# DEVELOPMENT OF A CHAT-BOT SYSTEM FOR ADMISSION INFORMATION ENQUIRY

**[1]PHUTI L.MOCHUENENG, [2]JOHNSON O. DEHINBO**

Tshwane University of Technology (TUT)
E-mail: [1]Phuti.lecia@gmail.com, [2]Dehinbooj@tut.ac.za

**Abstract** - University student recruitment involves a large volume of enquiries of a fairly routine and predictable nature from a world-wide pool of applicants (Hancox and Polatidis, 2012). The opportunity to communicate on a one-to-one basis is highly valued (Polatidis, 2014).Chat-bot is one of those techniques that could play the role of assistant to the studentsand which can respond to admission information in 24-hour live chats and as frequently as neededas long as they are connected to the Internet (Goh & Lim, 2016). In this study, a Chat-bot is built using algorithm that analyses user's queries and understands user's message using Artificial Intelligence Markup Language (AIML) to develop its knowledge base, which is a well-known XML derived language used in case-based reasoning and textual pattern matching algorithms. The Design Science Methodology is used and the study aims to overcome the existing shortcomings of websites, prospectus, brochures and etc. through the big advantage of providing unwearyingly 24 – hour conversation as long as you are connected to the internet. The Chat-bot has the convenience of accepting text input and the replies can also be in text.

**Keywords** - Chat-Bot System, Student Information Enquiry, Web Based Systems, Artificial Intelligence Systems

## I. INTRODUCTION

Admission information enquiry is important for students before they register with universities. Most universities use prospectors, websites and brochures to provide admission information for students and such do not are always provide all the required information that the students are looking for. And most Bachelor of Tech. students are working full time and they do not have time to go to universities to ask information about the course they want to register and they can't interact with those websites to get information quickly. And the other problem is that not all the distance learning or part time students have money to go to universities during the time for registration.University student recruitment thus involves a large volume of enquiries of a fairly routine and predictable nature from a world-wide pool of applicants (Hancox and Polatidis, 2012). And the communication of potential students with a university department is performed manually and in a time consuming way. Thus, the opportunity to communicate on a one-to-one basis is highly valued (Polatidis, 2014). Chat-bot (also known as a talk bot, Bot, chatterbox) could play the role of assistant to the students which can respond to admission information in 24-hour live chat and as frequently as needed, for the role of interacting with students in university website. This means that the students can get response at any time needed by them as long as they are connected to the Internet (Goh & Lim, 2016). There are many types of conversational bots that have been explored and developed over the years. They ranged from general conversational bots which do not specialize in any domain to those subject-matter expert bots. Chat-bot potentially can be used in a wide variety of ways in instructional situations. Goh & Lim, (2016)wrote that chat bots can play a useful role for educational purposes in an interactive mechanism as compared to traditional e-learning systems. Students can continually interact with the bot by asking questions related to a specific field. Chat-bot is built using artificial algorithm that analyses user's queries and understand user's message and it will be using Artificial Intelligence Markup Language (AIML) to develop its knowledge base. Artificial Intelligence Markup Language is an XML derived language which is used in case-based reasoning and textual pattern matching algorithms (Goh & Lim, 2016), to create stimulus-response chat bots. As an XML-compliant language, AIML also respects the grammar specification in XML such as the syntax of comments, white space handling, end-of-line handling, and the need of closing tag, and so on. This system is a web application which provides answer to the query of the student through the bot which is used for chatting(Shawar and Atwell, 2007). According to Allison (2012), the Chat-bot answers questions from a variety of users from around the world. It has attracted an unexpected number of social chatters, which required some additional metadata to accommodate personal chatting and to guide questions. The majority of questions are directional or factual questions that Pixel can handle (Allison, 2012). The answer to the query will be answered on the basis of the student's queries and the knowledge base. The important keywords will be fetched from the keywords and the answer to those keywords will be searched in the knowledge base. If the match is found, the relevant answer will be provided to the user or the default message will be shown to the user that "Answer to this query is not available at the moment, please revert back after some time". The response time to the queries of the user will depend upon the internet speed of the user, but usually within around 3-5 seconds. But even in the worst case, the response time will not exceed 15 seconds. Chat-bot can then be added on the university website so that students can

easily ask question about admissions without have to go personally to university office for enquiries and it saves time for the students. Chat-bot can be used for various purposes such as for learning but there is no chat-bot for making admission enquiries at TUT.Thus, the purpose of this research is to design and develop a Chat-bot as a tool for computer science Btech students to easily access admission information. The main research question then is: How can we implement a Chat-botsystem to improve the access of admission information by computer science Btech students?

**Sub research questions:**

- What are the issues concerning access to Btech admission information in computer science Department?
- What are the existing techniques/models used for accessing admission information in universities?
- How can Chat-bot model be effectively designed and developed?
- How can the Chat-botsystem be evaluated?

While this section introduces the background of this research, section 2 reviews the literatures on students' admission information enquiry and the Chat-bot model and its related fields. Section 3discusses the research methods used in this research to achieve the objectives and the system architecture. Section 4 presents the system development while section5 presents the output results. Section 6 evaluates results and concludes the study.

## II. LITERATURE REVIEW

### A. Introduction

This section outlines the significant works in Chat-bot which created impact or contribution to the development in this field. In addition, Artificial Intelligence Mark-up Language (AIML)which is part of Chat-bot implementation is also further elaborated. The purpose of the various conversational bots can be different; they may be developed for commercial needs such as attracting or assisting customers (Lim and Goh, 2016). One problem is that lots of students just aren't willing to open a browser window, find the right website, and then hunt around for the one piece of information that they need at that particular time. They don't want canned responses, long search and wait times, endless customer service menus, verbose FAQ lists, and spammy, impersonal content flooding their inboxes. However, with many hundreds of applications each year, one-to-one conversations are not feasible in most cases. The communication will require a member of academic staff to expend several hours to find suitable answers and contact each student. It would be useful to reduce his costs and time. (Polatidis, 2014). Many applicants still find themselves wanting to ask highly targetedquestions about, for instance, module choice deadlines and visa requirements (Hancox and Polatidis, 2012). Given thewide range of time zones that applicants come from,24 hour access to staff is not a possibility (Hancox and Polatidis, 2012).Chat-bot potentially can be used in a wide variety of ways in instructional situations (Hancox and Polatidis, 2012).Lim and Goh, (2016) introduced MOOC-bot, which is developed and integrated into MOOCs website to respond to the learner's enquiries using text or speech input. MOOC-bot is using the popular Artificial Intelligence Markup Language (AIML) to develop its knowledge base, leverage from AIML's capability to deliver appropriate responses and can be quickly adapted to new knowledge domains. Bii (2013) Indicated thatthe benefits of chatbots' use in instruction include collaboration, cooperation, interaction, active learning, constructive learning, creative learning and social learning – ingredients necessary to help students prepare for their future which demands 21st century skills of them. Exposure to use of chat-bots in their instructional processes is therefore a step in the right direction.

### B. Use of Artificial Intelligence Markup Language AIML

AIML was designed by Dr. Richard Wallace and Alicebot free software community to create stimulus-response chat bots. It is a derivative of XML with a specific structure. As an XML-compliant language, AIML also respects the grammar specification in XML such as the syntax of comments, white space handling, end-of-line handling, and the need of closing tag, and so on. An AIML file should be saved with ".aiml" extension, for example: "bot.aiml" and it must enclose "<aiml>" tag in file. The "<aiml>" tag may contain the AIML version (Lim and Goh, 2016).

Lim and Goh (2016), indicated that the basic unit of knowledge in AIML is called "category" and it is written as "<category>" in AIML file. Usually, the more categories an AIML file has, the more knowledge it contains. Each "category" is followed with input or question known as "pattern", written as "<pattern>" and the answer is matched with one or more output called "template" which is written as "<template>". The AIML pattern is consisting of only of words, spaces, and the wildcard symbols '_' and '*'. Beside this, there are two types of optional context called "that" (<that> tag) and "topic" (<topic> tag) which are part of the AIML main elements but not compulsory to be present. The "<that>" tag tells the system to refer to the last sentence presented by the chatterbot while the "<topic>" tag is used to organize subjects or topics that only applied to an active topic variable. AIML is an XML-compliant language that's easy to learn, and makes it possible for you to begin customizing an Alicebot or creating one from scratch within minutes.

**Example**

<aiml version = "1.0.1" encoding = "UTF-8"?>
<category>

<pattern> HELLO ALICE </pattern>
<template> Hello User!
</template>
</category>
</aiml>

**Result**

User: Hello
Alice Bot: Hello User.

**C. Negative reports on the use of chatbots**

The following are disadvantages of a Chat-bot indicated by Polatidis, (2014).

Chat-bots can also become spam; The experience isn't as intuitive on mobile devices; Internet connectivity; Difficulty of replacing human contact; Too many functions; Complex interface; etc.

More specifically, Polatidis (2014) observes that talking to a bot implies talking in a chat, meaning that a user will have to write a lot. And in case a bot cannot understand the user's request, it will have to write even more. It takes time to find out which commands a bot can respond to correctly, and which questions are better to avoid. Thus, talking to a chat-bot does not save time in the majority of cases.

**D. Existing techniques**

Chat-bots are used in many organisations instead of humans when this is possible. Most of the time systems like that are based on the ways ELIZA or ALICE communicates (Polatidis, 2014).Hancox and Polatidis, (2012) developed "Infobots" which are small-scale natural language question answering systems drawing inspiration from ELIZA-type systems. Their key distinguishing feature is the extraction of meaning from users' without the use of syntactic or semantic representations. Lim and Goh (2016) developed anIntelligent Conversational Bot for Massive Online Open Courses (MOOCs) that can respond to course-related enquiries in live chat and as frequently as needed. MOOC-bot also can solve the flexibility requirement needed in MOOCs. This means that the students can get response at any time needed by them as long as they are connected to the Internet.

**1) ELIZA**

The first chatbot developed was ELIZA (Shawar and Atwell, 2007). 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.

**2) A.L.I.C.E**

ALICE was implemented by Richard Wallace in 1995 (Shawar and Atwell, 2007). 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 chat-bots. There are three types of AIML categories, atomic categories, default categories and recursive categories.

## III. METHODOLOGY

The design science methodology is used. According to Dehinbo (2014), a suitable methodology for research involving software development is Design Science. The methodology consists of the following process steps (Vaishnavi & Kuechler, 2004):

**Awareness of problem** - Identifying the problem area by doing research on previous works done in the area of interest. Furthermore, understanding the problem can occur by engaging with the study area of the subject matter.

**Suggestion** - Suggesting resolutions and solutions to the identified problem, in which new functionality is envisioned.

**Development** - The development or implementation of an artifact involves using various techniques including algorithms, knowledge management tools, and expert systems.

**Evaluation** - Once development is completed, the artifact should be evaluated. The technique for evaluation could be a qualitative or quantitative approach, or using developmental evaluation approach/ adaptive evaluation which are best suitable for evaluating prototypes.

**Conclusion** - The evaluation would provide feedback so we could reach a conclusion on the research. This is the final stage, ensuring the results of the artifact developed meets the desired results. And if there is any minor divergence, deviations could be recommended as areas for future studies (Vaishnavi &Kuechler, 2004).

## IV. SYSTEM DEVELOPMENT – PROTOTYPING

Use of Chat-bot will be integrated into the university (TUT) website as its chat interface. It consists of the followings.

**A. System Architecture**

The website and AIML interpreter are hosted onApache web server while the database and knowledge base are using MySQL that runs at the server. The web server works by translating PHP codes into HyperText Markup Language (HTML) while the web client such as Internet Explorer, Google Chrome, and etc. will translate the client script such as JavaScript before display to the users. The result is displayed in text. When a user poses questions to Chat-bot's chat interface, the question will be processed by AIML interpreter by referring to the knowledge base which contains the BTech Admission knowledge and the general knowledge that comes from files. The Admin (botmaster) can constantly maintain the knowledge base by adding the knowledge

in AIML file format. Admin is also responsible for adding questions and answers to the bot or uploading AIML file, clear AIML categories (answers), Edit AIML and also Edit or add new admin users.

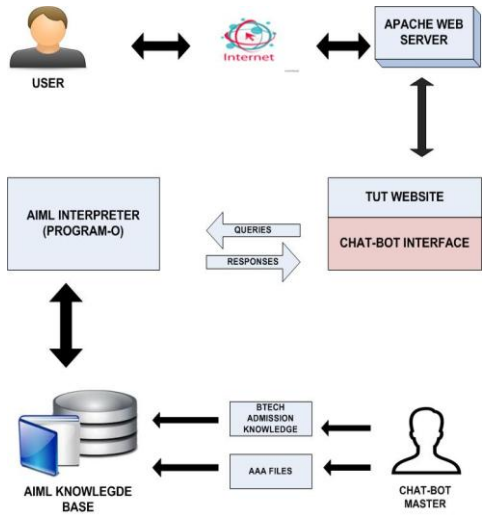



**Figure 4.1. System architecture**

## B. System Algorithm

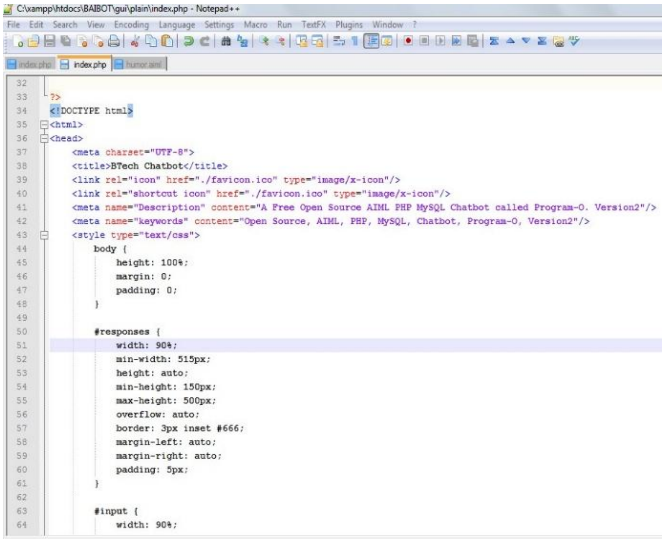
Step 1: Start.
Step 2: Get the user query. (INPUT)
Step 3: Pre-processing of the query E.g. suppose there is this query "what are the subjects for BTech web and application development " So, we are going to remove these stop words like „is", "the" using pre-processing technique.
Step 4: Fetch the remaining only keywords from the query.
Step 5: Match the fetched keywords with the keywords in Knowledge base, and provide an appropriate response. The keywords will be matched with the help of keyword matching algorithm.
Step 6: Return the query response as an output to the user.
Step 7: Exit

## C. System Modules

The developed system has the following modules:

- **Student** – user who uses the system to engage in a conversation.
- **Admin (Botmaster)** - administrator of the system, allowed carrying out admin tasks.
- **Chat-Bot interface** – Chat-bot's chat interface is integrated with university website. The chat interface will be on the web page of the website. The function of chat interface is to receive text input from the students and pass it to the AIML interpreter. The results from the interpreter will be displayed and read out to the student.
- **Knowledge Base** – The knowledge of Chat-bot consists of the BTech admission's knowledge, and the general knowledge that comes from AAA files. An AIML file can be created using any text editor such as Notepad++ and saved with ".aiml" extension. It is a derivation of an XML file with a specific structure. The BTech admission's knowledge is written in AIML files and saves into the knowledge base.
- **AIML Interpreter** –The Chat-bot will be using Program O as its AIML interpreter. Program O is an AIML engine written in PHP and uses MySQL database to store the bot's information. The text input from the chat interface will be processed by the interpreter by performing pattern matching with the AIML content in the knowledge base using depth-first search. The first matching response will be returned to the chat interface. The support of recursion in AIML makes it simple but yet powerful in pattern matching.
- **Website (University website)** – This is a website that provides computer BTech students with admission information. The integration of Chat-bot's chat interface in this website complements the role of the website.

Chat interface is written in PHP and HTML, CSS and JavaScript for design. Below is HMTL and CSS code.



```
?>
<!DOCTYPE html>
<html>
<head>
    <meta charset="UTF-8">
    <title>BTech Chatbot</title>
    <link rel="icon" href="./favicon.ico" type="image/x-icon"/>
    <link rel="shortcut icon" href="./favicon.ico" type="image/x-icon"/>
    <meta name="Description" content="A Free Open Source AIML PHP MySQL Chatbot called Program-O. Version2"/>
    <meta name="keywords" content="Open Source, AIML, PHP, MySQL, Chatbot, Program-O, Version2"/>
    <style type="text/css">
        body {
            height: 100%;
            margin: 0;
            padding: 0;
        }

        #responses {
            width: 90%;
            min-width: 515px;
            height: auto;
            min-height: 150px;
            max-height: 500px;
            overflow: auto;
            border: 3px inset #666;
            margin-left: auto;
            margin-right: auto;
            padding: 5px;
        }

        #input {
            width: 90%;
```

**Figure 4.2. Code (HTML) snippet of the chat interface**

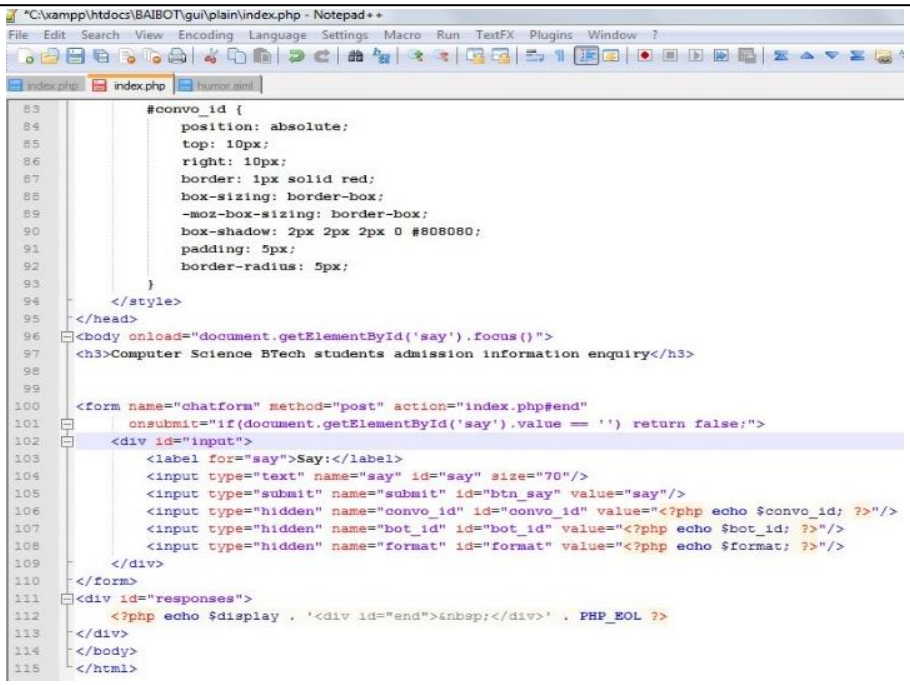



**Figure4.3. Code (HTML) snippet of the chat interface**

**AIML code/ Knowledge base creation.**

In order for the students to get answers for their queries, knowledge base needs to be created. Knowledge base has BTech admission knowledge and general knowledge. For the prototype purpose, only Computer science BTech student's knowledge will be created. AIML file will be created and added inside the system folders, AIML format is an XML-based format using specific tags such as "<aiml>", "<category>", "<pattern>", "<template>" and many more. Just like any XML tag, every tag must be in pair which are the opening and closing tags and written with the same case to ensure their validity. An AIML file can be created using any text editor such as Notepad++ and saved with ".aiml" extension. Below is an example of AIML file in nodepad++.

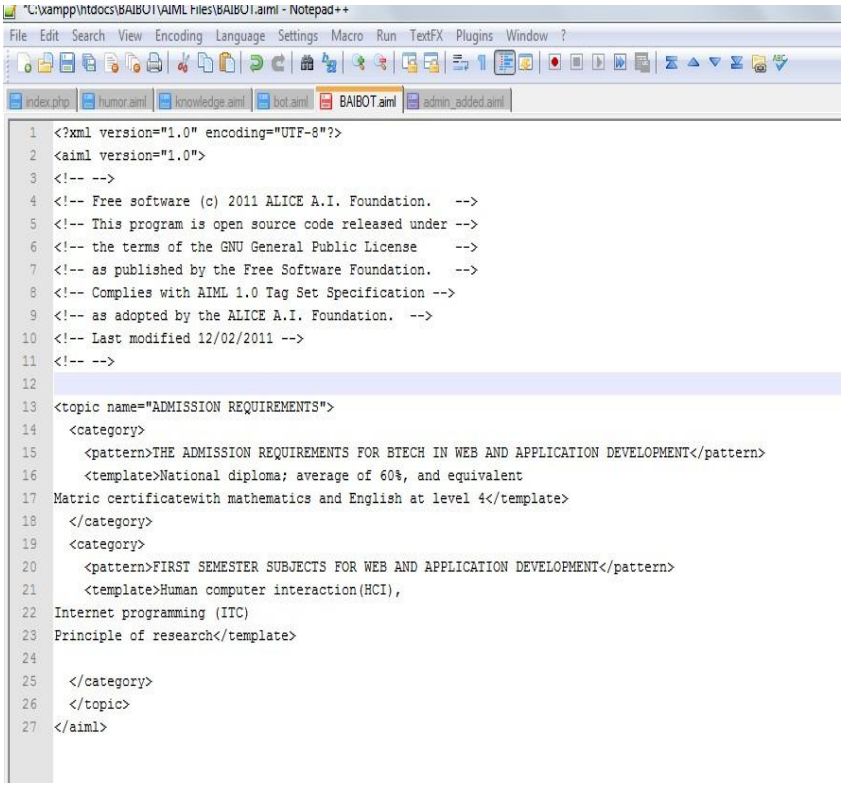



**Figure4.4. Example of an AIML File for BTech admission Knowledge**

In order for the interface to provide responses to the students, PHP code need to be written, below is the PHP code:

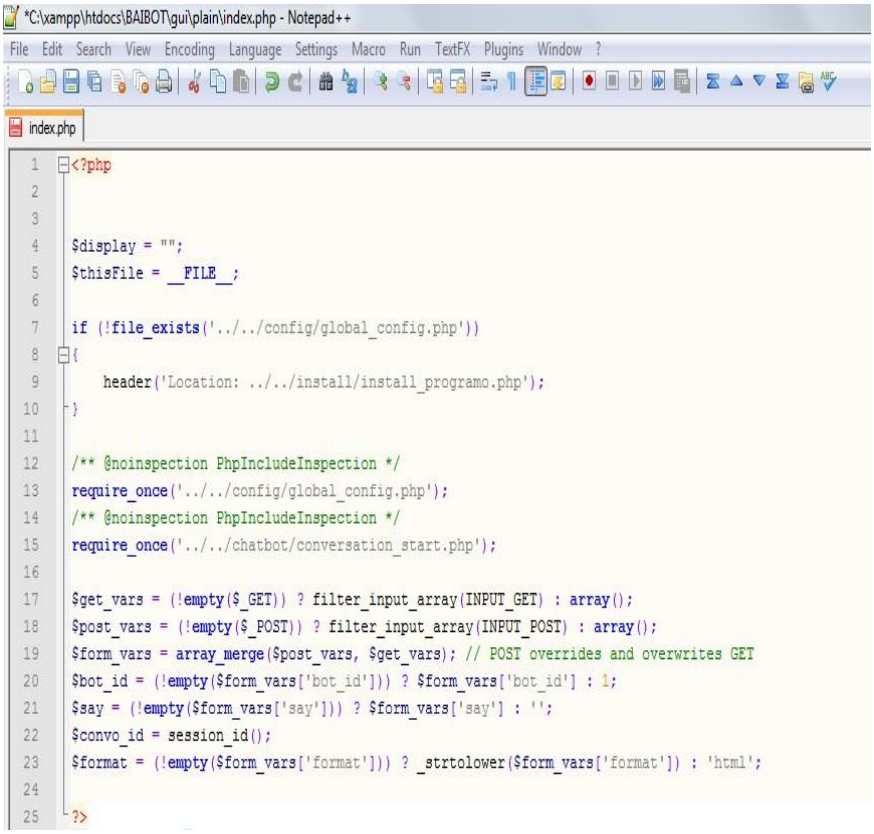



**Figure4.5.code (php) that displays the answers to the students**

## V. SYSTEM DEVELOPMENT RESULTS – OUTPUT

The website has a menu for admission enquiry which it will take you to the chat-bot, below is the page for admission enquiry:

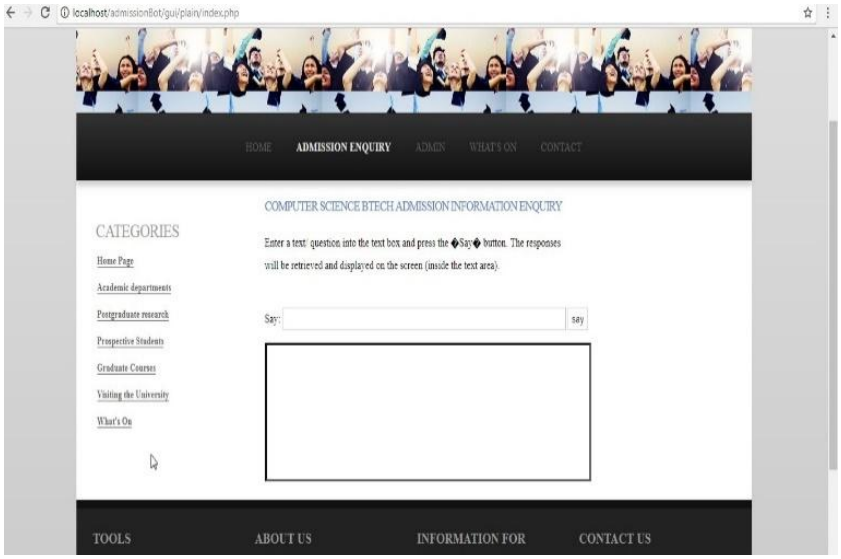



**Figure 5.1 Chat-bot Interface in the website**

The students don't have to login to the system, they open the system and click the admission enquiry on the menu bar Admission enquiry page consist of chant-bot interface, chat-bot interface has a text box where students right their questions, a say button to send your question and a text area that provide answers to the students.

When admin click on the links, below are the pages that he/ she will see:

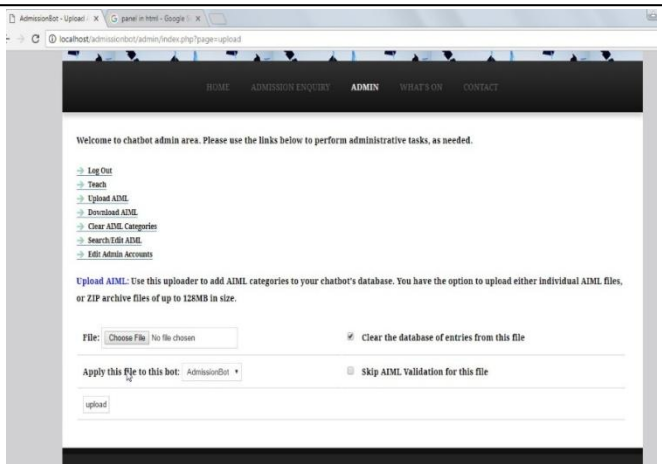



**Figure 5.2 Admin Upload page (uploading the AIML file to the system)**

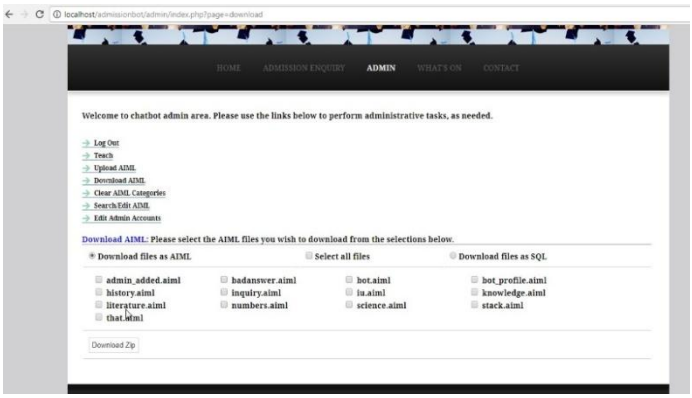



**Figure 5.3 Admin Download page (downloading AIML files)**

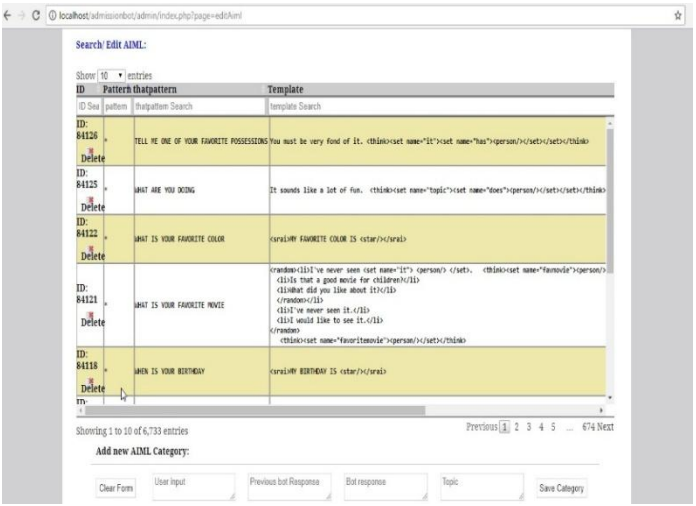



**Figure 5.4 Edit/ Search AIML page**

## VI. EVALUATION RESULTS

Evaluation is distinct from testing by the programmer as it is important to assert that the system meets the need of the admission enquiry information by the users. However, due to space limitations, such is not presented here as that is a study on its own.We however recommend that interested people can use quantitative methods (survey) to obtain as much data and information as possible for the evaluation of the system in this study.The responses through the written questionnaires can be collected using simple random sampling method. Desired output could be at the point where about Eighty percent (80%) of students says that the system is user- friendly and easy to use as in Figure 6.1. At least forty percent (40%) should concur that the system does not require computer skills to use, and over 70%should agree that the systemis very useful and will add value to the university. Hundred percent (100%) agrees that the system can be accessed every time, 24/7.

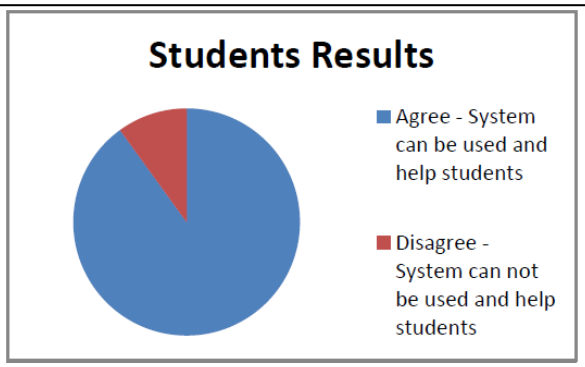



**Figure 6.1. Overall results of the system evaluation**

## VII. CONCLUSION

This study highlighted the development of a prototype Chat-bot to play the role of providing information to the students in live chat and as frequently as needed. Having reviewed the past literatures, Artificial Intelligence Markup Language (AIML) which is open source and can be quickly adapted to new knowledge domains, is chosen as the knowledge base along with AIML interpreter, chat interface and university (TUT) website to form the system architecture of Chat-bot. Chat-bot has the advantage of repeating the answers for the same questions without getting tired or fed up. This is very much needed in university situation where the students are massive in number and the possibility of encountering the same questions is very high especially for questions related to the admission information. Chat-bot has great potential to be implemented in future for different area in education field. One of the examples is to provide tutor service to help students in their learning process. Chat-bot can guide students when doing exercises or quizzes by providing explanation whenever needed.

## REFERENCES

[1] Abdul-Kader, S.A. and Woods, J., 2015. Survey on Chatbot design techniques in speech conversation systems. Int. J. Adv. Comput. Sci. Appl. (IJACSA), 6(7).

[2] Allison, D., 2012. Chatbots in the library: is it time? Library Hi Tech, 30(1), pp.95-107.

[3] Bani, B.S. and Singh, A.P.," College Enquiry Chatbot Using ALICE", International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169, Vol: 5, no. 3, pp. 463-466 2017.

[4] Bii, P., 2013. Chatbot technology: A possible means of unlocking student potential to learn how to learn. Educational Research, 4(2), pp.218-221.

[5] Benotti, L., Martínez, M.C. and Schapachnik, F., 2014, June. Engaging high school students using Chat-bot s. In Proceedings of the 2014 conference on Innovation & technology in computer science education (pp. 63-68). ACM.

[6] Dehinbo. J. (2014). Teaching Students on How Software Development Project can be turned into a Research Project, Paper presentation at the Society for Information Technology & Teacher Education International Conference (SITE 2014) held at Jacksonville, Florida. USA. 17-21 March 2014. Online. Available from http://www.editlib.org/p/131099

[7] De Jager, J. and du Plooy, T., 2010. Information sources used to select a higher education institution: Evidence from South African students.

[8] Hancox, P. and Polatidis, N., 2012. Query Matching Evaluation in an Infobot for University Admissions Processing. In OASIcs-OpenAccess Series in Informatics (Vol. 21). Schloss Dagstuhl-Leibniz-ZentrumfuerInformatik.

[9] Hussain, A., 2013. Use of Electronic Information Resources and Services among the Teachers and Students Institute of Engineering & Technology, CCSU, Meerut. Pearl: A Journal of Library and Information Science, 7(1), pp.50-56.

[10] Lim, S.L. and Goh, O.S., 2016. Intelligent Conversational Bot for Massive Online Open Courses (MOOCs). arXiv preprint arXiv:1601.07065.

[11] Polatidis, N., 2014. Chatbot for admissions. arXiv preprint arXiv:1408.6762.

[12] Saichaie, K. and Morphew, C.C., 2014. What college and university websites reveal about the purposes of higher education. The Journal of higher education, 85(4), pp.499-530.

[13] Shawar, B.A. and Atwell, E., 2007. Chatbots: are they really useful? In LDV Forum (Vol. 22, No. 1, pp. 29-49).

[14] Sinclair, E. and Connor, H., 2008. University admissions & vocational qualifications: two years on.

[15] V. Vaishnavi and B. Kuechler, "Design Science Research in Information Systems, January 20, Auerbach Publications, 2004.

★★★