PCBWIZ

ELECTRICAL COMPONENT DETECTION

USING OPENCV AND MACHINE LEARNING

TEAM RSA

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PROJECT INTRODUCTION

Welcome to the " Electrical Component Detection" project presentation. In this project, we explore the application of computer vision techniques to identify and label various electrical components in real-time using OpenCV and ML.

This project is to showcase our approach in leveraging OpenCV, a popular computer vision library, to analyze webcam frames and identify electrical components through contour analysis and ML. We will delve into the methodology, technologies used, and provide a demonstration of the project's capabilities.

OBJECTIVE

The identification of electrical components is crucial in various fields, including electronics maintenance, robotics, and automation. Rapid and accurate recognition of components such as capacitors, LEDs, chips, resistors, and transistors etc. can streamline troubleshooting processes and enhance the efficiency of electronic systems.

Technologies Used

- OpenCV for image processing
- Python programming language
- Webcam for capturing frames

1. Capturing Webcam Frames
The project starts by opening a connection to the webcam using OpenCV.
The cv2.VideoCapture function is used to access the default camera (represented by 0).

2. Image Processing
Each frame captured from the webcam is converted to grayscale to simplify processing.
Gaussian blur is applied to reduce noise in the image, improving the accuracy of subsequent operations.
Adaptive thresholding is employed to convert the blurred image into a binary image. Adaptive thresholding is particularly useful in handling varying lighting conditions.

3. Edge Detection
The Canny edge detector is used to identify edges in the binary image. This step helps in highlighting the boundaries of objects within the image.

4. Contour Detection
Contours are identified in the edge-detected image using the cv2.findContours function.
Contours represent the boundaries of connected components in the image.

5. Component Identification

The project defines a function (get_component_label) to analyze the contours and determine the type of electrical component based on its aspect ratio.

The aspect ratio is calculated from the bounding box of each contour.

6. Displaying Results

For contours with an area greater than a specified threshold, a bounding box is drawn around the identified electrical component on the original frame.

The component label is displayed near the bounding box.

7. Real-time Presentation

The processed frames are continuously displayed in real-time using OpenCV.

The user can see the webcam feed with identified electrical components and their labels.

THANK YOU