AI Chat bots developing

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We are the programmers of the Chat Bot RoboMatic X1. We are Egyptian freelance programmers interested in AI and Chat Bots developing.
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Introduction:

Artificial Intelligence (AI) technology provides techniques for developing computer programs for carrying out a variety of tasks, simulating the intelligent way of problem solving by humans. The problems that humans solve in their day-to-day life are of a wide variety in different domains. Though the domains are different and also the method, AI technology provides a set of formalisms to represent the problems and also the techniques for solving them. What AI technology provides us is what is described in the above sentences. Based on this, it is very difficult to precisely define the term *artificial intelligence*.

As you know the chat bot is a chatting robot that can understand what you are saying, analyze it and give you a suitable response, it's considered to be serious branch in AI developing as the purpose from programming a chat bot is to help people in getting info like:
Selling chat bots: helps people to know item prices and offers.
Supporting chat bots: you may find this kind of chat bots in websites which offers products and services.
Help desk (information desk) chat bots: you may find it in large libraries websites or programs.
Entertaining chat bots: This only made for fun and for chating.

In 1966, Eliza, the first chat bot, was created by Joseph Weizenbaum. In this article we are going to discuss how to build your chat bot, how to increase its ability to understand, how to make your bot able to do some operations which helps you in your daily life and finally tips & tricks to make your chat bot almost real like human. We are going to focus on logics only so any programmer can program our logics into any programming language.

Building your Chat Bot:

Before building your chat bot, you have to understand that any chat bot consists of three main parts:

- **Input text**: where you are going to write what you want to say to your chat bot.

- **Sending button:** so you can send your input to be analyzed before getting the output.

- **Output text:** where your chat bot is going to give a response.

The most important part is the sending button as it contains all the processes which analyze your input before copying the result to the output, so I will call the sending button the Artificial Intelligence Base (AI Base).

The AI Base Principles:

Any dialogue has beginning and ending like saying "Hello"-"Hey"-"Good morning"-"Hi, how are you?" ... etc, we always hear this sentences when two persons start talking. There is also other situations which don't need this sentences to begin like "Excuse me, what is the time?" ... etc, in other hand we hear other sentences like "I have to go now" - "bye, see you later" - "I'll call you later" - "looking forward to see you" ... etc, these sentences usually used to end the conversation.

As you see there are countless possibilities for inputs which your chat bot may not understand, for this reason we have to classify any dialogue to a number of subjects and expressions and create files for each subject and expression that contains all the related words. (See figure: 1)

Figure: 1

Now your chat bot has the database which understand user inputs and give suitable outputs, but that's not accurate as there are sentences have same words but have different meanings.
Example:
"I hate you." → will lead to make your chatbot angry.
"I hate myself." → also, will lead to make your chatbot angry as he is looking for the word "hate", but that's wrong because user didn't offense the chatbot so the chat bot should be sad or surprised not angry.

So you must build search engines to look for user inputs by different ways to make sure that your chat bot will understand user inputs well and give suitable response. We are going to discuss these search engines which I call it: Special Search Engine and Matrix Search Engine.

Special and Matrix search engines:
The Special Engine compares between sentences stored in the database and user inputs, while the Matrix Engine compares between words stored in the database and user inputs. Each file has two types, Matrix Database and Special Database, Each type of database uses its engine.
File: "Laugh" → Special "Laugh" Database
                → Matrix "Laugh" Database
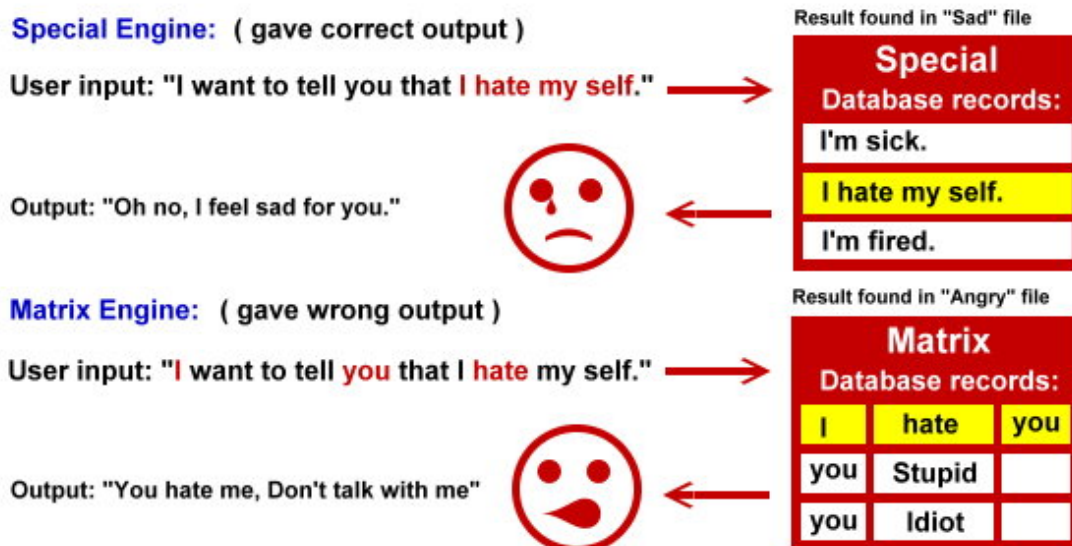The following example shows the difference between the two engines.

Figure: 2

As you see in figure 2, the Matrix Engine failed to give the correct answer because it was looking for words, you may think that the Matrix Engine is useless but actually it is not. As I said before, you can't fill AI Base with all possibilities and so Matrix Engine is very important to cover more possibilities than Special Engine.
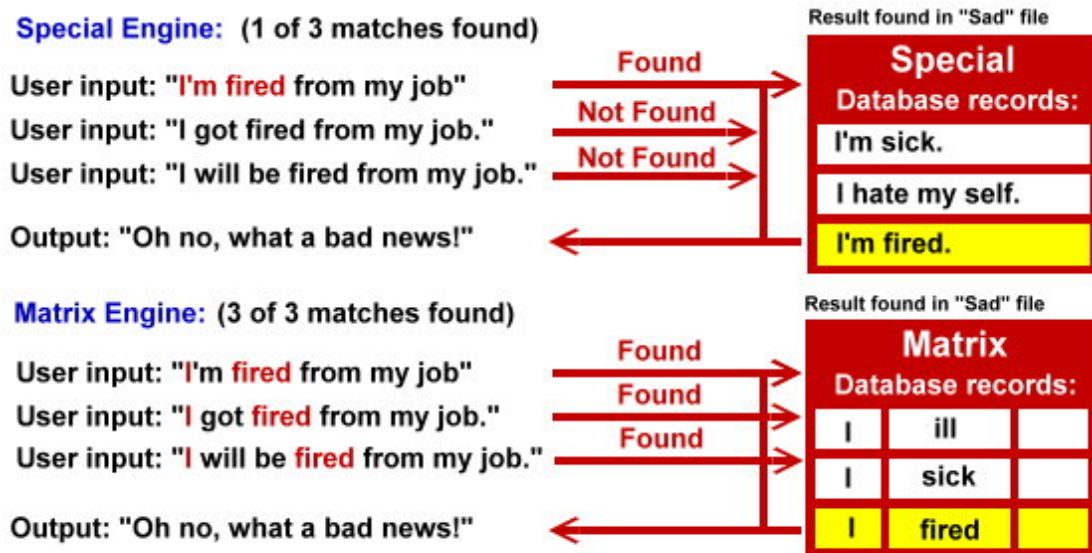
Figure: 3

Figure 3 shows the importance of Matrix Engine in understanding three different sentences have the same meaning which matches with one record only in the Matrix Database, that means Special and Matrix engine complete each other.

One last thing you should know about this engines is that the Special Engine is a part of (belong to) Matrix engine and so you should arrange the steps of searching as the following:

1st search in → Special Engine → If result found then give the output Else search using the Matrix Engine.

2nd search in → Matrix Engine → If result found then give the output Else search in the One Word File.

If you follow these steps in searching, you will not face the problem of Matrix Engine in figure 2 or the problem of Special Engine in figure 3. I think you wonder what the One Word File is, after the Matrix Engine and the Special Engine failed to find any matches. One Word File is a database contains only one word which may be found in user inputs and so your chatbot may reply with something related with user input but with less accuracy.

The accuracy of Special Engine, Matrix Engine and One Word File:

If result found in Special Database, may be its 95% accurate to give suitable output.

If result found in Matrix Database, may be its 65% accurate to give suitable output.

If result found in One Word Database, may be its 15% accurate to give suitable output.

You can increase the accuracy of your chat bot responding by increasing the records of Matrix and Special Databases of each file, and One Word Database.

Chat bot responding:

I'm going to discuss how the chat bot responds and gives suitable answers depending on user inputs; also how to make your chat bot gives more than one answer for the same input as it makes your chat bot more real like humans and more reasonable.

Each file has two databases which are Special database and Matrix database, also each database contains two fields:

1st field called "Request" where user inputs are compared with data recorded in this field. (See figure 2 and 3)

2nd field called "Respond" where chat bot outputs are taken from data recorded in this field.
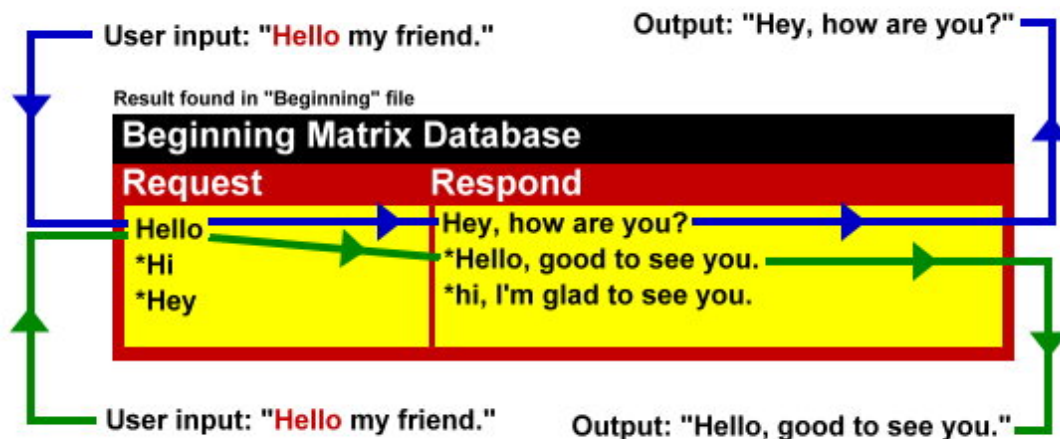
Responding System:

User input: "**Hello** my friend."

Output: "Hey, how are you?"

Result found in "Beginning" file

Beginning Matrix Database

Request	Respond
Hello	Hey, how are you?
*Hi	*Hello, good to see you.
*Hey	*hi, I'm glad to see you.

User input: "**Hello** my friend."

Output: "Hello, good to see you."

F i g u r e : 4

In figure 4 there are two outputs for the same input, also one row can contain more than one request and respond values and so that decreases the number of records as it reduces the repeated (related) sentences in one row.

How to make your chatbot respond by different ways?

To do that, you have to create a variable with initial value equal one, every time your chatbot give a respond, add 1 to the variable value and so on. When Request value matches with user input, the output equals the sentence which has the number of the variable.

If the variable is greater than the last sentence number, make this variable equal 1 and let the output equals the 1st sentence, else add 1 to the variable value.

Responding System:

1 possibility to respond in 1 record

Request	Respond
Hello	Hey, how are you?
Hi	Hello, good to see you.
Hey	hi, I'm glad to see you.

3 possibilities to respond in 1 record

Request	Respond
Hello	Hey, how are you?
*Hi	*Hello, good to see you.
*Hey	*hi, I'm glad to see you.

Reducing 3 records into 1 record.

F i g u r e : 5

Figure 5 shows how to merge related records into one record which also lead to merge responds into one record that makes your chat bot responds in different ways.

Misunderstanding:

Assume your chatbot didn't find any record in the databases similar to user input after using Matrix and Special search engines, which means your chat bot can't understand the user input as he/she may be mistyped the input or your AI databases are poor of records.

So you need to create a database which your chat bot uses it to get sentences about misunderstanding.

Example:

I can't understand.
Please, help me to gee the mean.

Also you can improve this database by inserting sentences which isn't referring to understanding or misunderstanding, these sentences leave an impression on the user as it makes your chat bot seems to be understanding.

Example:
Wait, I got a phone call.
Oh, my keyboard hangs again.

Previous Events Engine:

When you ask any one about something and then you ask about it again, he/she is going to say: "I told you that …etc", that means that his/her mind recorded a previous conversation about the same subject and that made him/her say this sentence.
Previous Events Engine function is to simulate the same thing with your chat bot. Without this engine, your chat bot will not be like human.
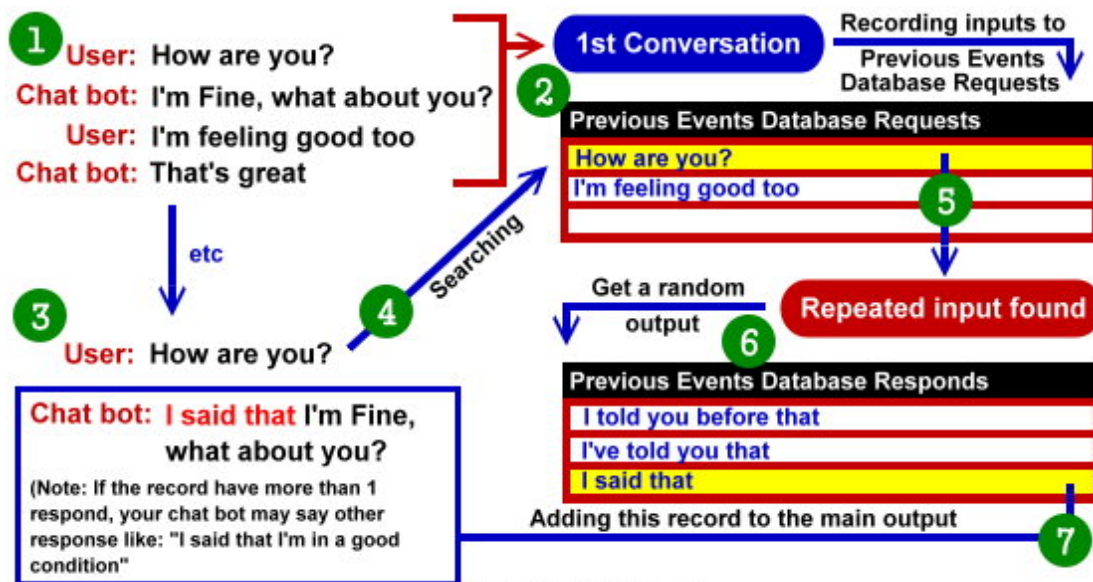

Figure: 6

Figure 6 shows how the Previous Events engine works so you may noticed that there are two databases for this engine, Request Database which records user inputs if there is no repeated input and Respond Database which your chat bot gets a random sentence which expresses a repeated input.

Auto Talk Engine:

This engine makes your chat bot responds automatically if user didn't chat in a specific time, you can also improve this engine by making your chat bot wait if user is typing a message.
Assume two minutes of the specific time before this engine works. If the time is out, your chat bot send him a respond from Auto Talk Database.
Example:
Chat bot: Where did you go?
Chat bot: Are you there?
Chat bot: I'm bored from talking to my self.

AM-ARE Functions:

This engine is considered the infrastructure of any chat bot. And this engine which I call "AM-ARE Functions" main task is to recognize the pronounces in the sentence user said as well as some verbs coming with these pronounces in all tenses such as verb to be, verb to have, verb to do and modal verbs then use them in the respond sentence to know what I mean let's take an example:
When user says: you are suspicious. If we look at this phrase we will find the two important

components 1- Pronounce you, 2- Verb are which the bot recognizes and excludes them for the sentence said to him first then begin to replace some pronounces in sentence like: (I/We → You, My/ Our → Your, Me/Us → You, Myself → Yourself, Ourselves → Yourselves ... etc) and also replace their verbs: (AM → Are, Was → Were .. etc). You can also add a small part on the sentence like "Why do you think that" and that will make the final output: "Why do you think that I am a suspicious?" Or you can convert sentence to a question like "Am I a suspicious?"

Proverbs:

The advantage of adding proverbs is that it can be a convenient respond for a lot of sentences; also it makes your chat bot wiser. Say the user is talking about trouble the bot can say "Don't trouble trouble until trouble troubles you". If he is talking about greedy "A bird in hand is worth two in the cloche". And as you know there are a lot of proverbs which is suitable for a lot of subjects.

Increasing your chat bot intelligence:

Your chat bot intelligence depend on two factors, good logic and databases contains a huge number of records, but since the most effective factor is the database then I should program something to increase my chat bot database while I'm chatting with him which I will call it the Learn Engine.
The Learn Engine function is to make your chat bot understands any information given by user, record it in his database and recall it when user asks about it.

Example:
WHAT IS THE COLOR OF THE SKY?
OF COURSE, THE SKY COLOR IS BLUE BUT SOMETIMES IT SEEMS TO WHITE AS THERE IS SOME CLOUDS

In the previous example, the chat bot replied with the right answer.

Example: (when your chat bot doesn't know the answer)
HOW MANY FINGERS IN YOUR HAND?
WHY YOU DON'T ANSWER THIS DIFFICULT QUESTION, I'D LIKE TO HEAR THE ANSWER FROM YOU?
YOU HAVE 5 FINGERS IN ONE HAND
BEFORE GOING TO SAVE THAT IN MY MIND, IS THAT THE ANSWER OF YOUR QUESTION?
YES
I APPRECIATE TEACHING ME, SAVE APPROVED.
HOW MANY FINGERS IN YOUR HAND?
YOU HAVE 5 FINGERS IN ONE HAND
Also your chat bot can recognize the behavior of any user while chatting with him and knows whether he/she is lying or not by analyzing previous user inputs, recording it and comparing it with the current conversation.

Tips & tricks to improve your chat bot abilities:

By improving your chat bot abilities to do specific tasks that make your chat bot has another part of AI developing which I will call it the AI operations like: the ability to play chess while chatting, the ability to organize your schedule or the ability to control your PC…etc
I'm going to discuss some ideas of our operations which programmed in RoboMatic X1 (our chat bot).

System Operations:

This is how to make your chat bot able to carry out some System Operations like opening and closing CD-Rom, browsing, copying folders …etc. Please remember that is a dangerous area as any fault in doing system operations doesn't only make user calls chat bot with stupidity but also it may make him doesn't open the chat bot program again, so in this case of dangerous operations like deleting files, the chat bot must warn the user before doing that. May be the chat bot doesn't understand correctly or doesn't exclude the path or name of the deleting file correctly from the sentence said to him.

Operations doesn't consider an isolated working area without caring about other chat bot engines so we have to treat the operation sentences like ordinary sentences first, and that what we have done when we make operations works depending on Matrix Engine to make the chat bot knows the meaning of sentences and choose the convenient answer for.

There is a little difference in Operations database as it doesn't contain request and respond sentences but also contain some information about the operation that the chat bot should carry out so we do that with a simple way by defining ID number for every operation. When the chat bot finds the equivalent ID for Operation Sentence, he does the operation that carries the same ID.

There are two main parts of operations: Limited (direct) Operations and Extended Operations.
The Limited Operations are the commands that chat bot carries out directly without caring about the next response of the user.
Example: Open CD-ROM, Opening a file, Minimize explorer widows…etc this wouldn't need a sentence to warn user whether he/she wants to open this file or not, the chat bot will open file directly and in these kind operations the difficulty found only in having the code of desired operation in the language you program your chat bot in.
The Extended Operations are the commands that chat bot carries out with caring about the next response of the user which specify more details about it and how it should be done.
The difficulty in these kind of operations not only in code but also in how to relate between the command sentence and the next sentences in which user will inform the chat bot more required information about the running operation.
In this part, efficiency in doing the task depending on the chat bot intelligence so we will use Previous Events engine which its main task is relating between sentences so it will so convenient to do the wanted relation. To know what I mean let's take an example and see the following flow chart.
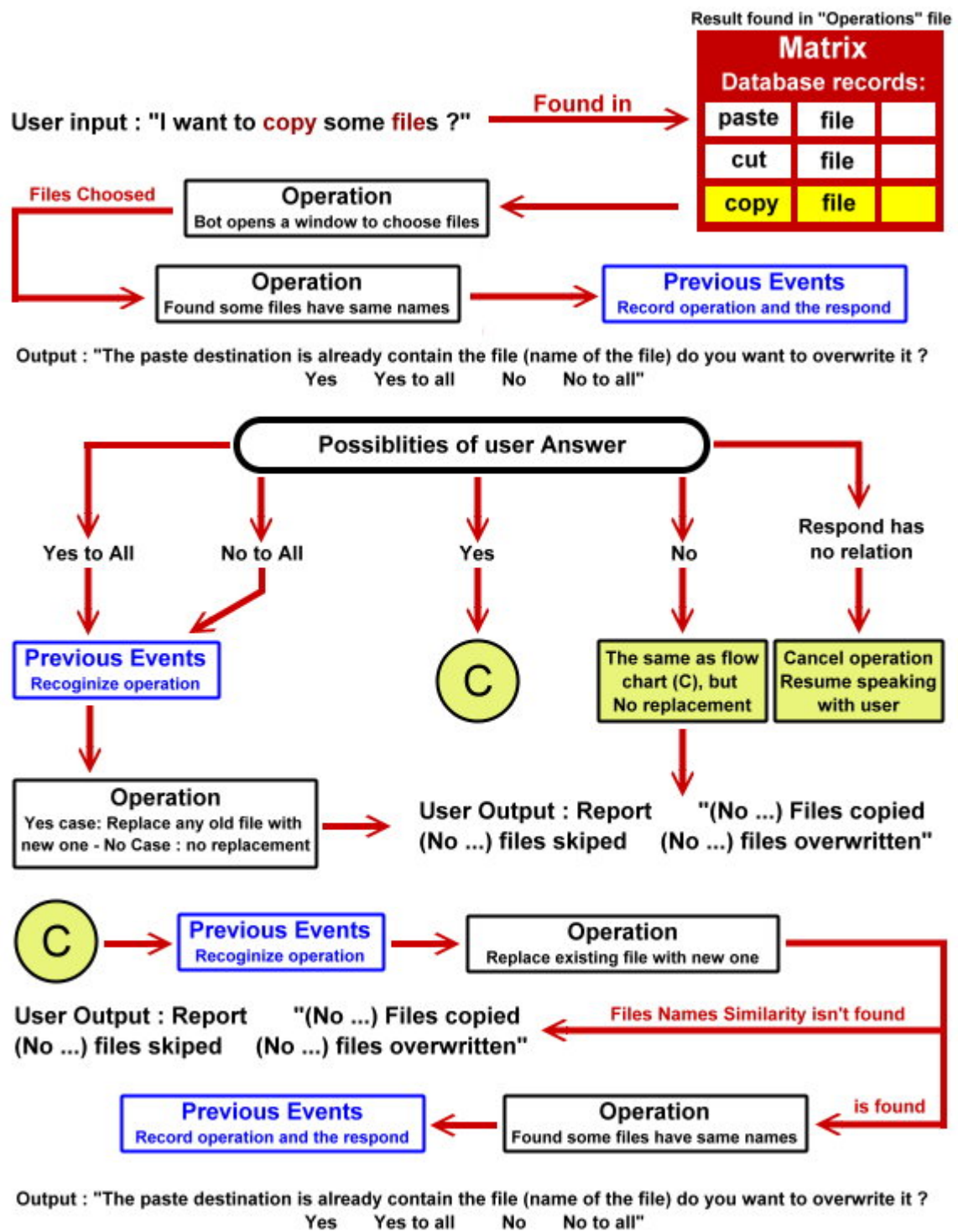
Figure: 7

Figure 7 shows copying some files from a path (e.g. E:\) to a definite destination (e.g. F:\) where there is some files has the same names of the copying files, let's see how can the chat bot do operation like that?

1- After the chat bot receive the sentence (which contains the command to copy files), it would be analyzed by Matrix Engine which recognizes the command, choose suitable respond for and make user determines the files and the destination where they should be copied to.

2- The chat bot will begin to copy files to the destination where some files has same names of copying files, so the chat bot will ask user what should he do in the sentence "The paste destination is already contain the file (name of the file) do you want to overwrite it ? Yes, Yes to all, No, No to all" this sentence will stored in Previous Event engine in addition to current process (copying) to make the chat bot relates between the question he ask and user reply.

3- User reply will pass through AI engines until it reaches Previous Event which will recognize that there is an event recorded before for a copying operation hasn't finished yet and this reply belongs to this event but there will be five possibilities for replying: Yes, Yes to all, No, No to all or a reply has no relation with the chat bot question.

Random Calling Name:

This feature will make the dialogue with your chat bot seems to be more reliable as it makes the chat bot add user name in the beginning or in the ending of the replied sentence,

Example: (Assume user name is John)

John: Hi bot.

Bot: Hi john, how are you? <OR>

    John, I'm glad to see you. <OR>

    Hello, john.

There are 3 ways to make your chat bot says user name:

First way, by making the chat bot says user name randomly by adding it to the replied sentence if the engine chooses to add.

Second way, by putting a symbol in your database responds records like (/N) symbol, so when the chat bot finds it in the respond sentence, he will replace it with user name, this way is not preferred as it makes the chat bot always calls user name in the same position of the sentence and repeat it because he always finds the symbol (/N) in the sentence.

Third way, by doing the two previous ways in a one way, let's take an example, user says "I'm sure you can swim" bot searches by Matrix Engine in database records then he found the respond "Why do you think that I can do this, (/N)" and found that there is the mark (/N) in the sentence then randomly, he will choose whether he replaces user name with (/N) symbol or not, if not (/N) symbol will be removed from the sentence.

Math Engine:

This engine makes your chat bot able to calculate numbers like: adding, subtracting, dividing …etc.

If you want to calculate something by chatting with your chat bot, then you should improve this engine to search for the equation in the sentences. The following figure shows how to do that and how to make your engine accepts numbers written in letters.
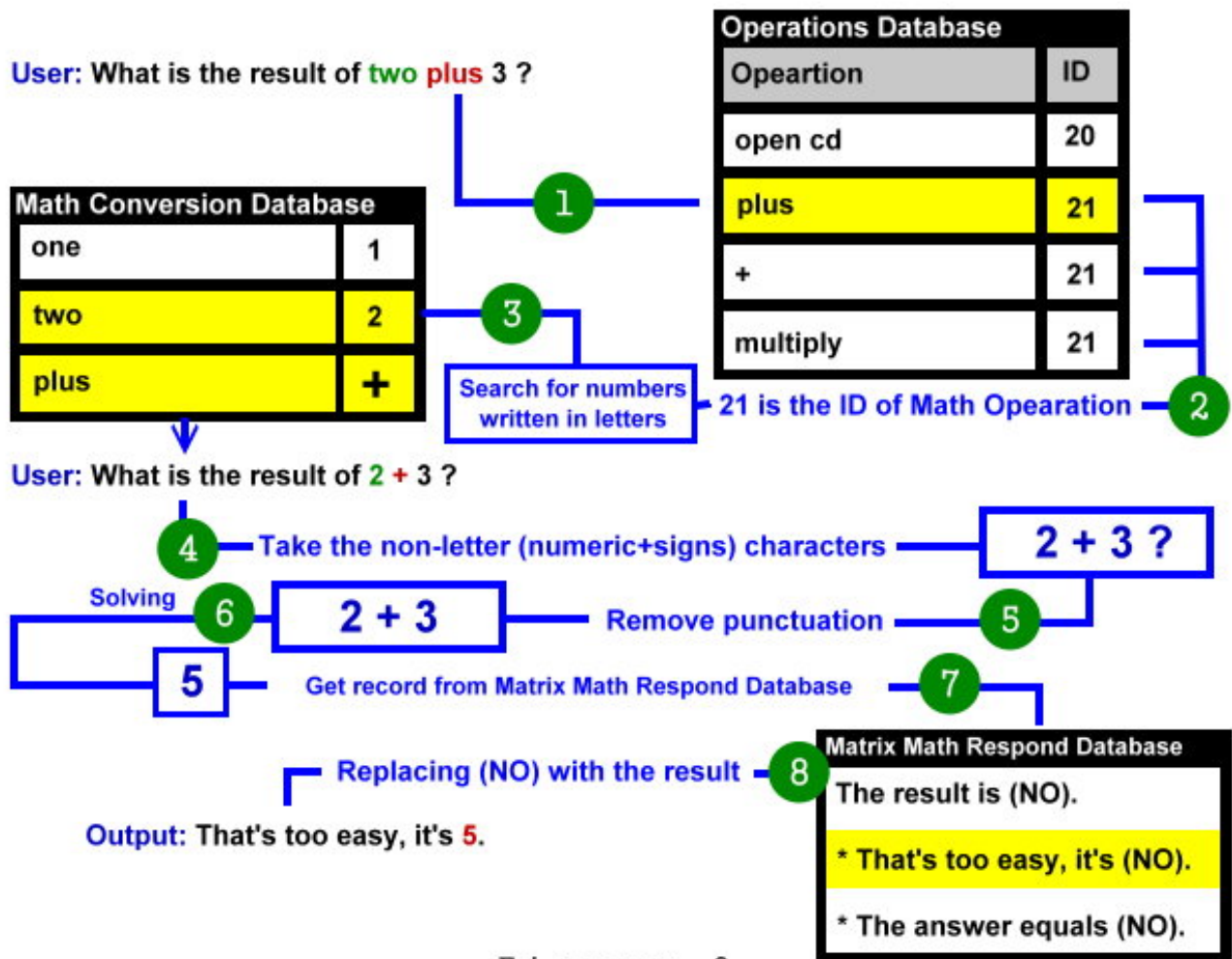
Figure: 8

Colors/Capitals databases:

You can increase your chat bot knowledge by teaching him the colors and countries and its capitals.

Create two databases, the first one contains the sentences which the user can say to ask about the color/capital of the thing like "what is the color/capital of ..." Or "Do you know the color/capital of ..." The other one contains the countries and its capitals. When the user say "What is the capital of USA?" First, bot will searches in first database where he will find this question and its respond "(/Cap) is the capital of (/Count)".

Second, he will exclude the name of the country from question (USA) and replace it with (/Count) symbol.

Third, He will search the second database to know the capital of this country (Washington) and then replace it with symbol (/Cap). Finally, the output will be "Washington is the capital of USA." and with the same way, we can do the color database.
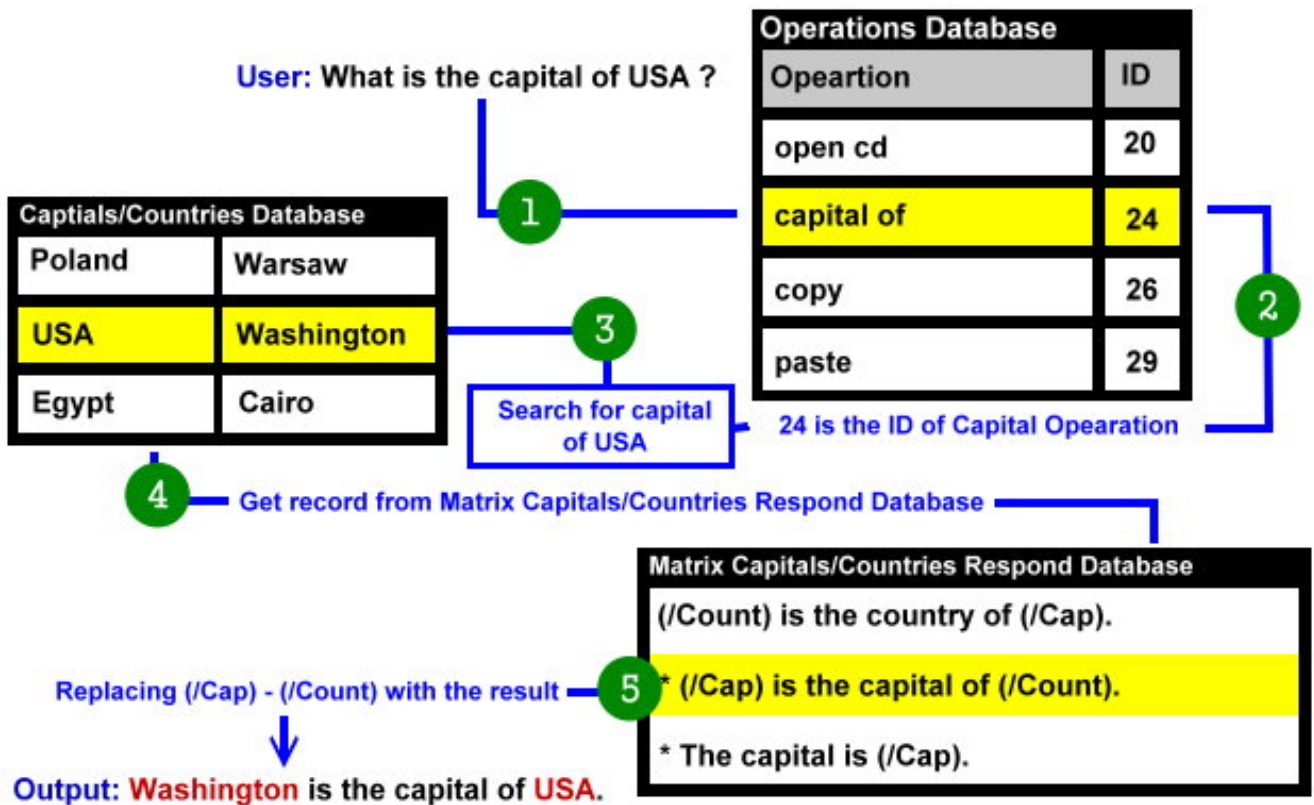
Figure 9 shows how it works.

Figure: 9

Reminders and Notifications:

To put this feature into your chat bot, you should create a database which contains all the events that happens in a specific date, time or date and time in records. After creating this database, make your chat bot always check the current time and date and compares it with the records in the database, if the current time or date or both equals one of the records then your chat bot should say what is recorded in the matched records.
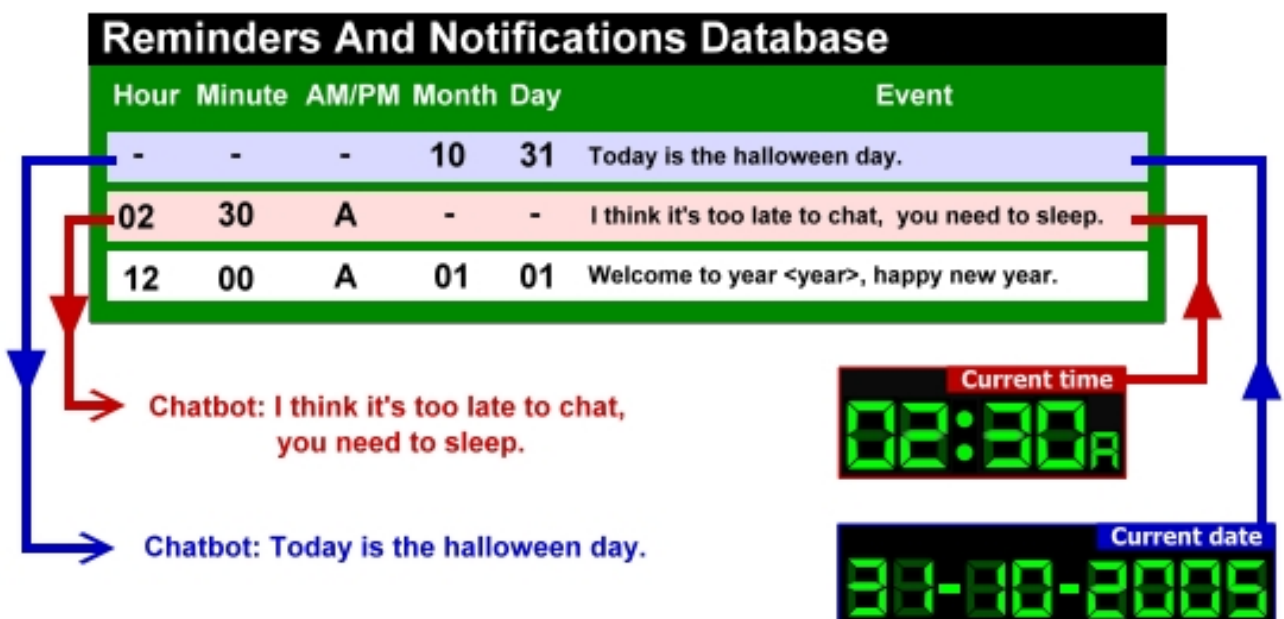

Figure: 10

Finally, you did it!

We hope you enjoyed our simple article as a guide to build your own chat bot by any programming language you want, we have discussed the basics of building a chatbot and used real examples from our chat bot Robomatic X1.

You can download the chat bot as a reference from this link:

http://www.infradrive.com/robomatic.php

Also we'd like to recommend you some useful links to help you to build your own chat bot:

http://www.personalityforge.com/

http://www.alicebot.org/

http://www.pandorabots.com/botmaster/en/home

If you have any thing you need to discuss with us, please contact us at: support@infradrive.com