**Deep Research Agent – Automating Web-Based Academic and Analytical Research**

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**AI Agent Title / Use Case:** Deep Research Agent – Automating Web-Based Academic and Analytical Research

**1.1. What problem does your AI Agent solve?**  
Researching complex topics—especially for academic, analytical, or content creation purposes—is time-consuming and mentally demanding. This agent simplifies that by performing the most tedious parts: discovering credible sources, summarizing them, generating citations, and creating structured outlines.

**1.2. Why is this agent useful?**  
This agent empowers users by turning a research question into a structured, source-backed brief in minutes. It automates cognitive load and repetitive information retrieval tasks, making high-quality insights more accessible to non-experts and experts alike.

**1.3. Who is the target user?**

* Academic researchers
* Analysts in tech, finance, health, or economics
* Policy writers and journalists
* Students working on dissertations or competitive exams
* Content creators exploring complex domains

**1.4. What not to include?**  
Excluded: real-time live API integrations, natural language generation for entire essays/articles, and deep NLP tasks like stance detection. These were out of scope for initial prototyping.

### 

### **🔹INPUT UNDERSTANDING**

**Prompt:**

The user query is: "{user\_query}"  
Classify the intent as research (yes/no).  
If yes, extract:  
- main\_topic  
- 3–5 subtopics  
- domain classification (e.g., tech, environment, politics, economics, medicine)  
Output in JSON format:  
{  
 "is\_research\_query": true,  
 "main\_topic": "",  
 "subtopics": [],  
 "domain": ""  
}

**What is this prompt responsible for?**  
To validate whether the input is a research-worthy query and to break it into manageable components.

**Example Input + Output:**  
Input: “Impact of quantum computing on AI”

{  
 "is\_research\_query": true,  
 "main\_topic": "Impact of quantum computing on AI",  
 "subtopics": ["computational speed", "AI model optimization", "data encryption", "energy efficiency"],  
 "domain": "technology"  
}

### **🔹 STATE TRACKER**

**Prompt:**

Session memory so far:  
- Previously completed subtopics  
- Cited sources  
- User's topic preferences  
  
Using memory state + current query, update this structure:  
{  
 "completed\_subtopics": [],  
 "pending\_subtopics": [],  
 "cited\_sources": {},  
 "preferred\_domains": []  
}

**How does this help the agent “remember”?**  
It maintains a persistent research state across multiple questions, simulating multi-session memory.

**Did you simulate memory with variables / system messages?**  
Yes. I used a persistent research\_state object and reinforced it through prompt chaining.

### **🔹 TASK PLANNER**

**Prompt:**

Given the topic: {main\_topic} and its subtopics: {subtopics}, do the following for each subtopic:  
1. Simulate a search using SerpAPI or similar  
2. Extract the top 3 trusted sources (BBC, MIT, PubMed, Stanford, etc.)  
3. Summarize findings in 3–5 key bullet points  
4. Record source links and origin metadata (author, date, institution)  
  
Return final structured content grouped by subtopic.

**What steps does your agent take internally to solve the problem?**  
It conducts simulated information retrieval, curates trustworthy snippets, and compresses them into digestible content with metadata.

**Did you use chaining? Branching?**  
Yes. The planner branches by subtopic and chains tasks: search → extract → summarize → cite.

### **🔹OUTPUT GENERATOR**

**Prompt:**

Format the planner output into a markdown-style research brief. Include:  
- Subtopic headers  
- Bullet point summaries  
- Inline citations with source metadata  
- A final outline/draft skeleton  
- Language: professional, accessible, and academically neutral

**What kind of output formatting or phrasing did you aim for?**  
Clean visual hierarchy, academic phrasing, and inline references for quick skimming and deep reading.

**Any special behavior?**  
Yes – output supports quick note-taking, presentation decks, or report drafts.

## 

| Attempt | Prompt Component | What Happened | What You Changed | Why It Improved |
| --- | --- | --- | --- | --- |
| 1 | Input parser | Did not extract enough subtopics | Added rule-based NLP segmentation | Better breakdown for planning |
| 2 | Task planner | Redundant facts in summary | Added deduplication filter on snippets | Cleaner output and reduced noise |
| 3 | Output generator | Too dense formatting | Introduced markdown and emoji labels | Improved scannability and engagement |
| 4 | State tracker | Forgot previously cited links | Persisted source registry across turns | Improved continuity |
| 5 | Domain detection | Misclassified “Quantum + AI” | Added keyword mapping + fallback logic | Better classification accuracy |

### ***✅ Test 1: Clear, Specific Input***

**Input:** “Research the impact of quantum computing on AI”

Subtopic: Speed & Parallelism  
- Quantum algorithms allow parallel computation on large data sets (Source: MIT Review, 2023)  
- Shor’s and Grover’s algorithms reduce training cycles  
  
 Subtopic: AI Model Optimization  
- Qubits help reduce floating-point errors in deep learning (Stanford AI Lab, 2022)

Citations: [MIT](...), [Stanford](...), [Nature](...)

Suggested Outline:  
I. Introduction to Quantum-AI Intersection   
II. Efficiency Gains   
III. Use Cases in Model Training   
IV. Future Challenges   
V. Conclusion

### 

***Input*:** “Help me do research”

Could you specify a topic of interest?  
For example:  
- "Social impacts of generative AI"  
- "Nuclear policy shifts post-2022"

### **Empty/Invalid Input**

**Input:** “”

I didn’t catch that. Try something like:  
"Impacts of automation on rural jobs" or "Role of gut microbiome in immunity"

**What was the hardest part of this assignment?**  
Simulating search engine behavior and reliable citation management without access to real tools like SerpAPI or LangChain. Designing prompts that scale well across research domains was also complex.

**What part did you enjoy the most?**  
Creating modular prompt chains that simulate a thinking assistant. It felt like designing a mental workflow.

**If given more time, what would you improve or add?**

* Live API integration (SerpAPI, Google Scholar)
* UI prototype to visualize research briefs
* Plagiarism detection and citation formatter (APA/MLA)
* Confidence scoring for each bullet point

**What did you learn about ChatGPT or prompt design?**  
Prompt modularity is the key. Assigning one job per layer created clarity, flexibility, and helped simulate memory and reasoning.

**Did you ever feel stuck? How did you handle it?**  
Yes, especially while balancing summarization length and source diversity. I iterated on test prompts, asked ChatGPT to critique itself, and kept logs of what worked.

## 

## **HACK VALUE**

* Simulated multi-layer AI logic with real-world research steps
* Created a reusable state object for memory and citations
* Designed with an eye for future LangChain + GPT-4 integration
* Prompt logic allows plug-and-play into front-end tools or notebooks
* Supports markdown-ready briefings, great for dashboards and academic workflows