Artificial Intelligence Approach for Covid Period StudyPal

Madhumita Venkataraman[1], Hemashrree J[2], Sudharsan V[3]

[1, 2, 3]First Department of Information Science and Engineering, Kumaraguru College of Technology
Coimbatore, Tamil Nadu, India

---***---

Abstract - *With the dawn of a new era where the world is dependent on digital platforms to carry out the most basic day to day tasks. Many industries have been transformed like never before. One such industry that has been constantly putting the efforts to make technology more accessible to everyone is the educational industry. There are close to 1.29 billion students around the world who faced a very confusing and tough situation during the COVID period. While systems were trying to make education more effective and reliable, students were having a hard time adapting to this new normal. They were faced by various challenges like lack of a proper network, lack of the right electronic devices, not being able to communicate effectively and many more. We would like to propose a bot named Study Pal that will accelerate the learning experience of students. Students can learn from their prescribed curriculum by invoking the bot with the grade they belong to followed by the subject name and chapter. The bot's success lies in completely educating a student without the interference of any external factor. The bot will be able to keep track of the students' progress and works on techniques like active recall, mind - mapping, etc. Another goal we envision to achieve is to make this ML model by the implementation of federated learning. A central cloud would exist and the ML model will be downloadable at various users' devices. There the ML model will be able to acquire the training data required for the model to learn, sending only the updated ML model to the cloud. The ML model will be democratic and will use a combination of 3 or more algorithms to get a high accuracy. A federated learning model will aid in maintaining data privacy and will also resolve the issues of bad networks or lack of a Wi-Fi network all together. The bot will provide one-on-one sessions essentially providing individual attention resulting in effective communication and understanding of concepts.*

*Key Words***:** *Bot, Federated Learning, Democratic Model, Machine Learning, Deep Learning, K means clustering algorithm, Python.*

1. INTRODUCTION

Artificial intelligence has recently advanced to the purpose that it will currently be employed in a range of fields. One such space of application is teaching with the assistance of technologically advanced bots; however, the bots are a posh and superimposed technical being that require to be additional researched to make and comprehend. because of the interclass commonalities and uneven intraclass characteristics, bots deployed for instructional help cause major hurdles. because of the Brobdingnagian diversity of the area, selecting the proper knowledge grouping and have illustration technique is very critical. These bots were created to produce sensible education system and super artificial intelligence; however, the up-to-date condition was created for little datasets and restricted classrooms. one amongst the key problems with existing machine learning techniques is that the matter is three-dimensional in nature and contains goodish hyperdimensional features. important analysis has been done on the development and study of predictors for multidimensional characteristics that require heaps of process resources to optimize. several machine learning techniques, appreciate Support Vector Machine (SVM), K-Nearest Neighbor (KNN), call Trees, Artificial Neural Networks (ANN), and Convolutional Neural Networks (CNN), are used with many various feature description strategies for instructional bots in a variety of real-world applications in recent years.

2. LITERATURE REVIEW

[1] A large variety of industries use applications enabled with intelligent bots to bolster users. In most cases these systems are deployed with bots that proactively monitors user requests giving solutions inside short periods accurately. This paper primarily deals with the creation of a Chatbot model within the instructional world: a system was created to help university students in sure courses. the most goal was to style an efficient architecture, a framework for establishing communication, and applicable replies for the pupils.

[2] The purpose of this research is to develop an automation process for the schooling system that can answer a user's question in place of a human. It's capable of answering any question provided by the user. Current bots such as Facebook's chatbot, WeChat, Hike's Natasha, Operator, and others were using local databases to respond. However, we are focusing on both the local and web databases, as well as making the system scalable, user-friendly, and highly interactive. Machine learning, natural language processing (NLP), pattern recognition, and data processing algorithms are used in this research to increase the system's performance.

[3] Although there has been a surge in desire for social bots, and human–chatbot interactions (HCRs) have become more popular, little is understood about how HCRs emerge and how they may impact users' broader social environment.

The authors of this paper used Social Penetration Theory to interview 18 people who had developed a relationship with a social bot called Replica in order to truly comprehend the HCR development process. Because of the consumers' interest, they realized that HCRs have such a deceptive element at first. The evolving HCRs are distinguished by extensive affective exploration and involvement as users' faith and engagement in consciousness rises.

[4] In the banking industry, chatbots are gaining traction as a vital instrument for digitalization. However, the majority of the studies have focused at chatbots from the customer's perspective and developers, with relatively few looking at bots' products from the employer 's point of view, who play a vital role in the deployment of chatbots in enterprises. In order to fully understand the advent of financial chatbots and forecast their prospect in South Korea, where financial institutions have made massive use of chatbots, this study will look into managers' perceptions of them. They conducted nearly fully interviews with supervisors of chatbot products in Korean financial firms using a core–periphery approach of social representations.

[5] In recent years, chatbots have gained popularity across a wide range of industries, including health care, marketing, education, support systems, cultural heritage, entertainment, and many more. The purpose of this article is to develop a specific framework, a methodology for managing discussion, and provide appropriate responses to students by creating a Chatbot model in the educational field. A system has been built for this purpose that uses artificial intelligence techniques and industry ontologies to recognize questions and offer answers to students. Finally, following the implementation of the planned model, an experimental campaign was conducted to demonstrate its utility.

[6] Econobox, a virtual assistant in the form of a chatbot or conversational robot, was crafted available to students in 2017 as part of the authors' ongoing automation of material and components for learning and digital education of an intro to Microeconomics at the National University of Distance Education (UNED). This study discusses the reasons for its adoption, the two-phase development process, its traits and functions, the assessment of its effectiveness, and the involvement of educators of this type of technological innovation.

[7]   Chatbots are increasingly being used in a wide range of online applications, with the majority of them used for retail or as an assistant. Personalization and speedy access during all times of the day, throughout the year are some benefits of these chatbots. Chatbots' advantages can be beneficial in the academic sector. They represent a new type of human-machine interface in natural language. Chatbots, on the other hand, have received only intermittent emphasis in academics, for example, by assisting with study, course, and test organization.

[8] It is impossible to overestimate the importance of spoken and written information in human communication. Per an article in "The New York Times," individuals now devote more than 8 hours per day staring at screens on computers or smartphones. As a result, the majority of human contact takes place through web programmes such as WhatsApp, Facebook, and Twitter, among others, as a form of speech and textual dialogue. The purpose of this work is to design a textual communication programme, specifically a chatbot, for usage in the educational domain. The suggested chatbot supports users in addressing their questions. We used a random forest ensemble learning method in the presence of extracted characteristics from our provided dataset to construct the system.

[9] Chatbots are conversational systems that can automate human-to-human chat exchanges. It's being designed as a voice assistant that will attract viewers by, among other things, answering inquiries, giving driving directions, and functioning as a human companion in smart homes. In order to get the required responses, most chatbots use artificial intelligence (AI) algorithms. In this paper the architecture of a University Chatbot that responds to user enquiries concerning university information in a timely and correct manner. This is the first University Chatbot for inquiring about school information in Myanmar, and it uses Pandorabots as an interpreter.

3. PROPOSED SYSTEM

Chatbots concentrate on discourse and discussion, striving for agent interaction patterns that are comparable to those used by humans. Chatbots must be able to analyse the context and offer solutions to issues, interpret emotions, and act appropriately or contribute to the learning process through dialogue. We have planned and constructed an educational chatbot with this goal in mind, with the goal of teaching primary school pupils (ages 4–10) the English language as well as a few rhymes.

Students are introduced to StudyPal, a chatbot that acts as a tutor in a theatrical capacity to better engage his or her students. StudyPal teaches without the help of a human instructor. Students conversing with StudyPal throughout their learning experience are enriched with proactive speech approaches that might be utilised by a teacher to address the student in a tailored and supportive manner. The following are some examples of speech in this conversational format:

- Questions aid learning in a variety of ways. They encourage kids to think critically and ask questions in order to improve their cognitive and language talents. In this way, StudyPal asks specific questions to help the conversation flow (for example, "What letter do you see on the screen?").

- Praise and encouragement aid information retention by inspiring pupils, boosting their self-

esteem, and bolstering their commitment to studying. With comments like "Oh, why not?" or "Super!," StudyPal is designed to encourage and drive students. You're fantastic!"

- StudyPal is an original educational teaching programme that uses an interactive educational learning environment to apply the main principle of learning subjects. This software is primarily based on the exchange of talks between a student and a virtual tutor–bot, which in our case takes the shape (and performs the job) of rhymes and English.

- The goal of StudyPal is to define the software's functional requirements, or what functionality it must deliver, as well as how the system will interact with users (students). StudyPal, in particular, satisfies the following key functional requirements:

- StudyPal communicates with the user (student) via guided and unguided (hybrid) speech.

- The user can choose the dialogue's flow using the provided choices.

- The system gives a clear and easy-to-understand dialogue flow to the user.

- The user's natural language (English or French) is recognized by the system.

- In the event that the user misunderstands the message, the system alerts the user to take appropriate action, such as repeating the message.

- The system does not breach the privacy protection policy governing data recording because the information presented to the user comes from trusted sources, such as Wikipedia.

- The system database safely and anonymously stores each user's history.

- The conversation's material includes text, image, video, and audio.

3.1 Design of StudyPal

StudyPal is built on a hybrid chatbot model's general architectural structure (guided and free-text communication). As a result, it contains the following components:

Natural Language Understanding (NLU) engine: The user's message goes through the component of the NLU engine, where, through tailored NLU models, the chatbot "uncovers" the meaning (purpose) of the user's message and gives the appropriate response.

Dialog Manager: This component is in charge of handling and controlling all text and audio communications exchanged (questions/requests, answers/responses). It is essentially the middleware of the chatbot between the NLU engine with the information retrieval components.

Information Retrieval and Knowledge Base: In this component, the chatbot searches the knowledge base (or the Web) for the best relevant response and transmits the retrieved information to the Dialog Manager. Essentially, this is where all of the information and knowledge that makes up the chatbot's 'brain' is stored and managed.

3.2 Development of StudyPal

StudyPal' s knowledge base (KB) was created utilizing the platform's template-driven graphical interface. Predefined answers were manually placed into the KB for each question designed in the dialogue. Because the bot can learn on its own, the KB is automatically updated with fresh information. The developers who watch the chat and collect the intents of users from the log files must manually extend/update the KB in this way. Furthermore, because the users' interactions with the chatbot are individualized, modification of the discourse is possible. Customizing the discussion (and, as a result, improving interactions) can be done at the class level by analyzing the interactions of the entire class.

The rationale proposed by the Alexa Skills and Google Home platforms for creating adjustable components to be synthesized for the development of StudyPal was followed during development. As a result, time and effort were devoted into identifying the required functionality and developing components that would suit each of their needs. As a result, the following components make up the primary element of the bot application:

A. Interactions

Interactions are the fundamental aspects that constitute a chatbot's behaviour, according to Alexa Skills nomenclature. Alexa is compatible with two different sorts of interaction models: Pre-programmed voice interface model — For each skill category, Alexa has a set of words pre-programmed. In a custom voice interaction model, you specify the terms or utterances that users can use to communicate. In StudyPal, a few more interactions were created under the custom interactions category, each defined according to the dialogue's needs and the educational scenario's requirements. In circumstances when StudyPal did not understand the user's message, reformulations of these interactions were put between the fundamental interactions, urging the user to try again (e.g., repeat the question).

B. Connections

The Alexa Skills platform provides developers with pre-trained natural language understanding models that may be

used at any moment. People in the room may now be detected by Amazon's Echo and Echo Dot, which is ideal for initiating Alexa routines.

New models for detecting frequent phrases used by users when they are unable to answer a question, as well as models for detecting negative and positive human reactions, were developed. For example, the following custom entity-based NLP models have been developed to a) detect general positive/negative emotions, such as boredom, happiness, and excitement, and b) detect disappointment or excitement from StudyPal performance (e.g., "you are not very helpful to me," "I no longer want to talk to you," "you are so bad").

When developers wish to focus on knowledge (intents or entities) that isn't covered by the pre-trained models, they'll need to create new custom models. The developer can manually insert knowledge (words or phrases) into bespoke models or use the "Bulk insert" feature to automatically insert huge amounts of samples at once. The term "intent" in the bot paradigm refers to the aim (intention) that the user has in mind while making/typing an inquiry (what he or she truly means), whereas the term "entity" refers to the modifier that the user uses to characterise an issue/concept. To understand (interpret) emotions, Alexa Skills combines emoji and text analysis (NLU). Alexa's natural language understanding (models) is what allows her to understand the meaning of a user's statement (context in the model) and respond appropriately. Alexa's natural language understanding (models) is what allows her to decipher the meaning of a user's statement (context in the model) and respond appropriately. NLU models are trained using machine-learning techniques, which teach them how to understand the intent of users and other things.

C. Prior Responses

The bot's dialogue recycles responses from the user who is currently conversing with it. StudyPal, for example, asks a student's name in the initial encounter and uses the response (the responding name) later in the conversation to personalize the interaction.

D. Custom Variables

Custom variables allow you to capture data/information from user interactions, which is very useful for running numerical calculations during a dialogue. They were, for example, used to gather correct/wrong responses (as positive or negative points) in order to determine each user's final test score.

E. Athematic Operations

This capability is in charge of conducting numerical operations, and it was used to add and subtract points during the dialogue, as well as determine the final test score.

A point is added or removed depending on whether a student answers a question correctly or incorrectly.

F. Embedding Media

This tool allows you to include images, videos, audio, and files in your conversation. These attachments can be placed directly in the bot by using a device screen to enter the URL or via the Rich Cards option. This option is a series of cards with any combination of text, graphics, and buttons on each one. It is possible to incorporate film, video, and audio into the dialogue for educational purposes using this method.

3.3 The Dialogue

A group of people was involved in the continual testing of the overall process during the development of the StudyPal. These tests were carried out by software engineers, bot experts (Conversational AI specialists), language educators (Language Education Experts/Teachers), and ordinary users. These tests were essential in removing issues that surfaced during the early phases of StudyPal's development.

Finally, language teachers provided feedback on recognizing syntax and grammatical flaws, inadequate vocabulary, spelling errors, and other issues in English and French dialogues, which helped to improve the dialogue's substance.
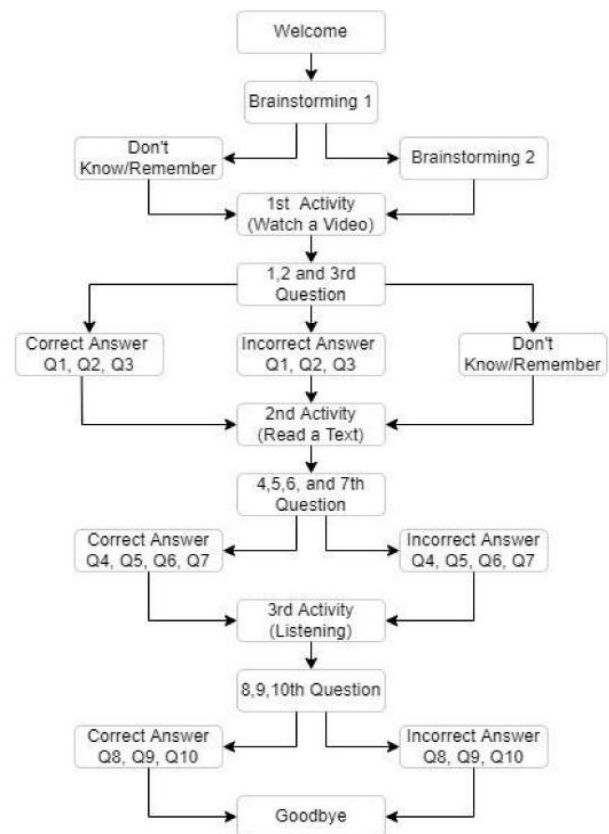

Fig -1: Flow chart

The final flow of the dialogue implemented in StudyPal has been developed in the form illustrated in Figure 2 after a long series of experimentation and evaluation cycles. The discourse, as can be seen, is made up of a series of questions to be answered and exercises to be done by the pupils. The flow is based on general pedagogical characteristics of educational programmes that were investigated prior to the creation of this discourse.

3.4 The Platform

A number of advantages of the Alexa Skills platform have been recognised based on hands-on experience during the creation and testing of the StudyPal:

Improved Interaction: Your app and its features will be more available to users with the help of Alexa Skills development. In the long term, this means that your users will no longer need to contact the app to use its features. They may easily accomplish this by employing voice commands, which will vastly improve the user's experience.

Get a leg up on the competition: Amazon Alexa skill creation will give your app a competitive advantage. As a result, your company will be able to boast a unique feature that improves accessibility and makes the navigating experience more engaging. This will assist your brand in developing a distinct identity, which will aid in attracting more potential users.

Functionality enhancements: The Alexa Skill Kit is constantly updated with new features and updates. As a result of the Alexa Skill development process, your business application will have a greater scope for growth and functionality enhancement. In the long run, this will help your company stay current and meet the changing needs of its customers.

Market Acceptance: Alexa Skills development is picking up speed, and investors are starting to sing its praises. Your brand will be recognised as progressive and innovative if you get started with Alexa Skills early. In the long term, this will enable you to ensure that your services are covered positively in the media.

 large market: Alexa is employed as a voice assistant by the majority of devices. You'll be able to tap into Alexa's large market and user base with ease if you develop Alexa skills. It eventually translates to improved outreach and a higher likelihood of conversions.

However, depending on the communication routes used to engage with StudyPal at the time of our research with the platform, there were certain challenges and limits. Furthermore, importing data, such as a movie or an audio clip, did not work properly.
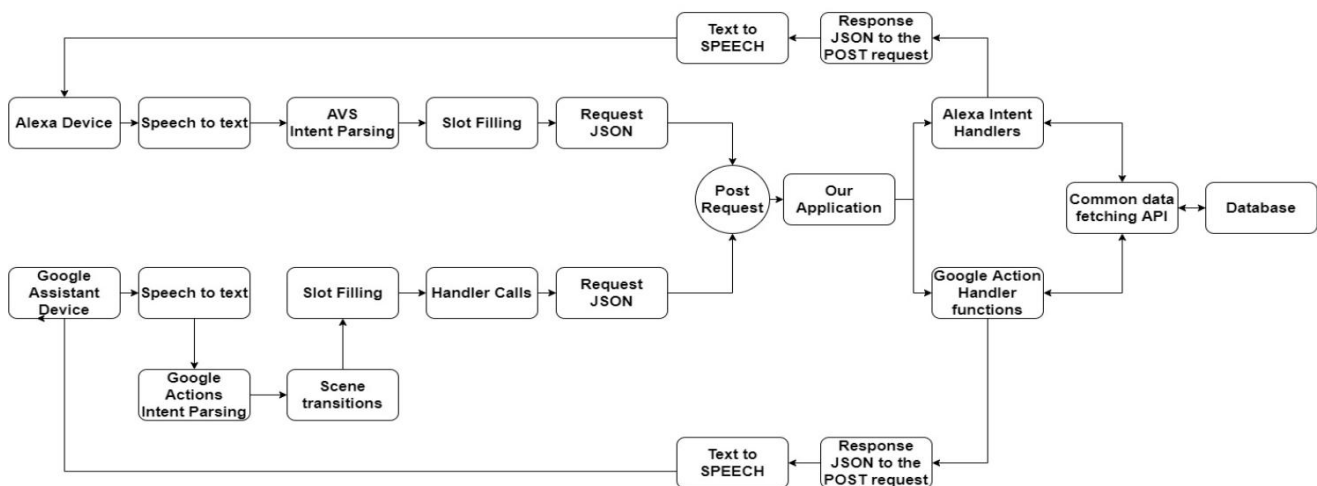

Fig -2: Workflow

4. METHODOLOGY

The voice of the user is captured using a speaker. This speaker could be on the user's device like mobile phone or laptop. It could also be utilized via Google home or Alexa. Simultaneously we define the intents for the bot as well. We then proceed to collect all the real end user utterances which is stored in a database.

 These utterances are then mapped to the respective intents. These intents are the divided and labelled to encapsulate the training and test data sets. This is then passed on to a training classifier which is passed on to the bot. After this process the test data is implanted on the trained bot to measure the performance of the bot. If the performance is proved to be good then our bot has started learning and is ready to use. However, if not the bot is updated using

training data again on iteration until its performance is standardized.

4.1 System Requirements

Model development

- TensorFlow

- Model and environment development software – AWS

Importing to virtual software

- Developed model is imported into AWS

- This is done in order to integrate the model to Alexa

5. CONCLUSIONS

The bot is used to assist students in attaining quality education with just a command. It keeps track of the students' progress and uses methods like active recall for effective studying. Students of different learning paces will find this useful as they have the liberty to move and study lessons at their own pace. Though learning for students can be divided in various subjects in both school and college, our bot will focus on providing a learning journey starting from kindergarten to the 8th grade. The goal of Study Pal is to provide quality education to every student in the nation irrespective of their socio economic and financial status.

REFERENCES

[1] M. Naveen Kumar, PC Linga Chandar, A. Venkatesh Prasad and K. Sumangali, "Android based educational Chatbot for visually impaired people", In 2016 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC), pp. 1-4, 2016.

[2] Donn Emmanuel Gonda, Jing Luo, YiuLun Wong and Chi-Un Lei, "Evaluation of developing educational chatbots based on the seven principles for good teaching", In 2018 IEEE International Conference on Teaching Assessment and Learning for Engineering (TALE), pp. 446-453, 2018.

[3] H. N. Io and C. B. Lee, "Chatbots and conversational agents: A bibliometric analysis", In 2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), pp. 215219, 2017.

[4] Sharob Sinha, Shyanka Basak, Yajushi Dey and Anupam Mondal, "An educational Chatbot for answering queries", In Emerging Technology in Modelling and Graphics, pp. 55-60, 2020.

[5] Menal. Dahiya, "A tool of conversation: Chatbot", International Journal of Computer Sciences and Engineering, vol. 5, no. 5, pp. 158161, 2017.

[6] Francesco Colace, Massimo De Santo, Marco Lombardi, Francesco Pascale, Antonio Pietrosanto and Saverio Lemma, "Chatbot for elearning: A case of study", International Journal of Mechanical Engineering and Robotics Research, vol. 7, no. 5, pp. 528-533, 2018.

[7] V. Selvi, S. Saranya, K. Chidida and R. Abarna, "Chatbot and bullyfree Chat", In 2019 IEEE International Conference on System Computation Automation and Networking (ICSCAN), pp. 1-5, 2019.

[8] Tarun Lalwani, Shashank Bhalotia, Ashish Pal, Shreya Bisen and Vasundhara Rathod, "Implementation of a Chat Bot System using AI and NLP", International Journal of Innovative Research in Computer Science & Technology (IJIRCST), vol. 6, no. 3, pp. 26-30, 2018.

[9] Sangeeta Kumari, Zaid Naikwadi, Akshay Akole and Purushottam Darshankar, "Enhancing College Chat Bot Assistant with the Help of Richer Human Computer Interaction and Speech Recognition", In 2020 International Conference on Electronics and Sustainable Communication Systems (ICESC), pp. 427-433, 2020.

[10] Ozoda Makhkamova, Kang-Hee Lee, Kyoung Hwa Do and Doohyun Kim, "Deep Learning-Based Multi-Chatbot Broker for Q&A Improvement of Video Tutoring Assistant", In 2020 IEEE International Conference on Big Data and Smart Computing (BigComp), pp. 221-224, 2020.

[11] G. Molnár and Z. Szüts, "The Role of Chatbots in Formal Education", 2018 IEEE 16th International Symposium on Intelligent Systems and Informatics (SISY), 2018.

[12] R. Sandu, "A Study to Analyse Economic Benefits of Cloud-Based Open-Source Learning for Australian Higher Education Sector", 1st International Conference on Business Research and Ethics (ICSBE), pp. 9-12, 2017.

[13] A. A. Georgescu, "Chatbots for Education-Trends Benefits and Challenges", Conference proceedings of» eLearning and Software for Education, 2018.

[14] M. Fleming et al., "Streamlining student course requests using chatbots", 29th Australasian Association for Engineering Education Conference 2018 (AAEE 2018), 2018.

[15] K. Mullamaa, "Student centred teaching and motivation", Advances in Social Sciences Research Journal, vol. 4, no. 1, 2017.

[16] Michael L. Mauldin, "CHATTERBOTS TINYMUDS and the Turing Test: Entering the Loebner Prize Competition", Proceedings of the 12th National Conference on Artificial Intelligence, vol. 1, pp. 16-21, July 31 - August 4, 1994.

[17] Babar Zia, Alexei Lapouchnian and Eric Yu, "Chatbot Design Reasoning about design options using i * and process architecture", iStar Workshop, pp. 119133, 2008.

[18] E. Gogh and A. Kovari, "Examining the relationship between lifelong learning and language learning in a vocational training institution", Applied Technical and Educational Sciences, vol. 8, no. 1, pp. 52, 2018.

[19] R. Rajkumar and V. Ganapathy, "Bio-Inspiring Learning Style Chatbot Inventory Using Brain Computing Interface to Increase the Efficiency of ELearning", IEEE Access, vol. 8, pp. 67377-67395, 2020.

[20] Eleni Adamopoulou and Lefteris Moussiades, Chatbots: History technology and applications, Elsevier, 2020.

BIOGRAPHIES

Madhumita Venkatraman has completed her BE Information Science and Engineering by passing in First Class with Distinction from kumaraguru college of Technology College in Coimbatore, Tamil Nadu. During her time in college, she undertook numerous internships. She also participated with her team in the Smart India Hackathon, a national wide held competition for innovators. She and her were successfully selected to represent Kumaraguru institutions as well. In addition to this she is currently on her way to pursue her masters in Data Science at the prestigious University of Melbourne.

Hemashrree has completed her BE Information Science and Engineering by passing in First Class with Distinction from kumaraguru college of Technology College in coimbatore, Tamil Nadu. She did her diploma in computer networking in PSG college of technology with Distinction. During her time in college, she undertook internship in various sectors like AWS, Mobile applications development and networking. She also completed and certified in CCNA. She also participated with her team in the Smart India Hackathon, a national wide held competition for innovators. She and her were successfully selected to represent Kumaraguru institutions as well. In addition to this she is currently on her way as a software developer at Mobiveil Technologies.

Sudharsan has completed his BE Information Science and Engineering by passing in First Class with Distinction from kumaraguru college of Technology College in Coimbatore, Tamil Nadu. He did his diploma in Electronics and communication engineering in Thyagaraja college of technology with Distinction. During his time in college, he undertook internship in salzer Electronics Limited And other sectors like python development, networking and SQL. He also participated with his team in the Smart India Hackathon, a national wide held competition for innovators. He and his were successfully selected to represent Kumaraguru institutions as well. In addition to this he is currently pursuing a development course on his way as a software developer.