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SCHOOL OF SCIENCE, ENGINEERREING, & TECHNOLOGY

Seamless Security: Developing an e-Commerce Platform for Digital Watermarking of Product Images

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BACKGROUND & MOTIVATION

Vietnam's e-commerce market is currently plagued by image theft, which harms sellers and erodes consumer trust.
Our project, Seamless Security, offers a solution by developing a new e-commerce platform with a built-in, invisible digital watermarking system.
This technology automatically embeds a hidden watermark into product images, serving as a powerful, automated tool for intellectual property protection.
Our goal is to create a more secure and trustworthy marketplace, ultimately benefiting both sellers and buyers.

OBJECTIVES

Platform Development: Develop and implement a full-featured e-commerce platform.

Watermarking System: Design and integrate a robust invisible digital watermarking system using a hybrid DWT-SVD algorithm.

Imperceptibility: Ensure the high visual and color quality of the image, while preserving the ability to extract the watermark

Robustness: Achieve high watermark resilience against common image processing attacks (e.g., compression, cropping), with goals of high PCC score for detection.

Detection Mechanism: Implement a detection system by extracting the watermark to prevent the upload of product images with pre-existing watermark.

ARCHITECTURE & FLOW

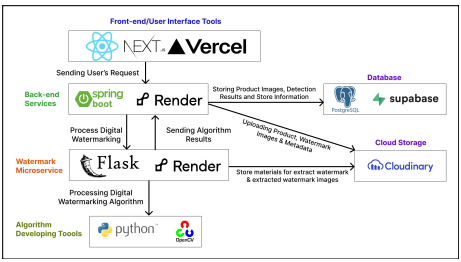


Figure 1. Origity's system architecture

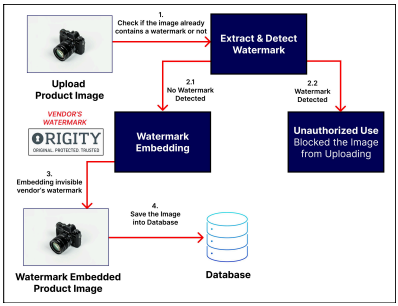
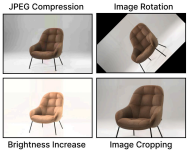


Figure 2. Watermarking system operation flow

EXPERIMENTS & RESULTS

- **Image Processing Attack Methods:**

Watermark Embedded Product Image



- **Extraction Results:**

Watermark Embedded in the Product Image

Extracted Watermark after Image being Attacked

- **Extensive Testing Data Results: Tested with 20+ images for each category**

Metrics	Testing Images Category	Testing Score Performance	Score
PCC	Product on White Background	Best	0.85
		Worst	0.62
		Average	0.735
	Product on Colored Background	Best	0.74
		Worst	0.6
		Average	0.85
	Product on Textured Background	Best	0.62
		Worst	0.21
		Average	0.415

Metrics	Testing Images Category	Testing Score Performance	Score
PCC	Square Product Image (250x250, 500x500, ...)	Best	0.85
		Worst	0.73
		Average	0.79
	Wide Product Image (150x400, 200x800, ...)	Best	0.77
		Worst	0.52
		Average	0.645
	Long Product Image (500x250, 800x200, ...)	Best	0.69
		Worst	0.19
		Average	0.44

An extensive testing was conducted to visualize the extracted watermark image quality on **different image characteristics** by embed the watermark in then extract and compared with the original watermark image for visualizing the PCC Score.

***Pearson's Correlation Coefficient (PCC):** Similarity in Intensity patterns between the extracted watermark and original watermark (0 → 1)

Conclusion:

- Bad extraction quality in some image is considered inevitable due to the difference in the characteristic of the original product image
- The embedded product image's color may changes slightly due to an extremely common real-life scenario: **Color Blending**

CONCLUSION

The results demonstrated that the hybrid DWT-SVD watermarking system is robust and resilient against common image processing attacks (compression, cropping, brightness adjustment), with consistently high detection scores.

Our project successfully integrated this advanced watermarking technology into a fully functional e-commerce platform. This provides a practical and effective solution for securing product images and protecting intellectual property in a digital marketplace.

Looking forward, this technology can be expanded to detect watermarks on a larger scale and can be adapted to protect other forms of digital media, such as video and audio. Our work provides a solid foundation for building more secure and trustworthy online platforms.