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Artificial Intelligence for Career Guidance

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I hereby declare that this dissertation is all my own work, except as indicated in the text.

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Abstract

Career counselling plays a very vital role in the process of planning the course of study, selecting the location of study, career selection or career path planning. Students generally rely on their family members, relatives, friends or classmates to select and decide the course to study further, without taking time to consider their interest in different topics. This affects their level of interest, exhibiting poor performance in studies or resulting in college dropout. Students who have received career counselling have a better understanding of their strengths, weaknesses, likes and dislikes, and knowledge about different possible career options and paths for themselves to explore, excel and grow. As the statistics have proved the effectiveness of career counselling there is an increase in demand for career counsellors. With human career counsellors, there are limitations with the availability, accessibility, reliability and inducing human bias towards a single job. Developing an Artificial Intelligence based chatbot to counsel students is a better solution to avoid human bias and lack of knowledge of current and upcoming career paths. The major drawback with the current chatbot systems is that it is text-based and this adds restrictions to users with physical disabilities like hearing, and speaking in terms of accessing and interacting with the chatbot. The proposed solution in this dissertation is to integrate the text-based career counselling chatbot using IBM Watson assistant with IBM speech recognition and text-to-speech technology which will make it easier for people with poor motor skills to interact with the chatbot with ease. The second feature integrated with the chatbot is a sign language detector model trained using LSTM neural network, which identifies the hand signs and converts them into text. The chatbot is able to identify the intents accurately despite the mode of interaction with the user. The overall accuracy of the sign detection model is around 90.5% when it comes to detecting and converting hand signs. The speech recognition model works well in converting the audio content to text and converting the chatbot response to audio.

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1. Introduction

The process of selecting an appropriate course of study based on an individual's interests is a challenge to many. Career counseling provides guidance to students in terms of course selection, career planning, and job skills requirements, and it also helps individuals to identify their strength and weakness. There are many factors influencing an individual's career choice, but not selecting a career based on their personality and interests might lead to work stress and decreased productivity (Rao et al., 2020). According to a survey, 47% of young professionals were looking for other opportunities, and the average job satisfaction level was reported as 6/10 (Suresh et al., 2021).

Job satisfaction leads to a happier self. A lot of people struggle with midlife crises as they are not happy with their jobs or are confused as to what they want to pursue, leading to severe depression, and this can be avoided with appropriate career counselling. Individuals who have received career counseling are more likely to succeed in school and in their jobs, which will lead to a happy and comfortable life (Kamal et al., 2021). One may not be comfortable discussing their interests and viewpoints with a human counseling agent, and not every human counselor may have adequate knowledge of all existing and upcoming career fields and opportunities.

Secondary schools should prioritize developmental career counseling since it helps young people with learning difficulties succeed in post-secondary jobs. These kids exhibit cognitive and behavioral habits that can be changed by teachers and counselors through cognitive intervention. Local school authorities may design career counseling programs, but a program like "Pathways" offers a successful model that is based on four years of creation and assessment study. In order to create a program that is specifically designed to suit the requirements of local adolescents with learning difficulties, career counselors, classroom teachers, and special educators can collaborate.

1.1 Aims and Objectives

The aim of this project is to address the following questions:

- How to develop a personalized, reliable, and accurate career counselling chatbot based on Artificial Intelligence?
- How to make the Artificial Intelligence-based counselling chatbot solution accessible to users with any sort of physical disability?

The objective of the proposed research is to design and develop an easily accessible and accurate chatbot to guide individuals of every age group using reliable data. The chatbot will interact with the students to get basic information like hobbies, interesting subjects, and ambitions. Based on the answers to the questions relating to general aptitude, personality, and career, the chatbot will recommend the most suitable career options to the individuals. This will ensure that the students are guided well before they set off to work or help people who are looking for a job change and would like to pursue opportunities they might be good at.

1.2 Problem Description

The challenges with human-based career counseling systems have multiple drawbacks as listed below:

- With advancements in both technical and non-technical domains most of the students are either confused about selecting the career options or lack information that students require for the existing job roles such as scope, skill requirements, growth aspects, income and future development.
- The other common drawback is that career counsellors tend to recommend commonly selected careers rather than focusing on individual skill sets and recommending personalized options.

- Lack of career counselling at an early stage of schooling leads to students losing focus and selecting subjects that will not help them or are not interested.

The above challenges can be addressed with the use of Artificial Intelligence-based career counselling systems, but the current AI-based solutions are not:

- Inclusive of users with diverse physical conditions as the traditional text-based chatbots can be challenging to be used with disabilities like hearing, speaking or seeing.
- Interactive as the user is only able to respond via text making it an unrealistic alternative to human career counsellors.
- Reliable due to lack of collection of accurate data for training the AI chatbot to recommend appropriate career options.

1.3 Traditional career counselling drawbacks

Unfortunately, traditional career counselling involves higher expenses, thus making it accessible only to a few students, and the opinions are often biassed and based only on academic grades. Providing a service to all students without a large staff, allowing for one-on-one student involvement, has always been a significant problem for university career services. While this method helps the learning and development of skills, it does not ensure that students will participate in personal career planning. Many have chosen to embed employability in the curriculum to make it structurally inevitable.

1.4 Types of chatbots

Chatbots can be of different types, like rule-based chatbots or Artificial Intelligence-based chatbots. A rule-based chatbot answers inquiries from users by using a stream that resembles a tree rather than artificial intelligence. This

suggests that the chatbot will eventually guide the visitor to the correct objective by asking them follow-up questions. The pre-characterized designs and responses are done so that you may lead the conversation. A Machine Learning-based chatbot is designed to have human-like discussions by utilising a cycle known as Natural Language Processing (NLP). An AI chatbot is a first-reaction device that welcomes, connects with, and serves clients in a well-organized and recognizable manner. The rule-based chatbots are less adaptable conversational streams, and these gatekeeper rails are likewise a benefit. You can all the more easily be assured of the experience they will convey. Rule-based chatbots have benefits like being, for the most part, quicker to prepare (more affordable), incorporating effective inheritance frameworks, effectively handover to a human specialist, being profoundly responsible and secure, can incorporate intelligent components and media, and are not limited to message communications. On the contrary, many assume that AI chatbots are more complex cousins of traditional chatbots. They function admirably for organisations that will have a tonne of information. In spite of the fact that they take more time to prepare at first, AI chatbots save a tonne of time in the case of long-term use. Artificial Intelligence chatbots gain from the data accumulated, they consistently work as additional information comes in, figure out examples of conduct, have a more extensive scope of critical thinking abilities, and can figure out numerous dialects compared to the regular chatbot.

AI-based reasoning chatbots can be customized to send back specific messages because of specific inquiries, yet their reactions are more adaptable. These AI-based chatbots are further classified into machine learning-based chatbots and deep learning-based chatbots. Machine learning-based chatbots use training data and Natural Language Processing to learn human behavioural patterns in conversations and conversational inferences. The Machine Learning chatbots become more accurate as they have conversations with humans. Deep learning-based chatbots are more advanced and they learn everything from the

data patterns. They are very effective in learning the patterns accurately, and they keep updating themselves to become more precise.

Deep learning chatbots are of two main types one of which is retrieval-based and the second one is generative-based. The retrieval-based chatbots use a knowledge repository to generate their responses, and they are trained with the existing conversational samples. These chatbots have data preprocessing levels where the data is reshaped to create message response pairs for the machines to identify the intent of the user response. The generative-based chatbots do not use any knowledge repository. For generating responses instead, they get trained based on the previous user's chatbot conversational history.

1.5 Role of chatbot in career counselling

The amount of individual career planning a student does is frequently influenced by the quality of the career guidance they got before enrolling in college and how much social capital they possess; students who have less of either require more assistance with their career planning. However, before the pandemic, these students were frequently less inclined to take advantage of traditional, in-person career programmes owing to their hectic schedules that included part-time jobs, family obligations, caring responsibilities, or commuting. Artificial Intelligence technology can help solve this issue as the individual is interacting with the system fed with data on all possible career options (Kiselev et al., 2020). Through a series of questions and responses, the AI-based software will be able to provide (Akshansh et al., 2019) the individual with a reliable, accurate, and personalised report, which will help them understand themselves better and identify their area of interest (Westman et al., 2021).

Chatbot technology has advanced over a period of time and the AI-based chatbots are more dynamic and complex. The demand for digital career counselling services has increased considerably due to the pandemic. This is

because many people are looking for ways to increase their job opportunities and salaries. In order to understand this demand, it is important to look at the jobs that are currently available in the market (Lokman et al., 2018). Chatbots are an interactive and smart technologies based on Natural Language Processing (NLP). NLP technology is a combination of multiple things like machine learning and deep learning models, statistics based on human language and computational linguistics.

Chatbots can be used to improve the way people interact with their digital world, and the use of chatbots for career counselling is a good alternative to human counsellors as the chatbot will provide an unbiased response and recommendation to the user. A chatbot is an Artificially Intelligent software that can mimic the conversational abilities of humans. The developed software can be deployed on any social platform like Facebook, Skype, or Slack, and it can be integrated with websites as well (D'Silva et al., 2020). High school students experience issues getting professional guidance because of the low counsellor-to-understudy proportion. Once in a while, they would neglect to make a meeting with a guide, drop in, and hold up an hour to see one. At different times, they have been kept away from the workplace completely on the grounds that the appointments were full. The artificial intelligence chatbot provides ease of access as it allows people to get individualised assistance from the chatbot at any point of time from any location.

1.6 Advantages of career counselling chatbots

Students are more welcoming towards the idea of career counselling chatbots and are very keen on experiencing the chatbot at their convenience. One of the surveys was conducted with 350 high school students about the role of a career counselling chatbot. The results were quite interesting as the majority of the students preferred the chatbot to offer information about different courses and recommend different courses to them, along with giving detailed information on

career development. The second major role that the students want a chatbot to do is to provide counselling sessions to help them understand their potential.

The users can experience 1:1 individual sessions and take advantage of personalized attention during every session. This also eliminates the waiting time, making it easier for the users to reach out to the career counsellors whenever they need any help. The viability of career guidance is entirely determined by the level of professional help received by the students. The chatbot for career counselling will be available 24x7 for these students to access and gain more benefits from it. Online career counselling meetings often require a stable wifi connection, whereas, in the case of chatbots, they are lightweight, do not require high-speed network connectivity, and offer a more flexible range of options to students.

The ability to further personalize career advice services via the use of AI and chatbots is another huge advantage of this technology. Because of Artificial Intelligence, chatbots can rapidly receive and interpret massive amounts of data. As a consequence, these chatbots can quickly learn every student's whole profile and utilize it to provide them with specialized help. Notably, chatbots powered by AI are made to determine each user's purpose. This implies that the chatbot will rapidly recognize when a certain student is writing to it with a specific aim in mind and will respond appropriately. Thus, we can provide more precise and individualized career planning advice for any student requesting assistance by combining AI and chatbots in this area.

1.7 Career counselling for people with disabilities

Lack of self-understanding was identified as a common trait in recent studies on people with learning difficulties who were unsuccessfully employed. These folks were aware of their issues but did not comprehend how their particular impairments led to them. As a result, they didn't apply for employment that made

use of their abilities, or they didn't foresee issues and come up with solutions when they were struggling to fulfil demands at work. The choice of occupations in their areas of strength and the desire for control over their lives have been cited as reasons for the successful employment of people with learning difficulties. Goal-setting, perseverance, and adaptation were all part of this search for control. Successful adult learners report getting or looking for specialised assistance to help them get around their constraints.

Participating in job-development programs and receiving career guidance while in secondary school is especially crucial for those with learning difficulties. By teaching students skills in resume writing and job interviews, these programs may assist them in choosing jobs that will capitalize on their strengths and downplay their deficiencies, as well as assist them in finding work. They may also deal with issues that come up at work, such as issues with interpersonal skills and anger management.

A chatbot's capacity to talk improves both its usability and accessibility. While conversing with your chatbot, students may perform other tasks thanks to the voice option, which is also related to the customer experience. By enabling users to carry on with their current tasks while interacting with the bot, this feature, together with the others, raises customer satisfaction. There are still some people who struggle with learning to write. In addition, some people have motor impairments that make it impossible for them to use keyboards or other tactile devices.

1.8 Voice-based chatbots

Voice-based chatbots are becoming more popular as they provide a hands-free user experience compared to traditional text-based chatbots. Traditional chatbots are text-based, and users have to type in their responses. As technology advances, more companies are incorporating speech recognition and

text-to-speech technology into their chatbots. This makes it possible for people with visual disabilities to use the chatbot without having to rely on a screen reader or another person to support them. Voice inputs make the chatbot more interactive and interesting. People will be able to relate it to the human counsellor by hearing it speak out loud. This will make it more realistic and comfortable to interact with it. The speech-to-text converter accepts voice as an input and outputs a text transcript. It may be applied to projects like multimedia transcription, analytical call centre tools, and voice-activated chatbots. The written text may be turned into realistic-sounding audio in a variety of languages and voices using the Text to Speech feature of an already installed program. An API cloud service can be used for this.

1.9 Sign language-based chatbots

One method of communicating for those with hearing and speech impairments is sign language (Rajendran et al., 2021), people with special disabilities may grow frustrated when communicating is challenging. By giving people a means of expressive communication in circumstances when verbal communication would be ineffective, sign language helps people feel less frustrated. People with a variety of impairments and requirements can communicate more easily with one another through sign language. The latest technical systems have image recognition techniques integrated into the systems to aid disabled people to use the system in an independent and effective manner. Integrating the sign language detection feature into the chatbot will help them access and interact with the chatbot independently, along with providing an enhanced, convenient, and interactive experience for the user.

Sign language interfaces are crucial for the section of the deaf community that has difficulty with reading and writing. Not all deaf signers are competent readers, despite the fact that many of them are also deaf. The systems analyze the text's linguistic organization. The lexicon, word choice, and grammatical

structure of the text is converted into its matching sign language counterparts. The ability of some machine learning techniques to use the linguistic structure of sign language input to predict the likelihood of the next sign a human will make based on the frequency of some signs following others or the syntactic structure of a sentence marks a crucial distinction between sign language recognition and the more general problem of gesture recognition. As a result, even if sign language uses more complex physical movements, the verbal framework of the performance might help with recognition.

2. Literature Review

In order to better understand the numerous chatbots created for career counselling and the various features added to chatbots to give counselling services to physically challenged people, this section analyses research done in the past by a number of researchers.

2.1 Chatbot development

A chatbot is one of the most common and commonplace forms of intelligent Human-Computer Interaction as well as a typical example of an AI system. Although chatbots can simulate human communication and amuse users, this is not their main purpose. They are helpful in applications like e-commerce, business, and information retrieval. There aren't many data requirements, and knowledge gained from using one chatbot may readily be applied to using others. Developers can also benefit from reliable communication, quick and simple development cycles, a lack of version fragmentation, and minimal interface design work.

Sample stimulus-response blocks provide the cornerstone of the pattern matching method. As a stimulus, a user enters a sentence, and the output (reaction) is generated in response to that input. The Artificial Intelligence Markup Language (AIML) was created between 1995 and 2000. It is based on the concepts of pattern matching or recognition. For human-computer interaction, it is utilized in stimulus-response-based chatbots that mimic natural language. Chatbots might be made using Latent Semantic Analysis (LSA) and AIML. It serves as a vector format for comparing word similarity. Chat script, an expert system composed of an open-source scripting language and an engine that executes it has been developed to replace the AIML language. A rule in that subject is then carried out after locating the item that best matches the user's search criteria. It is composed of regulations related to several subjects.

RiveScript is a line-based, plain text scripting language that may be used to build chatbots and other conversational entities. Natural language processing, or NLP, is the study of how computers can alter natural language text or speech. Knowledge about the comprehension and usage of human language is gathered with the aim of developing ways that will enable computers to interpret and change natural speech to perform predetermined tasks. The core of any NLP work is Natural Language Understanding (NLU). It is a technique for building organic user interfaces, like a chatbot. NLU attempts to extract context and semantics from natural language user inputs, which may be unstructured, in order to accurately interpret user intention.

A chatbot's creation and development includes a number of different methodologies. Developers may choose the algorithms, platforms, and tools to design the chatbot with the assistance of an understanding of what it will do and what category it belongs to. Additionally, it helps people make predictions about the future. The prerequisites for creating a chatbot include accurate knowledge representation, a strategy for producing answers, and a collection of ready-made neutral responses to utilize when a user's remark cannot be understood. There are currently too many chatbot-related technologies, and that number is only increasing. There are two approaches for creating chatbots: either by employing any programming language, like Java, Python, C++, or PHP, or cutting-edge platforms like DialogFlow by Google, LUIS by Microsoft, and Conversation with IBM Watson (Adamopoulou et al., 2020).

2.2 Career counselling chatbot

The paper “An Intelligent Career Guidance System using Machine Learning” focuses on the use of machine learning algorithms to predict the suitable course of study for high school students based on the analysis performed on the questionnaire related to skill sets. The proposed system consists of three modules; the first, of which is the skill set assessment developed using HTML5,

CSS3 and JavaScript, where the answers are validated and awarded marks accordingly. The second module is focused on prediction, of course, based on the assessment results using the K-Nearest Neighbor algorithm, and in the third module, detailed analytical results are presented.

The authors have used a manually developed dataset, of which 80% of the data was used for training the ML model and the remaining 20% was used for testing and validation. The dataset contains 500 samples, 7 features, and a multi-class target variable to be predicted. K-Nearest Neighbour was selected for classification purposes as it had an accuracy of more than 90% compared to the other algorithms like Support Vector Machine, which predicted with an accuracy of 86 % and the Naive Bayes algorithm, with an accuracy of 87%. To provide secondary recommendations, the departments were grouped to map the candidate's performance using the K-Means Clustering. The skills like analytical, logical reasoning, mathematical, problem solving, programming, creativity and hardware were the features used for determining the department. A confusion matrix was used to determine the performance measure of the model.

In conclusion, this paper highlights the issue of career selection, which is solved by developing a web-based recommendation system trained on data to predict the field of interest but lacks the following:

- Information about what methodologies were used for data collection
- Assessment type and the number of questions to be answered are not specified.
- There are 15 references mentioned in the paper but it does not seem to appear in the text as having been cited.
- There is no evidence presented on how similar predictions were used in the past and what transpired with the target population who followed such recommendations for selecting their course of study or profession. This is an example of a, not an appropriate research methodology (Vignesh et al., 2021).

The paper “Online Career Counsellor System based on Artificial Intelligence: An approach”, focuses on developing an online Artificial Intelligence-based system to guide and help students select a career path based on their areas of interest. The approach in this paper is similar to the one in the previous paper, the proposed software system in this paper is based on five different modules to question, evaluate, analyse, and generate a report. The first module is the maintenance module, dedicated to modifying and updating items by the administrator. The second module is the evaluation module for evaluating the student's answers. The third and fourth modules are the testing and test generation modules for the implementation of tests to be taken by the students, and the last module is for generating the report to provide a summarized report based on the student performance.

The machine learning model was trained on 80% of the data collected from various sources, like directly from employees, using an API of social sites, a college database, and some randomly generated data. Data preprocessing was done to clean and organise the collected data before using classification algorithms like SVM and Decision Tree algorithms to predict the student's field of interest. The proposed system checks for candidates' eligibility before generating questions. As the student starts to attempt the questions, answers are evaluated and selected questions are displayed to narrow down the interesting field, with results and recommendations displayed at the end.

In this paper, the author has developed a system to solve the issues of increasing unemployment rates and decreased work satisfaction due to the wrong selection of career. The approach is mentioned in the paper's source of data gathering, although it is not stated clearly. The paper does not include citations despite references mentioned at the end and also has missing information on the evaluation and results summarization process. It includes the working of SVM and Decision Tree algorithms but lacks information on the parameters that are classified using these algorithms and the performance of the

model. Overall, the purpose of artificial intelligence in the proposed system is not mentioned clearly (Joshi et al., 2020).

Unlike the previous papers, this paper “Development of an AI Chatbot to support admissions and career guidance for universities.” focuses on developing and integrating a chatbot into the system to enhance the process of counselling during admission. The dataset was created by mining data from web pages containing information like frequently asked questions by students and parents, and content from social media and school databases. TF-IDF algorithm and word vectorization techniques were used for identifying the keywords.

The chatbot was built on two models, the first of which is the SVM (Support Vector Machine) algorithm-based machine learning model for classifying the intent, and the second one is model-based matching to provide accurate answers to the questions asked by the user. The input data is processed to remove any special characters, punctuations, or emoji, and replace abbreviations and misspelt words. The chatbot has a good performance with an accuracy of over 90%, but the accuracy falls to the range of 65-75% when the input contains misspelt and omitted words.

To conclude, overall this paper covers all the aspects, from development to implementation, of the chatbot. The data collection sources and methodology are specified clearly. The author has very well explained the data processing and chatbot training process. However, the chatbot needs to be trained further to be able to provide precise output with misspelt inputs (Le Hoanh Su et al., 2020).

The paper “Use of Artificial Neural Network in Developing a Personality Prediction Model for Career Guidance: A Boon for Career Counselors” makes use of ANN (Artificial Neural Network) to help candidates choose the best career based on 4 important psychological categories like sensing, intuition, feeling and thinking, which are used for classifying people amongst 16 categories. This

paper focuses on the use of deep learning to develop an advanced career counselling system.

The data was collected through a survey conducted with 36 questions using Google forms, out of which the train-test data ratio is 80:20% of the total data. The ANN classification model consisted of 9 nodes at the input layer to handle the data with 9 different input features, a 5-node single hidden layer to perform computations, and a 2 node output layer, with a sigmoid activation function for forwarding propagation. The model's performance was measured using a confusion matrix, and the model's accuracy value was above 95% for all 4 categories. 10 bins with 100 samples each were used in k-fold validation. As the dataset used for training is small, the model was trained at an epoch value of 20. The epoch rate represents the number of times the data is fed into the model, and a higher epoch value would result in overfitting of the model.

The system can recommend jobs well suited for the individuals based on the type of personality determined by the deep learning model based on the questions answered. The model has higher accuracy levels, which proves that the ANN method can be advantageous for career counselling. The paper describes the process of data collection but does not specify the type of questions included in the questionnaire (Rao et al., 2020).

The paper "NEEV: An education informational chatbot" focuses on the development of a chatbot to interact with students and provide them with necessary guidance about different fields of study. The proposed system in this paper uses supervised machine learning and natural language processing techniques and the Google DialogFlow framework to develop the chatbot. Text or voice-based input is matched with intents and entities stored in the firebase, which is used as the data repository, and the output is given in the form of either text or speech format.

The data was used for training the following components of the chatbot:

- Intents - it is used for identifying the phrases or words to help the chatbot to respond to the user input with appropriate dialogue. This includes the training phrases consisting of user input samples, actions and phrases to process matched entities and provide appropriate output, and responses having defined dialogues to guide the user.
- Fulfillment - used for generating responses which are not defined, inferring from intents and entities.
- Entities - refers to the knowledge base the chatbot can refer to instead of matching exact phrases.

The author has described the implementation of a chatbot but the intents and entities the chatbot is trained on are not specified. This does not provide clarity on the questions the chatbot is trained to answer (Khan et al., 2019).

The paper “Web Based Career Counselling System With Chatbot" is based on the chatbot developed using Google Dialog Flow to help students plan their careers and get answers to questions relating to colleges, courses, and competitive exams. The proposed system contains a student module where the users can create an account, and log in to explore the information about courses, colleges, and entrance exams. The chatbot option is available to the students to interact as virtual counsellors. Along with the student module, the proposed system also contains an admin module to manipulate and update the information available on the website. The author does not explain the details like data collection methodology, development of the chatbot, and performance evaluation of the chatbot, and the paper does not contain the citations of the listed references (Suresh et al., 2021).

The paper “Career Counseling Chatbot on Facebook Messenger using AI” is based on developing a chatbot for career counselling using Facebook SDK, JavaScript, Messenger API and Wit.ai API after research was conducted to

collected information ostudents"s opinions about their careers, and it was found that the majority required career guidance. The system was developed in three phases, the design phase, where the collected data is analysed to identify the task to be implemented, and it also involved taking feedback from selected users on the performance, in the implementation phase, the chatbot was deployed on Facebook Messenger using wit.ai, and the final phase being the testing phase where all the feature implementations are tested. The chatbot can answer the user's questions relating to interview preparation, job listings, aptitude tests, or resume templates. There is no clear explanation of the chatbot training methodology (Dongre et al., 2021).

The paper ‘Chatbot Interaction with Artificial Intelligence: human data augmentation with T5 and language transformer ensemble for text classification’ is about developing a chatbot framework based on Artificial Intelligence. The model was trained to augment the data generated by the humans to create a large training dataset which can be used for further natural language processing.

The data set consists of 483 responses paraphrased by humans and is recorded to be split into training and validation sets. The T5 model further augments it before being fine-tuned by the text-based transformer algorithms. A classification accuracy of 98.96% was achieved when the data augmented by the T5 model was used with RoBERTa (Bird et al., 2021).

2.3 Chatbot for specially-abled people

The paper ‘Supporting Inclusive Learning Using Chatbots? A Chatbot Led Interview Study’ is focused on the development of a chatbot named Sammy for conducting interviews with students to understand their interests. The chatbot was developed using the Juji chatbot development platform. The data collected during the chatbot user interaction was analyzed and some of the findings were students, who require data support materials for learning, help with speaking,

creating professional networks, planning educational finance and career counselling. (Gupta et al., 2022)

In this paper ‘Android based educational Chatbot for visually impaired people”‘ the proposed system is an android application chatbot developed to support the educational queries of visually impaired students. The system includes text-to-speech features to provide audio-based information and responses to the user. The chatbot system is designed to take in audio input from the user, process the query via the database library, and provide a response to the user in the form of audio after being fetched from the MediaWiki or AB library database.

Techniques for matching the patterns like the symbolic reduction for simplifying the pattern, divide and conquer for breaking down the queries, synonym resolution for identifying similar words, and keyword detection for selecting important words in the sentence were used for improving the accuracy of the chatbot. To use the proposed system, the user will have to download the application and provide voice instructions to begin interacting with the chatbot. The user has an option to switch the response source from the default Wikipedia database option to the AB library (Kumar et al., 2016).

2.4 Chatbot with text-to-speech and speech-to-text functionality

The proposed system in this paper ‘Design of chatbot with the 3D avatar, voice interface, and facial expression’ is designed to provide an avatar-based chatbot experience to the user. The proposed system consists of multiple phases, with user interaction as the first phase. During the first phase, the user will answer the question asked by the chatbot using voice commands. The second phase is where the data is processed by the chatbot to provide related responses to execute pre-scripted actions. During the third phase of the proposed system, the avatar is rendered, and during the last phase, the response from the chatbot is generated as an audio output.

Tools like Pandorabots and Mondobots were used for the development of the chatbot, and the Google text-to-speech service, along with Oddcast and vocalware, were used for generating audio output. The facial expressions of the avatar were synchronised with the word or sentence to make it look more natural, instead of restricting it to opening and closing the mouth.

To experience the proposed system, the user will require a system supporting a 3D avatar and microphone. The overall accuracy of the proposed system is around 80%, and the authors look to improve the performance in future (Angga et al., 2015).

The proposed system in this paper ‘Augment reality chatbot using cloud’ uses IBM Watson, Unity, and Dialog Flow to implement the intended chatbot system. The speech-to-text and text-to-speech systems are implemented using the IBM Watson platform, and the chatbot is developed using the Dialog Flow platform. Intents were used for training the model, and after the data has been processed by the chatbot, it is sent to the text-to-speech service to generate the audio output. The ARCore equipped with 3D cameras was used for developing the augmented reality setup, while Blender and Unity were used for designing and developing the 3D environment. The chatbot was intended to be experienced by the users in any environmental space (Matukumalli et al., 2021).

In this paper ‘Development of the Speech-to-Text Chatbot Interface Based on Google API,’ the data is collected in audio and video format and is saved on local storage. The Google speech-to-text service was used as it has proper documentation for integration support. The authors have deployed the bot on social media, and this was done in two steps. The first step is called polling, where the users send in a request to the bot, and the second step is where the application is hosted on social media platforms through the webhook platform (Shakhovska et al., 2019).

2.5 Chatbot with sign language identification functionality

The paper ‘Sign Language Recognition using 3D convolutional neural networks is based on extracting spatial and temporal features using 3D CNNs from video streams to create descriptors for motion trajectories and hand forms, which is a major challenge in sign language recognition. For sign language recognition, features from previous layers are extracted as feature maps in 2D convolution. Capturing encoded motion information in multiple continuous frames was used to incorporate the motion information effectively during video analysis. To train the convolutional model, a total of 18 samples were chosen randomly, generating 480 samples for the training dataset. The colour image, along with the depth map and locations of body joints, were recorded using Kinect. The average accuracy rate of the model based on 3D CNN and GMM-HMM is around 90.8% when the trajectory and handshape alone are used (Jie et al., 2015).

The paper ‘Designing Accessible Chatbots for Deaf People’ uses Algho, a platform that allows users to create artificial intelligence (AI) assistants. A survey was conducted to find out the difficulties in using the chatbot, and the outcome of the survey proved that the users find it boring and hard to interpret when interacting with the chatbot. Modifications like the introduction of videos in LIS to complement written answers and clearer texts were proposed. Subjects of different age groups were used for testing and validating the performance of the chatbot. A total of 80% of the subjects had a good experience with the chatbot, but 20% of the subjects showed difficulties in using sign language to communicate with the chatbot (Apuzzo et al., 2022).

The paper ‘A translator for American sign language to text and speech’ uses a dataset of 39100 images to train the AI model to identify different alphabets of American Sign Language. The hand sign representations of certain letters were tweaked to avoid ambiguity during training, and custom hand signs were added to the dataset to incorporate extra actions. The hand detection model uses the

Haar cascade algorithm to classify the images along with SAPI 5.3 to convert text to speech. During the training process, the Haar-like feature was used for getting the difference between the pixel values of the black and white triangles present in each feature, along with the AdaBoost algorithm, collects important details from each image. The classifier was created by cascading these classifier structures.

The testing phases involved three stages, the first one being the preprocessing stage, where the algorithms were applied to execute image processing techniques for obtaining the features from the images after resizing them. The classification stage is the second one that has all the extracted features from the preprocessing stage compared to the training database to accurately relate the image to the letter. Text-to-speech is the third stage of the process, and it involves the conversion of input images to audio files of recognised letters as the output, with the ok sign being used to determine the completion of the process to capture the video frame. The proposed system can recognise the images, identify the letters, combine the recognised letters into sentences, and convert the sentences into an audio output with overall accuracy, precision, recall, and sensitivity, an F-score of 98.7% and a specificity score of 99.9% (Truong et al., 2016).

3. Methods

This section contains the details of the proposed solution and the tools used for addressing the problem of the lack of realistic, reliable, and interactive Artificially Intelligent chatbots that can cater to a wide range of users with or without any type of physical disability. This dissertation addresses the problems relating to the lack of development and accessibility in the field of career counselling. The proposed solution contains a text-based chatbot developed using IBM Watson assistant, which is integrated with voice-based input using IBM text-to-speech and speech-to-text services, along with a sign language recognizer, which is developed with the use of LSTM neural networks. This system allows users to interact with the chat through various methods, such as voice, text, and sign language.

As the user begins the interaction, the user is given the option to select the mode of interaction with the chatbot. Once the mode is selected by the user, the chatbot introduces itself and asks basic questions about his/her educational background to recommend the appropriate career path. Once it has determined the current education level of the user, the chatbot then asks specific questions to understand the interest of the user in different subjects, career ambitions, or dream jobs.

In a case where the user is a high school student and is looking to get support on available career options to select high school majors, then it will recommend subjects for him/her based on the patterns analysed in their interest levels. If the user is a high school student and is looking to select a career path or requires counselling to identify a suitable bachelor's degree, then the chatbot will question the student about his or her interests and understand the subject in which the student is interested. Based on the user's response, the chatbot will identify the patterns to recommend the most suitable bachelor's degrees or career paths. In a case where the user is a graduate and is looking to pursue his or her master's

degree then the chatbot will question the user about their bachelor's educational background and work experience to go ahead and recommend a suitable master's degree option along with the possible career growth.

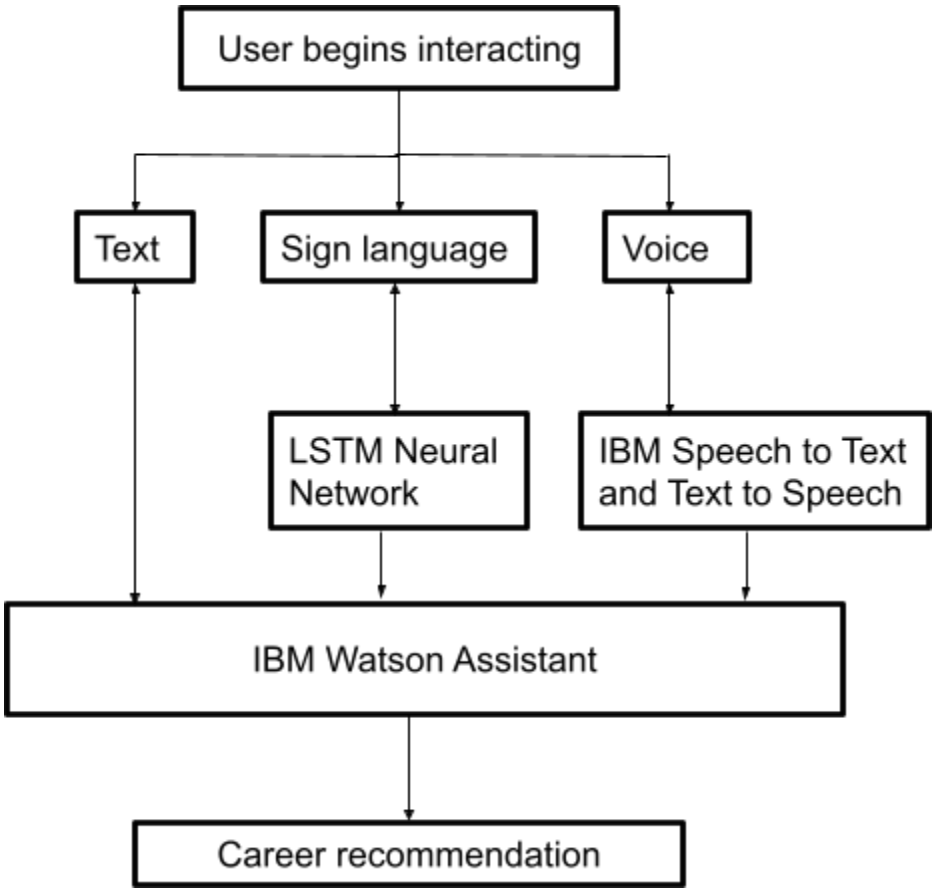

Figure 1: Proposed system

The proposed system was developed in the following phases:

1. The first phase of the project involved the development of the chatbot.
2. The second phase of the project is based on developing a chatbot using an SVM algorithm.
3. The third phase of the project is developing a KNN algorithm-based chatbot.
4. The fourth phase of the project was focused on the development of The sign language recognizer.

5. This fifth phase was about developing the text-to-speech and speech-to-text converter.
6. The system was integrated into the sixth phase of the project, the chatbot was combined with text-to-speech and speech-to-text technology along with a sign language recognition model.
7. This last phase is the testing and validation phase where the accuracy of the chatbot system was evaluated and features like voice-based and image-based input were tested.

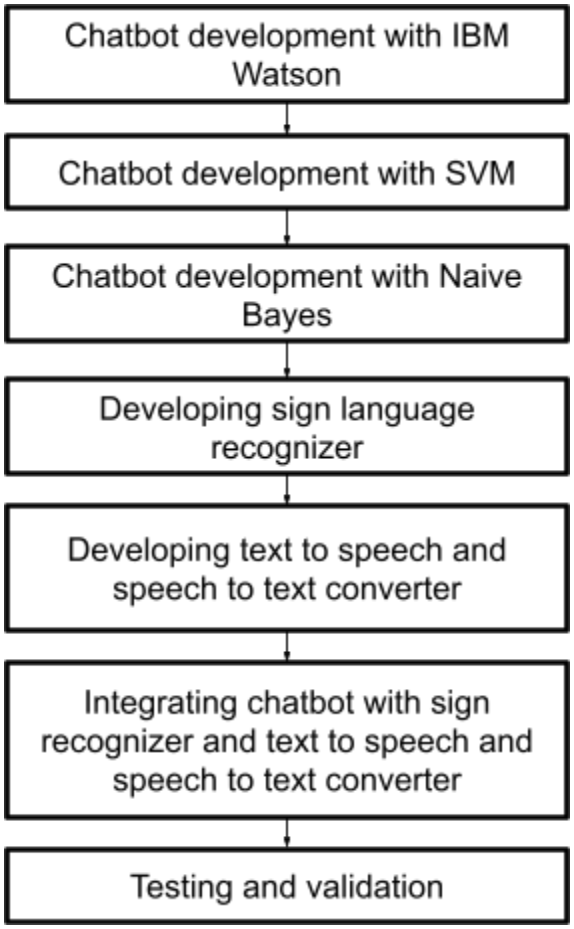

Figure 2: Project phases

NLP(Natural Language Processing) and NLU(Natural Language Understanding), two subgroups of AI that deal with how robots to process and comprehend

human inputs are the foundation of AI chatbots. A conversational chatbot can be as basic as an interface that offers a fixed set of options and a constrained range of replies, or it can be as complicated. The NLP and NLU capabilities found in more sophisticated chatbots allow them to reply to a wide range of human input with accuracy and diversity. Designing conversations and creating the chatbot itself are the two primary stages of chatbot development. The first step entails using a program to plan out every interaction that your chatbot may potentially have. In the second, the bot itself is built using one of the platforms or frameworks that are accessible. The conversation design takes into account both scripting and flow, or what your bot will say and how it will say it. In this step, the goal for the chatbot is set clearly, and audience experiences are set before the chatbot development process. It is crucial to examine all potential user responses to each bot output and the places where distinct flows intersect while defining all possible courses of a discussion. Scripting will be built on top of this flow diagram. In the project, three chatbots were created, comparing and evaluating the performance of the chatbots to identify the most accurate one for implementing the proposed system.

3.1 Chatbot development using IBM Watson

The chatbot was developed using the Watson Assistant tool available on the IBM cloud platform. The Watson Assistant is an enterprise-level white-labelled cloud service that allows developers to embed artificial intelligence into their products. The development of the chatbot was split into five stages.

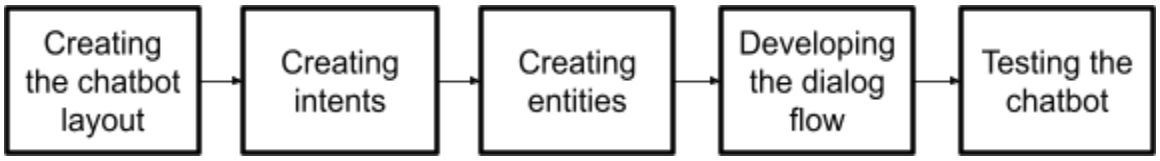

Figure 3: Stages of chatbot development

The first stage is where the chatbot layout was created. The layout was helpful to refer back to verify if the progress is in inline with the chatbot intended. The data required to train the chatbot was collected from online sources for career guidance and counselling. The second stage of the chatbot development phase is the process of creating intents, which is an essential part of the chatbot as this will help in identifying the goal of the customer. When the user is interacting with the chatbot, it is important for the chatbot to understand what the user intends in its response, as based on this the chatbot will decide on the next step of action, reply, or question.

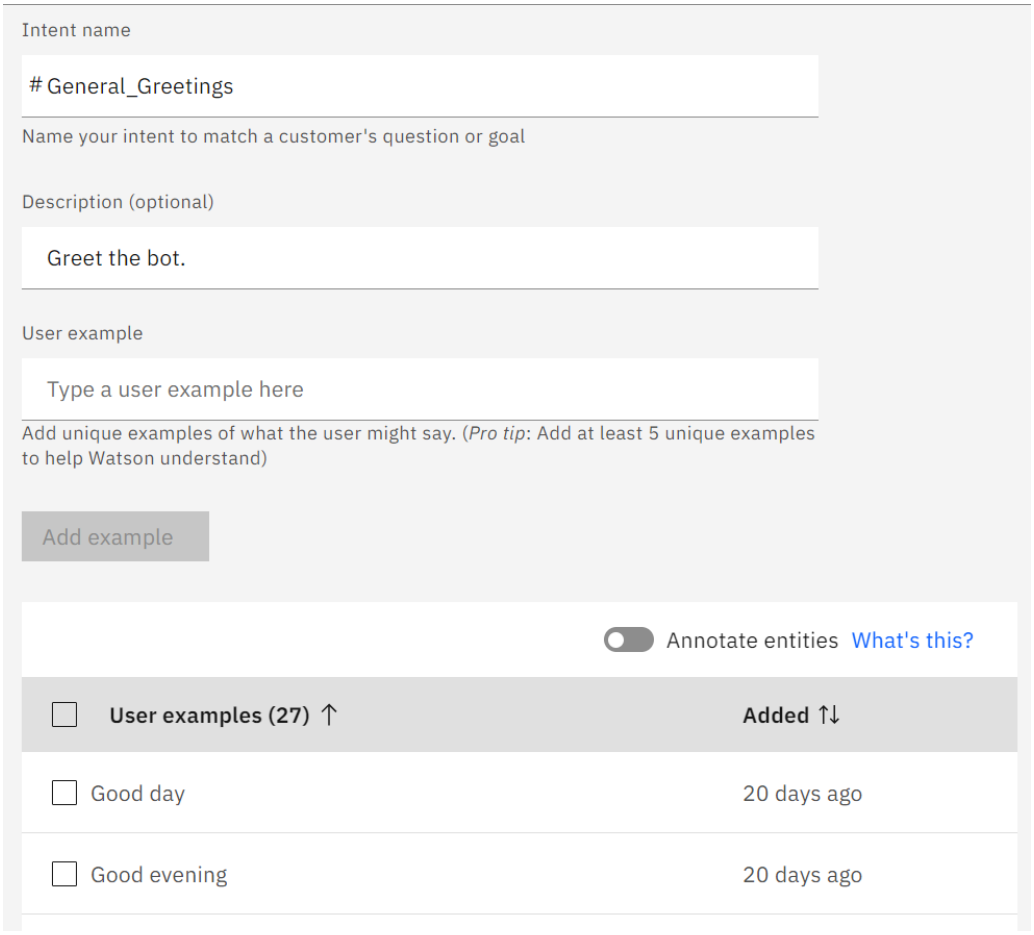

Figure 4: Example of intent

The above figure illustrates the process of intent creation. Examples of different sentences and keywords that can be used by the user are added to the respective intent labels, as the chatbot will refer to these samples to understand the intention of the user. Intents also come in handy when dealing with misspelt words or sentences. The chatbot will be able to successfully interact with the user if it can parse the intent.

The third stage of the process is to create entities, which are also known as the knowledge repositories for the chatbot. The entity is one of the two essential building blocks of natural language processing, the intent being the other. The role of the entity is to help the chatbot identify the correct intent. It usually takes the form of a phrase or value that appears in the user's answer and is crucial in determining how accurate a chatbot is.

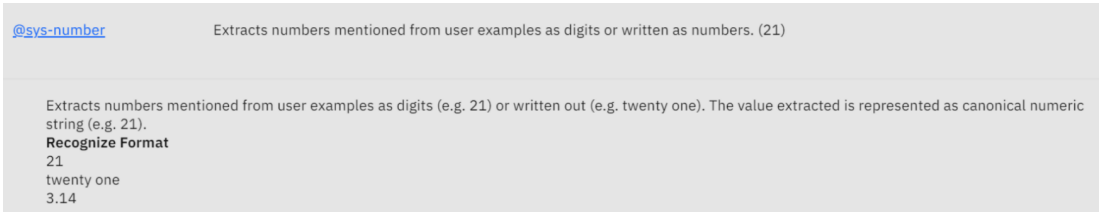

Figure 5: Example of an entity

The fourth stage deals with the creation of dialogue flow, where the chatbot conversational flow is set either by adding the main nodes or child nodes. Each of the nodes has multiple replies or questions to respond to the user, and conditions are added to control the execution of that particular dialog node. For example, if the node has the condition set to a particular intent, then the node will not be executed if the chatbot does not identify the set intent in the user's reply. Exit conditions are set to the node after execution as well in order to guide the chatbot on the next action.

The figure 6 below is a part of the developed chatbot, which shows the dialogue flow of the chatbot nodes. Here the chatbot starts with the welcome node, which greets the user, and depending on the response of the user, the chatbot will proceed to the next node. In our case, the second node has an entry condition set. If the user response contains any keywords or values relating to the intent or entity set as the entry condition, then it will enter the node, otherwise it will not.

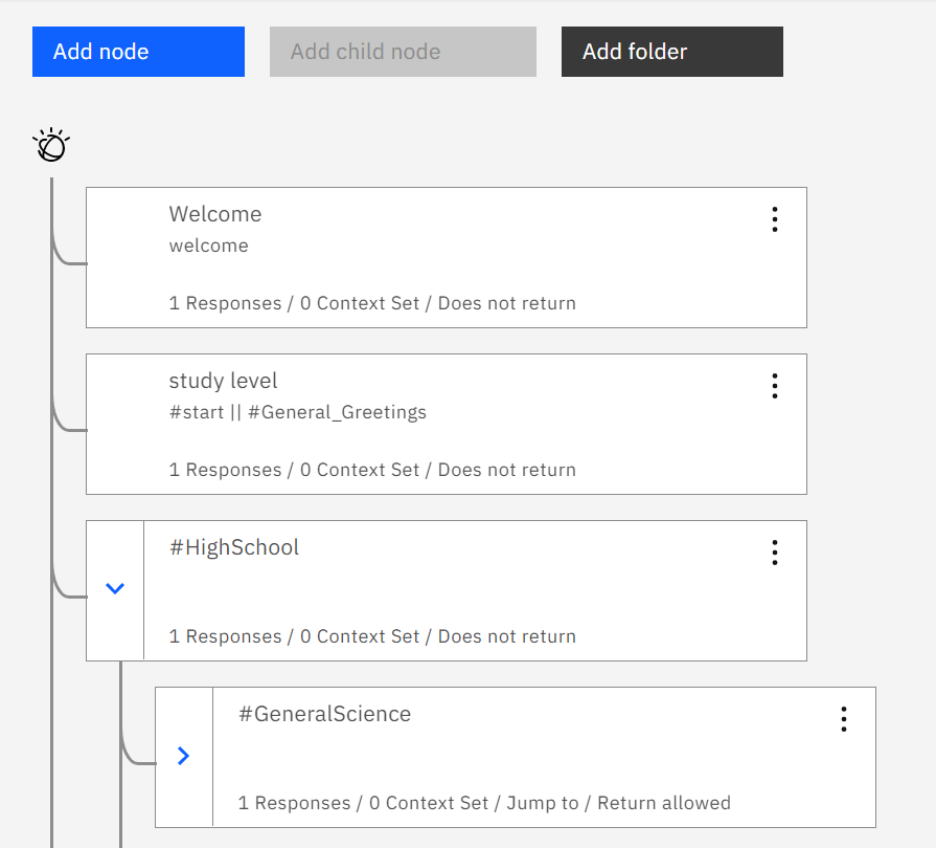

Figure 6: Dialog of the chatbot

Additionally, there are child nodes present as well. The child nodes will get executed only if the parent node is executed. Entry conditions for the child node can also be set and they have to be satisfied for the node to be entered along with the execution of the parent node.

The last stage of the chatbot development process is to test the chatbot to check if the bot can identify the intents and is able to respond when the user interacts. The entry and exit conditions of every node are tested along with the responses.

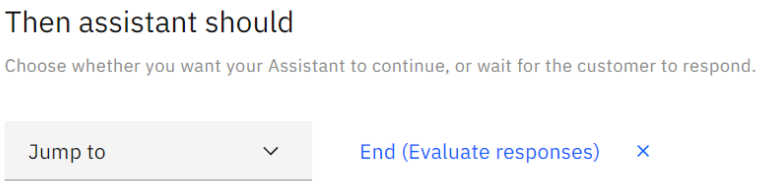

Figure 7: Node with exit condition

3.2 Chatbot using SVM algorithm

The next phase of this project is aimed at developing a chatbot using an SVM algorithm. SVM is one of the supervised machine learning algorithms. It creates decision boundaries called hyperplanes to classify different groups. The hyperplanes are created using the extreme points, and these extreme points are also called support vectors. The Support Vector Machine algorithm can be of two types: one linear support vector machine, which is used if the dataset has to be classified using a straight line, in a case where there are only two categories, then it will be very helpful to use the linear support vector machine. The second type is a non-linear Support Vector Machine which is used for non-linear data classification. Here the separation line cannot be a straight line and needs to be a curve. The chatbot developed uses a non-linear Support Vector Machine to classify the keyword that is present in the user response.

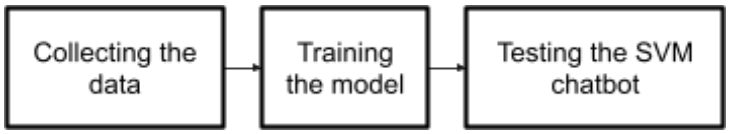

Figure 8: Stages of SVM chatbot development

This phase has three stages for completing the chatbot, the first stage is the data collection stage, where multiple sentences, words, and values are collected to be added as examples under each label. The data collected contains sentences with spelling mistakes as well, so that the chatbot can be able to recognize the labels accurately. The second stage of the project is the model training process, where the machine learning model is trained to appropriately respond to the user. The last stage of this phase is to test the chatbot's performance and validate its accuracy.

3.3 Chatbot using Naive Bayes algorithm

The third phase of this project focuses on developing a Naive Bayes algorithm-based chatbot. The naive Bayes algorithm is one of the supervised learning algorithms, which is very commonly used for text categorization based on Bayes' probability theorem and can be stated mathematically using the equation shown below. This equation can be used to find the probability of event A provided event B has occurred.

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

Figure 9: Bayes' theorem

It's a very simple algorithm which can be effective on large datasets. This algorithm is used for creating a closed domain chatbot which has the dataset with the questions, user responses, and replies pre-defined. The chatbot is able to reply back to the user based on the saved responses. This phase is divided into three stages. The first stage of this phase, as shown below in the figure, is collecting the data, which is done by making individual categories for each career path and adding the related questions and responses to labels. Labels are different sections to which related questions and queries will be added and these

labels are identified based on the user input. In this project, the labels are the different fields of study and career paths that are available. The chatbot model is trained to refer to the given dataset. The second stage of the phase is to train the model using the algorithm, and the final stage is to test the chatbot to see if the responses are appropriate.

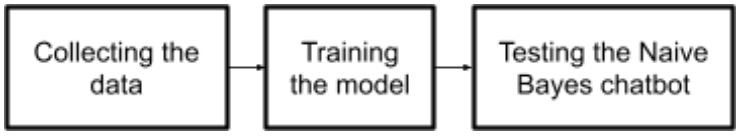

Figure 10: Stages of Naive Bayes chatbot development

Data preprocessing is required for identifying and understanding the keywords in the user intent. One of the most frequently used techniques is to first create tokens. The tokenization process deals with converting strings to smaller tokens. The second step is to reduce the length of the words, which is also known as lemmatization or stemming. Characters and symbols are removed from the text. The tokens are then counted to get the frequency. This will help the chatbot understand the most frequently used words, which will in turn help determine the importance of that particular keyword. One of the drawbacks of this method is some common words that occur in most of the sentences are considered as important and will affect the accuracy of the chatbot. To overcome this, the TF-IDF technique is used where the words are given weight. The ones occurring frequently get less weight value, and the ones occurring rarely get the higher weight value.

3.4 Sign language recognizer using LSTM algorithm

The fourth phase of this project focuses on developing an accurate sign language recognizer. The developed model is integrated with the chatbot for users to respond through hand signs. The first stage of the sign language recognition model is to collect the required and accurate dataset based on

images. The dataset collected contains 30 different hand signs and 20 images of each hand sign. The image captured with the help of an open computer vision library has key points marked on it. The media pipe holistic library is a combination of face, pose, and hand tracking models, which is used in this project for identifying the hand signs of the user. The input image has landmarks marked by the media pipe algorithm after identifying the Region Of Interest (ROI).

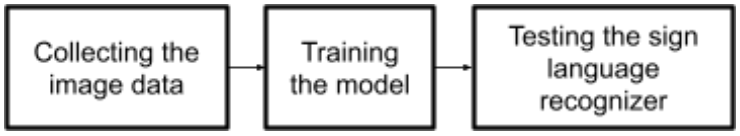

Figure 11: Stages of sign language recognizer development

Figure 12 is the sample frame which has the user hand sign data being captured along with the landmarks marked on it. The second stage of the process is to train the model using a feed-forward LSTM (Long Short Term Memory) neural network.

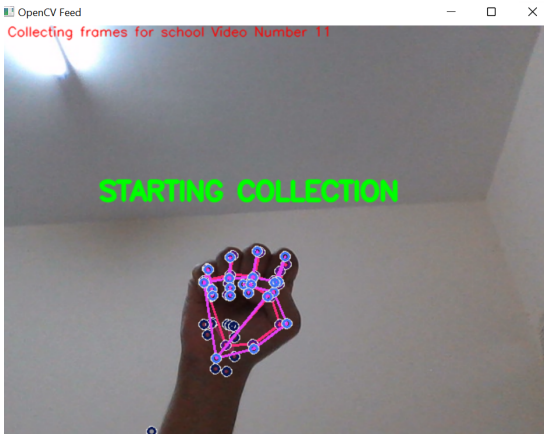

Figure 12: Data collection sample

The output from the previous step is considered in a recurrent neural network as a contribution to the following phase. The problem of RNN's long-haul circumstances, where the RNN can't predict the word stored in the drawn-out memory but can provide further precise predictions from the incoming input, may be handled by LSTM. Long Short-Term Memory can be utilised for handling, anticipating, and arranging based on time-series information. The LSTM model's ability to process multiple sequences of data makes it more reliable for image processing; it has a series of gates (input gate, output gate, forest gate) which act as filters as it has its own activation functions. LSTM has a chain structure that contains multiple cells. The data that is at this point not helpful in the cell state is taken out with the forget gate. The input of the particular time and the previous cell output are fed to the gate, after which the product of this, combined with the weight matrix, is calculated to be added with the bias. The output is passed to the final model, which will give the output in the form of binary values, either 0 or 1. The input gate has the extra information that is useful for the cell state. The patterns obtained with the vector and regulated values are multiplied.

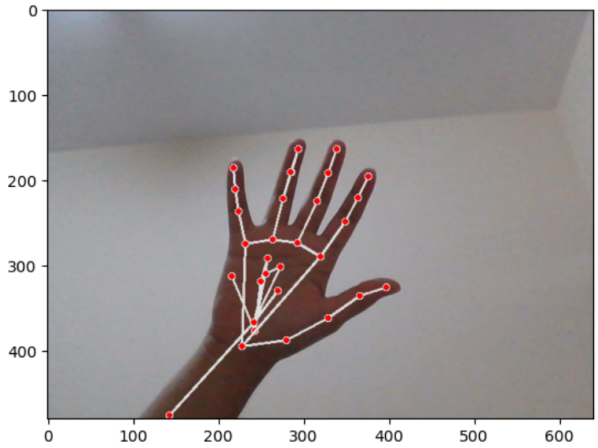

Figure 13: Landmarks marked on hand

The last gate is the output gate, and it is used for extracting the details from the current cell. During the last stage, the model is tested and verified to see if it is

able to recognise the hand signs accurately in a real-time environment, as the rate at which frames will change is higher.

3.5 Text-to-speech and speech-to-text using the IBM platform

The fifth phase of this project deals with the deployment and testing of the speech recognizer and text-to-speech converter, and this phase is completed in three stages, as shown in figure 9 below.

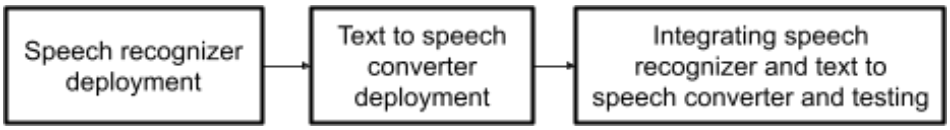

Figure 14: Stages of a speech recognizer and text-to-speech deployment

The deployment of the speech recognition service from IBM is the first stage, as the voice-based input data taken from the user needs to be converted into the text format. The IBM Watson Speech-to-Text service has speech transcription capabilities using machine learning to accurately translate a human speech by combining knowledge of grammar, linguistic structure, and the structure of audio and voice signals. The text transcript is given as an input response to the chatbot, which the chatbot will further process to relate it to intents and entities for providing an appropriate response back to the user.

The second stage of the process is the deployment of text-to-speech conversion, which is used for generating the audio response from the chatbot that is based on the user input. The last stage of the integration phase is to integrate the speech-to-text and text-to-speech converters to check their accuracy in being able to convert the content.

3.6 System integration

Integrating the speech recognition, text-to-speech, and sign language recognizer with the chatbot. This process is the sixth stage of the project. In this phase, the code is scripted to give the user the option to select the mode of interaction with the chatbot. If the user selects the text-based option then, they can continue interacting as usual. If the user selects the mode as sign language, then the video feed will turn on and the sign language will be converted to text as the user gets their turn to respond. If the user selects voice-based interaction mode, then the speech recognition system will be activated and the user will be able to respond to the Chabot through voice inputs.

3.7 System testing and validation

The last phase of this project is the testing phase, where the complete chatbot system is tested and verified. Each of the chatbot features is tested thoroughly to identify any logical errors. Multiple responses, which were set for the chatbot to answer users randomly, were also tested.

The figure 15 below shows the sample output when the text based interaction method is selected by the user. A input text box will be prompted for the user to enter their interest and the response will be displayed by the chatbot.

```
Hi, please enter the number to select the method of interaction:
 1. Text
 2. Voice
 3. Sign Language
 You can enter "quit" if you want to exit 1
Hi, I am Alicia, your virtual counsellor. Tell me about your interests.
>>  i want to be a accountant
Detected intent: #accounting
It looks like you are interested to become a A!ccountant!
```

Figure 15: Text based chatbot

The figure 16 below illustrates the the response give byt the chatbot when the user selects the voice based interaction technique. Here the user will have to passs in the audio file which will be converted to text for the chatbot to process and to identify the intent. The response will be returned in form of audio file along with displaying the response as text as well.

```
Hi, please enter the number to select the method of interaction:
 1. Text
 2. Voice
 3. Sign Language
 You can enter "quit" if you want to exit 2
Hello, I am your virtual counsellor, Alicia. Tell me about yourself.
enter voice message civil.flac
Detected intent: #civil
It looks like you are interested in Civil Engineering!
```

Figure 16: Text based chatbot

```
Hi, please enter the number to select the method of interaction:
 1. Text
 2. Voice
 3. Sign Language
 You can enter "quit" if you want to exit 3
Hello, I am your virtual counsellor, Alicia. Tell me about yourself.
<class 'mediapipe.python.solution_base.SolutionOutputs'>
<class 'mediapipe.python.solution_base.SolutionOutputs'>
<class 'mediapipe.python.solution_base.SolutionOutputs'>
```

4. Result and Discussion

The proposed system is able to perform as expected, it is able to recognise intents accurately and respond to the user. The figure above is an example of how the chatbot is able to recognise the keywords from the user input, and compare the identified keywords with the sample keywords and values available in the knowledge base (entity), to respond accordingly.

4.1 Comparing the chatbot performances

During the project development phase, the chatbot was developed using three different algorithms: IBM Watson, Naive Bayes, and Support Vector Machine. When all these three algorithms were compared, the IBM Watson chatbot had the better performance. The Support Vector Machine algorithm works very precisely when the separation between the classes is greater, and it is highly efficient in terms of memory. It can be applied to data that is irregularly distributed. It has a very useful method known as the kernel, and by utilizing the kernel function that goes along with it, we may tackle any challenging problem. With the SVM Kernel, the necessity for this premise may be eliminated by turning input data into high-dimensional data. The kernel allows the option of picking a function that is not always linear and that can assume multiple shapes depending on the type of data it acts on.

When there is clear differentiation of class separation, SVM frequently works effectively and does not experience overfitting. It performs and generalises on the extrapolated data well. The SVM algorithm has a few drawbacks as well, as this algorithm is not suited for large datasets. It's not very precise with huge datasets. The performance of this algorithm-based machine learning model is not

good when the target classes in the dataset are overlapping or contain noise. If the number of features is high and exceeds the number of data points, then the model performance suffers. In the case of the Naive Bayes algorithm, it performs well if the corpus is small and it is easy to implement. Since the probabilities may be determined immediately, evaluating the conditional probability is straightforward and rapid without the need for iterations. This technique is useful in circumstances when training speed is important. If the conditional independence presumption is correct, it could result in good outcomes.

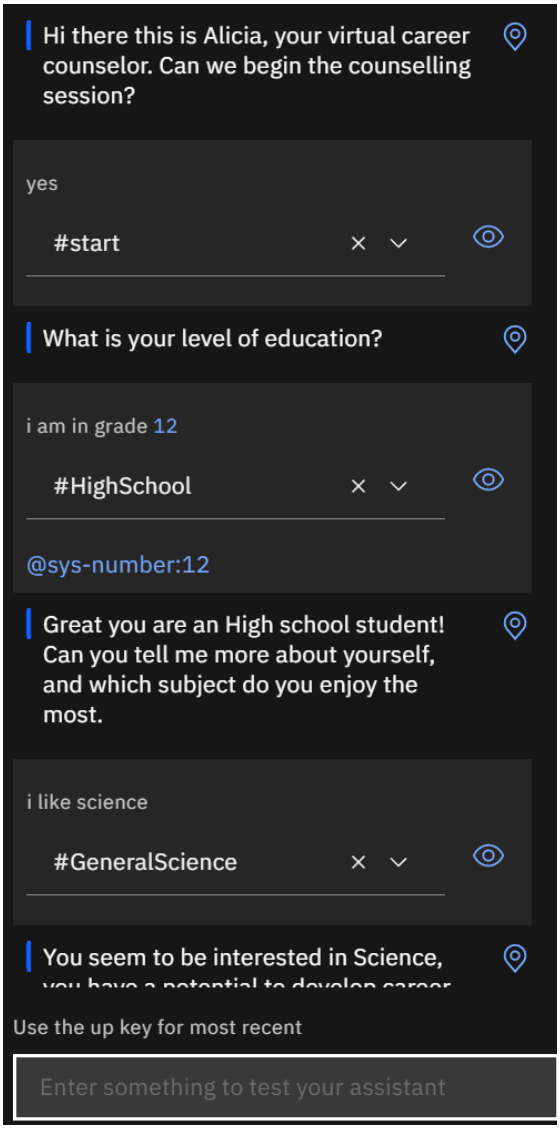

Figure 15: Chatbot - User interaction

The Naive Bayes algorithm has limitations in terms of independence. The assumption of the model is not always accurate, and the feature often exhibits some sort of dependence. It also has a zero probability issue: this issue occurs if there are zero class probabilities if we come across terms in the test data for a given class that are absent from the training data.

From a "features' perspective, the major difference between the chatbot model developed using the Naive Bayes and SVM is that Naive Bayes is more independent, whereas SVM, given the scenario, does a better job at capturing the keywords. The SVM outperforms the Naive Bayes. When compared to the performance of the support vector machine algorithm-based chatbot, the IBM Watson-based chatbot has a better performance. As shown in the figure 15 the chatbot is accurately able to identify the intent and is able to carry out the conversation with the user.

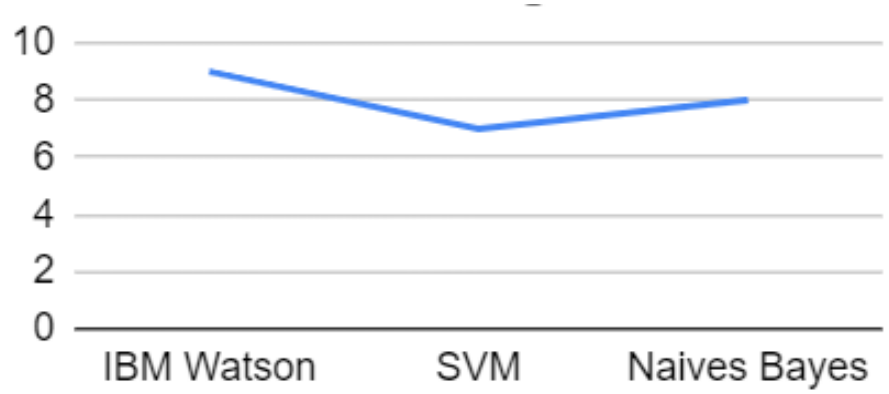

Figure 16: Performance comparison

The graph shown in figure 16 is the performance comparison done between the three algorithms used for developing the chatbot. The chatbots were tried multiple times, and out of 10 randomly selected trials, the chatbot developed

using the IBM Watson performed better, with responding 9 times accurately. The chatbot developed using SVM algorithm was aable to respond 7 out of 10 times correctly compared to the chatbot using the Naive Bayes algorithm which performed better than the SVM algorithm based chatbot, with accurately responding to the user 8 out of 10 times.

4.2 Evaluating the sign recognition model

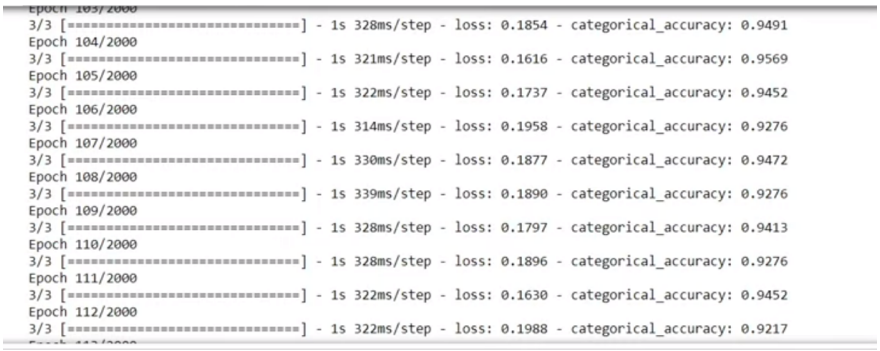

Figure 17: LSTM model training

The model used for the hand sign recognition was trained using the Long Short Term Memory algorithm for 2000 epochs as shown in the figure 17. Recurrent neural network models called LSTM network models have the capacity to recall and learn across lengthy input data sequences. They are designed to be used with data that consists of lengthy data sequences.

The model is capable of handling several concurrent input data sequences and learns how to map internal properties to different activity categories as well as how to extract features from observational sequences. Utilizing LSTMs for sequence classification has the benefit that they can learn directly from the unprocessed time series data, eliminating the need to manually create input features and freeing up domain expertise.

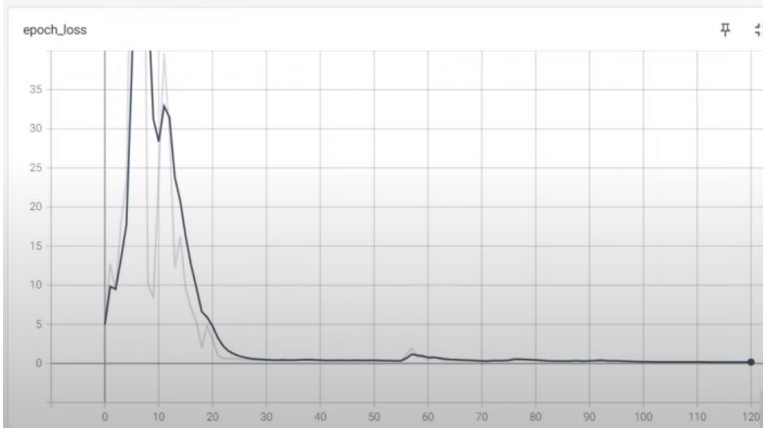

Figure 18: LSTM model epoch loss

While the model is trained, the epoch loss is also noted as low as 0.1630 and the accuracy of the model is around 90.50 %, which is good comparatively.

```
In [232]: accuracy_score(ytrue, yhat)
Out[232]: 0.9058823529411765
```

Figure 19: Accuracy of the model

Neural Convolutional Networks (CNN). Despite the better performance on static pictures, the application of these models to movies is computationally expensive and exhibits flickering and performance degradation. These less-than-ideal outcomes are mostly attributable to the inability to enforce sequential geometric consistency, handle extreme picture quality deterioration (such as motion blur and occlusion), as well as the incapability to capture the temporal connection between video frames. The Long Short-Term Memory (LSTM) outperformed cutting-edge methods on two large-scale video pose estimation benchmarks while also handling input quality degradation in movies well. The prediction for video-based posture estimates benefits from LSTM.

4.3 Evaluating the speech recognizer and text-to-speech model

The IBM speech recognizer and the text-to-speech converter have a good performance when they are able to recognise the sounds with different English accents and accurately convert them to the text format. The text-to-speech converter is able to accurately convert the text data or information from the chatbot to the audio format.

```
# Setup Service
authenticator = IAMAuthenticator(apikey)
tts = TextToSpeechV1(authenticator=authenticator)
tts.set_service_url(url)
```

Figure 20: Accessing the service

The speech recognition option in the chatbot is very precise when identifying the words pronounced and converting them. Virtual assistants, often known as chatbots, are cutting-edge devices that simplify human-computer interaction. They are two of the latest technologies used across all industries, and particularly in banking, they are designed to facilitate communication between people and computers. Overall, the system developed is able to perform as an expected proposed system.

Voice-based chatbots have a speech channel for communication powered by Artificial Intelligence and natural language understanding (NLU) that converts audio to text format. The use of AI technology enables the determination of the most appropriate dialogue responses by identifying important speech indicators. To finish the interaction, the text-to-speech (TTS) engine turns the response into audio or voice. The full speech understanding and response process is completed by these bots in a way that is quite similar to that of a person. They can also be referred to as voice chatbots or voice assistants. An intelligent method of communication that is simple to incorporate into many different

gadgets with the voice assistant. Speaking comes naturally far more than writing. User will thus have more impromptu and unplanned conversations than the user would with printed letters. The chatbot will benefit from this spontaneity as it broadens its knowledge base and improves its AI by responding to various inquiries.

4.4 Evaluating the performance of the proposed system

The proposed system is able to respond to the user based on the method of interaction. The output response is based on the interest of the user to mentioned in the user input.

Conclusion

One of the biggest obstacles for students whose graduation is soon is career preparation. It might be quite difficult to define your own professional path. Guidance professionals can assist young people in choosing the best course for their future in this situation. Or that's where they would intervene in the past. Chatbots and AI have been used to give better, more individualized advice to students in an effort to advance and empower the area of career planning. Even though some individuals might be wary of technology's usage in this industry, chatbots and AI can have a variety of positive effects on career planning. The transition for students with impairments from school to the workplace is fraught with difficulties. Future employment alternatives must be carefully considered, and the process might be difficult. Despite the wide variety of careers available, people with disabilities have historically had fewer career options. This is particularly true if they are unprepared for the demands of the workplace, underrate their abilities, or are not aware of the variety of workplace accommodations that can increase their career options. Students who receive career counselling have access to the knowledge and tools they need to get over these challenges and are better equipped to make decisions that are in line with their unique interests and talents.

This proposed system is designed to answer the research questions like how can Artificial Intelligence (AI) can be used to create a customized, trustworthy, and accurate chatbot for job counselling, and how can customers with any kind of physical disability utilize the chatbot-based counselling service powered by Artificial Intelligence. The creation of the chatbot is the first of several steps that make up the project. The creation of a chatbot based on the SVM algorithm will come next, followed by the creation of a chatbot based on the KNN algorithm. The complete system was incorporated after testing the text-to-speech and speech-to-text converters and the recognition of sign language. Testing and validation were completed at the end. The most effective method for getting the

required results have been demonstrated to be a combination of several AI types, such as NLP, machine learning, and computer vision. The integrated system developed was able to fulfil the objectives of this dissertation.

Future Work

The system can be further updated by adding more features to the voice-based input and text-based input. The system's future development may involve adding support for multilingual chatbot usage. The voice recognition system can be updated to recognize and respond to the user in different languages and dialects. Additionally, the feature of the chatbot to convert voice-based input to sign language will be especially beneficial as it will allow the user to have the dialogues shown in sign language along with voice-based and text-based responses.

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Words Count

The total number of words in this dissertation is 10,873 excluding quotations, references, titles for figures and tables, acknowledgements, and appendices.

Appendix

The figure 21 below shows the setup of the IBM Watson service, which is used for developing the chatbot.

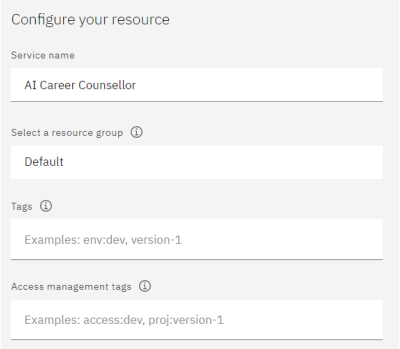

Figure 21: IBM Watson setup

The figure 22 below shows the setup of the IBM speech recognizer service, which is used for converting the voice input to the text format.

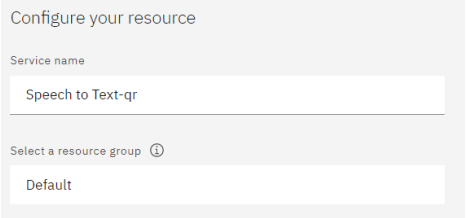

Figure 22: Speech recognizer setup

The figure 23 below shows the setup of the BM speech recognizer service, which is used for converting the voice input to the text format.

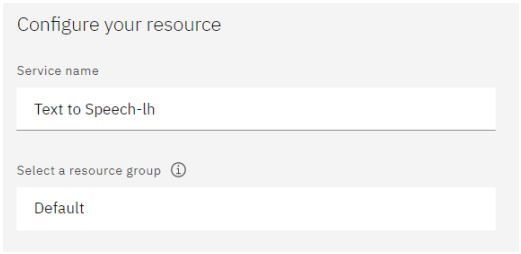

Figure 23: Text to speech converter setup

The figure 24, shows the code used for installing the required libraries to identify the landmarks on the captured images and to train the model to recognize the hand signs.

```
!pip install tensorflow==2.5.1 tensorflow-gpu==2.5.1 opencv-python mediapipe sklearn
```

Figure 24: Installing required libraries

The code in figure 25 is used for installing the IBM Watson library to call the chatbot to pass in the input taken from the user and to receive the response from the chatbot.

```
pip install --upgrade "ibm-watson>=6.1.0"
```

Figure 25: Installing IBM library

```
from ibm_watson import SpeechToTextV1
from ibm_cloud_sdk_core.authenticators import IAMAuthenticator
```

Figure 26: Installing Speech Recognizer

In figure 26, the codes are executed to install the necessary libraries for accessing the IBM speech-to-text.

```
from ibm_watson import TextToSpeechV1
```

Figure 27: Installing Text to Speech

In figure 27, the code is executed to install the required libraries for accessing the IBM text-to-speech.