INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT

OPEN ACCESS JOURNAL

Vol 13, Issue 1, (2024) E-ISSN: 2226-6348

Attending Teaching and Learning with Chatbot

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To Link this Article: http://dx.doi.org/10.6007/IJARPED/v13-i1/21107 DOI:10.6007/IJARPED/v13-i1/21107

Published Online: 13 March 2024

Abstract

Artificial intelligence technology such as chatterbot (chatbot) has widely been applied in various industries. The application of chatbot in education has become prominent and has been growing fast, assisting to provide smart responses between students and educators. A chatbot is a computer program that communicates in a normal, conversational way with users on a certain subject in particularly through text and voice. This project aimed to implement a web-based chatbot to assist users to interact using natural language and to train the chatbot using waterfall model since it able to generate an automatic response. In this context, Telegram will integrate with Python to implement the web-based chatbot. This project is a conversational agent to provide speedy and quick response to the basic PHP Programming enquiry with standard answers. It is hoped to minimize the response delay in getting answers due to the larger volume of enquiries. In addition, the recommended approach will benefit the users in more effective way of learning process and will improve the students' motivation and engagement. Functionality testing had been conducted to test the and the results showed that each function can run properly on Telegram Web in window and Telegram app in smartphone without any error occurred.

Keywords: Artificial Intelligence, Chatbot, Telegram, Waterfall Model, Programming.

Introduction

When Covid-19 hit the world in 2020, the education system profoundly impacted. It has disrupted in class activities and the changelings begun when everyone were not prepared for that. Following the health order by WHO, the universities were instructed to change their mode to online teaching and learning. The transition is another challenges for both students and educators as it is a new practices for them. Online teaching and learning formed its specific issues, technology devices, knowledge towards the knowledge, network coverage and many more. Since then, new application, websites, teaching aid and new technologies such as artificial intelligence has risen to help with this online teaching and learning (Teymori & Fardin, 2020).

Over the years, technologies based on artificial intelligence (AI) have taken over human intervention. It offers new mode to the success in delivering information over the

conventional way. Artificial Intelligence technologies attended to innovate our education system to ultimately use the embedded computer system and functions independently with or without the instructor. In early years, AI in education has been used in assessing students work for plagiarism, grammar mistakes, video conference, and many more. Its ability to adapt with new situation, deal with emerging situations has make it as dynamical platform to assist students and educators to expand this technology (Chen et al., 2020).

AI technology can be any form of computers and computer-related systems, potentially can be implanted in robots, cobots or humanoid robots and so chatbot that able to independently functions tutors. Chatbot has been applied in several areas such as customer services, health care and education (Chen et al., 2020). Chatbot is a software that can be given tasks to search information, solve problems and even answer questions. In education, the application of chatbot elevated to improve teaching and learning process. Chatbot has been gaining its place in education, as it is potentially able to attend the learning and teaching process (Ullman & Scoop, 2022). According to Smutny & Schreiberova (2020), instant messaging such as chatbots act as pedagogical agents that allowed educators to incorporate messaging technologies into teaching and learning over the last few years. For example, chatbot that has been names as Ethnobot substitutes a person ethnologist with, it able to gather ethnographic data in a chat format and asks respondents a set of questions. ELIZA was the first chatbot invented in 1966 by Joseph Weizenbaum from MIT. ELIZA act as psychotherapist interacting with human patient (Kuhail et al., 2023).

A study done by Okonkwo and Ade-Ibijola (2021), showed chatbot has been dominantly used for teaching and learning. Only 36% have been used in the area of research and development, advisory, assessment, and administration. The wide coverage of its used are primarily to deliver course content, allowing student engagement where student can ask questions and get spontaneous individual responses. The responses are available anywhere and anytime that can fit with students leaning time, interest, cognitive skills and accessibility.

According to Sandu and Gide (2019), chatbot can become study companion for the students. With chatbot, student can arrange and sort self learning time to fit with their speed and needs. Chatbot provides dialogues, the interaction that consist the activities of discussion where chat create the initiation, students responses and later they will get feedback. In computer science programme, the programming course become the subject matter that need to be concerned. According to Weragama & Reye (2014), new enrolled students claimed programming is a difficult course to understand, mainly the insight of building the code. New beginners required more time to learn at least the basics. Least learning time, with minimum guidance from the tutor may lead to unsatisfactory result from the student. Despite being compromise as hard and challenging course, a study showed majority students feel positive towards it if they work for it (Keuning, 2020)

With higher numbers of enquiries from the students and with the conversational interface such as WhatsApp, large volume of enquiries resulting in delays of responses from tutor. Hence, it can cause decrease student motivation in learning. Tutor always expects to have an online human computer that can reply all question from their students. The solution for these problems, the student needs automatic answering question assistance and get back immediately like chatbot. The chatbot architecture combines a linguistic model with

computational techniques to simulate natural language chat communication between a human and a computer. This bot will help tutor to decrease stress and tediousness by automating answering repetitive question. They would undoubtedly transform quest, decreasing not only the time it takes for face to face meeting, but also the expense of the labor required. Bot also can save time and workforce of tutor to serve the student (Smutny & Schreiberova, 2020).

The advantages shown by chatbot become the reason of the development of the project. This project proposed to develop a chatbot to assist the basic PHP programming enquiry that able to give standard answer suggestion based to the enquiry. Second is to implement a web-based chatbot that can assist users to interact with the chatbot using natural language input.

Methodology

Chatbot venture into education as early as 1870s. In education, mainly the interaction from students increase motivation, learning instructor, build social interaction and provide immediate response to the learners (Kuhail et al., 2023). In order to fulfill the immediate, inquire regarding the development of PHP programming. The chatbot developed is a web-based using natural language input.

There 5 stages of the development in this project. Planning, data collection and analysis, design, implementation and evaluation.

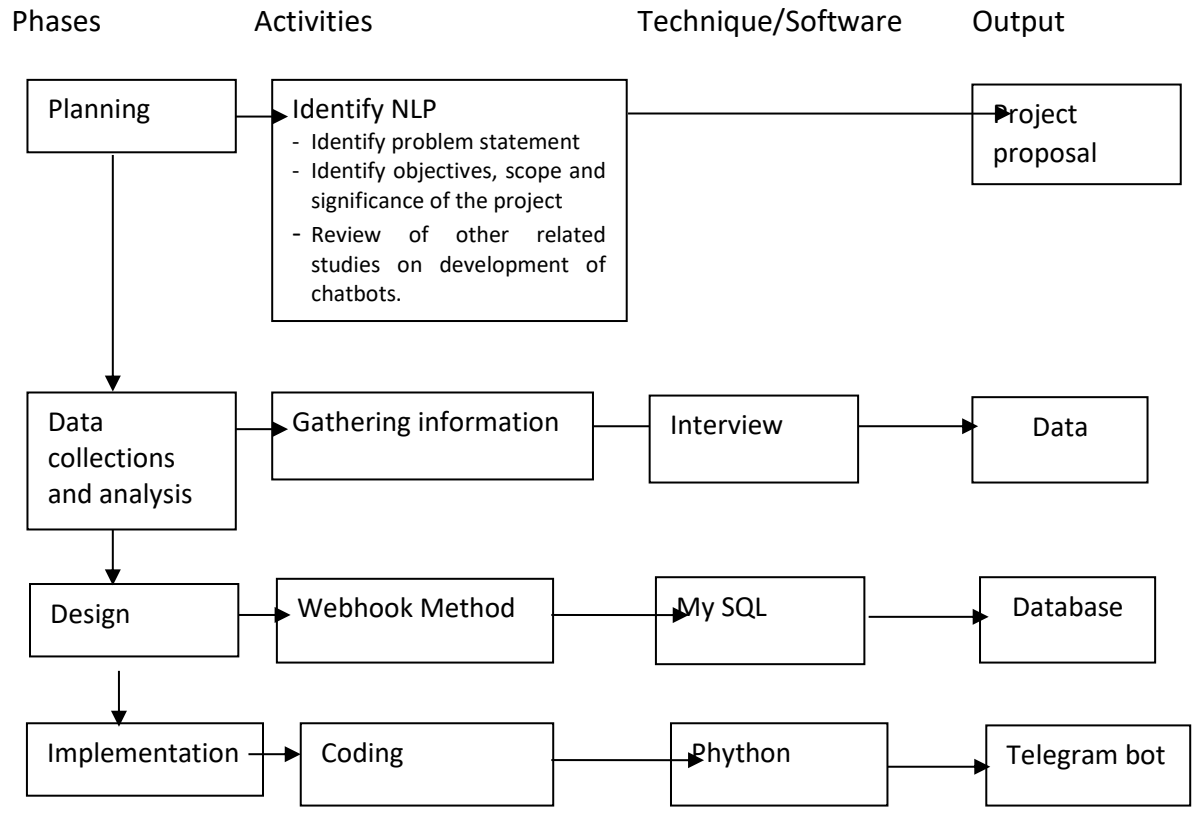


Figure 1. Five stages of project development

This project adopted waterfall model, a common model as it covers all stages of the life cycle of System Development Life Cycle (SDLC). It assumes linear and pattern matching for each move and sets targets. The waterfall method in the accounts does not include or combine iterative steps. This simplifies job preparation. In other words, using waterfall method, the phases must be completed before proceeding to the next phase (Heriyanti & Ishak, 2020). The stages in the waterfall model are shown in Figure 1.

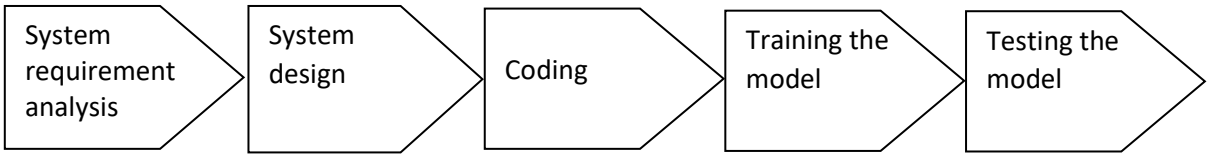


Figure 2. Project methodology using waterfall model

Data were collected and processed at the first stage to prepare for the input pipeline of the Sequence-to-Sequence model (seq2seq). In the original Sequence to seq2seq, there were two input data files and two vocabulary files. The two input files were a translation from and translation to the language input data file. Meanwhile, the vocabulary files contained the processed vocabulary for the two-input data file of two different languages respectably.

In the second stage, the dataset used was from the human and bot responses collected from Kaggle. Kaggle is a user-friendly dataset provider that can meet the criteria relevance to our development. Dataset is then cleaned with Regular Expression to make it as human like response before continue training them with seq2seq model. The model is trained to improve its performance for a better outcome. This step is essential for the model to understand various patterns, rules, and features. After the model has been trained with a given dataset, the model is tested to check the model's accuracy. For example, ‘hi’ is an input sequence, and ‘hi there how are you’ is the target sequence. Separate list needed to be created for the input sequence, target sequence and unique token in the dataset. Token is a small piece of data that contain confidential information such as username and password. in the target sequence, ‘<START>’ at the beginning of the sequence and ‘<END>’ at the end of the sequence.

Input token and target token for the dataset is stored in individual dictionary. The inputs are stored as key-value pairs where the any words are the keys and indexes are the values. The dictionary will help encode sentences into one-hot vectors. The decoding process works in reverse process. To decode the sentences, reverse dictionary stores indexes as keys and words as values. Data in both idle files concurrently will be cleared after separating two files.

Coding phase is where the model is developed. The implemented seq2seq framework which is a Recurrent Neural Network (RNN) architecture may comprises challenges with its vanishing gradient problem based on its recurrent process in buried layers. In other words, RNN suffers short-term memory which unable to provide long-term memory that cause vanishing gradient and explosion problem (Ghimire et al., 2022). In order to have better performance of the model, this study adopted seq2seq framework that comprises two Long Short-Term Memory (LSTM) that separately for encoding and decoding (Sutskever et al., 2014). The seq2seq model

takes as input sequence, process it one word at a time, generates an output sequence one word at a time.

Training and testing phase are defined separately. During this phase, the attention is on the operational of seq2seq model for long sequences. The training and testing decoder are described using the attention decoder FN. This step can help in improving the model for better accuracy. Define the seq2seq encoder by first defining a basic LSTM using the Basic LSTM Cell library of tensor flow. A dropout of 0.5 is applied on the LSTM cell, and then the LSTM cells are composed sequentially using the Multi RNN Cell function of tensor flow. The sequential LSTM cells are then used in both forward and backward directions using the bidirectional dynamic RNN function to generate the encoder state and encoder output. Finally, the decoder input layer, the encoder's final states, the decoder outputs from the decoder's dense layer, and the decoder output states that the network memory is from one term to the next during the network. Now can put all this together and configure the decoder model as shown below. Finally, define a program that recognizes our text inputs and uses the encoder and decoder we've developed to produce a response. Pass the NumPy matrix representing the text sentence to the function and get the generated answer back from it.

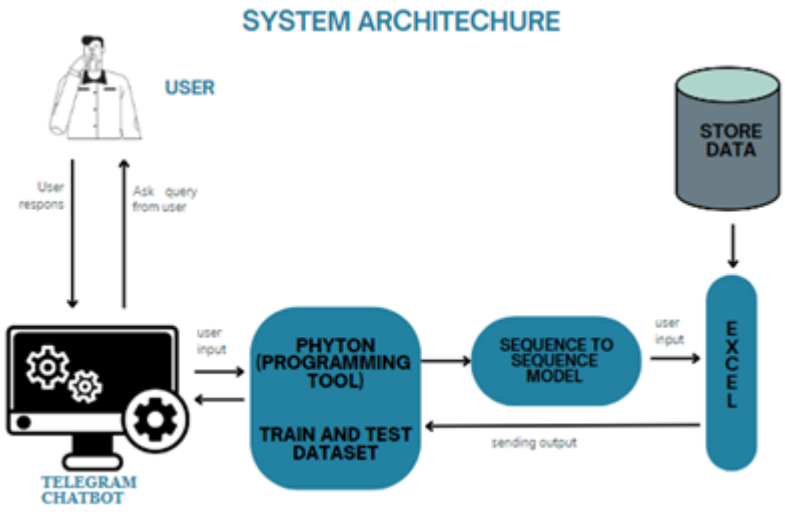


Figure 3. The system architecture for the implementing basic php enquiry chatbot

System architecture in figure 3 provide the structural overall of the project. The aimed user for this project is the students or any individuals who are interested to learn the basic php variable. The system begins when there is an input from the user; a question asked by the user regarding php variable. Two-dimensional string arrays are constructed to store demand and responses. These demand and responses are stored in rows in those arrays. Even rows are used to store inguiries or questions from users and odd rows contain answer/s. Columns in the list are used to save various types of user questions and answer that a Chatbot able to response. In that list, there will be a row containing default answers that are used when the corresponding query do not contain in the array. The role of phyton in the system is for the development and experimentation of the project.

The details of hardware and software used in the development are listed in the Table 1.

Table 1
Software and hardware used in the project

Software	Specification
Programming Editor	Phyton
Programming Tools	Anaconda Phyton, NLTK
Messaging App	Telegram
Storage data	Microsoft Excel 2019
Hardware	Specification
Mobile device	Android, IOS, Windows 10

The aim of this project is the conversational chatbot on messaging application, the telegram. At this moment, telegram application was chosen because it can interact flexible interfaces, from smartphones to pcs. The constructed bots in telegram also do not require a phone number to set up. Telegram will become the intermediate between users and bots, which the bots will process the inquiries from the users as input data and users will receive respective answer of the inquiry (Nizomutdinov, 2023).

The data used in this project is the dummy data, initially includes some basic important questions such as, ' What is php?', 'How to connect php and MySQL', 'What is advantage of php and many more. There are 75 questions in total.

Table 2
Sample of dummy data collection

Question	Answer
What is php?	Php is an open-source, interpreted, and object-oriented scripting language that can be executed at the server-side. Php is well suited for web development. Therefore, it is used to develop web applications.
Advantage of php?	Open source: It is developed and maintained by a large group of developers to help creating a support community and abundant extensions libraries. Speed: It is fast because it uses fewer system resources. Easy to use: It uses C like syntax, hence it is easy to pick up and easy to create websites scripts. Stable: Since it is maintained by many developers, bugs are rather found and fixed quickly, making it a stable software. Powerful family support: you can easily find functional modules you need such a PDF, graph and etc. Built in database connection modules: You can connect to databases easily using php, since many websites are data/content driven, so we will use database frequently, this will largely reduce the development time of web apps.
Connect php with MySQL	<?php $host='localhost:3306': $user=''; $pass=''; $conn=mysqli_connect($host, $user, $pass); If(!$conn)

	{
	Die('Could not connect: ' .mysqli_error());
	}
	echo 'Connected successfully';
	mysqli_close($conn):
	?>

Further system's flow is described using the following hierarchy. The purpose of the system flow hierarchy is to make a clear understanding of how the systems works, in the aspect of implementation and development. It depicted the general overview how the system deviate user input from the inquiries and chatbot output as the responses.

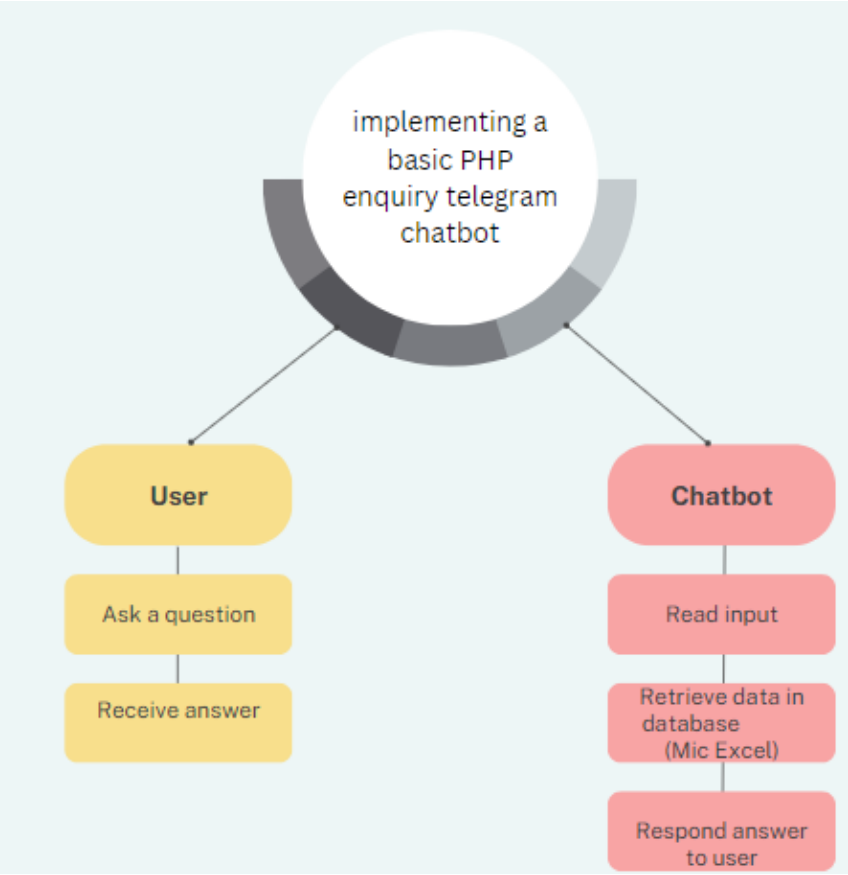
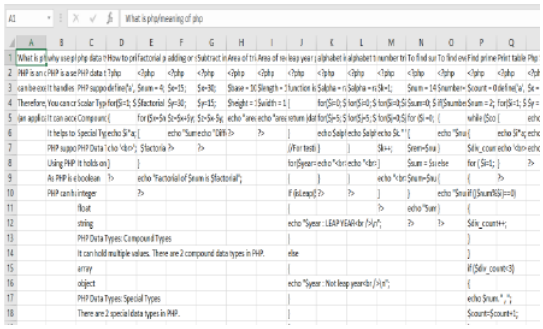


Figure 4: System flow hierarchy

The system created in this project has two types of user interaction. First is a chatbot administrator and second is a chatbot user. Chatbot user interactions are done by giving out answers based on the chat sent by the users. The replies are in the form of actions created in the action set.

Project Implementation and Development

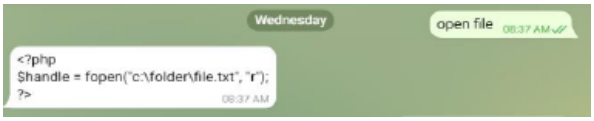
There are six phases in project implementation and development. Data collection, display answer, integrate phyton and telegram, display answer in telegram, chatbot implementation and creating telegram chatbot.



Phase 1

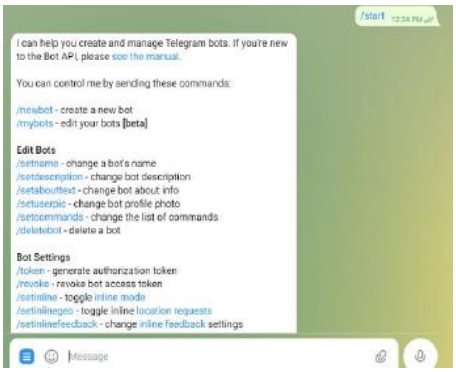
Phase 2

Phase 3



Phase 4

Phase 5



Phase 6

Figure 5: Six phases of project implementation and development

Data collection phase will update answers in database (Microsoft excel 2019). Data was collected from related websites that have the information about php. Python and excel are used to view answer for the user. At this phase, it will display all the data that have been entered in responses to the user's question. To stimulate the conversation, the instruction begin with command 'BotFather' in the telegram search bar and click the start button. Type "/newbot", create our user name which end with 'bot'. Later, a message that contain API will be given as in phase 3. In phase 4, phyton, Microsoft excel and telegram were utilized of sending the answer to the user. The response will be delivered based on the keyword used by the user. The heart of the project lies in the phyton programming language as part of the setting the telegram bot by using the telegram bot API. Then, it can be integrated with the telegram services. Last phase is creating telegram chatbot which the developer can follow the three steps. Step 1 is to enter @BotFather in the search tab. Step 2 is click on the 'BotFather' and type /newbot. Step 3 is to give a unique name to our bot. The BotFather will ask for its username and very important our unique name must end with the 'bot'.

Result and Discussion

The end product of this project is the telegram bot build to help student learning php programming. Thus, testing process is required to check the system's functionality. Functional testing are used in this project to secure the system run as it should be. Functional tests are also used to validate the output of a software application by giving adequate input and

comparing it to the functional requirements. It means that, it can be used as a basis for improving the system fully (Aisyah et al, 2020). In addition, the testing is a platform to verify the software system meets the functional requirements and specifications in the source code.

The environment in testing includes the device used and the success of deploying Basic php enquiry chatbot in telegram web and telegram apps. All tests were executed using two different web browser described in the table below.

Table 3
Testing environment

Web browsers	Security	Features	Speed
Telegram web	High	Max	Fast
Telegram app	High	Max	Fast

Table 4
Functional Testing

Module	Test expectation	Result
Users	- Able to ask question in telegram web	Yes
	- Able to ask question in telegram app	Yes
System	- Able to reply in telegram web	Yes
	- Able to reply in telegram app	Yes

The project underwent functional testing to ensure that all of the application's functions perform in good order. The project's features were tested on different web-based which were telegram web in browser and telegram apps in smartphones.

Conclusion

Implementing a Basic Php enquiry Chatbot is a web-based application especially targeted to student who needs help in php query. It is proposed to assist students in better understanding the subject. The developed chatbot is beneficial in giving immediate response, round the clock engagement with students which can motivate and encourage students to have independent learning at their convenient time. This web-based chatbot was developed with the goal of offering students with an easy method to clear up student uncertainty and aid in the ongoing development of knowledge in the php field.

Acknowledgments

The authors would like to thank the Universiti Teknologi MARA Cawangan Perak and the Faculty of Computer and Mathematical Sciences for the supports and facilities provided in the completion of this project.

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