Rajagiri School of Engineering & Technology (Autonomous)

Application format for RSET Research Seed Money

1. Title of the Project: Synapse: Where AI Meets Education

2. Name and department of the Principal Investigator: Gautham C Sudheer, Department of Computer Science

3. Name of the guide (if PI is a student): Dr. Mary Priya Sebastian

4. Name and department of Co-Investigator(s):
   Godwin Gino, Department of Computer Science
   Mohammed Basil, Department of Computer Science
   Fathima Jennath N K, Department of Computer Science

5. Broad Subject area (domain)/field of classification: This Project focuses on applying NLP techniques to enhance educational tools and digitize learning materials.

6. Project Type (Basic Research/Applied Research/Developmental/Demonstration/Others: Developmental Research

7. Precise objectives of the project:

   The project aims to develop an AI-powered platform for digitizing educational materials by implementing Optical Character Recognition (OCR) and Natural Language Processing (NLP) techniques for efficient text extraction and translation. Key objectives include:

   - Enhancing accessibility through real-time interactive chatbots.
   - Enabling multilingual support and speech-to-text functionalities.
   - Providing a seamless, user-friendly digital learning environment for a diverse range of users.

8. Applications/Socio economic importance:

   This project enhances educational accessibility by converting printed materials into editable, searchable digital formats using OCR and NLP techniques. It bridges the gap between traditional and modern education systems by offering features like text extraction, real-time translation, interactive chatbots, and speech-to-text functionality.

These tools make learning materials more accessible, support diverse learning preferences, and enable efficient note-taking, knowledge management, and interaction with educational content across different linguistic and cultural backgrounds.

9. Abstract (500 Ch.): The "Synapse" project seeks to revolutionize education by developing an AI-powered platform that converts text images—such as textbook pages or handwritten notes—into fully editable and searchable digital content. Leveraging advanced Optical Character Recognition (OCR) and Natural Language Processing (NLP) technologies, the platform enhances note-taking, supports multilingual content, and features an AI-driven chatbot for interactive learning. With integrated speech-to-text functionality, it promotes accessibility and bridges educational gaps, offering a scalable, secure solution for students and educators globally.

10. Details of state of the art in the research area and literature review done by the investigator(s): The "Synapse" project integrates advanced Optical Character Recognition (OCR) and Natural Language Processing (NLP) technologies to transform text images, such as pages from textbooks into editable and searchable digital content. By leveraging cutting-edge tools like Tesseract OCR and Google Cloud Vision API for accurate text extraction, Synapse enables seamless conversion of various text formats. Additionally, the project incorporates NLP frameworks such as BERT to provide contextual understanding and support features like text summarization and conversational AI. These technologies position the Synapse project at the forefront of AI-driven educational tools, offering innovative solutions for enhancing accessibility, interactivity, and engagement in learning environments

11. Details of any preliminary work done by the investigator(s): We have conducted significant preliminary work on the Synapse project, focusing on key technological implementations. Initial efforts have been directed toward experimenting with Optical Character Recognition (OCR) using Tesseract OCR and Google Cloud Vision API, which successfully extracted text from printed materials. This was followed by the trailing out Natural Language Processing (NLP) models like BERT and GPT, which have shown promising results in text

summarization and conversational capabilities through a chatbot prototype. These features were tested in small-scale scenarios, ensuring they meet the platform's educational goals. In addition, preliminary work on multilingual support and speech functionalities has been carried out using Google Cloud Translation API, Microsoft Translator Text API, and Google Cloud Speech-to-Text API. These trails have provided foundational support for real-time language translation and accessibility features like speech-to-text and text-to-speech. These initial successes set a strong foundation for the full development of the platform.

12. Methodology: The methodology of the "Synapse" project involves multiple advanced technologies. For image processing, OpenCV and Pillow (PIL) are employed to enhance images before text extraction. Text extraction is carried out using Tesseract OCR and Google Cloud Vision API, ensuring accurate recognition from various image formats. Natural Language Processing (NLP) tasks, such as text summarization and conversational AI, are handled by BERT and GPT models. The project's interactive chatbot features are developed using Dialogflow and Rasa. Additionally, multilingual capabilities are supported through the integration of Google Cloud Translation API and Microsoft Translator

13. Whether the project was submitted to any other organization for financial support, If so, the names of the institutions and their decisions may be indicated: No, the project has not been submitted to any other organization for financial support.

14. Work plan of action with time line and deliverables:

    Phase 1: Research and Design (Month 1-2):

    - Complete literature review on OCR, NLP, and chatbot systems.
    - Finalize platform design and architecture.
    - Deliverable: Detailed project design document and initial prototypes of text extraction.

    Phase 2: Core Development (Month 3-5):

    - Implement OCR capabilities with Tesseract and Google Cloud Vision.
    - Develop NLP modules using BERT and GPT for text summarization and chatbot responses.
    - Deliverable: Fully functional OCR system, NLP-based chatbot, and note organization

Phase 3: Feature Integration (Month 6-7):

- Integrate multilingual support with translation APIs.
- Implement speech-to-text and text-to-speech functionalities.
- Deliverable: Multilingual support, speech-to-text, and text-to-speech integrated.

Phase 4: Testing and Optimization (Month 8-9):

- Conduct user testing to evaluate performance and usability.
- Optimize the platform for speed, accuracy, and scalability.
- Deliverable: Optimized platform with feedback from testing.

Phase 5: Final Deployment and Documentation (Month 10-12):

- Finalize platform, fix bugs, and prepare deployment plan.
- Deliverable: Deployed Synapse platform, user guide, and final project report.

15. Budget estimate for the project

Sl.No.	**Items**	**Amount (Rs.)**
1.	Hiring of expertise / Human resources	8,000
2.	Software/Services	7,000
3.	Data Collection	5,000
4.	Publication charges (Upto Rs.10,000)	5,000
5.	Travel/Contingency (Shall not exceed 20% of the total amount)	3,500
6.	Other (specify) (Do not exceed 10% of the total amount)	1,500
	Total	**30,000**

16. Plan of action for utilization of research outcome expected from the project: The research outcome will be used to develop a scalable AI-powered platform for educational institutions. This platform will transform physical materials into interactive digital content, support multiple languages, and adapt to various educational environments. By incorporating AI-driven chatbots and personalized features, it will enhance learning experiences, improving accessibility and engagement for a diverse range of users.

17. Quantum and nature of assistance expected from RSET: We are seeking financial support from RSET to cover the costs of human resources, equipment, and software needed to develop the Synapse platform. Assistance with user trials will also be crucial for thorough evaluation and successful implementation in educational environments.

18. Key publications of the Investigators pertaining to the theme of the proposal during the last 5 years: Nil

Declaration

Certified that the details furnished above are correct to the best of our knowledge and belief and that the amount of financial assistance, if granted, will be utilized for the purpose for which it is granted within the time prescribed by RSET. We also undertake to abide by the rules and other conditions prescribed by RSET as per Research Seed Money Scheme.

Date **Name and Signature of the Investigator(s)**

For office use only

Reviews from Research Promotion Committee (RPC)

Date **Signature of the Coordinator**

Reviews from Research Advisory Committee (RAC)

Date **Signature of the Convener**