

# Intelligent Resume Assistant – An Employer's Perspective

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## Abstract:

The interaction of humans, in conversational speech, with computers, has no doubt been a favorite topic for research always. This proves that conversation-based input would be the most powerful User Interface (UI) to Personal Computers (PC). Recent active changes in PC innovation and in discourse and dialect handling, such frameworks are beginning to seem attainable and are known as Intelligent Personal Assistants. A software agent that is able to perform tasks for an individual is known as an intelligent personal assistant. The user input, location awareness, and the option to access information from different online sources (for example as weather, traffic conditions, news, user schedules, retail prices, etc.) affect these services or tasks. The aim of the paper is to introduce the concept of a system which can apprehend and respond to spoken inputs and increase the usability of the recruiters or interrogators (employers) in the form of an intelligent personal assistant. Hence, a major portion of this paper has been devoted to studying about the issues in the existing systems and making it better.

**Keywords:** Resume Assistant, Personal Assistant, Voice Enabled System.

## 1. Introduction

A system which has the capability to (or at least to some extent) apprehend and respond to spoken inputs and increase the usability of the end user [21] is called as an artificial personal assistant. For certain applications GUI isn't practical in light of the measure of the gadget one is interfacing with, or on the grounds that the assignment an individual is carrying

out requires utilizing his or her eyes or hands. In such cases, conversation-based input provides a natural additional modality. Verbal communication is generally less complicated, flexible and no cognitive efforts, consideration or memory assets in client's favor are required for the same. Voice interfaces, e.g., help in flattening out option menus and give complex verbal responses.

Hiring managers and recruiters who look for graduates to hire spend a lot of time in reading resumes. It is nearly impossible to hire a new employee without looking at his or her resume first, considering the amount of time resume screening takes, still gives exceptionally good results. Moreover, looking at thousands of resumes just to filter out students for the recruitment is tiring and not suitable. They only require some basic information about a candidate which in turn helps them to filter students. Resume is nothing but a bunch of text, it has become a need of the hour to come up with a smart system to enhance the recruiting procedures and make it intelligent [22]. With a competitive environment in during recruiting process, job seekers must become more creative in order to make the right impression on the people who will ultimately have to be impressed enough to invite them to the interview.

### 1.1 About Research Area:

The proposed research work is about “Intelligent Resume Assistant” in the field of Artificial Intelligence (AI). The study aims to build a voice-enabled conversational resume of the user, which will interact with the recruiters or interrogators. This area of research work has been chosen as the key applications of AI in any region includes a greater number of information that people can deal with individually, however which includes choices sufficiently basic that an AI can get some place with it. There’s another closely related area that depends on AI to make progress; Human Interaction. The product which has been proposed is based on the fact that how efficiently it will interact with human.

### 1.2 Objective

The objectives for making this product is to help user, so that they can save their time and effort. Following are

the objectives for making this kind of product:

- Keeping the output from the assistant in the same language as asked by the user.
- Incorporating other languages in it and keeping a translation option open to the user.
- Reducing the cognitive load of the user.
- Answer the entire question which is related to any resume.
- Easy to handle and can easily understand the user’s language or any language.
- Make small changes in user’s resume by just commanding the system.
- Provide the ease for transportability of language.

## 2. Background

With the idea of creating a voice-based resume which can interact with others, one can enhance the recruiting procedures during employment and make it an intelligent process. The recruiters will be able to go through bulk of resumes in no time while doing some other activity. The candidates will be able to make their resumes through speech and with great ease. With the inclusion of language selection and translate options one can broaden the languages available to the user, thereby having no language barrier.

Concepts involved while creating an Artificial Intelligent System [21]:

- a) *Agents*: relate to applications. When one prepares and test an operator, they can coordinate it with their respective application or gadget.
- b) *Entities*: speak to ideas that are frequently particular to an area as a method for mapping natural language phrases to canonical phrases that catch their importance.
- c) *Intents*: speak to a mapping between

what a client says and what move ought to be made by your product.

d) *Actions:* relate to the means your application will take when particular goals are activated by client inputs. An activity may have parameters for indicating detailed information about it.

The Proposed product is made in form of webpage, with the help of HTML CSS, JAVASCRIPT, which is the frontend of the product and the backend which includes parsing etc. are done in Java, Python and with the help of Django server. Below are the steps that how product is made-

- First through the bootstrap the frontend layout is made through the user interacts with the product and result is shown in that layout.
- The resume which is uploaded by the user is parsed and converted into the text file, through which product will fetch the answer for the query/questioned by the user related to resume. In the backend, parsing of resume is done with the following steps:-
  - If after the new line system got one space and after that a new line then it will split from that point, and it divided into blocks.
  - It will check that after the heading is there any bullet, if yes then it will split again and if no then the text is saved.
  - All the bullets are arranged in the list form and are stored in numbering format.
- After parsing the parameter which user will enter in the layout part of system will get in dictionary form in python.
- Then the data will be fetched and accessed from the resume for the query and result is shown.

### 3. Literature Review

The following section refers to the literature in the field of intelligent systems / personal assistance and

the same has been summarized in Table 1 in chronological order of the researches from done 1996.

We begin our review from the research from Qiuliang, et al, 1996, who proposed the Chinese speech recognition system and Chinese speech understanding system. This system translated Chinese syllable that is produced by Chinese speech recognition system into a correct Chinese word. The Chinese speech understanding system will convert Chinese speech to text altogether. This system only converts the Chinese speech to text and correct only Chinese speech and text. The first method according to this research paper through which system transform and correct Chinese word according to characteristics of language, whether satisfy the rule or not. In the second approach system correct any sentence according to statistical probability of word collocation rule. The methods through which the system done the process of speech to text transformation also had some limitation as in the linguistic method, system check the syllable according to linguistic rule of language but it is very difficult to make such rules, In the statistical method, the computer extracts the probability of all sentence applicants, which is yield of the speech acknowledgment, the greatest the likelihood of the sentence is. The privilege the sentence is. The restriction is the language barrier of the system; it can translate only Chinese language nothing else [11].

The transformation of Chinese speech to text and the feature of information feedback is the base of this research paper of Quiliang et al, 1996 paper [11], whereas Joachims, 1998, overcome the limitation and tries to implement the information feedback feature and the speech to text conversion. In his paper he tried to apply this aspect for every language not only for Chinese or any particular language. [16]

Subsequently, Allen, et al, 2001 in their paper published in AI Magazine proposed that for certain

applications GUI is not practical as a result of the span of the gadget one is interfacing with, or in light of the fact that the errand one is doing requires utilizing one's eyes as well as hands. In these cases, speech gives a beneficial and characteristic extra modality. There are noteworthy specialized issues that still should be understood before speech driven interfaces turn out to be really conversational. This paper depicts the aftereffects of a ten-year exertion building robust spoken dialogue frameworks. They discussed problemsoninstructions to construct an exchange framework that can be adjusted effortlessly to most any practical task. Given the scope of uses that may be utilized, from data recovery, to outline, to emergency relief management, to mentoring, one can't put extremely solid requirements on what the application program resembles. Actualizing a Mixed-Initiative Dialog Human Pragmatic Dialog framework would include the dynamic trade of control of dialogue flow; expanding speech viability; proficiency and empowering the two members' needs are to be met. The pattern-matching techniques used to incredible impact in outline based and consecutive setting frameworks essentially did not work for more unpredictable areas. They did not catch enough of the nuance and qualifications that individuals rely upon in utilizing dialect. Additionally, numerous territories of natural dialect handling have seen awesome improvement as of late with the presentation of measurable procedures prepared on substantial corpora, and a few people trust that exchange frameworks will in the end be worked similarly [1].

Intention Recognition is vital for figuring out what the client is attempting to do by saying the utterance. The requirement for aim acknowledgment is a key piece of the understanding procedure [1], though, a detailed semantic portrayal of what was said— something that catches what the client implied by the utterance need to be produced.

Furthermore, Bellegarda et al, 2004 proposed a technique and mechanical assembly to utilize semantic induction with speech acknowledgment frameworks incorporates perceiving no less than one talked word, handling the talked word utilizing a context-free grammar, getting a yield from the without context sentence structure, and making an interpretation of the yield to a predetermined command. A speech acknowledgment unit gets a sound info and creates a string of words from a vocabulary put away in a context-free grammar. A semantic grouping unit gets the series of words and, utilizing a substantial range semantic dialect model and semantic stays made utilizing preparing information, characterizes the voice contribution as comparing to a specific command. The semantic characterization unit sends a semantic portrayal of the series of words to an activity age unit that produces the fitting activity. [13]

Allen, et al, 2001 in their paper published in ACM, proposed a system named as 'TRIPS - The RochesterInteractivePlanningSystem' thattake part effectively in realistic practical dialogue. TRIPS is basically an end to system in which only the people communicating can read the messages, no eavesdropper can access the messages. Proposedsystemcanapplystrict turn taking amongst client and framework and procedures every announcement through a few phases, due to these confinements framework make the association unnatural and stilted. TRIPS is outlined as an approximately coupled gathering of segments that trade data by passing messages. They limit their study to practical dialogues: dialogues in which the conversant are cooperatively pursuing particular goals or tasks. Theymadeverycomplexsystem(TRIPS- the Rochester Interactive Planning System) having many levels and very difficult to understand. They did not focus on important thingslikeifsystemhassomethingimportantto tell but if



the user interrupt i.n between their conversation the system will shut up and move to the next command. Their research also talked about a design for conversational frameworks that possess human like execution and also work in different domains. The system is more realistic, and it talk to the user in very realistic way, like if a person asks system about places to hangout then the system did not directly search the Google and tell the amazing place to hangout. It will ask the user its priorities and some conditions and then show the place to hangout. [2].

In order to make a Feasible PA Agent the main challenges are in the field of human computer interaction and second how to assist the user. They made their system more complex by adding no. of levels So that the successfully completed activity is saved in knowledge base and if a user commands to product (similar to the previously saved command)[1], only solving the problem is not enough. Allen et al, 2001 [2], showed that A PA operator should have some learning identified with the assignments to be finished. Incrementing is the best aspect of TRIPS system that the paper aims to do too.

Ross, et al, 2004, proposed, UI standards managing the outline of a conversational operator equipped for discourse empowering various applications and give an example of its typical dialog. They developed a prototype- Lotus Conversational Interface (LCI), which includes these laid principals: encourage natural interaction, promote dependability on the interface and supports transparency in the model and give a seamless, cross- application conversational experience. But they failed to explain the working of the system. The paper was only restricted to the development of principles for a system. Moreover, every aspect of constructing a set of principles for a language can't be covered. The developed principles were focused on how to improve behavioral aspect of

the system. The conversation depicted as an example, doesn't reaches depth beyond other conversational assistants available today. Lack of speech understandability and conversion can also be found in the paper. The behavioral aspect depicted in the paper proposed by them, on UI standards managing the outline of a conversational specialist equipped for speech empowering numerous applications will help to make a more human like assistant for the users. The sets of rules depicted are clear. They will help to form a basic layout of how one can differentiate between the requests, action or any other query. It also coherently displays the ability to get feedback and user input in case of any trouble or plight. It's unique feature and will help our model to get more advanced. Principles distinguished in a set help us to understand the concept of modularity better and thus better clarity of the working of the proposed system can be inferred [12].

Paraiso, et al, 2005, proposed Speech PA which is a speech interface based on ontology, for personal assistants in particular spaces. In this, an arrangement of errand and area ontologies are utilized for dealing with learning proficiently. From the client's perspective, the framework is a Service Center and the individual associate is its Service Provider. As a reasonable aftereffect of this conversational discourse interface, an expansion in the nature of help and a decrease of the time expected to answer a client's demand is expected. The paper starts by depicting a PA and the effect of the speech technology in the outline of our approach. Ontologies play two primary parts: (I) they help translating the setting of messages sent by different operators or by the client (expressions); and (ii) they keep a computational portrayal of learning valuable at inference time [8].

They defined conversational interfaces which gives the user a chance to state what they need in their own terms, similarly as they would do, addressing someone else. Obviously, the communication is more

perplexing, however the multifaceted nature is dealt with by the framework [8], though, Brown et al , 2015, in their paper said that conversational interfaces will let the user to focus on their primary action and, on occasion, let them trade talked words with their Personal Assistant. [17]

Paraiso, et al, 2005, the plan of ontologies must cover the world encompassing the client, as far as substances and of their relations. Likewise, the ontologies should likewise encourage the procedure of syntactic elucidation, providing the parser with semantics components, for example, thing equivalent words, hyponyms/hypernyms etc. Secondly, Speech acknowledgment is a to a great degree complex process, very mistake inclined, and can't be executed today without a lot of information about what the utterances are probably going to be. The outcomes from a programmed speech acknowledgment motor might be very a long way from what the client really said; the distinctions might be lexically and grammatically noteworthy. In their paper, to treat utterances, the parser checks the setting of the information. It confirms that it is a request identified with the space (recall that the parser characterizes all articulations as a request or an inquiry or an answer). To do that, it utilizes the space cosmology and the dictionary. The dictionary contains a great many words enhanced with the rundown everything being equal and properties of the cosmology. Since the articulation is a request and since it is identified with the application space, the parser module restores a network containing the rundown of tokens and their syntactic order. At the point when the client asks for an activity, the Dialog Manager endeavors to execute it, making an assignment that is dispatched by the Action Looping module. Be that as it may, if the underlying articulation needs urgent data, e.g., an activity parameter, it starts sub-assignments to supplement the activity list, asking extra data from the client. To do

that, it utilizes an activity library (library consisting of all the possible actions that are allowed for a particular command/request/order/query etc.). They proposed the plan of a voice-empowered Personal Assistant to help users (civil servants) prompting residents in an e-Government multi-operator framework. Specialists are totally free and convey when required. Certain correspondences may happen between human operators and their Personal Assistant, and between the Personal Assistant and administration specialists to achieve an assignment. [9]. Brown et al , 1996 has already stated in their paper about an essential bearing for future work is enabling users to get to their assistant by various means, for example, phone or individual computerized associates (PDA). User portability may force fascinating requirements to be handled in the following forms of the speech interface.[23]

Czibula, et al, 2009, proposed an Intelligent Personal Assistant that learns by supervision to help clients in playing out their tasks. This system has the most important feature is that the user assistant is an adaptive interface technology: the more assistant interacts with the user the more system knows about user's preferences about his/her work, the more it can find and comply with that client's propensities, capacities and so forth the principle objective is to enhance the capability of personal assistant agent, by give it insight. All the actions that are done by personal assistant are saved and the errors that the system made, this storage is called knowledge base. This knowledge base is used to improvise the in future aspects. In their paper have some loopholes like the system improved its behavior on the basis of actions. So it will take some time to give better results to the user. Their paper describes in a smart individual specialist created to help learning laborers in booking their errand. The specialist learns, in view of dynamic and inactive learning, user inclinations and it is equipped for basic leadership.

The paper proposes an intelligent Personal Assistant agent which is smart enough to predict the user's next instruction

on the basis of its knowledge base. But how a system can predict user's next instruction? System make record of successful events performed by itself in the database called Knowledge base. They defined a model where IPA agent examines the interaction of clients with a software application SA, the task performed by system with T. The number of action taken by the system in completing the task is A the set  $(a_1, a_2, \dots, a_n)$ . In performing any task T given by user traces are generated, system stores the successful traces. A successful trace is a sequence  $\langle x_1, x_2, \dots, x_l \rangle$ , which accomplishes the task T, where  $t \in \mathbb{N}$ , and  $x_j \in A, \forall 1 \leq j \leq l$ . These successful traces are stored in knowledge base of the IPA agent for future work. After the unsuccessful trace, system repeated the activity it failed to complete automatically, Czibula, et al, didn't define any condition related to unsuccessful trace. Moreover, all data whether successful or unsuccessful will be stored in knowledge base, which may lead the system towards the problem of lack of memory [3], whereas, Joachims et al, 1998, in their paper, incorporates to adapt the feature of information learning and information feedback, which are the two most important aspects of any system. Knowledge base is made of two processes; first one is learning process and other one is training process. [16]

Fabrizio, et al, 2011, proposed that voice-based cooperation is typically straightforward, flexible and does not require intellectual endeavors, consideration or potentially memory assets in favor of the client. Voice interfaces for instance, can flatten alternative menus and supply quickly complex verbal reactions. It is a method of providing a natural voice user interface between a human and a computing device, the natural voice user interface having a module for handling frequently asked questions. Their handmade frameworks require manual preparing, fragmenting

and marking of information in anticipation of the voice UI in the specific area of the organization. The information required for high quality frameworks may involve a really long time of scripted dialogue with people and the PC. The scripted PC human associations are contemplated and prepared in a work escalated way to prepare the new talked dialog service. Such frameworks are tedious and expensive to assemble, along these lines adequately keeping numerous organizations from taking an interest and getting the enhanced client mind benefit that can be given. Be that as it may, what is required in the craftsmanship is an assistance work area benefit that gives a more natural data trade between a user and the assistance work area that expands consumer loyalty. [4], though, the assistant should know the mental inspirations of the user, it ought to have the capacity to see the user's feelings and even ready to recommend activities that incorporate the user's social connections (e.g. prescribing a companion's as of late distributed research paper). Furthermore, the assistant talks flawlessly fluent English, utilizing fitting inflection that transmit multi-etymological data, such as in dialect method of German or French as indicated by the user's needs. Bartneck et al, 2004, in his paper already said that the goal for the future is to further improve our solutions and meeting the sophisticated real-world dialog requirements. It should be to enhance client associations with organizations utilizing a natural dialect help work area that comprehends and collaborates with users in a more proficient and wonderful way, particularly when taking care of as often as possible made inquiries. The dialog among the digital assistant and the user ought to be free of any imperatives. Automated characters may have the capacity to express their feelings better since their physical embodiment and make them more human than screen characters. In any case, expecting that screens are accessible, it is considerably simpler to build up a screen character than a mechanical character in light of the fact that a virtual world can be

controlled less demanding. Automated characters need to manage indeterminate tangible information and an erratic situation. A superior capacity to express feelings could legitimize the additional exertion of making an automated character. Three parameters and their collaboration are vital for the correlation between the passionate articulations of a screen character and an automated character: geometrical power, saw force and acknowledgment precision [15].

Pozna, et al, 2013, proposed a paper whose subject is a personal assistant design. The aim of personal assistant is a daily activities list planning. The main work of system is to plan all the activities of user of any day according to user preferences. This application has the aim to assist the client in a daily activity planner. System has to plan user's activity according to user's comfort and on the basis of knowledge system provided by user like time, priorities about different activity and some fix schedule activities. The problem with this system is that the solution depends on objective information i.e. activities timing, state of the town etc.; and subjective information about the customer comfort expectances i.e., priorities about the events etc. It will be more frustrating for the user to if he had to tell about the information about the events every minute. The implementation of this model is only from theoretical point of view nothing practical. They proposed a paper whose subject is a personal assistant design. Pozna, et al, 2013, defined the mathematical part of proposed system, in which they defined the cost function and the necessary conditions in order to do the activity  $A_j$  in the place  $P_j$ . The PA solution is linked to the client subjective preferences, which means the activities are planned according to user's preferences [10].

Pozna, et al, illustrated the Personal Assistant Application with the mathematical expressions. In Pozna's model: the status of activities is not defined,

*whereas, If the activity failed or succeed system will give the notification about that ( $PA_i = 1$  or  $PA_i = -1$  or  $PA_i = 0$ ).*

Pozna, et al, defined the activities like  $(p_{i,j} = 1)$  which means that activity  $A_j$  can be performed in place of  $A_i$ , but they didn't save the activity for future purpose, *whereas, successful traces are stored in the knowledge base by the system is the key feature of this system for future purpose ( $Q_i = K_b$ ).* Pozna didn't link the current activity with the next activity ( $t_{si} > t_{c(i-1)}$ ), *whereas, any activity that will be going to start will wait until the previous activity ends and if any activity is processing then other activity doesn't start ( $T_p \leq T_c \leq T_n$ ).* According to Pozna, et al, model system stops if the activity fails and didn't notify the user, *whereas, if the activity fails to perform an instruction given by the user then it will restart the process and didn't save it to the knowledge base (IF ( $PA_i = -1$ ) then REPEAT) [10]*

Milhorat, et al, 2014, proposed the challenges in creating customized speech-operated assistive technology and propose various innovative work headings that have been attempted keeping in mind the end goal to solve them. They deployed systems, regardless of whether they have a business or an exploration reason, for the most part use the dialog history as an instrument to disambiguate client articulations and to monitor the dialog state. However, the remembered action log is frequently centered on a single dialog and does not spread crosswise over various discussions. The data state worldview is considered as an incorrect hypothetical structure and in this manner does not meet the prerequisites of most functional usage. The same applies to stochastic procedures whose fundamental downside is that preparation information must be gathered keeping in mind the end goal to assemble a framework. Notwithstanding what is straightforwardly asked for by the client, a tremendous measure of data is



normally accessible which might be handled by a framework and in the end could enhance its setting mindfulness. For instance, sensors implanted in (future) homes, in the office or basically in ordinary utilized apparatuses, for example, our darling cell phones, are valuable information sources that could be utilized to increase human-machine association. They proposed that the overall interaction could be enhanced if the framework has data about the personality, the sexual orientation and the age of a user and besides regards his/her inclinations for collaborating with innovation. They proposed an automatic speech recognizer which converts human speech and makes that easy to understand for the system. Author used Natural Level Processing for converting speech to text. It involves some steps like:

- First step is lexical investigation constituting the dissection of the structure of words.
- Parsing includes investigation of words in the sentence and finding out the proximity of the similarity between them.
- Third step is semantic investigation which draws the correct importance or the word reference significance from the text. [6]

The most common drawback for the speech recognizer is accent of any user, most of the time it can misinterpret the predictions in the sentence. The chances of accent problem in the proposed system may arise less because there are no restrictions related to language. Using a multi-agent architecture will be beneficial as the settings of one specialist can be changed in view of the info originating from different agents. So, on the off chance that one segment recognizes an adjustment in the dialog context it can educate the various parts, refreshing their configuration. This dynamic component would take into consideration altering the framework even while it is running. There are two foremost contrasts which exist between speakers: acoustic contrasts which are

identified with the size and state of the vocal tract, and elocution contrasts which are for the most part alluded to as highlight and are regularly geologically based. One can make voice commands, which will be standard words by phonemic organization and change the tone of the voice commands. It will fundamentally enhance the procedure to evade the ambiguities that emerge amid a question between voice requests and conventional words.

Later in 2015, Mishra, et al, proposed a speech-controlled personal assistant robot. The voice charges are given to the automated partner remotely, by utilizing a smart cell phone. The voice charges are handled continuously, utilizing an online cloud server. Assistant robots can be utilized for different purposes, for example, in chemical industries or in homes to handle perilous synthetic chemicals and objects individually. These automated aides can be utilized for forming, producing and tooling purposes in different divisions, for example, fabricating, resistance and so on. An automated assistant that can be controlled utilizing speech orders is created in this paper and it tends to be utilized in healing centers, homes, businesses and Educational organization. The voice summons is given to the robot utilizing a smart cell phone which depends on an Android OS based platform. The voice flag is then changed over to the content frame utilizing an online cloud server, continuously. This content charge is sent by means of Bluetooth system of the advanced mobile phone to the Bluetooth module on the robot. In their paper, exactness and accuracy of voice signal transformation to text shape relies upon the separation that is kept between the smart phone, signal quality and different factors too. Speech acknowledgment is an amazingly complex process, very blunder inclined, and can't be executed today without a lot of information about what the articulations are probably going to be [7].

They proposed a speech-controlled individual assistant robot. The intonation of the speaker ought not influence the activity of the robot as the voice commands are prepared utilizing a cloud server which works independent of the complement of the speaker [7], though, utilizing inexhaustible wellspring of vitality for the working of the robot would not just enhance the cost of the robot however would additionally turn out to be eco-accommodating. Sun based cells can be a conceivable wellspring of vitality that can be utilized. The weight conveying limit of the robot can be expanded by utilizing a more grounded metal of the arms and the engines with high torque[23]

Han, et al, 2016, proposed a control system for home appliances utilizing human speech and setting data. The paper presents engineering of the control framework and a procedure to control home apparatuses made out of three stages: speech discovery, speech acknowledgment, and charge execution. Human speech is a complex phenomenon, a dynamic process without clearly distinguished parts. All modern descriptions of speech are probabilistic at some degree. Also, improving the recognition accuracy and the utilization of human speech for controlling home appliance should also be taken place [5].

In 2016, Han, et al proposed a control system for home appliances using human speech and context information. The paper describes the concepts of Home Automations system which is based on Human speech which defines the language model for speech recognition. Language model describes the object tokens (like: light, bulb, music player etc.) which are controlled by the user, the commands tokens (like, turn on, turn off, play, start etc.) and location tokens

(like: in the kitchen, in the bedroom etc.). The output of speech recognition module is a tuple of tokens, <command, object, location>, and command and location token could be omitted. In the model for speech recognition Han, et al, made a class for each set of word token and describe the functioning of each token in the set. To improve the recognition accuracy and the utilization of human speech for controlling home appliance, the author defined language model in Java Speech Grammar Format (JSGF). In Java Speech Grammar Format (JSGF) command given by the user should be particular format (like: open the window, close the light switch) that will be difficult for user to remember every command. Also, it's not mandatory to give a command to system in a particular format, user can communicate with the system in a formal way, whereas, Han, et al, put a condition that command should be in Java Speech Grammar Format (JSGF). A entity is a man, place, or protest that is viewed as significant to the association between a user and an application [5], whereas, a user can't communicate with smart control home system due to lack of voice enabled system. Additionally, the System can convey the message related to completion of any command or for any other subject with the voice control system. Han's, et al, system doesn't support the voice control feature. Users are displayed as fluffy personas and these models are semantically related. Vlachostergiou et al, 2016 in their paper mentioned how context data is gathered by means of sensors and relates to different parts of the inescapable association, for example, temperature and stickiness, yet additionally smart city sensors and administrations. This context data improves the keen home condition through the joining of user characterized home run the show. [14]

TABLE I. Comparative Analysis of Intelligent Assistants developed so far as a part of literature review

Author,	Background	Data and methods	Performanc	Feasibility	Limitations
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Year			e		
Quiliang, et al, 1996 [11]	Chinese Syllable into correct Chinese Word	Correct any sentences according to Statistical Probability Characteristics of Language	Information feedback-capability of being corrected itself.	Provides accuracy for the Chinese word detection.	Doesn't allow transportability of the language and is restricted only to Chinese.
Allen, et al, 2001 [1]	Robust Spoken Dialogue Systems.	Finite-state Script Frame-based Plan-based Models. Agent-based Models	Increase in dialogue effectiveness	Revolutionize the way people interact with computers	Pattern-matching techniques used to great effect in frame-based and sequential-context systems simply do not work for more complex domains.
Allen, et al, 2001 [2]	Architecture for Conversational Resume	Personal Assistant Architecture and Human Computer Interaction	More realistic conversations.	Feasibility can be improved by the TRIPS systems.	Very complex system (TRIPS- the Rochester Interactive Planning System) having many levels and very difficult to understand.
Ross, et al, 2004 [12]	Potential of the Current state-of-the-art in Speech Recognition Technologies	Voice User Interface Principles	Make the conversational agent behave as a faithful servant	Feasibility depicted by the LCI prototype	Lack of speech understanding ability and conversion can also be found in the paper. It also failed to explain the working of the system.
Paraiso, et al, 2005 [8]	Ontology-Based Speech Interface	The Speech Interface Architecture. Knowledge Handling: Ontologies.	System capable of performing tasks with an intuitive interface.	Intelligent user interfaces that enable unsophisticated users, such as civil Servants	Parsing of each word using a lexicon containing thousands of words enriched with the list of all concepts and attributes of the ontology is time

					consuming and costly process.
Paraiso, et al, 2005 [9]	Ontology-Based Speech Interface for Personal Assistants.	Service Centre. Service Provider.	Help interpreting the context of messages sent.	Complex process and quite error prone.	Ontologies must also represent the process of syntactic interpretation feeding the parser with linguistic data.
Czibula, et al, 2009 [3]	Personal Assistant that Learns by Supervision	Implementation on knowledge base.	Aid knowledge workers in scheduling their tasks	Can improve the behavior based on Actions.	Response to a command or a request is limited.
Fabrizio, et al, 2011 [4]	Providing a Natural Voice User Interface	Automatic Speech Recognition Dialog Management Text to speech	Simple and flexible	Time-consuming and costly to build	Systems built are time-consuming to implement and costly to build, thus effectively preventing many companies from participating and receiving the improved customer care service.
Pozna, et al, 2013 [10]	Plan the activities of according to User Preferences.	Implementation based on Knowledge systems provided by the user.	Customer feedback is efficiently done.	Implementation only theoretical not practical.	Solution depends on objective information i.e. activities timing etc. and subjective information about the customer comfort expectancies i.e., priorities about the events etc. making process more frustrating for the user (he had to tell the information



					about the events every minute).
Milhorat, et al, 2014 [6]	Personalized Speech-Operated Assistive Technology	Dialog Management aspects. Natural language understanding	Activity log is often focused on a single dialog	Dynamic mechanism is helpful	Memorized activity log is often focused on a single dialog and does not spread across different conversations.
Mishra, et al, 2015 [7]	Voice Commands given to the Robotic Assistant by a smart phone.	<ul style="list-style-type: none"> <li>Voice Control over Bluetooth</li> <li>Operation using Bluetooth</li> </ul>	Performs various actions as per the speech commands	Using renewable source of energy, prove to be eco-friendly.	Accuracy and precision of voice signal conversion to text form depends on the distance that is kept between the smartphone, signal strength and other factors as well.
Han, et al, 2016	Control System for Home Appliances using Human Speech	<ul style="list-style-type: none"> <li>Speech Detection.</li> <li>Speech Recognition</li> <li>Command Execution.</li> </ul>	Accuracy of speech recognition	POSTECH smart home and UPnP-OSGi simulator	Recognition accuracy can be improved and the utilization of human speech for controlling home appliance could also be taken place

#### 4. Proposed Model with Comparison with the Existing Systems

This paper aims to build an Artificial Intelligence based Intelligent Personal Assistant. It includes a voice-enabled conversational resume of the user, which will interact with the recruiters or interrogators. The objective would be to integrate intelligent voice commands into a consumer-friendly voice-based user interfaces. In addition to it, language selection and translate options will also be incorporated. The

resume assistant can interact with others in as many languages as one feed in it and with a voice command, asking to switch over to a different language according to the user's choice, creating a consumer-friendly voice-based user interfaces that will help to lessen the load of resume review process prior to interview would prove to be efficient. In addition to it, language selection and translate options will also be incorporated to broaden the languages available to the user, thereby having no language barrier.

#### 4.1 Architecture of Proposed Model:-

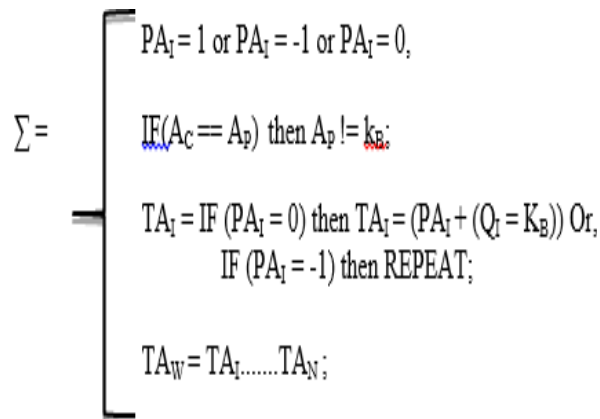
The system includes 3 components:

I. *Speech Recognition*: This step would convert the speech command of the user into readable texts so



that it can be processed.

II. *Natural Language Understanding and Conversation Management*: Converts transcribed text into structured objects for accurate



interpretation. This allows to understand the real intent behind voice commands and initiates proper responses through various delivery channel.

III. *User Fulfilment*: This would be the last step which would convert the text into speech and would be delivered to the user in the same language as the user's input language.

#### 4.2 Hardware and software requirements of the proposed system

Hardware Requirements:

- Internet Access via Wi-Fi/Ethernet
- Computer/Laptop with minimum 2GB Ram Dual Core Processor (make the software to run smoothly)

Software Requirements:

- Python >= 3.x
- Django >= 1.9
- >= Java 8
- HTML3, CSS3, JS
- itextpdf-5.4.1.jar

#### 4.3 Mathematical Modelling of the Proposed System.

The system can be mathematically modelled as follows:

Suppose  $A_w$  is the list of all activities and  $(A_1, A_2, A_3, \dots)$  are the activities which will perform (or are running) by the "Intelligent Resume Assistant".

The successful trace of sequence of activities done by the system is:

Let Say "PAI" is the activity that is running and is the command given by the User to the system.

Where: -

- PAI = CurrentActivity;
- QS = total number of successful traces;
- QI = A successful trace;
- KB = Knowledgebase;
- AC = CurrentActivity;
- AP = PreviousActivity;
- TAI = Time taken by one activity;
- TAW = Time taken by all the activities.

Explanation :-

- System will return (1 or -1 or 0) when the activity is completed which indicates activity is currently in processing (1) or Activity is

unsuccessfully finished (-1) or Activity is successfully finished (0) respectively.

- b. If current activity is same as previous activity, then did not save it in knowledgebase.
- c. If the activity is successfully completed then total time (TAI), taken by one activity is equal to the time taken to complete the activity plus time taken to save that successful trace (QI) in the Knowledgebase.
- If the activity is unsuccessfully finished (PAI = -1) then repeat the unsuccessful activity.
- d. Total time (TAW) in completing the whole process is equal to the summation of time taken in

completing all activities.

Furthermore, a knowledgebase can be created, so that the successful traces are saved in the knowledge part of the product and if a user gives any commands to the application it will generate the correct answer. The Feedback Processing of Speech Recognition System Step by Step has been depicted in Fig 1. The mathematical modelling of the proposed system has been summarized in comparison of the existing system developed so far in Table 2.

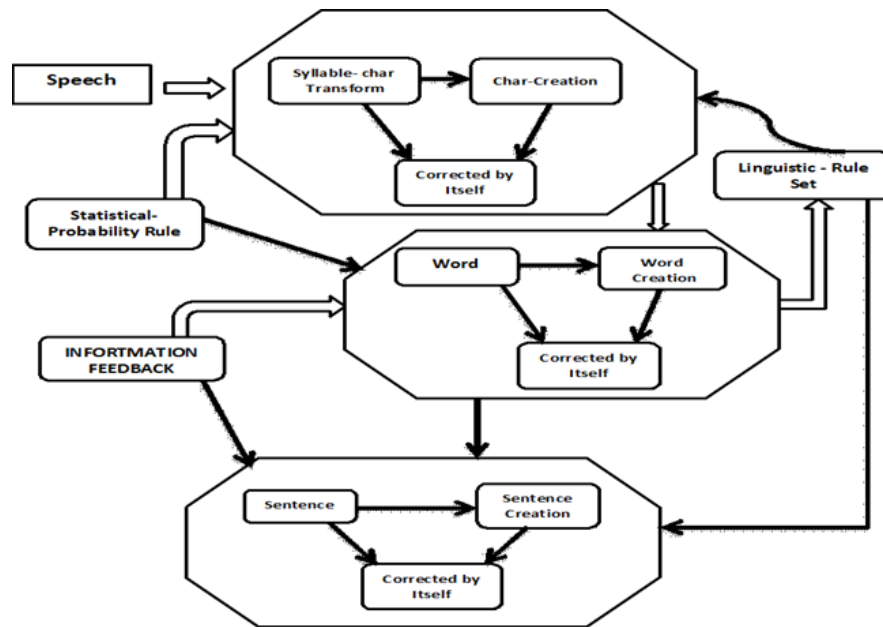


Fig 1. The Feedback Processing of Speech Recognition System Step by Step

Table 2: summarizes the proposed mathematical modelling of the system in comparison to the existing system developed so far

Author, Year	Commands	Voice Enabled System	Model	Limitation of the Model	Proposed Model in their respective comparison
Czibula et al, 2009 [3]	User can give commands in formal talk	IPA has voice enable feature	Mathematical expression for knowledge	Black box in nature means that it is hard to look 'into' the system and figure out	System did not save the instruction in knowledge base if it is already present. System refresh the

			e base	exactly what it has learnt. Greater computational burden, bias to over fitting	knowledge base time to time
Pozna et al, 2013 [10]	Paper from theoretical point of view	No product is made	Mathematical expression for to do list for user	Mathematical model from theory point of view, there is no practical proof There is no database for storing the user activity for further reference	Mathematical modelling is user friendly and there is an availability of database system.
Milhorat et al, 2014 [6]	As per Natural Level Processing	Voice enabled system is available	Speech to text architecture	Sometimes did not understand the accent of user and give wrong interpretation	Due to absence of any communication format the proposed system can easily communicate with user
Han, et al, 2016 [5]	Command should be in Java speech grammar format	Voice enabled system is not available	Language model for speech recognition	Should be Java Speech Grammar Format User can't communicate with the system due to non-availability voice enabled system	User can communicate in any language and in a format talk. There is not any format.

#### 4.4 FlowChart of the proposed system

The Flowchart in Fig 2 explains the brief flow of the system

- The user gives a speech input to either edit or interrogate the application about a resume. The questions in the interrogation can include keywords like: skills, background,

- Once the input is given, the application understands the language. Another input to the application is the PDF based resume of the user.
- The parsing begins by entity extraction of the textual data which is further done by sentence segmentation and tokenization to extract the necessary keywords.



- The extraction is done by splitting the data based on hyperlinks, special characters or blank lines and storing the input as a text file.
- c. Finally, based on the speech input the application

searches for the right keyword in the parsed text file and then subsequently converts it into speech output for the user.

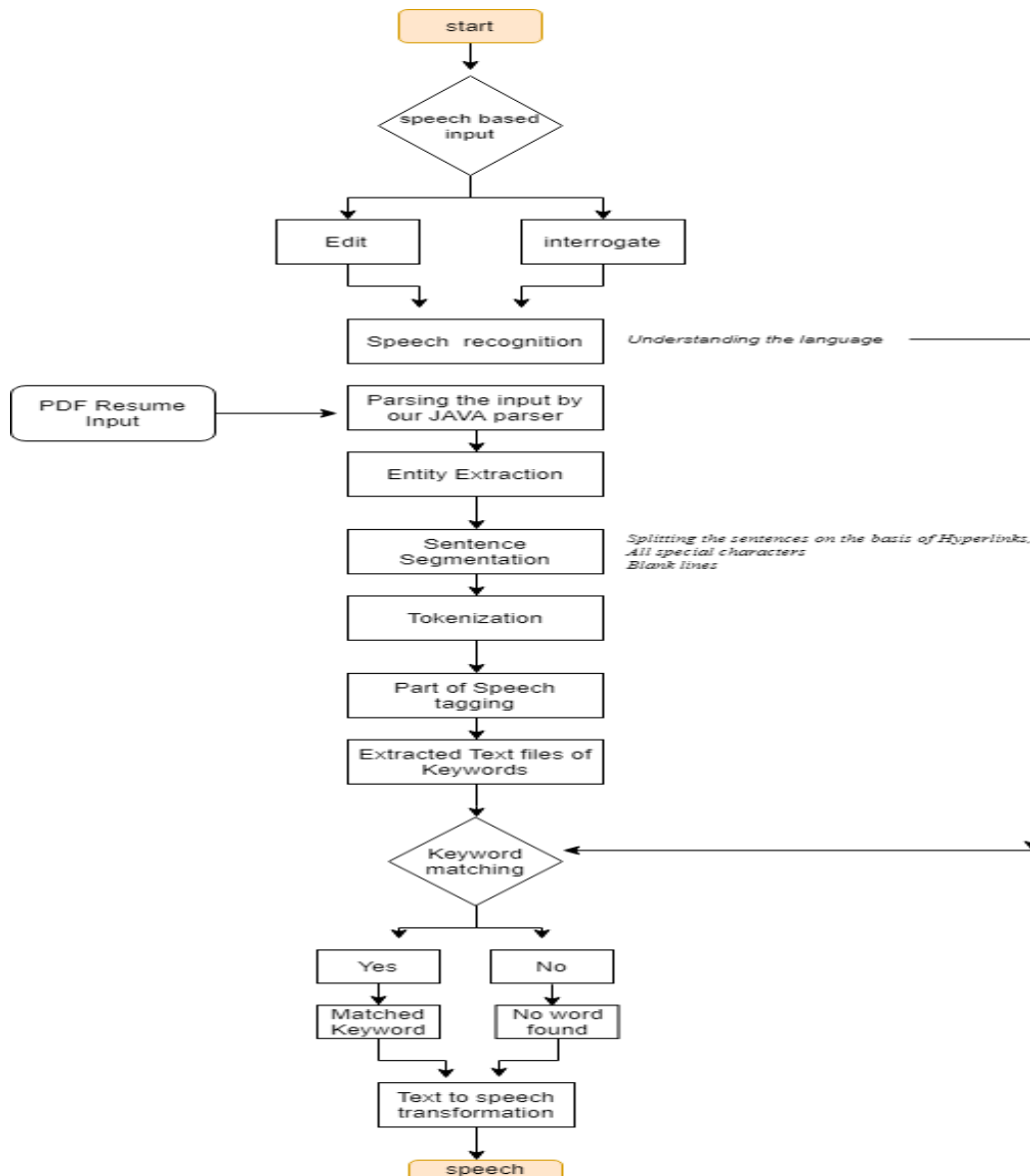


Fig 2. Flow graph of the proposed system

#### 4.5 Interface design, the code and brief working of the parser

Parsing the input: The input file which is in PDF format will be parsed using JAVA. The following are the sub-

steps required while parsing the input –0

- Splitting the data if there is a space or a new line.
- Checking if there is a bullet after the heading, if

there is no bullet then treat it as a paragraph otherwise split the data by the nextline.

- Storing the bullets in a list form using numbering.
- Data manipulation by Python: reading/writing the file and further parsing the resume into a text file as depicted in the Fig 3 and Fig 4.
- Taking the input from the user and storing it as a dictionary in python
- *User fulfillment:* By using APIs from Linguistic Analysis and Natural understanding intelligent service to generate speech outputs. Fig 5 describes the screenshot of our web application depicting the search option, speak option in multiple languages given in the form a dropdown.

```
import os, re
from Tkinter import Tk
from pyPdf import PdfFileReader
from tkFileDialog import *

def main():
    filename = askopenfilename() # show an "Open" dialog box and return the path
    to the selected file
    file = open(filename, 'rb')
    pdf = PdfFileReader(file)
    print pdf.getPage(0).extractText().split('\n')

if __name__ == '__main__':
    main()
```

Fig 4. Parsing of PDF to Text

A JAVA program of PDF parser has been used to parse the input resume and convert it into a text file. It will provide highlights to extricate crude information from PDF reports, as compacted pictures. PDF-parsers can likewise manage vindictive PDF reports that utilization muddling highlights of the PDF dialect.

The parsing can be done keeping the following steps in mind:

- Hyperlinks
- All special characters
- Blanklines
- Headers/footers of pdf files
- “1)”, “2)”, “a)”, “bullets”, etc.

```
public class PDFTextParser {
    PDFParser parser;
    String parsedText;
    PDFTextStripper pdfStripper;
    PDDocument pdDoc;
    COSDocument cosDoc;
    PDDocumentInformation pdDocInfo;

    // PDFTextParser Constructor
    public PDFTextParser() {
    }

    // Extract text from PDF Document
    String pdfToText(String fileName) {
        System.out.println("Parsing text from PDF file " + fileName + "....");
        File f = new File(fileName);

        if (!f.isFile()) {
            System.out.println("File " + fileName + " does not exist.");
            return null;
        }

        try {
            parser = new PDFParser(new FileInputStream(f));
        } catch (Exception e) {
            System.out.println("Unable to open PDF Parser.");
            return null;
        }

        try {
            parser.parse();
            cosDoc = parser.getDocument();
            pdfStripper = new PDFTextStripper();
            pdDoc = new PDDocument(cosDoc);
            parsedText = pdfStripper.getText(pdDoc);
        } catch (Exception e) {
            System.out.println("An exception occurred in parsing the PDF Document.");
            e.printStackTrace();
            try {
                if (cosDoc != null) cosDoc.close();
                if (pdDoc != null) pdDoc.close();
            } catch (Exception e1) {
                e1.printStackTrace();
            }
        }
        return null;
    }

    System.out.println("Done.");
    return parsedText;
}
```

Fig 3. File Operations using PDF Parser

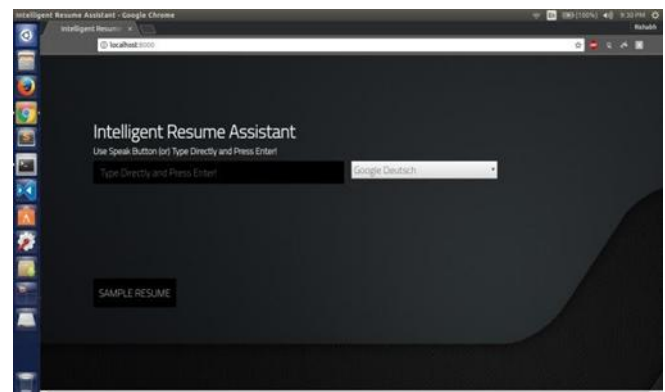


Fig 5. Sample UI for IRA

#### 4.6 Algorithm of Proposed System-

In the Proposed system algorithm, the activities that are successfully completed are saved for the future purpose, in the system. This algorithm has been compared with the algorithm defined by Pozna, et al. They defined their system through which illustrated that the activities that happened will be occurred under certain conditions like—‘the gazing time must be greater or if nothing else meet with the present time after the past movement;’ etc. Pozna et al proposed algorithm was

Step 1. Start the Activity or command given by user-

Step 2. Initialize Activities are  $A_1, A_2, A_3 \dots A_n$ .

Step 3. Activity  $PA_{i,j} = 1$ ;

Step 4. Starting time  $T_s$  greater than equal to current time  $T_c(i - 1)$

Step 5. Starting time  $T_{sj}$  and the activity  $\Delta t_i$  related to closing and opening time ( $to_j, tc_j$ ).

Step 6. Starting time  $T_{sj}$  and the activity  $\Delta t_i$  must be less than Maximum Time ( $T_{max}$ ).

Step 7. End the Activity.

This algorithm conclude that time taken by any activity must be related to the starting time of the next activity and many other things which are defined above already. After analyzing this algorithm the complexity is  $O(n)$ .

In contrast to the Pozna et al algorithm, the algorithm of the proposed system is as follows:

Step 1. Start the Activity or command given by user.

Step 2. Initialize the Activities ( $A_1, A_2, A_3 \dots A_n$ ) and Successful traces are ( $X_1, X_2, X_3 \dots X_n$ ).

Resume\_Assistant( $A$ )

If ( $PA_i = 0$ )

Print (Activity performed successfully.)

else if ( $A_c == A_p$ )

then  $A_p \neq kb$ ;

else:

Print (Activity performed unsuccessfully.)

if ( $PA_i = 0$ ) // Activity successfully Performed.

then total time  $TA_i = (PA_i + (Q_i = Kb))$

elseif ( $PA_i = -1$ ) // Activity unsuccessfully Performed.

then REPEAT;

else:

break;

Step 3. Current time  $T_c$  is greater than the previous activity finished time  $T_p$  and less than starting time of next activity  $T_n$ .

Step 4. Total time  $TA_w$  equal to all activities time ( $TA_1, \dots, TA_n$ ). The proposed algorithm involves:

- If the activity  $PA_i$  is completed successfully then saved it to the knowledge base  $Kb$ .
- Else if the current activity  $A_c$  is same as previous one  $A_p$  then do not save it to the knowledge base.
- If the activity  $PA_i$  is completed successfully then the total time  $TA_i$  taken by activity must be equal to time in completing that activity and it is taken in saving in knowledge base.
- Else if the activity is failed ( $PA_i = -1$ ) then repeat the process.

#### 4.7 Efficiency of the proposed system algorithm

According to mathematical modelling proposed in the product defines that the process (or the questions) will be saved in knowledge base ( $Kb$ ) and will be helpful in the effectiveness and the complexity of process unlike the Pozna et al [10] algorithm where every process is creating new instance, although it's already done once because as per the product, it saves the previous activity. Pozna, et al, also didn't define about saving the successful traces so that system could use that part of algorithm.

Additionally, the proposed system is also seeking information from the previous processes, for example it will help in some grammatically errors and some easy calculation unlike the other state of the art algorithms. Further details are given in the architecture section.

## 5. Limitations of the Proposed Model

Every software has its own limitations. There are some limitations related to the proposed model

- In any voice-enabled system there are problems such as programs can't comprehend the context of dialect the manner in which that people can, prompting mistakes that are frequently because of distortion.
- Every person has a different accent of talking, so voice recognition systems can have problems with accents.
- User can't do any major changes in their resume through voice enabled system.
- Software can be easily hack-able with the help of pre-recorded voice of user.
- There is particular syntax of asking questions to the system, one can't talk casually as they talk to humans.

## 6. Conclusion and Future Scope

Assistants should fully comply the scope of Personal Assistant duties and the required duties. Resume review during recruiting can be a strenuous process. With the development of knowledge base part user can efficiently talk to the product and the interview process can be made easy and smart. Also, the cognitive load of the user will be decreased. The paper broadly aims to reduce the cognitive load of the user. With an effective comparison with the other models mentioned in the literature review section, a proper and accurate picture of the

proposed model can be made out. The goal is always be to reduce the time, load and complexity of the existing systems and to provide easy to understand speech interfaces for the assistants. The resume assistant proposed in this paper improves customer relationships with organizations utilizing a natural dialect help work area that comprehends and cooperates with the users in a more productive and lovely way, particularly when taking care of every now and again made inquiries. The dialog between the digital assistant and the client is free of any restrictions.

The resume assistant can interact with others in as many languages as it is fed with a voice command, asking to switch over to a different language according to the user's choice, creating a consumer-friendly voice-based user interface that will help to lessen the load of resume review process prior to interview would prove to be efficient.

The aim for the future is to improve the designed solutions further and meeting the sophisticated real-world dialog requirements. Right now, the implementation of PA tackles the pdf version of resumes. For the future improvements in terms of tackling multilingual resumes, the concept of universal grammar can be implemented that can parse the resume, so that one can fetch the different sections inside a resume accurately despite being in different languages. To tackle the situation of images/gif-based resumes, image character recognition application can be written that will eventually parse the image/gif, then feed the data to the grammar described above. This application should be in high precision so as to minimize the fault. For this higher sample resumes is required to train the application for higher precision.

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