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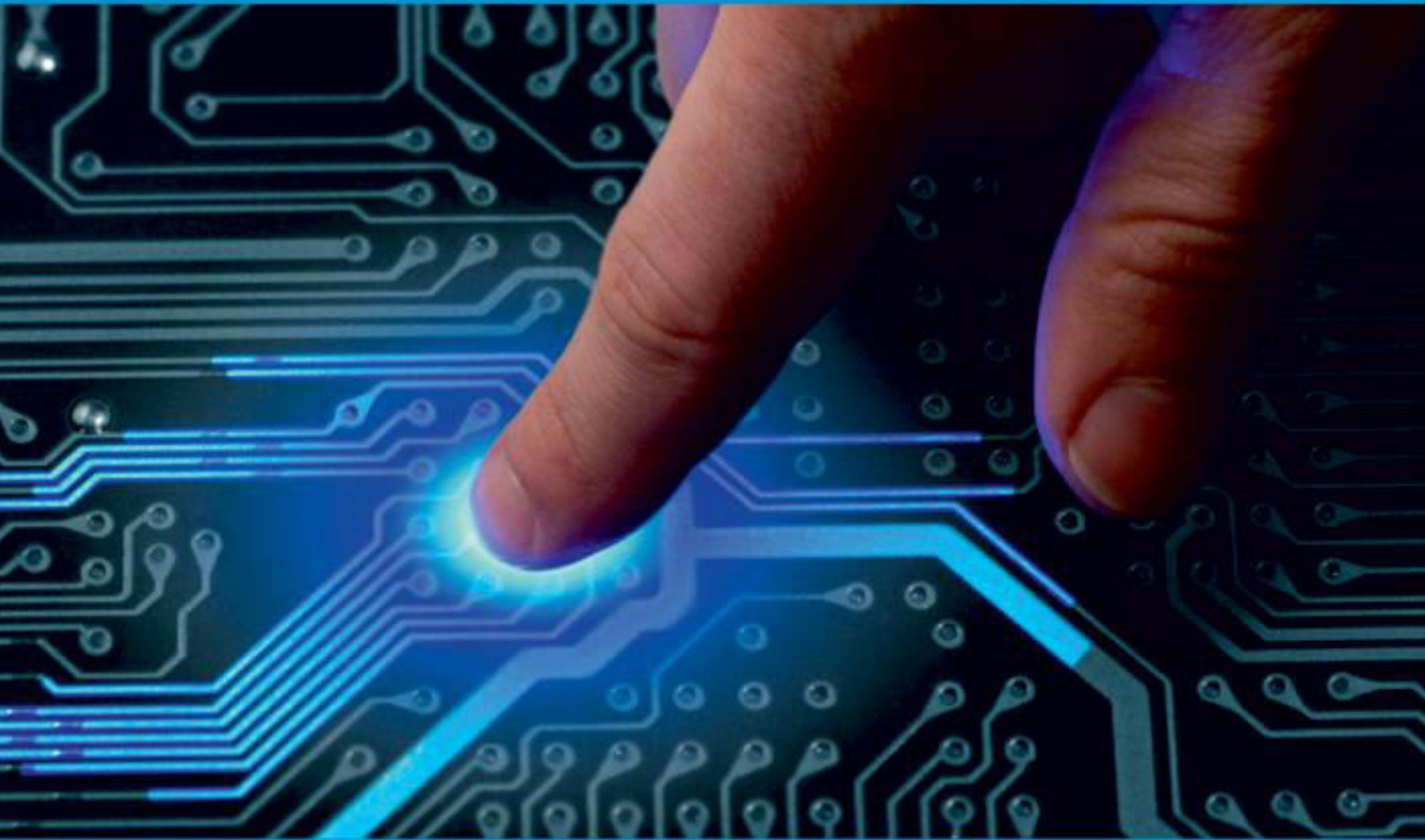

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Analyze – Real-Time Object Detection and Measurement Dimensional Check of Mechanical parts using Digital Image processing

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ABSTRACT: Quality Assurance and dimensional check of mechanical parts using digital image processing, study presents an enhanced technique for detecting objects and computing their measurements in real time from video streams. We suggested an object measurement technique for real-time video by utilizing OpenCV libraries and includes the canny edge detection.

KEYWORDS: Segmentation, Image Processing, mechanical parts/jobs, Camera.

I. INTRODUCTION

In mechanical industry there are various products and mechanical jobs/parts which are used in various automobiles. This products are produced using various techniques such as moulding, cutting etc. So some of the mechanical jobs/parts are produced by cutting technique and for this may machines is being used such as CNC, VMC etc. But after producing the product it should be checked or validated. So now in industry the mechanical jobs/parts are validated using complex measuring tools or using laser machines. As the production of each every mechanical jobs/parts is huge quantity i.e minimum 200 jobs each day. So it very difficult to check those many jobs/parts with complex measuring parts or it is very slow process using measuring tools. And if we talk about laser machines it is very expensive not affordable by every vendors. So our aim is to give a solution to solve these two problems which is fast dimension checkwith affordable price. Using image processing it is possible to solve this problems by finding the dimensions of the mechanical parts/jobs by taking image of the parts and finding the job dimension. This introduces importance of real- time object dimension measurement in industrial applications, Background and significance of object detection and dimensioning. Overview of OpenCV and its capabilities for measuring object dimensions.

II. OBJECTIVES

Discuss the benefits of automated fault detection, including increased productivity, reduced downtime, and improved product quality. The objective is to enhance inspection processes, reduce human involvement, and improve the overall reliability and productivity of mechanical systems. Explanation of the object detection process using computer vision algorithms.

III. LITERATURE REVIEW

(1)Describe the solution real-time object detection and dimensioning of objects is an important issue from many areas of industry. This is a vital topic of computer vision problems. This study presents an enhanced technique for detecting objects and computing their measurements in real time from video streams.

We suggested an object measurement technique for real-time video by utilizing OpenCV libraries and includes the canny edge detection, dilation, and erosion algorithms(6).

The suggested technique comprises of four stages: identifying an object to be measured by using canny edge detection algorithm, (2) using morphological operators includes dilation and erosion algorithm to close gaps between edges, (3) find and sort contours, measuring the dimensions of objects. In the implementation of the proposed technique, we designed a system that used OpenCV software library(7).

(4)Describes a machine learning approach for visual object detection which is capable of processing images extremely rapidly and achieving high detection rates.Object Recognition is a technique used in the field of computer. It is assumed to be one of the most difficult and challenging tasks in computer. Many methods have been proposed

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in the past, and a model with new techniques which is not only fast but also reliable. Easynet model has been compared with many other models as well. At the time of prediction, our model bring forth scores for the presence of the object in a particular category.

IV. **RELATED WORK**

1) Proposed algorithm

Canny Edge Detector

- Image Acquisition: Capture an image of the mechanical job or component using a digital camera .

- Preprocessing: Convert the image to grayscale if it is in color.

- Edge Detection: Apply the Canny edge detection algorithm to the preprocessed image. The Canny algorithmdetects edges by looking for significant changes in intensity. It produces a binary image where edges are represented as white pixels and non-edges as black pixels.

- Edge Analysis: Once the edges are detected, you can analyze them to measure dimensions or perform quality checks. This step may involve additional image processing techniques such as geometric transformations, contour analysis, or feature extraction. Its accuracy and effectiveness depend on various factors such as image quality, lighting conditions, and the complexity of the mechanical job. Calibration andoptimization may be required to achieve accurate dimension checks.

- Negatives
    - The Canny edge detector can sometimes fragment edges into multiple small segments, especially in regions with complex geometry or texture. This fragmentation can make it challenging to accurately determine the dimensions of the mechanical parts, as the edges may not align correctly.

    - If the mechanical parts being analyzed have occluded or shadowed regions, the Canny edge detector may struggle to detect edges accurately in those areas. This can introduce errors in dimension measurement, especially if the occluded or shadowed regions are critical for determining the part’s dimensions. It is essential to consider these limitations and negatives when utilizing digital image processing techniques, including the Canny edge detector, for dimension estimation of mechanical parts. Additional preprocessing steps.

2) Hardware and Software requirements:

Camera specification: 720px hd
Camera And object distance range: 30-40 cm (Recommended)

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Software: Python Libraries.

Modules In brief:

V. PSEUDO CODE

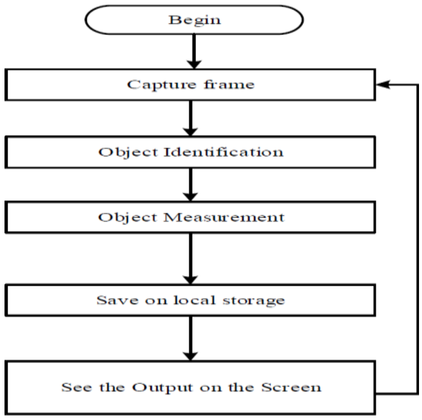


Fig 1. Work flow diagram

Mode 1:Auto mode-

Dimensions are visible Automatically , No requirement of specific variable.
Gaussian and Threshold To be an added feature to blur Edges and Match to Background color , Usually Contrastexpected.

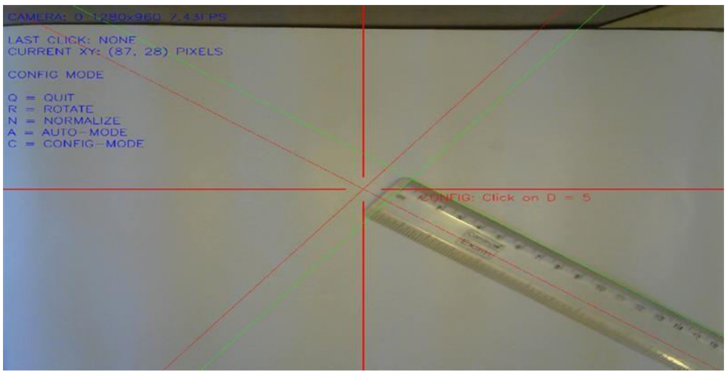
Mode 2:Normal mode

Mode 3:Rotate mode-

When Object to be measured not aligned specifically, could rotate to specific required orientation.Rotated with 90 degrees.

Mode 4-Confic mode-

Config call variable , Scale distance , camera distance to be an parameter of discussion in this particular mode.
Images below describe confic Mode in detail.



Cal_range :165
Distance : 37cm camera to object

distanceCamera specification:720px hd

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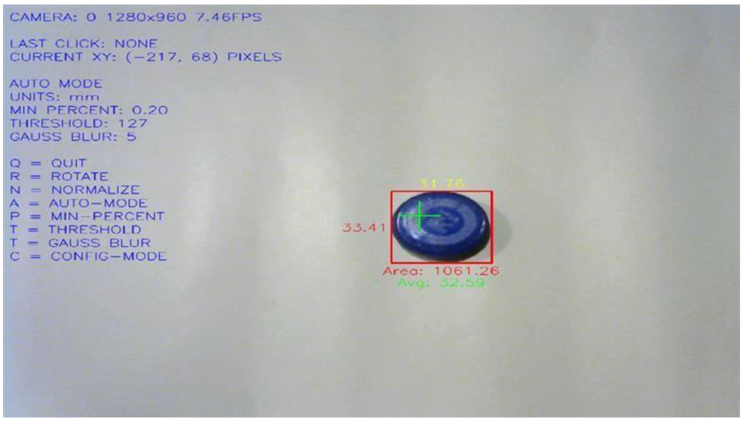
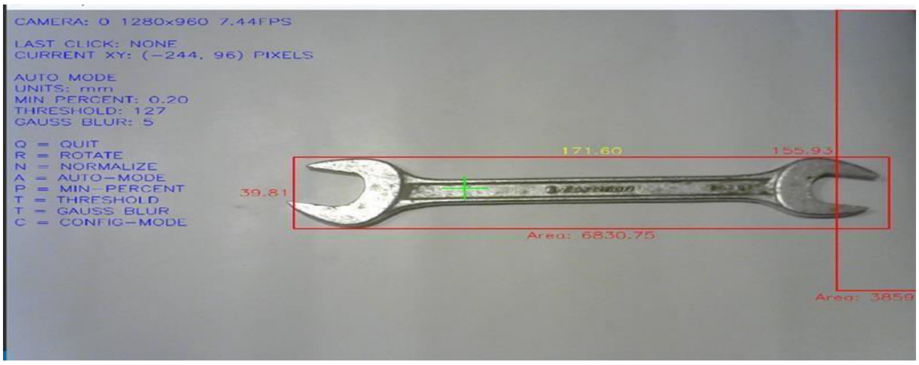
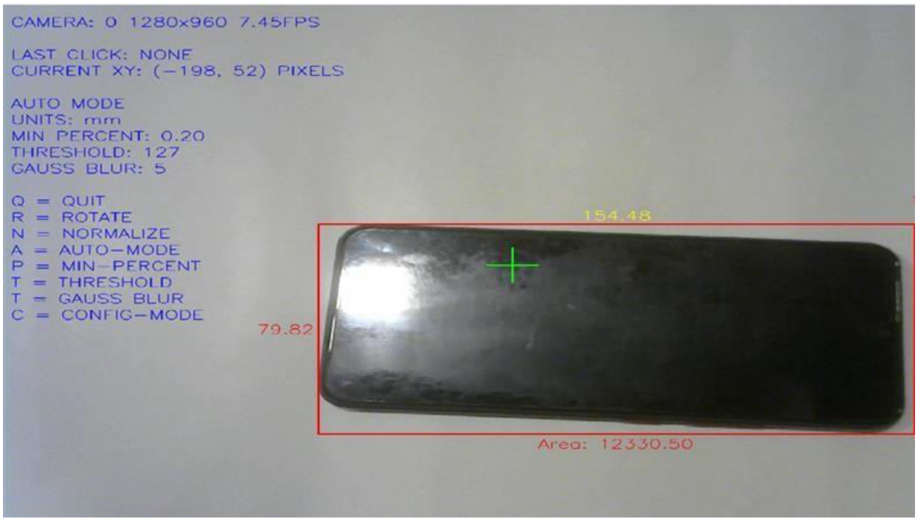


Object 1 : vics small : 3 cm diameter (Expected)
33.41 mm(output)



Object 2 : screw driver : length 18 cm
Circular part width : 3.5(expected)



Object 3 : mobile Vivo :15.5cm length
7.3 width (expected)

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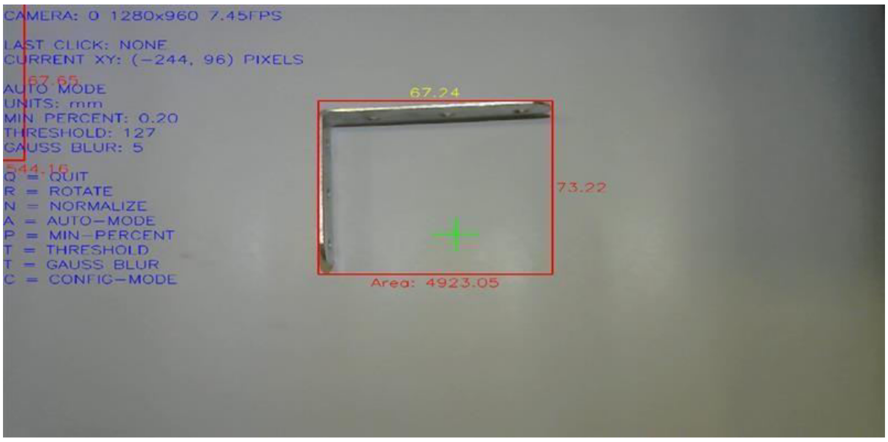

Object 4: mechanical

part: 7cm for both sides

(expected)
73.22mm(Output)

VI. Simulation Results

• Following Results were computed After The was Experiment performed:

• The Frames are captured via Camera As and when mechanical jobs moving on conveyor belt. Not necessaryObject should be captured from moving frame it can be stable object.

• To be taken into consideration no other object fall in frame of capture would return into measuring dimensions ofthat as well.

• Output Displayed with measurement of dimensions. To be noted measurement displayed in above fiq., are in mmunits.

• Comparison of the estimated dimensions with ground truth measurements or reference values. Calculation ofmetrics such as mean absolute error, root mean square error, or percentage error.

Example- Object 4- mechanical part
dimensionsExpected dimensions=7 cm (70
mm)
Output dimensions= 73.22
mmTherefore, 97.76 %
accuracy.

• The specific numerical results and findings will depend on the experimental setup, the quality of the dataset, and the effectiveness of the chosen image processing techniques. It is crucial to provide detailed analysis, quantitative measurements, and visual representations (e.g., graphs, images) to support the obtained results and draw meaningful conclusions from the experiment.

VII. Conclusion and Future Work

Proposed system is experimented for collection of components and we have obtained above 90(percent) of accuracy (The percentage calculation is based on the experiment performed as well Reference papers, Links been Used for analysis Purpose). Contour based feature extraction can be used to enhance the accuracy and it would be considered for future work. The advantages of using digital image processing for dimension measurement of mechanical parts are evident. It offers a non-contact and non-destructive approach, reducing the need for physical measurement tools and minimizing the risk of damaging the parts. Additionally, the automation provided by image processing techniques enhances productivity and reduces human error in the dimension measurement process. However, it is important to acknowledge the limitations and challenges associated with the proposed method.

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Variations in lighting conditions, surface textures, and complex geometries of mechanical parts can pose difficulties in edge detection and accurate dimension extraction. Calibration and optimization techniques should be considered to mitigate these challenges and improve measurement accuracy. To overcome Lighting and shadow effect closed container, Dark room , Enclosed Entity could be used as an an entity. In future research, advancements can be made by integrating additional image processing algorithms and techniques to enhance the dimension measurement process.

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