EduFinance: A Web-Based Expense Tracker and Scholarship Finder for Students using Natural Language Processing

Dr. Snehal Rathi
Vishwakarma Institute of Information Technology, Pune, Maharashtra, India
Email: snehal.rathi@viit.ac.in

Suyog Shete
Vishwakarma Institute of Information Technology, Pune, Maharashtra, India
Email: *suyog.22110070@viit.ac.in*

Aditya Vadgave
Vishwakarma Institute of Information Technology, Pune, Maharashtra, India
Email: *aditya.22220191@viit.ac.in*

Karan Raul
Vishwakarma Institute of Information Technology, Pune, Maharashtra, India
Email: *karan.22220109@viit.ac.in*

Omkar Sapkal
Vishwakarma Institute of Information Technology, Pune, Maharashtra, India
Email: *omkar.22220048 @viit.ac.in*

Abstract - Even with numerous financial aid options available, students often find it challenging to identify and manage the most suitable scholarships while keeping an eye on their expenses. Traditional methods for tracking expenses and discovering scholarship opportunities can be both time-consuming and inefficient. This project introduces a conversational service that utilizes advanced chatbot technology to streamline the scholarship search, monitor spending, and provide personalized financial insights. By integrating Google and LangChain with Gemini for AI-driven responses, users can explore scholarship options, manage their expenses, and engage in meaningful financial planning discussions.

The application allows users to upload and manage their personal financial information, using vector embedding to ensure efficient and accurate retrieval of data. This makes it simpler and more available for clients to look for grants and analyze their costs. The improvement handle joins procedures like information extraction, vector implanting, and real-time interaction to move forward the client encounter. This think about investigates how AI can back students' monetary needs and broaden their openings for making educated choices.

In an era where AI is reshaping access to financial resources, this application bridges the gap between students and the financial tools essential for educational success. By leveraging conversational AI, this solution goes beyond static lists of scholarships and expense trackers. Through intuitive language understanding and real-time analysis, the chatbot not only helps students discover scholarships aligned with their profile but also encourages proactive financial planning by tracking daily expenditures and identifying potential savings opportunities.
Our integration of vector embedding and data retrieval further enhances the usability of the system. It enables students to quickly retrieve relevant financial information with precision, creating a more responsive and personalized user experience. With the addition of advanced data extraction methods, this application is designed to continuously learn from user interactions, evolving to meet diverse student needs.

Keywords: Google Dialog-Flow, Scholarship Management, Expense Tracking, Chatbot, NLP, TF-IDF.

I. INTRODUCTION

Although finding relevant scholarships and managing expenses remains a challenge, the rapid rise of digital platforms has transformed how students manage their finances and financial aid. Traditional methods for handling financial data and searching for scholarships can be quite tedious, but the structured format and easy access of web applications make them ideal for these tasks. This evaluated system improves reach and ease of usage in that it consists of a web-based MERN stack application deployed with Google Dialoglow which is considered one of the top Conversational AIs. Through the chatbot, scholars can pose questions to the users about a variety of subjects, look up available scholarships, and find out about costs and spending patterns. Other important functionalities such as encoding financial figures into vector embeddings enhance efficient information search and the overall experience of the interface dealing with personal finance and scholarship management.

In addition to simplifying scholarship searches and expense tracking, integrating machine learning algorithms further refines the platform’s capabilities. By leveraging machine learning, the system can personalize financial advice, suggest scholarships that best match a student’s profile, and identify spending trends based on historical data. Moreover, predictive analytics can help students anticipate future expenses and budget accordingly. This tailored approach allows students to manage their financial aid more effectively, making the experience not only user-friendly but also proactive in addressing potential financial gaps. With tools like these, students can focus more on their studies and less on financial stress, creating an environment where they are empowered to make informed financial decisions seamlessly.

Key Insights:

- **Role of Dialogflow:** Google Dialogflow enables smooth conversational interaction, allowing users to engage effectively with the chatbot.
- **Modular Development with MERN:** Using the MERN stack ensures a scalable, maintainable codebase suited for a web-based app.
- **Effective Data Handling:** Data on vector embeddings enhances the ability of fast and accurate scholarship data searches, thus improving the speed and efficiency of information retrieval.
- **User-friendly Interface:** The web application's user interface makes it easy to monitor expenditures and search for financial assistance.
- **Scalability:** The software is meant to accommodate many users, large datasets, and thus will fit various requirements for the financial management process.

This paper demonstrates how AI-driven tools can help students make informed financial choices, improving their skills in managing expenses and easily locating the most suitable scholarships.

II. LITERATURE SURVEY

Muhammad et al.[1] demonstrated the possibility of creating an English discussion chatbot based on Dialogflow, an artificial intelligence conversational interface created by Google. Thus, the objective of the research was to recreate situations in real life, such as the use of immigration services or the visit of currency exchange offices. These tales were created using Twinery, which is a free and open source program for designing dialogue systems that require users to choose between established dialogue sequences. Because of the abilities such as "intent-matching", context handling and obtaining parameters of the chatbot performed those requests made by users and provided relevant responses. Users of the system were concerned about the evaluating performance of the bot in recall and precision metrics.

Athota et al. [2] reviewed several published articles in the development of AI-based healthcare chatbots, with a focus on a few. The key strategies involved are common NLP techniques like N-gram and TF-IDF; the use of cosine similarity along with keyword extraction finally implements this precisely. Matching the responses stored with user queries. Machine learning classifiers like Support Vector Machines (SVM) simplify classification tasks, while recurrent neural networks (RNNs) improve emotion recognition in counseling applications. Expert techniques are used to answer questions that are beyond the chatbot's programming powers. For better processing, the chatbot applies tokenization and stop-word removal to filter out the unnecessary words from user input. Structured data storage systems, such as RDBMS, assist in efficiently retrieving responses and advanced Models employ multimodal approaches for intent enrichment, interpretation, and interpersonal flow.

Chizhik and Zherebtsova [3] studied the development of conversational bots and limited their analysis to three main architectures– generative, rule-based and retrieval-based models. In the case of rule-based chatbots, the only approaches used are the ones that have been designed and prepared in advance. On the other hand, retrieval-based systems generate a response by finding the best match from previously prepared responses using some similarity measurement and therefore tend to use some methods such as TF-IDF or word embedding (for example Word2Vec and GloVe) among several others. Generative bas models with the use of RNN or Seq2Seq, construct a response from scratch, these however are very demanding in training data as well as computing resources. There angular greets text vectorization whereas static word embeddings achieve basic semantic similarity between words contextual models like BERT and LASER improve semantic similarity by remembering the conversational context. Data quality is important not only because performance gets degraded with very noisy types of datasets but also because more and more ethical perspectives come into play.

The analysis of the existing body of literature on the model and its modifications by Mishra and Vishwakarma [4] was mainly concerned with the application of the TF – IDF model in the process of document retrieval from the database via the vector space model. This model is known as TF-IDF, which makes it relevant for weighted scoring of documents since it weighs words according to their occurrence in the document and ignores common words that occur in the same document across different publications. To enhance the accuracy of retrieval, advanced retrieval techniques called Lemur TF-IDF was developed. However, to enhance the model's text retrieval efficiency, preprocessing techniques, such as tokenization, stemming, and removal of stop-words are employed. However, in information retrieval tasks, it is important to evaluate the performance of these models using some effective measures such as accuracy and recall.

In their article published in 2024, Alodadi and Janeja [5] conducted a review of the existing research on the approaches to document similarity found in patient support online communities, mainly the approaches aimed at improving the relevance of retrieval. They integrated distance measures toward the objects studied by describing textual data as vectors using the vector space model. This method is mostly based on the TF-IDF model, which considers both the importance of each term in the documents and the frequency at which such authors appear in the entire database. In order to quantify similarity, cosine similarity measures the angle between document vectors. Subsequently it returns a score on the interval of 0 and 1, with 1 referring to identical content.

Sushil S [6] in this paper has come out with an AI-based chatbot that utilizes DialogFlow for NLP for developing the placement process in professional colleges. The ALICE chatbot provides answers to student queries in a moment. Such services help to eliminate the necessity of in-person questioning, which satisfies the demand of contemporary technical solutions in the classroom. Research has shown that chatbots are helpful in educational contexts, with various implementations affecting user engagement and tasks on administrative aspects. The proposed solution here exceeds the inadequacies of traditional query and enhances the educational experience of all students by offering 24/7 assistance.

Kavitha and Murthy [7], analyzed the application of chatbots in the context of health care especially with regard to improving the front end of the patient and decreasing on consultation time. The system they have put forward use NLP techniques such as n-gram analysis, TF-IDF and cosine similarity to extract the keywords and compare sentences to make the chatbot generate the right response to the user queries. Furthermore, if there were any questions none of the bot could understand, these were referred to an external expert system for a quick response. Thus, the study also demonstrates how the concept of AI through the chatbot can further the healthcare industry and enrich the user experience.

The study of E. Prasetyo Sutono [8] presents a proposal that focuses on the creation of a chatbot application to enhance notification of mass schedules within the Diocese of Bandung which has its drawbacks when compared to other forms of announcement. Since the present study adopts a qualitative descriptive research design, the study shall involve observations, interviews and literature scouting. The Android application proposed in this paper uses the Dialogflow API for natural language processing to make the application more accessible and engaging for the users. Hypothesis for improvement Analysis of the results provides the basis for further improvements in application performance.

III. METHODOLOGY:

The first feature allows users to add and manage their daily expenses. As shown in **Fig. 1**, the interface provides fields for entering expense details, including category, amount, and date. The expense is then recorded in the system and categorized for easy tracking.

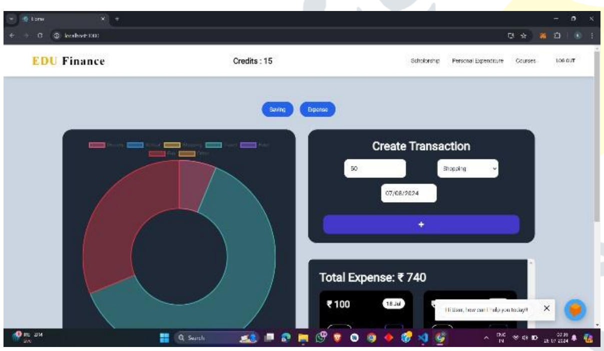


Fig. 1: Expense entry form displaying fields for amount, category, and date.

Users can allocate part of their income into a dedicated savings section, designed to help them set aside funds and gain rewards. As illustrated in **Fig. 2**, when a user enters a saved amount, a percentage (e.g., 5%) is automatically converted into credits.

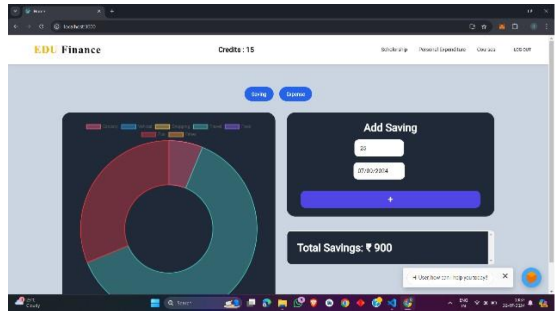


Fig. 2: Savings input field with credit calculation displaying the converted credits based on the saved amount

4. EduFinance allows users to search and filter scholarships based on criteria such as income, degree, and college name. **Fig. 3** shows the filtering options available to narrow down scholarship opportunities that match the user's profile.

5.

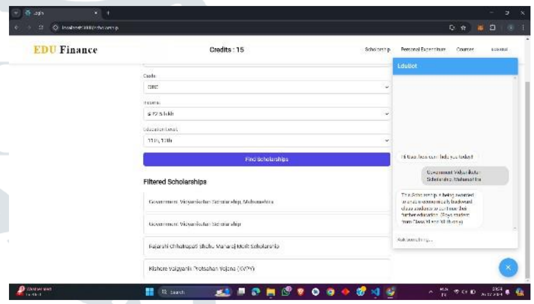


Fig. 3: Scholarship search interface with filtering options for income, degree, and college name.

The application features a course catalog where users can use accumulated credits to purchase educational courses. As displayed in **Fig. 4**, each course card shows the course name, credit cost, and a "Buy" button. If the user has sufficient credits, the "Buy" button is enabled, allowing the course purchase.

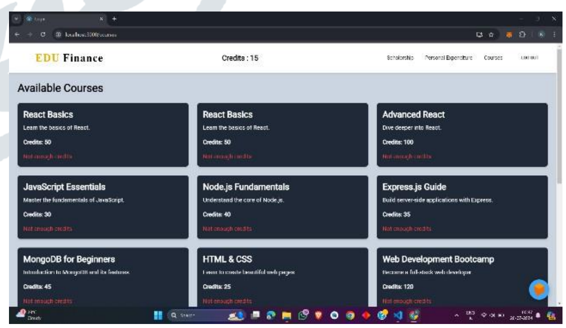
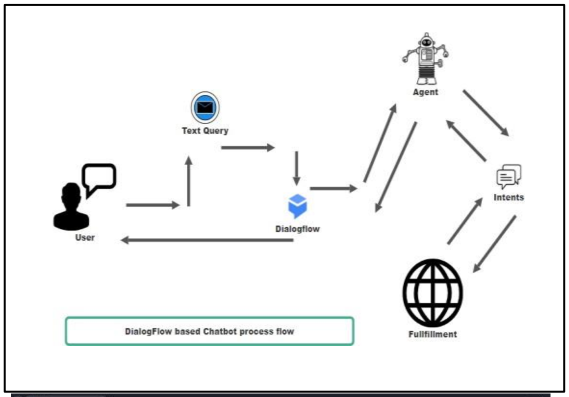


Fig. 4: Course catalog with available courses, credit costs, and an enabled "Buy" button for courses the user can afford.

EduFinance includes a chatbot powered by Google Dialogflow to answer queries related to scholarships, expenses, and savings. **Fig. 5** demonstrates how users can interact with the chatbot to get immediate answers on topics such as budgeting tips and scholarship availability.



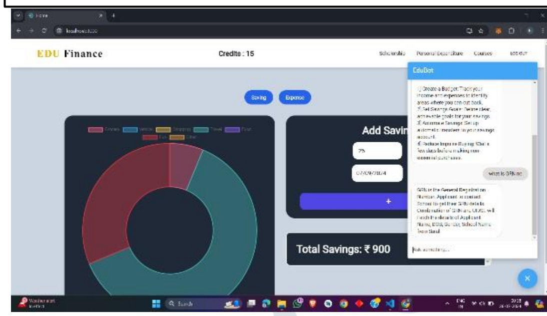


Fig. 5: Chatbot interface showing a conversation about scholarship-related queries and expense management tips.

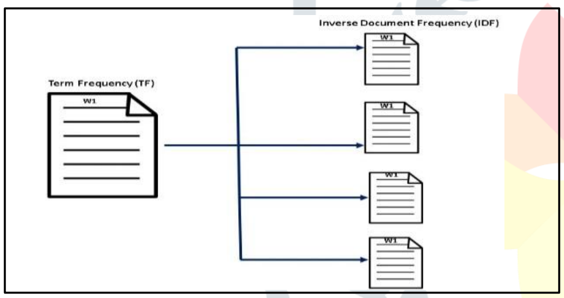


Fig. 6: TF- IDF

As shown in **Fig. 6**, TF-IDF (Term Frequency-Inverse Document Frequency), which is a commonly used statistical measure in text mining and information retrieval. TF-IDF helps in evaluating the importance of a word (or term) within a document relative to a collection of documents (corpus).

A term's term frequency (TF) indicates how often it occurs in a given document. A word's phrase frequency is frequently normalised by the document's word count to take into consideration documents of different lengths.

By measuring a term's relevance across several texts, the Inverse Document Frequency (IDF) is calculated. Since a term is seen less informative, it is given a lower weight when it appears frequently in papers. A phrase that is used in a small number of papers, on the other hand, is given more weight since it is thought to be more distinctive or important to those texts.

The formula is displayed in Fig. 7,

$$TF(t,d) = \frac{number\ of\ times\ t\ appears\ in\ d}{total\ number\ of\ terms\ in\ d}$$

$$IDF(t) = log\frac{N}{1+df}$$

$$TF-IDF(t,d) = TF(t,d) * IDF(t)$$

Fig. 7: Cumulative formula of TF-IDF

This chatbot was created using the DialogFlow interface, which happens to be owned by Google and is frequently employed in developing chatbots or chatbots based on natural language processing. NLP is what enables machines to understand instructions given in standard English, making computers much simpler to use.

It understands. It is used in creating the user interface of chat platforms, mobile application, corporate websites, to name a few, with a "Build once and deploys everywhere development suite". There is now a new analytics tool that could be designed to identify trends of usage issues, latency problems, and the agent's high intention. DialogFlow provides an easy way for non-technical users to implement AI-based chatbots because of GUIs or Graphical User Interface.

A. Components of DialogFlow

The following components of DialogFlow are used to develop chatbots:

User: A human can be the user.
Text Query: When the user initiates communicating with the bot, it occurs through an application for example, Google Home or Facebook Messenger.

Dialogflow: It is a platform utilized for developing agents for bots. Virtual agent or AI chatbot.

Intent: Intent refers to that particular action that can be invoked from the console in the Dialogflow by the user.

Fulfillment: This code is implemented as a web hook. The business is called through an intent-based call by an agent who is using the DialogFlow interface. With this, during a discussion, the user can create a dynamic response or initiate a back-end action by making use of the data retrieved through DialogFlow's natural language processing.

III. RESULTS AND DISCUSSION

EduFinance illustrated a striking instance of how well students' financial requirements could be fulfilled to using AI conversational systems. Users were able to track spending, look for scholarships and get financial help with ease due to the simple collaborative fusion of Google Dialogflow into a MERN stack application. The performance of the chatbot as a functional entity was gauged by means of users' engagements. Apart from having quick response times that enhanced user satisfaction, it was successful in achieving accurate information related to scholarships management and expenditure management rather well.

Due to the integration of vector embeddings in data retrieval, the performance of the application has improved in precision and efficiency enabling more elaborate and precise search results. Many users have praised the enhanced filtering mechanism done to scholarship opportunities whereby, potential applicants were able to filter the opportunities available according to their income or degree and this made their search for relevant opportunities easier. The cost management tool received many users' compliments as it had a very friendly user interface for money management which helped the users to organize their daily expenses and monitor their spending.

Through its credit-based savings system which provided students with credits that could be used to pay for educational courses, EduFinance encouraged students further to save and plan their expenditures for the future. Tests indicated that the savings module enhanced user engagement by gamifying the activities, where students had to keep track of their finances so as to earn credits.

Taking everything into account, EduFinance believes that students would greatly benefit from utilizing an AI-based finance management application to help them with appropriate financial decisions. Therefore, future studies may focus on widening the scope of financial products on offer, enhancing user interface communication skills with advanced natural language processing systems, and adopting additional protective measures for user information without compromising the users' financial privacy.

EduFinance has ambitious plans to expand its features, aiming to offer even smarter, more secure, and more inclusive support for students. By integrating adaptive learning algorithms, the platform's chatbot could analyze individual spending patterns to give more tailored advice on budgeting, saving, and scholarship opportunities, making the guidance it provides more relevant and personal. To safeguard sensitive financial information, EduFinance also plans to adopt advanced encryption and privacy-preserving machine learning practices, reinforcing trust and security for its users. Additionally, by introducing multi-language support, EduFinance aims to reach a broader audience, allowing students from diverse backgrounds to access its benefits. Future collaborations with educational institutions and financial providers could enable EduFinance to offer customized financial solutions like student loans, tuition payment plans, and even investment options tailored for students. Through these enhancements, EduFinance not only helps students meet immediate financial needs but also fosters long-term financial understanding, empowering them to make confident financial decisions well beyond their studies.

IV. CONCLUSIONS

Financial illiteracy is rampant among students and EduFinance is using artificial intelligence powered chatbots to bridge this gap while providing cost management and scholarship resources to students. EduFinance enables financial decision making by making a provision of a complex semi-structured interactive system – the platform built on MERN Stack with Google Dialogflow as conversational engagement support. Apart from such beneficial services like course catalog, savings management, spending tracking and scholarship search, users are able to control their finances and education as per their needs. Advanced technologies such as vector embeddings help to retrieve the needed information in a very effective manner by providing the worried with valuable information about finances and personalized scholarships. The platform is inherently modular due to the use of MERN stack architecture that supports its growth and thus encourages large amounts of data to be handled and many users too.

Instead of just providing tools, EduFinance is dedicated to assisting students in becoming more financially literate by actively teaching them how to manage their money in a way that appears natural. The platform's chatbot, which makes use of state-of-the-art AI like Dialogflow, not only responds to financial enquiries but also provides personalised guidance on how to increase spending and make plans ahead of time, which lessens the strain of budgeting. EduFinance adapts to each user's daily schedule and offers helpful data according to their unique financial patterns. Its flexible design also makes it easy to add features like real-time expenditure tracking, more comprehensive financial education resources, or a larger scholarship database as more users sign up. EduFinance combines entertaining elements, like money-saving incentives, to maintain students' motivation and

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