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RISK ASSESSMENT IN SOCIAL NETWORKS BASED ON USER ANOMALOUS BEHAVIORS

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Abstract

Online Social Networks (OSNs) have become integral to modern communication, enabling users to connect, share information, and engage globally. However, the open nature of these platforms exposes them to various security and privacy risks from users exhibiting anomalous behaviors, such as fake accounts, compromised profiles, spam campaigns, coordinated misinformation, and cyberbullying.

Risk Assessment in Social Networks Based on User Anomalous Behaviors is a machine learning-driven framework designed to detect and quantify risks associated with deviant user activities. The system analyzes user behavioral patterns (posting frequency, interaction graphs, content semantics, and temporal activity) to identify deviations from normal behavior. It employs unsupervised anomaly detection techniques, including clustering of similar users, behavioral modeling, and metrics like deviation scores to assign risk levels to individual users or groups.

By grouping users with similar profiles (based on demographics, activity levels, and network structure) and building group-specific normal behavior models, the framework achieves higher accuracy than global models. Experiments on real-world datasets (e.g., Facebook-like graphs) demonstrate effective detection of diverse anomalous behaviors such as Sybil attacks, click-spam, and collusion networks while maintaining low false positives. This approach enhances platform security, reduces malicious activity, and supports proactive risk mitigation for OSN providers and users.

Keywords: Social Network Security, Anomaly Detection, User Behavior Analysis, Risk Assessment, Unsupervised Machine Learning, Graph-Based Anomaly Detection, Sybil Attack Detection.

I.Introduction

Online Social Networks (OSNs) such as Facebook, Twitter (X), Instagram, and LinkedIn have transformed how individuals interact, share information, and build communities. With billions of active users, these platforms generate vast amounts of behavioral data daily. While they offer significant societal benefits, they also introduce serious risks including identity theft, misinformation spread, cyberbullying, spam, and coordinated attacks by malicious actors.

Anomalous user behaviors — actions that significantly deviate from typical patterns — often signal potential threats. Examples include sudden spikes in posting activity, unusual friend

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request patterns, repetitive content sharing, or interactions inconsistent with a user's historical profile. Traditional rule-based or supervised detection methods struggle with evolving attack strategies and require labeled data, which is often scarce or outdated.

This project presents a comprehensive risk assessment framework that quantifies the risk level of users based on the degree of divergence from normal behavior. The core idea is that the greater the deviation, the higher the associated risk. The system operates in two phases: (1) grouping similar users to create personalized behavioral baselines, and (2) measuring divergence using statistical and machine learning models.

The framework supports real-time or near-real-time monitoring and can be integrated into OSN platforms for automated alerts, account flagging, or enhanced verification. It addresses limitations of existing methods by being unsupervised and adaptive to group-level variations in user behavior.

II. Literature Survey

Research on anomaly detection in social networks has evolved from structural graph analysis to behavioral and hybrid approaches.

- Laleh et al. (2016) proposed a risk assessment model based on user anomalous behaviors in OSNs. They grouped similar users and built behavioral models per group, showing improved performance over global models on Facebook datasets.
- Viswanath et al. (2014) introduced unsupervised PCA-based anomaly detection for detecting fake likes, Sybil accounts, and compromised users in Facebook, achieving effective identification without prior attack knowledge.
- Savage et al. (2016) surveyed anomaly detection techniques in OSNs, classifying them into static/dynamic and labeled/unlabeled categories, covering graph-based, content-based, and temporal methods.
- Yu et al. (2016) reviewed social media anomaly detection, highlighting point anomalies (individual user behavior) and group anomalies (coordinated activities), with techniques ranging from scan statistics to tensor decomposition.
- Xing et al. (2024) provided a recent survey categorizing methods into user behavioral features, network topological structure, and collaborative fusion approaches, emphasizing challenges in large-scale dynamic networks.
- Additional works explore graph neural networks, isolation forests, autoencoders, and UEBA (User and Entity Behavior Analytics) for risk scoring in social and enterprise environments.

These studies underscore the shift toward unsupervised and hybrid methods capable of handling diverse, evolving anomalous behaviors in social networks.

III. Existing System & Proposed System

A. Existing System

Current OSN security mechanisms primarily rely on:

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- Rule-based filters for spam and abusive content.
- Supervised machine learning trained on known attack patterns.
- Manual reporting and behavioral thresholds.

Disadvantages of Existing Systems:

1. High dependency on labeled data.
2. Poor detection of subtle or group-level anomalies.
3. Global models ignore user diversity.
4. High false positive rates.
5. Limited risk quantification.
6. Scalability issues.

B. Proposed System

The proposed system introduces a two-phase risk assessment framework:

Phase 1: User Grouping — Cluster users based on demographics, activity levels, and network features.
Phase 2: Behavioral Modeling & Risk Scoring — Build normal profiles and compute deviation-based risk scores.

The system integrates behavioral and graph-based features, assigning continuous risk scores and enabling automated interventions.

Supports real-time streaming data analysis using incremental learning.

Incorporates temporal anomaly detection to track behavior evolution.

Enables risk categorization (Low / Medium / High) for better decision-making.

Can be extended to cross-platform analysis (e.g., linking behavior across multiple social media accounts).

Provides explainable risk scores for transparency and trust.

Advantages of the Proposed System:

1. Unsupervised detection.
2. Improved accuracy via group-aware modeling.
3. Continuous risk scoring.
4. Scalable with modern ML techniques.
5. Adaptive to evolving behaviors.
6. Detects diverse anomalies.
7. Privacy-aware design.

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IV. System Design & Architecture

A. System Architecture

The architecture includes:

- Data Collection Layer
- Feature Extraction Layer
- User Grouping Module
- Anomaly Detection & Risk Engine
- Risk Scoring & Alert Module
- Visualization & Feedback Module

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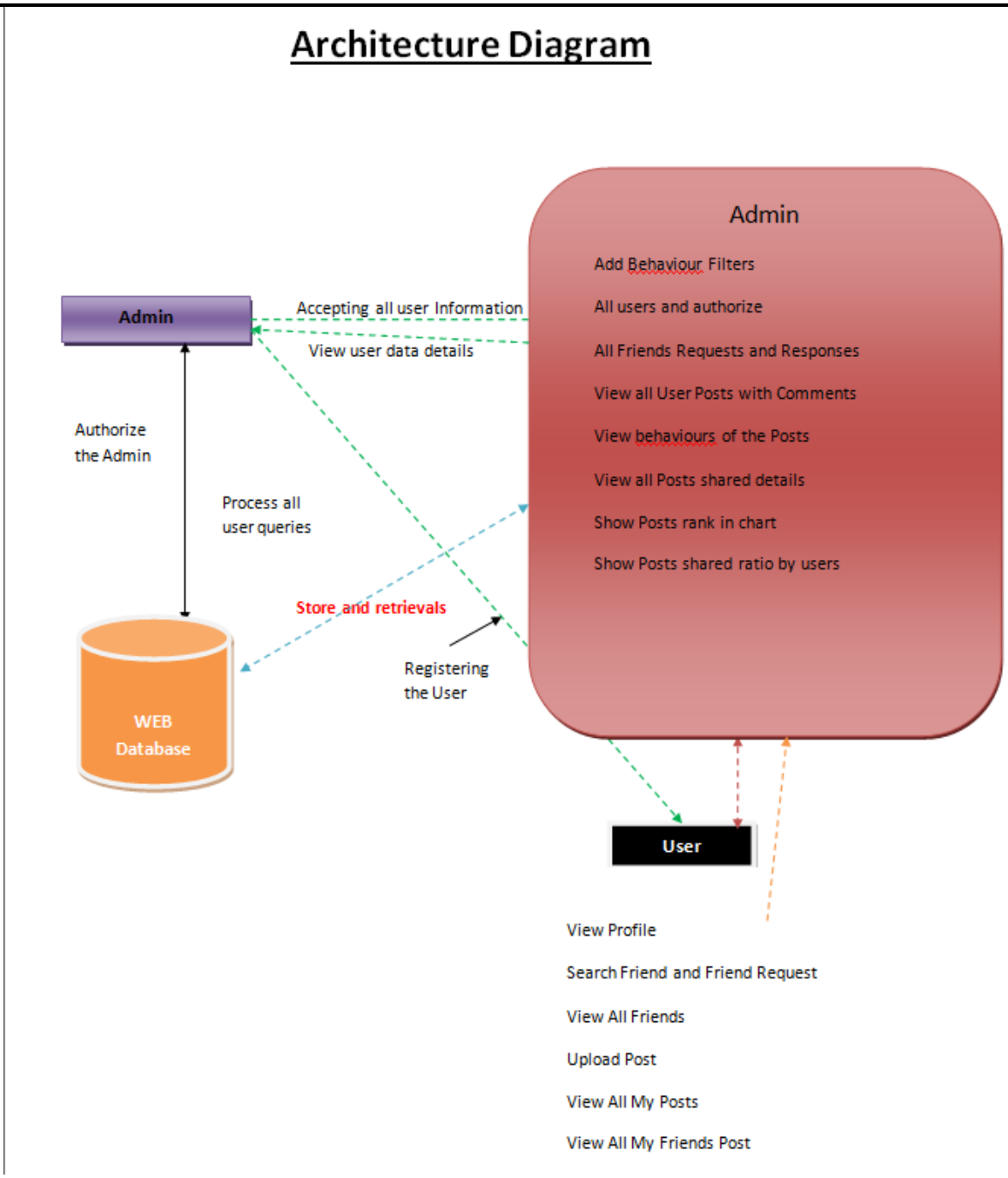

B.System Flow:

Data flow: Raw activity → Feature extraction → Grouping → Modeling → Risk scoring → Alerts.

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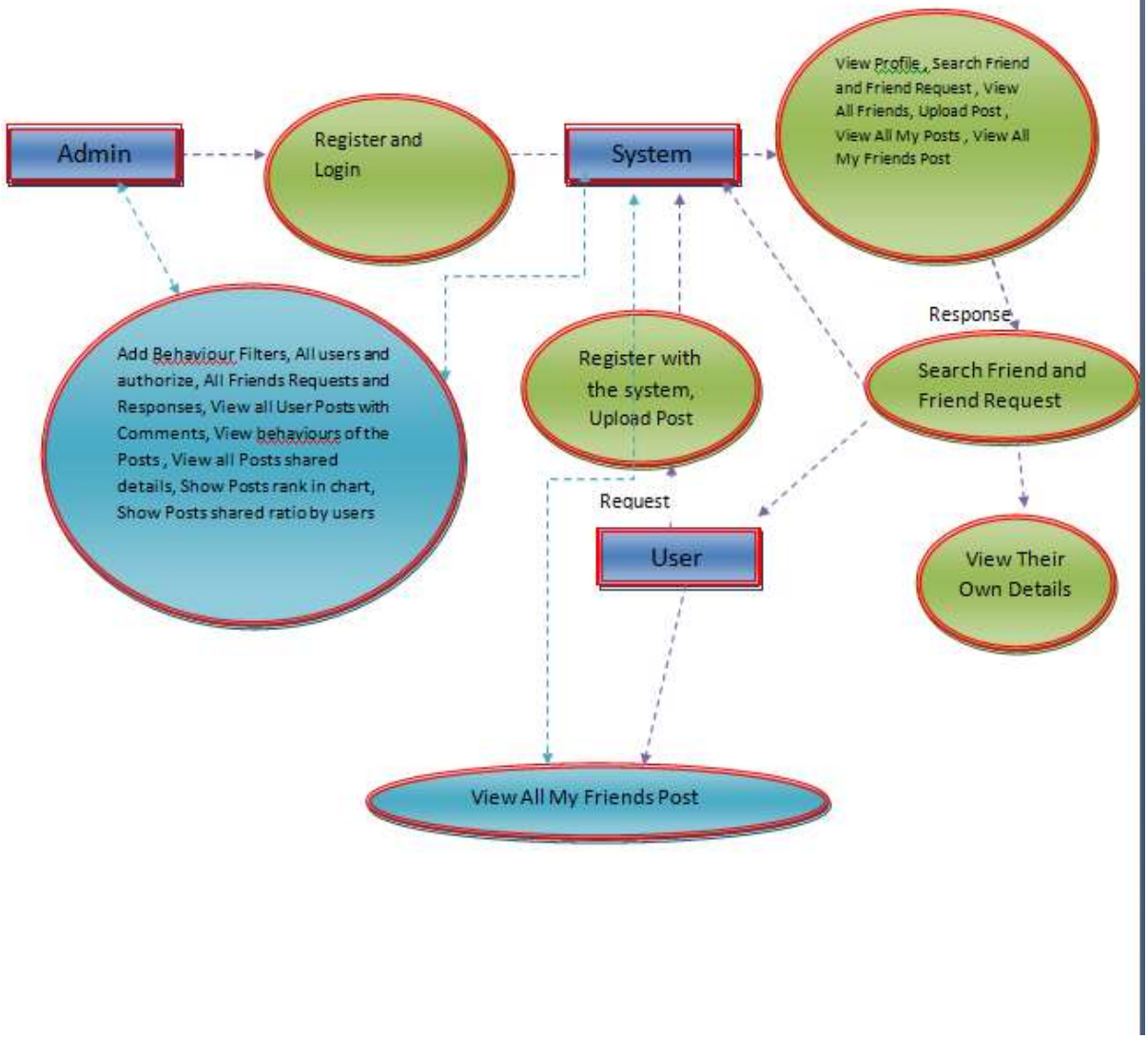
➢ Data Flow Diagram :



B. Modules Overview

- **Admin**

In this module, the Admin has to login by using valid user name and password. After login successful he can perform some operations such as Add Behaviour Filters, All users and authorize, All Friends Requests and Responses, View all User Posts with Comments, View behaviours of the Posts , View all Posts shared details, Show Posts rank in chart, Show Posts shared ratio by users

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Friend Request & Response

In this module, the admin can view all the friend requests and responses. Here all the requests and responses will be displayed with their tags such as Id, requested user photo, requested user name, user name request to, status and time & date. If the user accepts the request then the status will be changed to accepted or else the status will remains as waiting.

- **User**

In this module, there are n numbers of users are present. User should register before performing any operations. Once user registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Verify finger print and Login Once Login is successful user can perform some operations like View Profile , Search Friend and Friend Request , View All Friends, Upload Post , View All My Posts , View All My Friends Post

Searching Users to make friends

In this module, the user searches for users in Same Network and in the Networks and sends friend requests to them. The user can search for users in other Networks to make friends only if they have permission.

Table I: Technology Stack

Component	Technology / Tool
Programming Language	Python 3.10+
ML / Anomaly Detection	Scikit-learn, TensorFlow / PyTorch
Graph Processing	NetworkX, Graph Neural Networks
Web Framework	Flask / Streamlit
Database	MySQL / PostgreSQL
Visualization	Matplotlib, Seaborn, Plotly
Deployment	Docker, Cloud platforms

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Table II: Performance / Evaluation Summary

Metric	Proposed System	Traditional Models	Remarks
Detection Accuracy (F1)	85–95%	60–80%	Group-aware modeling
False Positive Rate	Low	Higher	Personalized baselines
Risk Quantification	Continuous	Binary	Better prioritization
Scalability	High	Limited	Handles large graphs
Adaptability to New Attacks	Excellent	Poor	Unsupervised approach

Fig 1:-Home page

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Fig 2:- Admin Home page

Fig 3:- Add Behaviour Keywords

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Fig 4:- Result of Attacking Behivour

Fig 5:-Software attacks behaviour

VI.Conclusion

This project presented a robust risk assessment framework for detecting anomalous user

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behaviors in social networks. By combining user grouping with deviation-based modeling, the system provides accurate and scalable risk analysis without relying on labeled data.

The framework enhances platform security, enables proactive detection, and supports administrators in mitigating risks effectively. Future enhancements include integration with graph neural networks, real-time analytics, and privacy-preserving techniques.

The system bridges the gap between **security** and usability in OSNs.
It provides a proactive defense mechanism rather than reactive detection. .The framework can be generalized to other domains such as banking fraud detection and insider threat detection.

Future Enhancements:

- Multimodal data integration
- Real-time streaming analysis
- Explainable AI models
- Federated learning
- Cross-platform evaluation

This work contributes to safer and more secure online social environments.

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