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Research Paper

MULTI-AGENT AI RESEARCH REPORTER

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Abstract

Research is an essential activity in academics, business, technology, and many other professional fields. Preparing a detailed research report usually requires collecting information from multiple sources, evaluating their relevance, comparing different viewpoints, organizing findings, and preparing a structured document. Performing these activities manually can be time-consuming, especially when the research topic is broad and involves a large amount of information. The Multi-Agent AI Research Reporter is proposed as an intelligent system that uses multiple specialized AI agents to automate and coordinate the research-report generation process.

The proposed system divides the research process into multiple specialized tasks and assigns them to independent AI agents. A Research Agent searches for relevant information, while a Source Analysis Agent evaluates and organizes collected sources. A Fact-Checking Agent verifies important claims, and a Synthesis Agent combines the collected information into meaningful findings. A Report Generation Agent then converts the analyzed information into a structured research report containing sections such as introduction, literature review, methodology, findings, discussion, and conclusion.

The agents communicate through a central orchestration layer that manages tasks, information flow, dependencies, and intermediate results. The system can use web sources, academic resources, documents, and other authorized information sources depending on the research requirements. Retrieved information is organized into a knowledge repository so that different agents can access relevant evidence during the research process. Source references and citations can be maintained alongside claims to improve traceability.

An important feature of the system is iterative research and verification. If an agent identifies missing information or conflicting evidence, the orchestrator can assign additional research tasks to appropriate agents. The fact-checking component can compare claims across multiple sources and identify information that requires further verification. This multi-agent approach can provide broader coverage than relying on a single AI agent to perform every research activity.

I. Introduction

Research involves the systematic collection, analysis, evaluation, and presentation of information to answer questions or understand a particular subject. Researchers often

need to examine numerous sources, identify relevant information, compare different perspectives, and organize their findings into a structured report. As the amount of information available online continues to grow, manually reviewing every potentially relevant source becomes increasingly difficult.

Traditional research workflows require users to perform several activities independently. They need to formulate search queries, locate appropriate sources, read articles and papers, extract important information, compare findings, verify facts, and prepare citations. These activities require significant time and attention, especially when the research topic covers multiple subtopics or disciplines.

Artificial Intelligence has introduced tools that can assist with information retrieval, summarization, question answering, and content generation. Large Language Models can analyze text, summarize documents, generate explanations, and help users formulate research questions. However, a single AI model performing the entire research workflow may have limitations related to source coverage, verification, reasoning, and consistency.

Multi-agent AI provides an alternative approach by distributing complex tasks among multiple specialized agents. Each agent can be assigned a particular responsibility, such as searching for sources, extracting information, checking facts, analyzing evidence, or generating reports. A central orchestrator coordinates these agents and combines their outputs into a coherent research workflow.

The proposed Multi-Agent AI Research Reporter uses this concept to automate the research process. The user provides a research topic or question, and the system creates a research plan. Specialized agents then conduct parallel or sequential research activities, collect evidence, analyze sources, identify important findings, and verify claims before the final report is generated.

The main objective of the system is to reduce the manual effort involved in research while improving organization and traceability. The system is designed as a research assistant rather than a replacement for human researchers. Users can review sources, verify important findings, modify the generated report, and make final judgments based on the evidence.

II. Literature Survey

Traditional research systems depend primarily on search engines, digital libraries, academic databases, and manual reading. Researchers formulate search queries and examine search results to identify relevant information. Although these systems provide access to large amounts of information, the responsibility for evaluating sources, extracting findings, comparing evidence, and preparing reports remains largely with the researcher.

Information-retrieval systems have improved the process of locating relevant documents. Search engines and academic retrieval systems use keyword matching, ranking algorithms, metadata, and increasingly semantic retrieval techniques to identify relevant content. However, retrieving relevant documents is only one part of research,

and users still need to determine whether the information is accurate, current, and appropriate for their research question.

Natural Language Processing has been widely used for document summarization, text classification, information extraction, and question answering. NLP systems can identify important entities, concepts, and relationships within documents. Automated summarization can reduce the time required to read large amounts of material, although summaries may omit important context or fail to represent disagreements between sources.

Large Language Models have significantly expanded AI-assisted research capabilities. They can summarize documents, explain technical concepts, generate research outlines, compare information, and assist with report writing. Retrieval-Augmented Generation can provide models with relevant external information during response generation. However, language models can still produce unsupported statements or inaccurate references if source grounding and verification are not properly implemented.

Multi-agent systems extend AI capabilities by dividing complex problems among multiple autonomous or semi-autonomous agents. Different agents can specialize in planning, retrieval, reasoning, verification, summarization, or content generation. A coordinating agent can assign tasks, monitor progress, resolve dependencies, and combine outputs from multiple agents. This architecture is particularly suitable for research because research itself consists of several interconnected activities.

Recent AI research systems increasingly explore autonomous research agents that can search information, analyze sources, conduct iterative investigations, and generate reports. However, challenges remain in source reliability, citation accuracy, conflicting evidence, hallucination, task coordination, and computational cost. The proposed Multi-Agent AI Research Reporter addresses these challenges through specialized agents, source tracking, evidence-based synthesis, fact verification, orchestration, and human review.

III. System Analysis

The proposed system provides an intelligent platform for automating the major stages of research and report preparation. The process begins when a user enters a research topic, question, or objective through the system interface. A Planning Agent analyzes the request and divides it into smaller research questions and investigation tasks. A Research Agent searches authorized information sources and collects potentially relevant documents, articles, reports, and other materials. A Source Analysis Agent evaluates the collected information based on relevance, credibility, date, and relationship to the research topic. An Information Extraction Agent identifies important facts, statistics, arguments, concepts, and evidence from the selected sources. A Fact-Checking Agent compares important claims with supporting sources and identifies contradictions or information requiring further verification. A Synthesis Agent combines verified information from different sources and identifies common findings, differences, trends, and research gaps. The central Orchestrator manages communication between agents and determines whether additional research is required. A Report Generation Agent converts the synthesized findings into a structured report according to the user's selected format. Citation and Reference Management maintains

source information and connects important claims with their supporting references. A quality-control module checks the generated report for structure, consistency, unsupported claims, and missing references. The final report is presented through a dashboard where users can review sources, findings, citations, and generated content. Human researchers can modify or approve the final report before publication or submission.

Existing System

Existing research workflows generally depend on search engines, academic databases, digital libraries, online articles, and manual document analysis. Researchers manually enter search queries and examine the returned results to identify useful sources. After collecting sources, they need to read and summarize relevant content themselves. Information from different sources is often stored separately in notes, spreadsheets, reference managers, or documents. Researchers must manually compare different viewpoints and determine whether individual claims are supported by reliable evidence. Fact-checking is frequently performed manually by searching for additional sources and comparing information. Writing the final report requires researchers to organize findings into appropriate sections and manually insert citations. Large research projects can therefore require substantial time and effort. Conventional AI assistants can help with summarization and writing but may not independently coordinate the complete research workflow. Single-agent systems may also have limited specialization when handling complex research tasks. Conflicting information from different sources can be difficult to identify automatically. Citation errors or unsupported statements may also occur when generated content is not properly grounded in sources. These limitations demonstrate the need for a multi-agent system that can distribute research tasks, verify information, synthesize evidence, and generate structured reports.

Disadvantages of Existing System

- Research requires significant manual effort.
- Searching multiple sources is time-consuming.
- Large volumes of information are difficult to analyze manually.
- Source comparison often requires manual work.
- Fact-checking can be repetitive.
- Identifying conflicting information is difficult.
- Manual note-taking can become disorganized.
- Citation management requires additional effort.
- Traditional search systems mainly retrieve information rather than analyze it.
- Basic AI assistants may depend heavily on a single model.
- Limited specialized task coordination.
- Generated content may contain unsupported claims.
- Research findings may not be systematically organized.
- Preparing the final report can take considerable time.
- Limited automated quality checking.

Proposed System

The proposed system introduces a Multi-Agent AI architecture for intelligent and automated research reporting. The user begins by entering a research topic, question,

objective, or desired report format. A Planning Agent analyzes the request and creates a structured research plan containing relevant subtopics and tasks. Specialized Research Agents investigate different subtopics in parallel and collect relevant information from authorized sources. A Source Evaluation Agent analyzes source relevance, credibility indicators, publication information, and evidence quality. An Information Extraction Agent extracts important facts, arguments, statistics, definitions, and findings from the selected sources. A Fact-Checking Agent validates important claims by comparing them against supporting evidence and identifying contradictions. A Synthesis Agent combines the verified findings and develops a coherent understanding of the research topic. The central Orchestrator coordinates all agents, tracks task completion, manages dependencies, and requests additional investigation when information is insufficient. A Report Generation Agent creates a structured report containing sections such as abstract, introduction, literature survey, methodology, findings, discussion, and conclusion. A citation module associates important claims with their supporting sources and maintains a reference list. A quality-control module checks the generated report for unsupported content, structural problems, inconsistent information, and citation gaps. Users can inspect the research sources and generated findings through a dashboard before approving the final report. This approach provides a systematic research workflow while keeping humans involved in final validation and interpretation.

Advantages of Proposed System

- Automates multiple stages of research.
- Uses specialized AI agents for different tasks.
- Supports parallel research activities.
- Reduces manual information-collection effort.
- Improves organization of research findings.
- Supports source evaluation and comparison.
- Provides automated fact-checking assistance.
- Identifies conflicting information.
- Maintains evidence and source relationships.
- Generates structured research reports.
- Supports automated citation management.
- Provides centralized research monitoring.
- Enables iterative research when information is insufficient.
- Reduces repetitive summarization and writing work.
- Improves research workflow efficiency.
- Keeps human researchers involved in final validation.

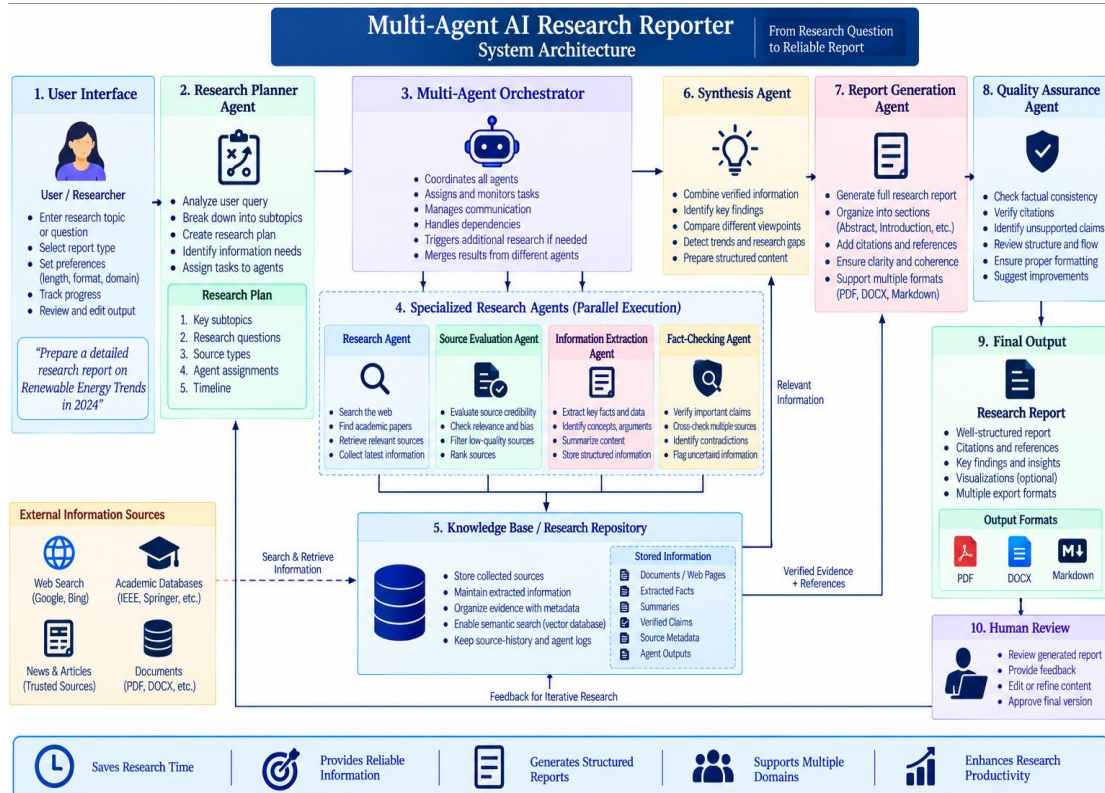
IV. Methodology

The methodology of the proposed system consists of several coordinated stages beginning with research-question formulation and ending with report generation and human review. The first stage is research request collection, where the user provides a topic, research question, objectives, and desired output format. The Planning Agent analyzes the request and divides it into smaller research questions and information requirements. The Orchestrator assigns these tasks to specialized Research Agents that investigate different aspects of the topic. The agents retrieve information from authorized web sources, academic resources, documents, and other relevant data sources. A Source Evaluation Agent examines the collected material and identifies

sources that are relevant and suitable for further analysis. An Information Extraction Agent extracts facts, statistics, concepts, arguments, and supporting evidence from the selected sources. A Fact-Checking Agent verifies important claims by comparing information across independent sources and highlighting contradictions. The Synthesis Agent organizes verified findings into themes and identifies similarities, differences, trends, and research gaps. If important information is missing, the Orchestrator creates additional research tasks and sends them back to the appropriate agents. The Report Generation Agent converts the synthesized evidence into a structured research report with appropriate sections and citations. A Quality Assurance Agent reviews the report for consistency, unsupported claims, missing references, and structural problems. The final report and supporting evidence are presented to the user through a dashboard for human review and approval. System performance can be evaluated using source-relevance accuracy, claim-verification accuracy, citation correctness, report completeness, response time, and human acceptance rate.

System Architecture

The system architecture consists of several interconnected components including the User Interface, Research Planner, Multi-Agent Orchestrator, Research Agents, Source Evaluation Agent, Information Extraction Agent, Fact-Checking Agent, Synthesis Agent, Knowledge Base, Citation Manager, Report Generation Agent, Quality Assurance Module, and Research Dashboard. The process begins when the user submits a research topic or question through the interface. The Research Planner analyzes the request and creates a structured research plan containing subtopics and information requirements. The Multi-Agent Orchestrator distributes these tasks among specialized research agents and manages their execution. Research Agents retrieve information from authorized web sources, academic resources, documents, and other available information sources.



The Source Evaluation Agent analyzes the retrieved sources for relevance and quality before they are included in the research knowledge base. The Information Extraction Agent identifies important facts, claims, statistics, concepts, and evidence from selected sources. The Fact-Checking Agent validates important claims and identifies conflicting or insufficient evidence. The Synthesis Agent combines verified information from multiple agents and produces a coherent set of research findings. The Citation Manager maintains source metadata and links supporting references to relevant claims. The Report Generation Agent uses the synthesized findings to create the final research report according to the selected structure and format. The Quality Assurance module checks the report for consistency, unsupported statements, citation gaps, and formatting problems. The Research Dashboard allows users to monitor agent activities, inspect sources, review findings, and edit the generated report. The complete architecture follows the flow **User → Research Planner → Multi-Agent Orchestrator → Specialized Research Agents → Source Collection → Source Evaluation → Information Extraction → Fact Checking → Knowledge Base → Evidence Synthesis → Report Generation → Quality Assurance → Human Review → Final Research Report**.

V. Result and Output

The screenshot displays the 'Multi-Agent AI Research Reporter' interface. On the left is a dark sidebar with navigation options: Dashboard, New Research, Research Library, Agents, Sources, Reports, and Settings. The main area features a top dashboard with four cards: '1 Active Research' (Renewable Energy Trends), '24 Sources Analyzed' (+12 new sources), '18 Facts Verified' (96% accuracy), and '1 Report Generated' (Today, 2:30 PM). Below this is a section for 'Current Research' with a report titled 'Renewable Energy Trends in 2024'. To the left of the report is an 'Agent Progress' section showing six agents (Research Agent, Source Evaluation Agent, Information Extraction Agent, Fact-Checking Agent, Synthesis Agent, and Report Generation Agent) all at 100% completion. The report itself includes an abstract, an introduction, and a literature survey. On the right, 'Key Findings' are listed, such as 'Global renewable energy capacity increased by 13% in 2024'. Below this is a 'Top Sources' list with five entries from IEA, IRENA, Nature, World Bank, and ScienceDirect. At the bottom right, 'Export Options' are provided for PDF, DOCX, Markdown, and LaTeX. A green banner at the bottom states 'Research report generated successfully! All agents have completed their tasks. You can now review, edit, and export the report.'

VI. Conclusion

The Multi-Agent AI Research Reporter provides an intelligent and automated approach to conducting research and generating structured research reports. By combining multiple specialized AI agents, Natural Language Processing, information retrieval, source evaluation, fact-checking, evidence synthesis, and Generative AI, the system can significantly reduce the manual effort involved in the research process.

The system can divide a research topic into smaller tasks and assign them to specialized agents such as the Research Agent, Source Evaluation Agent, Information Extraction Agent, Fact-Checking Agent, and Synthesis Agent. These agents work together to collect relevant information, verify important claims, identify key findings, and organize evidence before generating the final report.

The proposed system also provides a centralized dashboard where users can monitor agent progress, review sources, inspect verified facts, view key findings, and access the generated report. Citation management and quality checking help improve the traceability and reliability of the generated content.

Overall, the project demonstrates how Multi-Agent AI can make research faster, more organized, and more efficient. The system can assist students, researchers, professionals, and organizations in preparing comprehensive reports while keeping human review as an important final validation step. Future enhancements can include advanced academic-paper analysis, multilingual research, automatic research-gap detection, graphical visualization generation, deeper fact verification, voice-based research interaction, and integration with academic databases.

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