Count to Decorate: Hand-Controlled Interactive Christmas Tree

Project Overview

Count to Decorate is an interactive application that lets users decorate a digital Christmas tree using hand-gesture commands detected through a webcam. By showing numbers with their fingers (1, 2, 3…), users can select digital ornaments and place them on the tree, creating a fun and seasonal Natural User Interface (NUI).

This project applies principles learned in Digital Image Processing, including:

- brightness/darkness adjustment
- blurring and sharpening
- mosaic effects
- histogram contrast stretching
- histogram equalization
- image composition

It also introduces computer vision techniques such as hand gesture recognition and real-time webcam processing.

Team Members

Name	Year	Role
Juyeon Lee (이주연)	4th year	Hand Gesture Team • Team Leader
Ines Hafraoui	4th year (France)	GUI Team
Minseo Cho (조민서)	3rd year	GUI Team
Sowon Kim (김소원)	3rd year	Hand Gesture Team

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Introduction

The goal of this project is to create an intuitive, joyful, and seasonal interaction experience where users can decorate a digital Christmas tree without touching a keyboard or mouse. Instead, they simply use their hands.

By combining image processing techniques with a hand-gesture-based interface, we aim to provide:

- a creative form of visual interaction
- a demonstration of real-time computer vision
- a playful holiday-themed application

Why Hand Gesture Interaction?

We chose hand gesture recognition for several reasons:

- Natural User Interface (NUI)
  Gestures are intuitive and direct — users interact with digital content the same way they interact with the real world.

- Immersive Experience
  Decorating a tree with your hands feels more playful and engaging than clicking with a mouse.

- No Special Hardware Needed
  The system works with a standard webcam, making it accessible and easy to set up.

- Practical Educational Value
  Hand-gesture detection allows us to apply and understand:

  - image thresholding
  - region segmentation
  - contour/area measurement
  - time-series gesture stability
  - real-time video processing

System Overview

1. Hand Gesture Recognition

- Captures webcam frames.

- Segments the hand region (color-based or MediaPipe Hands).

- Computes the number of raised fingers.

- Interprets gestures as commands:

```
1 → ornament 1
2 → ornament 2
3 → ornament 3
etc.
```

2. Tree & Ornament Visualization
   Renders a digital Christmas tree in a graphical window.
   Displays available ornaments in a side menu.
   Allows users to add, toggle, or remove ornaments.

Uses custom image processing (no OpenCV pre-built functions) such as:

- compositing via manual pixel blending
- brightness/contrast adjustments on ornaments
- mosaic or blur effects as visual decoration styles

3. Interaction Flow

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```
User opens the app.
Clicks Start → webcam activates.
The system waits for a recognized gesture.
Recognized gesture selects the ornament.
The ornament is applied to the tree.
Additional gestures can remove/change decorations.
```

Survey

Types of User Interaction:

- Command-Based Interfaces
  CLI, keyboard shortcuts, menu selections.
- Touch-Based Interfaces
  Touchscreens, stylus input.
- Natural User Interfaces (NUI)
  Voice, hand gesture recognition → our project belongs here.
- Immersive Interfaces
  VR, AR, multi-modal interaction.

Related Works

Gesture-controlled installations such as
Aurora Borealis – Interactive Light Installation
(gesture-based environmental control)

These works show how touchless interaction can improve immersion in artistic or entertainment-oriented systems.

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Tools & Libraries

Computer Vision :

OpenCV – for webcam capture, drawing utilities
MediaPipe Hands – gesture detection model

Graphics / UI

Qt (PyQt6 or PySide6 for Python)
or
Tkinter (simpler, but less polished)

Multithreading (if needed)

threading / multiprocessing (Python)

Hardware

Standard webcam
Laptop or desktop computer (Windows or Linux)