I3 Bot: Empowering Small and Medium Scale Enterprises with Machine Learning

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Abstract: The incessant need to furnish better interfaces between people and computer engendered in intelligent systems with prime emphasis on User Interface, basic software engineering principles and simplified yet powerful data analytics for the Business.
In this race, Small and Medium Scale Enterprises fell behind due to lack of human, technical and financial resources.
The i3 bot application solution presented in the paper provides adaptive response by learning from real time user interaction and provides a minimalistic interface [3] thus permitting humans interact with the system (computer) in a novel way. In addendum to this i3 bot is optimized using machine learning algorithm coupled with simple yet important engineering concepts like customer feedback to burgeon its ability to deliver output in adherence to user's demands and ever-changing needs.
This paper is focused on empowering the Small scale and Medium Scale Enterprises and Institutes in the form of technological solution (SAAS model) of through I3 Bot.

Keywords: Machine learning, Chat bot, Naive Bayes classifier, Small and Medium Scale Enterprises

I. INTRODUCTION

I3 Bot stands for intelligent, interactive, interface which are the 3 pillars of the imminent software needs.

Human-computer interaction(HCI) is a multidisciplinary field of study focusing on design of the computer technology and between human and computer [1]. With the gaining demand to provide an efficient and easy human computer interactions, the study progress in natural language processing and in speech recognition has bolstered to provide an optimistic solution to Human computer speech Interaction with various interfaces. HCI draws on knowledge and skills from Anthropology, Sociology and Psychology along with Computer Science. [15]

For a fruitful use of speech to text conversion the technology must be designed in such way to break the sentences and words into meaning full phonemes. To serve this purpose advent of chatbot began to emerge. These chatbots are amalgam of real time learning and complex algorithms to provide adaptive responses.

However, these chatbots are not pervasive due to their extravagant price. The article [4] suggests that Building a Full Chatbot from the Ground Up: $30,000 – $150,000. The important to consider long-term maintenance costs, which will typically require either your own IT specialist with enough skills to manage and update the bot, or repeated sessions with outside experts to help fine-tune it. Because of which these chatbots are used extensively with tech giants and Multi-National Companies resulting in dearth of its use in modest industries, small scale enterprises and institutions.

The "I3- Bot" presented this paper heed these drawbacks to provide a web application open source software as a service model(SAAS) to small scale and medium in scale industries to **aid their sales and acts as a vehicle in path of better Customer service and interaction**.

The i3 bot is designed keeping on mind to provide real time interaction with the user to give succor to their queries revolving around the 3 I's principle.

II. LITERATURE SURVEY

This division discerns about the related papers referred while designing the i3 bot.

The paper developed by the Bayers Etiaji et al [1] aims at providing a chatbot to make a conversation with the humans and machine. The knowledge of the chatbot is stored in the data base and the appropriate response is provided by pattern matching. "The intelligent web-based voice chat bot" designed by S.J. du Preez et al [2] intends to provide voice recognition chat bot. This paper utilizes black box approach to control communication structure to and from web services. "Chappel – A Semi-automatic intelligent chatbot" developed by Bibek Behera [20] to meet a business requirement to provide a chatbot as personal assistant. The chappel is a semi-automatic chatbot that is able to provide appropriate service based on user's intent. The paper presented by Nikita Hatwar et al [21] consists of a software which harness the artificial intelligence to enable the user to interact with the system. This chatbots were designed to heed to needs of customers service, call center. The "MOOC: Buddy" designed by carmen holotese to assist as a possible recommender system for best learning resource. The chatbots

decisions here are based on the user's social media profile and interests.

The paper presented by Bhavika . R. Ranoliya et al [22] allows an efficient way to suffice user queries using Artificial Intelligence markup language (AIMC) and latent semantic analysis (LSA). "The programming challenges of Chatbot: Current and Future prospective" by AM Rahman et al [23] throws in plausible challenges of programming in current and future era of chatbots. The paper presented by YU Wee et al develops an automatic chatbot to knowledge acquisition method which includes classification model and theory of ensemble learning to make decision.

The paper presented by Bill Allcock et al [12] suggests that highly distributed user communities require high-speed access to valuable data, whether for visualization or analysis. The quantities of data involved (terabytes to petabytes), the scale of the demand (hundreds or thousands of users, data-intensive analyses, real-time constraints), and the complexity of the infrastructure that must be managed (networks, tertiary storage systems, network caches, computers, visualization systems) make the problem extremely challenging. These are the de facto standards for the data management projects worldwide.

III. KEY CHALLENGES

As we discussed earlier the chatbots are mainly advantageous and huge boon if used in write manner for any business. But we also have some key challenges which hinders the usage of these.

1. Cost of implementation: The main problem faced by SME's are the cost of the implementation of this technology in their official website. The price to develop may range from $30,000 – $150,000 [4].

2. User Interface: The minimalistic and easy to use interface is a vital component of software engineering. [5]. The study says 52% of users said that a bad mobile experience made them less likely to engage with a company. [6]

3. Self-adaptive Intelligence: The ability to learn from every interaction, Resulting in access to unlimited pool of data. This makes the chat bot system more smarter and ability to render user specific expected solution.

4. Interactive: In today's data hungry world, the requirement of solution in multiple mode of delivery form is the minimal requirement.

5. Ability to modify replies: The system is bound to make mistakes. But the ability to modify them or in certain cases block them if necessary. In order of keeping SME reputation in mind is once again a minimal requirement.

6. Analytics: The ability to trace footsteps of user is very prominent. To understand the view of customer towards SME is always an invaluable asset for enterprise. This helps in serving the customers better.

7. Security: The user information and related queries should be protected and used adhering to the local data protection policy. Especially customers Trust is an important criterion for the SME.

8. Robustness: According to a survey 50% of web users expect a site to load in 2 seconds or less, and they tend to abandon a site that isn't loaded within 3 seconds. [7] A customer lost is huge loss for SME.

IV. PROPOSED METHODOLOGY

The user has a query regarding a [SMALL AND MEDIUM SCALE ENTERPRISES] SME. The user wants to clarify it. The user logon to the USER panel in SME website and enquires his question vocally. The system answers to his problem and gives relative additional information. If the user is unhappy about the solution or problem intended couldn't be found, user will be able to report the question to the administrator.

The Voice to text algorithm will convert the user voice to the text. These texts are tokenized and then fed to the machine learning Naives bayes classifier algorithm [13] which will convert these user's questions into a predefined tag shown in fig1.
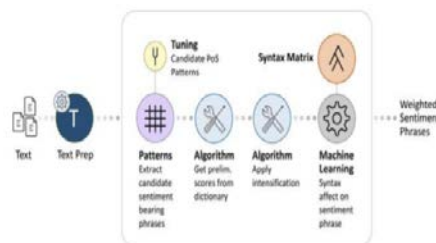

Fig1: Conversion of Text to tag classification

These tags are mapped to the solutions bundle. Each solution bundle consists of the solution to the query as information, indistinguishable human voice and a web page which helps to user to explore extra additional information towards the solution. This will generally relate to customized "landing page" of website. Ultimately helps in conversion of visitor to a client for SME.

There will be Admin panel which provides the below features: Admin Logs, User logs, Train algorithm for new questions, modify wrong answers, change admin credentials, provide graphical statistics. These **features empower the SME's to have control over the Reponses the system could provide upon queried which is the significant let down in the existing chatbots such as Siri, Cortana and others**.

V. IMPLEMENTATION

A. Tools and Technology

These are the below hardware and software requirements used to build I3 bot application as shown in table1.

Front end	HTML, CSS, Bootstrap
Client-Side components	Ajax, JavaScript
Scripting language	PHP, Python
Algorithm implementation language	Python
Servers	XAMPP stack and Flask Framework
PIP Modules	Textblob, python-vlc,gtts
Browser	Internet Explorer, Chrome
Hardware	Headphone, Speaker

Table 1: System Requirements

B. Applied Principles:

The I3 bot follow the 3 principles of Software Engineering: Intelligent, Interface and Interactive.

Interface:

• Rich User Interface: The Rich User Interface is key part for every web application system. How well the user can feel and use the system to navigate themselves throughout the system is the top priority. We have employed HTML, CSS, JS for frontend designing part. Python and PHP language are used for code implementation part.

• Multiple Functionalities: The admin dashboard promises the many customized functionalities for the privileged admin such as Admin Logs, User logs, Train algorithm for new questions, modify wrong answers, change admin credentials.

• Robustness: The speed of the web application should be minimal for user convenience. So standard practices such as using multi-threading techniques to training data at initial and retraining stages, storing the model using pickle, running the program as well as creating the voice output by another child process. Where ever non- required the use of the SQLI is optimized with normal file operations to decrease retrieval time of I/O operations [14].

• Quality and Design standards: The color combination standards practiced today in professional web designing world are carefully followed. Since the whole project contains my different languages, cross platform integration and unit testing will be done and recorded carefully.

• Security: The Security is the critical issue as it is in real world competitors exist, because the failure of this system could lead to financial losses. Hence for critical data storage python SQLI database will be used which is SQLite version. Every movement of the User and admin is carefully observed, and any malicious activities should be quickly attended.

Text Blob [9]:

TextBlob is a Python (2 and 3) library for processing textual data. It provides a simple API for diving into common natural language processing (NLP) tasks such as part-of-speech tagging, noun phrase extraction, sentiment analysis, classification, translation, and more.

Flask Framework [10]:

Flask is a Python web development framework based on the Werkzeug, Jinja, MarkupSafe and itsdangerous pallets libraries. It was originally created in 2010 and has since powered some of the largest websites on the internet due to its MVC (Model View Controller) architecture [11]. The Model View Controller (MVC) is a software architecture pattern, commonly used to implement user interfaces. This separates out the application logic into three separate parts, promoting modularity and ease of collaboration and reuse. It also makes applications more flexible and welcoming to iterations.
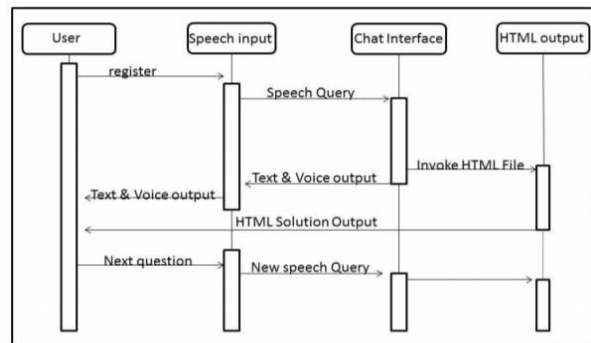
VI. VALIDATION AND DEMONSTRATION

A. Control Flow

The Control flow fig2 explains how the data transfers

Fig 2: The Control flow diagram of the system

Control Flow Diagram

internally in the system. user invokes the system. The user

should register first (only the user name is stored) Then the system gratifies the user and prompts for the input through voice. Once the input is received it is fed into speech to text conversion algorithm. The audio file output will be converted to text form. This is later fed to text classification algorithm which returns the tag. The tag is mapped to solution bundle returns to user with Voice, Text and an Information page in the form of the HTML as user output.

Meanwhile, we will ask the user for feedback for the satisfaction of answer received. If the user is happy about solution, we can conclude that the machine has classified and retrieved accurate information as per user needs by training on the limited database. The user query can be added to training set of databases which could further bolster the performance of the Machine learning algorithm.

If the user is unhappy of the response from the system, then we will provide the opportunity to notify the question to the system admin as shown in fig3 & fig4 and admin can act accordingly, by increasing the training set values or by creating a new classification tag.
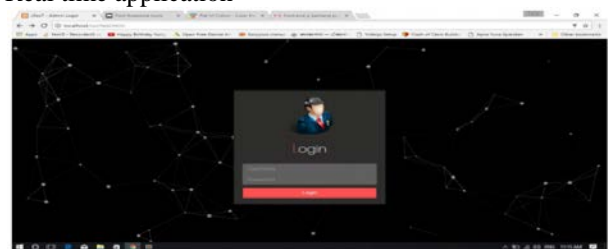
B. Real time application

Fig3: The Admin login screen of the I3 bot.

The data are stored in SQLI database and timely database backup will be taken as per best software practices.
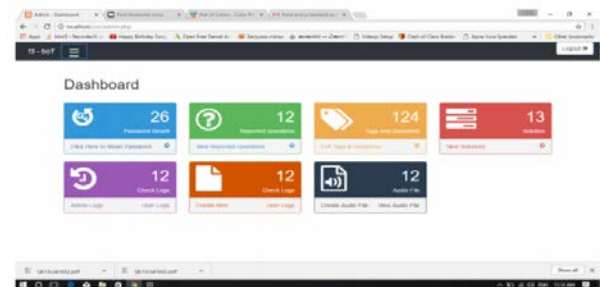

Fig 4 Dashboard HomePage
Fig 4: The Dashboard of the Admin.

This Dashboard have the advanced features such as

- Training the Model by adding the New questions or answering the questions which users have reported.

For SME perspective: The Ability to modify the replies for the user questions is a greatest asset which most of the Generic Chatbots available in market doesn't provide.

- Tracing the footprints of the user and analytics.

For SME Perspective: The information regarding the most frequently visited or queried questions or landing page will help SME's to fine tune their services and also a end user perspective which is vital for the marketing campaigns and product reviews.

Fig 5: Chat Conversation for a Educational Institution screenshot

As the early adopters, the application solution was trained upon the sample data of Educational Institute "SJB Institute of Technology". The chatbot was questioned with frequently asked questions.

The Performance of the system was plausible. The system responded with appropriate classifications as expected and response was in the form of Text, Voice as well as HTML solution where interested users can pursue for more information as shown in figure 6.
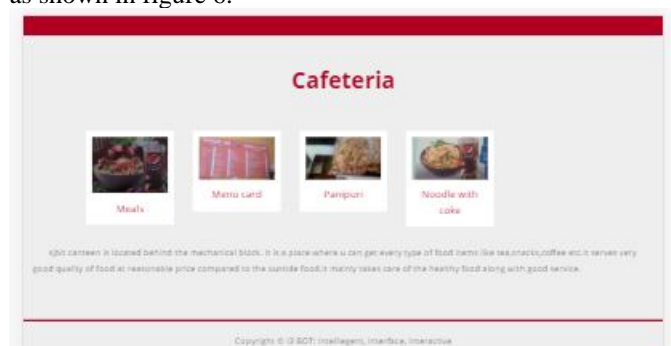

Fig 6: The Information site page of the institute when queried for question regarding topic "Cafeteria"

C. Problems

- The training data was limited in scope.
- The voice was robotic.
- Dependency on dual Servers: Xampp and Flask. The XAMPP was used as application server. The Flask server handled the Algorithm implementation and database operations.

D. Overcome Solutions

- The System emphasizes the partial trust on the users and fetches the user's feedback. This will search for the existing questionnaire in training database and will inform the Administrator to Add them. This process of system self-evaluating its knowledge and providing a suggestion for Administrator to improvise it is a key feature of this solution.

- Since the system generated voice are robotic in nature, the alternative is Google's "text to speech"[16] could be employed which uses WaveNet Voices[17] to produce human like voice output.

- The usage of Multi-tier architecture is more secure, scalable and efficient than single tier architecture.

VII. CONCLUSION

The actual power of science lies in the ability to reach the horizon of users to make their life easy and simple. This software is built to attain that specific purpose especially for the SME and Institutions which lacks the technical and financial resources. This application can be hosted on server [18]: Henceforth this reduces cost of application as this is used as [Software As A Service] SAAS, Uptime of system is 99%, Robustness, Security are all inbuilt traits of modern day server. The technology coupled with the Software Engineering principles and Best Architectural principles can bring down the development cost of these system by huge margin.

This application proved that, SME due to various constraints are reluctant to these modernization, but upon onboarding these features will gain tremendous edge in [19] **soft power** and **information in terms of marketing leads**, **user insight of company**, **response time**, **chat contact channel** which is **self-service** by reducing the **service costs**, **unknown waits**   and less human resource (Jobs such as receptionist, tele caller)

Future enhancements are deploying this as a Mobile phone application model since it expands the target reach for large user base for SME. The reinforcement learning, or deep learning algorithms can be used to increase accurate classification of system. The Application after perfection can be increased to perform plethora of opportunities ranging from simple to complex tasks such as Shop opening hours, Provide the on-demand Office reports to Plan the holiday by suggesting the deluge of entertainment options by previous chats, pre-enquiring the hotels upon various refiners and booking a hotel room in just one chat request. This proves that there are tremendous applications and the era is just starting.

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