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IPMV MINI PROJECT REPORT	
PROJECT NAME	**To find the number of pipes or straws in given image using atleast two methods.**
ELECTRONICS AND TELECOMMUNICATION ENGINEERING	

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SEM/Year/CAY	VI/TE/2023-24
Problem Statement (Initial Goal)	In many industrial and engineering scenarios, it's crucial to accurately detect and count pipes or straws in images for various purposes such as quality control, inventory management, and maintenance scheduling. This project aims to develop a system that automatically detects and counts pipes/straws in given images using at least two different methods: preprocessing techniques with thresholding and the Hough Circle Transform.
OBJECTIVE(s)	The main objective of this project is to develop algorithms that can accurately identify and count the number of pipes/straws present in a given image using two distinct methodologies. By comparing the results obtained from both methods, we aim to evaluate their effectiveness, efficiency, and reliability in pipe/straw detection.
SPECIFIC:	Develop a system capable of automatically detecting and counting pipes or straws in images using preprocessing techniques with thresholding and the Hough Circle Transform.
MEASURABLE:	The system should accurately detect and count pipes or straws in given images with a high degree of precision and provide a quantitative measure of the detected objects.

ACHIEVABLE:	By leveraging image processing algorithms and techniques, it is feasible to develop a system that can effectively identify and count pipes or straws in images.
RELEVANT:	Accurate detection and counting of pipes or straws in images are crucial for various industrial and engineering applications such as quality control, inventory management, and maintenance scheduling.
S.M.A.R.T. Goal	By the end of the project, the developed system should be able to detect and count pipes or straws in images with an accuracy rate of at least 95%.

Introduction :

The task at hand involves the development of a system that can automate the detection and counting of pipes or straws in images. This system will employ preprocessing techniques with thresholding and the Hough Circle Transform to achieve its objectives.

Description:

The project seeks to bridge the gap in industrial and engineering domains by providing a robust solution for automating the detection and enumeration of pipes or straws within images. Through the utilization of advanced computer vision techniques, the system will be adept at scrutinizing images, discerning relevant features indicative of pipes or straws, and subsequently tallying their occurrences. By doing so, it aims to streamline processes such as quality assurance, inventory management, and maintenance scheduling, thereby enhancing operational efficiency and minimizing human intervention in these critical sectors.

Describe idea of your project:

The project revolves around leveraging image processing techniques to automate the detection and counting of pipes or straws in images. By implementing preprocessing techniques such as thresholding, the system will enhance the quality of images, making it easier to identify objects of interest. Additionally, the Hough Circle Transform will be utilized to detect circular objects, which are characteristic of pipes and straws. Overall, the goal is to develop a robust system that can accurately count these objects in various industrial and engineering settings.
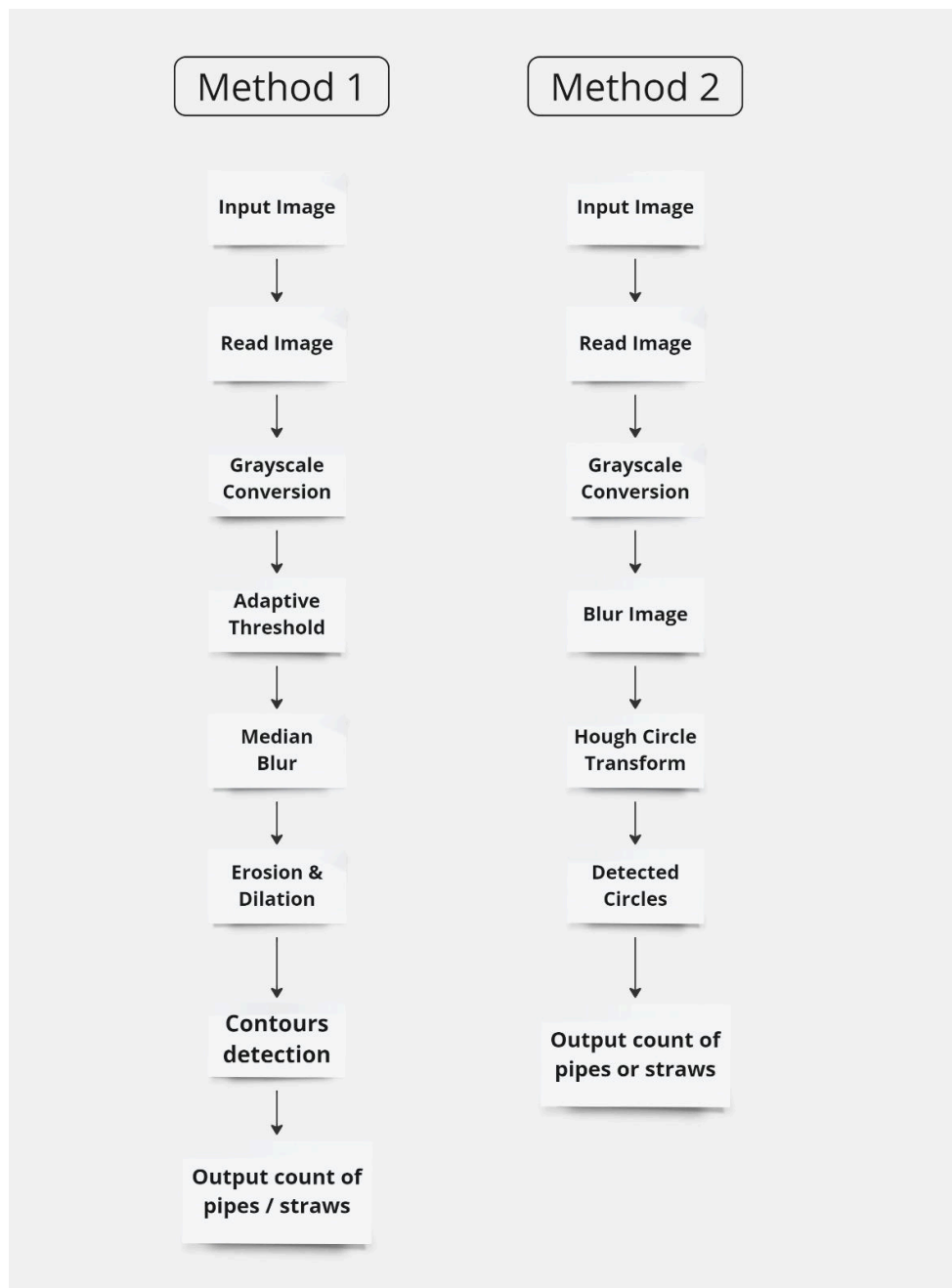
Methodology :

Preprocessing Techniques and Thresholding:

- Convert the input image to grayscale to simplify processing.
- Utilize adaptive thresholding to create a binary image, highlighting regions of interest.
- Apply median blur to reduce noise and smooth the image.
- Perform morphological operations like erosion and dilation to clean up the binary image.
- Detect contours in the binary image and draw bounding circles around detected regions.
- Count the number of detected circles to determine the total number of pipes/straws.

Hough Circle Transform:

- Convert the input image to grayscale.
- Apply blur to the grayscale image to reduce noise.
- Utilize the Hough Circle Transform algorithm to detect circles in the blurred grayscale image.
- Adjust parameters such as dp, minDist, param1, param2, minRadius, and maxRadius to fine-tune circle detection.
- Draw circles on the original image corresponding to detected circles.
- Count the number of detected circles to determine the total number of pipes/straws.

Block Diagram :-

Method 1

Input Image
↓
Read Image
↓
Grayscale Conversion
↓
Adaptive Threshold
↓
Median Blur
↓
Erosion & Dilation
↓
Contours detection
↓
Output count of pipes / straws

Method 2

Input Image
↓
Read Image
↓
Grayscale Conversion
↓
Blur Image
↓
Hough Circle Transform
↓
Detected Circles
↓
Output count of pipes or straws

References:

1. R. C. Gonzalez, R. E. Woods, and S. L. Eddins, "Digital Image Processing Using MATLAB," Gatesmark Publishing, 2020.
2. R. O. Duda, P. E. Hart, and D. G. Stork, "Pattern Classification," Wiley, 2012.
3. M. Sonka, V. Hlavac, and R. Boyle, "Image Processing, Analysis, and Machine Vision," Cengage Learning, 2014.

Mentor Name & Signature with date: