Geometrical Analysis-Length and Breadth of Objects

*Dr.T.A.Albinaa, *Roshini B
*Department of Data Analytics (PG)
PSGR Krishnammal College for Women, Coimbatore, India.

Abstract

This paper will show how to use the Open CV library for accurate length and width identification. The proposed technique relies on Open CV's strong image processing and geometrical analysis functions hence able to obtain real-time measurement of dimension accurately. By examining contours, bounding boxes and spatial relationships in the picture, OpenCV can precisely detect the dimensions of length and width. This is a technique that has great potential in manufacturing, quality control, and computer vision because automating these processes needs accurate measurements as well as quality assurance procedures.

Keywords: OpenCV, computer vision, contour, threshold, dimension.

1. INTRODUCTION

Critical to many industries such as manufacturing, construction and quality control is the accurate measurement of object dimensions, including length and breadth. Dimension measurements traditionally have been done manually leading to time-consuming, labour-intensive methods that are error prone. To address this issue, computer vision technologies have provided an alternative solution for automating dimension measurement tasks [1]. OpenCV (Open Source Computer Vision Library) is a versatile framework for image processing and analysis among the various tools available for computer vision applications [3]. It comes with a range of functions that help in contour detection, shape recognition; and geometric measurements making it ideal for dimensional identification-related activities. This project aims to use OpenCV capabilities to create a novel method for the accurate determination of length and width measurements [4]. Digital images or video streams can then be used by this approach which strives to exploit the strength behind image processing in OpenCV to correctly establish an object's dimensions. Accurate extraction of all relevant features from contours, edge detection and geometric calculations allows the system to determine the size of an object accurately [10].

Besides this, the method assesses range and width, as well as finds the area covered by them within an image. With OpenCV's spatial analysis and geometric calculations, there can be accurately calculated the area that is occupied by an object in a space providing some valuable insights for various applications [11]. This methodology has numerous applications in diverse industries like manufacturing where accurate measurements of dimensions are important to ensuring product quality and adherence to specifications. This study will focus on automating dimension measurement tasks using OpenCV to improve efficiency, reduce errors and enhance quality control processes in industrial sectors [12]. Additionally, OpenCV-based dimension detection aims at driving computer vision technologies forward

thereby enabling their application for automation and optimization purposes across different fields.

2. METHODOLOGY

The proposed system is based on the strength of OpenCV, a comprehensive open-source computer vision library, that will record the optimal and eco-friendly reading measures for duration and breadth of identity. this system fully relies on its strength whether on OpenCV image processing with rich characteristics or geometric evaluation, rendering real-time video cameras to give a precise dimension of objects in the surrounding environment [13].

Image Pre-processing:

The method of classification starts with treating the images and seeing whether the information is captured in a clear way needed for the accurate measurement of any object. Along with noise cancelling, photograph denoising and comparison enhancing are performed to consolidate the details of the objects and capabilities of the scene.

Contour Detection and Extraction:

OpenCV's Contour Detection Algorithms, which are utilised to recognize and extract objects' contours from the image, are hired for this purpose. Scents represent the outline of items and they offer some significant details for the dimension.

Geometric Analysis:

The gadget then carries out the phrasing out of the contours by applying the functions of OpenCV to get the length and width of the object. Spatial houses with all the attributes of boundaries, centres and area momentums are employed to calculate those dimensions that are essential.

Dimension Calculation:

The system utilizes the geometric sequences of contour houses which in turn, makes the system compute the duration and magnitude of the feature in the image. Others would be supporting it with trivial geometric terms or more difficult algorithms, that deal with the geometry of the objects.

Validation and Refinement:

The calculated values are defended by corresponding criteria or thresholds to make sure that the accuracy and believability are met. In a situation where inaccuracies are revealed, the use of refinement methods that would include the removal of outliers or smoothing could be necessary to improve the final results.

Output Presentation:

The last one is a finding of the application duration and width of the devices in a simple, viewable form to the consumer. They can be a supplement given specifically to the image according to the situation detected by the software to highlight those specific points.

2.1 Problem statement

The process of measuring traditional objects with the manual way leads to some spending of time and mistakes that experts connect with the human factor. As well, several specialist instruments could be necessary, preventing some measurements from being available in certain settings. This project deals with this problem by using a computer vision-based solution to measure the width and length of being through a webcam or other external camera.

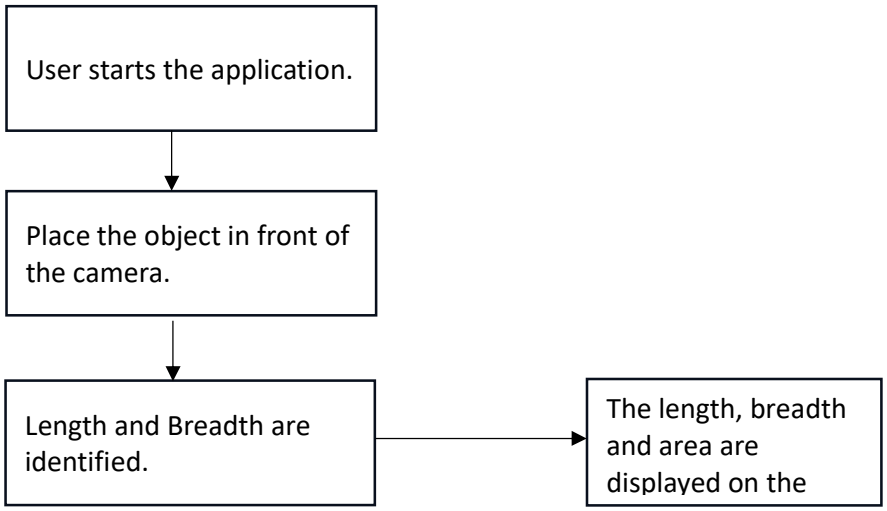
2.2 Proposed approach

The system is designed to recognize multiple objects simultaneously by analyzing the images of the surrounding environment captured by a computer's webcam or an external camera. It can provide accurate measurements of the object's dimensions and other information like the object's area of occupancy. The system is developed using Python programming language with the integration of several Python libraries, including queue, math, numpy, and computer vision (OpenCV-cv2). It consists of three modules (a, b, and c) that perform various system-related tasks, as explained below in sequence.

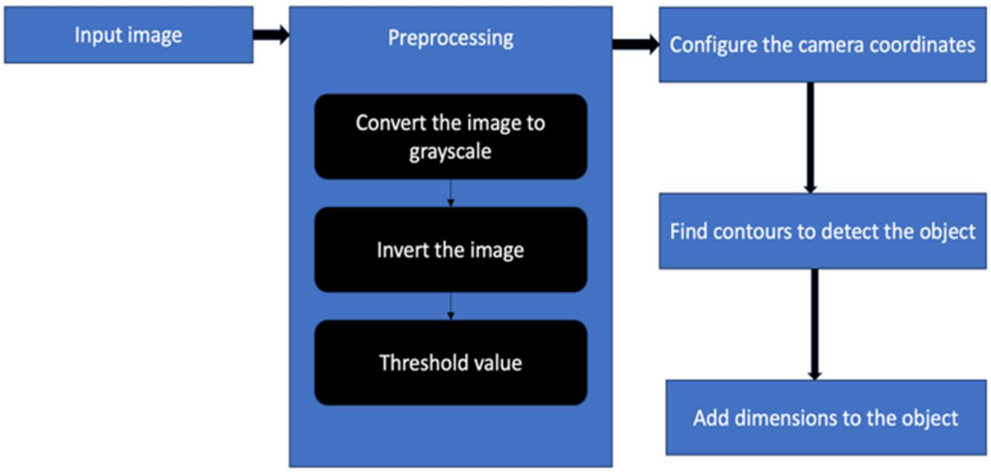
Module 1: The first module is responsible for obtaining the image frame input. This module enables the configuration of the environment by setting the camera width, height, and frame rate of the input.

Module 2: The second module captures the object's boundaries to detect multiple objects. It converts the input frame to grayscale to improve the clarity of details in the image. Then, the image thresholding technique is applied to identify contours.

Module 3: The third module is designed to extract object dimensions accurately. It uses the hypot method, which calculates the Euclidean distance, to measure the object's length and breadth



2.3 Process flow diagram



3. RESULT

The use of OpenCV creates a powerful system for object dimension identification. OpenCV enhances the accuracy of measurements through image processing and geometric analysis.

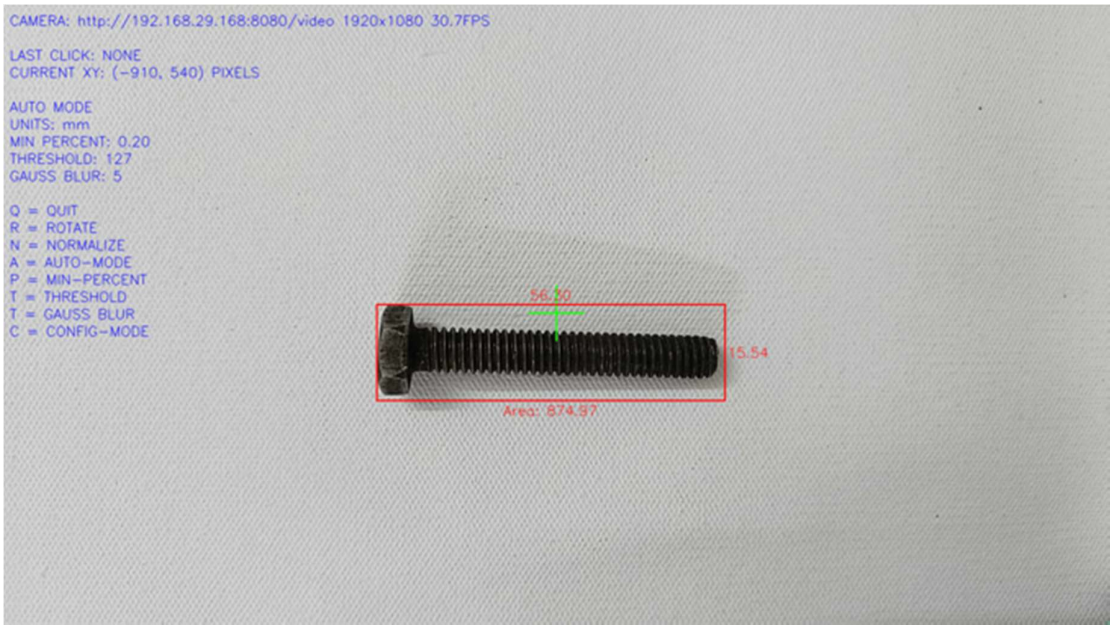


Fig.1 Sample Output

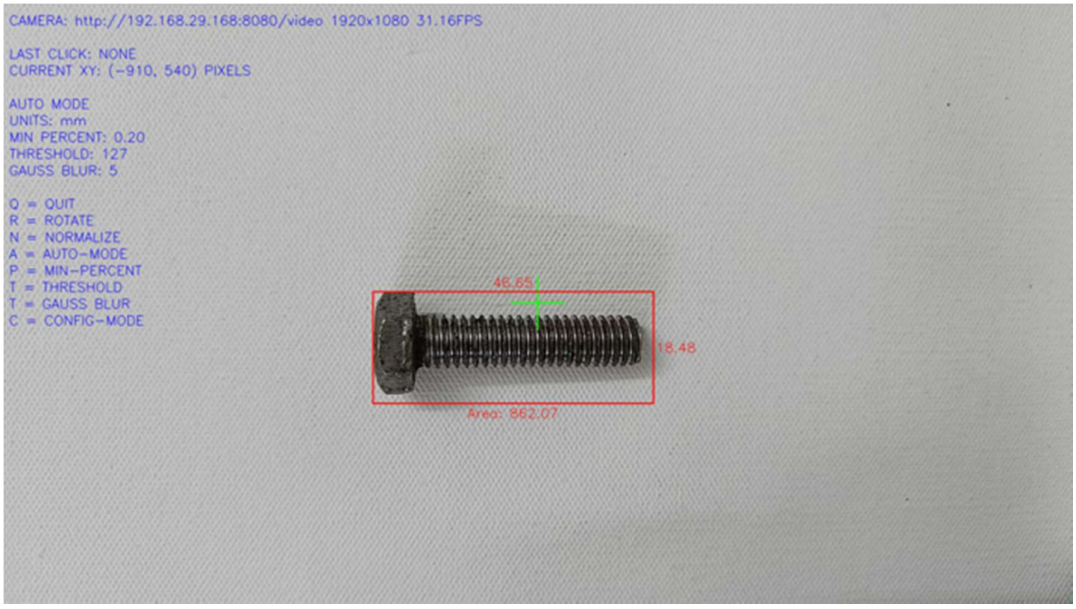


Fig.2 Sample Output

Object	Bolt 1	Bolt 2
Actual length of obj (mm)	54	44
Actual breadth of obj (mm)	13	14
Actual area of obj (mm)	702	616
Observed length of obj (mm)	56.3	46.65
Observed breadth of obj (mm)	15.54	18.48
Observed area of obj (mm)	874.93	862.07

To determine the accuracy of a measurement, one needs to compare the measured dimensions of an object with its actual dimensions and calculate the percentage error.

Percentagee Error = |OA − AA |/|AA| * 100

OA=Observed Area

AA=Actual Area

Accuracy (%) = 100 - Percentage Error

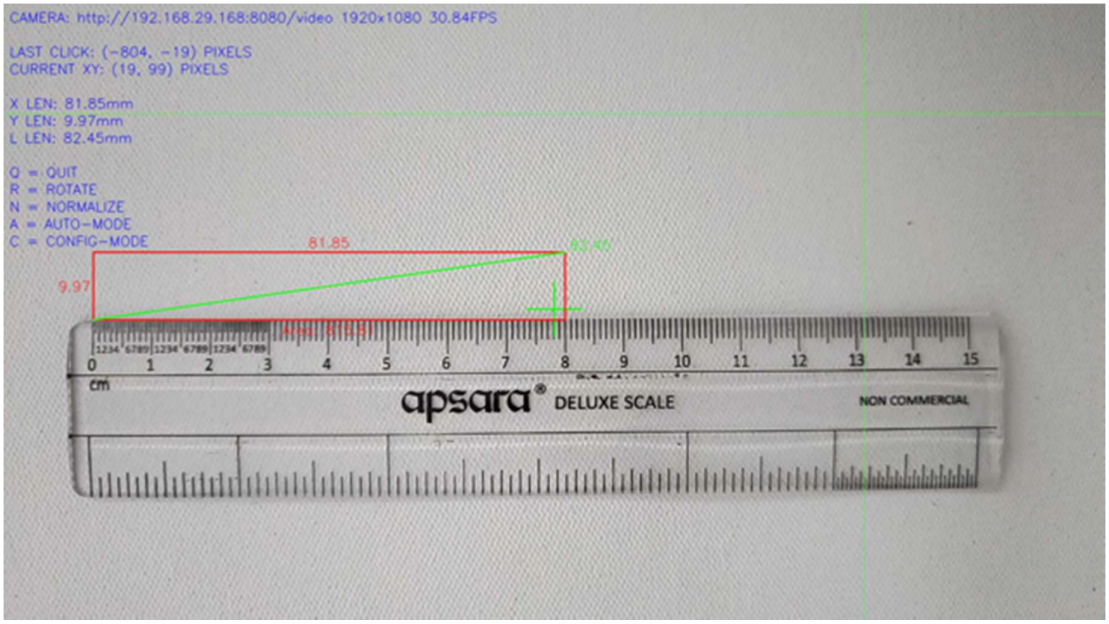


Fig.3 Accuracy of measurement

Object	**Scale**
Actual length of scale (mm)	80
Actual breadth of scale (mm)	10
Actual area of scale (mm²)	800
Observed length of scale (mm)	81.85
Observed breadth of scale (mm)	9.97
Observed area of scale (mm²)	815.81

Calculation: Scale

OA =815.85

AA=800

Percentage Error = |OA − AA |/|AA| * 100

= | 815.85 – 800 | / | 800 | * 100

= | 15.85 | / | 800 | * 100

≈ | 0.0197625 | * 100

Percentage Error ≈ 1.97625%

Accuracy (%) = 100 - Percentage Error

Accuracy (%) = 100−1.97625

Accuracy (%) ≈ 98.02375%

4. Conclusion

The work proposed in this study demonstrates the ability of computer vision to efficiently process, analyze and comprehend digital videos. The research focuses on object detection and dimension measurement and shows high accuracy levels in these areas. By obtaining object dimensions, the proposed work can calculate the area occupied by each object. This technology has a wide range of potential applications, including everyday use, e-commerce, industrial use, and AI automobiles.

5. References

[1] Chen. W, Yue. H, Wang. J, Wu.X. "A better edge discovery calculation for profundity map in painting." Optics and Lasers in Engineering 2014.

[2] Brain Team, V. Quoc Le, Google Research, R. Pang, M. Tan, "EffificientDet: Scalable and Efficient Object Detection", CPR, 2020.

[3] Geng Xing, Chen Ken, Hu Xiaoguang "A superior Canny edge identification calculation for variety picture" IEEE TRANSATION, 2012.

[4] G. Chandan, Mohana, A. Jain, "Real-Time Object Detection and Tracking by Using OpenCV and Deep Learning", ICIRCA, 2018.

[5] Muthu Krishnan. R, M.Radha "Edge Detection Techniques for picture Segmentation" International Journal of Computer Science and Information Technology (IJCSIT) Vol3, No 6, Dec 2011.

[6] Moeslund T, "Shrewd Edge identification", Denmark: Laboratory of Computer Vision and Media Technology, Aalborg University.

[7] Nedev, S, Ivanova, V.C, "Web camera as an estimating device", The undergrad material science research centre, European Journal of Physics, 2006.

[8] W. Wang, Z. Li, J. Deng, H. Yao, X. Xuan, Z. Wang, "A review of research on an object detection based on deep learning", AINIT, 2020.

[9] S. Manjula, Dr. K. Lakshmi, "A study on object detection", IJPTFI, 2016.

[10] U. Binay, N. Yadav, "Comparative Study of Object Detection Algorithms", IRJET-V4I1103, Volume 4, Issue 7, 2017.

[12] Sunil, Gangandeep, "Study of object detection methods and applications on digital images", IJSDR1905088, Volume 4, Issue 5, 2019.

[13] Shreyamsh, "UAV: Application of object detection and tracking techniques for unmanned aerial vehicles", Texas A & M University, 2015.

[14] R. Girshick, Fast R-CNN, In Proceedings of the IEEE international conference on computer vision pp. 1440-1448, 2015.

[15] R. Girshick, S. Divvala, J. Redmon and A. Farhadi, (YOLO) You only look once: Unified, real-time object detection, arXiv preprint arXiv:1506.02640, 2015.
[16] G. Bradski, OpenCV: A general purpose computer vision library, Computer Vision, 2008.

Internet sources

1. https://www.geeksforgeeks.org/measure-size-of-an-object-using-python-opencv/
2. https://pysource.com/2022/11/29/measure-size-of-objects-in-real-time-with-computer-vision-opencv-with-python/
3. https://pyimagesearch.com/2016/03/28/measuring-size-of-objects-in-an-image-with-opencv/
4. https://python.plainenglish.io/measuring-object-size-with-opencv-b5acf4f4cb62
5. https://realpython.com/len-python-function/
6. https://www.irjmets.com/uploadedfiles/paper//issue_1_january_2022/18684/final/fin_irjmets1643529295.pdf
7. https://www.smartick.com/blog/mathematics/measurements-and-data/dimensions-length-width-height/
8. https://blog.roboflow.com/dimension-measurement/