

# Artificial Intelligence Chatbot Advisory System

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**Abstract:** A chatbot is an intelligent agent that aims at providing a better, easier way to handle activities through smartphones or PCs by simulating the interaction between humans and machines. Chatbots can be deployed on various platforms such as social media applications, web applications, or websites. This project is designed to simulate communication between user and system using natural language processing with python programming and also to provide easy access to information that they would traditionally have to seek through confrontation or handbooks, simply by sending a text message. The motivation behind this work is to have a more direct, automatic way of getting information, to overcome the pitfalls of manual book searching and physical meetings. These existing methods are not very efficient and are usually time-wasting. Analysis of existing methods and related acts enabled the requirements of the specifications to be gathered, and this initiated the design and implementation of the project. The project was developed using the Agile methodology. Artificial Intelligence technology and modern internet technological tools which included NLTK-model (natural processing algorithm model), Sentiment Analyzer model, and Python programming language, respectively. This system was tested for accuracy, and human-interaction likeness. It is deployed on the Telegram messaging app, through Telegram API keys obtained on Botfather. The system effectively responds to queries and on time.

**Keywords:** Chatbot, Machine Learning, Natural Language Processing, Conversational Agent, Artificial Intelligence

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## 1. Introduction

The traditional method of information enquiry has been to consult with course advisors or other lecturers for answers to important, yet commonly asked questions. Questions like, how the cumulative grade point average is calculated and so many others, thought to be common knowledge to the students. Another way sort to ease this process is by having a printed handbook containing answers to these frequently asked questions. These handbooks are distributed once registration into a department is finalized and is expected that every student go through it from time to time, when they need information to formulate plans or strategize for the semester, but students do not seem to have the capacity to focus on books or make the time to meet with their course advisors for guidance [1]. Inherently, this affects the performance of the student at the end of a

semester, due to poor planning or miscalculations. Students with carry overs or spill-overs cannot properly plan their schedules with not enough information and so become lazy until the very last minute. The issues here raises three major questions;

How does this affect the department? The grade performances of each student has shown to affect the success rate of any department in a tertiary institution. The department would, therefore, want to boost the factors that would lead to maximizing student performances.

How does this affect the student psychologically? It may seem rather small of a problem, and occasionally, it could be termed as laziness from the students, which would be correct, but from answers gotten during data collection, it would seem that at least 60% of the people, in different situations in

the department claimed that they would have acted differently had they gotten the correct or complete information and on time too.

How can technology help? Supposing the suggestion of using computers to reach students and deliver more information to them, in a bid to extricate all excuses for poor planning, the system will not be without requirements, such as how best to move ahead with this? Would the system be able to learn from input? Could it simulate interaction while relaying information?

Introducing a virtual chatbot assistant capable of receiving inputs and generating outputs at any time by simply learning from the inputs and understanding the natural language, in order to present the correct output in the same language [1].

This project aims to use Artificial Intelligence concepts to stimulate lecturer-student conversation and at a quick response rate, so as to reduce time spent on seeking information.

Chat bots are becoming an integral part of service provision around the world [2]. Various companies, business platforms, medical services acknowledge the widespread of intelligent chat bots as they take on different levels of functions and activities, which in turn improves productivity, customer validity and care. Bots have come a long way in making our life easier in many ways and ensuring the interaction with the machine is evolved, interesting and contextual. With accelerated digital transformation and changed consumer behavior, we only see faster adoption of both the automation and conversation bots in times to come. [3]. Like most chat bots, this bot will be developed using artificial intelligence technologies such as machine learning, natural language processing algorithms and training the language module.

Machine learning, natural language processing, both processes enable automation of even complex tasks by understanding any type of unstructured data from any type of document, extracting the data, classifying the information and bringing empowerment in decision making [3, 4].

Chat bots seems to hold tremendous promise for providing users with quick and convenient support responding specifically to their questions. The most frequent motivation for chat bot users is considered productivity. It has been proved that productive and effective time management is important to increase functionality and event executions.

The increasing progress in Artificial Intelligence and respective machine learning technology has fostered the proliferation of chat bots to the point where today they are being embedded into various human technology interaction tasks [5]. Repetitive tasks such as visiting course advisor or lecturer to handle mundane things like asking frequently asked questions can be done simply by asking a chatbot, this saves time and cost and almost an existential dread of not getting enough information. This reasonably may increase the productivity of the student using the chat bot. The application of a pro active chatbot on students, may also

inspire the student to take a flyer with idea, acceptance, understanding and development of new, helpful technologies that boost efficient time, productivity and active participation in the work ahead or at hand. This will in turn instill in them the eagerness and passion for solving real time problems with technology.

This project AI chatbot is an example that shows that FAQ and short response chat bots do provide a variety of enhancements for students learning and education for content delivery. One of which is to create awareness and interest for developing software to enhance human to computer interaction.

## 2. The Concept of Artificial Intelligence in Management

Without a doubt, the evolution of Artificial Intelligence (AI) fosters improved growth and effectiveness in the management of time and productivity in the workplace. A review article from the Harvard Business blog did note that “the rising technological faith in Artificial Intelligence has given it the freedom to spread past conventional manufacturing functionalities to very humanitarian fields like education and management of work time and load. Many alarms have sounded at the potential for Artificial Intelligence (AI) technologies to upend the workforce, especially for easy-to-automate jobs [6]. The advancement in Artificial Intelligence (AI) is surging and it is at the center of improved output consequent to the advancement in the science of AI that human-to-machine interactions are facilitated. The idea and actualization of AI, have undoubtedly improved the living standards of humans and society. Business models and logic may vary but the lifestyle as well as the living standards of humans, has changed [6, 7].

Despite its success and technological advancements, AI is not a very trusted side of technology, due to many factors that range from ignorance to misinformation. More often than not, AI is regarded as a sketchy area of technology. It is not without its fair share of streamlined descriptions and hazy assumptions [8].

The divide between users and machine usually borders on misunderstanding and risks. The risk implications of AI vary and it's dependent on the degree of its usage. Rao did point out that the advantages of AI outnumber the risks it conveys, particularly in the world of business usage and its applications resulting in a world that is innovative and smarter. Technically speaking, AI is a necessary evil. It is paramount in this digital age to and for the future of firms. It will have varying degrees of effect on management [9]. AI technology will discharge managerial assignments challenges. AI can speed up decision-making, bringing more complex problem solutions and more biased data analysis to the boardroom than would otherwise be possible, all while maintaining creativity [10].

## 2.1. Conversational Artificial Intelligence

Artificial Intelligence is a very modern and interesting part of the technology field, as it explains how humans can go beyond very basic machine manipulation to the most advanced concept that involves understanding and interacting with machines, that have the potential to mimic human thinking and logic formulations. From smart calculators to smart refrigerators, AI is slowly and eagerly embedding its roots into automation of all kinds. One important factor of AI is the idea or simulation of human interaction from a computer or machine, usually termed as smart devices. Devices use AI to simulate conversations and interact with humans through an understanding built on NLP processing and algorithms [11]. Conversational AI integration is roaring high in the almost every area of human interaction. It includes core components that allows it to process requests, understand them and respond in a way a human would.

Machine Learning is a core component of conversational AIs as it is a field of AI that includes the algorithms, features and data sets that self learn, that means, they are programmed to improve their knowledge from learning from existing or previous events or requests. This is a process backed by Game Theory, where an optimal solution is based on previous event models. As the input grows, that is as more requests are made frequently, the AI device gets better at predicting the next event from recognising and studying patterns. Machine Learning is a very important aspect of AI, as it explains how a smart device can make decisions and predict future events.

Resurging interest in machine learning is due to the same factors that have made data mining and Bayesian analysis more popular than ever. Things like growing volumes and varieties of available data, computational processing that is cheaper and more powerful, and affordable data storage [12]. Machine Learning is studied and researched due its many benefits, and applied in almost all sectors of human resources, like in medical research, scientific studies, businesses, education, literally anything that has to do with data can integrate the processes of ML in order to automate and effectively implement successful predictive algorithms. The possibilities of Machine Learning are extremely transformative. Organizations may soon find themselves dependent on Machine Learning technologies for making decisions based on core business processing and automation [13].

Another key component behind the brilliance of AI is the language processing. Natural Language Processing techniques and algorithms allow a device or system to be able to "interpret" human language, to computable codes for the system to understand and respond in the same human language so they humans can understand. This is a groundbreaking work in technology, as we've evolved from understanding machines, to machines understanding us. High level programming languages like JavaScript or Python do a fraction of machine understanding because they are compiled

to transform any line of code into low computer level language, for that code to run.

NLP does a lot more, as it introduces algorithms that can make a system understand a human user, without the use of a programming language and such system can communicate or respond in the same human language as if it were just another human. NLP make uses of two phases, the first being the data preprocessing phase, where the data in the language module is prepared or cleaned for an algorithm to work with [13, 14].

Although NLP feels like a done deal and it is incredibly important and useful, it is not without a few challenges. The human language is not one language, there are more than 7100 languages spoken in the world today, this is a challenge in NLP because trained language module are usually trained in the popular languages. The Igbo Language for example, has no trained language module, to create a device that can listen and respond to requests in Igbo will require a developer to train a new language module and the task can be quite daunting.

Other challenges in natural language processing frequently involve speech recognition, natural-language understanding, and natural-language generation.

The benefits of conversational AI is concentrated on how fast a device can process an input and deliver an output, and how easy it is to automate a lot of menial processes that would have usually required more time and efforts. Conversational AI and Automation are no longer buzzwords. They have changed into undeniable and demonstrated business methodologies, one that can be utilized for numerous touchpoints in customer journeys. Also, when you examine intently, the advantages are clear – high-caliber, steady, and personalized customer service experiences alongside increased income and backing proficiency. Conversational AI can rapidly streamline support infrastructures with the assistance of self-service portals for clients. This normally prompts quicker query resolutions, sparing endless long periods of support agents (and reducing the associated costs) [15].

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## 2.2. Related Works

Chatbots, also known as chatter bots, is a form of Artificial Intelligence (AI) in messaging apps. They are conversational software agents developed to simulate communication. Chatbots are being considered as useful technology to facilitate learning within the educational context.

“Chatbots tend to operate in one of two ways, - either via Machine Learning or with set guidelines, although the latter is not almost a historic footnote”, as stated in an article on Investopedia, “the progressive advance of technology has seen an increase in businesses moving from traditional to digital platforms to transact with consumers [18, 19].

The first chatbot is said to be a software program called ELIZA [20] which was developed by a MIT professor, Joseph Weizenbaum in the 1960s. ELIZA's key specs were the ability to recognize certain key phrases and respond with open-ended questions or comments. ELIZA was developed primarily as an interactive device to serve as a sort of therapist that could listen to people's problems and respond in a way that makes them think the software understood and empathized with them. Today, companies and businesses develop chatbots for different reasons, with the goal to manage time, resources and customer relationship. In 2019, consumer retail spending via chatbots reached \$2.8 billion. By 2024, that number is set to increase approximately 500 percent to \$142 billion. This shows that more and more people are actively using chatbots to make things easier for them.

UBA Leo [12] as a faster easier way to enable customers to make use of their social media accounts to carry out key banking transactions with ease.. Pan-African Financial Institution, United Bank for Africa (UBA) Plc, changed the face of e-banking in the African continent for the first time with the introduction of LEO - UBA'S chat banker (Oluchi Chibuzor for thisdaylive blog, 2020). It is reported that customers can use LEO to perform

operations like opening new accounts with ease, receiving instant transaction notifications, check their balances on the go. Transfer funds and airtime top-up. Also, cheque confirmation, bill payments, loan application, account freezing, request for mini statements, flight bookings, airtime and data purchases, basically all processes and purchases that would have normally required a customer to physically transport themselves to the bank's nearest location to do any of these tasks. Leo uses AI technology to converse with customers and respond to user requests with ease and within seconds.

Flo Chatbot [21], a popular period-tracking app that is very popular among women, especially those within that have begun their menstrual periods. With over 230 million downloads of the app, according to Flo Health. Three out of five women have it installed on their smartphones. It works using predictive modeling techniques to map past inputs and events to predict the next menstrual cycle of the month of a user. The application is estimated to be 80% accurate each time. Embedded in this application is a chatbot that acts like a sort of health expert. This chatbot advises on proper healthy behaviors during and after menstrual periods, educates on various female health issues and benefits, predicts pregnancy possibilities, and gives advice on any issue, related to female health and it is based on the user inputs. Flo does have a privacy discretion that points out that the pieces of advice given are not from a medical doctor, though they are based on knowledge gotten from medical research and would advise users to seek medical help, just in case.

COVID-19 has negatively affected the sports industry. Now, injured athletes who need treatment may not get assessed and receive medical care quickly. This may lead to the worsening of their injuries. The pandemic has also affected students who aspire to become athlete's trainers that specialize in treatment for injured athletes. A framework [22] was presented for a mobile application with a chatbot that gathers necessary information from injured athletes who require medical attention as well as performs contact tracing during the pandemic. Athletes and trainers will interact with a chatbot named Athlete Trainer Bot (ATBOT). ATBOT assesses injuries and a suitable rehabilitation plan will be provided by the athlete trainers through the mobile application.

Apple's Siri [23], an Apple's smart virtual assistant isin-built and predominantly voice-activated, but a user can activate Siri by simply by long pressing the home button for the button version iPhone and the power button for the other versions. Siri is more than a chatbot, though, it is like having an assistant on your device that makes certain things easier. Siri makes use of an advanced level of NLP processing to understand human languages. Siri's Machine Learning techniques and algorithms enable it to predict excellent events from previous requests. There's a huge amount of work in Siri that can predict what you're getting at based on keywords that you use, as well as your general habits and language choice. She is designed to adapt to your individual preferences over time and personalize results. Siri is so clever,

and it interacts like it's another human at the other end. It also can laugh and makes jokes, meaningful thoughts, and reactions to vulgar statements or words deemed popularly negative or offensive. Siri can access all the apps and services of the device.

### 3. Analysis of the Existing System

All enquiries made to the department are done manually or in person (face-to-face). Students are expected to direct all their questions to course advisors, course representatives, other lecturers or consult the handbook for further enquiry or in the absence of all the aforementioned people. The handbook is a piece of document given to each and every student upon registration into the department. This is the procedure that is observed in every department as a way of giving all information required to students.

On the surface level, these methods are temporary fixes and they work to an extent, but when certain factors such as time, resources, distance etc, start to play into the mix, these methods crumble and do not prove effective anymore.

Upon observation, it is clear that the students are not readily accepting of the physical book approach. This does not mean they do not imbibe the culture of reading, but rather that they do not usually consult the book when searching for answers. They would rather want something more direct. Sometimes the problem is the unavailability of the books. The books can get missing or ruined by unforeseen accidents. The department tried to curb this by introducing the digital copy of the book. This solution is okay but then it poses another challenge, which is that students still find it difficult to use the softcopy version, as it is not very easy to navigate.

This makes students seek for the attention of their lecturers and course advisors. Students have to book appointments in order to see them or hear from them. The lecturers all have busy schedules and sometimes do not have the time to meet up with students to discuss or answer their questions. When they do fix a time, it either happens or it does not. The students are either made to leave lectures to meet up with that time because that may be the only available time for the lecturer to meet them. Most of the questions asked are often commonly asked questions that repeated over and over again. The lecturers have to deal with their workload and cater to the likes of not just one student, but many students.

Students have a schedule and it is mandatory for them adhere to it. That means more times than often, students leave their functions to meet up with lecturers and still miss them. They spend time and resources to have answers, which causes them to disrupt their schedules.

Also, what is said to one is not what is said to all. There is also the factor of how correct these answers are. Sometimes

the information can be outdated or not tally with the current process, for example, a student that has no idea how much the department dues cost or the procedures for paying it, may be told by a friend or a someone else that department dues cost 2500 naira and then upon getting to bursar's office, will find out that it actually costs a lot more than that. Information is revised and updated, that is a fact, but it is not often circulated well. In order to, it may require reprinting the handbook again and redistributing it. All of which takes a long time and a whole lot of resources.

Therefore students, lecturers and everyone that is directly involved in this current approach, need a better way of getting information that is guaranteed to be correct and up to date. The department of Computer Science of FUTO, require an automated system that simulates this enquiry process, and provide a centralized means of storing information, that allows for easy updating with new details.

There is not enough information passed around when need be. It is hectic having to answer repetitive questions or cater to the same requests or processes daily.

Some problems that exist with the current system include:

- 1) Students have to physically set up meetings with lecturers or course advisors, just to get answers, forfeiting an entire day to this single act.
- 2) The process of getting information is unnecessarily long and stressful on the students.
- 3) There is a lot of time and resources wasting.
- 4) Lecturers and course advisors have to come in on a day off or a busy day, just to handle the same questions or processes. This is not very productive.
- 5) The processing speed of information is slow and hindered by when the time is taken to get the answers or update the existing information.
- 6) It leads to lots of bad and messy decisions being made due to poor planning.
- 7) Inconsistency, which is due to misinformation or outdated information.
- 8) The process is so long, it makes some students not want to do anything, thereby making them lazy.

### 4. Artificial Intelligence Powered Chatbot Advisory System

The implementation of the design phase using the framework of choice which is Python is deployed. The chatbot is deployed on Telegram through long pulling and API calls.

#### 4.1. Creating the Agent

An agent is an intelligent component of a chatbot. It is the part that interacts with the user. An agent called CSCBot is developed, the figure below shows this.

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1  import Constants as keys
2  from telegram.ext import *
3  #import Responses as R
4  from textblob import TextBlob
5  from chatterbot import ChatBot
6  from chatterbot.trainers import ListTrainer
7  import os
8  import logging
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Figure 1. Maintrained.py file creating the agent (bot).

Here, the chatbot library is imported on the mainTrain.py file. This is the file that calls all other files through inheritance, an aspect of Python OOP. In the mainTrain.py file, a log session is created by importing the library. It is a library that lets python log the interaction that happens when using the program or chatbot. The ListTrainer library feeds

conversations to the chatbot. The function start\_command starts the initial conversation text “Type something to get started”. This message is what the user sees when the bot is started. It takes in two parameters (update and context), the chatbot uses a process called long pulling to carry the contents of these parameters during API calls.

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Figure 2. Screenshot of Code handling the longpulling API calls.

When a user sends a text to the chatbot, the chatbot checks for sensitivity and polarity in the text. This is done using a conditional statement, *if, elif, else*, to check if a statement sounds or looks anyway like a negative comment or a sensitive remark; if *sentiment.polarity < 0*, the chatbot sends a default message, warning the user to change the words.

All of these processes are handled in the *handle\_message* function. A *textblob* is the space that the text is sent by either

a user or the chatbot.

#### 4.2. Training the Chatbot with the Corpus

The chatbot is trained with a corpus, which should not be confused as the one that is used to store messages that do not have replies. This corpus handles the conversations from the chatbot. The code below reads through the corpus because it is in a file like format and trains the chatbot with the data in the corpus.

```

for files in os.listdir(r'C:\Users\DELL\Desktop\CSCBot\cscbot_code\theola\telbot\english'):
    if files == '.DS_Store':
        pass
    else:
        data = open(r'C:\Users\DELL\Desktop\CSCBot\cscbot_code\theola\telbot\english/' +
files, 'r').readlines()
        trainer.train(data)

```

Figure 3. Screenshot of training set in the corpus.

```

def sample_responses(input_text):
    user_message = str(input_text).lower()

    if user_message in ('hello', 'hi', 'sup', 'good day', 'whatsup'):
        return "Hey how's it going today? \nHow can i be of help?"

    if user_message in ('who is the vice chancellor of the school?', 'who's the vice chancellor of the school?', 'who is the vc of the school?', 'who's the vc of the school?'):
        return 'Prof. (Mrs.) Nnenna Nnannaya Oti (2021-Date)'

    if user_message in ('who is the dean of sict?', 'who's the dean of sict?', 'who's the dean of sict', 'who is the dean of sict?'):
        return 'Engr. Prof. (Mrs) Gloria A. Chukwudebe'

    if user_message in ('who is the head of department of computer science department?', 'who's the head of department of computer science department?', 'who is the head of department of computer science department?', 'who's the head of department of computer science department?'):
        return 'Dr. (Mrs.) Juliet N. Odii'

    if user_message in ('what are the departments in sict?', 'what are the departments in sict?'):
        return 'The departments in SICT include: \nComputer Science, \nInformation Technology, \nCyberSecurity, \nSoftware Engineering.'

    if user_message in ('what does sict stand for?', 'what does sict stand for'):
        return 'SICT is an acronym for School of Information and Communication Technology.'

```

Figure 4. Intents.

### 4.3. Creating Intents

The chatbot uses intents to understand what the user wants or is asking for. The chatbot is trained with all the data gotten during data collection, which is considered the intents of the chatbot. A python file, Response.py is created and the responses and data are typed in in a fuction which is called in the mainTrain.py file. Below shows the some of the functions that holds the data, manually used in the training of the chatbot.

### 4.4. Deployment on the Telegram Platform

This section explains how the chatbot is deployed on telegram. In order to use the Telegram API keys, it has to be applied for, which for this project was done on botfather. Botfather is used to generate the Telegram API keys as well as the bot profile and its description.

In the text editor (VS Code), the API keys are interfaced with the code where queries are sent using the Telegram package. The keys are used to fetch reseponses using the package. The query and constants are collected a response is returned. The API keys are provided to the Telegram SDK which automatically reflects everything on the Telegram interface.

```
c1oud4o4@derricks-MacBook-Air telbot % python3 chatbot\ train.py
[nltk_data] Downloading package averaged_perceptron_tagger to
[nltk_data] /Users/c1oud4o4/nltk_data...
[nltk_data] Package averaged_perceptron_tagger is already up-to-
[nltk_data] date!
[nltk_data] Downloading package punkt to /Users/c1oud4o4/nltk_data...
[nltk_data] Package punkt is already up-to-date!
[nltk_data] Downloading package stopwords to
[nltk_data] /Users/c1oud4o4/nltk_data...
[nltk_data] Package stopwords is already up-to-date!
List Trainer: [#####] 100%
c1oud4o4@derricks-MacBook-Air telbot %
```

Figure 5. Screenshot of Model Training.

Figure above shows the training process of the proposed chatbot. A query is sent to the corpus which is sent to the NLTK model which tokenizes the words through a process known as tokenization. This breaks the query into understandable formats called tokens for the chatbot model to read. The tokens are sent to a text blob in the sentiment model, which checks for sensitivity and polarity, after which determines which appropriate response is suited for the query.

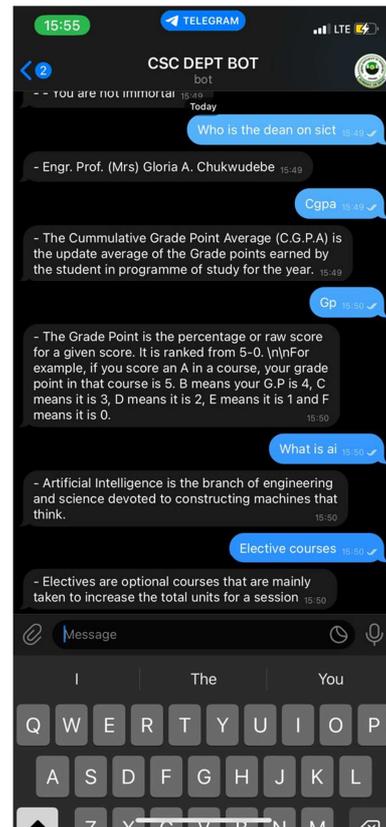


Figure 6. Screenshot of CSCBot answering questions mobile view.

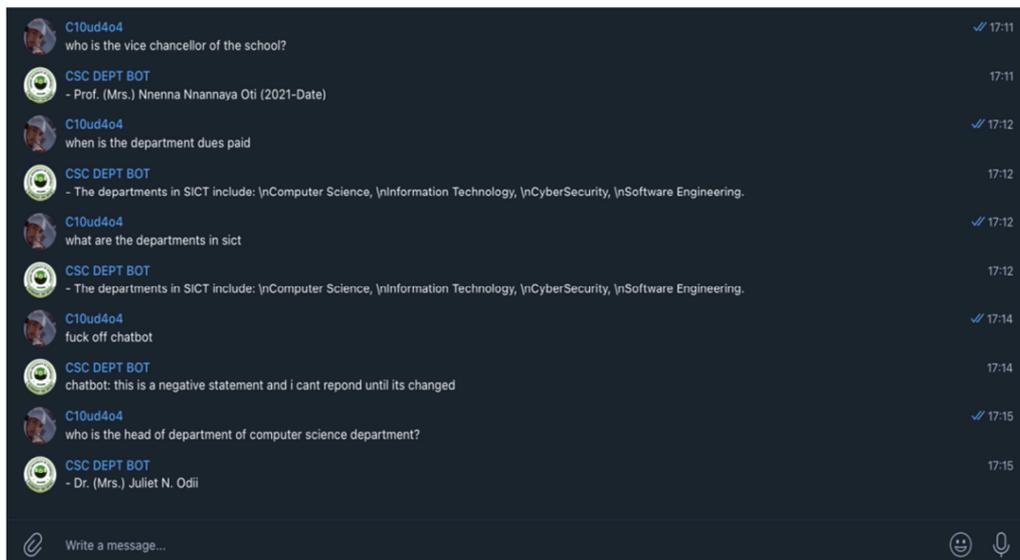


Figure 7. Screenshot of CSCBot answering questions.

## 5. Conclusion

The project's primary aim was to develop an automated system for handling FAQs for both students and lecturers to make use of via smartphones or PCs. The project was deployed on a social messaging application called Telegram and can be accessed by anyone with access to a Telegram app. Furthermore, with a proper analysis of the proposed system, it can be concluded that the chatbot is effective, and accurate and meets the minimum standards and expectations of smart AI-powered software.

In conclusion, this project is effective in performance, accurate and quick in replies, and ready to be used by anyone with access to the Telegram application.

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