Enhancing LMS Experience through AIML Base and Retrieval Base Chatbot using R Language

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***Abstract*--According to UNICEF, globally youth literacy rate has increased from 83% to 91%. Despite of continuous growth of youth literacy providing education and educational tools in many undeveloped countries remains a challenge. Online education a medium of E-Learning can be one of the most effective platforms to bridge this gap. As today approximately 51% percent of world's population is using Internet so using the platform of internet for the education can be very useful. System advocates about closed environment while interaction, as when a student start interaction, all details of student is already captured by chatbot (like, name, Programme, courses, which are registered with institution) Learning management system (LMS) is one of the categories of E-Learning. In this paper we have discussed a concept of chatbot, which is easy to implement with the help of R programming language. Major keywords which will be classified with R programming Language can be further framed as a query with the help of Artificial Intelligent Markup language (AIML) script. Along with AIML script of the query is unsuccessful then this will be framed as query with help of SQL lite. If both of the queries are unsuccessful then same will be transferred to human interface. AIML is a free scripting language and easy to implement as well. This entire concept will add value to any LMS system, and at the very same time, it will be helpful for student to get answer for ad-hoc quires and institution will also be benefited, as this institution has all information about each student, which will help institution to offer services in more personalized way.**

Keywords--Chatbot, R-Language, LMS, AIML, Artificial Intelligence.

I. INTRODUCTION

According to the report by United Nations International Children's Emergency Fund (UNICEF), globally youth literacy rate has improved and it has increased from 83% to 91%. [1] There are various reasons which contribute to this growth. The Internet also has been a backbone to support this growth, as today approximately 51% percent of the world's population is using the Internet. [2] This has also given rise and access to online education. With global growth and acceptance of digital technology, the expectation from technology is exceeding. With the fast-moving technological advancements, the daily life is changing and replacing things around us quickly, similarly, the chatbots are revolutionizing the industries. As the NLP (Natural Language Processing) and AI (Artificial Intelligence) techniques are easily available and the concepts like chatbots are now a reality for many small and medium-sized organizations because of wider acceptability and easy implementation. The users are also preferring chatbots due to round the clock availability, reliability, accessibility, and instantaneous accurate response. The Chatbots at an institutional level are acting as a counselor and advisor for hundreds of students at the same time with same effective. approach and updating for several guidelines and crucial data for each program, subject and module for all students like word limits, submission due date and time etc. World's leading organizations in digital worlds have launched their own chatbot time to time.

TABLE I. TIMELINE OF CHATBOT [3]

Year	*Timeline of Chatbots*
1950	Chatbots Revolution Concept of truly intelligent Machine
1966	Eliza – MIT – Simulate Human Conversation
1972	Parry- Added Conversational Strategy.
1988	JABBERWACKEY- Simulate natural human Chat with Entertaining and Humorous Manner.
1992	Dr. SBAITSO- Speech Synthesis Program
1995	Alice- Artificial Linguistic Internet Computer Entity – Heuristic Patten
2001	SMARTERCHILD- Fun Personalized network; Precursor to Apple's SIRI
2006	IBM's WATSON- Natural Language Processing; Machine Language
2010	SIRI- Apple's IOS, Natural Language UI
2012	Google Now- uses natural language for google search on mobile
2015	Alexa- Amazon Echo Device; using language processing Algorithms
2015	CORTANA- Bing Search; Natural Voice; Different Language
2016	Facebook user bots
2016	TAY- Microsoft to mimic the speech and habit of teenage girl

A. *Learning Management System*

Learning management system is software used to deliver education and training courses by organizing details, creating, managing and delivering the courses. LMS can be used for all learning activities weather it's an employee training, orientation, and knowledge retention or learning in school and higher education institutions. [4]

The vast repository of LMS to trace the stored information for the objectives of the organization's training strategy to make it available to the remote user at his convenience. An LMS system is equipped with reports

and analytics to monitor the performance of the individual or group. Moreover, it adds on to the utility by spontaneous user interface, supportive assessment tools, interactive social groups and the localization through the customizations as per the requirement.[5]

The worldwide e- learning LMS market size is estimated to be growing in all regions of the world as per the report of Statista 2018.Fig.1 [6]

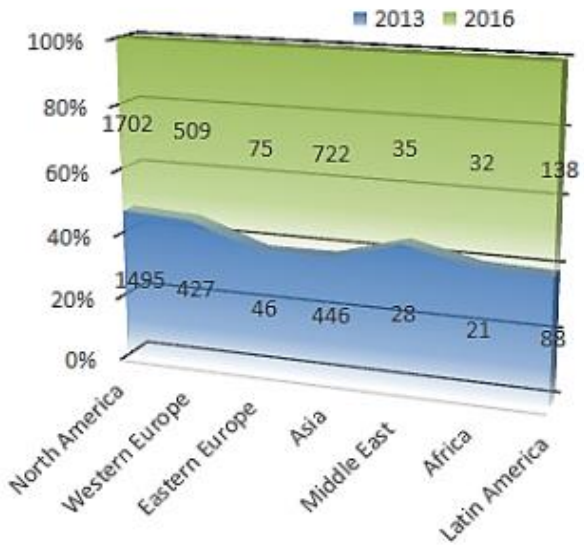

Fig. 1. Market size-LMS –Region wise

The market estimates the global academic LMS market is $ 15-20 billion per year and forecast to grow to $8.2134526 billion by June 3, 2022 as per the article published in 2017.[7]

B. Chatbot

Chatbot is software programs which answer's for the quires asked by users. Chatbot works on text or voice base interactions, which are always supported by strong database. Interaction between user and chatbot needs to design carefully, which should also have to understand user behaviors.

The Chatbot, or a text communication tools are not only accepted while they are preferred over the calls and the indulgence in providing platforms from the big companies like Microsoft, Facebook, Google, etc. has made it swifter for society. These chatterbots help to resolve the problems more quickly, act in synchronized manner among all devices, keeps record of communications and of course convenient due to ease of use and sharing documents as well. The service providers will not lose any customer due to long waiting time without spending a lot on resources.[8] The global market of chatbots has been developing significantly and is estimated to reach USD 1230 million by 2024 at a CAGR of 22.6%. [9]

As per the survey conducted among 800 decision makers by Business insider 80% of respondents agreed to the use or planned to use the chatbots by 2020.[10]

II. Motivation and Challenges

The paper acknowledges the importance and growing trends of the chatbots in the industry development and user's convenience. The Chatbots are effective in resolving problems and providing information accurately to the user and at the same time provides major analytics and tools to the company. The LMS has also revolutionized the learning industry worldwide through its utilities to students, teachers and administrators at their own choices. The usage of Chatbots on LMS is an approach towards a more systematic and user-friendly environment to seek right information at right time through the effective usage of natural language and Artificial intelligence.

The Chatbots can effectively reduce the time a student spend to locate his information, and allows the teacher to monitor the usage for effective teaching. The LMS with the chatbots will enable the continuous learning among the students even between the short and long breaks due to ease of access, connectivity and relevance of information. The bots will keep updating the question bank and the answers thereof to reach the maximum accuracy.

The user need not to understand the complex LMS interface to resolve his doubts by peeping in his LMS but will get the quick access to the intelligent search. The institution will get a chance to closely observe the data related to content, learning habits, usefulness, and ways to deliver the content to make the learning more successful through the planned scripting, data analysis and content creation for the learner-centered model. The chatbots in LMS will enable institutions to know what the students need to learn, how they learn, what is being learned and when to make the learning more effective. [11]

III. Literature Review

Technology has been evolving the environment and working styles with its upcoming innovations. The Learning management system is well known and adapted innovation in learning and teaching platform. The LMS (Learning Management System can be divided broadly into two major criteria, on the basis of licensing (Proprietary and open source) and on the basis of deployment (on-Premise and Hosted). [12]

There are thousands of LMS vendors and multiple features to be accessed on selection criteria of the user. The usage and growing demand of LMS are common but the features play an important role in determining its importance and quality. The wide outreach capability and cost-saving solution are also one of the key reason to choose the LMS system.[13]

The chatbots one of the latest feature, are a medium for interaction between the user and data through a programming language to convey the interpretation made by the algorithm into sensible results lead to the answers and faith on the application. As per the data more than 30,000 chatbots have been launched on the Facebook messenger

itself within one year of availability of resources, clarifies the need.[14] However, most of the endeavors to replace the need for human partially failed due to ambiguous purposes, nonsensical responses, and insufficient usability. [15]

Chatbots have gained the popularity due to its unique nature of friendly easily understandable, natural, search speed, no human inaccuracy due to emotions and fatigue. Furthermore, they are enhancing the customer service and interaction with the customers without losing the content. Artificial intelligence, big data, natural language processing, and cloud computing are providing a boost to the application. The open source communities are further accelerating the growth by providing features in a cost-efficient way. The chatbots are consistent, conveniently and cheaply available as an intelligent assistant and raising the benchmark of the customer service. Through a programing language, Chatbots are creating focused approach with convenience and capability to manage the high volume of requests at a time with the same focus. [16]

The usage of Chatbot on the learning management system can be done through the natural language generation and intelligent process automation on question answer, assessment, search assistant and teaching as well. [17]

The one of the artificial intelligent application language 'AIML' matches word by word of the string to get the patterns matching in the files and directories in the set of patterns as per the first word or most significant word approach. [18]

Moreover, the Chatbots have been proved to be preferred more than the doctors and nurses in receiving the support on the depression related issues and made them learn higher independence of assistance from a human. The approach worked well with the patient and the same could be applicable to the students and education institution as well if focused on the empathetic communication from the LMS at the time of teaching, learning and nurturing to counsel, comfort, emphasize, illustrate or demonstrate as per the decision on the topic analyzer check of the presented framework. [19]

At the same time the motivational interviewing dialogue technique to be used at the given time of conversation to motivate the user to participate or enhance the performance as it boosted the consumption of fruits. [20]

Similarly, the career counseling bot that will think like humans and counsel students to choose a career without being stressed by asking the questions related to hobbies, qualifications etc. due to quick answer and accurate knowledge. [21]

A study conducted to develop a multimodal bot for enhanced e-learning experience that has resulted in the satisfactory interface and very positive pedagogical potential in the study of the urban environment. [22]

The DLMS system of the Malaysian Distance Learning institution had several languages as per the need of students of different locations focused on the adaptability, comparability, and monitored research on all three modules of the LMS and on the mobile interface as well. [23]

Another study conducted on educational technology Moodle also proves the positive impact on engagement, motivation, and performance over the students [24] Whereas, a critical study focuses on the augmentation and complementation of the study without substituting the core teaching and their implementation must be open inclusive and educationally informed. [25] To summarize a study on does LMS among university student works concludes that it is necessary to be implemented due to usefulness not ease in all universities worldwide.[26]

The study conducted found that the Sum Total Moodle and Blackboard proved to be useful because of its unique characteristics. The open source platform is preferred due to better service, adaptability as per the user requirement, and initial low cost as well with an added subscription and maintenance fee.[27]

The results obtained by the experimental campaign are satisfying and show the good perspective of this kind of approach. Further developments involve the application of the proposed approach in various contexts and improvement of e-learning platform. The results obtained by the experimental campaign are satisfying and show the good perspective of this kind of approach. Further developments involve the application of the proposed approach in various contexts and improvement of e-learning platform.[28]

The intelligent Pedagogical Agent (IPA) or chatterbot communicates with its logical brain AIML, Artificial Intelligent Markup language on open source platforms to answer the questions. They must not be a decorated search and find options though have a long-lasting update and adding user specific details in the scenario, such as – teacher or counseling department noting down the details issues and personal weaknesses and qualities of the student to build a correct approach to the decision to answer.[29]

The usage of LMS by the faculty will enhance the learning and overall development of the innovative pedagogical methods to make the use of tools to support the student. [30] Additionally, the integration of openness of LMS and tool is appreciable, whereas the convenience of a student by integrating LMS to his own environment and tool must be integrated.[31] Moreover, the quality a major concern check on Analytical hierarchy process, AHP approach parameters (Performance, Functionality, humanity, accessibility, affect, ethics and behavior) should be handled to measure the efficiency and effectiveness of the chatbots.[32]

The study conducted on the factors impact student usage of LMS concludes, that apart from the technical aspect the usability of the application mostly its usefulness depends upon the purpose, time and need of the source. The

LMS acts as a parallel work on the regular studies and teachers also at times use traditional methods to teach due to lack of time.[33] Henceforth, the LMS must be developed considering the in-depth personalization and contextualization to integrate it with the requirement of the user. [34] To conclude, the overall effectiveness will depend on the individual student difference in chatbots mediated learning as a result of well-organized structure for input, quality and effectiveness of process and learning outcomes must be different with the different requirement of student influenced by individually designed LMS for the needs of the student. [35]

As the same has been evidenced in the study which evaluated Moodle as an LMS based on six criteria on the implemented system architecture and proved to be more useful on the usage of learning material .[36] Another study on multi-agent based intelligent adaptive learning environment, the user may define the role based on his educational goals, learning style and mode of LMS will be set as administrator, walk through, or author related function, and personalized e-tutor function will be displayed on the window. [37]

IV. CHATBOT MODEL FOR LMS

Our approach (Fig.2.) is based on user personalization, this can be achieved as who is asking a question/who is chatting is already known, as a student who is chatting needs to login in his/her account. Login account details and previous chat history is already available with chat system and by this way, chatbot understands the student in a better way. At any point in time if a student has any query about anything related to his academic or related to the university, which can be easily supported by a chatbot. University has a lot of data regarding student interaction; logs of those interactions can be used as a primary database to start with. Over a period of time, new interaction and data also can be added. This will make chatbot more effective.

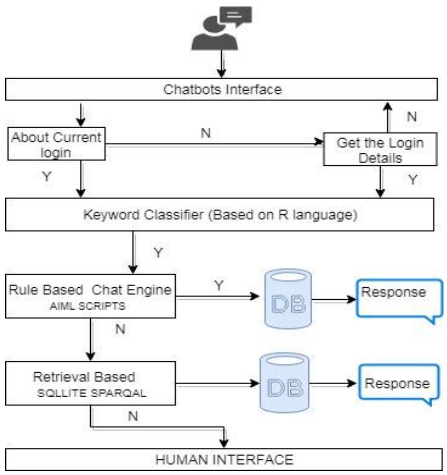

Fig. 2. Methodology for chatbot interaction

It is not necessary that all the chatbot must be AI based; many of the chatbot may not need the complex features of AI in chatbot. So some of the Chabot may be started with the functions of Pattern recognition or based on rule base data base and these databases may need AI implementation later on. Majorly chatbot can be categorized in two types, *rules based chatbot* and *AI based chatbot.*

Rule based Chabot works only on a given database and if asked query is not matching with any of the given response then chatbot will transfer this to human interface or will not be able to respond.

An AI-based chatbot is more complex as they have continuous learning capability, they can communicate like a normal person, it knows how to categorize information, how to store information, and along with this based on the previous history how to help in a more proactive way to the user.

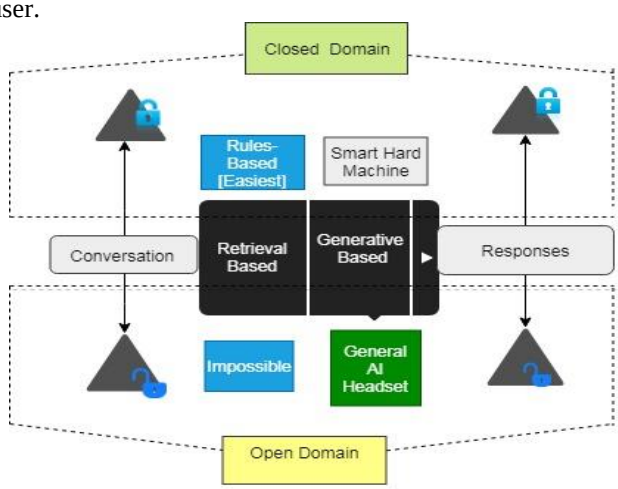

Fig. 3. Chatbot Conversation Framework

The communication is completed with the responses from the conversation initiated on either retrieval or generative basis resulting in the closed or open domain. The Fig.3 explains the possible solution and complexities on both generative and retrieval based communication (conversation and Response) in the closed and open domain.

In this paper for research methodology we have proposed a model Fig.4, which is based on rule based and retrieval based chatbot on a given database.

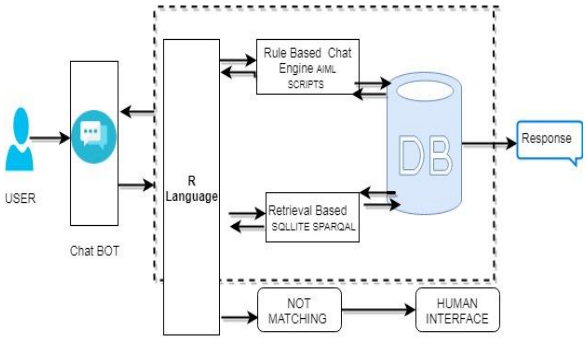

Fig. 4. Chatbot Model based on AIML and Retrieval base

R Language

R language is an interpreted language, not the compiled one, its syntax is intuitive and simplified, it stores the

variables, functions, data, results etc.in active memory in a names form of object in the memory of computer, on which actions can be taken by operators such as arithmetic, logical and comparison etc. with large quantities of data. [38]

It is a programming language which is free to use. This is one of the most popular languages for data analysis. Statistical computing and graphical designing can be supported by R language. This can work easily with all popular platforms like UNIX, Windows, MAC, and Linux. Easy to use feature of this language make it more popular. We have used pattern matching from each conversation of student to generate clearer chatbot based interaction. As each conversation is a combination of few words. It is important for a chatbot to understand the keywords in each conversation. Based on keywords chatbot can respond related to extracted keywords. Group of keywords can be prepared already so that it is easy to match, after keyword extraction. Each keyword is immediately transferred into related parse tree, from where is easy to know user intent for asking this query.

Following sequence flow can be considered for the same.

Group of Keywords: {Result, Mid-term, Project, Sports, complaint, Feedback, counseling)

Parse tree example (Project): Fig.5.

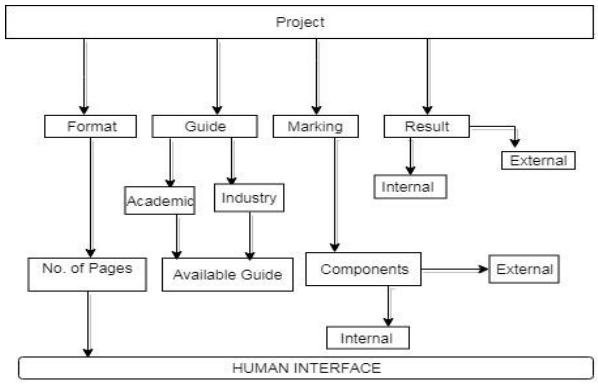

Fig. 5. Parse tree example for keyword "PROJECT"

Rule based chatbot works efficiently, but the problem with this kind of chatbot is that they don't understand the intent of conversation. These kinds of chatbot can only answer with set of pre-defined rules and their response, there may be many instances where the two different conversations is having the same meaning but, if only one of them is register then only registered one will get response and next one may not even get the response, or next one will be transferred to human interface. Rule-based chatbot check for a fixed word, expression against a given database and reply based on that only. For example, Student is asking "What is a semester project." "Can I do semester project in this semester", "Tell me about the project" Fig.6 represents this condition-based keyword matching concept.

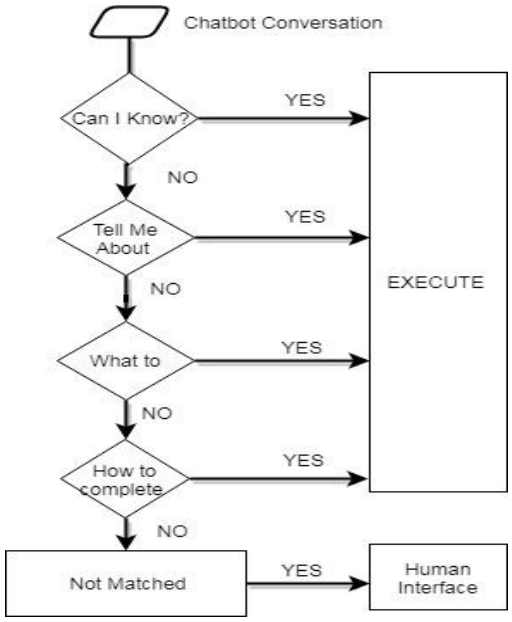

Fig. 6. Keyword base Search for next execution

Example of rule based chatbot like ELIZA and ALICE, which are a category of deterministic response. The success of rule based chatbot is directly dependent on the kind of data with it is supported. As rule base chatbot work with the support of database. The stronger database for searching the better responses can be generated. If database is not strong there will be very poor response. Following is an example of student conversation with chatbot. This is also translated in AIML.

AIML:

Artificial Intelligence Markup Language is XML based language. By this human knowledge can be captured and converted into knowledge base with the help of A.L.I.C.E (Artificial Linguistics Internet Computer Entity), which is developed by Richard Wallace. This is free software available on Internet. Following is a sample of conversation between chatbot and student.

Student: Hi
Chatbot: Hi, <Student name>, How can I help you.
Student: Can I know about project.
Chatbot: which semester project.
Student: Current semester.
Chatbot: Please specify in number (numerical) Example Semester 4
Student: 5

Outcome of following sample code is Fig.7. Sample code of above conversation in AIML:

```
<?xml version="1.0" encoding ="UTF-8">
<aiml version="2.0">
<category>
        <pattern> Can I know about *</pattern>
        <template>
        Please refer following about <star/>
                <button>
                <text> Click Here</text>
```

```
                <url>https://
university_website/<star/></url>
                </button>
            </template>
</category>
```

Fig. 7. Outcome of AIML sample code

Retrieval Based Database chatbot:

In this chatbot mechanism, system is able to generate responses based on specific words. If query does not have these words, then response will not be generated. Chatbot cannot generate new responses. To make more effective rule based chatbot, keywords from query will be extracted with the help of R language pattern matching. As soon as keywords are received these keywords will be matched with available grouping. Rule base chatbot will also search this query in past history and will immediately response with best response. Grouping of keywords needs to be done carefully.

For example:

Student: Hi
Chatbot: Hi, <Student name>, How can I help you.
Student: Can I know about project.
Chatbot: which semester project.
Student: Current semester.
Chatbot: Please specify in number (numerical) Example Semester 4
Student: 5

Generate Query: Select Project page of Semester <Semester> from Project.

V. Conclusion

According to a report by Gartner by 2020, approximately 25% of jobs will be taken by a chatbot. [39] LMS is a closed environment, where all related data about a student is almost fixed. This paper presents a model of chatbot in LMS, which will solve many ad-hoc queries of a student and this can be a very helpful tool, to save student's and institution time. This chatbot model is based on AIML and rule-based system, which is easy to implement on the technical side. This chatbot will also generate a lot of query-based data, which will help the institution to understand its student more in detail, hence institution can help or response in a more personalized way to each student. This model can be extended by addressing more ad-hoc discrete queries.

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