



SMART PRICE MANIPULATION & SCAM DETECTION SYSTEM

Dr.A. Karunamurthy^{1*}, S.Praveen Kumar²

¹Associate professor Department of Computer Science and Engineering,

Sri Manakula Vinayagar Engineering College (Autonomous), Madagadipet, Puducherry – 605107, India

²PG Student Department of MCA, Sri Manakula Vinayagar Engineering College (Autonomous), Madagadipet, Puducherry – 605107, India

ABSTRACT

In the digital era, online transactions and e-commerce platforms have become an essential part of daily life. However, the increasing growth of online marketplaces has also led to various fraudulent activities such as price manipulation, fake discounts, scam advertisements, and deceptive seller practices. These fraudulent activities mislead customers and result in financial losses, reduced trust, and unfair market competition. This paper proposes a Smart Price Manipulation & Scam Detection System that utilizes Machine Learning and Artificial Intelligence techniques to automatically identify suspicious pricing behaviors and online scam activities. The proposed system analyzes product prices, seller information, customer reviews, transaction history, and market trends to detect anomalies and fraudulent patterns. Advanced machine learning algorithms are used to classify legitimate and suspicious activities based on historical data and behavioral analysis. The system continuously monitors price fluctuations and identifies unusual changes that may indicate price manipulation or scam attempts. Experimental results demonstrate that the proposed system achieves high accuracy, precision, and reliability in detecting fraudulent activities across various e-commerce environments. The system can be integrated into online shopping platforms to enhance consumer protection, improve marketplace transparency, and reduce financial fraud.

KEYWORDS: Price Manipulation, Scam Detection, Machine Learning, Artificial Intelligence, Fraud Detection, E-Commerce Security, Data Analysis, Anomaly Detection, Consumer Protection, Online Marketplace.

I. INTRODUCTION

Online shopping and digital marketplaces have transformed the way consumers purchase products and services. Millions of transactions occur daily through e-commerce platforms, making them attractive targets for fraudulent activities. Among these threats, price manipulation and online scams have become major concerns affecting both consumers and businesses. Fraudsters often manipulate product prices, create fake discounts, publish misleading advertisements, and engage in deceptive selling practices to exploit customers and gain unfair profits. Traditional fraud detection methods primarily rely on manual monitoring and rule-based systems, which are often insufficient to handle the large volume of online transactions and rapidly evolving scam techniques. As a result, there is a growing need for intelligent and automated systems capable of detecting suspicious activities in real time. Artificial Intelligence and Machine Learning technologies provide effective solutions by analyzing large datasets, identifying hidden patterns, and detecting abnormal behaviors with high accuracy. The proposed Smart Price Manipulation & Scam Detection System utilizes advanced machine learning algorithms to analyze product pricing trends, seller activities, customer feedback, transaction records, and market behavior. The system automatically identifies unusual price fluctuations, fake discount strategies, and suspicious seller actions that may indicate fraudulent activities. Through continuous monitoring and anomaly detection techniques, the system can provide early warnings and assist users in making informed purchasing decisions. Furthermore, the system enhances online marketplace security by reducing fraudulent transactions, improving transparency, and increasing customer trust. Experimental evaluation demonstrates that the proposed approach

effectively detects price manipulation and scam activities under various market conditions, making it a valuable solution for modern e-commerce platforms and digital marketplaces.

a. Machine Learning:

Machine Learning is a branch of Artificial Intelligence that enables computer systems to learn patterns from historical data and make predictions without being explicitly programmed. In the proposed Smart Price Manipulation & Scam Detection System, machine learning algorithms are used to analyze product pricing behavior, seller activities, customer reviews, and transaction records. The system learns from both legitimate and fraudulent cases to identify suspicious patterns that may indicate scams or price manipulation. By continuously analyzing new data, machine learning models improve detection accuracy and adapt to emerging fraud techniques. Due to its ability to process large amounts of information and identify hidden relationships, machine learning plays a crucial role in building an effective fraud detection system.

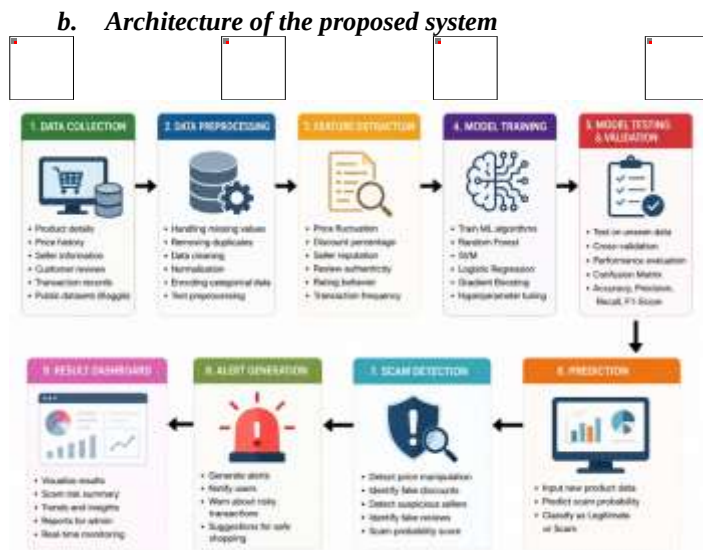


Fig 1.1 Architecture of the proposed system

II. PROPOSED SYSTEM

The proposed Smart Price Manipulation & Scam Detection System is designed to automatically identify fraudulent pricing activities, fake discounts, scam advertisements, and suspicious seller behaviors in online marketplaces. With the rapid growth of e-commerce platforms, customers often face deceptive pricing strategies and fraudulent transactions that can result in financial loss and reduced trust in digital shopping environments. To overcome these challenges, the proposed system utilizes Machine Learning and Artificial Intelligence techniques to continuously monitor and analyze product prices, seller activities, customer reviews, and transaction records. The system aims to provide real-time detection of abnormal pricing patterns and scam-related activities before customers become victims of fraud. The proposed system follows an intelligent data-driven approach where information is collected from various online sources, including product listings, transaction histories, customer feedback, and seller profiles. The collected data is preprocessed and analyzed to extract important features related to pricing behavior and fraud indicators. Machine learning models are then trained using historical data containing both legitimate and fraudulent transactions. The trained model learns patterns associated with price manipulation and scam activities and can accurately classify suspicious behavior. Whenever abnormal pricing fluctuations or fraudulent activities are detected, the system generates alerts and notifications for customers and platform administrators. Experimental results demonstrate that the proposed system effectively improves online shopping security, enhances transparency, and reduces financial fraud.

a. Data Collection from Kaggle Open Source

Data collection is one of the most important stages in developing the Smart Price Manipulation & Scam Detection System. In this project, datasets are collected from open-source platforms such as Kaggle and other publicly available e-commerce repositories. The collected datasets contain product details, historical price records, seller information, customer reviews, ratings, transaction histories, and fraud-related data. These

datasets provide valuable information required to train and evaluate machine learning models for detecting suspicious activities. The collected data includes both normal and fraudulent cases, enabling the system to learn different behavioral patterns associated with price manipulation and scams. Historical pricing information helps identify unusual price fluctuations, while customer reviews and seller ratings assist in recognizing fraudulent sellers and fake product listings. The datasets is divided into training, validation, and testing sets to ensure proper model evaluation and performance analysis. Proper data collection improves the accuracy, reliability, and effectiveness of the proposed fraud detection system.

b. Pre -Processing

Pre -processing is an essential step that improves the quality of collected data before it is provided to the machine learning model. Raw data obtained from e-commerce platforms often contains missing values, duplicate records, inconsistent formats, and irrelevant information that may affect model performance. Therefore, several preprocessing techniques are applied to clean and standardize the datasets. Initially, missing values are identified and handled using appropriate techniques such as replacement or removal. Duplicate records are eliminated to prevent biased model training. Data normalization and feature scaling techniques are applied to ensure consistency across numerical attributes. Text-based data such as customer reviews and product descriptions are processed using Natural Language Processing techniques, including tokenization, stop-word removal, and stemming. These preprocessing operations improve data quality and enhance the overall performance of the fraud detection system.

c. Feature Extraction

Feature extraction plays a crucial role in identifying important patterns related to price manipulation and scam activities. During this stage, meaningful attributes are extracted from the processed datasets to help the machine learning model make accurate predictions. Important features include product price variations, seller ratings, customer feedback scores, transaction frequency, review authenticity, discount percentages, and product popularity metrics. Advanced statistical and machine learning techniques are used to analyze relationships between these features and fraudulent activities. By extracting relevant information from large volumes of data, the system can effectively distinguish between legitimate and suspicious transactions. Feature extraction reduces computational complexity while improving detection accuracy and model efficiency.

d. Model Creation Using Machine Learning

The model creation phase involves developing and training machine learning algorithms capable of detecting price manipulation and scam activities. Various supervised learning algorithms such as Random Forest, Decision Tree, Support Vector Machine (SVM), Logistic Regression, and Gradient Boosting are utilized for fraud classification and anomaly detection. These algorithms analyze historical transaction data, pricing trends, seller activities, and customer behavior to identify patterns associated with fraudulent practices. The primary objective of the



model is to accurately distinguish between legitimate marketplace activities and suspicious transactions that may indicate scams or price manipulation. The collected and preprocessed datasets are provided as input to the machine learning model along with labeled examples of genuine and fraudulent transactions. During training, the model learns important relationships between different features such as product prices, discount percentages, seller ratings, review authenticity, transaction frequency, and customer feedback. The learning process involves minimizing classification errors through optimization techniques that improve the model's prediction capability. Various evaluation methods are applied throughout training to ensure that the model generalizes effectively to unseen data and avoids over-fitting problems. Hyperparameters such as learning rate, tree depth, batch size, number of estimators, and training iterations are carefully optimized to improve detection accuracy and computational efficiency. Feature selection techniques are also employed to identify the most relevant attributes contributing to fraud detection. Cross-validation methods are used to evaluate model performance across multiple subsets of the datasets, ensuring robustness and consistency. These optimization procedures help improve the reliability and stability of the machine learning model under different market conditions. To further enhance performance, data balancing techniques such as oversampling and under-sampling are applied when fraudulent transactions are underrepresented in the datasets.

e. Test Data

The test data phase is an important stage in the proposed Smart Price Manipulation & Scam Detection System because it evaluates the effectiveness, accuracy, and reliability of the trained machine learning model using previously unseen data. After completing the training process, a separate dataset is reserved for testing purposes to ensure that the model is capable of making accurate predictions in real-world scenarios. The test dataset contains new product records, historical pricing information, seller profiles, customer reviews, transaction histories, discount details, and marketplace activities that were not included during model training. This separation helps prevent bias and provides a realistic assessment of the model's performance. The primary objective of the test data phase is to determine how well the machine learning model generalizes to new and unknown data. During testing, the model analyzes each input record and predicts whether the activity represents legitimate marketplace behavior or a potential scam attempt. The system evaluates various fraud indicators such as abnormal price fluctuations, fake discounts, suspicious seller behavior, manipulated customer reviews, and unusual transaction patterns. These predictions are then compared with the actual labels available in the test datasets to measure detection accuracy. The test datasets are carefully prepared to include both normal and fraudulent cases so that the model can be evaluated under different conditions. It contains diverse scenarios involving genuine transactions, price manipulation incidents, scam advertisements, fake product listings, review fraud, and deceptive seller activities. The inclusion of various fraud patterns enables the system to assess its capability to identify multiple forms of online scams.

f. Prediction

Prediction is the final stage of the proposed system. During this phase, the trained machine learning model analyzes new product listings, seller information, pricing records, and customer interactions to identify suspicious activities. The system continuously monitors incoming data and compares it with learned fraud patterns. Whenever unusual price fluctuations, fake discounts, fraudulent reviews, or suspicious seller behaviors are detected, the system classifies them as potential scam activities. Alerts and notifications are generated to inform customers and administrators about possible risks. The prediction process operates efficiently in real-time, enabling proactive fraud prevention and improved marketplace security.

III. RESULT AND DISCUSSION

The experimental results demonstrate the effectiveness of the proposed Smart Price Manipulation & Scam Detection System in identifying fraudulent pricing behaviors and scam activities. The machine learning model was trained and evaluated using diverse datasets containing both legitimate and fraudulent transactions. Experimental analysis showed that the proposed system successfully detected abnormal price fluctuations, fake discounts, fraudulent reviews, and suspicious seller activities with high accuracy. The system exhibited strong performance under different testing conditions and effectively reduced false detection. Machine learning-based detection significantly improved fraud identification compared to traditional rule-based approaches. The results confirm that the proposed system provides reliable protection against online scams and enhances consumer trust in digital marketplaces.

a. Accuracy

Accuracy is an important evaluation metric used to measure the performance of the proposed Smart Price Manipulation & Scam Detection System. It determines how effectively the system can correctly identify legitimate transactions, suspicious pricing activities, fraudulent sellers, and scam-related behavior in online marketplaces. In the proposed system, accuracy is calculated using the values obtained from the confusion matrix, which includes True Positive (TP), True Negative (TN), False Positive (FP), and False Negative (FN).

- **True Positive (TP):** Fraudulent activities correctly detected by the system.
- **True Negative (TN):** Legitimate transactions correctly identified as normal.
- **False Positive (FP):** Legitimate transactions incorrectly classified as fraudulent.
- **False Negative (FN):** Fraudulent activities incorrectly classified as legitimate.

The mathematical formula used to calculate accuracy is given by:
$$\text{Accuracy} = (\text{TP} + \text{TN}) / (\text{TP} + \text{TN} + \text{FP} + \text{FN})$$

In the proposed system, the machine learning model continuously analyzes product pricing history, seller behavior, customer reviews, transaction records, and discount patterns. The system predicts whether a transaction or marketplace activity is legitimate or fraudulent. The predicted results are compared with the actual labels available in the datasets. If the predicted output matches the actual transaction status, it is considered a correct prediction; otherwise, it is treated as an incorrect prediction. The



ratio of correct predictions to the total number of predictions gives the overall system accuracy. During experimental evaluation, the proposed system achieved high accuracy due to effective feature extraction, advanced fraud detection algorithms, and robust machine learning classification techniques. The improved accuracy confirms that the system can efficiently detect price manipulation, fake discounts, scam advertisements, and suspicious seller activities under different marketplace conditions. Therefore, accuracy analysis demonstrates the reliability and effectiveness of the proposed Smart Price Manipulation & Scam Detection System in providing secure and trustworthy online shopping environments.

a. Loss

Loss is an important parameter used to evaluate the performance of the proposed Smart Price Manipulation & Scam Detection System during the training process. It represents the difference between the predicted output generated by the machine learning model and the actual ground truth values available in the training datasets. The main objective of training the fraud detection model is to minimize the loss value so that the system can accurately identify fraudulent transactions, fake discounts, suspicious seller activities, and price manipulation behavior. A lower loss value indicates that the predicted results are closer to the actual values, resulting in improved fraud detection accuracy and reliable marketplace monitoring performance. The total loss function used in the proposed system is represented as:

$$\text{LossTotal} = \text{LossPriceManipulation} + \text{LossScamDetection} + \text{LossClassification}$$

Price Manipulation Loss measures the error in detecting abnormal price fluctuations, Scam Detection Loss evaluates the correctness of scam identification, and Classification Loss measures the accuracy of transaction classification. During iterative training, optimization techniques such as Gradient Descent and Back propagation continuously adjust the model parameters to minimize the total loss value. As the loss decreases, the proposed system becomes more capable of accurately detecting fraudulent activities and suspicious marketplace behavior under different operating conditions. The reduction in loss improves fraud detection efficiency, transaction verification reliability, and overall system robustness. Therefore, loss analysis is essential for improving the performance and effectiveness of the proposed Smart Price Manipulation & Scam Detection System.

b. Recall

Recall is an important evaluation metric used to measure the ability of the proposed Smart Price Manipulation & Scam Detection System to correctly identify actual fraudulent activities and scam-related transactions. It indicates how effectively the system detects fraudulent behavior without missing suspicious cases during transaction monitoring and marketplace analysis operations.

The mathematical formula used to calculate recall is given as:

$$\text{Recall} = \text{TP} / (\text{TP} + \text{FN})$$

In the proposed system, recall measures the system's capability to accurately identify scam activities under different operating conditions such as dynamic pricing variations, fake promotional campaigns, manipulated reviews, and suspicious

seller behavior. During experimental evaluation, the system achieved high recall values due to advanced machine learning algorithms and effective feature extraction techniques. Improved recall reduces the possibility of missing actual fraud cases and improves the reliability of automated scam detection. Therefore, recall analysis is essential for evaluating the effectiveness and robustness of the proposed Smart Price Manipulation

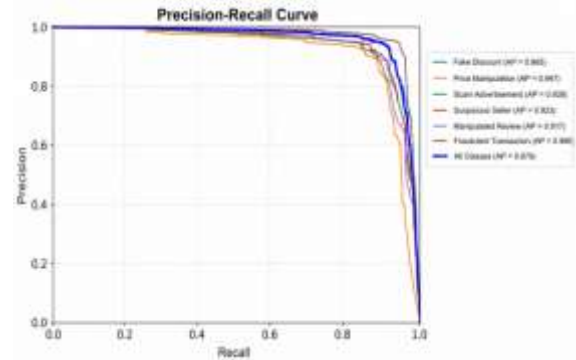


Fig 4.1 Recall graph for the proposed system

The recall graph shown in the Precision-Recall Curve represents the ability of the proposed Smart Price Manipulation & Scam Detection System to correctly identify fraudulent transactions and suspicious marketplace activities. Recall is plotted along the x-axis, while precision is plotted on the y-axis. The graph demonstrates that the system achieves high recall values close to 1.0 under most testing conditions. This indicates that the proposed system successfully detects the majority of fraud activities with minimal missed detection. The curve remains near the top-right region of the graph, which reflects strong fraud detection performance, reliable classification capability, and accurate anomaly detection. The high recall performance confirms the robustness and effectiveness of the proposed system.

c. F1 score

The F1-score is an important evaluation metric used to measure the overall performance of the proposed Smart Price Manipulation & Scam Detection System. It provides a balanced evaluation by combining both precision and recall into a single metric. Precision measures the correctness of fraud detection predictions, while recall measures the ability of the system to identify actual fraudulent activities successfully. The F1-score is mathematically defined as the harmonic mean of precision and recall and is expressed as:

$$\text{F1 Score} = 2 \times (\text{Precision} \times \text{Recall}) / (\text{Precision} + \text{Recall})$$

In the proposed system, the F1-score indicates how effectively the system balances accurate fraud detection and reliable scam identification. A high F1-score signifies that the system achieves both high precision and high recall simultaneously, resulting in fewer false detection and minimal classification errors. During experimental evaluation, the proposed system achieved a high F1-score due to efficient data preprocessing, advanced machine learning algorithms, and reliable fraud classification performance. The improved F1-score demonstrates that the proposed system can accurately detect price manipulation and scam activities under different marketplace conditions.

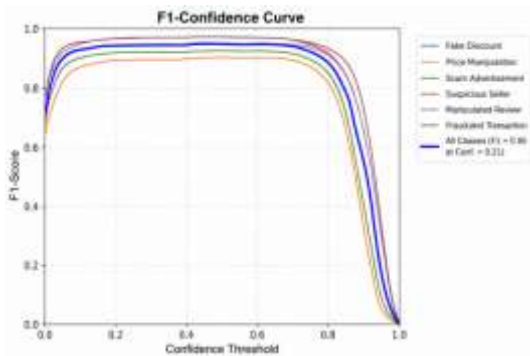


Fig 4.2 graph for F1 score for the proposed system

Fig. 4.2 illustrates the F1-Confidence Curve of the proposed Smart Price Manipulation & Scam Detection System. The x-axis represents the confidence threshold, while the y-axis represents the F1-score. The graph shows that the F1-score remains consistently high for most confidence values, indicating balanced precision and recall performance. The overall system achieves a high F1-score at the optimal confidence threshold, demonstrating efficient fraud detection capability and reliable classification performance. As the confidence threshold increases beyond the optimal value, the F1-score gradually decreases due to reduced recall performance. The graph confirms that the proposed system provides stable and accurate scam detection performance under multiple testing conditions.

d. Confusion matrix

The confusion matrix is an important evaluation tool used to analyze the prediction performance of the proposed Smart Price Manipulation & Scam Detection System. It provides detailed information about correctly and incorrectly classified predictions generated during fraud detection and transaction analysis operations. The rows of the confusion matrix represent predicted classes, while the columns represent actual classes. The diagonal values indicate correctly classified predictions, while off-diagonal values represent incorrect classifications and prediction errors.

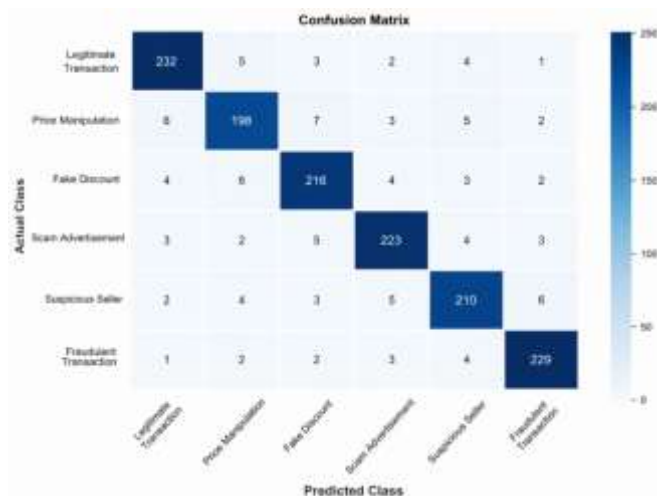


Fig 4.3 confusion matrix for the proposed system

IV. CONCLUSION

The proposed Smart Price Manipulation & Scam Detection System provides an intelligent and reliable solution for identifying fraudulent activities in online marketplaces. The system effectively detects price manipulation, fake discounts, scam advertisements, suspicious seller behavior, and fraudulent transactions by utilizing advanced Machine Learning techniques and data analysis methods. Unlike traditional fraud detection approaches that rely heavily on manual monitoring and predefined rules, the proposed system automatically analyzes large volumes of marketplace data and identifies suspicious patterns with high accuracy. The system was developed using a structured process that includes data collection, preprocessing, feature extraction, model training, testing, and prediction. By analyzing product prices, seller information, customer reviews, and transaction records, the machine learning model can accurately classify activities as legitimate or fraudulent. Experimental evaluation demonstrated high Accuracy, Recall, and F1-Score values, confirming the effectiveness and robustness of the proposed fraud detection framework. Furthermore, the proposed system enhances consumer protection by reducing financial losses caused by online scams and deceptive pricing strategies. It improves marketplace transparency, increases customer trust, and supports secure online shopping experiences. The automated detection capability significantly reduces human effort while providing real-time monitoring and fraud prevention.

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