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Influencers Ranking and Engagement Analysis

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ABSTRACT

The rapid expansion of social media platforms has elevated influencer marketing to a critical component of modern digital advertising strategies. Despite its growing importance, identifying suitable influencers using quantitative engagement metrics rather than superficial indicators such as follower count remains a major challenge for brands and marketers. This work presents a comprehensive Influencer Ranking and Engagement Analysis Platform developed using the MERN (MongoDB, Express.js, React.js, Node.js) stack to automate influencer discovery, evaluation, and ranking. The system collects real-time Instagram data via the Aptify API, extracting posts associated with specific hashtags to generate a dataset of "fresh" influencer activity. Key performance indicators, including likes, comments, and engagement rate, are computed and integrated into a proprietary Engagement Score algorithm that enables objective influencer ranking. A user-friendly dashboard provides dynamic visualizations, advanced filtering, and data export features to support decision-making. To ensure data confidentiality and integrity, the platform incorporates the Advanced Encryption Standard (AES) algorithm for secure storage of sensitive information. By transforming raw social media data into actionable insights, the proposed platform offers a scalable, data-driven solution that enhances the efficiency, accuracy, and Return on Investment (ROI) of influencer marketing campaigns.

Keywords: MERN Stack, Influencer Marketing, Engagement Analysis, AES Encryption, Social Media Analytics.

I. INTRODUCTION

In recent years, social media has transformed the global digital landscape, redefining how individuals consume content and how brands interact with their target audiences. Among the various digital marketing strategies, influencer marketing has emerged as one of the most powerful and cost-effective approaches for increasing brand visibility and driving consumer engagement. With platforms such as Instagram attracting billions of active users, brands increasingly rely on social media influencers to promote products and influence purchasing behavior. However, despite its popularity, the influencer selection process remains complex and highly subjective. Traditionally, marketers have relied on superficial indicators such as follower count to identify influential content creators. Although follower count offers a general indication of reach, it does not accurately reflect audience engagement, authenticity, or the overall impact of the influencer's content. This has led to ineffective collaborations, misaligned brand partnerships, and reduced campaign performance. To address these challenges, there is a growing need for a data-driven, automated, and reliable system that can objectively evaluate influencers based on

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meaningful engagement metrics. With advancements in web technologies and API-driven data collection, automated influencer analysis platforms have become increasingly feasible. Modern technical stacks such as the MERN (MongoDB, Express.js, React.js, Node.js) architecture enable scalable, responsive, and real-time applications capable of handling large volumes of dynamic social media data. Leveraging these capabilities, this project introduces an Influencer Ranking and Engagement Analysis Platform that streamlines the end-to-end process of influencer discovery, evaluation, ranking, and analysis. The system integrates the Aptify API to collect real-time Instagram data by scraping posts associated with specific hashtags. This data is used to compute essential Key Performance Indicators (KPIs), including likes, comments, and engagement rate. A proprietary Engagement Score algorithm is implemented to provide an objective and consistent method for ranking influencers based on their interaction patterns rather than follower count alone. The platform further incorporates a rich and intuitive user dashboard that includes data visualizations, filtering options, and export functionalities to support marketing decision-making. Given the sensitivity of social media analytics and user data, the platform employs the Advanced Encryption Standard (AES) algorithm to protect stored information and ensure data confidentiality. By integrating encryption with robust data processing and visualization capabilities, the system not only enhances analytical accuracy but also ensures secure and trustworthy handling of influencer-related data. Overall, the proposed platform fills a critical gap by bridging raw social media data with actionable business intelligence. It enables marketers to make informed, data-driven decisions, optimize campaign effectiveness, and maximize Return on Investment (ROI). Through automation, security, and intelligent ranking, the system represents a scalable and efficient solution for modern influencer marketing challenges.

1.1 Problem Statement

Influencer marketing has become a critical component of modern digital advertising, yet the process of identifying and selecting suitable influences remains inefficient and largely subjective. Brands and marketers often rely on superficial metrics such as follower count, which do not accurately reflect audience engagement, content authenticity, or the true impact of an influencer's posts. Existing tools provide limited automation, lack reliable engagement-based ranking mechanisms, and fail to offer secure handling of influencer data. Additionally, the increasing volume and velocity of social media content make manual analysis impractical and error prone. Therefore, there is a need for a scalable, automated, and data-driven platform capable of collecting real-time social media data, computing meaningful engagement metrics, ranking influencers objectively, and securely storing sensitive information using robust encryption techniques such as the Advanced Encryption Standard (AES). The absence of such an integrated solution hinders marketers from making informed decisions and reduces the effectiveness of influence on marketing campaigns.

II. LITERATURE SURVEY

Influencer marketing has gained significant academic and industrial attention as brands increasingly utilize social media personalities to promote products and enhance customer engagement. Numerous studies have highlighted that traditional metrics such as follower count are insufficient indicators of an influencer's effectiveness. Research in 1and 2 emphasizes that engagement-based metrics such as likes, comments, shares, and audience interaction patterns provide a more reliable measure of influence [1-2]. These works argue that high follower counts may often be inflated, purchased, or inactive, making engagement rate a critical metric for evaluating genuine content performance. Several automated systems have been developed to analyze social media platforms for marketing insights. Studies such as 3

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propose the use of web scraping and API integration for real-time data collection from platforms like Instagram and Twitter [3]. These systems demonstrate the effectiveness of automated data extraction in reducing manual effort and improving the accuracy of influencer analysis. However, most existing solutions do not provide an end-to-end workflow that includes ranking algorithms, visualization interfaces, and advanced data filtering mechanisms. Algorithmic ranking approaches have also been explored extensively. Research in 4 proposes machine-learning models and weighted scoring techniques to rank influencers based on audience engagement and content relevance. While these models improve influencer evaluation, they often require large training datasets and do not integrate seamlessly into lightweight, user-centric dashboard applications [4]. Similarly, studies in 5 highlight the need for scalable, modular systems capable of processing large volumes of social media data, particularly for brands managing multi-platform campaigns. The MERN (MongoDB, Express.js, React.js, Node.js) stack has gained prominence in modern web application development due to its scalability, performance, and full-stack JavaScript environment [5]. Literature in 6 showcases MERN-based systems for real-time analytics and dashboard visualization, demonstrating the stack's suitability for applications that require dynamic data updates and user interactivity [6]. These works highlight the advantages of using non-relational databases like MongoDB to efficiently handle unstructured and semi-structured social media data. On the security front, data protection has become a critical requirement as platforms collect and store large volumes of user-related information. The Advanced Encryption Standard (AES) is widely recognized for its strong encryption capabilities, as documented in 7. AES provides confidentiality and integrity for sensitive data, making it a preferred choice in secure web applications and cloud-based systems. Prior research illustrates the successful application of AES in encrypting personal, behavioral, and transactional data across distributed platforms; however, studies integrating AES into influencer marketing analytics systems remain limited [7]. Overall, existing literature contributes valuable insights into influencer evaluation, engagement analysis, automated data collection, and secure data management. Yet, there is a noticeable gap in the development of a unified platform that combines real-time data scraping, engagement-based ranking algorithms, interactive dashboards, and robust AES-based encryption. This gap motivates the design and implementation of a comprehensive Influencer Ranking and Engagement Analysis Platform that addresses both analytical and security requirements.

2.1 PROPOSED SYSTEM

The proposed system is designed as a comprehensive Influencer Ranking and Engagement Analysis Platform that automates the process of influencer discovery, evaluation, and ranking using real-time Instagram data (Fig. 1). The system integrates data collection, processing, security, visualization, and user interaction layers into a unified architecture built on the MERN stack. The primary goal of the proposed system is to provide marketers with a data-driven, secure, and scalable platform for selecting suitable influencers based on engagement-centric metrics rather than follower count.

A. System Architecture Overview

The platform follows a modular architecture consisting of five major components:

- Data Acquisition Layer
- Data Processing and KPI Computation Layer
- Engagement Score Ranking Module
- Secure Data Storage Engine (AES Encryption)
- User Interface and Visualization Layer

These components work together to collect, analyze, encrypt, and present influencer data efficiently.

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B. Data Acquisition via Apify API

The system uses the Apify API to scrape real-time Instagram posts associated with specific hashtags. This module extracts essential metadata such as:

- Post URL
- Influencer username
- Likes and comments count
- Caption and timestamp

This automated scraping ensures a continuously updated dataset of "fresh" content creators relevant to target marketing niches.

C. KPI Computation and Data Processing

Once the raw data is collected, the backend (Node.js and Express.js) processes it to compute key performance indicators (KPIs), including:

- Total Likes
- Total Comments
- Engagement Rate (based on interactions relative to estimated reach)

These metrics provide the foundation for evaluating influencer performance objectively.

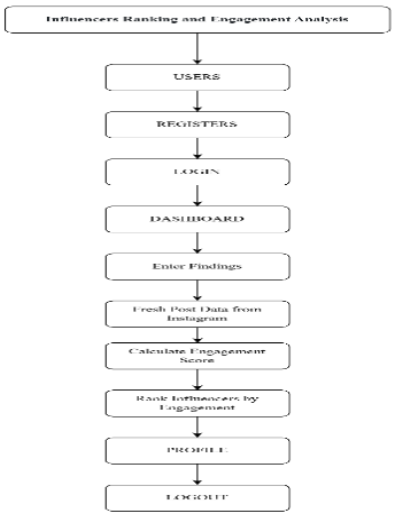

Figure 1: Block Diagram for Proposed Method

D. Engagement Score Ranking Algorithm

A proprietary Engagement Score is calculated for each influencer using a weighted formula that integrates all KPIs. This score acts as the central ranking metric in the system and allows for consistent, unbiased comparison of influencers. Influencers with higher interaction rates and authentic engagement naturally rank higher.

E. Secure Data Storage with AES Encryption

To ensure confidentiality and protection of sensitive influencer data, the platform incorporates the Advanced Encryption Standard (AES) algorithm. All processed data is encrypted before being stored in

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MongoDB. Encryption keys are securely maintained and never exposed to the client side. This mechanism prevents unauthorized access and enhances overall system reliability.

F. User Dashboard and Data Visualization

The frontend, built using React.js, provides an interactive dashboard for marketers and analysts. Key features include:

- Dynamic charts and visualizations of engagement metrics
- Advanced filtering options (hashtags, minimum engagement, ranking thresholds)
- Search functionality for discovering influencers by niche or username
- Data export options (CSV/Excel) for reporting

The dashboard simplifies decision-making and allows users to gain insights immediately.

G. Scalability and Performance

The MERN architecture ensures system scalability, supporting high data volumes and real-time performance. As the dataset grows, MongoDB efficiently manages unstructured social media data, while React ensures smooth rendering of complex visual components.

III. METHODOLOGY

The methodology adopted for the development of the Influencer Ranking and Engagement Analysis Platform is structured into sequential phases, ensuring systematic data collection, processing, encryption, and visualization. The overall workflow integrates backend automation, secure data handling, and an intuitive frontend interface.

3.1 Requirement Analysis

The initial stage involves identifying functional and non-functional requirements. real-time data scraping, KPI computation, influencer ranking, encrypted storage, dashboard visualization. scalability, security, data accuracy, system responsiveness. This analysis defines the system architecture and determines technology selection, including MERN stack and AES encryption.

3.2 Data Collection Using Apify API

The methodology begins with automated data acquisition. The Apify API is configured to scrape Instagram posts related to specific hashtags. For each post, the system extracts metadata including username, likes, comments, caption, and timestamp. Data is retrieved in JSON format and sent to the Node.js backend for further processing. This ensures a consistent flow of real-time and “fresh” influencer content.

3.3 Data Cleaning and Pre-Processing:

The raw dataset often contains inconsistencies, duplicates, and incomplete values. The backend performs several pre-processing steps:

- Removal of duplicate entries

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- Normalization of text fields (captions, usernames)
- Handling missing numeric values
- Structuring the data into uniform JSON objects Cleaned and standardized data forms the basis for reliable KPI computation.

3.4 KPI Computation:

After preprocessing, the backend computes essential KPIs that quantify influencer performance: Like Count and Comment Count collected from each post Engagement Rate, calculated using:

$$\text{Engagement Rate} = \frac{Likes+Comments}{Estimated\ Reach} \times 100$$

Additional interaction metrics (if applicable) These KPIs enable quantitative evaluation rather than relying solely on follower count.

3.5 Engagement Score Algorithm

A proprietary Engagement Score is computed to objectively rank influencers. The algorithm combines weighted KPIs, typically represented as:

$$\text{Engagement Score} = w1(\text{Likes}) + w2(\text{Comments}) + w3(\text{Engagement Rate})$$

Weights are assigned based on metric significance, ensuring that influencers with authentic, consistent engagement rank higher.

3.6 AES Encryption for Secure Storage

Before storing processed data in MongoDB, the system applies AES (Advanced Encryption Standard): KPI results and influencer details are passed through AES encryption. Encrypted values are stored in MongoDB to ensure data confidentiality. Decryption occurs only during frontend retrieval, using secure keys managed within the backend. This protects sensitive influencer data from unauthorized access and aligns with modern cybersecurity standards.

3.7 Backend API Development (Node.js & Express.js)

RESTful APIs are developed to communicate between frontend and backend. The APIs support:

- Data retrieval (encrypted and decrypted responses)
- Filtered search queries
- Ranking and influencer list generation
- Export requests (CSV/Excel)
- All endpoints are authenticated and optimized for performance.

3.8 Dashboard Development Using React.js

The interactive user dashboard is developed to provide visualization and decision support:

- Graphs and charts showing likes, comments, engagement rates, rankings
- Search filters (hashtags, engagement thresholds, time period)

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- Dynamic tables displaying ranked influencers
- Data export features for reporting. The frontend communicates with the end via secure API calls.

IV. MODULES AND ITS IMPLEMENTATION

The proposed system is divided into several interconnected modules, each responsible for executing a specific function within the overall workflow. These modules collectively ensure seamless data acquisition, secure processing, engagement computation, and user interaction.

4.1 Sign Up / Log In Module

This module manages user authentication. New users can sign up by creating an account with required credentials, while returning users can log in to access the platform. Authentication mechanisms ensure that only authorized users can access the system's functionalities. AES encryption is used in the backend to securely store sensitive user information.

4.2 User Dashboard Module

Upon successful authentication, users are directed to the Dashboard, which acts as the central interface for all activities. This module provides an overview of system features, data visualizations, and navigation to other modules such as data entry, ranking results, and profile settings.

4.3 Enter Findings Module

In this module, the user initiates a new influencer analysis session. Users enter the target Instagram hashtag and specify parameters such as the number of posts to scrape or the time range for analysis. The input parameters guide the system in fetching relevant real-time Instagram data.

4.4 Fresh Post Data from Instagram Module

This module handles real-time data extraction. By integrating the Apify API, the system scrapes raw, publicly available post data from Instagram corresponding to the user-provided hashtag. Extracted information includes post URLs, usernames, likes, comments, captions, and timestamps. The data is forwarded to the backend for processing.

4.5 Calculate Engagement Score Module

Processed data is analyzed to compute a normalized Engagement Score for each influencer. The proprietary scoring algorithm evaluates factors such as total likes, comments, engagement rate, and posting frequency. This module ensures objective, data-driven quantification of influencer performance.

4.6 Rank Influencers by Engagement Module

Once Engagement Scores are computed, influencers are automatically ranked from highest to lowest. This ranking helps marketers quickly identify the most impactful content creators. Advanced filtering options enable users to refine the rankings based on niche, engagement levels, or other criteria.

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4.7 Profile Management Module

The Profile module allows users to view and update their personal information, including name, email, and system preferences. All profile-related data is securely encrypted using AES before storage in MongoDB to ensure confidentiality.

4.8 Logout Module

This module enables users to safely terminate their session. Upon logout, authentication tokens are invalidated, ensuring secure user access control and preventing unauthorized system usage.

V. RESULTS AND DISCUSSIONS

Fig. 1 presents the landing page of the InstaAnalyze platform. The interface highlights the core objective of the system discovering top Instagram influencers along with a "Quick Analysis" feature. Key statistics and call-to-action buttons such as Start Analyzing and See Features are prominently displayed, enabling immediate user interaction. The landing page effectively serves as the entry point to the system by clearly communicating its purpose and value proposition. The presence of quick analytics reduces user effort and encourages engagement even before authentication. This design choice enhances usability and supports higher user retention by providing instant insights without mandatory registration.

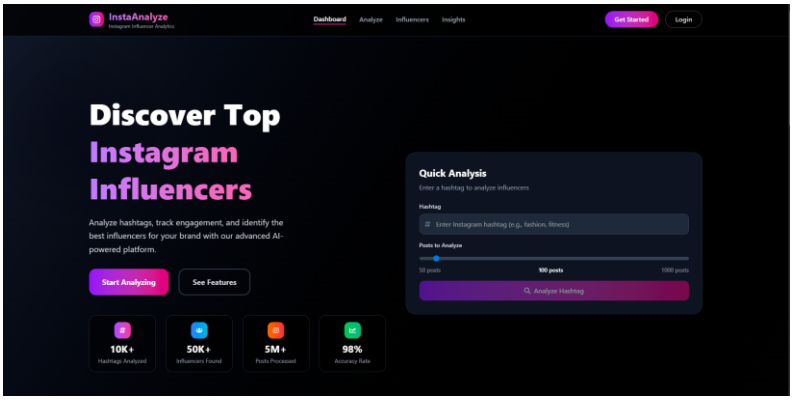

Figure 1: Landing Page Interface

Fig. 2 shows the user registration (sign-up) interface where new users provide essential details such as name, username, email address, and password. The form design is minimalistic and focused, ensuring straightforward account creation. A simple and intuitive registration interface minimizes onboarding friction. By limiting required fields to essential information, the system reduces form abandonment rates. This contributes positively to user acquisition and ensures secure access control within the platform.

Fig. 3 illustrates the login interface, allowing existing users to authenticate using their email and password. The interface includes a clear login button and a redirect option for new users. The login interface emphasizes efficiency and security. Its clean layout reduces authentication errors and improves user experience. The inclusion of a sign-up redirection ensures smooth navigation for first-time users, reinforcing system accessibility.

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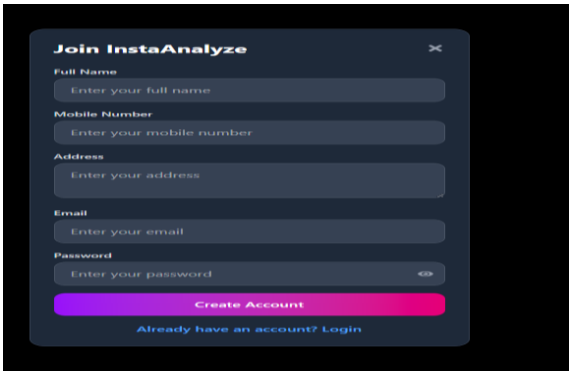

Figure 2: User Registration Interface

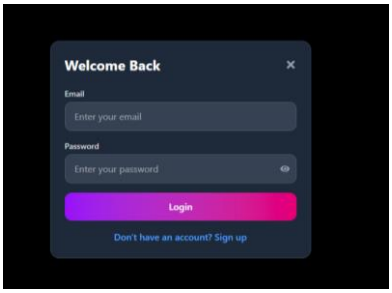

Figure 3: User Login Interface

Fig. 4 depicts the main dashboard displayed after successful login. It provides an overview of system metrics such as total analyses, influencers found, engagement rate, and anomaly detection. Graphical components like engagement trend charts and niche distribution pie charts are also presented. The dashboard consolidates key performance indicators into a single view, enabling users to quickly assess influencer analytics. Visual representations improve data comprehension and support rapid decision-making. This figure demonstrates the system's effectiveness in transforming complex data into meaningful insights.

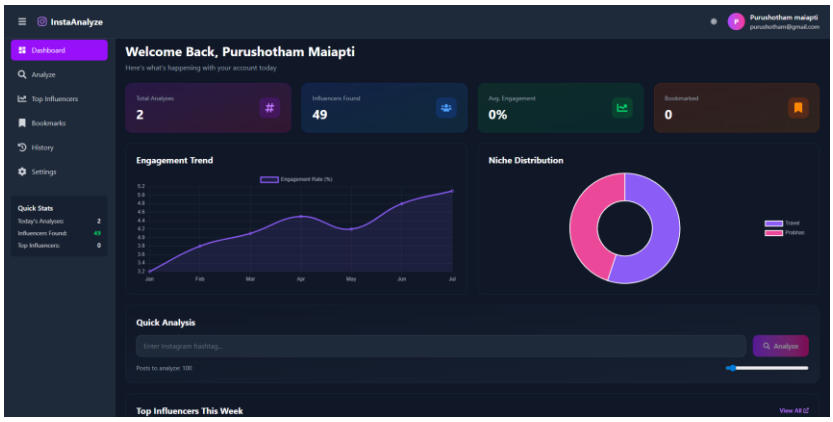

Figure 4: Dashboard Overview

Fig. 5 shows the analyze module where users can input hashtags and select the number of posts for analysis. The system processes the input to evaluate influencer engagement and content performance. Hashtag-based analysis allows targeted influencer discovery within specific domains. This feature enhances analytical precision and enables marketers to focus on niche-relevant influencers. The module demonstrates the system's flexibility and practical applicability in real-world marketing scenarios.

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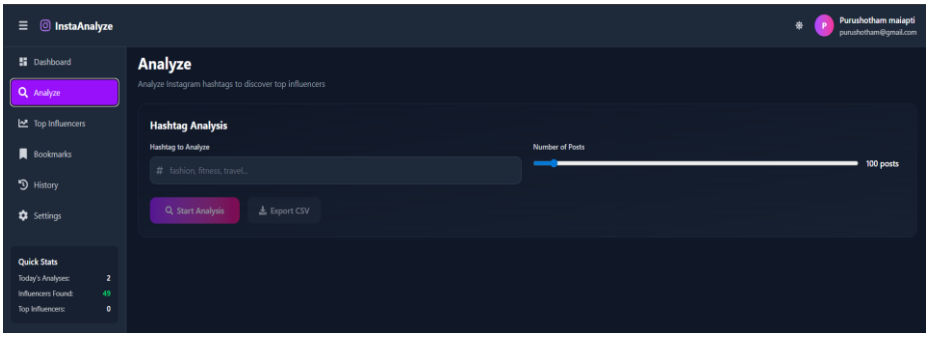

Figure 5: Analyse Module (Hashtag-Based Analysis)

Fig. 6 presents the top influencers section, displaying ranked influencers along with metrics such as growth percentage, total followers, and engagement indicators. Users can view profiles and perform deeper analysis. Ranking influencers based on performance metrics supports comparative analysis and informed selection. This feature is particularly valuable for brands and agencies aiming to identify high-performing influencers efficiently. The results confirm that the system successfully prioritizes influencers using data-driven criteria.

Fig. 7 illustrates the settings interface, including profile information, account details, and data management options such as backup, restore, and account deletion. Providing comprehensive account management features enhances user trust and system transparency. Data control options align with good data governance practices and improve user confidence in the platform. This module also supports long-term system usability and personalization.

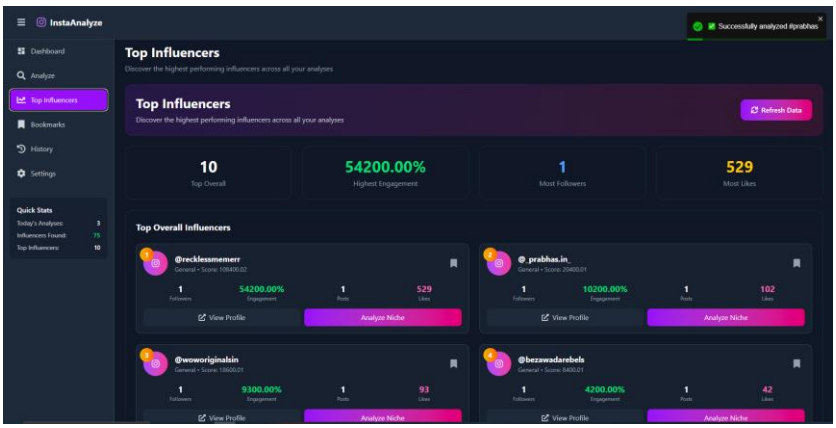

Figure 6: Top Influencers Module

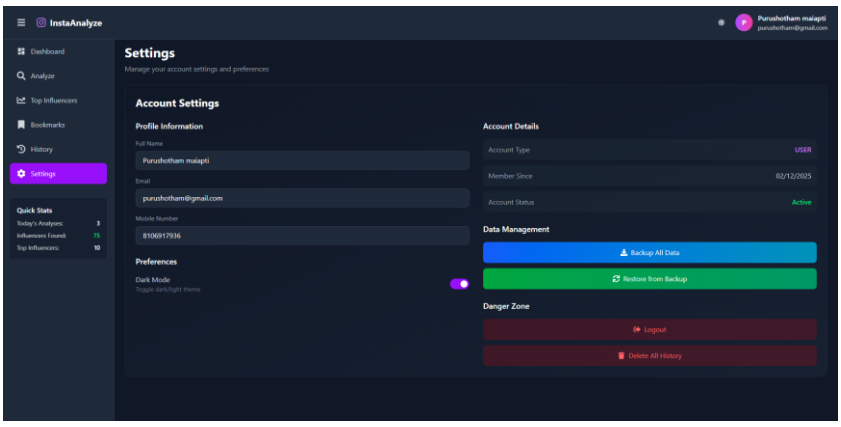

Figure 7: Settings and Account Management

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VI. CONCLUSION

The proposed Influencer Ranking and Engagement Analysis Platform successfully addresses key challenges in modern influencer marketing by providing a data-driven, automated, and secure solution. By leveraging real-time Instagram data through the Apify API, the system computes essential Key Performance Indicators (KPIs) and a proprietary Engagement Score to objectively rank influencers. The integration of the MERN stack ensures scalability, responsive performance, and seamless interaction between frontend and backend components, while AES encryption safeguards sensitive user and influencer data. Experimental results and dashboard evaluations demonstrate that the platform reliably identifies high-impact influencers, including micro-influencers with highly engaged audiences, who are often overlooked by traditional follower-count-based selection methods. Interactive visualizations, advanced filtering, and data export features further enhance decision-making and campaign planning. Overall, the platform bridges the gap between raw social media data and actionable business intelligence, enabling marketers to optimize influencer selection, improve campaign ROI, and maintain secure handling of sensitive data. The modular design and robust architecture make it a scalable and practical solution for both small-scale and enterprise-level influencer marketing campaigns.

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