Project Report

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1. Introduction

Digital Image Processing (DIP) is the technique of manipulating digital images using computational algorithms. One important application is **image watermarking**, which ensures **ownership and authenticity** of digital images.

This project implements a **step-wise image watermarking system** where multiple images are processed sequentially, with a final watermark applied to demonstrate proof of processing. The watermark includes copyright information and the last processed date/time.

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2. Objectives

The main objectives of this project are:

- To understand the fundamentals of **Digital Image Processing**.
- To process multiple images **step-by-step**.
- To apply watermarking **only in the final step** for authenticity.
- To provide **clear visual proof** of processing.
- To develop a professional academic project.

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3. Tools & Technologies Used

- **Python** – Programming language
- **OpenCV (cv2)** – Image processing library
- **NumPy** – Numerical operations
- **Matplotlib** – Image visualization
- **Google Colab** – Execution environment
- **OS & Shutil Libraries** – File management

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4. Methodology / Processing Steps (Theory)

Step 1: Upload & Original Image

- Users upload multiple images.
- Original images are saved in `results/original/`.
- **Purpose:** Maintain unmodified reference images for comparison.

Step 2: Grayscale Conversion

- Convert images from RGB to grayscale.
- Reduces complexity and prepares images for filtering.
- **Purpose:** Simplifies images for further processing.

Step 3: Gaussian Blur Filtering

- Apply Gaussian blur to smooth images and reduce noise.
- **Purpose:** Prepares images for watermarking while preserving quality.

Step 4: Watermarking (Final Step)

- Add watermark text with **Copyright © Aleeha** and **Last Processed Date & Time**.
- Applied only at the final step.
- **Purpose:** Ensures ownership and authenticity.

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5. Results & Screenshots (Theory)

- All images are processed successfully in a **step-wise manner**.
- The final watermark guarantees ownership.
- **Note:** Screenshots of each step can be inserted manually after running the code.

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6. Key Features

- Step-by-step processing workflow
- Watermark applied only in the final step
- Organized folder structure for outputs
- Suitable for academic submission

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7. Applications

- Protecting digital image ownership
- Academic learning of image processing techniques
- Demonstration of digital watermarking
- Understanding image filtering and visualization

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8. Conclusion

This project demonstrates a **step-wise image watermarking system** using Python and OpenCV. By applying the watermark only in the final step, the system ensures **ownership authenticity** while providing **clear proof** of each processing stage.
