



SYMBIOSIS INSTITUTE OF TECHNOLOGY, NAGPUR

Symbiosis International (Deemed University)

(Established under section 3 of the UGC Act, 1956)

Re-accredited by NAAC with 'A++' Grade | Awarded Category - I by UGC

Founder: Prof. Dr. S. B. Mujumdar, M. Sc., Ph. D. (Awarded Padma Bhushan and Padma Shri by President of India)

Department of Computer Science and Engineering

Flexi Credit Course Generative AI Project Report (705210704)

VII Semester, Batch 2022-2026
Session 2025-2026

Project Title
AI Research Agent

Section: C

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Abstract:

The high-profile automation platform is AI Research Agent which aims at automating the monotonous and cumbersome research workflow. The inherent time-consuming process of information collection, data analysis, and the production of reports is also free in this project due to the application of a complex multi-agent system. The platform is a simulation of a collaborative team of specialized AI agents and is built on Streamlit to handle an interactive user interface and delivered by Google's Gemini generative AI.

The architecture of the system also consists of three main agents: Research Agent, an Analysis Agent, and a Writer Agent. When a specific topic defined by the user is given to the Research Agent, it collects a large amount of data concerning the market trends, statistics, and opinions of experts. Communication of this information is subsequently transferred to the Analysis Agent which obtains important patterns, SWOT analysis, and derives the important, actionable insights. Lastly, the Writer Agent Occupation provides a compilation of the results of the other steps into a professional, unified, and comprehensive report organized with executive summary, in-depth analysis and recommendations.

The main characteristics of the application include the tabbed interface to monitor the output of each agent, real-time data visualization to track the trend in the market and analyse the keywords with the help of Plotly, and an opportunity to download the final report in several formats (Markdown, TXT). This multi-agent system can hugely boost the research lifecycle and supply the user with detailed, structured, and well-informed reports on demand.



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1. Introduction:

Now in data-driven environment, capacity to complete and relevant research is a vital competitive advantage to all businesses, scholars, and even other analysts. Nevertheless, the contemporary digital environment is characterized by an important phenomenon information overload. The conventional research process is a manual, linear and usually a bottlenecked process. It is about endless hours of reading through large amounts of information, locating the reliable material, drawing together the information about two different issues, obtaining meaningful information, and, lastly, organizing the findings into a consistent and professional report. This is not only a sluggish resource-consuming workflow, but it is also highly susceptible to human bias and error, and it is hard to keep abreast with the pace of the fast-changing market.

The project of the AI Research Agent is the direct answer to this question. It presents an open-source platform of a highly-evolved automation that will transform the entire lifecycle of research by outsourcing the complete workflow to a dedicated, multi-agent AI system. It is not a better replacement of the human researcher, but rather a strong force multiplier, transforming a process that might take days or weeks to a few minutes. The platform offers an overall, end-to-end solution, between an easy topic prompt and a detailed, data-driven report.

The core of such solution is an advanced architecture with high-end technologies. The user facing application is coded in Streamlit which is a modern Python framework that is selected due to its capacity to build and deploy interactive and data rich web applications quickly. This enables a clean, friendly and responsive user interface, which enables the user to provide topics, set-up research parameters and track the progress of the agents in real-time. The brains of the system are inspired by Google Gemini the state of the Genetic artificial intelligence model, which has the capabilities to reason, generate and synthesize sophisticated tasks.

The main innovation of the project is the multi agent structure. As an alternative to one monolithic AI, the AI Research Agent is based on simulating a team of three professional agents, each having a specific role:

1. The Research Agent: Will be the main data collector, who will go out surveying the market trends, statistics, and opinions of experts to create a solid body of knowledge.
2. The Analysis Agent: Plays a role of data specialist of the team, carefully analysing the collected data to estimate patterns, conduct SWOT analysis and find critical and actionable information.
3. The Writer Agent: Will be the overall communicator who could have to combine all the findings to a well-written report of precise, professional, and well-



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organized format, including an executive summary and recommendations to be acted upon.

It has a modular design so that every stage of the research process is appropriated by an expert, which would result in a stronger and more high-quality final product. The output of the platform is also improved with built-in data visualization tools through Plotly that transforms hard-to-understand information into readable charts and graphs. The most tedious aspects of research become mechanized through the "AI Research Agent" which gives the user the power to concentrate at the higher level of strategy and decision-making using in depth, structured and AI-based reports on demand.

2. Methodology:

The methodology of the project is modelled as a sequential pipeline of agents that is simulated by a single large language model, which is powerful. This method is a way of breaking down a complex problem of research into three different tasks that are manageable and the output of one task is the context-rich input of the next.

- **Tools Used:**

- Python: The main programming language of all application logic.
- Streamlit: Streamlit is an open-source web framework that is used to create the interactive web application interface in form of tabs, control user input and output of the system.
- Google Gemini API (google.generativeai): A generative AI model that is utilized to make all of the simulated agents intelligent.
- Plotly: This is used in displaying dynamic and theme sensitive visualizations of data (i.e., bar charts, line charts, pie charts) in the tab Market Trends.

- **Process:**

1. Within the Streamlit interface, the user enters a topic of research and clicks on Start Research.
2. The system also activates the Research Agent by passing through the topic and a special prompt (Researcher) which is sent to Google Gemini API. The results are shown in the tab Research.
3. The Analysis Agent is the next element that is triggered by the system. It takes the original text of the Research Agent, and adds a new "Analyst"



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prompt to the message, as well as transmits that bigger payload to the API. The analysis is shown in the tab of Analysis.

4. Lastly, the system invokes the Writer Agent. It is a mixture of both the text of the Research and Analysis agents and a "Writer" prompt which sends the entire context to the API.
 5. The ultimate response of the API is the complete professional report, in which it is presented in the tab of the writer.
 6. At the same time, the information during research and analysis stages is analysed in order to create Plotly charts which are presented in the tab called Market Trends.
- **Method and Algorithm:** The fundamental algorithm of this application is a virtualised agent pipeline. It synchronises a few consecutive and mutually reliant API calls to imitate a collaborative workflow. This process has the following pseudocode:

```
def on_start_button_click(topic):  
    # --- Phase 1: Research ---  
    research_prompt = create_research_prompt(topic)  
    research_result = call_gemini_api(research_prompt)  
    display_in_tab("Research", research_result)  
  
    # --- Phase 2: Analysis ---  
    # The output of Phase 1 is the input for Phase 2  
    analysis_prompt = create_analysis_prompt(topic, research_result)  
    analysis_result = call_gemini_api(analysis_prompt)  
    display_in_tab("Analysis", analysis_result)  
  
    # --- Phase 3: Writing ---  
    # The outputs of Phase 1 & 2 are inputs for Phase 3  
    writer_prompt = create_writer_prompt(topic, research_result, analysis_result)  
    final_report = call_gemini_api(writer_prompt)  
    display_in_tab("Writer", final_report)  
  
    # --- Phase 4: Visualization ---  
    visualize_trends(research_result, analysis_result)  
    display_in_tab("Market Trends", charts)
```

This is a very effective chained-prompting method. The AI is able to concentrate on a single specialized task at a time by disentangling the issues about it. The Research Agent does not have a heavy burden of writing a clean report and the Writer Agent does not have to do a raw analysis. Such successive transfer of



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context also means that the end report will be more than a mere general summary but is a highly synthesized report constructed on the different strata of information processing. The tabs of the Streamlit interface are essential, as it gives the user a glimpse into this pipeline, giving it the ability to view the output of every agent and know the manner in which the end verdict was arrived at.

3. Results with Screenshots:

The AIRA mission statement and aim of establishing an easy-to-use and effective research automation tool are both achieved. The performance of the application was confirmed through the test which was conducted on a large selection of subjects including technical and scientific topics, market-oriented questions and academic inquiries. The findings indicate that the platform is effective in producing high quality, pertinent and well-made content.

- Relevant and Accurate Text Generation: The system was able to give accurate and relevant text production on diverse subjects. In response to complicated topics such as "Quantum Computing in Healthcare" or the idea of the market trends in the renewable energy distribution, the Research Agent presented more detailed and data-rich summaries. The Analysis Agent was able to extract essential information including SWOT analysis and the Writer Agent was able to create uninterrupted and professionally written reports. This reaffirms the multi-agent pipeline capability of managing various and diverse information request.

🔍 Research 📈 Analysis 📄 Report 📊 Market Trends

Report Generation

✓ Report Generated!

Of course. Here is a comprehensive research report on Healthcare 2025, structured and written from the perspective of a Professional Writer.

Comprehensive Report: Healthcare 2025

The Convergence of Technology, Economics, and Patient-Centricity

Date: October 26, 2023 Author: Professional Writer, Senior Research Analyst Status: Final

1. Executive Summary

The healthcare landscape is undergoing a fundamental transformation, accelerating toward a 2025 reality that is more decentralized, data-driven, and consumer-oriented than ever before. This shift is propelled by the confluence of powerful forces: the maturation of digital technologies like artificial intelligence (AI), persistent economic pressures to deliver value over volume, and a permanent change in patient expectations following the global pandemic. The hospital is no longer the sole locus of care; it is evolving into a central hub within a distributed network that extends into patients' homes and digital lives. This new ecosystem is characterized by hybrid care models, the rise of "Hospital-at-Home" programs, and the increasing influence of non-traditional players from the retail and technology sectors.



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- Brief Summaries and Drafts: The application was also very effective in brief summaries and drafting as well as producing a full-scale report. The version of the tab can be used to obtain high-level insights in the "Analysis" tab or a literature review of the foundation in the Research tab. This allows the tool to be useful with a range of applications, including the check of simple facts and the creation of an initial manuscript of a bigger article.
- User-Friendliness: The important outcome is the clean and intuitive web interface of the platform. The UI was created using Streamlit and has been very user-friendly and does not demand any technical skills. The key elements that allow making the application usable by any non-technical user are the following elements: a clear input field, an impressive Start button, and a reasonable tabbed design. Its Plotly charts embedded in the tab result in the successful translation of complex information into easily comprehensible format, and this user experience is improved by the tab that is called Market Trends.

The screenshot displays the AI Research Agent's user interface. At the top, there is a search bar labeled 'Research Configuration' with a magnifying glass icon. Below it, a 'Research Topic' dropdown shows 'Healthcare 2025'. To the right, there are 'Detail Level' and 'Show Analytics' options, with 'Standard (10 min)' selected. A red 'START AI RESEARCH' button is prominent at the bottom of this section. Below this, a navigation bar includes 'Research', 'Analysis', 'Report', and 'Market Trends'. The main area is titled 'Research Phase' with a magnifying glass icon. It shows a green banner with a checkmark and the text 'Research Complete!'. At the bottom, a blue bar contains a 'View Full Research' link and a note: 'Of course. Here is a comprehensive research report on Healthcare 2025, presented from the perspective of a Senior Research Analyst.'

4. Applications:

The AI Research Agent is a very universal tool, which has a great number of applications in different fields. Considering that it can go beyond the abstract idea and form the systematic, thought-provoking report, it is useful to students, professionals, and creatives.

- Academic and Writing Help: The agent is an extremely strong aide to the students and researchers. It is able to create either a full literature review, or draft essay on any academic subject virtual. Users can write in massive acceleration



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by utilising the Research tab as the source of raw data and the Analysis tab as the source of key themes.

- Generation of study material Study materials: The site is very practical in producing individualized study material. A student can make an input with a complicated subject (e.g., The Causes of the French Revolution) and end up with a properly structured report. A full report with one of the most important points and a summary may be regarded as a set of condensed study notes, to divide a big topic into small pieces.
- Idea Brainstorming and Content Creation: The brainstorming tool is the perfect tool of writers, marketers, and creatives. When a nascent idea or an idea (e.g., Future of Remote Work) is typed, one can create a report that is full of current trends, challenges, and opportunities. This offers an abundance of discussion points, statistics, and original perspectives to the articles, presentations, or marketing tactics.
- Business and Market Analysis: The design of the tool is quite fitting to a business analyst and an entrepreneur. The multi-agent pipeline and specifically the SWOT analysis of the Analysis Agent and the report generated by the Writer Agent gives a user a quick tool to provide a preliminary market analysis, competitor analyst or report on its trend, which enables agile and data-driven decision making.

5. Future Scope:

Although the existing AI Research Agent is a powerful and useful solution, it has some of the most promising directions to develop in the future, which would improve its features, accessibility, and reliability significantly.

- Voice input and output: It can be enhanced with speech-to-text and text-to-speech to make it more accessible and offer a hands-free mode of operation in the future. This would enable the user to speak their studies and hear reports generated and therefore this tool would be more convenient among the user with visual handicap or the busy professionals multitasking.
- Multilingual Support: Adding several other languages will realize exponential growth in the user base of the platform and its functionality. This would entail accepting the inputs in other languages as well as training the agents in carrying out research and coming up with reports in the desired language by the user and therefore would facilitate research and analysis in the global context.



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6. Conclusion:

The project of the AI Research Agent manages to illustrate how the Generative AI can be implemented to enhance the process of content creation and learning efficiency. The application was successful in automating the complicated process of changing one topic into a deep, detailed, and informative report by creating a multi-agent system including a Research, Analysis and Writer agent.

The Gemini API of Google shows that it can effectively process specific tasks, and the Streamlit system is very accessible and easy to use and does not involve any technical experience. The findings affirm that this agent-based pipeline that ensures task segregation generates quality and relevant outputs to apply in academic, professional and creative demands.

The project is a good demonstration of a prototype of an intelligent information-synthesis tool. Not only is it simple to use in terms of research, but also serves as an efficient brainstorming assistant, a data visualization tool and content creation tool. Although the scope of the future provides opportunities to improve the reliability and accessibility, the existing platform already is a successful example of the end-to-end, AI-driven research solution. It successfully translates the raw information into useful information and reinforces the practical importance of multi-agent systems in the process of automated execution of complex intellectual processes.