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Using Artificial Intelligence to Speed Up Post-Recruitment Process

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Abstract: ***Acquiring a degree doesn't help the candidates understand what they would be good at in the practical world. The theoretical world doesn't help understand the potential of an individual. This BOT uses the Artificial Intelligence domain in a way that the responses provided by the person will help the bot analyse what technical aspect he might be good at. Initially the bot starts interaction with an individual and these responses are stored as sessions in the Node JS back end code. The entire bot is trained using the LUIS Framework. This training helps to get responses back to the user to analyse his behaviour, his reaction to various questions, his way of tackling situations, understanding his thoughts on problems thrown at him and numerous analytical and logical based questions to see his grip on the specified concepts. When the session ends, the bot successfully displays what particular domains the user can take up as a career option because this result is obtained after total processing of the user's response. Hence, Artificial Intelligence helps analyse the real intelligence of a human to make him understand where his alliance lies.***

Keywords: Artificial intelligence; chatbots; recruitment process; Microsoft bot framework; Bot emulator; Node js; LUIS framework; recruitment industry.

I. INTRODUCTION

A Chatbot[8] (also called a talkbot, chatterbot, Artificial Conversational Entity, Bot, chatterbox, IM bot, interactive agent,) is a computer program which helps to conduct conversations using auditory features or textual means. Such programs pass the Turing test because they are designed to convincingly simulate how a human would behave as a conversational partner. They are used for various practical purposes including customer service or information acquisition and in dialog systems. Some chatbots make use of sophisticated NLP systems, whereas many simpler systems scan for keywords within the input. They then display a reply with the most matching keywords, or the most similar wording pattern.

The term "ChatterBot" was originally announced by Michael Mauldin (creator of the first Verbot, Julia) in 1994 for describing conversational programs. Today, Chatbots are a part of virtual assistants such as Google Assistant, Alexa by Amazon etc and can be accessed via many organizations' apps, websites, and on instant messaging platforms such as Facebook Messenger. Non-assistant applications include Chatterbots that are used for various purposes like entertainment, for research, and social bots which promote a particular product, candidate, or issue.

This Bot helps the company recruiters working for the HR desk to make sure that their abilities are put in a proper use, and not for slight judgment of domains, in the proper functioning of the company. The perfect scenarios for a Chatbot are replying to frequently asked questions (FAQ) or providing simple and timely information. One of the major burdens for customer support is to respond to the same requests over and over again. A Chatbot could provide correct answers, directly reply, or even escalate the request to a person freeing up recruiters' time to work on more complex issues. Chatterbots make life much easier for consumers and support crew. With the inventions of Chatbots, no need for long waits on to talk to a person on the phone or going through multiple steps to research and complete a purchase on websites and no more toll free numbers.

It is a means to provide the employees, a moment of respite from investing time in helping guide their future aspirants to their invested domains. The candidates appearing in the company recruitment can start interacting with the bot to classify themselves into various domains. There are tests pertaining to particular domains and also an in-general quiz to predict the suitable domain.

Key components in building a solution for the pertaining problem are:

A. Microsoft Bot Framework

The Bot Framework [2] is a platform that helps to build, connect, test, and deploy powerful and intelligent bots. You can get the Bot Builder SDK and quickly start building bots with the Bot Framework and with support for .NET, Node.js, and REST.

The Bot Framework helps in building bots that support different types of interactions with users. You can design conversations in your bot to be free form and more guided interactions where it provides the user choices or actions. Their conversations can just use simple text strings or more complex rich cards that contain text, images, and action buttons. One can also add natural language interactions that let your users interact with your bots in a natural and expressive way.

B. Microsoft Bot Emulator

The Bot Framework Emulator [3] is a desktop application that helps in testing and debugging your bot, be it locally or remotely. Using the emulator, you can chat with your bot like a channel and inspect the messages that your bot sends and receives as if it were published. The emulator is a desktop application, not a mobile one, that lets you test and debug your bot on localhost or running remotely through a ngrok tunnel.

C. Language Understanding Intelligent Service (LUIS)

Language Understanding Intelligent Service (LUIS) [4] enables developers to build smart applications that enable understanding human language and reacting accordingly to user requests. Just so that your application doesn't have to, LUIS uses the power of machine learning to solve the difficult problem of extracting meaning from natural language input.

Generally, you create an intent to trigger an action in a client application or bot and create an entity to model some parameters required to execute an action.

D. Node JS

Node.js [5] is a platform built on Chrome's JS runtime for easily building fast yet scalable network applications. Node.js uses an event-driven and non-blocking I/O model that makes it lightweight and efficient. It is efficient for data-intensive real-time applications that perform across distributed devices.

Node.js is an open source and a cross-platform runtime environment in order to develop server-side and networking applications. Node.js applications are coded in JavaScript, and can be executed and run within the Node.js runtime on OS X, Microsoft Windows, and Linux.

E. Visual Studio Code

The Visual studio [6] is an innovative launching Integrated Development Environment (IDE) pad which is used to edit, build code, debugs, and publish an application. It is one of the characteristic-rich programs used for the software development. Compared to the many IDE's the Visual Studio comprises of compilers, code completion tools, graphical designers and many more characteristics to simplify the process of developing an application software.

II. LITERATURE REVIEW

Websites are seen to be built for the large screen and don't proffer as well on mobile devices. Apps are delightful, except that they require you to download the app in advance of the actual need. The cost of developing client-side apps is high. Every upgrade requires a new download. And worst of all, users aren't downloading apps. There exist millions of apps and yet users operate barely a dozen apps daily. Bots will dramatically improve the way we use mobiles and computers. Bots will make it easier and faster to get things done. In particular:

1) Initially, bots serve as a solution to the download problem caused by mobile apps. As mentioned above, users don't like to download mobile apps. Users are seen to consume dozens of brands but they don't download the apps created by each of those brands. A situation being: Just when a flight booking needs to be changed in a hurry, you realize that you don't have the airline app that enables you to do it.

2) Secondly, bots solve the huge usability problem caused by apps and websites. Bots force computers to behave like humans, while apps and websites force humans to behave like computers. Instead of finding your way to page 14 paragraph 3, as you would with a website; you will simply be able to chat with a bot, like you would with a person.

3) Thirdly, bots help in enabling businesses to come where you already are. by a very wide margin, messaging is the top most activity performed by mobile users as users already love their messaging app. Unlike apps and websites which require you to take more steps, bots will be right there, within the messaging app that is visited dozens of times every day, Also, bots have a higher scalability than apps or websites. It will be a lot easier dealing with a large number of bots, while it is hard to manage dozens of apps or websites. Bots will disappear quietly into the older messaging threads when they have nothing to say and when you need them, it's as easy to chat with bots as it is with friends.

4) Lastly, bots substantially reduce the cost and time of developing and marketing their services for developers and businesses. Server-side development costs less than client side development for many technical reasons. Creation of bots costs less than building an app with comparable capabilities.

This leads to more developers driving faster innovation, leading to greater usage of their services. This encourages more users to use more bots, creating a positive feedback loop.

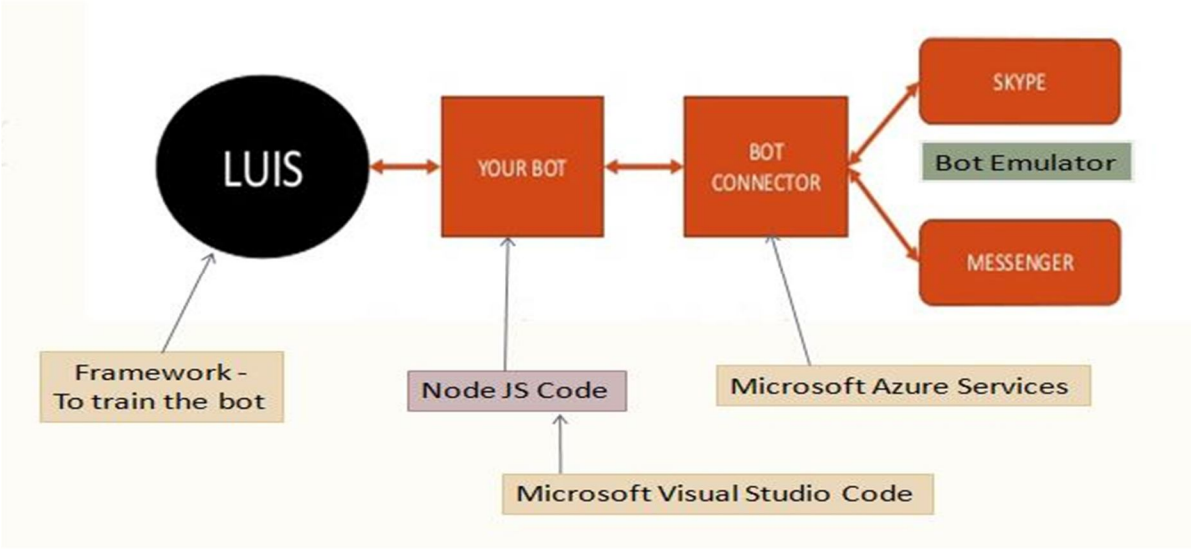

Figure 1. Working structure of Chatbot

A unique pattern must be available in the database to provide a suitable response for each kind of question. With lots of combination on patterns, it creates a hierarchical structure. We use algorithms to reduce the classifiers and generate the more manageable structure.

Multinomial Naive Bayes [7] is the classic algorithm for text classification and NLP. For an instance, let's assume a set of sentences are given which are belonging to a particular class. Each word is counted for its occurrence and is accounted for its commonality and each class is assigned a score with every new input sentence. The highest scored class is the most likely to be associated with the input sentence.

Word matches are found, with the help of equation, for some given sample sentences for each class. Using classification score one can identify the class with the highest term matches but it also has some limitations. This score helps to signify which intent is most likely to the sentence. This does not guarantee a perfect match so the highest score only provides the relativity base.

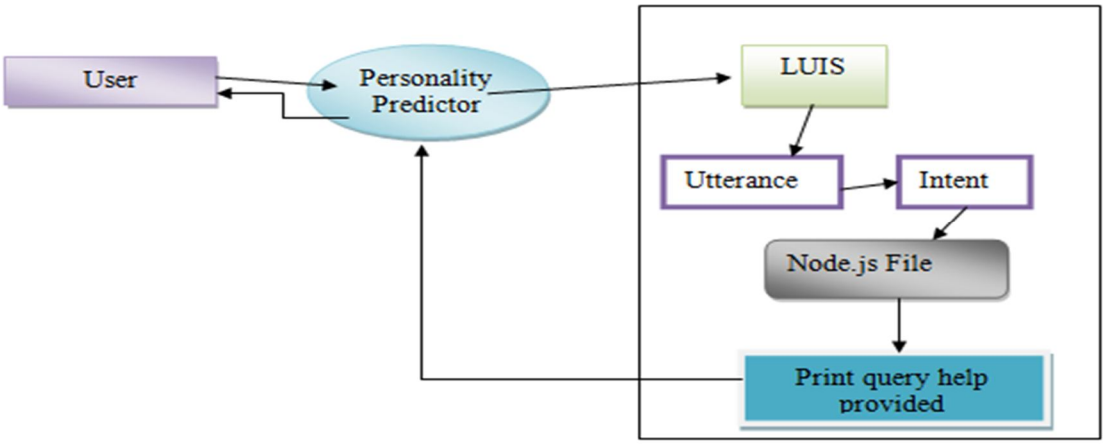

Figure 2. Application flow of the chatbot

Candidates are shown various questions and greetings are sent to the bot which in turn responds to the user. When a user greets the bot, the bot then poses various questions. After all the answers are received, they are analyzed and predictions are made.

The bot module provides a platform for the interaction between the user and the LUIS API. In this module, the user actively interacts with the bot by posing answers to asked queries. The bot processes these user queries and thereby connects it to the backend of the bot called the LUIS API. It checks if the query entered by the user matches any of the existing utterances of the database. Once it matches a particular utterance, the next question in the queue is passed to the bot. The bot processes the further answers given by the user and thereby displays it as a Hero card format about which domain exactly suits the candidate.

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III. PROPOSED WORK

Bots have been designed to make our lives better and simpler in far too many ways. Bots are essentially the latest re-incarnations of apps and websites. All the things that initially websites and apps helped you with, you will now be able to do through bots, with the added capability of doing it right within your favorite messaging app. The current recruitment system has flaws in the sense of training the employees in various aspects and checking which department suits the candidate appropriately. Otherwise, the company takes it upon itself to divide the fresher into various categories. To ease up this process, a bot is created with a questionnaire to predict whether the candidate belongs in his desired domain or somewhere else.

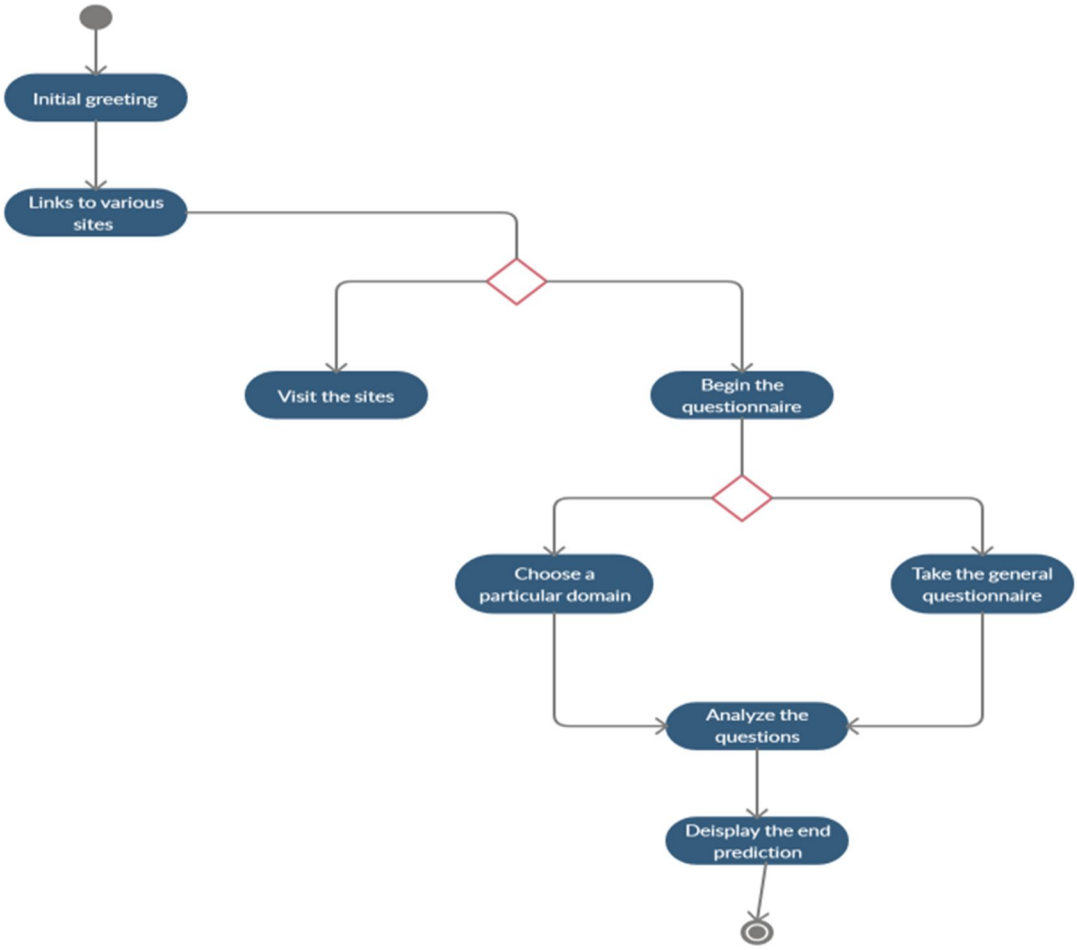

Figure 3. Flow diagram of the process

The organizations aiming to adopt automation process across the functional areas, this will minimize the time and effort of human resources, in other words artificial intelligence (AI) will replace human routine work, enforced them to generate strategies and become craft in the domain. Adoption of artificial intelligence has helped in increasing to build momentum, by reducing tedious routine work of recruiters through AI chatbots. [1]

A. Initial greeting

For the bot to initially respond, one must trigger the conversation by initially telling a 'hi' like greeting to the bot. Once this is received by the bot, LUIS connection is triggered and the intent is matched. Intent matching leads to the Node JS code being checked and the following matter is displayed to the user.

B. Links to Various Sites

The initial greeting follows up with various aspects the user is informed about. A set of guidelines are provided to him that he has to focus on. These guidelines are a part of every questionnaire and let the user know what he has to keep in mind while giving answers that will lead to future prediction.

The company that wishes to hold this quiz on their platform could include their social links that the user may view to gain more knowledge about them.

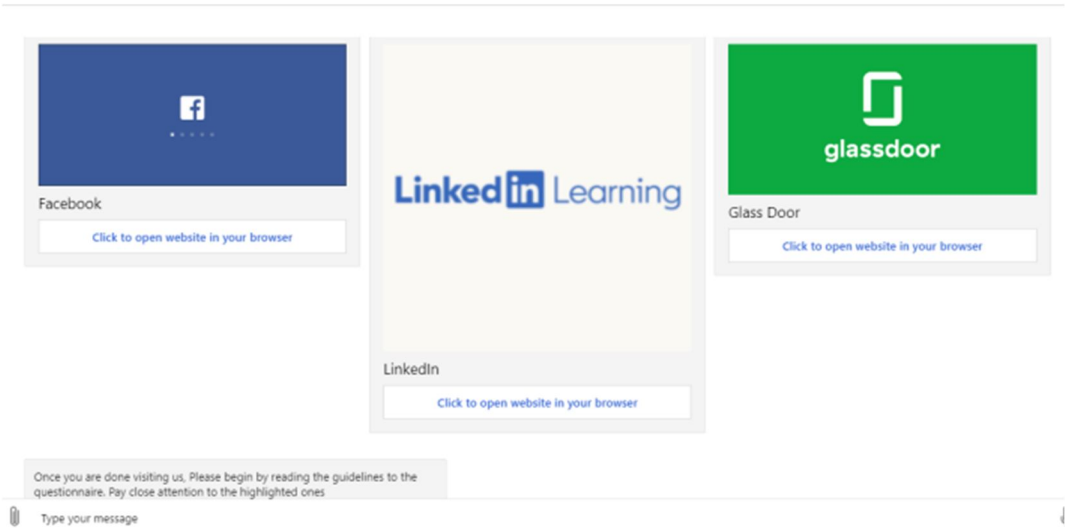

Figure 4. Social sites link

C. Choice of Domain

This module helps the users to answer questions posed by the bot. The bot directly interacts with the user to provide the questionnaire to the candidate by matching intents in the LUIS module. When the user receives the apt response of which domain has been predicted by the bot, he can exit the chat with the bot. Otherwise, the user has an option to continue taking a different questionnaire. If he fails to go through his chosen domain then he can take a General test to judge where his efforts would be worth.

Domains chosen

1) *Database Administrator:* Database administrators use specialized software for storing and organizing data. They have various roles like planning, module installation, system configuration, database design, data migration, performance monitoring, security plus troubleshooting and lastly backup and data recovery.

Qualities tested

a) Certification and Level of expertise
b) Attention to Detail
c) Problem Solving skills
d) Assertive Reasoning
e) Decision Making
f) Conflict Management
g) Technical questions

2) *Software Tester:* He is defined as a quality assurance expert who puts applications through the wringer to root out bugs, poor performance and funky interface issues. Testers are technically brought in at the planning and design stage, and often remain involved throughout post-release support, but must be present throughout the planning as well.

Qualities tested

a) Certification and Level of expertise
b) Sorting out priorities
c) Data analysis
d) Positive Attitude
e) Multitasking Abilities
f) Communication skills
g) Team player
h) Technical questions

3) *Coder:* Basically a coder is a person who can write code. If that seems like a pretty all-encompassing definition, that is because it is. As *Mike Jackson* puts it, a coder is, *"Anyone who can write some code that compiles and runs, which will do something they want when it's given the right inputs."*

Qualities tested

a) Certification and Level of expertise
b) Logical Skills
c) Creative Thinking
d) Team player
e) Problem Solving
f) Quick Thinking
g) People Skills
h) Patience
i) Prioritizing
j) Technical questions

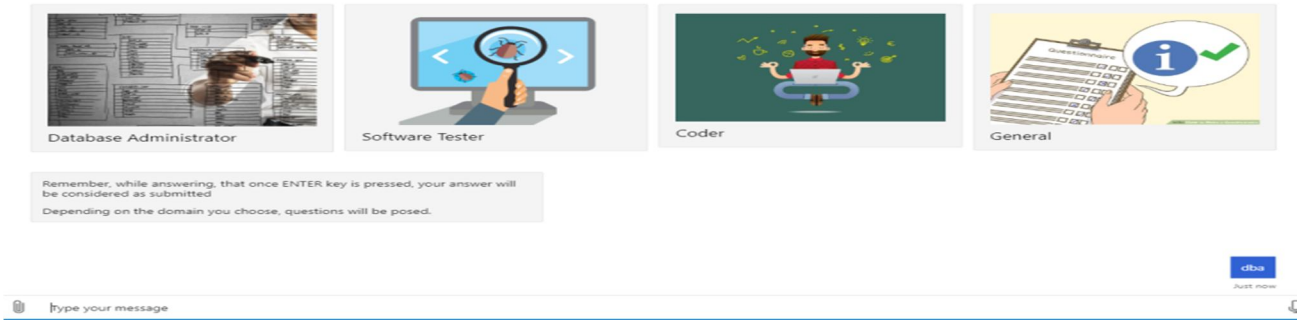

Figure 5. Domains to choose from

D. Questions posed and analysis

Numerous questions of chosen domains are posed and the user must answer. These answers are then analyzed to predict if you are suitable for the domain or which domain fits them. Various aspects of the domain are tested and finally the technical questions are presented to the user to check his knowledge about the particular occupation. At the end of the questionnaire either the result can be viewed or you continue to answers questions from other domains. Once the domain is chosen, the bot confirms if you possess a certification or not. If so, the level of expertise is confirmed and the questions continue.

Figure 6. Questions to check qualities like 'Attention to Detail'

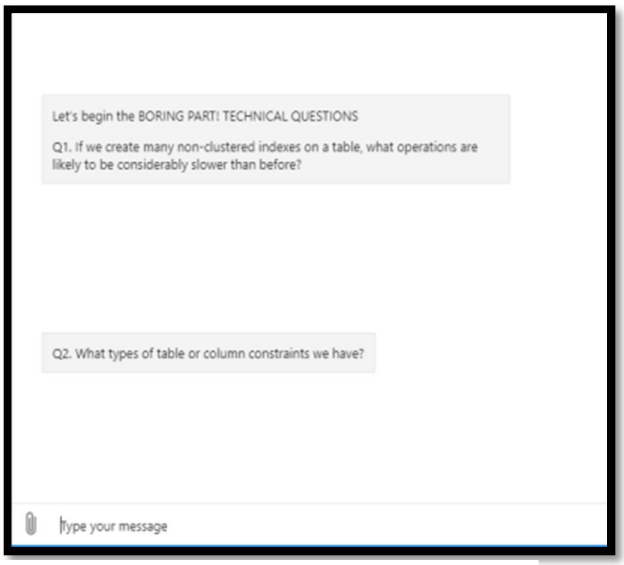

Figure 7. Question to check technical knowledge

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E. Prediction

At the end of the questionnaire, there can be 2 cases:

1) Case1: When a particular domain was chosen at the beginning

In case a particular domain is chosen, the end result shows whether you are eligible to continue on that course or one has to improve their skill set. He may then continue taking questions from another domain to check if he fits there or he could quit the bot application.

2) Case 2: When general quiz was chosen at the beginning

If a candidate chose the general quiz then the bot asks various questions regarding different domains and finally the more suitable domain is displayed to the user answering the questions.

As per requirement, one can keep adding the amount of domains he wants to keep for the candidates trying. For now, this paper focuses on testing the individual over the three domains chosen and mentioned above. Only in the case of a general quiz does the bot compare each domain. Otherwise, individual evaluation is also available as mentioned in case 1.

```
{   if(dbcount>stcount && dbcount>ccount)
    {
        if(d[redacted]unt>=18)
        {
        session.beginDialog('/DBSuccess');
        }
    }
    else if(stcount>dbcount && stcount>ccount)
    {
        if(stcount>=21)
        {
            session.beginDialog('/STSuccess');
        }
    }
    else if(ccount>dbcount && ccount>stcount)
    {
        if(ccount>=23)
        {
        session.send("You are on your way to become a great CODER");
        var cdcard = getCDcard();
```

Figure 8. Comparison code for prediction

IV. TRAINING THE BOT

Before you start creating it in the LUIS web interface, plan your LUIS app by preparing an outline or schema to describe intents and entities in your application. Generally, you create an intent to trigger an action in a client application or bot and create an entity to model some parameters required to execute an action. For example, for booking a plane ticket, "BookFlight" intent could trigger an API call to an external service, which requires entities like the travel destination, date, and airline. See ‘Plan your app’ for examples and guidance on how to choose intents and entities to reflect the functions and relationships in an app.

The LUIS module provides the prebuilt domains that help the bot application by providing intents and entities that can be mixed in and modified to create better language understanding required for the bot to interact with the user effectively. Through LUIS, the bot works interactively with the user by retrieving necessary information according to the query provided by the user. LUIS acts like a backend to the bot application. It also provides the option to train our application with different user utterances by enabling suggested utterances to be displayed in the database. This module thereby helps the bot application to be updated from time to time easily.

The LUIS model begins with categories of user intentions called intents. Each intent needs examples of user utterances. Each utterance can provide a variety of data that the user might enter as a response.

An intent represents a task or action the user wants to perform. It is a purpose or goal expressed in a user's utterance. Define a set of intents that corresponds to actions users want to take in your application. The intent represents an action the chatbot should take for the user and is based on the entire utterance. The app domain intents should have a balance of utterances across each intent. Do not have one intent with 10 utterances and another intent with 500 utterances.

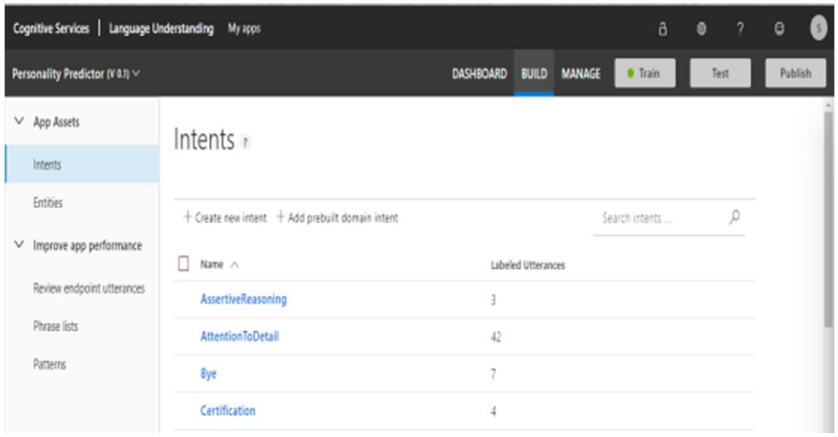

Figure 9. Intents that help train the bot

Utterances are input from the user that your app needs to interpret. To train LUIS to extract intents and entities from them, it's important to capture a variety of different example utterances for each intent. Utterances aren't always well formed. It may be a sentence, like "Book a ticket to Paris for me", or a fragment of a sentence, like "Booking" or "Paris flight." Users often make spelling mistakes. When planning your app, consider whether or not you use Bing Spell Check to correct user input before passing it to LUIS.

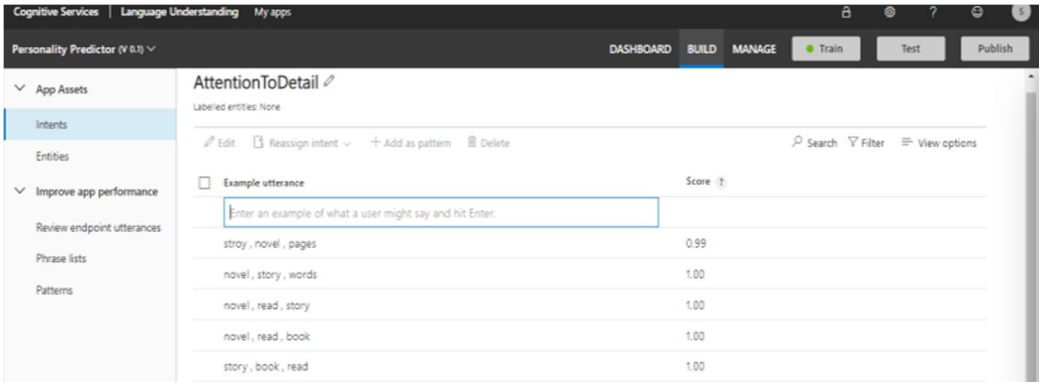

Figure 10. Utterances under a single intent

After you train your LUIS app, you test it with sample utterances to see if the intents and entities are recognized correctly. Once the app is published, a URL is generated and this URL must be included in the back end code to link the LUIS app with the chatbot. Once the initial greeting is observed by the bot, the first thing to do is shown by the Node JS code, and following intents are then successively checked. Once the utterance in an intent matches, the corresponding text is displayed to the user to tell him what to do next.

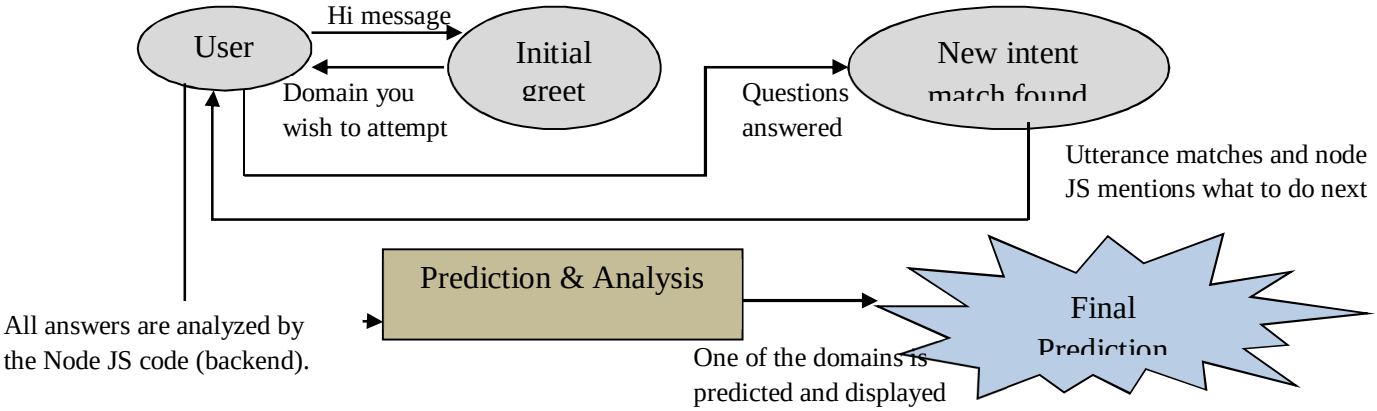

Figure 11. LUIS Flow

V. TESTING

Each phase of the development makes sure the process has a specific set of input and a desired output. As soon as the project is confirmed to start, the phases of the development of project can be divided into the following phases:

A. Software requirements phase.
B. Software Design
C. Implementation
D. Testing
E. Maintenance

In this entire process of development, testing consumes highest amount of time. Most of the developers oversee that and testing phase is generally seen to be neglected which leads to erroneous software being released. That is why testing team should be involved right from the requirements stage itself.
Various levels of testing are:

1) White Box Testing
2) Black Box Testing and Regression Testing
3) Unit Testing
4) Functional Testing
5) Performance Testing
6) Integration Testing
7) Objective
8) Validation Testing
9) System Testing
10) Structure Output Testing and User Acceptance Testing

a) *White Box Testing*- includes execution of every path in the program.
b) *Unit testing*- also known as Module Testing, which focuses verification efforts on the module. The module is tested separately, which is carried out at the programming stage itself.
c) *Functional testing*- involves exercising the code with normal input values for which the outputs are known, as well as the boundary values.
d) *Black Box Testing*- Exhaustive input testing is required to find all errors.

Test Case	Check Field	Objective	Expected Result	Actual Result	Status
TC-01	Skype	Install Skype app	Should indicate that Skype installed successfully	Skype installed	Pass
TC-02	Skype	Launch the application on mobile/desktop	Application should be launched successfully	Application Launched	Pass
TC-03	Sign in /Signup	Fill all the empty fields and click Submit	Clicks submit	Details submitted	Pass
TC-04	Submit button	Fill all the empty fields and click Submit	Clicks submit	Error appeared	Fail
TC-05	Submit button	Click button with correct details	Successfully redirects to home page	Home page appeared	Pass
TC-06	New chat	Choose the BOT to start the chat with	New chat with the BOT starts	Chat successfully launched	Pass
TC-07	New chat	Choose the BOT to start the chat with	New chat with the BOT starts	BOT not found	Fail
TC-08	Initial	Type the greet	Hello message	Hello message	Pass

	Message	message	appears	appeared	
TC-09	Web Search	Social media sites pop up	Facebook, Linkedln pages open up	Pages opened up	Pass
TC-10	Web Search	Social media sites pop up	Facebook, Linkedln pages open up	Pages don't open up	Fail
TC-11	Choose Domain	Choosing domain to have questions posed	Questions relating to that domain must appear	Questions relating to that domain appear	Pass
TC-12	Choose Domain	Choosing domain to have questions posed	Questions relating to that domain must appear	Questions relating to other domains also appear	Fail
TC-13	Prediction	Final prediction by the BOT	Answers are analyzed and final prediction must appear	Final prediction appears	Pass
TC-14	Prediction	Final prediction by the BOT	Answers are analyzed and final prediction must appear	Final prediction appears	Fail

e) Regression Testing- a full or partial selection of already executed **test** cases which are re-executed to ensure existing functionalities work fine.

Test case	Check field	Expected Result	Actual Result	Remarks	Status
TC-04	Submit button	Clicks submit	Error appeared	User must enter appropriate details to enter Skype.	Pass
TC-07	New chat	New chat with the BOT starts	BOT not found	Use the Skype search option or ask a friend to share the BOT as contact	Pass
TC-10	Web Search	Facebook, Linkedln pages open up	Pages don't open up	Check your net connection	Pass
TC-12	Choose Domain	Questions relating to that domain must appear	Questions relating to other domains also appear	Restart the bot or type the domain again	Pass
TC-14	Prediction	Answers are analyzed and final prediction must appear	Final prediction appears	Threshold value is set for all domains	Pass

VI. CONCLUSION

It is not mere automation but a bot, in the modern context, is a piece of software that can execute a digital task that would traditionally require human interaction. But they are typically designed to mimic or simulate human behavior, engaging in realistic conversations or providing information in a naturalistic, context-sensitive fashion. Most definitely, Twitter has had bots for years in the form of Twitter bots that can send automated responses and retweets, or automatically follow users.

Bots can also be found working in chat apps like Big basket and Skype and the fresh attention of two of the world's biggest tech companies, and massive advances in AI will mean that bots are now firmly in the limelight like never before. It's not the matter of technology anymore, there's the question of whether humans will take to their new AI servants. There can also be adverse effects on employment with the rise of the bots as it will inevitably mean a reduced reliance on call centre and support staff, which means millions of jobs, will be at risk, especially in developing countries. Hence this bot is not targeting any loss of jobs. Instead, this bot helps to reduce load on the recruiters.

VII. FURTHER RESEARCH DIRECTIONS

Various domains and several other questions and aspects can be added to the test the applicants on. These bots definitely help the students also decide what domain to focus on as their skills can then be appropriately honed in that field. Resume upload and analysis is also a major enhancement in this path.

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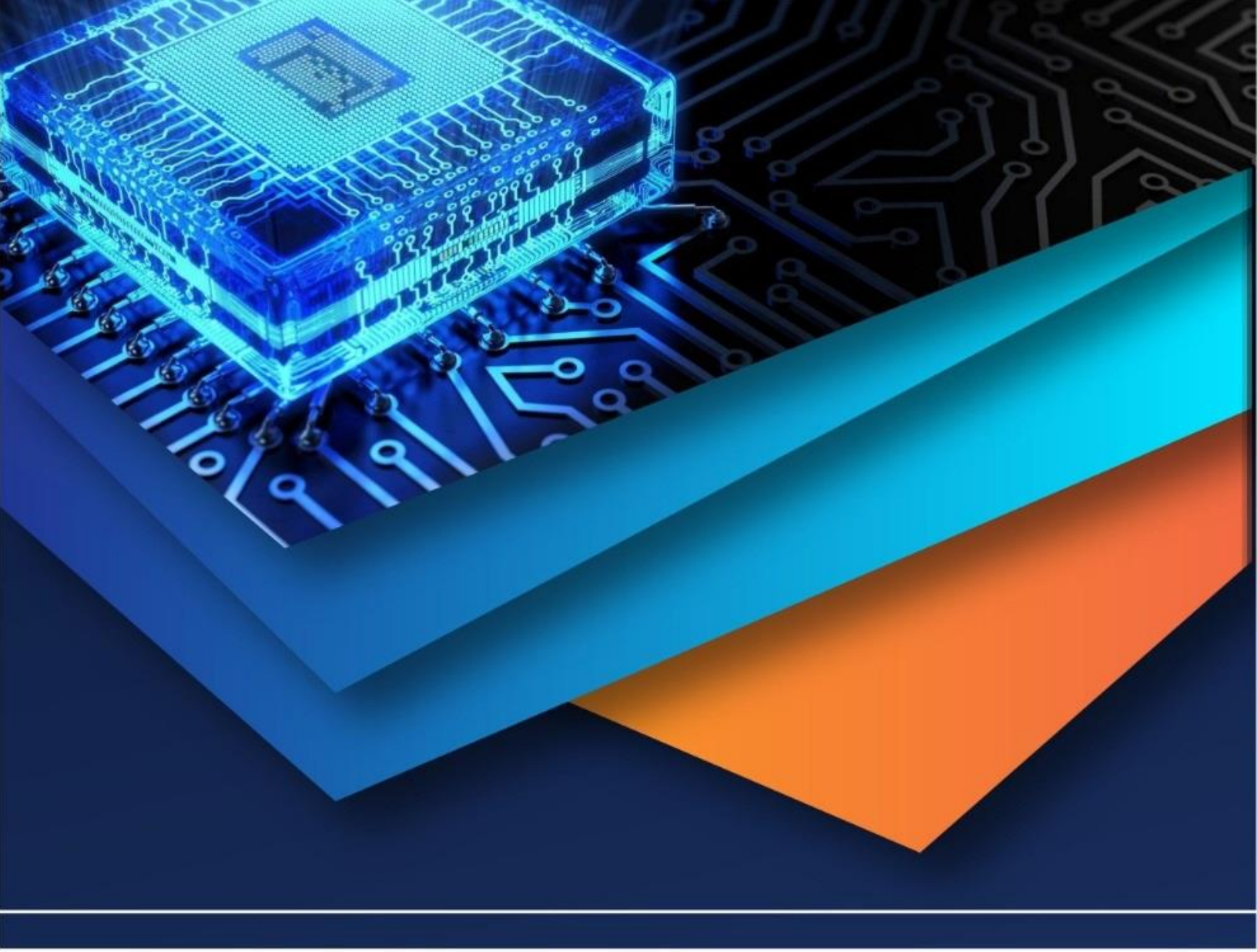

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