

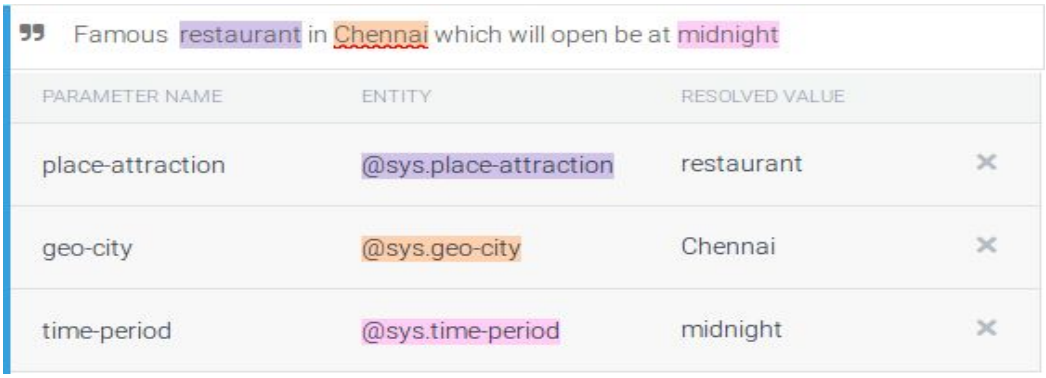

Fig 4: Example of Entities.

6.3. MAINTAINING DIALOG FLOW :

A “Dialogue” is a task that you expect your bot to do. In most cases, An external API performs this action. Since the bot platforms do not support external API calls, An external program is used to drive that functionality.

For example, When you ask your bot to order pizza for you, the bot extracts all the information(Entities) required to order pizza say, size, type, topping etc and sends it to an external API and gets a response whether the order is successful or not.

The below fig is for showing the response to delivery information asked, like “Do you deliver on weekends?”,”How many fays, it takes for delivery?”.”Is COD available?”. The chatbot will respond with something, suitable to the situation.

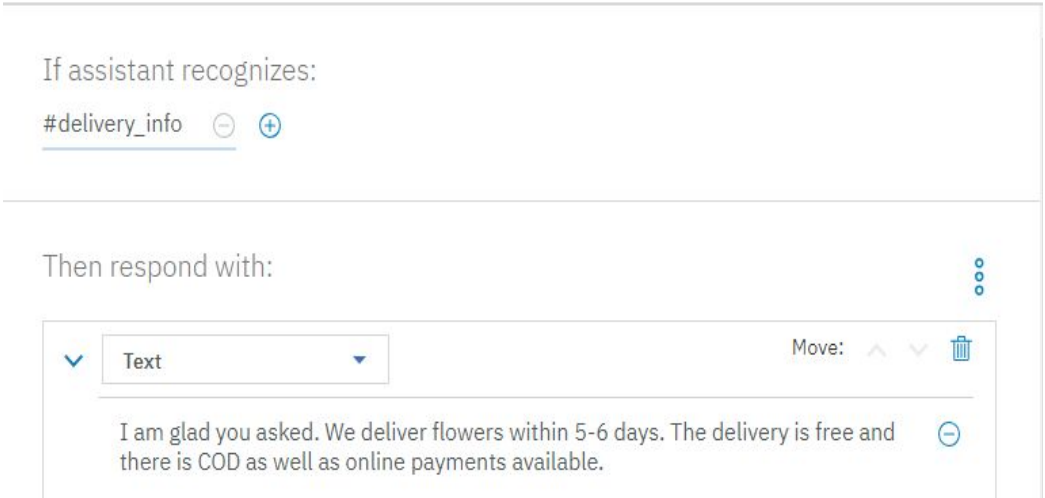

Fig 5: Example of dialogue flow

6.4. DEPLOYMENT :

The final step is to deploy the chatbot for public use, by integrating it with a website, app like WordPress, Slack, Discord etc. This step helps the company to gain some popularity and the bot to gain some experience and learn in the process.

7. MACHINE LEARNING BEHIND CHATBOTS :

Chatbots generally uses three machine learning concepts, given below:

1. **NLP (Natural Language Processing) :**

   It is a blanket term used to describe a machine's ability to ingest what is said to it, break it down, comprehend its meaning, determine appropriate action, and respond back in a language the user will understand.

2. **NLU (Natural Language Understanding) :**

   It is a subset of NLP that deals with the much narrower, but equally important facet of how to best handle unstructured inputs and convert them into a structured form that a machine can understand and act upon. While humans are able to effortlessly handle mispronunciations, swapped words, contractions, colloquialisms, and other quirks, machines are less adept at handling unpredictable inputs.

3. **NLG (Natural Language Generation) :**

   NLG processes turn structured data into text.

7.1 UNDERSTANDING THE WORKFLOW WITH AN EXAMPLE

The messenger bot was asked to buy a Tropicana bottle from some website. These are some of the steps that might be followed.

Let us say, a product on Facebook's Messenger was found and for the sake of consistency, let's say it's the same bottle of Tropicana. Through the presentation layer, a message is sent to the bot, that is picked up by the backend saying some Tropicana is wanted. Using Natural Language Processing, this plain text request is converted into codified commands for itself. Now the chatbot throws this data into a decision engine since in the bots mind it has certain criteria to meet to exit the conversational loop, notably, the quantity of Tropicana you want. Using Natural Language Generation , the bot asked how much of said Tropicana is wanted.This array of responses goes back into the messaging backend and is presented to you in the form of a question. You tell the bot you want 1 litre.The bot now analyzed pre-fed data about the product, stores, their locations and their proximity to your location. It identifies the closest store that has this product in stock and tells you what it costs. It then directs to a payment portal and after it receives confirmation from the gateway, it places the order, and in one to two business days, the 1 litre of Tropicana 100% Orange Juice is delivered to the home address.

8. CONCLUSIONS :

- A chatbot named Florence was made during this project using Watson Assistance and NLU Analysis, for the chatbot the *accuracy was almost 90%.*

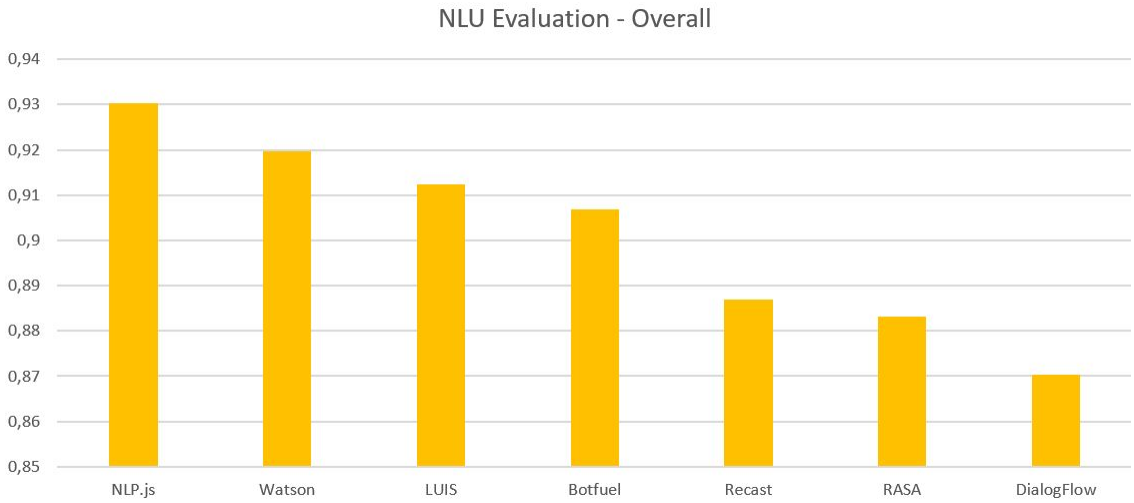

Fig 6: NLU Analysis for chatbots built on different platforms

- As the database was stored in the *IBM cloud*, it was easier for data backup.
- *Chatbots integration* with mobile and web application could be done directly.
- A good dialogue flow was maintained by the chatbot. It tried to make the conversation more humanely. The chatbot could *recognise the proper intents and entities.*

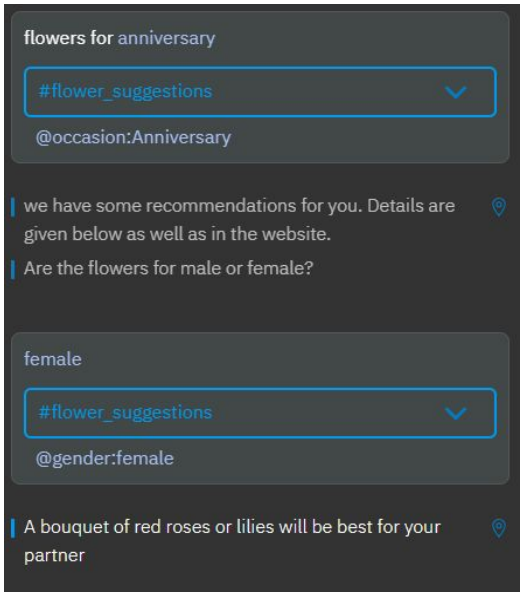

Fig 7: Results for flower suggestions by Florence

9. FUTURE REFERENCE :

What's the predictive future of Chatbots*?*

1. *Advances in AI development will impact Chatbots*

2017 has gone by and we haven't found any Chatbot that can pass the Turing test yet. But there are some exciting advances in AI development. The AI developed by Elon Musk went in for competing against the world's best players in Dota2 and won with ease. The most important news would be the new paper published by Google DeepMind regarding AlphaGo Zero. It was created without using data from human games and became stronger than any previous version. The release of AlphaGo Zero could potentially change how we will develop AI software in the future. It means that data would become less critical, and the key would be finding use cases where you could get a high volume of iterations, so the AI system could iterate fast enough to improve itself. For chatbot development, this is a significant advantage due to the massive level of conversations a chatbot could perform with users. Though we still have to figure out how to validate the answers. I predict in 2019 we will see more advances in AI that can improve significantly the conversational capabilities of chatbots

2. *Voice Experiences Going Mainstream*

2017 has been an excellent year for Voice Interfaces due to the effort from Big Corps like Amazon and Google to pushing forward the Smart Speakers market. According to official data Amazon has already sold more than 20M Echo devices and with more than 20K skills available on Alexa Store. Google, on the other hand, is trying to make its assistant available on all Android devices like Smartphones, Android Wear, Smart tv, Smart speaker, etc. In 2018 this trend is continuing, we might see some early success from a few voice bots.

3. *Blockchain the Surprising Ally for Chatbot*

In 2017 we all have seen the hyper-growth of Cryptocurrencies where Bitcoin and Ethereum are in the headline of every major media news. Bitcoin has already passed the 18k dollars milestone. Bubble or not, we can see blockchain is rapidly changing the technology landscape. Some players in the chatbot space have already started to toy around with this new technology. Companies & Governments are toyed to build their own crypto-token to build virtual economy inside its messaging platform, companies are also betting big on the blockchain technology to incentivize their network of advice givers to use the bot platforms and continue the relationship with the learners.

4. *Social Messenger Applications will aggressively drive Chatbot Marketing*

“Messaging is one of the few things that people do more than social networking” Mark Zuckerberg. But there are only a few platforms that people are messaging on. Credence Research recently predicted enterprises would transmit two trillion messages a year by 2017 to create a market worth $78m by 2022, 72% of U.S smartphone users use less than 7 apps in a day. This created a need for existing platforms to step up, and large platforms started letting businesses build platforms on top of them.

Facebook reports that there are over 10,000 developers on their platform developing chatbots. Slack, the world’s fastest-growing business tool is reportedly investing $80 million in slack-bot startups. Chatbots allow the flexibility to use an app without actually installing it on your phone.

6. *Reach of Deep Learning and Artificial Intelligence* will increase across all domains from 2018. Consider this statistic from Gartner, that artificial intelligence will amount to 85% of customer relationships by 2020. “AI is not new to marketing. It actually began with automation of lots of marketing tasks that were initially done manually,” says David Geer, TNW writer. Chatbots are going to get a lot smarter, with speculation, imagine a chatbot that was indistinguishable from a human. It could run millions of algorithms in real time and using analytics devise a strategy to convert every prospect individually. In today’s sensitive and polarized online world, it will take some trial and error before AI chatbots master the delicacies of polite conversation. Microsoft AI Tay has already taught us the unpredictable nature of AI in less than 24 hours of its launch.

7. *Cost of Chatbots will get cheaper* as the adoption of it increases across domains.

Facebook’s decision to let third-party applications build chatbots in its messenger platform has drastically lowered the price. Companies like Kore, give access to the development of individual.chatbots to fit the customer need, which is simple to create, structured, easy to use without much programming fed into them but through predetermined menu options, they let the customer, browse, interact, or make a purchase — such platforms will eventually bring down the cost for making a bot. Companies need to stay on top of developments like these to remain competitive

10. REFERENCES :

1) Computer History Museum (2006), "Internet History—1970's", *Exhibits*, Computer History Museum, archived from the original on 2008-02-21, retrieved 2008-03-05
2) Güzeldere, Güven; Franchi, Stefano (1995-07-24), "Constructions of the Mind", *Stanford Humanities Review*, SEHR, Stanford University, 4 (2), retrieved 2008-03-05
3) Mauldin, Michael (1994), "ChatterBots, TinyMuds, and the Turing Test: Entering the Loebner Prize Competition", *Proceedings of the Eleventh National Conference on Artificial Intelligence*, AAAI Press, retrieved 2008-03-05 (abstract)
4) Network Working Group (1973), "RFC 439, PARRY Encounters the DOCTOR", *Internet Engineering Task Force*, Internet Society, retrieved 2008-03-05
5) Sondheim, Alan J (1997)*Important Documents from the Early Internet (1972)*, nettime.org, archived from the original on 2008-06-13, retrieved 2008-03-05
6) Searle, John (1980), "Minds, Brains and Programs", *Behavioral and Brain Sciences*
7) Shevat, Amir (2017). *Designing bots: Creating conversational experiences* (First ed.). Sebastopol, CA: O'Reilly Media.
8) Turing, Alan (1950), "Computing Machinery and Intelligence"
9) Weizenbaum, Joseph (January 1966), "ELIZA—A Computer Program For the Study of Natural Language Communication Between Man And Machine", *Communications of the ACM*
10) https://chatbotsmagazine.com
11) https://en.wikipedia.org/wiki/Chatbot
12) https://medium.com/swlh/