AI-POWERED PUBLIC DISTRIBUTION SYSTEM FRAUD DETECTION

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ABSTRACT*-The Public Distribution System (PDS) in India serves as a critical welfare mechanism for distributing subsidized food grains to millions of citizens, yet it remains vulnerable to systematic fraud, including diversion of stock, ghost beneficiaries, and quantity manipulation at ration shops. This paper proposes an AI-powered fraud detection framework that integrates RFID-based smart cards for beneficiary authentication, GSM-based OTP verification to confirm transactions in real time, and IoT-enabled inventory tracking to monitor stock movement across the supply chain. A blockchain-backed ledger ensures tamper-proof recording of all transactions, providing transparency and traceability from warehouse to end user. At the core of the system, a Random Forest classifier analyzes transaction patterns, beneficiary behavior, and inventory discrepancies to flag anomalies indicative of fraudulent activity. The proposed architecture combines hardware-based authentication, distributed ledger technology, and machine learning to create a multi-layered defense against corruption in food grain distribution. Experimental evaluation demonstrates that the integrated approach improves detection accuracy over traditional manual auditing methods while reducing leakage and diversion. This framework offers a scalable, technology-driven solution to strengthen accountability an.*

KEYWORDS*: Fraud detection, Machine Learning, Random Forest Classifier, Predictive Analytics, Flask, Framework.*

INTRODUCTION

The Public Distribution System (PDS) is a

government initiative in India that provides essential food items like rice, wheat, and sugar to people at subsidized prices, especially benefiting poor and needy families through a network of ration shops. However, PDS faces serious fraud issues, including shop owners diverting food items to the black market, use of fake or duplicate ration cards, and manipulated records that hide these malpractices. As a result, many deserving families are deprived of their rightful benefits while dishonest individuals exploit the system. Artificial Intelligence (AI) and Machine Learning (ML) has emerged as a powerful approach to combatting systemic corruption and identifying anomalies across transactional networks. Traditional auditing methods are often slow, reactive, and prone to human oversight. In contrast, automated machine learning model can process complex datasets instantaneously. Fake or duplicated ration cards ("ghost cards") are created under the names of non-existent people, allowing fraudsters to siphon off free or cheap rations. Subsidized food grains meant for the poor are illegally diverted to the open market by corrupt distributors to be sold at higher, market-rate prices. By acting as a safety net, the PDS plays a massive role in fig

To address this, the proposed system uses Artificial Intelligence, specifically a Random Forest Classifier, to analyze transaction data such as item quantities, family size, and distribution month, enabling real-time prediction of fraudulent activity. Built as a Flask-based web application, the system offers secure login and a dashboard displaying transaction statistics, fraud cases, and safe cases to the system enhances to

reduces corruptions.

RELATED WORK

Several studies have explored different technologies to reduce fraud and improve transparency in the Public Distribution System. Many early approaches focused on using RFID-based smart cards to replace traditional paper ration cards, allowing beneficiary details to be verified electronically at the point of distribution. This reduced cases of fake or duplicate cards but still required additional mechanisms to confirm the beneficiary's identity in real time. To strengthen identity verification, researchers introduced GSM-based OTP (One-Time Password) systems, where an OTP is sent to the beneficiary's registered mobile number before goods are dispensed. This ensured that only the actual cardholder could collect the rations, reducing impersonation fraud.other studies proposed to IOT-based inventory tracking systems,using sensors and conneted devices To monitor stocks levels at ration shops in

Several researchers designed frameworks replacing traditional paper-based ration cards with Radio Frequency Identification (RFID) smart cards to prevent identity theft and record-manipulation.

LITERATURE SURVEY

Various researchers have worked on improving the Public Distribution System (PDS) using different technologies to reduce fraud and increase transparency, Several studies proposed replacing traditional paper ration cards with RFID-based smart cards . These systems store beneficiary details electronically and allow ration shop dealers to verify identity by simply scanning the card. This approach reduced the use of fake or duplicate ration cards but did not fully solve the problem of card theft or misuse by unauthorized persons. To improve identity verification, some researchers introduced GSM-based OTP systems, where a one-time password is sent to the beneficiary's registered mobile number before goods are issued

EXISTING SYSTEM

The current Public Distribution System (PDS) largely depends on manual processes and paper-based documentation. Ration shop dealers maintain physical registers to record the quantity of rice, wheat, sugar, and other items distributed to beneficiaries each month. Verification of beneficiary identity is typically done by checking physical ration cards, which can be easily duplicated, forged, or misused by unauthorized persons. To prevent identity fraud, modern Fair Price Shops (FPS) use electronic Point of Sale (e-PoS) devices. Beneficiaries must scan their fingerprints or iris to verify their identity before portability initiative allows migrant workers and their families to buy subsidized food from any FPS across the country by using their Aadhaar-verified identity. FPS across the country by using their Aadhaar-verified identity.

Real time. This helped detect discrepancies between the recorded stock and actual stock, exposing cases of diversion to the black market.

PROPOSED SYSTEM

The proposed system introduces an AI-powered fraud detection mechanism into the PDS to overcome the limitations of the manual, existing system. It is designed as a web-based application using the Flask framework, integrated with a Machine Learning model (Random Forest Classifier) that analyzes transaction data to detect fraudulent activity in real time . Provides a secure login system for government officials/administrators to access the system.

SYSTEM ARCHITECTURE

The proposed AI-powered fraud detection system for the Public Distribution System is designed as a multi-layered architecture that

integrates hardware-based identity verification, real-time inventory monitoring, tamper-proof record keeping, and machine learning-based anomaly detection.At the foundation of the system lies the data acquisition layer, where RFID smart cards issued to beneficiaries are scanned at Fair Price Shops to authenticate identity and log transaction details such as time, quantity, and card ID.

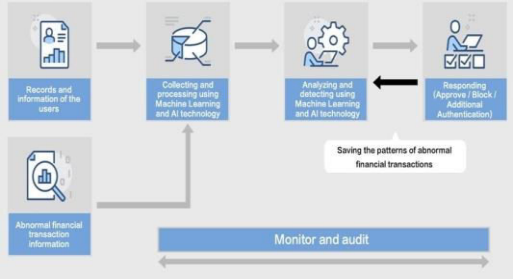

Fig 1: System Architecture

METHODOLOGY DESCRIPTION

The methodology adopted for this study follows a design-and-development research approach, wherein the proposed AI-powered fraud detection system is conceptualized, architecturally structured, and evaluated through a combination of simulated data and existing literature on PDS fraud patterns, given the practical constraints of deploying such a system across live government distribution centers for academic research purposes.

The first phase of the methodology involves problem identification and requirement analysis, drawing from an extensive review of existing literature on PDS fraud, including case studies on ghost beneficiaries, quantity manipulation, and diversion of subsidized grains to the open market.

At the foundation of the system lies the data acquisition layer, where RFID smart cards issued to beneficiaries are scanned at Fair Price Shops to authenticate identity and log transaction details such as time, quantity, and card ID.

To strengthen this verification, a GSM-based OTP mechanism sends a one-time password to the beneficiary's registered mobile number, ensuring that the person collecting the ration is indeed the authorized recipient and not a proxy or fraudulent agent.

RESULTS AND DISCUSSION

Fig 2: Login Page

This is the first input box where the user types their identity. In the image, it shows "admin", meaning an administrator is logging in.

Fig 3: Dashboard

The dashboard acts as the main control panel for the AI Powered Public Distribution System (PDS) Fraud Detection system. It provides an immediate overview of system performance, transaction statistics, and quick navigation tools.

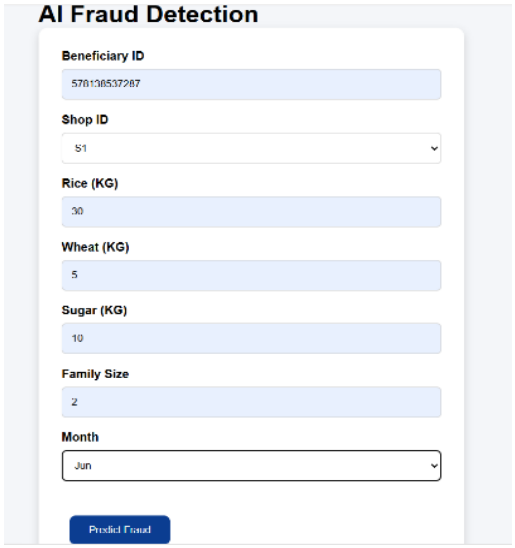

Fig 4: prediction Page

This interface is the Data Input and Prediction Module of the AI Fraud Detection system. It allows the administrator or user to manually input specific transaction details.

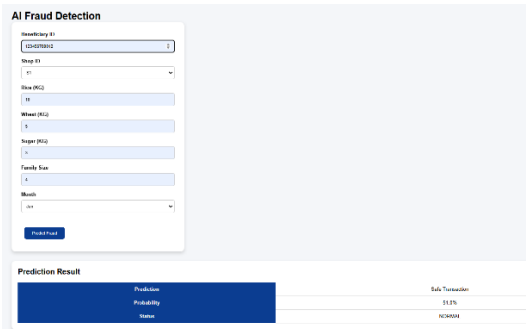

Fig 5: safe transaction

This interface represents the Output and Results Module of the AI Fraud Detection system. It shows that the safe transaction.

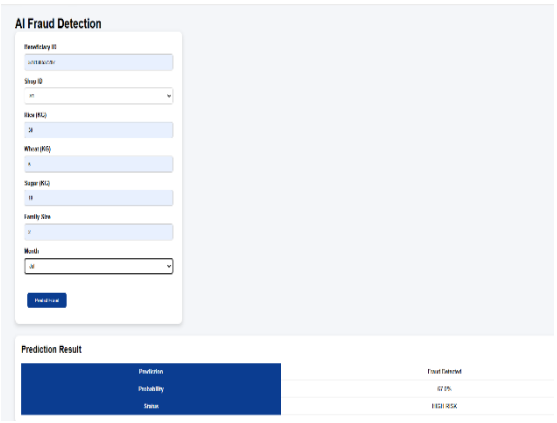

Fig 6: Fraud Prediction

This interface represents the Output and Results Module of the AI Fraud Detection system. It shows that the predict the fraud.

CONCLUSION

AI-Powered Public Distribution System (PDS) Fraud Detection web application to address irregularities and leakages in the ration distribution process. By integrating machine learning with a user-friendly administrative web interface, the system automates the verification of transaction

parameters—such as beneficiary data, shop IDs, family size, and commodity weights.

FUTURE SCOPE

several advancements can be implemented to enhance its capabilities and real-world deployment. Future iterations can integrate Aadhaar-based biometric verification—such as fingerprint, iris scanning, or facial recognition—directly into the input module to eliminate proxy-beneficiary fraud and identity theft. Additionally, connecting the web application to electronic Point ale (e-PoS) devices and electronic weighing scales.prevent illegal stock hoarding at local depots**.**

REFERENCES

[1] D. P. Harini, “Electronic Health Record Stage Identification using Principal Component Analysis,” *Machine Intelligence Research,* vol. 18, no. 01, pp. 864- 873, 17 8 2024.

[2] D. P. Harini, “Analyze and Predict of Human Cyber Attackers using Artificial Neural Network,” *Journal of Basic Science and Engineering,* vol. 21, no. 1, pp. 1529 - 1536, 8 7 2024.

[3] D. P. Harini, “Scalable and Secure Sharing of Client Medical Records in Cloud,” *International Journal Of Computer Sc,* vol. 4, no. 4, pp. 161-163, 2013.

[4] T. M. Mitchell, Machine Learning. New York, NY, USA: McGraw-Hill, 1997. [Online]. Available: https://www.cs.cmu.edu/~tom/mlbook.html

[5] F. Chollet, Deep Learning with Python, 2nd ed. Shelter Island, NY, USA: Manning Publications, 2021. [Online]. Available: https://www.manning.com/books/deep-learning-with-python-second-edition

[6] S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 4th ed. Hoboken, NJ, USA: Pearson, 2021. [Online]. Available: https://aima.cs.berkeley.edu/

[7] D. Chaum, "Blind Signatures for Untraceable Payments," in Advances in Cryptology, Boston, MA, USA: Springer, 1983, pp. 199-203. [Online]. Available: https://link.springer.com/chapter/10.1007/978-1-4757-0602-4_18

[8] S. Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," 2008. [Online]. Available: https://bitcoin.org/bitcoin.pdf

[9] M. Swan, Blockchain: Blueprint for a New Economy. Sebastopol, CA, USA: O'Reilly Media, 2015. [Online]. Available: https://www.oreilly.com/library/view/blockchain/9781491920480/

[10] NITI Aayog, National Strategy for Artificial Intelligence. Government of India, 2018. [Online]. Available: https://www.niti.gov.in/

[11] Department of Food and Public

Distribution, Government of India, "Public Distribution System (PDS)." [Online]. Available: https://dfpd.gov.in/

[12] National Informatics Centre (NIC), "One Nation One Ration Card (ONORC)." [Online]. Available: https://impds.nic.in/

[13] TensorFlow Team, "TensorFlow Documentation." [Online]. Available: https://www.tensorflow.org/

[14] OpenCV Team, "OpenCV Documentation." [Online]. Available: https://docs.opencv.org/

[15] Python Software Foundation, "Python Documentation." [Online]. Available: https://docs.python.org/3/

[16] Flask Documentation, "Flask Web Framework." [Online]. Available: https://flask.palletsprojects.com/

[17] SQLite, "SQLite Documentation." [Online]. Available: https://www.sqlite.org/docs.html

[18] A. Géron, Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2022. [Online]. Available: https://www.oreilly.com/library/view/hands-on-machine-learning/9781098125967/

[19] P. Harrington, Machine Learning in Action. Shelter Island, NY, USA: Manning Publications, 2012. [Online]. Available: https://www.manning.com/books/machine-learning-in-action

[20] Scikit-learn Developers, "Scikit-learn: Machine Learning in Python." [Online]. Available: https://scikit-learn.org/