VocaVisionary: A Career Guidance Chatbot

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***Abstract*—In today's rapidly evolving career landscape, students encounter a myriad of challenges and uncertainties as they embark on their professional journeys. Traditional career paths have given way to a more dynamic and adaptable approach, placing a premium on informed decision-making. Recognizing this need, an innovative career guidance chatbot has emerged. This pioneering tool offers students a more engaging and empathetic experience, providing tailored advice and personalized recommendations based on individual profiles and aspirations. This paper delves into the current state of career guidance for students and introduces a transformative chatbot harnessing generative AI capabilities. By combining technological innovation with personalized support, this chatbot aims to empower students to navigate the complexities of today's job market with confidence, offering a path toward informed decisions and the pursuit of personal and professional fulfillment.**

Keywords—Chatbot, AI, NLP, Career Counseling, Sten, API

I. Introduction

In today's fast-paced and dynamically changing world, students embarking on their career journeys face a unique set of challenges and uncertainties. The traditional pathways to success that previous generations followed have evolved, demanding a higher degree of adaptability and informed decision-making. Navigating this complex landscape can be a daunting task, and students often find themselves in need of comprehensive guidance to make well-informed choices that align with their skills, interests, and aspirations.

As the demands of the job market continue to shift, the importance of career guidance becomes increasingly pronounced. Students and job seekers are actively seeking tools and resources that can provide not only direction but also personalized advice tailored to their individual profiles and ambitions. In this context, the emergence of artificial intelligence (AI)-powered career guidance chatbots presents an exciting opportunity to bridge the gap between students and the wealth of information and insights available.

This paper explores a pioneering career guidance chatbot that is developed with the help of the Chat-Bison model for providing career assistance to the users. By examining this innovative chatbot, we aim to shed light on how it add

II. Literature Survey

In [1] the development of an online vocational aptitude test is a pivotal advancement in education and career guidance, addressing long standing challenges associated with traditional tests. Drawing from established research on the significance of aptitude assessment in educational and career decision-making, this study's online test offers a promising solution. The test's performance metrics, including precision, recall, and accuracy, affirm its suitability for online use. Moreover, the test empowers students to independently recognize their talents and make informed educational choices, aligning with the principles of autonomy in motivation and decision-making. Future directions should concentrate on enriching the test's content to encompass a wider array of aptitudes, building upon the evolving understanding of human intelligence. This research marks a significant step toward more efficient and personalized education and career pathways.

This study [2] uses artificial intelligence to present a chatbot system for job advice. Without causing any financial consequences, the chatbot works continuously, engaging consumers in human-like interactions. It allows for user mistakes and departures from patterns by utilizing machine learning models for training and data storage. This results in a conversational experience that is adaptable. AI powers the chatbot by interpreting nonverbal clues, emotions, and subtleties in conversations, all of which increase its efficacy. This chatbot helps students on several platforms by lowering stress, offering advice, and helping them make educated decisions about their future vocations through the use of Indigenous Language Processing and a large knowledge library. By depending on current events and evidence-based answers, it guarantees precision and user contentment, finally accomplishing the objective of helping learners make knowledgeable decisions.

This [3] contributes to the field of psychological measurement and education by investigating the predictive validity of the Differential Aptitude Test (DAT) in the context of psychology study programs. The research findings indicate that DAT scores, particularly in the verbal and numerical subtests, can effectively predict academic success among psychology students, accounting for a substantial portion of the variance. This underscores the importance of aptitude

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assessment in higher education admission and program placement decisions. However, the study also suggests the need for further research exploring additional factors beyond aptitude that influence success in psychology and other study programs. Additionally, it calls for a comprehensive review and development of aptitude test validity criteria and methods, reflecting the evolving landscape of psychological measurement. This research opens avenues for future investigations into a broader spectrum of success determinants in higher education across various study disciplines.

This [4] delves into the critical issue of inadequate career counseling for university students and recent graduates, which often leads to employment challenges and job dissatisfaction. It emphasizes the role of AI-powered chatbots in addressing this problem by offering efficient and accessible career guidance. The study cites a survey indicating that a significant portion of young professionals is dissatisfied with their current jobs, highlighting the importance of selecting careers aligned with individual interests. In many cases, career choices are influenced by parental or financial considerations rather than personal passion. The study advocates for AI, specifically chatbots, as a promising solution. It defines chatbots as AI software capable of simulating natural language conversations and highlights their potential in career counseling through Natural Language Processing. Ultimately, this research seeks to implement a chatbot system that can analyze user input and provide relevant career guidance, aiming to improve career decision-making and overall satisfaction among students and graduates.

This [5] addresses the pressing issue of career choice dilemmas arising from the uncertainty and constant change in the corporate world. It proposes a comprehensive product that leverages various methodologies to assist individuals in selecting the most suitable profession. The key aspects considered include both conscious and subconscious factors that influence one's attitude and aptitude toward specific careers. The research includes three essential modules: handwriting analysis, psychometric testing (using the Myers-Briggs Type Indicator, or MBTI), and aptitude testing. While the psychometric and aptitude tests offer insights based on people's conscious replies, handwriting analysis explores the subconscious elements of personality and career compatibility. Offering customers a comprehensive grasp of their job alternatives is the goal of this method. In order to make handwriting analysis more effective and labor-efficient, the study also emphasizes the significance of image processing. It also emphasizes the importance of objective tests in aptitude testing and the MBTI in identifying psychological preferences, which eventually help individuals make well-informed job selections. This study shows promise in addressing career uncertainty in the corporate setting by combining several analytical techniques into a cohesive guiding framework.

This [6] emphasizes the critical role that mentoring plays in a student's educational path, recognizing that advice is necessary in higher education and covering

program and career options, individual counseling, and general growth. It offers a way out—a chatbot built to interact with students—that allows them to express themselves freely and anonymously without worrying about prejudice or judgment. Based on the questions the students ask, the chatbot's goal is to assist, respond to inquiries, and provide advice on both personal and professional. An alternative to conventional mentoring sessions, which are frequently laborious and might not be as successful, is this technique.

The project intends to use technology to improve and democratize mentoring, which is acknowledged as a crucial part of students' development and decision-making in higher education.

This [7] is to create an expert system that will provide students with educational assistance after they have finished their secondary (SSC) and higher level (HSC) education. It gives importance to the application of artificial intelligence (AI) in educational counseling, drawing on the fundamental principles of AI, which involve studying human thought processes and representing them in machines. The project aims to utilize AI technologies to provide students with insights into potential career opportunities, considering their interests and aptitude test results. In today's dynamic world, having knowledge about various career fields is important, as many individuals later regret their initial career choices or feel pressured by other people, such as parents. This study recognizes the importance of informed decision-making in course selection and proposes that AI, specifically fuzzy expert systems, can play a pivotal role in narrowing down suitable career options based on a person's abilities and interests. Fuzzy expert systems are highlighted as a valuable AI approach, using membership functions and fuzzy logic rules to reason about data, offering a more nuanced approach than traditional Boolean logic. This research aligns with the growing interest in AI-driven educational guidance systems to empower students to make informed career decisions.

This [8] highlights the growing significance of textual communication in today's digital age, where adults spend a substantial amount of time on screens, primarily engaging in web applications like WhatsApp, Facebook, and Twitter for speech and textual conversations. Focusing on the educational domain, the study introduces a chatbot designed to answer user questions. To develop this system, an ensemble learning approach, specifically the random forest algorithm, is employed alongside feature extraction from a prepared dataset. Notably, the system is deployed as a Telegram bot, acknowledging the chatbot's potential to enhance responsiveness, increase availability, and reduce dependence on human resources in an era of automation. This research thus identifies the need for an automated conversational system tailored to the educational sector, setting the stage for the development of the described chatbot.

This [9] underscores the transformative potential of chatbots, also known as conversational interfaces, in reshaping human-computer interactions. It introduces a chatbot system with a specific focus on improving communication between parents and educational institutions. Studies have highlighted the importance of parental involvement in a student's academic journey, yet often, there is a significant communication gap between parents and schools. This research uses Natural Language Processing (NLP) techniques—specifically,

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the Dialog Flow API—to create a chatbot that can respond to parent inquiries in Tamil, the native language of the study participants. Intent detection, conversation management, dialogue design, and slot fulfillment are the main features of the chatbot. Pusher Channels and the Flask micro framework are used in its implementation. Traditionally, excessive dependency on student posts in contacts between educational institutions and parents has prevented effective communication. However, recent technology advancements have made it possible to establish new, international communication channels. The field of Natural Language Processing (NLP) in artificial intelligence has advanced quickly, allowing machines to understand and generate natural language—a essential function for chatbots. One possible use of combining chatbots and NLP is this project. This project provides parents with a helpful tool to help them maintain a stronger home-school connection and stay informed about their children's academic success. It is a potentially useful application of chatbot and natural language processing technologies.

This [10] explored generative AI and its applications. It reviewed various generative AI models, including Restricted Boltzmann Machines, Deep Belief Networks, Deep Boltzmann Machines, Generative Adversarial Networks, and Transformers. It highlighted that generative AI can be used to generate creative text formats, audio, images and even 3D models. The applications of generative AI include business, education and healthcare sectors. However, this study also raised concerns regarding the potential negative aspects of generative AI, such as copyright infringement, misuse and fake information.

III. Proposed Work

The Chat-Bison model is being used for developing this chatbot. The model is a fine-tuned version of the PaLM 2 model, specifically designed for multi-turn conversation use cases It can be used to generate text and write many kinds of creative work. This model is customizable to any chatbot. This strategy makes effective use of the Career Counseling chatbot. Through the utilization of aptitude tests, individuals can discover skills they were previously unaware of.

A. Model Details

Chat Bison is a fine-tuned version of the PaLM 2 model, the task of this model is basically text generation. This model is designed to excel at understanding user queries, generating natural language responses, and engaging in back-and-forth conversations. The model can handle zero, one, and few-shot tasks which means the model needs less data. The properties of this model are:

- Max input token: 4,096
- Max output tokens: 1,024
- Max turns : 2,500

B. Set-up

The chat-bison model is available in Vertex AI which can be accessed by creating an account in Google Cloud. Choose chat-bison model from Vertex AI. Next, we have to set up the parameters for getting better response from the chat bot the parameters set-up:

- temperature: 0.25
- top_k: 40
- top_p: 0.95
- candidate_count: 1

C. Leverage Knowledge Bases

Chat-Bison allows integration with external APIs that provide relevant knowledge for the chatbot. Using career-related APIs that offer information like job descriptions, salary data, educational programs etc.

D. Integrating Chat-Bison

The Chat-Bison model can be integrated into websites, with the help of API endpoints. Vertex AI provides API endpoints which can be integrated to a website. By importing the JavaScript library provided by Vertex AI is used to connect the Chat-Bison model to the website. When a user enters a query, it will send a request to the endpoint and return an appropriate response for the query.

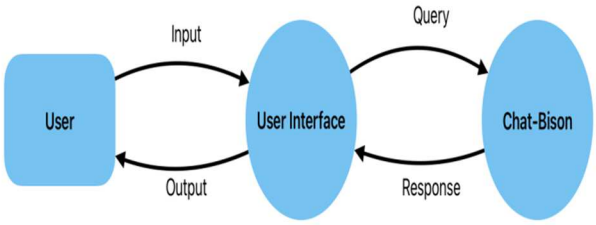

Fig. 1. Data Flow of the Chatbot

E. Implementing Aptitude Test

The next step after implementing chatbot is implementing an aptitude test which is a key step in assessing the individual's skills. An aptitude test evaluates a person's potential for success in a subject area in which they lack experience or formal education.

F. Analyzing Test

Various tests are analyzed in order to analyze user skills via aptitude testing. There are many categories of aptitude tests and after analyzing each 7 tests are selected for users. These tests help in assessing users skills. Each test contains atleast 30 questions. Users need to take time and answer accordingly.

G. Sten Score

The score the user gets after completing the test is converted to Sten (Standard Ten) score. Sten scores are standardized 1-10 scores commonly used in psychometric testing. A sten score represents a person's predicted position compared to other members of the same population and the population of values. First the obtained score is stored in the database and is compared with the other individual's mark based on that the mean and standard deviation is calculated. This is then used to calculate Z-score, from this Z-score Sten score is obtained. The mathematical equation of Z-score and Sten score are:

$$z = (x - \mu) / \sigma$$

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$$Sten = (Z\text{-}score\ x\ 2) + 5.5$$

Where:

- z = Z-score
- x = the value being evaluated
- μ = the mean
- σ = the standard deviation

H. Initializing Database

For safe storage of user's personal data, initializing a secure database is essential. Firebase is a backend cloud computing service provided by Google. Firebase is a NoSQL database which stores users data seamlessly. Firebase provides user-friendly real-time database functionality.

I. Website Development

The user interface is developed as a website is created using HTML, CSS and JS. HTML provides the structure and content of the page using a markup language consisting of tags. These tags define different elements like headings, paragraphs, images, links, and more. CSS allows defining styles for different HTML elements using selectors and properties. These styles determine the visual appearance of the page, including fonts, colors, layout, spacing, and more. JS adds interactivity and dynamic behavior to web pages. It helps in interaction with external sources with the help of APIs. JS connected the Chat-Bison model and Firebase.

J. User Authentication

For preventing unauthorized individuals from accessing sensitive information on someone else's behalf, user authentication is done. With the help of Firebase Authentication is done. User's login using email/password authentication for accessing the chat bot.

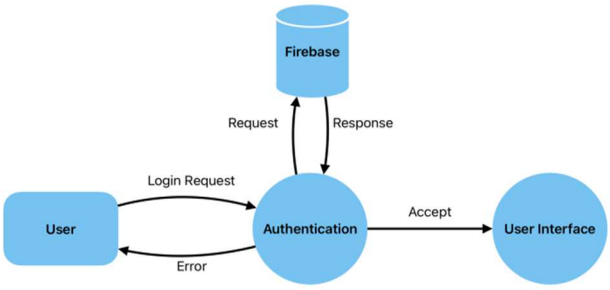

Fig. 2. User Authentication

IV. ARCHITECTURE

A. User Signup

For accessing the career guidance chatbot and its other functionalities users need to create an account. Users have to create an account with their email and password. This is analyzed with JavaScript to check all the information is added based on the rules provided in the code and then after analyzing data is gone through the Firebase authenticator which verifies that the password and email requirements are met.

B. User Profiling

Involves creating thorough profiles of people according to their name, age, skills, interests, hobbies and education qualification. This is frequently accomplished by gathering and analyzing data from a variety of sources, including online interactions, activities,and demographic data. User profiling helps to understand users interest which can be used as input for career guidance chatbot. These data are stored in the database.

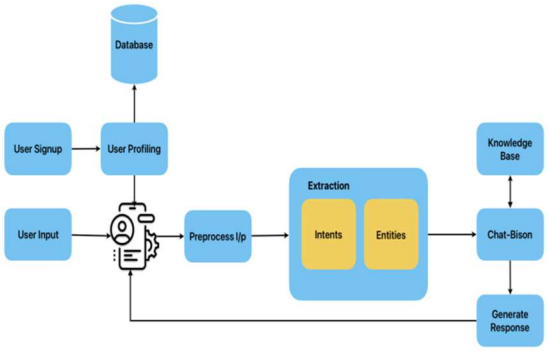

Fig. 3. System architecture for chatbot

C. User Interface

From Fig.3. after signing in, the user is navigated to the U.I which contains a chat window where the user can input text and receive responses which is dynamically updated with the chatbot's text responses retrieved from the API. A button is present when clicked navigates the user to the aptitude test page where the user can take the test. U.I is created using HTML which is styled using CSS. The input data provided by the user is passed to preprocess the input data.

D. Preprocess Input

The next step after implementing chatbot is implementing an aptitude test which is a key step in assessing the individual's skills. An aptitude test evaluates a person's potential for success in a subject area in which they lack experience or formal education.

E. Extract Intent & Entities

Various tests are analyzed in order to analyze user skills via aptitude testing. There are many categories of aptitude tests and after analyzing each 7 tests are selected for users. These tests help in assessing users skills. Each test contains atleast 30 questions. Users need to take time and answer accordingly.

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H. Response

Here the user receives the response based on the input provided to the chatbot. The response is viewed in the U.I the response is given by the model with additional details provided by the knowledge base. The response would be the career recommendation based on the query.

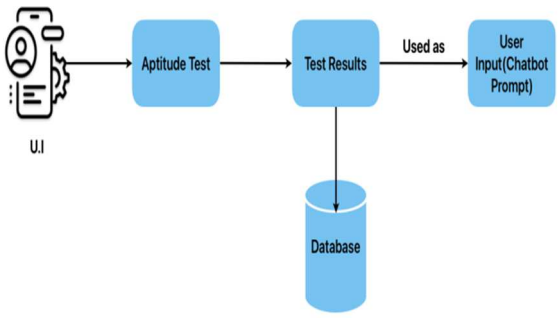

Fig. 4. System architecture for aptitude test

I. *Aptitude Test*

Its purpose is to assess an individual's innate aptitude or ability to acquire particular skills. Users can access the test from the U.I. Users have to attend a series of questions in each category.

J. *Test Result*

Generating User reports is the next step after completing the aptitude test. In this step firebase is involved in retrieving the user details and score obtained. The score is then converted into Sten (Standard Ten) format for easier understanding. These converted marks are also viewed as Bar Graph for a better view. And also provide insights in which category the user excels in which user needs improvement and also provide overall Remarks of User's performance. Here javascript is used for accessing data converting into Sten scores, viewing it in a Bar Graph and providing insights. A grade-scale is created to analyze users' performance. A sample report card is shown in fig 7. Based on these, the Remarks are generated to the user. Users can understand in which area the person can excel and in which area it would be difficult. The marks can be used as an input to chatbot for receiving Career Recommendation.

K. *Database*

Database contains user details including the test results. Database used here is the Firebase realtime database. This database helps with real time data with ease. As the firebase

is a NoSQL database there is no table, the data is stored as JSON objects. Data can be accessed by referring to the user ID which has all the details of the user. The format of realtime database is:

```
UserID {
        Age
        Education
        Gender
Marks {
            Test1
            Test2
            Test3
            Test4
            Test5
            Test6
            Test7
            }
        Hobbies
        Interest
        email
        username
    }
```

V. RESULT AND ANALYSIS

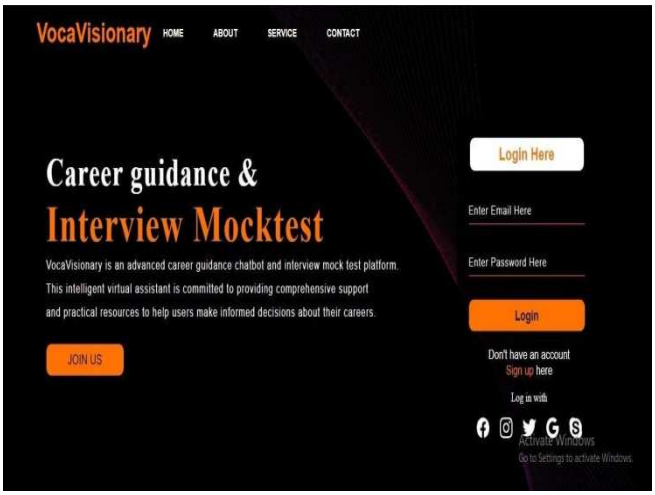

Fig. 5. Website of the VocaVisionary Career Guidance Chatbot

The chatbot has provided excellent performance on the basis of career guidance. The aptitude test results can be viewed by the user and can be used as input for the chatbot. But there are some limitations as the chatbot takes time to process the input data. The chat-bison model cannot be trained with custom data.

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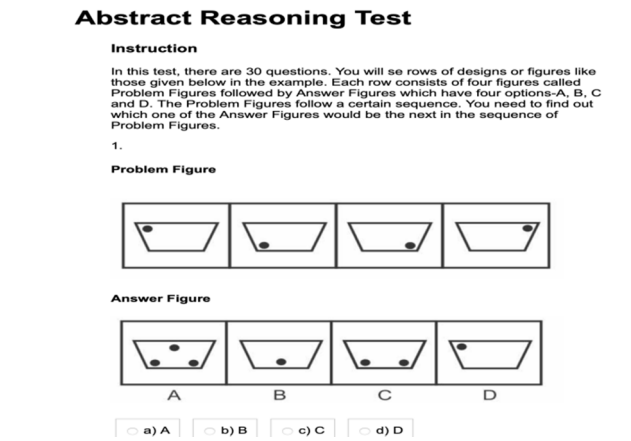

Fig. 6. Sample Aptitude Test

Fig. 7. Sample Report of Aptitude Test

VI. Future Work

For the better utilization of the chatbot following things can be done:

- Alternative LLMs: Exploring other Large Language Models (LLMs) that allows fine tuning with custom data.
- Hosting: Once a suitable LLM is fine-tuned, host it on AWS, Google Cloud or other servers to create accessible API endpoints.
- Integration of Voice Recognition: Enhance user accessibility and experience by integrating voice recognition technology, allowing users to interact with the chatbot through spoken commands or queries.
- Develop strategies to foster long-term user engagement with the chatbot, including the integration of gamification elements, personalized notifications, and periodic check-ins to track progress and provide ongoing support throughout users' career journeys.

VII. Conclusion

In the rapidly changing world of career development, the integration of voice-to-speech technology and AI-driven sentiment analysis within career guidance chatbots stands as a signal of progress. This technology not only acknowledges the intricate challenges students face but actively addresses them with an innovative, empathetic approach. The traditional, linear career paths have given way to a more dynamic landscape, necessitating tools that not only recognize individual aspirations but also adapt to the ever-shifting demands of the job market.

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