



Independent University, Bangladesh

AI Powered Chatbot for Customer Service Enhancement

An undergraduate internship report submitted by

Reyad Hossain Rony

ID: 1721027

In consideration of the partial fulfillment of the requirements for the degree of

Bachelor of Science in Computer Science

Supervised by: Md. Fahad Monir

Department of Computer Science & Engineering

School of Engineering, Technology & Sciences

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## Letter of Transmittal

Date:

Md. Fahad Monir

School of Computer Science and Engineering

Independent University Bangladesh.

Subject: Submission of Internship Report.

Dear Sir,

It is a great pleasure to submit my report on Internship at Shikhao. I have tried to narrate my project's inner workings, achievements, and experiences in this report. All the work presented here was done with utmost sincerity and honesty.

During the three months internship at Shikhao, I have not only gained professional experience but understood the process of the department and its various aspects. This report includes a detailed review of the office as well as the functions of the department. This document serves as means of proof of my research during the internship on the requirements and functions of the department.

I hope and pray this report will be informational and fulfill all criteria assigned. I have tried my best to avoid any inefficacies. Finally, I would like to thank you again for allowing me to submit this report.

Sincerely,

Reyad Hossain Rony

Id - 1721027

## Letter of Endorsement

To Whom It May Concern

Subject: Approval of the report.

This letter is to certify that all the information mentioned in this document is true and confidential to the company. The project mentioned here has been successfully completed with the involvement of Reyad Hossain Rony, bachelor's in computer science and engineering, Independent University, Bangladesh (IUB).

I wish him all the best and hope he will lead a successful career.

Internship Supervisor

Signature \_\_\_\_\_

Ankur Datta

CEO

Shikhao

## Evaluation Committee

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Signature

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Name

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Supervisor

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Signature

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Name

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Internal Examiner

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Signature

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Name

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External Examiner

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Signature

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Name

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Convener

## Approval

This report entitled

Back-end Developer

By

Reyad Hossain Rony

Has been approved by

The Department of Computer Science and Engineering

Independent University, Bangladesh (IUB)

Supervisor: Md. Fahad Monir

The final copy of this report has been examined by the signatory and I find that both the contents and the form meet acceptable presentation standards of scholarly work in the above-mentioned discipline.

Signature \_\_\_\_\_

Date \_\_\_\_\_

### Originality Statement

This is to certify that the report titled, “AI Powered Chatbot For Customer Service Enhancement” was completed by Reyad Hossian Rony (1721027), submitted in partial fulfillment of the requirement for the Degree of Computer Science from Independent University, Bangladesh (IUB). It has been completed under the guidance of Md. Fahad Monir (Internal Supervisor) and Ankur Datta (External Supervisor). I also certify that all my work is original and has not been submitted earlier to this university or any other institution. All the sources used in this Project Report have been duly acknowledged in it.

Signature

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( Reyad Hossian Rony )

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I am grateful to Independent University, Bangladesh (IUB) for offering me this course and I express my thanks to my faculty and internship supervisor, Mr. MD Fahad Monir.

I want to stretch out my earnest gratitude to him. I am profoundly obligated to Independent University, Bangladesh (IUB) for their direction and consistent supervision just as for giving important data with respect to the course.

I am very much grateful towards my external supervisor, Ankur Datta for his guidance and support that I needed for the fulfillment of my internship and project. I might want to offer my extraordinary thanks and gratitude to the Shikha developers and employees for giving me such consideration and time and directing through the internship.

I also want to thank my parents for who have not only supported me financially but have always believed in me and always motivated me to accomplish the things that I achieved.

## Abstract

After the immense success of the world wide web and mobile applications, virtual chatbot applications are the new and promising invention to be introduced in the digital world. These applications are well known for automatic conversational agents that run on computer programming or artificial intelligence (AI) interaction between the users and machines with the intervention of natural language processing (NLP).

When I started my internship in Shikha, I was assigned to the customer service chatbot project. My task was to research various technologies that are used in the industry to develop ai powered chat applications. After presenting my finding the agreed upon using rasa as the chat engine core. I then worked with the customer service team to gather frequently asked questions and other data regarding the customer services. I processed the data and formatted it to the requirement of rasa. After that I trained the chat models and tested the model with our test data. I then connected to a noSQL database called mongo DB, to store the conversations to improve future version of the chat bot. I was also required to provide biweekly updates to the team and show case my work each month.

Rasa Conversational AI assistant is different from earlier traditional FAQ interactions as it is based on natural conversations as it mimics how humans interact with each other. This is done by programming presets of human-human interactions based on their context so that the AI can interact with the user like a normal being would when assisting the user. When the user changes the context of the conversation, the AI will then attempt to contact a live agent for a response. But in keeping with its presets, the AI will try to solve the problems and questions presented by the user in a more efficient and time-saving manner. Hence, keeping in mind the benefits of AI in general, it can be inferred that chatbots could be implemented in many aspects of life such as education, social media platforms, games and even in businesses where time and efficacy are both core determining factors of profitability.

## Chapter 1

### Introduction

A chatbot is a service that provides a communication interface with users based on rules that are programmed into the AI. A chatbot produces answers based on understanding the intentions of texts from users using natural language processing (NLP). In the world of fast-paced technology-driven businesses, appreciation for the customer's time is paramount and a good user experience is fundamental for long-term customer retention and maintaining a healthy service. Businesses globally aim and spend a major portion of their resources to achieve satisfaction among their users and this method of communication has been proven to yield maximum amounts of satisfaction with minimum use of resources.

Artificial Intelligence has come a long way from being able to play games with thousands of lines of code based on hard logic to a process of learning that can be somewhat equated to the learning process of human beings. With the advent of supervised learning that uses large datasets to train and test a machine learning model until the desired functionality is achieved, the process of generating an intelligent agent has been streamlined. This newfound knowledge has allowed the use of AI in previously unanticipated fields.

With the use of an open-source machine learning framework and web framework as an encapsulation, the service is ready for deployment. The service is an artificial intelligence-powered customer service chatbot, which would be able to give 24x7 service to customers. Chatbots are, therefore, capable of answering and solving simple queries without expending human resources towards this service. If chatbots cannot answer a query or solve an issue, it will prompt the system to involve a live agent to assist the user.

Ultimately, it will provide the customer with a sense of promptness and assurance that they deserve while bringing a structure to the customer service of the company. This report will explain in detail the development process and functions of the chatbot.

## 1.1 Project Background

The business model of Shikhao depends on the establishment of proper communications between their clients who are generally students and teachers as the service providers. Being a resource for finding tutors for students in different levels of their education life, the business receives a significant number of personalized queries that can only be answered by a real life agent. However, the regular queries can be distinctly categorized.

After analysis, it was determined that most of the questions asked by the students were repetitive and here, a bot would be effective. Add to that the constraints of regular working hours for the customer service representatives and hence the delay in giving the customer a prompt reply.

Now, most of the messaging applications have an automated replying mechanism that can be set using their integrated system but those can be very generic and may not be useful to a customer.

The idea for this application was thought out by the CEO and the technical team of Shikhao, to be more engaging with customers while relieving pressure from the customer representatives currently working for the company.

The plan was very simple, create a contextual chat assistant that was trained to recognize the frequently asked questions about the services provided by the company and answer them accurately. Data from prior communications between the customers and representatives would be used to identify the frequently asked questions, train the machine learning models, and test the models. After the successful completion of the chatbot engine, the encapsulation needed to get the chatbot ready to be deployed would be prepared and then all the different parts of the application would be joined together using endpoints which would finally complete the project.

I was first assigned to do R&D on different chatbot frameworks and then finally choose one that fits our use case perfectly and then I was required to develop the chatbot with the supervision of my supervisor and the technical team at Shikhao. My roles will be discussed more in-depth in the upcoming chapters.

## 1.2 Objectives

### 1.2.1 Primary Objective

The primary objective of this report is to explain the process by which an Artificial Intelligence-based contextual chatbot is created and implemented.

### 1.2.2 Specific Objectives

- Analyze and understand data retrieved from customer-machine interaction sessions.
- Design and implement a Chatbot Engine.
- Implement API Endpoints
- Connect with Front-end users.

## 1.3 Scope

- Improve upon the current customer service framework by providing a user-friendly interface.
- Reduce redundant work for the customer service representatives thereby saving time and allowing relocation of these representatives to other areas of need in the company.
- Reduce the response time for the customers and thereby providing faster service, increasing customer satisfaction.
- Collect data from customer interaction to be programmed into the presets for future reference to refine the system.
- Analyze the efficiency of the current presets as it relates to customer satisfaction and initiates any changes as needed including but not limited to bug fixes.

## Company Profile

### 1.4 Company Background

Shikhao is an on-demand tutoring platform for university students by university students. Shikhao aspires to fill the gap that exists in the tuition market through the on-demand service. It facilitates the process of connecting university students with tutors on a case-to-case basis <sup>[1]</sup>. This provides the tutors with a passive source of income and the students with a means of learning from peers of seniors who can relate to their academic needs and thereby cater specifically to their areas of need.

### 1.5 Vision, Mission and Values

1. Improving learning experience: Shikhao generates prospects to improve student to student tutoring. It allows the students an opportunity to learn in a more optimal method by just hiring a tutor for what is needed. On the other hand, it creates a source of passive income for the tutors themselves, who are also students. Having Shikhao as a medium eases the process and creates room for higher quality tutoring <sup>[1]</sup>.
2. Continuous growth: Shikhao allows its students to obtain quality education by easing the process of finding a teacher. Shikhao's Teacher database contains a good number of qualified tutors for all necessary Subjects and departments. Furthermore, it creates an income source for students by setting the stage for them to become tutors.
3. Beneficiaries: Firstly, the students who hire tutors for sessions as they can easily get the required teachers. Secondly, the students who teach, as they now have more passive income. Thirdly, Shikhao Itself, because it is built using a scalable model to generate revenue and increase job opportunity <sup>[1]</sup>.

### 1.6 Services

- On-Demand Tutorials: We provide on-demand sessions on a case-to-case basis. Eliminating the need to hire teachers on a long-term commitment such as, monthly. Students will be able to get tutorials for time durations as low as one hour <sup>[1]</sup>.
- Catered Lessons: Our clients can take classes on industry-relevant skills from experienced individuals from the particular field in question. These classes are designed to

provide a pathway for prospective students to explore topics that they are sure to encounter when they enter the job market.

### 1.7 Contacts and Address

Shikhao

House:129, Lane:1,

Baridhara DOHS, Dhaka-1213

[info@shikhaabd.com](mailto:info@shikhaabd.com)

[www.shikhaabd.com](http://www.shikhaabd.com)



## Chapter 2

### 2.1 Literature review

A chatbot is a program that is used to participate in conversations with humans. It uses an appropriate interface for input and output and with the use of AI techniques it can provide realistic answers so the user will think that the communication taking place is with another human. The implementation of such systems varies from using keyword matching, string similarity or complex natural language processing techniques. More sophisticated chatbots could learn from the user input. Nowadays chat bots are used widely in web applications to provide help or information when it is asked by the users.

In terms of AI world, a normal chatbot is not enough to serve all the purpose. So, as it is recommended to a chatbot with AI backup is much more realistic to serve the real purpose.

### 2.2 Relationships with Undergraduate Study

Chatbots are software that behave like humans and used in responding to queries submitted to the website of an organization within a short time without the utilization of human resources. Nowadays, development in this field has scaled up for various reasons<sup>[2]</sup>. Chatbots not only answer simple questions but can perform complex tasks like fetching the results from API, booking appointments and various management tasks. For the development of a chatbot, it requires a team of experts and to overcome the scarcity of time and resources, open source data is often used<sup>2</sup>. Courses such as Web Application Development, Data Mining and Warehousing as well as Artificial Intelligence were offered by IUB in the curriculum of Computer Science. These courses have contributed to the foundation of this project.

### 2.3 Web Application

A web application is application software that runs on a web server, unlike computer-based software programs that are run locally on the operating system of the device<sup>[3]</sup>. Web applications



are accessed by the user through a web browser with an active network connection<sup>3</sup>. Here we have done frontend design and set API.

## 2.4 Machine learning

Machine learning (ML) is the study of computer algorithms that improve automatically through experience. It is seen as a subset of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", to make predictions or decisions without being explicitly programmed to do so<sup>[4]</sup>. Machine learning algorithms are used in a wide variety of applications, such as email filtering and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

## 2.5 Data Mining

Data mining is the process of finding patterns and extracting useful data from large data sets. It is used to convert raw data into useful data. Data mining can be extremely useful for improving the marketing strategies of a company as with the help of structured data we can study the data from different databases and then get more innovative ideas to increase the productivity of an organization. Text mining is just a part of data mining<sup>[7]</sup>.

## 2.6 Data collection

Data collection is the process of gathering and measuring information on targeted variables in an established system, which then enables one to answer relevant questions and evaluate outcomes. Data collection is a research component in all study fields, including physical and social sciences, humanities, and business. While methods vary by discipline, the emphasis on ensuring accurate and honest collection remains the same. The goal for all data collection is to capture quality evidence that allows analysis to lead to the formulation of convincing and credible answers to the questions that have been posed<sup>[6]</sup>.

## Data preprocessing

Data preprocessing is a data mining technique which is used to transform the raw data in a useful and efficient format<sup>[6]</sup>.

### Steps Involved in Data Preprocessing:

#### 1. Data Cleaning:

The data can have many irrelevant and missing parts. To handle this part, data cleaning is done. It involves handling missing data, noisy data etc.

#### 2. Data Transformation:

This step is taken to transform the data in appropriate forms suitable for the mining process <sup>[6]</sup>.

#### 3. Data Reduction:

Since data mining is a technique that is used to handle huge amounts of data. While working with huge volumes of data, analysis became harder in such cases. To get rid of this, we use data reduction techniques. It aims to increase the storage efficiency and reduce data storage and analysis costs <sup>[6]</sup>.

### Database

It is an organized collection of data, generally stored and accessed electronically from a computer system. Where databases are more complex, they are often developed using formal design and modeling techniques. We use NoSQL database for this project which is called mongoDB.

## 2.7 Rasa

### "Open-Source Conversational AI, Rasa

Rasa is an open-source machine learning framework, which can be a suitable tool for the aim of this project. It provides infrastructure and tools to build contextual assistants that can automate text-and voice-based conversations. The application can be deployed on various platforms such as Facebook Messenger, Slack, Telegram and so on.

Rasa provides an open-source version which is sufficient. It contains two components: NLU (Natural Language Understanding), which determines what the user wants and captures key

contextual information; and Core, which selects the next best response and/or action based on conversation history <sup>[13]</sup>.

## 2.8 NLP

Natural language processing (NLP) is a subfield of linguistics, computer science, and artificial intelligence concerned with the interactions between computers and human language, and how to program computers to process and analyze large amounts of natural language data <sup>[5]</sup>. The result is a computer capable of "understanding" the contents of documents, including the contextual nuances of the language within them. The technology can then accurately extract information and insights contained in the documents as well as categorize and organize the documents themselves <sup>[5]</sup>.

### 2.11 Technology used:

There were several technologies that go into programming a chatbot for its function. In this instance, Python 3.6 is the most compatible version of python language that has been used to programming purpose. Next one used is Rasa 2.0 which is an open source for NLP and functions to turn messages received from customers into entities and intents that are recognizable by chatbots. PyCharm is an IDE or Integrated Development Environment for Python that enables the chatbot's code to be written, edited, debugged, and executed all at once, thereby increasing program productivity. Mongo DB was used to give the chatbot a quicker way to evolve it's codes and scale up slowly. Mongo db atlas allows the deployment to the cloud as well as management of the codes written for complex functions. React js was used to enable the chatbot to change any data without reloading the page the customer is using. Finally, REST api was used to be able to take advantage of the preset codes repeatedly while also adding onto the codes for further improvement also allowing the chatbot to be compatible with most common operating systems such as iOS and Android.

## 2.12 Related work

Chatbots are used in many organizations instead of humans when this is possible. Most of the time systems like that are based on the ways ELIZA or ALICE communicates.

### 2.12.1 Examples

#### a. ELIZA

The first chatbot developed was ELIZA. It was developed by Joseph Weizenbaum using a keyword matching technique. The idea was to read the user input and search for certain keywords, if a keyword was found then the answer was retrieved. If a keyword was not present then ELIZA would try, according to specified rules, to get more information from the user to keep the conversation going. Consider the following example to understand how this would work.

User: How can I get in touch with my mother?

Then the chatbot would identify the keyword mother and would find a connection between mother and family and it would respond with a question.

ELIZA: Tell me more about your family?

The chatbot does not understand what it is saying. It only produces results according to rules and in this case, there was a rule connecting mother and family. Then it had to produce an answer that would encourage the user to submit another question with the hope of finding a keyword. However, most of the time there are some standard replies that ELIZA would use if a keyword were not found <sup>[14]</sup>.

#### b. A.L.I.C.E

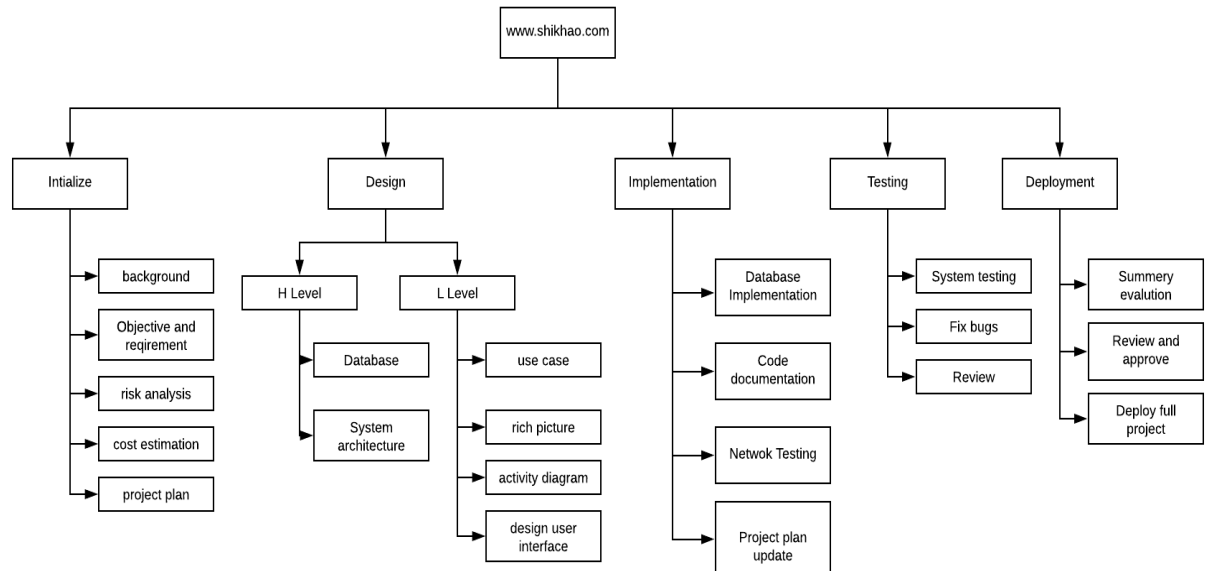
ALICE was implemented by Richard Wallace in 1995<sup>[15]</sup>. It uses pattern matching and stores the information in Artificial Intelligence Mark-up Language, or else known as AIML, files. An AIML file is similar to an XML file that was developed to store pattern knowledge for chatbot.

## Chapter 3

### Project Management & Financing

#### 3.1 Work Breakdown Structure

A project work breakdown structure (WBS) is a deliverable or product-oriented grouping of project work elements shown in graphical display to organize and subdivide the total work scope of a project.

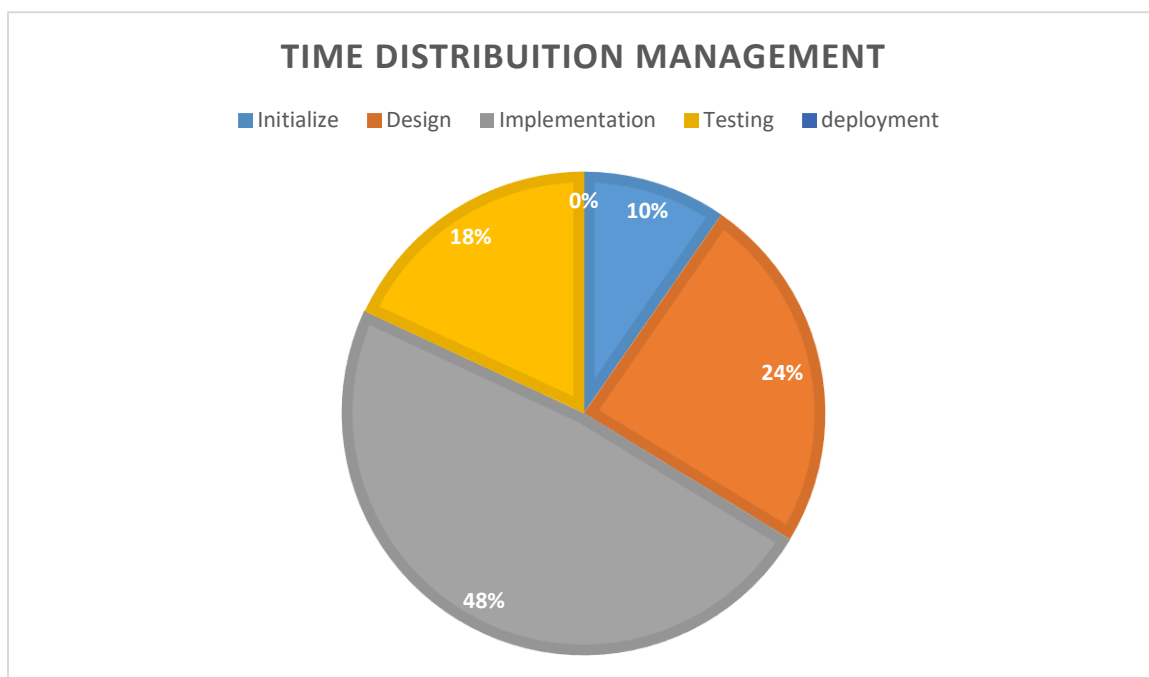


#### 3.2 Process/Activity wise Time Distribution

For each section that I have mentioned in my Work Breakdown Structure, time was allocated so that the project completes on time. This table below shows the time allocation of the work.

Task	Days	Work percentage
Initialize	15	8%
Design	10	20%
Implementation	18	40%
Testing	15	15%
Deployment		
Total	58	83%

### 3.3 Gantt Chart



### 3.4 Process/Activity wise Resource Allocation

Process	Resource allocation	
	Resource	Details
<b>Hosting</b>	Server	2 CPU 4GB ram
<b>Bot Engine</b>	Rasa	Open source
<b>Storage</b>	MongoDB	Single cluster

### 3.5 Estimated Costing

As this is an in-house project, thorough cost analysis was not done due to the prototype nature of the development. 2000 taka per year for shared hosting.



## Chapter 4

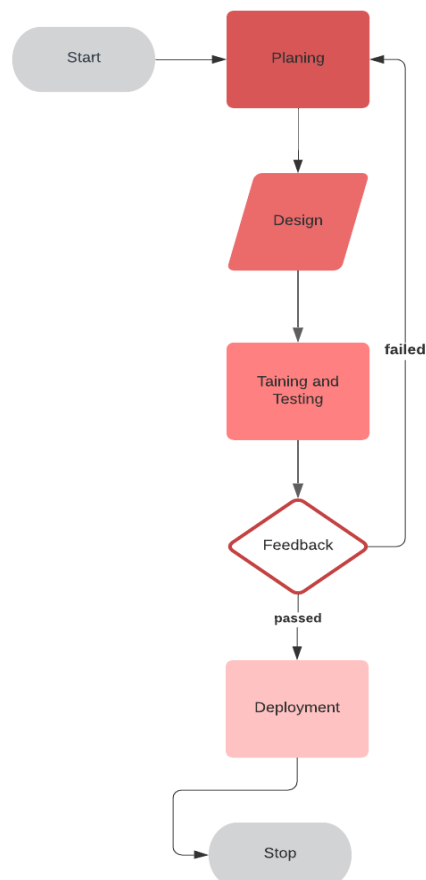
### 4.1 Methodology (Agile)

I have chosen Agile development Methodology for this project. It is an iterative approach to software delivery that focuses on collaboration and continuous releases. Rather than working towards one big go-live at the end of the development process, the team works to deliver incremental value <sup>[9]</sup>. Team members continually evaluate requirements, plans and outcomes, enabling them to respond quickly to change.

Agile enables us as programmers to more and accurately and succinctly document processes. Agile methods focus on tight feedback cycles and continuous improvement.

#### Flow chart of Methodology

Reyad Hossain | May 29, 2021



## Chapter 5

### 5.1 Work Description

The sole purpose of creating a chatbot is to ensure timely and efficiently provided customer service. For this, the AI must be trained thoroughly and often to be able to answer simple queries and perform some complex tasks. Although it is almost impossible to predict the queries or requests that may come from a customer but by feeding the chatbot's programming with repetitively submitted data, it is possible to train the AI to recognize the queries and how they should be answered <sup>[2]</sup>. Continuous cycling of collected query data was done to enable full functioning of the chatbot. However, there are several things that need to get done for the preparation of the bot.

### 5.2 Familiarization with tools:

1. Research: This was done to determine viable technologies to be used for the project as well as defend the use of such developmental tools.
2. Design: Have extensive meetings regarding the design of the project and finalize the plans to start the development. Coordinate with the technical team and the supervisors of the company to make sure the requirements of the company were met by the developed AI.
3. Collection of Data: Acquire data from the customer service department to pre-program the AI with queries that are frequently received to allow the system to "learn" to respond to them. Allows contextual learning and preset programming.

The data retrieved will have many inconsistencies and redundancies that need to be dealt with. The retrieval of frequently asked questions is also done. Numerous techniques are used to accomplish this task which will be further in later chapters. Next, intent for the chatbot is selected and they are reviewed by the technical team. The purpose and inner working of the chatbot will be determined by the intent. Once the intent is set for the chatbot, training is given to the RASA model using the selected intents and the AI is taught to learn new queries. Finally, extensive testing of the model is done for false replies and other inconsistencies. This is done by using "default\_fallback\_action"

and the “Fallback\_classifier”. Testing will be repeated regularly to ensure the system operates efficiently <sup>[10][17]</sup>.

### 5.3 Integrating with API and database

When a query or data is received by RASA from the end user, RASA will predict the values of entities and intents from the message, all this handling will be done by RASA NLU unit. Intent is classified from the message and RASA stack will act on the response that is encoded in the domain.yml<sup>[10]</sup>. Based on this response, requests will be made to the defined API in action.py to get the updates requested by the user. After this RASA core tries to predict what to do next, this decision will be based on various learning paradigms and dialog flow in the stories.yml <sup>[10]</sup>. Once the AI is integrated with API and the query database, the final steps of the process can be moved forward with.

1. Chatbot Frontend Creation: Frontend for the chatbot is created in a JavaScript framework for the frontend and then connected to API. API then becomes the interface that the end user interacts with.
2. Deployment: The bot along with API will be deployed in the linux based server.

## 5.4 System Analysis

There are two system one is existing system, and another is proposed system. In the existing system people send query is over the phone and generate response by a human. In the proposed system three process is done sending query, generating response, and receiving response most of the job is done automatically except sending query. In the six-element analysis I have discussed how the system is run or system rolls in different process.

### 5.4.1 Six Element Analysis

#### Existing system

process	System roll					
	Human	Non-Computing hardware	Computing Hardware	Software	database	Communication and Network
<b>Sending query</b>	Humans send query	Mobile phone,	Personal computer	N/A	N/A	Communication over the phone, Internet, Facebook messenger
<b>Generating response</b>	Human replay	N/A	N/A	N/A	N/A	Communication over the phone, Internet, Facebook messenger
<b>Receiving response</b>	Human replay	Telephone,	N/A	N/A	N/A	phone calls from the official sim

						number, or other messaging app
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### Proposed System

process	System roll					
	Human	Non-Computing hardware	Computing Hardware	Software	database	Communication and Network
<b>Sending query</b>	Humans send query		Personal computer, smart phone	chatbot	Mongo DB	Internet, chatbot, email.
<b>Generating response</b>	N/A	N/A	server	chatbot	Mongo DB	Internet, On application conversation, email
<b>Receiving response</b>	N/A	N/A		chatbot	Mongo DB	Internet, chatbot, email.

### 5.4.2 Feasibility Analysis

To optimize the effectiveness of the project, it was necessary for the right questions to be asked and answered. The focus was on how much the chatbot was truly needed. In order to assess the need for the chatbots, the daily functions of the service could be tested through observation of the volume of requests each agent has to process, interviewing the staff to obtain their opinion on what kind of technology would be helpful for their daily work and by making the staff categorize the

types of request they encounter on a daily basis. The client's needs and specific requests also need to be considered as a reputable relationship must be built with the actual customers who will be the primary users of the chatbot <sup>[11]</sup>. To do this, it was proposed that the student's complete questionnaires that would give an insight as to what they are looking for in the chatbot to provide effective customer service. The remainder of the section will detail the process by which the feasibility analysis is run, and the future of the project is decided.

#### 5.4.3 Problem Solution Analysis

*Problem: How much human-agent involvement will be needed in this project and how will it affect the chatbot's functional abilities?*

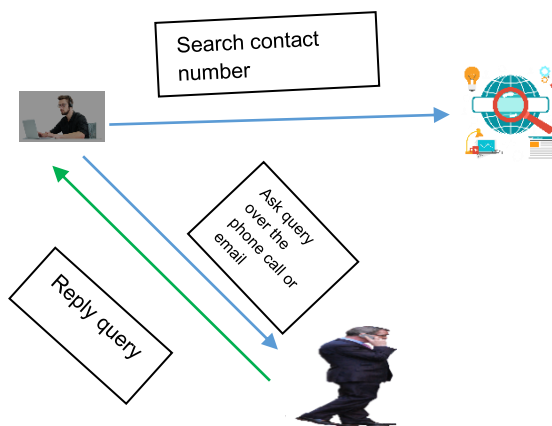
*Solution:* The problem of human-agent involvement already possesses more issues with customer service, and it proposed that the system be completely stand-alone where human-agent interaction is only required when the customer requests are out of its preset data and the system cannot come up with a response, it will contact the agent only then. Once the answer has been input by the agent, the system will program into itself the query as well as the response for agent interaction to be minimized in the future. The self-learning programming of the chatbot will effectively and eventually completely eradicate the need for agent interaction which then means faster customer service which are mostly if not completely human error free.

#### 5.4.4 Effect and Constraints Analysis

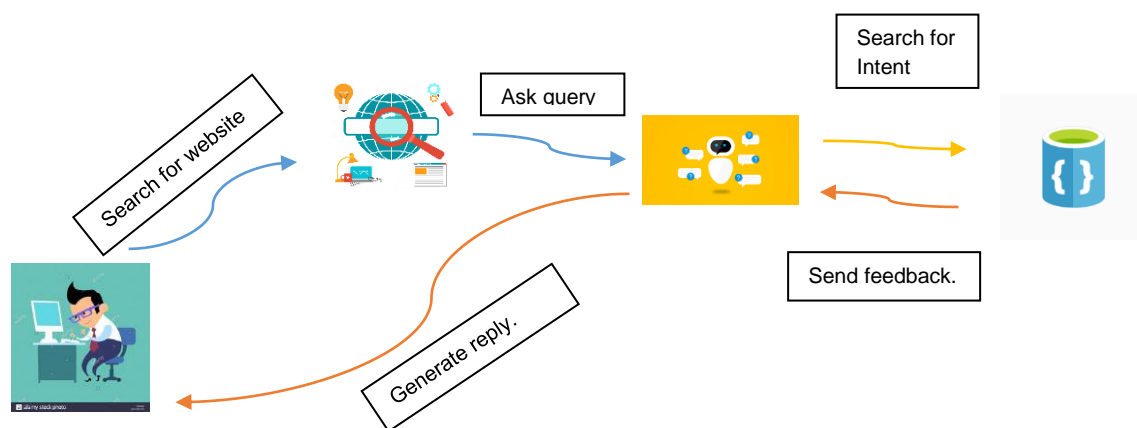
While the idea of a self-learning system sounds like a dream come true, there are several constraints that will be hindering the process and ultimately the implemented system. Self-learning system can only be effective if there is enough data continuously fed to it that would allow it to learn new information to add to its preset programming <sup>[10]</sup>. Most of the queries presented to the chatbot can be clearly categorized and thereby the system then runs on those presets unless a new query is presented to it. With the data collected to create the code of the chatbot, it becomes clear that the chatbot is highly unlikely to receive customized queries that can be incorporated in the

preset programming often. This limits the scope of the program to self-learn. The limitation will then cause the programming of the chatbot to remain limited unless new scenarios can be encoded in by the programmers to help the system “learn” without input from the actual end-users. The effects can include storage or programming of presets that are rarely used. This could cause the system to lag as storage space is taken up by such presets. Increasing storage capacity will entail another full course analysis of the system, finding areas where expansion is required and then acquiring the funding for it. The whole process will add to the cost and man-power expenditure [15].

### 5.5 Existing Rich picture

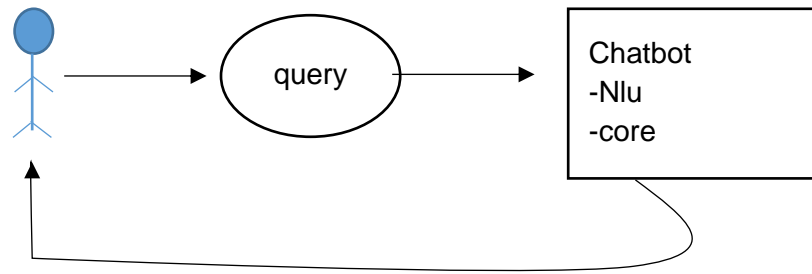


## 5.6 Proposed Rich Picture





### 5.3.2 UML Diagrams



### 5.3.3 Functional and Non-Functional Requirements

#### Functional Requirements

1. Chatting:
  - a. The system should allow users to chat.
  - b. The system shall inform the user if an answer is not available.
  - c. The system shall inform the user about spelling mistakes.
  - d. The system shall inform the user about the validity of the sentence.
2. Searching:
  - a. The system should allow users to search for information about admissions.
  - b. The system should allow users to search for information about tuition fees.
  - c. The system should allow users to search for information about accommodation.
3. Logs:
  - a. The system should maintain a log of the current question and answer if the user is not satisfied that logged will be saved in the database.
4. Administrative system
  - a. Information management: The administrator should be able to to add, update and delete questions, answers, and keywords.
  - b. Log management: The administrator should be able to view and delete logs.
  - c. Feedback management: The administrator should be able to view and delete feedbacks.

#### 3.3 Non-Functional Requirements

1. User Interface:
  - a. The system shall maintain an easy-to-use interface across all functionalities and for all users.
  - b. The clients' user interface should be compatible with all commonly used browsers, such as Internet explorer, Firefox, Google chrome and Safari.

2. Scalability: a. The system shall be able to scale based on the number of users using the resources provided by the server.

## 5.7. Product Features

### 5.7.1 Input

Human queries will be considered as input.

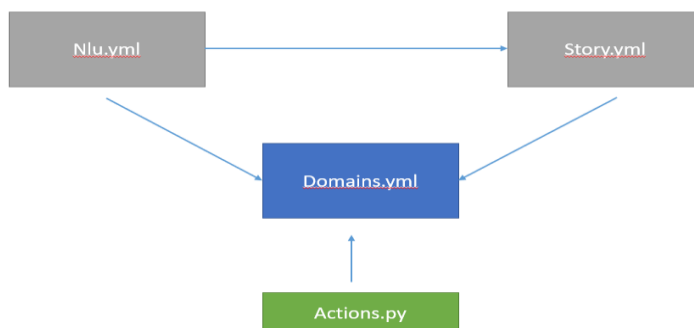
```
Your input -> hi
Hello sir/madam. Thank you for reaching out to Shikhao. How can we help?
Your input -> i need help with a couese
Give details regarding your query and someone from Shikhao will contact.
```

### 5.7.2 Output

Best matched reply of the query asked by human is the output.

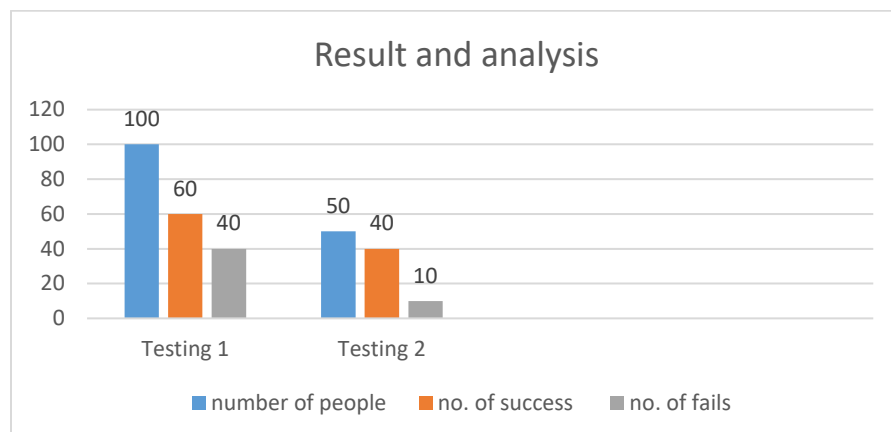
```
Your input -> hi
Hello sir/madam. Thank you for reaching out to Shikhao. How can we help?
Your input -> i need help with a couese
Give details regarding your query and someone from Shikhao will contact.
Your input -> math 301
We have received your information, someone from shikhao will contact you
```

### 5.7.3 Architecture



## Chapter 6

### 6.1 Result and analysis



Multiple forms of testing would be conducted on the system using end-users as testers. The chatbot was encoded with the data collected from the surveys and interviews conducted with the customer service agents and the frequent end-users. Students selected the category of questions they wanted to ask, added additional details, and waited for the chatbot to retrieve the response to the query. In about 60 out of the 100 end-users were able to have their queries responded to as they were encoded into the chatbots during their initial programming but the 40 people who could not get their queries answered had customized queries that were not part of the bot's original programming so it could not pull up a response for the end-user right away. This then caused the agents to get involved and contact these end-users for their queries. So, there was really no way for the chatbot to tell if the session with these 40 end-users were effective and it cannot learn the query and it's appropriate response until a programmer intervenes. Most chats ended with the end-user responding to a survey at the end of the session asking, "Did this chat help you?".

Those end-users that had the customized queries did not get to that part of the session and therefore left the "learning" process of the bot incomplete. It was found that the bot uses this feedback to analyze the effectiveness of the preset used and then gives feedback to the programmer if there is any alteration needed <sup>[16][17]</sup>. The 6 people who did have their request processed right away, reported higher rates of customer satisfaction.

With this data, it can be inferred that the chatbot does contribute to higher customer satisfaction and thereby higher customer retention at Shikhao, which can then generate a higher revenue for

the company without expending higher amounts of manpower. This fulfills the two two-fold goal of faster and effective customer service with the least amount of human resource and spending.

## Chapter 7

### 7.1 Sustainability of the Project

The chatbot for Shikhao is a customizable application which can be easily modified and updated with new programming to keep up with the increasing volumes of data being input daily. The program being able to change with the changing input makes the chatbot a viable application that can detect the changes that are made due to the code molding itself to accommodate the new information, thereby keeping the self-learning program running <sup>[17]</sup>. With a program that tries to do most of the updating on its own, the company can then focus on providing the teaching services which is its primary function.

### 7.2 Social and Environmental Effects and Analysis

When testing the last prototype, we acquired findings suggesting that the participants did not have a problem with getting information from a chatbot instead of a human. The information that they got was not seen as less trustworthy as the chatbot cited information source when it responded to the users. Users were given a satisfaction survey at the end and on an average, 7 out of 10 people responded to have been fully satisfied with the results. Upon interviewing a group of end-users, there was a mixed response about their opinions about using an automated system to answer their queries. Since simple queries were answered rather promptly, users felt this to be an effective way of communicating with Shikhao instead of having to wait in line, in-person, to meet with an agent or having to call multiple times just to have a simple question answered. While this was true, a portion of the interviewed group also expressed concern that the bot was too much of a rigid framework and that the scopes of asking follow up questions seemed rather limited in their opinion<sup>10</sup>. Even with the mixed reviews, the outcome of the research showed that the chatbot being a platform which is easily accessible and widely available to all those who seek services from this company, will allow more students to have access to a resource that will ultimately be of great assistance in their academic journey <sup>[16]</sup>.

### 7.3 Addressing Ethics and Ethical Issues

The collection of huge amounts of data using the chatbot, leaves an avenue for misuse of personal data of the users. While it is necessary for the chatbot to collect all relevant information from the users, many users do express the concern of what is being done with this data once they are done using the services of the chatbot. To solve this issue, we programmed the chatbot to delete all personal information entered by the user once the user had closed the chat window. Only the query and the response to the query was saved. In addition to that, the chatbot is on a secured server that can only be accessed with Shikhao employees with their access codes and is protected by an encrypted firewall. This two-fold protection helps with maintaining any collected data that is not immediately deleted and is secured during storage <sup>[17]</sup>.

## Chapter 8

### Lesson Learned

During this pandemic, I got an opportunity to do an internship as a web developer in Shikhao, and it was the first-ever real-world project I have ever worked on. This internship gives me valuable working knowledge, information, and work experience with the industry that makes me an asset to potential employers. During my internship it teach me two things like:

a. Set deadlines.

Having a fixed deadline automatically makes us more focused than we would normally be. It helps us to make the final product much more effective and polished which also bring client satisfaction.

b. Do your research.

Doing research on frameworks/technologies and choosing the right tech stack is by far the most important part of the app/software development process, if you do this wrong you will spend a lot of time finding workarounds to solve the simplest tasks that you would easily solve using any other framework.

#### 8.1 Problems Faced During this period.

Problems face in software development:

1. There were some software dependency issues for which framework does match with other software.
2. There was difficulty in implementing fallback\_classification methods that would send out default message whenever the query was out of its scope.
3. There were issues connecting the local MongoDB database to rasa core.
4. Implementing the built-in chat widget (GUI) was a hassle as there were some versioning conflicts in the project.

Problems in online internship:

i. Mental health

One of the biggest problems faced by remote working is mental health. As pandemic makes us feel that life is too short.

ii. Communication

As we are not used to with remote working, we had had issues with communication.

iii. Managing team members

As people were in bad physical and mental condition. There was a certain time it was difficult for our team members to balance Work-life balance.

iv. Loneliness

Going from a busy office to a home office is a significant change and one that shouldn't be taken lightly. Whether it's watercooler chats or going for lunch with a friend or colleague, these times aren't going to be happening at home and can start to cause a sense of loneliness.

## 8.2 Solution of those Problems

Solution of software problem:

1. The dependencies for each of the packages used were rechecked and recompiled. We also used a python virtual environment to safeguard our packages.
2. We used `default_fallback_action` and configured the `config.yml` file, to set the parameters for fallback classifier
3. We used a cloud-based system to host our mongoDB database.
4. Due to version incompatibility of rasa web chat widget was not loading in web page. By changing the version of rasa and trained the model with the updated rasa.

Solution of online office:

- Include social breaks in your schedule which help to reduce mental health condition
- Use Screen Sharing Software
- Use Collaborative Platforms
- Establish a Clear Work Schedule
- Make Roles and Responsibilities Clear
- Live Caption Zoom Meetings



## Chapter 9

### 9.1 Conclusion

The evolving world of data science gains a new tool in form of the AI that the project has been dedicated to creating. Chatbots are a tool of the present that has numerous applications in the future data science market. Through my internship at Shikhao, I have been fortunate enough to be able to work with their technology department to create and implement this chatbot that not only helps the existing customers of Shikhao but also has the potential to serve students across the globe. With the support from my project supervisor and colleagues alike, I have been exposed to the world of AI creation and implementation in the real world. What I have learnt during my time of the internship will be lessons I carry with me as I set foot in my professional career ahead. My goal is to use the knowledge to better serve the nation and then extend my reaches to the world.

### 9.2 Future work

Here are some improvements that will be done in the future version of the project:

- Implementation of React.Js based graphical user interface.
- Fully costumed Ai chatbot that will integrate with any framework.
- Addition of new features such as voice messages and file upload feature
- Will through notification or email to the admin for exceptional or unhandled queries.
- Automated teacher assignment for prospective student.

## References

- [1] "Shikhao : Make University Easier with our On-Demand Teachers", *Shikhaabd.com*, 2021. [Online]. Available: <https://www.shikhaabd.com/>. [Accessed: 15- Mar- 2021].
  
- [2] Husak V, Lozynska O, Karpov I, Peleshchak I, Chyrun S, Vysotskyi A. "Information system for recommendation list formation of clothes style image selection according to user's needs based on NLP and chatbots." pp.788-818. [Accessed: 22- Mar- 2021].
  
- [3] "Web application - Wikipedia", En.wikipedia.org, 2021. [Online]. Available: [https://en.wikipedia.org/wiki/Web\\_application](https://en.wikipedia.org/wiki/Web_application). [Accessed: 22- Mar- 2021]
  
- [4]. "What is Machine learning and its Benefits", SearchSoftwareQuality, 2020. [Online]. Available: <https://searchsoftwarequality.techtarget.com/definition/Machine-learning> [Accessed: 24- Feb- 2021]
  
- [5]. "NLP" - Wikipedia. [https://en.wikipedia.org/wiki/Natural\\_language\\_processing](https://en.wikipedia.org/wiki/Natural_language_processing) [Accessed: 28- Feb- 2021]
  
- [6] "Data Preprocessing in Data Mining - GeeksforGeeks", GeeksforGeeks, 2020. [Online]. Available: <https://www.geeksforgeeks.org/data-preprocessing-in-data-mining/>. [Accessed: 27- Feb- 2021]
  
- [7] K. Chowdhary, "Data Mining", Fundamentals of Artificial Intelligence, pp. 507-555, 2020. Available: 10.1007/978-81-322-3972-7\_17 [Accessed 24 July 2020]
  
- [8] "What is Web Application (Web Apps) and its Benefits", SearchSoftwareQuality, 2020. [Online]. Available: <https://searchsoftwarequality.techtarget.com/definition/Web-application-Web-app>. [Accessed: 24- Jul- 2020]

- [9]. Azumo. Using Agile Software Development to Build Modern Software. Published 2019. <https://azumo.co/solutions/agile-software-development/> [Accessed: 24- Feb- 2021]
- [10]. Rakesh Kumar Sharma. An Analytical Study and Review of open source Chatbot framework, Rasa. *Int J Eng Res.* 2020;V9(06):1011-1014. doi:10.17577/ijertv9is060723
- [11]. Rajput M. How Education Apps Can Benefit from Chatbots. Datafloq. Published 2019. <https://datafloq.com/read/educational-apps-benefit-chatbots/6885> [Accessed: 24- Feb- 2021]
- [12]. Cui L. Fme-Project-Principles.Pdf. Published online 2017:97-102. [Accessed: 24- Feb- 2021]
- [13] Rakesh Kumar Sharma, "An Analytical Study and Review of open source Chatbot framework, Rasa", *International Journal of Engineering Research and*, vol. 9, no. 06, 2020. Available: 10.17577/ijertv9is060723 [Accessed 14 March 2021].
- [14] "Eliza, a chatbot therapist", *Web.njit.edu*, 2021. [Online]. Available: <https://web.njit.edu/~ronkowit/eliza.html>. [Accessed: 14- Apr- 2021].
- [15] "Artificial Linguistic Internet Computer Entity - Wikipedia", *En.wikipedia.org*, 2021. [Online]. Available:[https://en.wikipedia.org/wiki/Artificial\\_Linguistic\\_Internet\\_Computer\\_Entity](https://en.wikipedia.org/wiki/Artificial_Linguistic_Internet_Computer_Entity). [Accessed: 03- May- 2021].
- [16] Bocklisch, T., Faulkner, J., Pawlowski, N., & Nichol, A. "Rasa: Open Source Language Understanding and Dialogue Management" [Accessed: 03- May- 2021].
- [17] Rakesh Kumar Sharma, "An Analytical Study and Review of open source Chatbot framework, Rasa", *International Journal of Engineering Research and*, vol. 9, no. 06, 2020. Available: 10.17577/ijertv9is060723 [Accessed 14 May 2021].