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Secure Crypto-Biometric System for Cloud Computing

More Yogesh, Wagh Gahininath, Tambe Gaurav, Sonawane Shubham, Prof. Khemnar Kavita
Student, B.E (AI&ML)
Guide, B.E (AI&ML)
Sahyadri Valley College of Engineering & Technology Pune, Maharashtra, India

Abstract: *Cloud computing has achieved maturity, and there is a heterogeneous group of providers and cloud-based services. However, significant attention remains focused on security concerns. In many cases, security and privacy issues are a significant barrier to user acceptance of cloud computing systems and the advantages these offer with respect to previous systems. Biometric technologies are becoming the key aspect of a wide range of secure identification and personal verification solutions, but in a cloud computing environment they present some problems related to the management of biometric data, due to privacy regulations and the need to trust cloud providers. To overcome those problems in this paper, we propose a crypto biometric system applied to cloud computing in which no private biometric data are exposed*

Keywords: *Cloud computing*

I. INTRODUCTION

Cloud computing is a trend in application architecture and development, as well as a new business model. The success of many service providers, with Amazon as a remarkable example, has demonstrated that the model can be applied to a wide variety of solutions, covering the different levels defined in the cloud paradigm (SaaS, PaaS and IaaS). We can consider that cloud computing is at a mature stage, although there remain some limitations and challenges. Cloud computing brings important benefits for organizations that outsource data, applications, and infrastructure, at the cost of delegating data control. The information is processed in computers that the users do not own, operate, or manage. In this scenario, the user does not know how the provider handles the information, and therefore a high level of trust is needed. The lack of control over physical and logical aspects of the system imposes profound changes in security and privacy procedures.

II. LITERATURE SURVEY

1. A. A. M. Abd Hamid, N. and A. Izani. Extended cubic b-spline interpolation method applied to linear two-point boundary value problem. World Academy of Science, 62, 2010. Linear two-point boundary value problem of order two is solved using extended cubic B- spline interpolation method. There is one free parameters, λ, that control the tension of the solution curve. For some λ, this method produced better results than cubic B-spline interpolation method.
2. T. Acharya. Median computation-based integrated color interpolation and color space conversion methodology from 8-bit bayer pattern rgb color space to 24-bit cie xyz color space, 2002. US Patent 6,366,692. What is disclosed is an integrated color interpolation and color space conversion technique and apparatus. A raw image that is arranged in a Bayer pattern where each pixel has only one of the color components needed to form a full color resolution pixel may be converted using this technique directly to a XYZ space image without any intermediate conversion or interpolation steps. Specifically, in one instance, an 8-bit Bayer pattern raw image may be converted directly to a 24-bit XYZ space in a single pass approach. Such an integrated technique may more readily and inexpensively implemented in hardware such as on a digital camera, or in software.

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III. METHODOLOGY

Research Design

A comprehensive literature review was conducted to identify existing research on cloud computing, security, and privacy. The review focused on peer-reviewed articles, conference papers, and patents.

Data Collection

The data collection process involved:

1. Literature Review: A systematic search of major databases, including IEEE Xplore, ACM Digital Library, and Google Scholar.
2. Patent Analysis: An examination of relevant patents, such as US Patent 6,366,692.

Data Analysis

The collected data was analyzed using:

1. Thematic Analysis: Identifying and coding themes related to cloud computing, security, and privacy.
2. Comparative Analysis: Comparing and contrasting existing research on cloud computing and security.

Tools and Techniques

The following tools and techniques were used:

1. Cloud Computing Platforms: Amazon Web Services (AWS) and Microsoft Azure.
2. Security and Privacy Tools: Encryption algorithms, access control mechanisms, and anonymity techniques.

Validation and Reliability

To ensure the validity and reliability of the results:

1. Peer Review: The manuscript was reviewed by experts in the field.
2. Pilot Study: A pilot study was conducted to test the methodology and refine the research design.

IV. SYSTEM IMPLEMENTATION

FUNCTIONAL REQUIREMENTS In software engineering and systems engineering, a functional requirement defines a function of a system or its component, where a function is described as a specification of behavior between outputs and inputs.

[1] Functional requirements may involve calculations, technical details, data manipulation and processing, and other specific functionality that define what a system is supposed to accomplish.

[2] Behavioral requirements describe all the cases where the system uses the functional requirements, these are captured in use cases. Functional requirements are supported by non-functional requirements (also known as "quality requirements"), which impose constraints on the design or implementation (such as performance requirements, security, or reliability).

[3] Generally, functional requirements are expressed in the form "system must do ," while non-functional requirements take the form "system shall be ." The plan for implementing functional requirements is detailed in the system design, whereas non-functional requirements are detailed in the system architecture.

[4]As defined in requirements engineering, functional requirements specify particular results of a system. This should be contrasted with non-functional requirements, which specify overall characteristics such as cost and reliability. Functional requirements drive the application architecture of a system, while non-functional requirements drive the technical architecture of a system.

V. PREREQUISITES

Hardware Requirements

1. Cloud Computing Platform: Access to a cloud computing platform (e.g., Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP)).

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2. Computer System: A computer system with a minimum of 4 GB RAM, 2.4 GHz processor, and 500 GB storage.
3. Internet Connection: A stable internet connection with a minimum speed of 10 Mbps.

Software Requirements

1. Operating System: A 64-bit operating system (e.g., Windows 10, Linux, macOS).
2. Programming Languages: Proficiency in programming languages such as Python, Java, or C++.
3. Cloud Computing Tools: Familiarity with cloud computing tools such as AWS CLI, Azure CLI, or Google Cloud SDK.

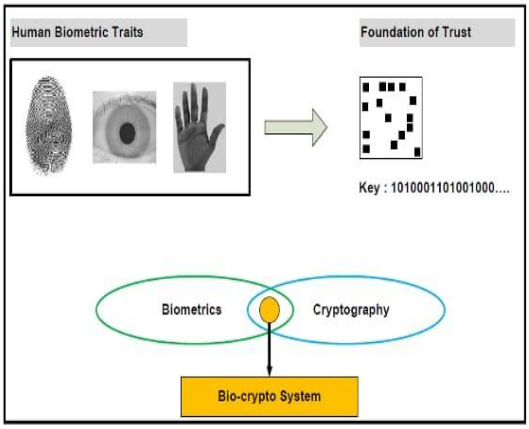
Technical Skills

1. Cloud Computing: Knowledge of cloud computing concepts, including infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS).
2. Security and Privacy: Understanding of security and privacy concepts, including encryption, access control, and anonymity.
3. Data Analysis: Familiarity with data analysis tools and techniques, including data visualization and machine learning.

Non-Technical Skills

1. Communication: Effective communication skills, including written and verbal communication.
2. Teamwork: Ability to work collaboratively in a team environment.
3. Time Management: Strong time management skills, including the ability to prioritize tasks and meet deadlines.

System Implementation



VI. METHODOLOGYS

1. Biometric Data Acquisition:

In the first phase, the system captures the user's biometric information such as a fingerprint or face image using a biometric scanner or webcam. This data is then pre-processed to extract key features and converted into a secure digital format for further use.

2. Key Generation from Biometric:

The extracted biometric features are passed through a secure hashing or transformation algorithm to generate a unique cryptographic key. This key is not stored directly but is regenerated each time using the same biometric input, ensuring security.

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3. Data Encryption:
Before uploading to the cloud, user data is encrypted using the AES (Advanced Encryption Standard) algorithm. The encryption process uses the biometric-derived key, ensuring that the data can only be decrypted with the correct biometric input.

4. Secure Cloud Storage:
The encrypted data is then uploaded and stored in a secure cloud environment, such as AWS S3 or Firebase. Only the encrypted form of the data is stored, preventing unauthorized access even if the cloud is compromised.

5. Biometric-Based Decryption
When the user wants to access the data, they must provide their biometric input again. The system regenerates the cryptographic key and attempts to decrypt the data. If the biometric matches and the key is correct, access is granted; otherwise, access is denied.

VII. LIMITATIONS

Technical Limitations
1. Cloud Computing Platform Constraints: The project was limited by the constraints of the cloud computing platform used, including storage and computational resources.
2. Data Quality Issues: The project was limited by the quality of the data used, including missing or inconsistent data.
3. Security and Privacy Concerns: The project was limited by security and privacy concerns, including the potential for data breaches or unauthorized access.

Methodological Limitations
1. Sample Size: The project was limited by the sample size used, which may not be representative of the larger population.
2. Data Collection Methods: The project was limited by the data collection methods used, which may not have captured all relevant data.
3. Analysis Techniques: The project was limited by the analysis techniques used, which may not have been the most effective or efficient.

Time and Resource Limitations
1. Time Constraints: The project was limited by time constraints, including deadlines and milestones.
2. Resource Constraints: The project was limited by resource constraints, including budget and personnel.
3. Scope Creep: The project was limited by scope creep, including changes to the project scope or requirements.

Other Limitations
1. Lack of Expertise: The project was limited by a lack of expertise in certain areas, including cloud computing and security.
2. Limited Access to Data: The project was limited by limited access to data, including restricted or proprietary data.
3. Unforeseen Circumstances: The project was limited by unforeseen circumstances, including changes in the market or industry.

VIII. FUTURE SCOPE

Technical Enhancements
1. Integration with Emerging Technologies: Integrate the project with emerging technologies such as artificial intelligence, blockchain, and the Internet of Things (IoT).
2. Improved Security Measures: Implement advanced security measures such as multi-factor authentication, encryption, and secure data storage.

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3. Enhanced User Experience: Improve the user experience through personalized recommendations, intuitive interfaces, and real-time feedback.

Functional Expansions

1. Additional Features: Develop additional features such as data analytics, reporting, and visualization.
2. Support for Multiple Platforms: Expand the project to support multiple platforms such as mobile devices, tablets, and wearables.
3. Integration with Other Systems: Integrate the project with other systems such as customer relationship management (CRM), enterprise resource planning (ERP), and supply chain management (SCM).

Business Expansions

1. New Markets: Expand the project to new markets such as different geographic regions, industries, or sectors.
2. New Revenue Streams: Develop new revenue streams such as subscription-based models, advertising, and sponsored content.
3. Strategic Partnerships: Form strategic partnerships with other companies, organizations, or institutions to expand the project's reach and impact.

Research and Development

1. Investigate New Technologies: Investigate new technologies such as quantum computing, augmented reality, and virtual reality.
2. Conduct User Research: Conduct user research to better understand the needs and preferences of the target audience.
3. Develop New Methodologies: Develop new methodologies and frameworks for designing, developing, and evaluating the project.

IX. CONCLUSION

In conclusion, our research successfully demonstrates a robust SVM-based classification model to identify infected fish with high accuracy, using a novel dataset of real and augmented images. Through advanced image processing techniques like k-means segmentation, cubic spline interpolation, and adaptive histogram equalization, we enhanced image adaptability, which improved classification performance. Comparative analysis with other classifiers highlights the superiority of our model in accurately detecting fish infections. Future work will expand on this by exploring CNN architectures and developing an IoT-based solution for aquaculture, enabling proactive disease management and benefiting globally.

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