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A Hybrid Biometric Approach for Secure Vaccination Status Verification

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Abstract: Thisproject introducesaTransformer-BasedAI system for verifying vaccination status using face.Traditionalmethods like QR codes and paper certificates are prone to forgery and securityrisks.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 verificationof an individual's vaccination statushasemergedasapublichealthpriority.Traditional methods of verification, such as physical vaccine cards and digital certificates (e.g., QR codes), arevulnerable 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, unimodalbiometricsystems relying on a single trait such as afingerprint or facial imageoftenfacelimitationsincludingspoofing vulnerabilities, environmental sensitivity, and incompletedata.Toovercometheselimitations, a hybrid biometricapproach, which integrates twoor morebiometricmodalities, is proposed for securevaccination status verification.

II. LITERATURESURVEY

R.B.Chien(2021): Usesfacerecognitiontoidentifyindividuals in real-time.Linksfacialdatawithvaccination records stored in a secure database. Supports touchless verification, reducing physical contact in public areas. Based on pattern recognitionandfeatureextractiontechniquesin computer vision.

T.H.Ngo(2021): Combinesdigital identity systems with biometric face recognition. Provides a secure and efficient method to track and confirm vaccinationstatus.Emphasizesdataprivacyand authentication protocols.

Y.Zhang(2020): Applies deep learning algorithms, especially CNNs (Convolutional Neural Networks), for accuratefacerecognition. Focuses on healthcare environments,whichmayhavechallengeslike 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 isalsowidelyused,whereusersreceiveaone- timepasswordtoconfirmtheir identity. Some systems relyonQRcodes, whicharescanned for quick verification of vaccination status.

Additionally,manualcertificatechecksarestill in use at certain locations.

IV. PROPOSED SYSTEM

Theproposedsystemintegratesface recognitionfor secure vaccinationstatusverification.This authentication method enhancessecurity by mitigatingspoofingrisksassociatedwiththe singlebiometric systemsLivenessdetection ensures that theuser ispresent andnot using photos orrecordings. Bycombiningthese technologies,the system providesreliable fraud-resistant, anduser-friendly solution for verification.

V. IMPLEMENTATION

The hybrid biometricapproach 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 dataverification is critical.

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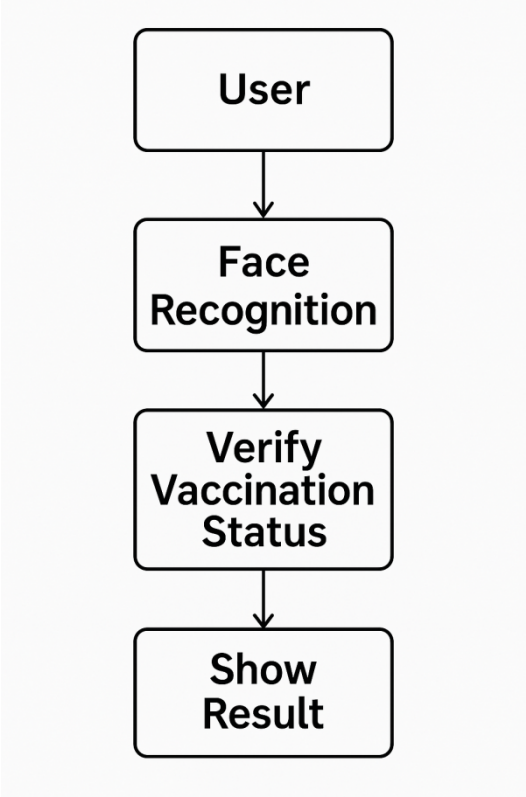
VI. MODULES

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. RESULTANDANALYSIS

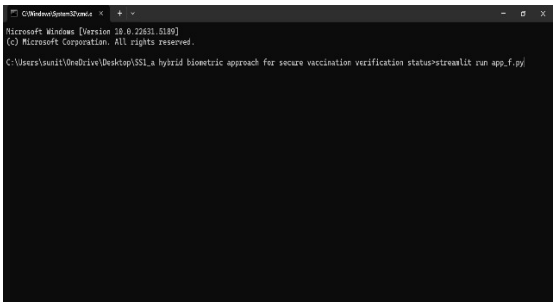


Fig1: Open Command Prompt

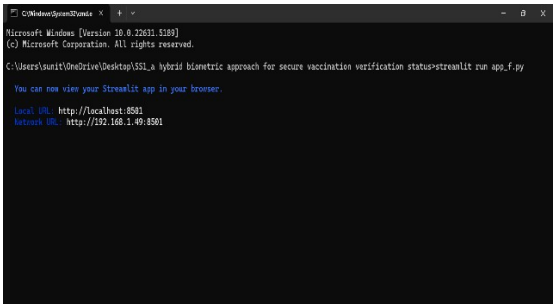


Fig2: Type the Command

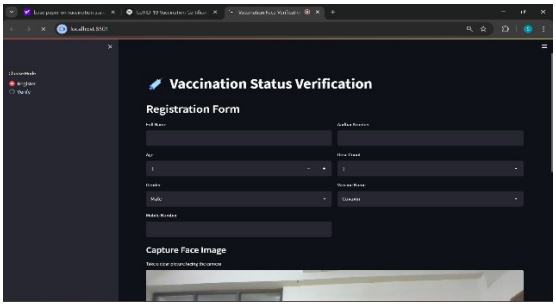


Fig3: User Interface

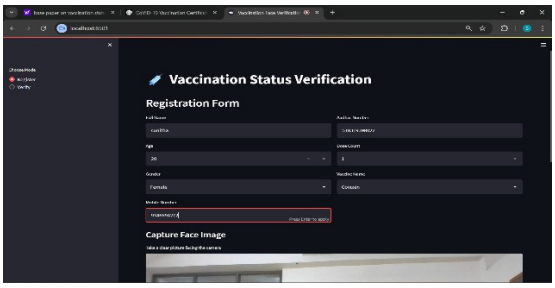


Fig4: Enter the Details

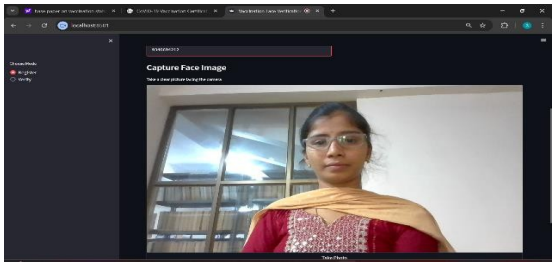


Fig5: Capture the Image and click on register button

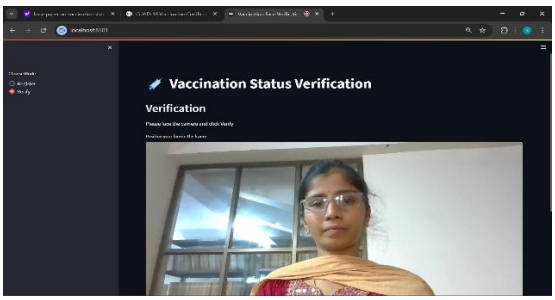


Fig6: Verify Face

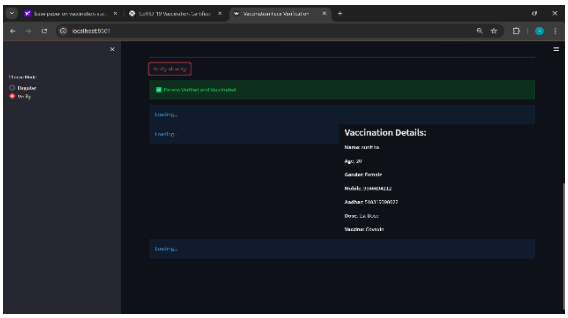


Fig7: Successfully Verified

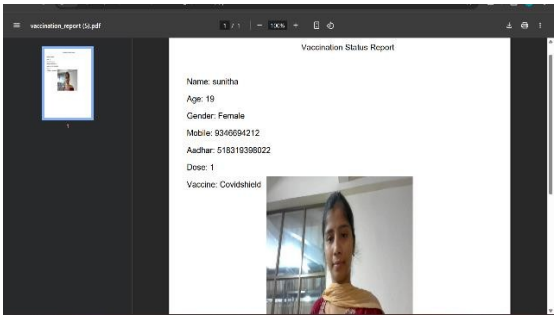


Fig8: Download Report

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 enhancesaccuracy, reducestheriskofspoofing, and ensures that vaccination data is accessed only by authorized individuals.

XI. FUTURE SCOPE

The hybrid biometric approach, which involves thecombinationoftwo or more biometricmodalitiessuch as facial recognition, fingerprintscanning, and voice authentication holds vast potentialforfuturedevelopment. Theoretically,this approach offers amultidimensional framework that can be extendedacross technological,healthcare, and security domains, providing numerous avenues for research and practicalimplementation.

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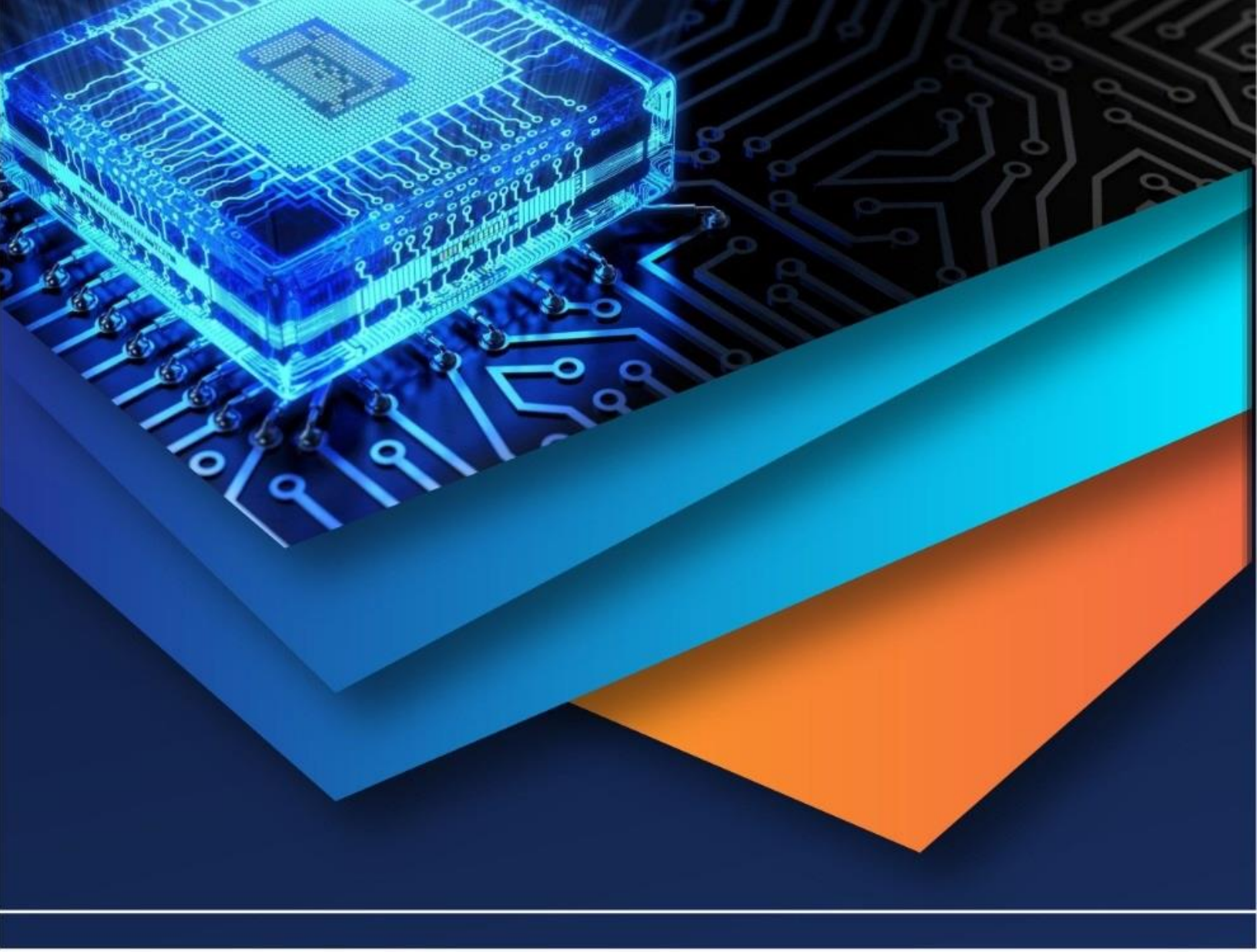


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