IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 1, January 2026

DOI: 10.17148/IJARCCE.2026.151105

Gov-Scheme Analysis and Tracker

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Abstract: The increasing number and scale of government welfare schemes have created a strong need for effective systems that can analyze scheme performance and improve transparency. One of the major challenges faced by administrators and policymakers is the lack of a centralized mechanism to monitor beneficiary coverage, financial utilization, and overall scheme impact. Traditional methods rely on manual reports and fragmented data sources, which often result in delayed insights and inefficient decision-making.

The **Government Scheme Analysis and Tracker** is developed to address these challenges by providing an intelligent and automated platform for analyzing welfare schemes. It is a web-based application that processes scheme-related data to evaluate beneficiary trends, expenditure patterns, and district-wise and state-wise performance. By using analytical and forecasting techniques, the system enables users to understand how schemes are performing and identify areas that require improvement without relying on manual analysis.

The system is implemented using **React.js** for the frontend interface, **FastAPI** for backend processing, **MongoDB** for data storage, and **Python-based analytics and AI models** for data analysis and forecasting. The project demonstrates effective integration of modern web technologies and artificial intelligence to support data-driven governance. The **Government Scheme Analysis and Tracker** aims to enhance transparency, support informed policy decisions, and improve the overall effectiveness of government welfare programs

I. INTRODUCTION

The Government of India implements numerous welfare schemes to support diverse socio-economic groups such as students, farmers, women, senior citizens, and economically weaker sections. These schemes span critical sectors including education, healthcare, housing, agriculture, employment, and financial inclusion, with billions of rupees allocated annually for public welfare. However, assessing their real impact and reach remains challenging due to fragmented data sources, manual reporting systems, and limited accessibility of information for both policymakers and citizens.

Traditionally, monitoring government schemes involves manual collection of district-wise and state-wise reports, tracking beneficiaries and fund utilization, and analyzing large volumes of statistical data. This approach is time-consuming, prone to errors, and lacks real-time insights, making it difficult for decision-makers to identify trends, detect inefficiencies, or evaluate whether schemes are effectively reaching their intended beneficiaries. As digital governance expands, there is a pressing need for a centralized, intelligent system that can automate analysis and provide timely, data-driven insights.

The Government Scheme Analysis and Tracker project addresses these challenges through an AI-powered platform that enables real-time monitoring and evaluation of welfare schemes. Using technologies such as FastAPI, React.js, MongoDB, and AI/ML models including the Prophet forecasting model, the system analyzes multi-year data on funding, beneficiaries, GDP trends, and regional performance. Interactive dashboards, predictive analytics, and NLP-based simplified summaries allow stakeholders—both technical and non-technical—to clearly understand scheme performance and support more informed policy decisions.

1.1 Project Description

The Government Scheme Analysis and Tracker is a web-based platform developed to analyze the effectiveness and impact of government welfare schemes. It collects scheme-related data from MongoDB and preprocesses it by removing duplicates, cleaning inconsistencies, and organizing data year-wise and state-wise. Artificial intelligence techniques are applied to study beneficiary growth, scheme coverage, fund utilization efficiency, and the relationship between scheme performance and economic indicators such as GDP. This analysis helps determine whether welfare schemes are meeting their intended objectives. To assist future planning, the system integrates the Prophet forecasting model to predict beneficiary counts and growth trends. These forecasts enable policymakers to anticipate future needs and allocate resources efficiently. The frontend is built using React.js, TailwindCSS, and Recharts to provide interactive and visually appealing dashboards. Users can explore district-wise and state-wise performance and year-by-year trends. An NLP-

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based summary generator converts complex analytics into simple insights for non-technical users. Overall, the FastAPI and MongoDB-based system is fast, responsive, and user-friendly for effective scheme evaluation.

1.2 Motivation

Effective monitoring and evaluation of government welfare schemes are critical for ensuring inclusive growth and social development, as these schemes aim to support diverse socio-economic groups such as students, farmers, women, senior citizens, and economically weaker sections. Despite substantial budget allocations, minor inefficiencies—such as delayed fund utilization, uneven regional coverage, data inaccuracies, or lack of beneficiary awareness—can significantly reduce the overall impact of welfare programs. These challenges often result in resource wastage, policy misalignment, and limited improvement in the living standards of the intended beneficiaries.

Currently, most government scheme monitoring mechanisms rely on manual data collection, periodic reporting, and fragmented information systems across districts and states. Such approaches are time-consuming, error-prone, and lack real-time visibility into scheme performance. The absence of transparent, centralized, and data-driven evaluation tools makes it difficult for policymakers and administrators to accurately assess beneficiary reach, track fund utilization efficiency, and identify underperforming regions or schemes. As a result, decision-making is often reactive rather than proactive, limiting the effectiveness of policy interventions.

The growing scale of welfare programs and the push toward digital governance highlight the need for an intelligent, automated, and scalable analysis framework. Recent advancements in Artificial Intelligence, Machine Learning, and data analytics enable real-time performance evaluation, predictive forecasting, and insight generation from large and complex datasets. Motivated by these needs, this project aims to develop an AI-powered Government Scheme Analysis and Tracker that integrates automated data processing, predictive modeling, and intuitive visualizations to enhance transparency, support informed policy decisions, and improve the overall effectiveness of government welfare schemes.

II. RELATED WORK

Several studies have examined government welfare schemes in India from social, economic, and policy-oriented perspectives by reviewing official documents, survey data, and existing literature. Research by Tripathi et al., Patil et al., Jha, and Choudhury & Srinivasan focused on understanding scheme objectives, historical evolution, coverage, and beneficiary impact across agriculture, women empowerment, insurance, and social protection domains. Other works such as Sasikumar & Balaji and Sravanthi & Chandrakanth relied on survey-based and institutional economic analyses to assess awareness, utilization, and benefits received by specific beneficiary groups. While these studies provide valuable qualitative insights, most of them depend on manual data collection, small sample sizes, and descriptive evaluation methods, limiting their scalability and real-time applicability.

Recent studies by Rahimi & Prabhakar and Elizabeth et al. introduced financial and visualization-based perspectives to evaluate fund utilization and demographic distribution of schemes across states. Although visualization techniques improved interpretability, these approaches lacked advanced data-driven analytics, automated performance tracking, and predictive modeling capabilities. Furthermore, studies such as Manisha et al. and Pandey & Parthasarathy highlighted gaps in scheme awareness and impact evaluation but did not propose a centralized technical platform for continuous monitoring, district-wise analysis, or AI-driven forecasting. Overall, existing research treats scheme analysis, visualization, and evaluation as isolated tasks without integrating them into a unified analytical framework.

Despite extensive literature on welfare scheme evaluation, there remains a significant research gap in developing an intelligent, automated, and centralized system that combines real-time data processing, interactive visualization, performance evaluation, and predictive forecasting. Most existing approaches lack AI-based models for trend prediction, NLP-driven insight generation, and scalable architectures for multi-year and multi-region analysis. The proposed **Government Scheme Analysis and Tracker** addresses this gap by integrating data analytics, machine learning forecasting, and NLP-based summarization into a single platform, enabling end-to-end monitoring, transparent evaluation, and informed decision-making for government welfare schemes.

III. METHODOLOGY

A. System Architecture Overview

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The Government Scheme Analysis and Tracker is developed as a full-stack, web-based analytical platform that integrates frontend visualization, backend processing, database management, and AI/ML analytics. The system follows a modular architecture with clearly separated components for user authentication, data ingestion, preprocessing, analytics, forecasting, and visualization. The backend API, built using FastAPI, manages user requests, data validation, scheme analysis logic, and communication with the database. The frontend, developed using React.js, provides an interactive interface for dashboard visualization, scheme selection, filtering, and result interpretation. The AI/ML analytics module operates independently to perform trend analysis, impact evaluation, and time-series forecasting using historical scheme data.

B. Scheme Data Profile and Customization

The system allows administrators or users to upload and manage scheme-related datasets containing attributes such as scheme name, year, beneficiary count, expenditure, district, state, and economic indicators like GDP. Based on user-selected filters such as scheme type, year range, district, or state, the system dynamically customizes the analysis output. A persistent dataset structure is maintained in MongoDB to store historical records, enabling longitudinal analysis of scheme performance across multiple years. This structured data organization allows the system to adapt analysis views and insights according to user preferences and selected evaluation criteria.

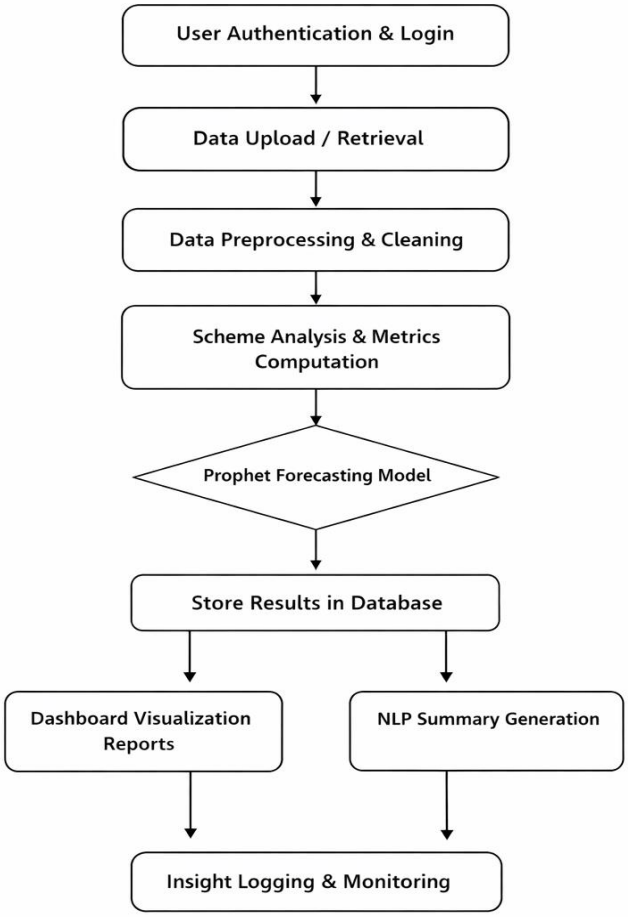

Fig. 1. Flowchart of methodology

C. AI-Based Scheme Analysis and Forecasting Module

The analytical module leverages machine learning and statistical techniques to evaluate scheme performance. Key performance indicators such as beneficiary growth rate, fund utilization efficiency, and regional performance variation are computed automatically. For predictive analysis, the system integrates the Prophet time-series forecasting model to predict future beneficiary counts and growth trends based on historical data. These forecasts help identify long-term

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patterns and support proactive policy planning. The analytical module ensures accuracy by validating data consistency and avoiding duplicate records during processing.

D. Data Processing and Insight Generation

Uploaded or stored scheme datasets undergo automated preprocessing, which includes duplicate removal, missing value handling, and data normalization. Once cleaned, the data is passed to analytical routines that compute metrics such as year-wise growth, district-wise performance comparison, and economic impact relationships. An NLP-based summary generator converts complex analytical results into simple, human-readable insights, allowing non-technical users to understand trends and outcomes easily. Error-handling mechanisms ensure system stability during invalid input or incomplete datasets.

E. Implementation Flow

1. Initialize the system and authenticate users through a secure login interface.
2. Upload or retrieve scheme-related datasets from the MongoDB database.
3. Preprocess data by cleaning inconsistencies, removing duplicates, and organizing records year-wise and region-wise.
4. Perform analytical computations to evaluate beneficiary growth, expenditure efficiency, and regional performance.
5. Apply Prophet-based forecasting models to predict future trends and scheme outcomes.
6. Store all processed data, analytical results, and predictions in the database for traceability.
7. Update dashboards with real-time charts, comparative analysis, and forecast visualizations.
8. Generate NLP-based summaries to explain insights and performance indicators.
9. Log analytical results and system metrics for continuous improvement and evaluation.

F. Hardware and Software Requirements

- Standard desktop or laptop system with a minimum of 8 GB RAM and a multi-core processor.
- Python 3.8+ with FastAPI for backend development and API handling.
- React.js with TailwindCSS and Recharts for frontend visualization and dashboards.
- MongoDB for scalable and flexible data storage.
- AI and data processing libraries such as Pandas, NumPy, Scikit-learn, and Prophet for analytics and forecasting.
- A modern web browser (Google Chrome, Firefox, or Edge) for system access and visualization.

IV. SIMULATION AND EVALUATION FRAMEWORK

This section describes the overall system design, evaluation workflow, and performance assessment methodology adopted for the **Government Scheme Analysis and Tracker**. The framework integrates data analytics, machine learning, time-series forecasting, and web-based technologies to analyze welfare scheme performance and generate actionable insights. The system is implemented as a web-based analytical platform, with **React.js** handling frontend visualization and **FastAPI** managing backend processing and API operations. The evaluation process focuses on assessing beneficiary growth, fund utilization efficiency, regional performance variation, and future trends using AI-driven analysis, ensuring accurate, transparent, and scalable evaluation of government welfare schemes.

A. System Architecture and Workflow

The proposed architecture is designed to support automated data processing, analytical evaluation, forecasting, and visualization of government welfare schemes. The system ensures seamless interaction between users, data sources, and analytical modules while maintaining scalability, consistency, and secure data handling. The major components of the system are described below:

Web-Based Analytics Platform:
The application provides access to users such as students, analysts, and policymakers through an interactive dashboard. It enables scheme selection, district-wise and state-wise analysis, year-wise trend exploration, and visualization of analytical and forecast results. Users can monitor scheme performance and compare multiple schemes through charts, tables, and dashboards.

Data Analytics and AI Processing Layer:
This layer performs automated preprocessing, analytical computation, and predictive modeling. Historical scheme data is analyzed to evaluate beneficiary growth, expenditure efficiency, and economic impact. The Prophet forecasting model

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is used to predict future trends such as beneficiary counts and scheme growth patterns, supporting long-term planning and decision-making.

Authentication and Data Management Module:
Secure authentication mechanisms manage user access and session validation. Scheme datasets, processed records, analytical outputs, and forecasting results are stored in a centralized **MongoDB** database, ensuring data consistency, traceability, and reliable historical analysis.

Visualization and Insight Generation Layer:
A centralized visualization module presents analytical and forecast results using interactive charts and dashboards. An NLP-based summary generator converts complex numerical results into simple, readable insights, enabling non-technical users to understand scheme performance clearly.

B. System Evaluation Setup

The evaluation framework is designed to measure the effectiveness of the Government Scheme Analysis and Tracker under realistic data analysis scenarios. Multiple datasets covering different schemes, regions, and time periods are used to assess analytical accuracy, forecasting reliability, and system performance.

Scheme Configuration:
Evaluation is conducted using multiple welfare schemes with varying beneficiary sizes, expenditure levels, and geographic coverage to simulate real-world government data conditions.

Data Processing Scenarios:
Scheme datasets are uploaded and processed to evaluate data cleaning accuracy, analytical computation correctness, forecasting consistency, and dashboard responsiveness.

C. Evaluation and Verification Process

Each analytical operation is associated with structured dataset records linking scheme data, computed metrics, and forecast outputs. As users apply filters and analysis options, the system processes data in real time and stores results securely. Upon completion of analysis, users can review detailed dashboards and summaries that include beneficiary trends, regional performance comparisons, and future projections. This evaluation process ensures transparency, repeatability, and reliability of analytical outcomes for administrators and policymakers.

D. Results and Observations

Scheme Analysis Performance:
• AI-based analytics effectively evaluated beneficiary growth, fund utilization efficiency, and district-wise performance.
• Forecasting results generated meaningful future trend insights aligned with historical data patterns.

System Reliability and Consistency:
• Data processing and analysis were performed without data loss or inconsistencies.
• Dashboards and analytical results were generated promptly after data processing.

User Impact:
• Users gained clear, visual, and data-driven insights into scheme performance.
• Policymakers and analysts benefited from structured evaluation metrics and predictive analysis for informed decision-making.

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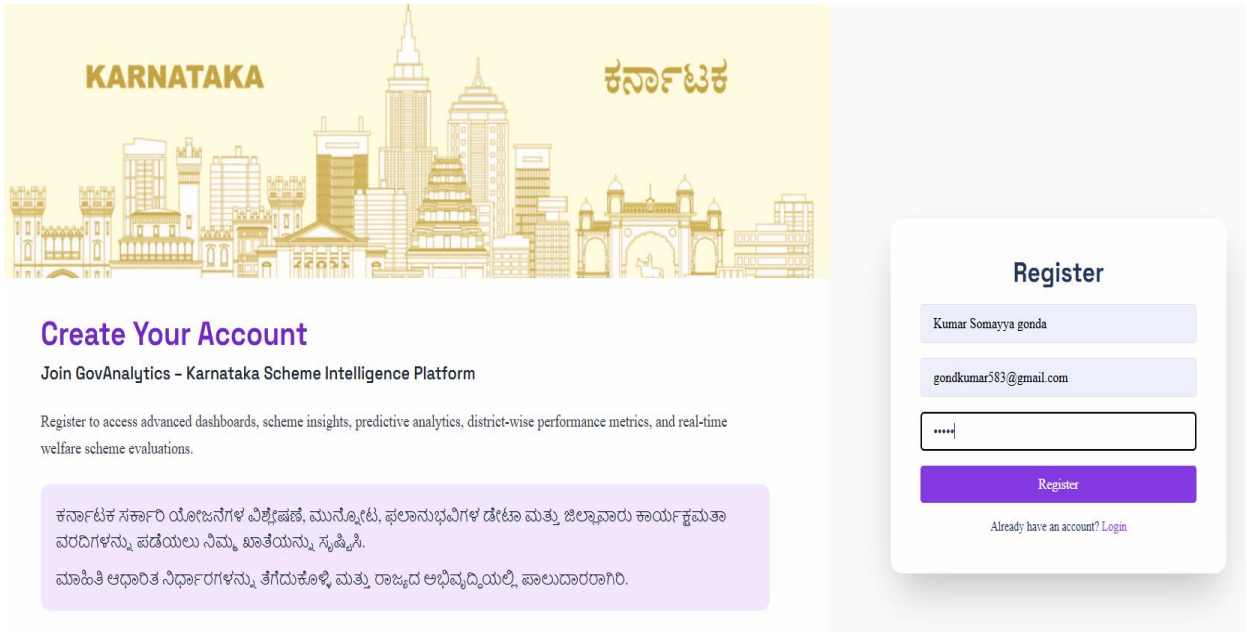

Fig.2. Register Details Page

The registration page allows new users to create an account by providing basic details such as name, email, and password. Once registered, users can securely access dashboards, scheme analytics, and predictive insights offered by the platform.

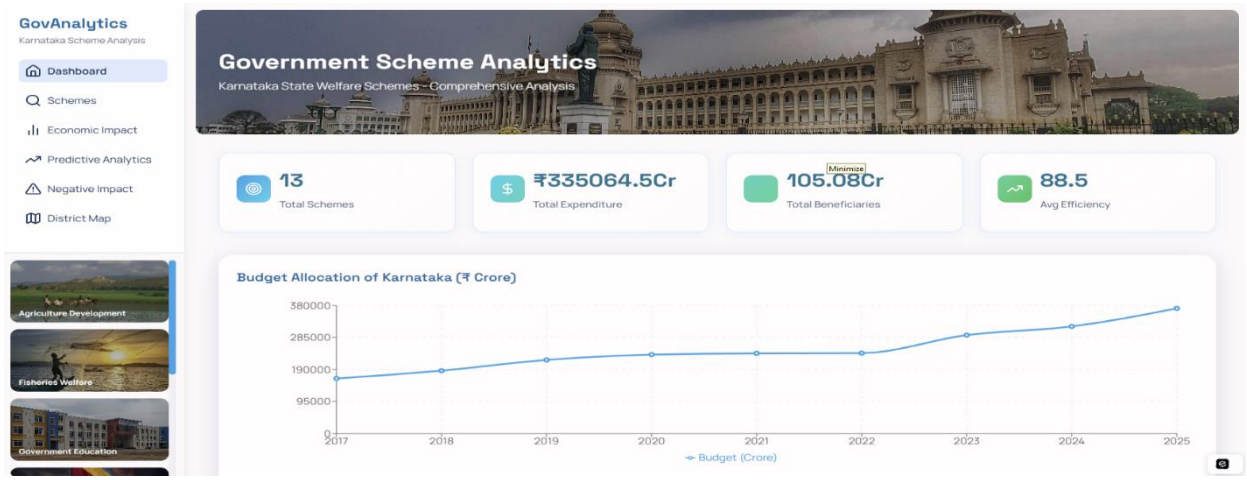

Fig.3. Dashboard Page

This dashboard page provides a **comprehensive overview of Karnataka government welfare schemes**, highlighting total schemes, expenditure, beneficiaries, and overall efficiency at a glance.

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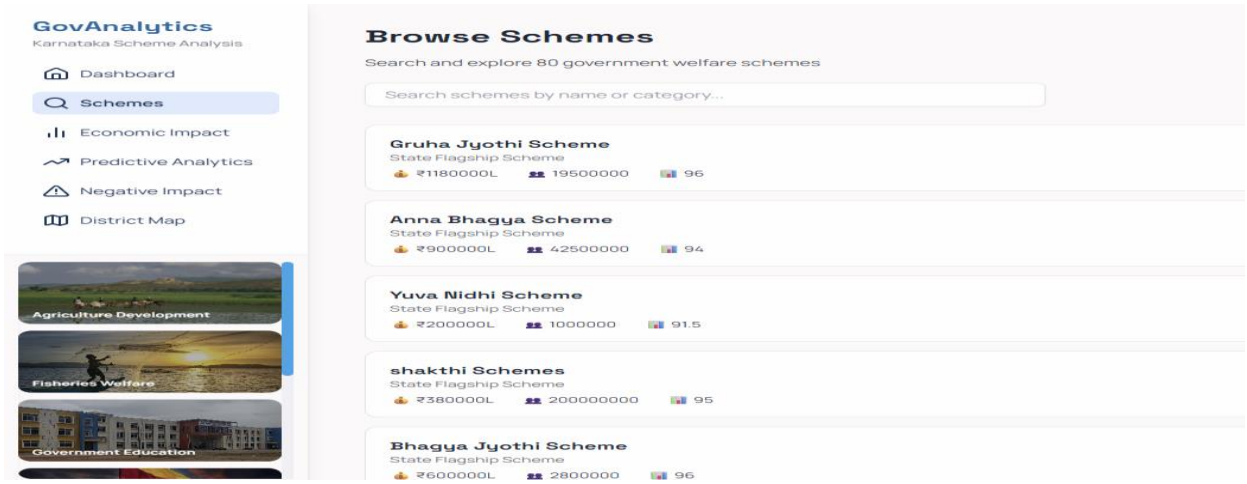

Fig. 4. Scheme Details Page

The schemes page allows users to browse and search government welfare schemes by name or category. It displays key details such as expenditure, beneficiaries, and efficiency to help users quickly compare and explore different schemes.

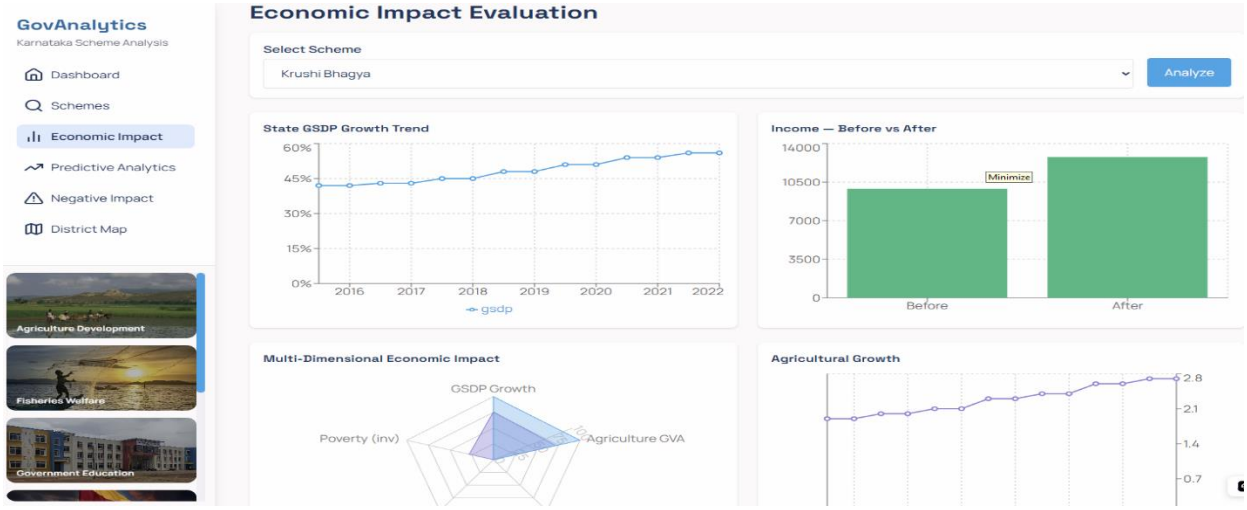

Fig. 5. economic Details Page

The economic impact page evaluates how government schemes influence key indicators such as GSDP growth and income levels. It uses interactive charts to clearly present before-and-after comparisons and overall economic trends.

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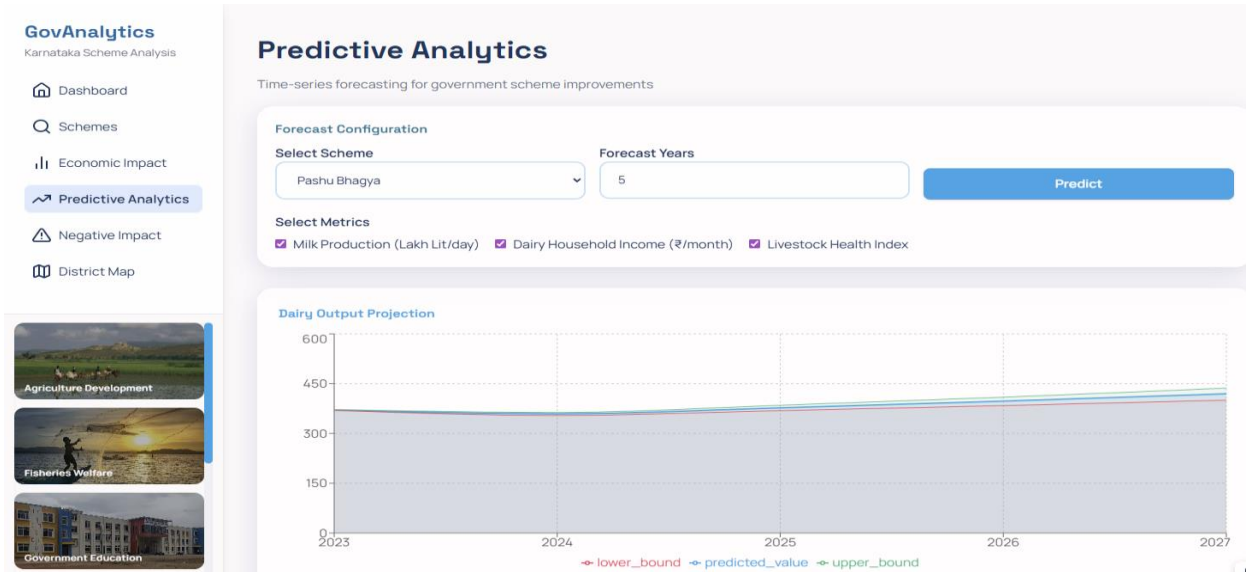

Fig. 6. Predective Details Page

The predictive analytics page allows users to forecast future outcomes of government schemes using time-series models. It visualizes predicted trends with confidence bounds to support informed planning and decision-making.

Fig. 6. Negative Impact Page

The negative impact analysis page highlights potential risks of welfare schemes such as dependency effects, regional disparities, and fund sustainability issues. It uses indicators and visual charts to help users identify imbalances and assess long-term policy impact.

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V. RESULTS AND DISCUSSION

The experimental evaluation of the proposed **Government Scheme Analysis and Tracker** demonstrates its effectiveness in analyzing, monitoring, and forecasting the performance of government welfare schemes using data analytics and machine learning techniques. Multiple scheme datasets covering different years, districts, and states were analyzed to evaluate system performance under realistic governance and policy evaluation scenarios.

The results indicate that the data preprocessing and analytical modules successfully handled scheme datasets uploaded through CSV and Excel formats. The system accurately cleaned inconsistencies, removed duplicate records, and organized data year-wise and region-wise for meaningful analysis. Compared to traditional manual reporting methods, the automated approach significantly improved efficiency, accuracy, and consistency in scheme evaluation.

The analytical and forecasting components effectively evaluated key indicators such as beneficiary growth, fund utilization efficiency, and regional performance variation. The Prophet forecasting model generated reliable future trends based on historical data, enabling users to understand long-term scheme impact and expected growth patterns. Real-time processing ensured that analytical results and forecasts were generated promptly, allowing users to explore insights without delay.

Furthermore, the visualization and NLP-based insight generation modules successfully presented complex analytical results in a clear and user-friendly manner. Interactive dashboards, charts, and AI-generated summaries helped users easily interpret scheme performance, identify underperforming regions, and recognize resource gaps. The system reliably stored processed data, analytical outputs, and predictions, enabling consistent performance tracking across multiple analysis sessions.

Overall, the integrated platform demonstrated improved transparency, data-driven evaluation, and decision-support capability for government welfare schemes. The results confirm that the Government Scheme Analysis and Tracker provides an efficient, scalable, and reliable solution for policy analysis and planning while reducing manual effort and enhancing the accuracy and clarity of scheme performance evaluation.

VI. CONCLUSION

The Government Scheme Analysis and Prediction System effectively demonstrates how data analytics and machine learning techniques can be applied to evaluate and enhance the performance of public welfare schemes. By integrating data collection, preprocessing, analysis, and visualization into a single web-based platform, the system converts raw scheme data into meaningful insights that support informed and data-driven decision-making.

The project efficiently manages scheme data uploaded through CSV or Excel files by validating, storing, and analyzing it using analytical techniques and AI/ML models. The system identifies economic impact, negative impact, and future trends of welfare schemes, while interactive dashboards and reports present the results in a clear and visual manner. This makes complex analytical information easy to understand for users, administrators, and policymakers.

Additionally, the system improves transparency and accountability by enabling consistent monitoring of scheme performance across different regions and time periods. Its modular and scalable design allows easy integration of new datasets, analytical models, and visualization techniques. With future enhancements such as real-time data integration, advanced forecasting models, and automated reporting, the platform has strong potential to evolve into a comprehensive decision-support system for large-scale government policy planning and evaluation.

VII. FUTURE WORK

While the proposed **Government Scheme Analysis and Prediction System** effectively demonstrates the use of data analytics, machine learning, and modern web technologies for evaluating public welfare schemes, several enhancements can be considered to further improve its capabilities and real-world applicability. One important future improvement involves integrating real-time data sources through government APIs and live data feeds instead of relying only on CSV or Excel uploads. This enhancement would enable continuous monitoring of scheme performance and provide up-to-date insights, allowing policymakers to respond quickly to emerging trends and issues.
Another significant enhancement includes the incorporation of advanced machine learning and deep learning models such as LSTM, GRU, and Transformer-based architectures. These models can improve the accuracy of beneficiary trend prediction, fund utilization forecasting, and long-term impact analysis of welfare schemes. By leveraging more

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sophisticated learning techniques, the system can better capture complex temporal patterns and non-linear relationships present in large-scale government datasets.

Additionally, future versions of the system can introduce GIS and map-based visualizations to analyze scheme performance across districts, states, and regions more effectively. This will help policymakers easily identify regional disparities and focus attention on geographically underperforming areas. The implementation of role-based access control (RBAC) can further enhance system security by restricting sensitive data and administrative functions to authorized users only. Together, these enhancements will strengthen the platform's scalability, security, and effectiveness as a comprehensive decision-support system for government policy planning and evaluation.

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