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Vellore Institute of Technology

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CHATBOT

Submitted in partial fulfillment of the requirements for the degree of

Bachelor of Technology

in

COMPUTER SCIENCE

By

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CERTIFICATE

This is to certify that the thesis entitled “CHATBOT” submitted by

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, VIT, for the award of the degree of **Bachelor of Technology in Computer Science**
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The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university. The thesis fulfills the requirements and regulations of the University and in my opinion meets the necessary standards for submission.

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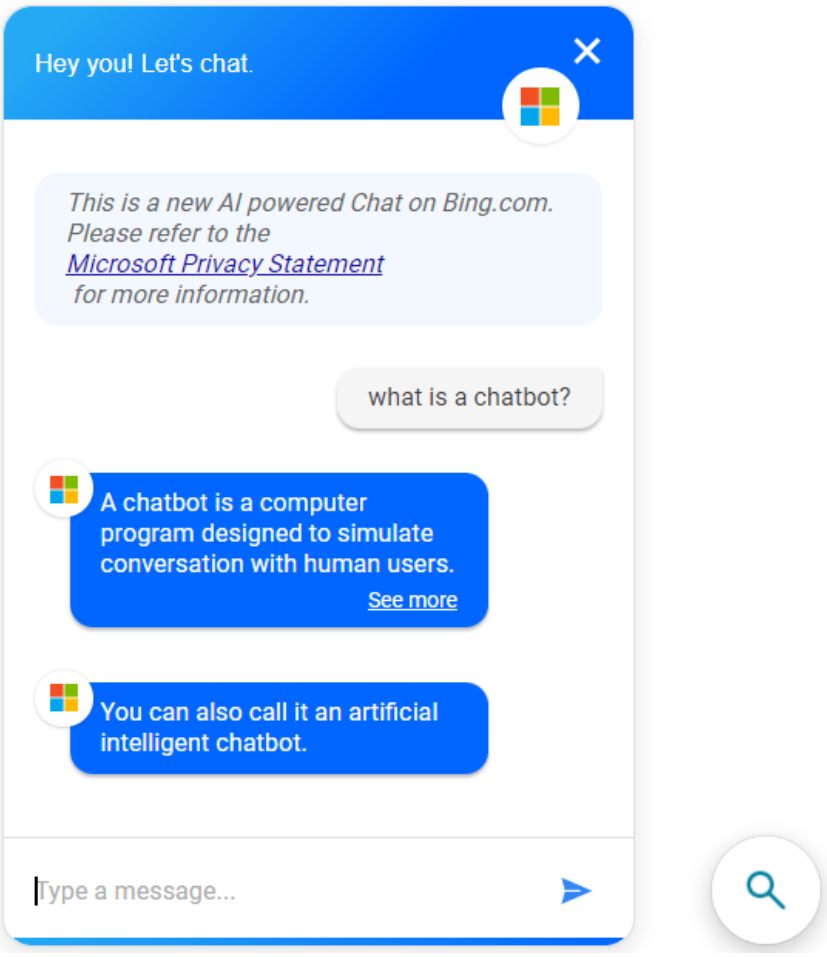
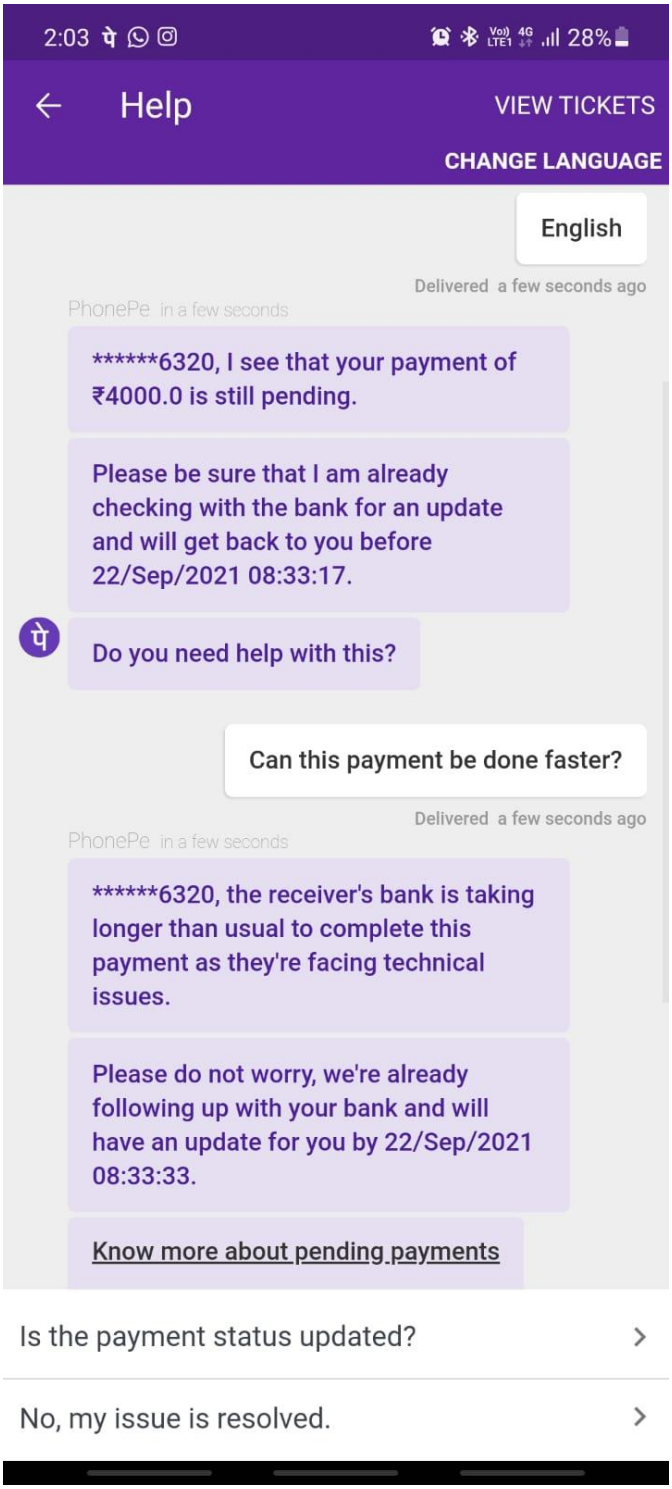
Contents:

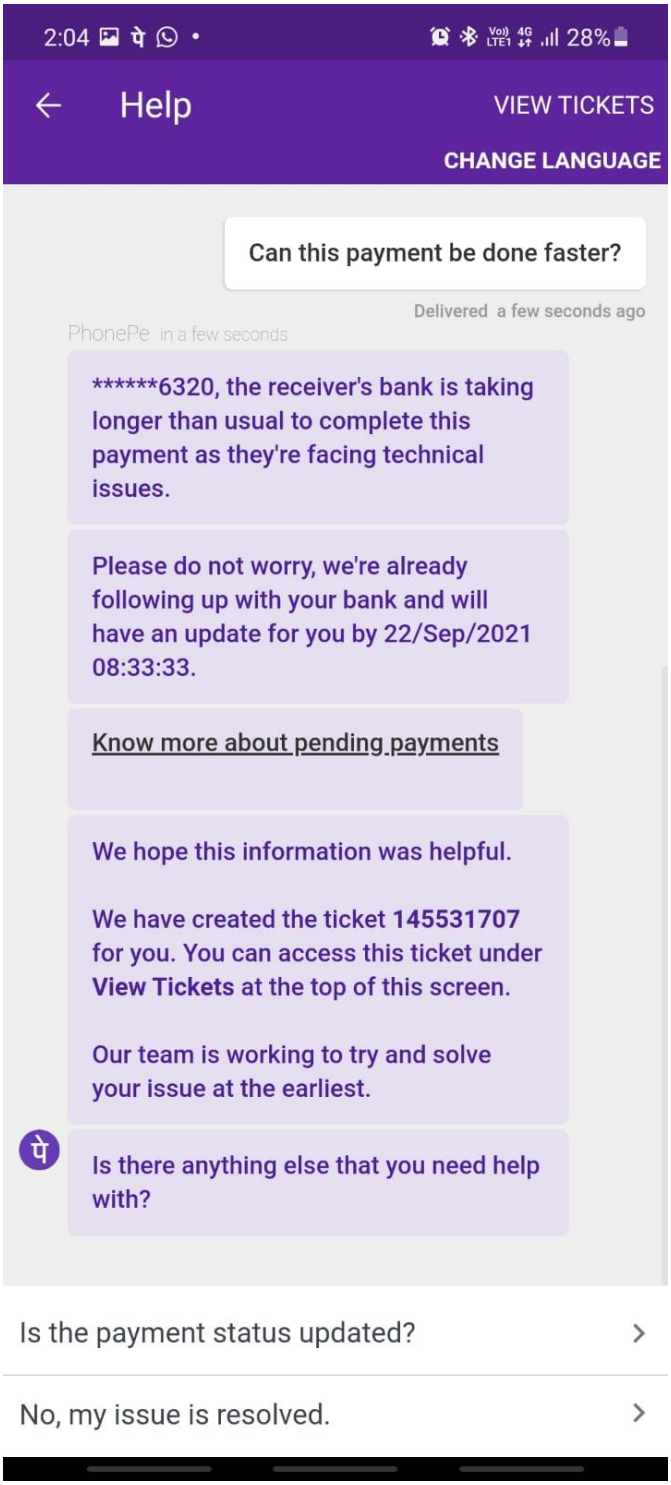
What is a Chatbot?

- A chatbot can be defined as a developed program capable of having a discussion/conversation with a human. Any user might, for example, ask the bot a question or make a statement, and the bot would answer or perform an action as necessary. A chatbot communicates similarly to instant messaging.
- Chatbots are widely in use now-a-days for various business or personal purpose. They brought a new way for businesses to communicate with their customers with the help of emerging technologies like Artificial Intelligence. Not only chatbots can be used for customer support but also it can help users to act as their companion.



REAL-LIFE EXAMPLE OF CHATBOT (CUSTOMER SERVICE)

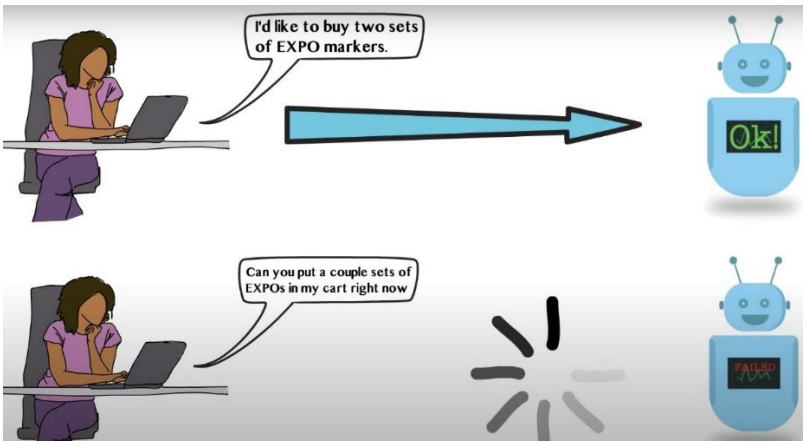




TYPES OF CHATBOTS

There are 2 categories of chatbots:

1. **Rule-based chatbots:**
   A rule-based bot can only comprehend a limited range of choices that it has been programmed with. Predefined rules define the course of the bot's conversation. Rule-based chatbots are easier to build as they use a simple true-false algorithm to understand user queries and provide relevant answers.

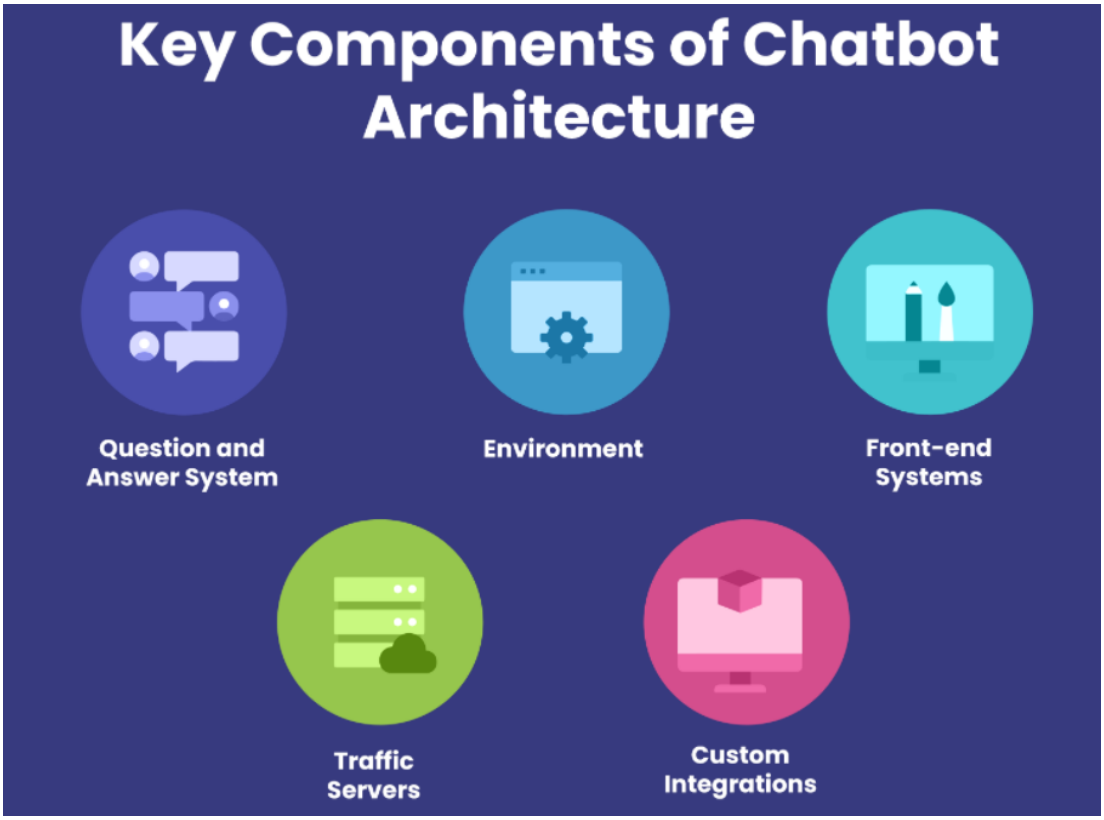


2. **AI-based chatbots:**
   This bot is equipped with an artificial brain, also known as artificial intelligence. It is trained using machine-learning algorithms and can understand open-ended queries. Not only does it comprehend orders, but it also understands the language. As the bot learns from the interactions it has with users, it continues to improve. The AI chatbot identifies the language, context, and intent, which then reacts accordingly.

What is Chatbot Architecture?

Chatbot architecture is the spine of the chatbot. The type of architecture for your chatbot depends on various factors like use-case, domain, chatbot type, etc. However, the basic conversation flow remains the same.

1. **Question and Answer System:**
   The Q&A system is responsible for answering customers' frequently asked questions.
2. **Environment**:
   The environment is mainly responsible for contextualizing users' messages using natural language processing (NLP). The NLP Engine is the central component of the chatbot architecture. It interprets what users are saying at any given time and turns it into organized inputs that the system can process.
3. **Front-End Systems:**
   Front-end systems are the ones where users interact with the chatbot. These are client-facing systems such as – Facebook Messenger, WhatsApp business, Slack, Google Hangouts, your website or mobile app, etc.
4. **Node Server / Traffic Server:**
   It is the server that deals with user traffic requests and routes them to the proper components. The response from internal components is often routed via the traffic server to the front-end systems.
5. **Custom Integrations**
   With custom integrations, your chatbot can be integrated with your existing backend systems like CRM, database, payment apps, calendar, and many such tools, to enhance the capabilities of your chatbot.



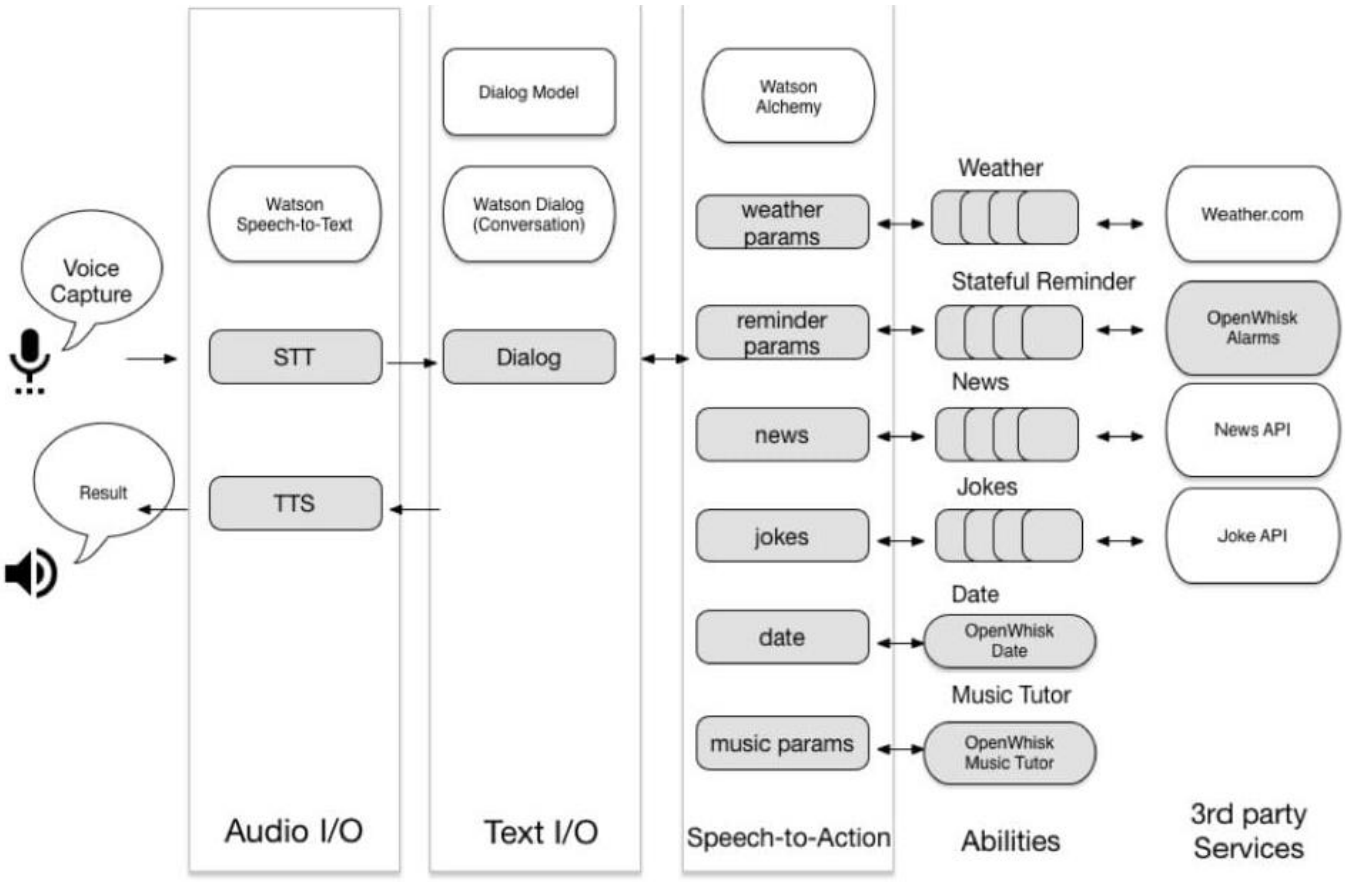


Figure 2. Chatbot Architecture

WORKING OF CHATBOTS

1. Pattern Matchers

Bots use pattern matching to classify the text and produce a suitable response for the customers. A standard structure of these patterns is “Artificial Intelligence Markup Language” (AIML).
Example:

```
<aiml version = "1.0.1" encoding = "UTF-8"?>
  <category>
    <pattern> WHO IS ABRAHAM LINCOLN </pattern>
    <template>Abraham Lincoln was the US President during American civil war.</template>
  </category>

  <category>
    <pattern>DO YOU KNOW WHO * IS</pattern>
    <template>
      <srai>WHO IS <star/></srai>
    </template>
  </category>
</aiml>
```

The machine then gives and output:

Human: Do you know who Abraham Lincoln is?
Robot: Abraham Lincoln was the US President during the American civil war.

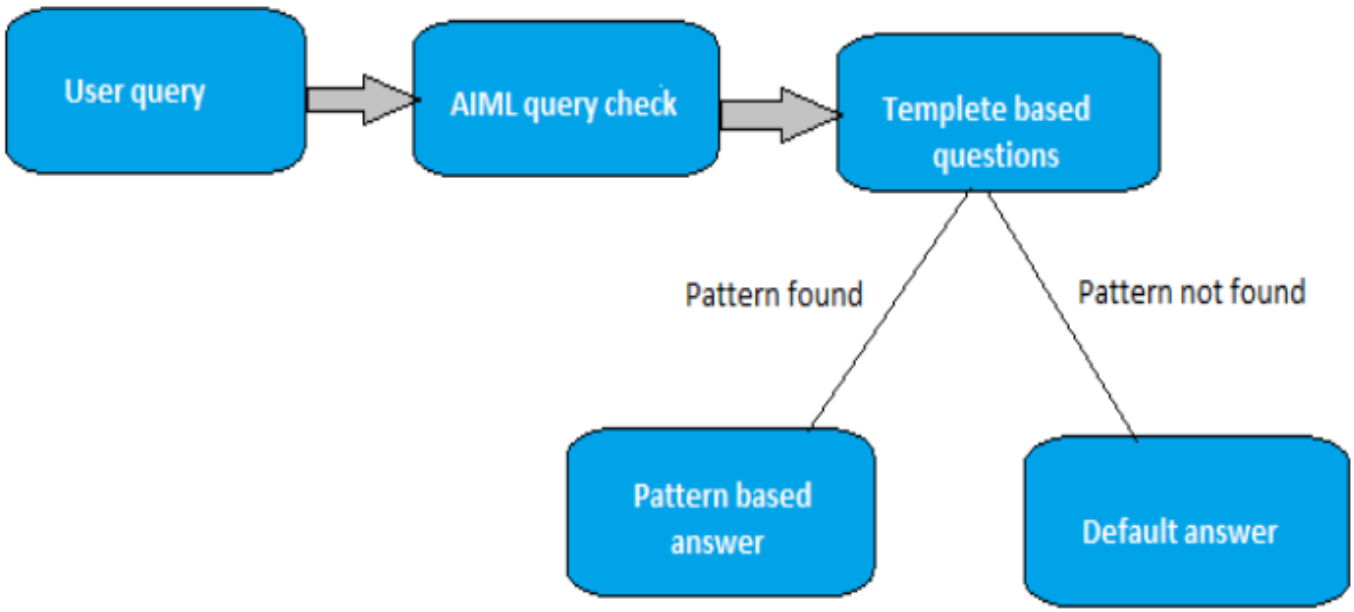
Chatbot knows the answer only because his or her name is in the associated pattern. Similarly, chatbots respond to anything relating it to the associated patterns. But it cannot go beyond the related pattern. Algorithms can help for an advanced level of working.

2. Algorithms

A unique pattern must be available in the database to provide a suitable response for each kind of question. A hierarchy is created with lots of combinations of patterns. Algorithms are used to reduce the number of classifiers and create a more manageable structure.

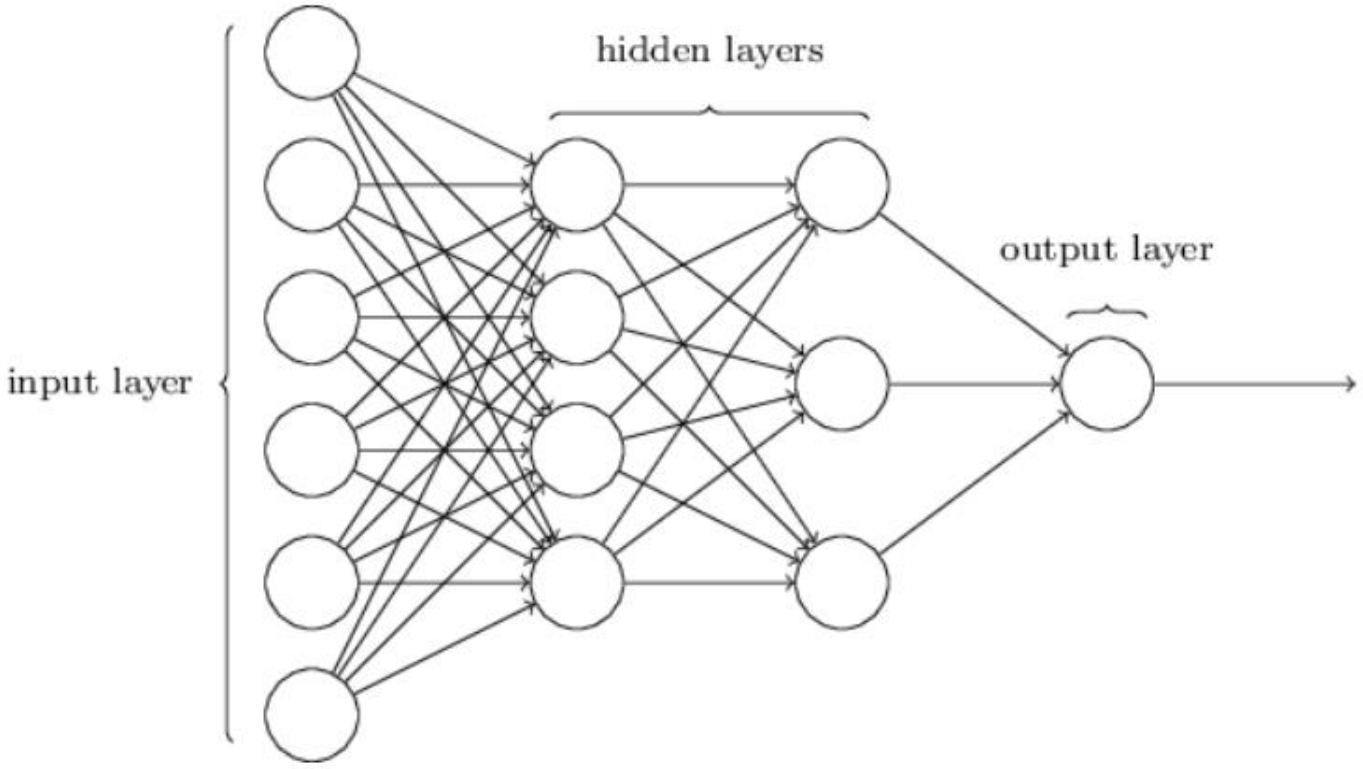
Computer scientists call it a “Reductionist” approach- to give a simplified solution; it reduces the problem.

Multinational Naive Bayes is the best example of the algorithm for NLP and text classification. For instance, let’s look at the set of sentences that belong to a particular class. With new input sentences, each word is counted for its occurrence and is accounted for its commonality. Then, each class is assigned a score. The highest scored class is the most likely to be associated with the input sentence.



3. Artificial Neural Networks

Neural Networks are a way of calculating the output from the input using weighted connections, which are computed from repeated iterations while training the data. Each step through the training data amends the weights resulting in the output with accuracy.



The trained data of a neural network is a comparable algorithm with more and less code. When there is a comparably small sample, where the training sentences have 200 different words and 20 classes, that would be a matrix of 200×20. But this matrix size increases by n times more gradually and can cause a massive number of errors. In this kind of scenario, processing speed should be considerably high.
There are multiple variations in neural networks, algorithms as well as patterns matching code. Complexity may also increase in some of the variations. But the fundamental remains the same, and the critical work is that of classification.

NLU (NATURAL LANGUAGE UNDERSTANDING)

NLU helps the chatbot understand the query by breaking it down.

- **Entities**: An entity represents keywords from the user's query picked up by the chatbot to understand what the user wants.
- **Intents**: It helps identify the action the chatbot needs to perform on the user's input.
- **Context:** With context, you can easily relate intents without any need to know what was the previous question.

ARTIFICIAL INTELLIGENCE MARKUP LANGUAGE

It has class of data object called an AIML object that describes the behavior of computer programs. It consists of units or tag called topics and categories. In AIML, categories are basic unit of knowledge. Each category consists of pattern which contains input and template which contain answer of chatbot.

There are three types of AIML classes:

Atomic category:

$< category >$
$< pattern >$How are you$< /pattern >$
$< template >$I am fine!$< /template >$
$< /category >$

Default category:

$< category >$
$< pattern >$Who is * $< /pattern >$
$< template >$ He is my brother $< /template >$
$< /category >$

Recursive category:

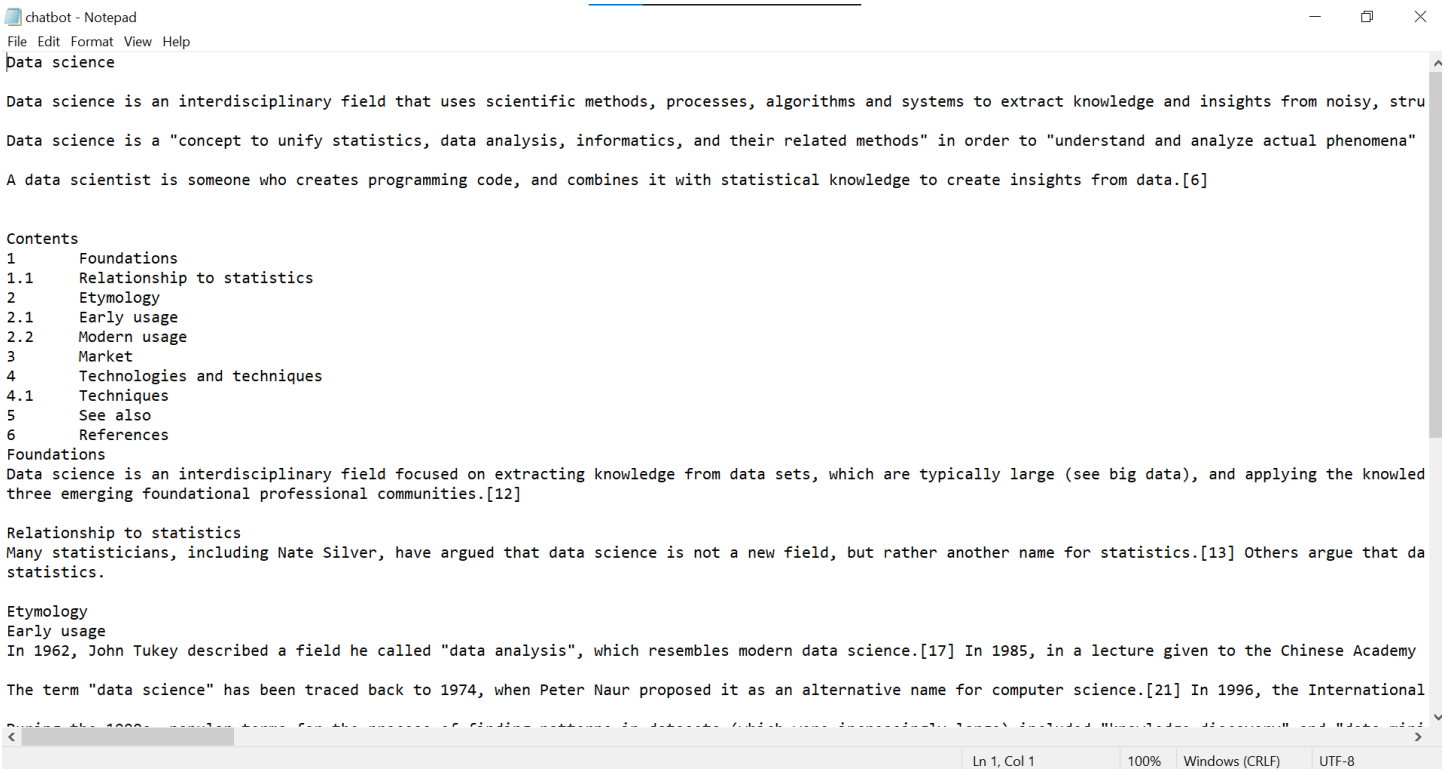
$< category >$
$< pattern >$ Can you tell who the * is $< /pattern >$
$< template >$ He is my brother
$< srai >$ Who is * $< /srai >$
$< /template >$
$< /category >$

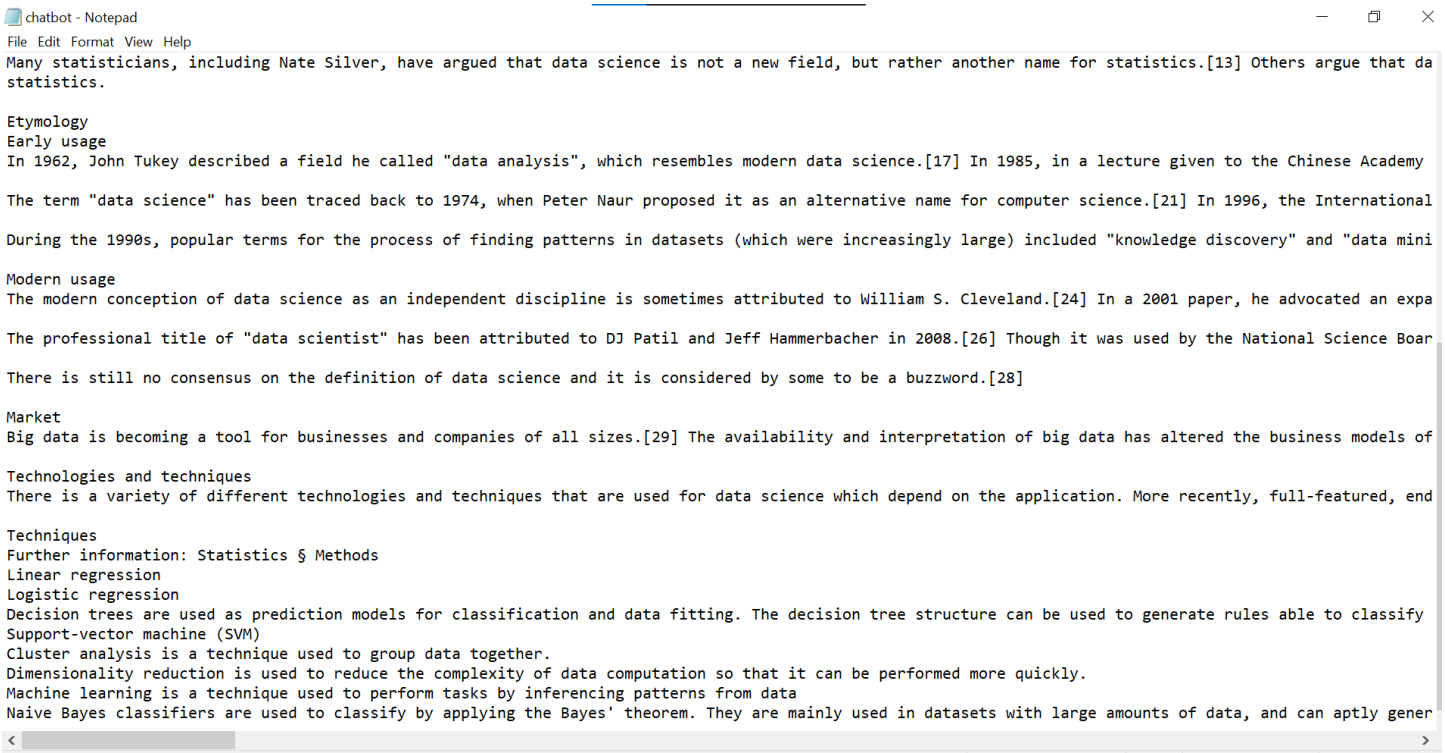
NLP (NATURAL LANGUAGE PROCESSING)

Natural Language Processing (NLP) chatbot takes some steps to convert the customer's text or speech into structured data to select the related answer.

- **Sentiment Analysis**: With this, the algorithm tries to interpret the sentiment of the user's query by reading into the entities, themes, and topics.
- **Tokenization**: The NLP divides a string of words into pieces or tokens. These tokens are linguistically symbolic or are differently helpful for the application.
- **Named Entity Recognition**: The chatbot program model looks for categories of words, like the name of the product, the user's name or address, whichever data is required.
- **Normalization**: The chatbot program model processes the text to find common spelling mistakes or typographical errors in the user's intent. It gives a more human-like effect of the chatbot to the users.
- **Dependency Parsing**: The chatbot looks for the objects and subjects- verbs, nouns and common phrases in the user's text to find dependent and related terms that users might be trying to convey.

Datasets for the AI based chatbot





AI – BASED CHATBOT

CODE:

Untitled0.ipynb

File Edit View Insert Runtime Tools Help

+ Code + Text

```
[1]  import numpy as np
     import nltk
     import string
     import random
```

importing and reading the corpus

```
[3]  f=open('chatbot.txt','r',errors='ignore')
     raw_doc=f.read()
     raw_doc=raw_doc.lower()
     nltk.download('punkt')
     nltk.download('wordnet')
     sent_tokens=nltk.sent_tokenize(raw_doc)
     word_tokens=nltk.word_tokenize(raw_doc)
```

```
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Unzipping tokenizers/punkt.zip.
[nltk_data] Downloading package wordnet to /root/nltk_data...
[nltk_data]   Unzipping corpora/wordnet.zip.
```

example of sentence tokens

```
[ ]  sent_tokens[:2]
```

```
['data science\n\ndata science is an interdisciplinary field that uses scientific methods, pro
 'data science is related to data mining, machine learning and big data.']
```

example of word tokens

```
[ ]  word_tokens[:2]
```

```
['data', 'science']
```

text preprocessing

```
[ ]  lemmer=nltk.stem.WordNetLemmatizer()
     def LemTokens(tokens):
       return [lemmer.lemmatize(token) for token in tokens]
       remove_punct_dict=dict((ord(punct), None) for punct in string.punctuation)
       def LemNormalize(text):
         return LemTokens(nltk.word_tokenize(text.lower().translate(remove_punct_dict)))
```

defining the greeting function

```
     GREET_INPUTS = ("hello","hi","sup","greetings","what's up","hey")
     GREET_RESPONSES = ["hi","hey","*nods*","hi there","i'm glad you are talking to me"]
     def greet(sentence):
       for word in sentence.split():
         if word.lower() in GREET_INPUTS:
           return random.choice(GREET_RESPONSES)
```

response generation

```
[ ]  from sklearn.feature_extraction.text import TfidfVectorizer
     from sklearn.metrics.pairwise import cosine_similarity
```

```
[ ]  def response(robo1_response):
       robo1_response=''
       TfidfVec=TfidfVectorizer(tokenizer=LemNormalize, stop_words='english')
       tfidf=TfidfVec.fit_transform(sent_tokens)
       vals=cosine_similarity(tfidf[-1],tfidf)
       idx=vals.argsort()[0][-2]
       flat=vals.flatten()
       flat.sort()
       req_tfidf=flat[-2]
       if(req_tfidf==0):
         robo1_response=robo1_response+"i'm sorry! i don't understand you"
         return robo1_response
       else:
           robo1_response=robo1_response+sent_tokens[idx]
           return robo1_response
```

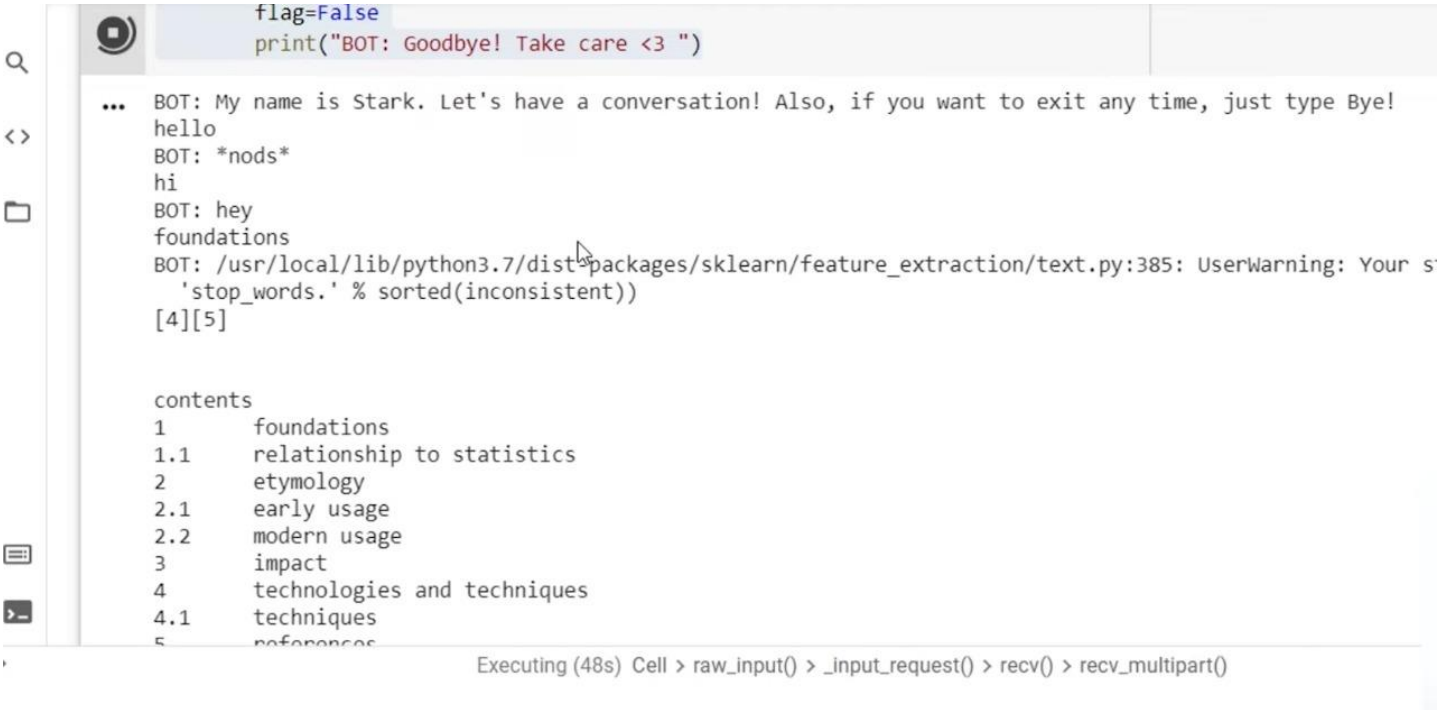
+ Code + Text

```
     flag=True
     print("BOT: my name is Stark. Let's have a conversation! Also, if you want to exit any time, just type Bye!")
     while(flag==True):
       user_response=input()
       user_response=user_response.lower()
       if(user_response!='bye'):
         if(user_response=='thanks' or user_response=='thank you'):
           flag=False
           print("BOT: you r welcome..")
         else:
             if(greet(user_response)!=None):
               print("BOT: "+greet(user_response))
             else:
                 sent_tokens.append(user_response)
                 word_tokens=word_tokens+nltk.word_tokenize(user_response)
                 final_words=list(set(word_tokens))
                 print("BOT: ",end="")
                 print(response(user_response))
                 sent_tokens.remove(user_response)
       else:
                   flag=False
                   print("BOT: goodbye! take care")
```

OUTPUT:

In general output:

Referring the corpus output:



RULE/KNOWLEDGE – BASED CHATBOT

CODE:

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source code

```
#include <iostream>
#include <string>
#include <vector>
#include <ctime>
const int MAX_RESP = 3;
typedef std::vector<std::string> vstring;
vstring find_match(std::string input);
void copy(char *array[], vstring &v);
typedef struct
{
    char *input;
    char *responses[MAX_RESP];
}record;
record KnowledgeBase[] =
{
    {"WHAT IS YOUR NAME",
    {"MY NAME IS CHATTERBOT2.",
     "YOU CAN CALL ME CHATTERBOT2.",
     "WHY DO YOU WANT TO KNOW MY NAME?"}
    },

    {"HI",
    {"HI THERE!",
     "HOW ARE YOU?",
     "HI!"}
    },

    {"HOW ARE YOU",
    {"I'M DOING FINE!",
    "I'M DOING WELL AND YOU?",
    "WHY DO YOU WANT TO KNOW HOW AM I DOING?"}
    },

    {"WHO ARE YOU",
    {"I'M AN A.I PROGRAM.",
     "I THINK THAT YOU KNOW WHO I'M.",
     "WHY ARE YOU ASKING?"}
```

Run | Debug | Stop | Share | Save | { } Beautify

source code

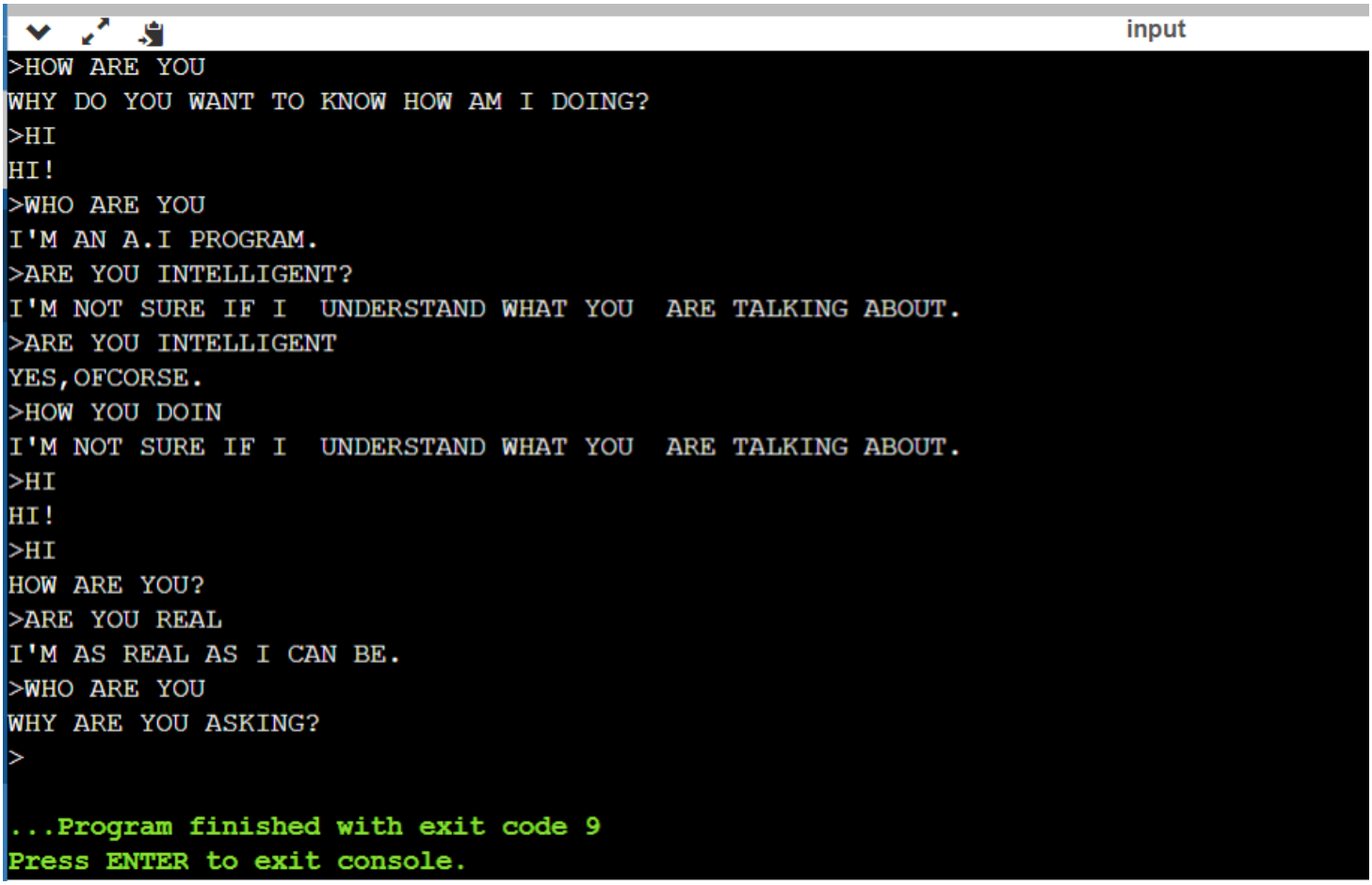
```
    },

    {"ARE YOU INTELLIGENT",
    {"YES,OFCORSE.",
     "WHAT DO YOU THINK?",
     "ACTUALY,I'M VERY INTELLIGENT!"}
    },

    {"ARE YOU REAL",
    {"DOES THAT QUESTION REALLY MATERS TO YOU?",
     "WHAT DO YOU MEAN BY THAT?",
     "I'M AS REAL AS I CAN BE."}
    }
};
size_t nKnowledgeBaseSize = sizeof(KnowledgeBase)/sizeof(KnowledgeBase[0]);
int main()
{
    srand((unsigned) time(NULL));
    std::string sInput = "";
    std::string sResponse = "";
    while(1)
    {
        std::cout << ">";
        std::getline(std::cin, sInput);
        vstring responses = find_match(sInput);
        if(sInput == "BYE")
        {
            std::cout << "IT WAS NICE TALKING TO YOU USER, SEE YOU NEXTTIME!" << std::endl;
            break;
        }
        else if(responses.size() == 0)
        {
            std::cout << "I'M NOT SURE IF I  UNDERSTAND WHAT YOU  ARE TALKING ABOUT."
                      << std::endl;
        }
        else
        {
             int nSelection = rand()  % MAX_RESP;
             sResponse =   responses[nSelection]; std::cout << sResponse << std::endl;
         }
     }
     return 0;
}
// make a  search for the  user's input
// inside the database of the program
vstring find_match(std::string  input)
{
    vstring result;
    for(int i = 0; i < nKnowledgeBaseSize;  ++i)
    {
        if(std::string(KnowledgeBase[i].input) == input)
        {
            copy(KnowledgeBase[i].responses, result);
            return result;
        }
    }
    return result;
}
void copy(char  *array[], vstring &v)
{
    for(int i = 0;  i < MAX_RESP; ++i)
    {
        v.push_back(array[i]);
    }
}
```

The program can understand some sentences like "**what is your name**", "**are you intelligent**", etc. And also, he can choose an appropriate response from his list of responses for this given sentence and just display it on the screen.
We've also added a couple of new techniques to these new programs: when the program is unable to find a matching keyword for the current user input, it simply answers by saying that it doesn't understand which is quite human like.

OUTPUT:



References

[1] IRJET-V7I51160.pdf

[2] How do Chatbots work? A Guide to the Chatbot Architecture (marutitech.com)

[3] (PDF) A Smart Chatbot Architecture based NLP and Machine Learning for Health Care Assistance (researchgate.net)

[4] (PDF) Chatbot for university related FAQs (researchgate.net)

Thank you