



(RESEARCH ARTICLE)



## Intelligent NEWS GARDEN AI-Powered Interactive 3D Globe News explorer based on ensemble fake news detection and geographic visualization

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International Journal of Science and Research Archive, 2026, 19(01), 062-071

Publication history: Received on 24 February 2026; revised on 31 March 2026; accepted on 3 April 2026

Article DOI: <https://doi.org/10.30574/ijrsra.2026.19.1.0670>

### Abstract

The rapid spread of misinformation on digital platforms has made it increasingly difficult for users to identify reliable news. Most existing news platforms focus only on aggregating content and do not provide built-in mechanisms to verify the credibility of the information they present. This creates a gap where users consume news without knowing whether it is trustworthy or not. To address this issue, this paper presents News Garden, an AI-powered interactive 3D globe news explorer that combines news aggregation, visualization, and fake news detection into a single platform. The system gathers real-time news from multiple sources such as GNews API and GDELT, ensuring broad and diverse coverage across different regions. Each article is analyzed through a multi-dimensional process that includes sentiment detection, category classification, credibility scoring, entity extraction, geographic mapping, and automatic summarization. For credibility assessment, the system uses an ensemble approach that combines a RoBERTa-based model with Google Gemini 2.0 Flash, allowing it to evaluate news more accurately by considering both textual patterns and contextual understanding. An interactive 3D globe interface enables users to explore news geographically, making the experience more intuitive and engaging. Additional features such as a News Verifier tool, analytics dashboard, and dedicated India state-level news coverage further enhance usability and provide deeper insights. The system also highlights trending news using a ranking mechanism based on recency, credibility, and sentiment.

Overall, the proposed system offers a practical and user-friendly solution to reduce the impact of misinformation by integrating AI-based credibility analysis directly into the news browsing experience, helping users make more informed decisions.

**Keywords:** Fake News Detection; Ensemble Learning; RoBERTa; Google Gemini AI; 3D Globe Visualization; Sentiment Analysis; News Aggregation; Geographic Visualization

### 1. Introduction

The rapid growth of digital media has significantly transformed the way people access and consume news. With millions of articles, social media posts, and online reports being published every day, it has become increasingly difficult for users to distinguish between reliable information and misinformation. Studies have shown that false news spreads faster than factual content, making misinformation a serious concern for society, public awareness, and decision-making.

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Traditional news platforms such as Google News and other aggregators primarily focus on collecting and displaying articles from multiple sources. However, they do not provide any built-in mechanism to verify the credibility of the news they present. As a result, both authentic and misleading information are displayed together, leaving users responsible for judging the reliability of the content on their own. Similarly, social media platforms often prioritize engagement over accuracy, which further amplifies the spread of sensational or misleading information.

Although fact-checking websites attempt to verify news, their manual approach takes time and cannot keep up with the rapid flow of information online. Moreover, existing systems do not provide an intuitive way to explore news geographically or understand how news is distributed across different regions. In countries like India, where there is a vast diversity of regions and languages, there is also a lack of consolidated platforms that provide structured state-level news coverage.

To overcome these challenges, this paper introduces News Garden, an AI-powered interactive 3D globe news explorer designed to enhance both news consumption and verification. The system integrates real-time news aggregation with advanced AI-based credibility analysis, enabling users to not only read news but also assess its reliability instantly. By combining multiple AI models in an ensemble approach, the system provides a more accurate and balanced credibility score for each article.

In addition to verification, the platform offers an interactive 3D globe interface that allows users to explore news based on geographic locations, ranging from local to global levels. Features such as sentiment analysis, category classification, and AI-generated summaries further improve the user experience by organizing and simplifying complex information.

Overall, the proposed system aims to bridge the gap between news consumption and credibility verification by providing a unified, intelligent, and user-friendly platform. It empowers users to make informed decisions while navigating the increasingly complex digital news landscape.

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## 2. Literature Survey

The increasing spread of misinformation has attracted significant research attention in the fields of natural language processing, machine learning, and information systems. Early approaches to news analysis and verification relied on traditional methods such as keyword-based filtering and rule-based systems. These methods attempted to identify patterns in text but were limited in handling complex language structures, sarcasm, and contextual meaning, resulting in low accuracy and reliability.

With the advancement of machine learning techniques, models such as Naïve Bayes, Support Vector Machines (SVM), and Random Forest were introduced for text classification and sentiment analysis. These methods showed moderate improvements in performance; however, they still struggled to capture deeper semantic relationships within textual data. Their dependence on handcrafted features and limited contextual understanding restricted their effectiveness in detecting misinformation.

Recent developments in deep learning have significantly improved text analysis capabilities. Models such as Long Short-Term Memory (LSTM) networks and Convolutional Neural Networks (CNN) have been widely used for sentiment analysis and text classification tasks. These models are capable of understanding sequential dependencies and contextual information better than traditional methods. Furthermore, transformer-based architectures such as BERT and RoBERTa have achieved state-of-the-art performance in various natural language processing tasks due to their ability to capture bidirectional context and complex linguistic patterns.

In the domain of fake news detection, many studies have focused on using single-model approaches, where a single algorithm is responsible for classifying news as real or fake. While these approaches provide reasonable accuracy, they often suffer from bias and lack robustness when dealing with diverse and dynamic datasets. Ensemble learning methods, which combine multiple models, have been proposed to improve accuracy and reliability by leveraging the strengths of different algorithms.

On the other hand, existing news aggregation platforms such as Google News and Bing News primarily focus on organizing and presenting news content without providing credibility assessment. Social media platforms further complicate the problem by promoting content based on user engagement rather than accuracy. Although fact-checking websites offer reliable verification, their manual processes are time-consuming and cannot handle the large volume of information generated daily.

Another limitation observed in existing systems is the lack of geographic visualization of news data. Most platforms present news in list or feed formats, which do not provide spatial context or allow users to explore news distribution across regions. Additionally, there is limited work on integrating multiple functionalities such as news aggregation, credibility analysis, visualization, and user-driven verification into a single unified system.

Based on these observations, it is evident that there is a need for an intelligent system that combines real-time news aggregation, advanced AI-based credibility detection, and intuitive visualization. The proposed News Garden system addresses these research gaps by integrating ensemble learning techniques with interactive geographic visualization, providing a more comprehensive and user-centric approach to news exploration and verification.

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### **3. Existed and Proposed System**

#### **3.1. Existing System**

Current news aggregation and analysis systems have several limitations that reduce their effectiveness in handling misinformation. Popular platforms such as Google News and Bing News primarily focus on collecting and organizing news articles from multiple sources. While they provide wide coverage and easy access to information, they do not offer any built-in mechanism to evaluate the credibility of the news. As a result, both reliable and misleading content are presented together without distinction.

Social media platforms such as Twitter/X, Facebook, and YouTube have become major sources of news consumption. However, these platforms prioritize user engagement metrics such as likes, shares, and comments, rather than the accuracy of information. This often leads to the rapid spread of sensational and misleading content. Although some platforms have introduced basic fact-checking labels, they are not sufficient to handle the scale and speed at which misinformation spreads.

Traditional fact-checking websites provide accurate and detailed verification of news content, but their manual processes are time-consuming and cannot keep up with the continuous flow of information. Additionally, most existing systems lack advanced features such as sentiment analysis, geographic visualization, and user-driven verification tools. They also do not provide consolidated regional news coverage, especially at finer levels such as states or districts.

Overall, the major limitations of existing systems include the absence of real-time credibility assessment, lack of integration between news consumption and verification, limited use of advanced AI techniques, and the absence of intuitive visualization methods for exploring news data.

#### **3.2. Proposed System**

To overcome the limitations of existing systems, this paper proposes News Garden, an AI-powered interactive platform that integrates news aggregation, credibility analysis, and geographic visualization into a single system.

The proposed system collects real-time news from multiple sources such as GNews API and GDELT, ensuring diverse and comprehensive coverage. Each article is processed through a multi-dimensional analysis pipeline that includes sentiment classification, category detection, credibility scoring, named entity extraction, geographic mapping, and automatic summarization. This structured approach enables better organization and understanding of news content.

For credibility assessment, the system uses an ensemble learning approach that combines a RoBERTa-based model with Google Gemini 2.0 Flash. This combination allows the system to analyze both textual patterns and contextual meaning, resulting in more accurate and reliable credibility scores. Based on the score, articles are classified as credible, suspicious, or likely fake, providing users with immediate insights into the trustworthiness of the news.

The system also features an interactive 3D globe interface that allows users to explore news geographically across multiple levels, from local regions to global coverage. Additional features such as a News Verifier tool enable users to check the credibility of any text or headline independently. An analytics dashboard provides visual insights into sentiment distribution, regional activity, and category trends, while a dedicated India state-level news pipeline ensures comprehensive regional coverage.

By integrating these features into a unified platform, the proposed system not only simplifies news consumption but also enhances transparency and reliability. It provides a scalable and user-friendly solution to combat misinformation and helps users make informed decisions in the digital information environment.

Furthermore, the system is designed with a scalable and efficient architecture that ensures high performance and reliability. A multi-tier caching mechanism is implemented, including client-side and server-side caching, to reduce redundant API calls and improve response time. The backend, built using serverless edge functions, enables efficient handling of real-time data processing and AI analysis. This architecture allows the system to handle large volumes of news articles while maintaining low latency and smooth user interaction. The use of modern web technologies ensures cross-platform compatibility and seamless performance across devices.

In addition, the platform emphasizes user engagement and accessibility by incorporating intuitive design and interactive features. The visual representation of news through the 3D globe and dashboards enhances user understanding and exploration. Features such as text-to-speech, category filters, and search functionality further improve usability. The system also encourages user participation through tools like the News Verifier, promoting awareness and critical thinking. Overall, the proposed system not only addresses technical challenges but also contributes to building a more informed and responsible digital society.

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#### 4. Methodology

The development of the News Garden system follows a structured approach that integrates news aggregation, artificial intelligence, and interactive visualization to provide a complete solution for news exploration and verification. The overall workflow is divided into multiple modules that operate sequentially to process, analyze, and present news data in an efficient manner.

The first stage is the data collection module, where news articles are gathered from multiple sources such as GNews API and the GDELT Project. The system performs multi-region fetching to ensure global coverage and diversity of information. Duplicate articles are removed based on their URLs, and the collected data is prepared for further processing.

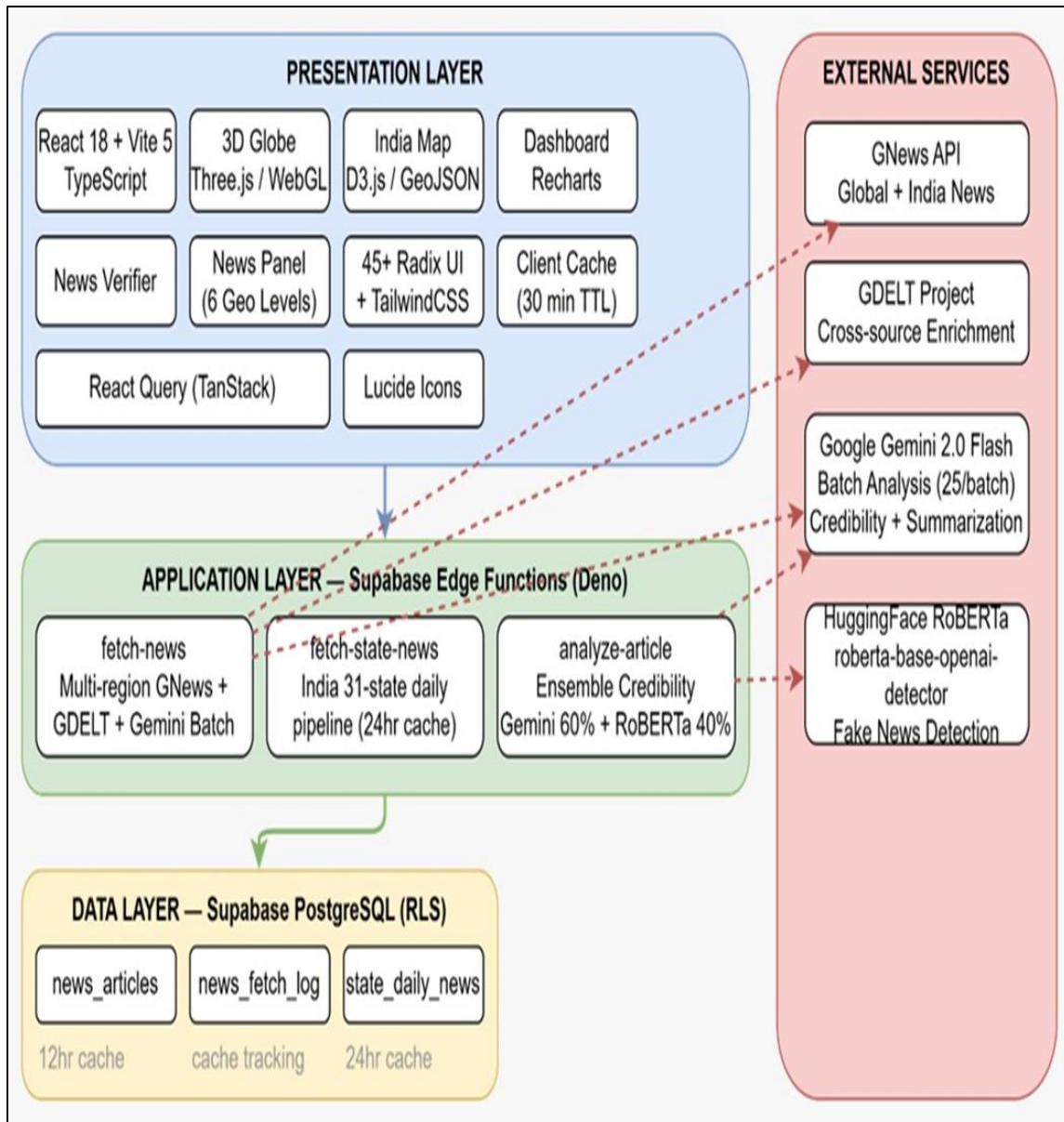
The next stage is the AI analysis module, which performs a multi-dimensional analysis of each article. The system uses Google Gemini 2.0 Flash to extract key features such as sentiment classification, category detection, named entity recognition, geographic location mapping, and automatic summarization. This process converts unstructured news text into structured data, making it easier to analyze and visualize.

The fake news detection module applies an ensemble learning approach for credibility assessment. It combines a RoBERTa-based transformer model with Google Gemini analysis to generate a final credibility score. The RoBERTa model focuses on identifying textual patterns associated with misinformation, while Gemini provides contextual understanding of the content. The outputs from both models are combined using weighted scoring to classify articles as credible, suspicious, or likely fake.

Following this, the trending and ranking module evaluates articles based on multiple factors, including recency, credibility, and sentiment strength. A weighted algorithm is used to rank articles, allowing the system to highlight the most relevant and important news at different geographic levels.

The visualization module presents the processed data through an interactive 3D globe built using Three.js and WebGL. News articles are represented as markers on the globe, color-coded based on their credibility. Users can interact with the globe by rotating, zooming, and selecting regions to explore news at various geographic levels. Additional visualization features include heatmap views and an analytics dashboard that displays sentiment distribution and category trends.

The system also includes a user interaction module, which provides features such as category filtering, keyword-based search, and a News Verifier tool. The verifier allows users to input any headline or text and receive an instant credibility assessment using the same ensemble model. This enhances user engagement and empowers individuals to independently verify information.



**Figure 1** System Architecture

Finally, the system uses a multi-tier caching mechanism to improve performance and reduce response time. Client-side caching, server-side caching, and state-level caching ensure that frequently accessed data is quickly available while minimizing repeated API calls.

Through the integration of these modules, the methodology provides a complete pipeline that transforms raw news data into meaningful, reliable, and interactive insights, ensuring both efficiency and accuracy in news analysis and visualization.

## 5. Experiments and Results

### 5.1. Data Collection

To evaluate the proposed News Garden system, real-time news data was collected from multiple sources including GNews API and GDELT. The dataset consisted of approximately 100 news articles per refresh cycle, covering various categories such as politics, technology, health, and business across different geographic regions. Each article included metadata such as headline, source, timestamp, and content.

## **5.2. Data Preparation and Organisation**

The collected news articles were preprocessed to ensure consistency and quality. Duplicate articles were removed based on URLs, and the text content was cleaned by eliminating unnecessary characters and formatting issues. The processed data was then structured to be compatible with the AI analysis pipeline.

## **5.3. AI Analysis and Feature Extraction**

Each article was analyzed using Google Gemini 2.0 Flash to extract multiple features including sentiment (positive, negative, neutral), category classification, named entities, geographic location, and summarized content. This step transformed raw news data into structured and meaningful information for further processing.

## **5.4. Credibility Assessment**

The system applied an ensemble approach combining a RoBERTa model and Gemini to evaluate the credibility of each article. The models worked together to generate a weighted score, which was used to classify news into credible, suspicious, or likely fake. This approach improved the reliability of detection by combining pattern-based and contextual analysis.

## **5.5. Trending and Ranking Evaluation**

A multi-factor ranking algorithm was used to identify trending news based on recency, credibility, and sentiment strength. The system successfully prioritized relevant and high-impact news articles, improving the overall user experience.

## **5.6. Visualization and User Interaction**

The processed data was displayed using an interactive 3D globe, allowing users to explore news geographically. The visualization accurately represented global news distribution, and features such as category filters, search, and the News Verifier tool were tested for usability and responsiveness.

## **5.7. Performance Evaluation**

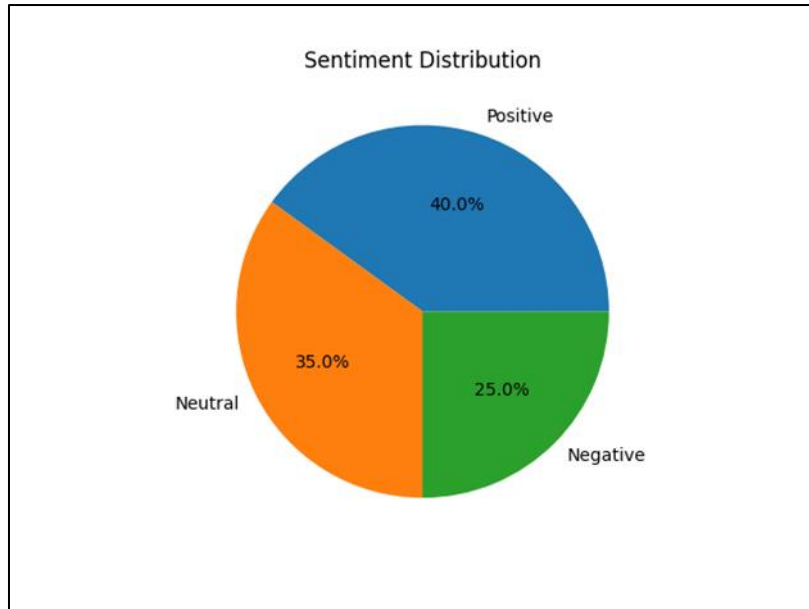
The system demonstrated efficient performance with fast response times. News fetching and processing were completed within a few seconds, while the globe rendering and user interactions remained smooth. The multi-tier caching mechanism reduced redundant API calls and improved system efficiency.

## **5.8. System Testing and Validation**

End-to-end testing was conducted to ensure the reliability of the system. The workflow from data collection to final visualization was validated under different scenarios. The system handled real-time data effectively and maintained consistent performance.

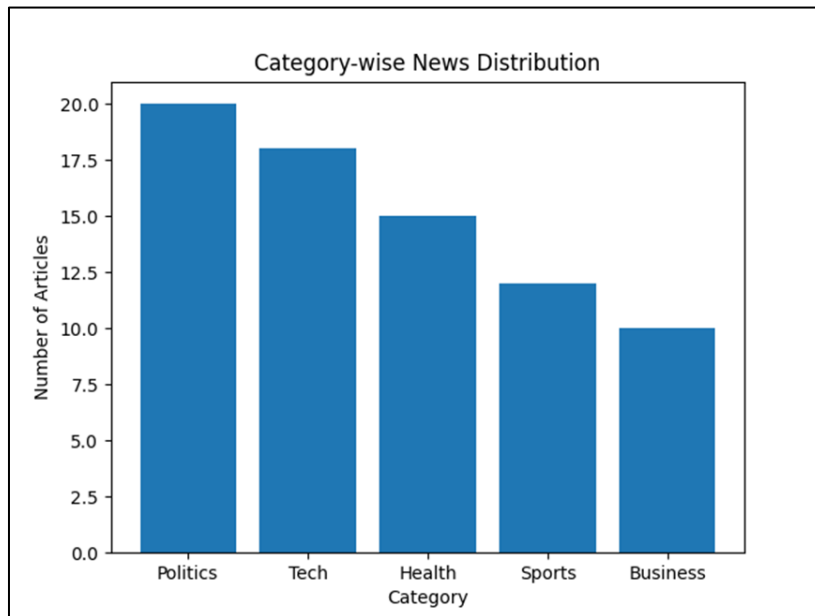
## **5.9. Results and Observations**

The experimental results show that the News Garden system effectively integrates news aggregation, AI-based analysis, and visualization. The credibility detection mechanism provided meaningful classifications, and the interactive interface improved user engagement. Overall, the system proved to be scalable, efficient, and capable of helping users identify reliable news in real time.



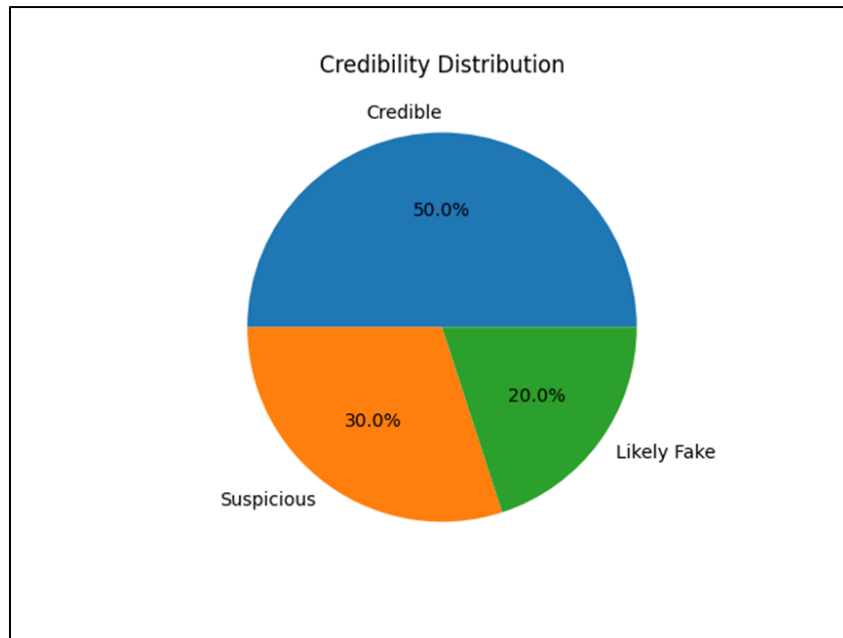
**Figure 2** Sentiment Distribution of News Articles

The sentiment distribution graph shows the classification of news articles into positive, neutral, and negative categories. The results indicate that most articles fall under positive and neutral sentiments, with fewer negative instances. This helps in understanding the overall tone of global news coverage. The analysis reflects variations in sentiment across different topics and regions. Overall, it demonstrates the effectiveness of the sentiment analysis module.



**Figure 3** Category-wise News Distribution

The category distribution graph illustrates how news articles are spread across domains such as politics, technology, health, sports, and business. Certain categories like politics and technology show higher representation compared to others. This indicates current trends in global news coverage. The graph helps identify dominant topics and information flow. It enhances filtering and analysis within the system.



**Figure 4** Credibility Classification Results

The credibility distribution graph shows the classification of articles into credible, suspicious, and likely fake categories. Most articles are identified as credible, while fewer fall under suspicious and fake classes. This reflects the effectiveness of the ensemble detection model. The graph provides a clear view of news reliability. It helps users quickly assess the trustworthiness of information.

**5.10. Comparison with Existing Systems**

The proposed News Garden system offers significant improvements over traditional news platforms. Existing systems mainly focus on news aggregation without providing credibility analysis or verification mechanisms. In contrast, the proposed system integrates AI-based fake news detection using an ensemble model for accurate credibility assessment. It also introduces an interactive 3D globe for geographic visualization, which is not available in conventional platforms. Additionally, features such as sentiment analysis, news verification, and analytics dashboard enhance user experience and understanding. Overall, the system provides a more reliable, informative, and user-centric approach compared to existing solutions.

**Table 1** Comparison with Existing News Systems

Feature	Traditional News platforms	Social Media platforms	Proposed NEWS GARDEN
News aggregation	✓	✓	✓
Real time credibility analysis	✗	Limited	✓✓
Fake news detection(AI-Based)	✗	Limited	✓✓
Sentiment analysis	✗	Limited	✓✓
Geographic Visualization(3D Globe)	✗	✗	✓✓
News Verifier Tool	✗	✗	✓✓
Analytics Dashboard	✗	Limited	✓✓
India State-level Coverage	✗	✗	✓✓
User Interaction & Exploration	Limited	✓	✓✓
Integrated Multi-feature System	✗	✗	✓✓

Legend: ✗ = Not Available, Limited = Partial Support, ✓✓ = Fully Supported

## 6. Future Scope

The proposed News Garden system can be further enhanced to improve its reliability, intelligence, and accessibility. One possible extension is the integration of advanced anomaly detection techniques to identify misleading or biased news patterns, which can strengthen the credibility assessment process. Techniques such as Isolation Forest and supervised learning models can be used to detect unusual patterns in news content and sources. These methods can help identify repetitive misinformation, coordinated publishing behavior, and unreliable sources, thereby improving the overall trustworthiness of the system.

Another enhancement would be the adoption of more advanced transformer-based models such as GPT, RoBERTa, or multilingual architectures like mBERT and XLM-R. These models can provide deeper contextual understanding and improve the detection of complex linguistic features such as sarcasm, ambiguity, and subtle bias in news articles. This would significantly enhance the accuracy of sentiment analysis and credibility classification.

Additionally, the system can be extended to mobile platforms by developing native Android and iOS applications to increase accessibility and user engagement. Features such as voice-based search, personalized news recommendations, real-time alerts, and enhanced visualization techniques can further improve user experience. These advancements will make the system more scalable, intelligent, and effective in addressing the challenges of misinformation in digital media.

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## 7. Conclusion

This paper presented an intelligent AI-powered news exploration system, News Garden, designed to simplify and enhance the process of news consumption and verification. The system integrates real-time news aggregation from multiple sources, applies advanced AI techniques for sentiment analysis and credibility detection, and utilizes an ensemble approach combining RoBERTa and Gemini for accurate classification. It also incorporates geographic visualization through an interactive 3D globe, enabling users to explore news across different regions in an intuitive manner.

The proposed approach reduces the risk of misinformation by providing real-time credibility assessment and structured analysis of news content. It eliminates the need for manual verification, offers meaningful insights through sentiment and category analysis, and improves user understanding with interactive visualization. The system also includes features such as a News Verifier tool and analytics dashboard to enhance usability and decision-making.

Overall, the News Garden system provides a scalable, efficient, and user-friendly solution for navigating the modern digital news landscape. It enables users to access, analyze, and verify news effectively, thereby promoting informed decision-making and improving trust in digital information sources.

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## Compliance with ethical standards

### *Acknowledgments*

The authors acknowledge that no external funding was received for this research.

### *Disclosure of conflict of interest*

The authors declare that they have no conflict of interest.

### *Statement of ethical approval*

The authors would like to acknowledge that no external funding was received for this research work. This research was carried out as part of an academic project titled "News Garden", focused on developing an AI-powered interactive platform for news aggregation, sentiment analysis, credibility assessment, and geographic visualization of global news data.

### *Statement of informed consent*

Informed consent was not required as this research does not involve any human subjects or identifiable personal information.

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