BARCODE DETECTION AND DECODING

Project submitted to the

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for the partial fulfillment of the requirements to award the degree of

Bachelor of Technology

In

Computer Science and Engineering

School of Engineering and Sciences

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Certificate

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This is to certify that the work present in this Project entitled "**BARCODE DETECTION AND DECODING"** has been carried out by **P. DURGA MAHESH, G. JASHIT RAJIV, N. DURGA NAVEEN, M. KARTHIK, P. SAI AKASH** under our Professor supervision. The work is genuine, original, and suitable for submission to the SRM University – AP for the award of Bachelor of Technology/Master of Technology in **School of Engineering and Sciences**.

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Abstract

This project focuses on detecting and decoding barcodes from images using computer vision techniques. Tools such as OpenCV and ZBar were employed to preprocess images, locate barcodes, and extract the encoded data. The system processes an input image, highlights the detected barcodes, and decodes the information they contain. This solution offers an efficient and low-cost alternative to traditional barcode scanners and is applicable in areas such as retail, inventory management, and ticketing systems.

1.Introduction

1.1 Problem Statement

Barcodes are widely used to encode information, such as product details, for easy scanning and identification. Traditional barcode scanners are often costly and inflexible. This project aims to develop an efficient and cost-effective solution to detect and decode barcodes from images using computer vision techniques.

1.2 Motivation

Barcodes are ubiquitous, appearing on products, shipping packages, and tickets. This project's motivation stems from the need to:

- Provide a fast and reliable solution for barcode detection and decoding.
- Eliminate the dependence on expensive hardware scanners.
- Enhance item tracking and management in industries like retail, shipping, and inventory management.

1.3 Objectives

The key goals of this study are:

- To detect and decode barcodes using images.
- To process images using OpenCV for locating and highlighting barcodes.
- To decode barcode information using ZBar, accommodating various types of barcodes (e.g., QR codes, Code128).

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2. Methodology

2.1 Image Processing Steps

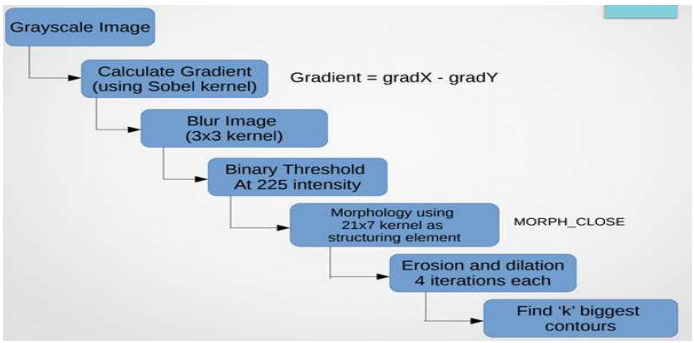
- Resizing: Input images are resized for consistent processing.
- Grayscale Conversion: Images are converted to grayscale for simplified analysis.
- Gradient Computation: Edge detection is performed using gradients to identify sharp intensity changes.
- Enhancement: Subtraction and smoothing operations are applied to highlight barcode regions.
- Thresholding: Images are binarized to focus on barcode-like structures.

2.2 Barcode Localization

- Contour Analysis: Contours in the image are analysed to identify the largest, rectangular-shaped regions as potential barcodes.
- Highlighting: A bounding rectangle is drawn around detected barcodes for visualization.

2.3 Decoding Barcodes

- ZBar Integration: The ZBar library is used to decode barcode data and identify the barcode type.



3. Results and Discussion

3.1 Results

- Detected barcodes were successfully highlighted in input images.
- The decoded data, such as product details or identifiers, was displayed on the screen.
- The solution demonstrated compatibility with various barcode formats, including QR codes and Code128.

3.2 Advantages

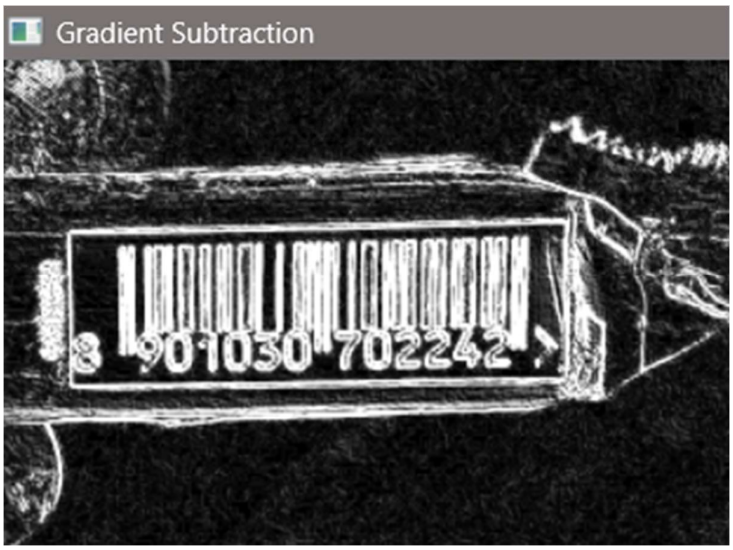
- Works with a variety of barcode types and formats.
- Requires only standard image inputs, eliminating the need for specialized hardware.
- The system is scalable and adaptable to various industries.

3.3 Industry Applications and Impact

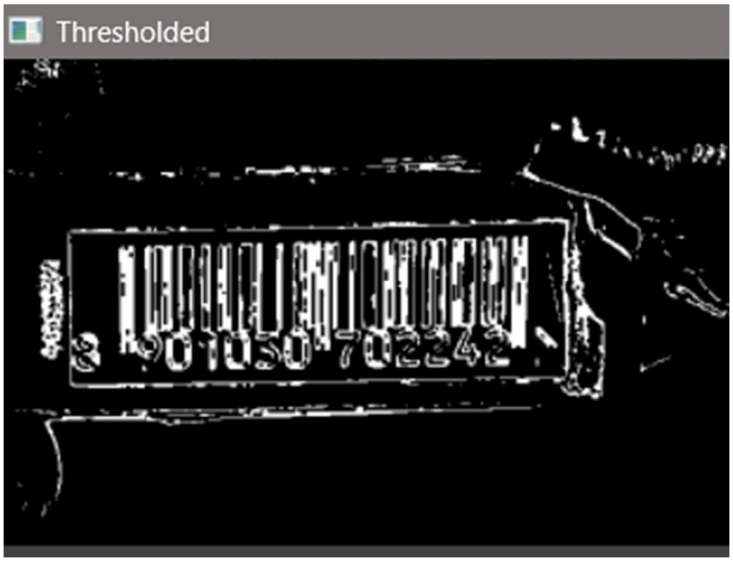
- Retail Enables automated checkout systems and efficient inventory management without requiring physical scanners.
- Logistics and Supply Chain Facilitates package tracking and warehouse automation, reducing processing time and improving accuracy.
- Health care Ensures error-free tracking of medications and rapid access to patient records via barcode-scanned wristbands.
- Education and Research Streamlines library cataloging and inventory tracking in academic institutions.

4.Outputs

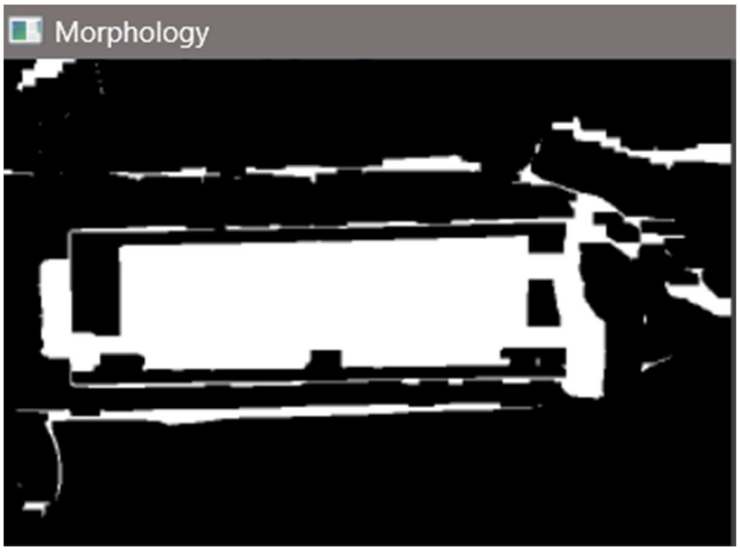
4.1 Gradient Subtraction



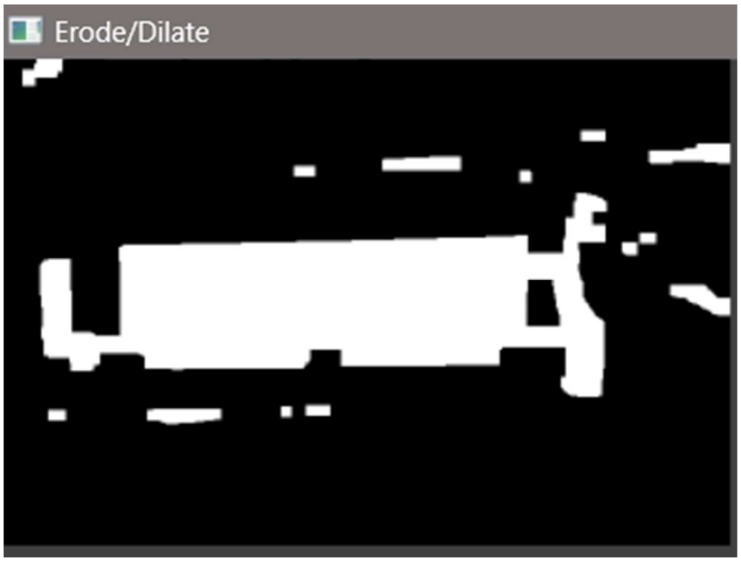
4.2 Threshold



4.3 Morphology



4.4 Erode



4.5 Detected Barcode

4.6 Barcode data

```
e:\3.2\frontend\project\tempCodeRunnerFile.python:36
  box = np.int0(cv2.boxPoints(rect))
Detected Barcode - Type: EAN13, Data: 8901030702242
```

5. Industry Use

Barcode detection is an essential part of many industrial processes, including:

- **Inventory management**: Barcodes help companies track and manage their inventory by updating product information in a database.
- **Product tracking**: Barcodes can be used to trace parts or shipments, and document the stage of manufacturing, vendors, and material origin.
- **Product authenticity**: Barcodes can help verify the authenticity of products.
- **Biometric checking**: Barcodes can be used for biometric checking.

Barcode scanners can be used in a variety of industries, and are the backbone of industrial connectivity. They can be used in manufacturing, logistics, retail, and more.

6. Concluding Remarks

The project successfully implemented a barcode detection and decoding system using OpenCV and ZBar, offering a cost-effective alternative to traditional scanners. By using standard image inputs and open-source tools, it eliminates the need for specialized hardware, making it accessible to small and medium-sized enterprises. The system demonstrated high accuracy in detecting barcodes under diverse conditions and effectively decoded data from formats such as QR codes and Code128. Its scalability and versatility make it suitable for applications in retail, logistics, healthcare, and inventory management. In retail, it enables automated checkouts and efficient inventory audits. For logistics, it enhances package tracking and warehouse operations. In healthcare, it ensures accurate medication tracking and patient record management. The project highlights the potential of computer vision in solving practical problems and lays the groundwork for future enhancements. Possible advancements include real-time processing, mobile application deployment, and AI-driven analytics integration. Overall, it provides a reliable, low-cost, and scalable solution for modern industries.

7. Future Work

Future enhancements include:

- Develop a mobile application for real-time barcode detection using smartphone cameras, offering portability and ease of use.
- Extend compatibility to more complex barcode formats, including custom or industrial codes, and handle challenging conditions like poor lighting or motion blur.
- Optimize the system for edge computing, enabling offline usage on embedded devices such as drones and handheld scanners for remote applications.
- Integrate advanced machine learning models to improve detection accuracy, processing speed, and resilience against false positives.
- Incorporate a cloud-based database for efficient storage and retrieval of product or inventory details, making the system suitable for enterprise-scale operations.
- Enhance system scalability to support bulk processing of images and enable seamless integration with existing enterprise software solutions.

8.References

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