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A Hybrid Biometric Approach for Secure Vaccination Status Verification

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Abstract: This project introduces a Transformer-Based AI system for verifying vaccination status using face. Traditional methods like QR codes and paper certificates are prone to forgery and security risks. Vision Transformers (ViTs) replace CNNs for face recognition, improving accuracy and adaptability. Dual-layer authentication provides a seamless and fraud-proof process. The system is designed to be robust, secure, and user-friendly.

I. INTRODUCTION

In the era of global pandemics and increasing digital integration, the secure and reliable verification of an individual's vaccination status has emerged as a public health priority. Traditional methods of verification, such as physical vaccine cards and digital certificates (e.g., QR codes), are vulnerable to forgery, loss, and misuse.

These challenges have prompted the exploration of more secure, scalable, and tamper-resistant alternatives for identity and health status authentication. Biometric systems, which authenticate individuals based on unique physiological or behavioral traits, offer a promising solution. However, unimodal biometric systems relying on a single trait such as a fingerprint or facial image often face limitations including spoofing vulnerabilities, environmental sensitivity, and incomplete data. To overcome these limitations, a hybrid biometric approach, which integrates two or more biometric modalities, is proposed for secure vaccination status verification.

II. LITERATURE SURVEY

R.B.Chien(2021): Uses face recognition to identify individuals in real-time. Links facial data with vaccination records stored in a secure database. Supports touchless verification, reducing physical contact in public areas. Based on pattern recognition and feature extraction techniques in computer vision.

T.H.Ngo(2021): Combines digital identity systems with biometric face recognition. Provides a secure and efficient method to track and confirm vaccination status. Emphasizes data privacy and authentication protocols.

Y.Zhang(2020): Applies deep learning algorithms, especially CNNs (Convolutional Neural Networks), for accurate face recognition. Focuses on healthcare environments, which may have challenges like masks, lighting variations, etc.

III. EXISTING SYSTEM

The current vaccination status verification systems commonly use face recognition for identity verification, integrated with vaccination databases. OTP-based verification is also widely used, where users receive a one-time password to confirm their identity. Some systems rely on QR codes, which are scanned for quick verification of vaccination status. Additionally, manual certificate checks are still in use at certain locations.

IV. PROPOSED SYSTEM

The proposed system integrates face recognition for secure vaccination status verification. This authentication method enhances security by mitigating spoofing risks associated with the single biometric systems. Liveness detection ensures that the user is present and not using photos or recordings. By combining these technologies, the system provides a reliable, fraud-resistant, and user-friendly solution for verification.

V. IMPLEMENTATION

The hybrid biometric approach combines two or more biometric traits (e.g., fingerprint and facial recognition) to improve the accuracy, security, and reliability of verifying an individual's vaccination status. This system is especially valuable for use in areas such as healthcare centers, airports, or schools, where accurate health data verification is critical.

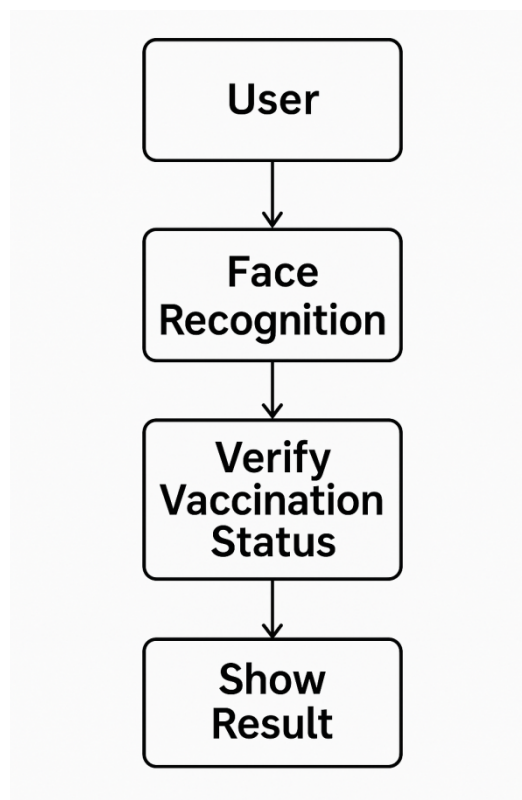
VI. MODULES

- 1) *Streamlit Module*: For creating the UI, camera input
- 2) *Cv2Module*: Used behind the scenes for image processing
- 3) *Numpy Module* : For handling numerical arrays
- 4) *PIL Image Module*: For image loading and manipulation
- 5) *Pickle Module* : To save and load user data

VII. ALGORITHMS

- 1) Machine Learning Algorithms: Support Vector Machine (SVM) is used to classify and recognize facial patterns.
- 2) Face Encoding: Transforms unique facial features into numerical data for easy comparison.
- 3) Image Processing: Utilizes OpenCV to detect and analyze facial structures from images or video streams.
- 4) PDF Generation: Automatically creates downloadable PDF files to present results or reports.

VIII. DATA FLOW DIAGRAM



IX. RESULT AND ANALYSIS

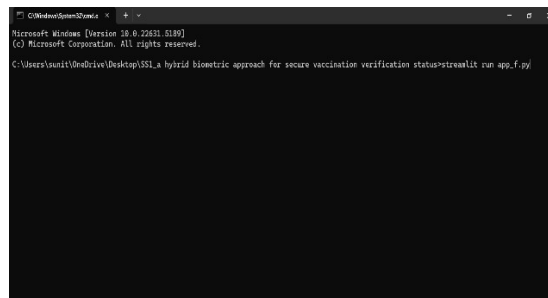


Fig1: Open Command Prompt

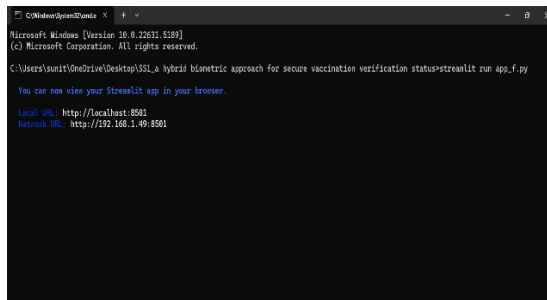


Fig2: Type the Command

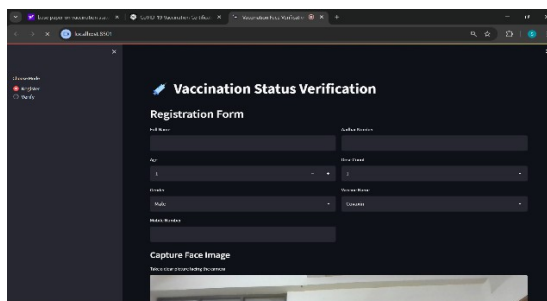


Fig3: User Interface

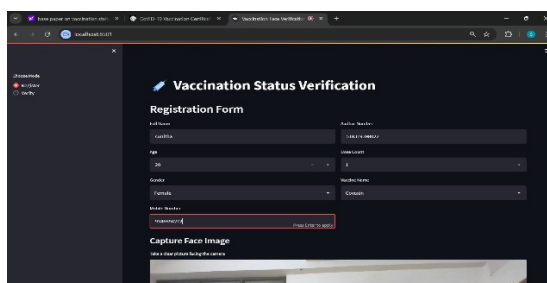


Fig4: Enter the Details

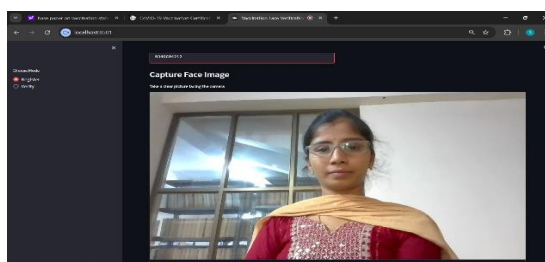


Fig5: Capture the Image and click on register button

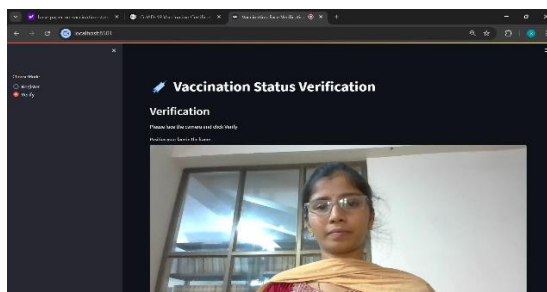


Fig6: Verify Face

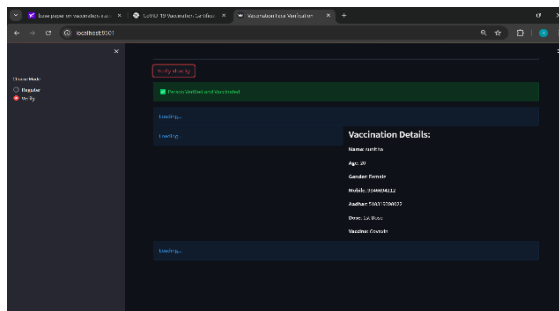


Fig7: Successfully Verified

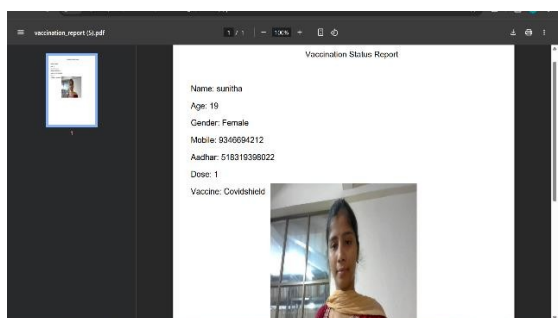


Fig8: Download Report

X. CONCLUSION

The face recognition-based vaccination verification system provides a fast, secure, and contactless way to confirm vaccination status. verification offers a robust, reliable, and tamper-proof solution for modern identity and health record management. By integrating multiple biometric modalities such as fingerprint, facial recognition, and voice authentication the system significantly enhances accuracy, reduces the risk of spoofing, and ensures that vaccination data is accessed only by authorized individuals.

XI. FUTURE SCOPE

The hybrid biometric approach, which involves the combination of two or more biometric modalities such as facial recognition, fingerprint scanning, and voice authentication holds vast potential for future development. Theoretically, this approach offers a multidimensional framework that can be extended across technological, healthcare, and security domains, providing numerous avenues for research and practical implementation.

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