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ADVANCEMENTS AND CHALLENGES IN BIOMETRIC AUTHENTICATION SYSTEMS: A COMPREHENSIVE STUDY

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ABSTRACT :

Biometric authentication systems are emerging as robust security solutions in various sectors, utilizing unique physiological and behavioral characteristics for identity verification. This study explores technological advancements, challenges, and applications of biometric systems across industries such as banking, healthcare, and government security. The research highlights trends, evaluates reliability, and proposes solutions to overcome existing limitations. Findings suggest growing potential for multimodal systems and AI integration to enhance security and efficiency.

KEYWORDS : Biometric authentication, security, fingerprint recognition, voice recognition, multimodal systems, AI integration

INTRODUCTION :

As cybersecurity threats increase, conventional authentication methods such as passwords are proving insufficient. Biometric systems offer advanced security by using unique physical or behavioral traits for authentication. The rise of AI and machine learning has enhanced biometric system accuracy and reliability, making them essential in safeguarding sensitive information across various sectors.

OBJECTIVES

- To evaluate the effectiveness of biometric systems in ensuring secure access.
- To investigate AI's role in enhancing accuracy.
- To identify challenges faced by existing systems.
- To propose solutions for improving reliability, privacy, and scalability.

SCOPE OF THE STUDY :

This study covers applications in:

- Banking and finance: Secure transactions.
- Healthcare: Secure patient identification.
- Government and defense: Identity verification for national security.

It also explores emerging technologies like AI-powered recognition and blockchain integration for secure data management.

STATEMENT OF THE PROBLEM :

Despite significant advancements, biometric systems face persistent challenges:

- Privacy concerns over unauthorized access to biometric data.
- High costs for large-scale deployment.
- Inaccuracies such as false acceptance/rejection rates.
- Lack of accessibility for users with disabilities.

LITERATURE REVIEW :

- A.K. Jain et al., 'An Introduction to Biometric Recognition', IEEE Transactions on Circuits andSystems for Video Technology, 2004.

- J. Wayman, 'Fundamental Issues in Biometric Performance Testing', Pattern Recognition, 2000.
- D. Maltoni et al., 'Handbook of Fingerprint Recognition', Springer, 2009.

RESEARCH METHODOLOGY :

- Data Collection: Surveys from organizations using biometric systems.
- Statistical Analysis: Regression analysis for FAR and FRR.
- Case Studies: Evaluating biometric systems in banking and healthcare.

DATA ANALYSIS AND INTERPRETATION :

- Fingerprint Recognition: Accuracy rates and response times.
- Voice Recognition: Environmental impact analysis.
- Multimodal Systems: Error rate reduction and accuracy improvement.

RESULTS AND DISCUSSION :

Multimodal systems outperform unimodal ones in accuracy and reliability. However, privacy concerns and costs hinder broader adoption. AI integration significantly reduces error rates, improving system efficiency.

CONCLUSION AND FUTURE WORK :

Biometric systems offer robust security solutions but need further research for scalability, accessibility, and privacy protection. Future research should focus on blockchain integration and lightweight algorithms for mobile applications.

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