MCD411 B. Tech Project

Week 11 Report

Submission Due: 11-Nov-2024, 5:00 PM

Project number & Title of the project: D3 Computer Vision system for 3D dimension measurement and defect detection on conveyor line

Student Name with Entry number:

1. Aditya Bisen 2021ME21084
2. Ayush Kumar Singh 2021ME20298

Supervisor(s): Prof. Sunil Jha, Prof. Arpan Gupta

Planned Week 11 activity (as per Gantt chart): Development of user interface

Week 11 progress (*Kindly report work done by individual student*):

Aditya Bisen: UI and frontend, 3-camera implementation

Ayush Kumar Singh: Dimension measurement, 3-camera implementation

Meeting with supervisor (Should be before 11-Nov-2024)

Date: November 4, 2024

Time: 3PM

Minutes of Discussion: Setup integration

Account of Time: *(Mention hours spent individually on tasks)*

Frontend and UI code: 3 hrs, Edge dimension measurement: 4hrs, 3 camera integration: 3hrs

Declaration:

I/We have taken consent of our supervisor on __11 Nov__(Date) at __12 Noon___(Time) and discussed the report before submission. *(Fill Date and Time by Ink Pen at the time of meeting before signature)*

(Student 1 Signature) **(Student 2 Signature)**

To be filled by the Supervisor

Progress					
Ayush Kumar Singh	Excellent	Good	Average	Marginal	Unsatisfactory
Aditya Bisen	Excellent	Good	Average	Marginal	Unsatisfactory

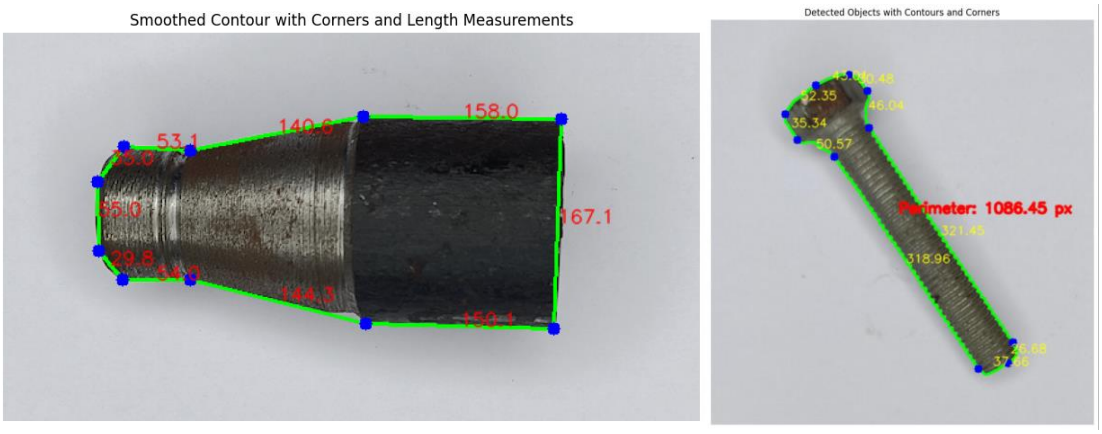
Comments (if any):

[Supervisor Signature]

Progress Overview: This week, we focused on enhancing the dimension measurement algorithm for the computer vision system. The primary improvement involved modifying the algorithm to measure edge dimensions accurately, moving beyond the previous method, which only created a bounding box around the object. This change enables more precise measurements of both straight and curved edges.

Key Developments:

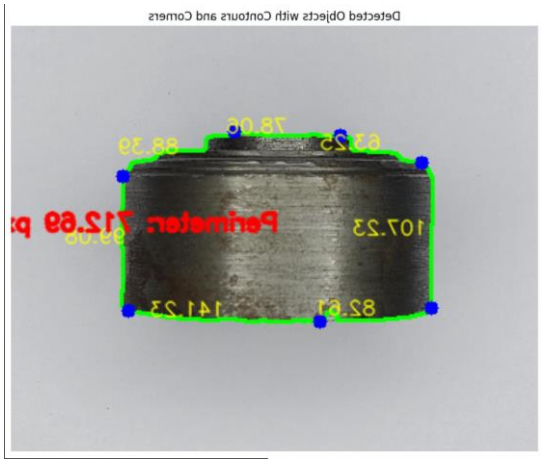
1. **Algorithm Enhancement for Edge Dimension Measurement:**
    - Implemented a refined algorithm to calculate the lengths between consecutive corners along the object's perimeter.
    - Introduced a function to calculate the arc length between points for measuring curved edges.
    - Enhanced the visualization of measurements by displaying the distances on the image.



Code Explanation: The code begins by reading and preprocessing an image, converting it to grayscale, and applying a Gaussian blur to reduce noise. A binary threshold is then applied to isolate the object from the background. Contours are detected, and small ones are filtered out to focus only on significant objects.

The code then smooths the detected contours using an approximation function (cv2.approxPolyDP) to simplify the edges while maintaining the shape. The corners of these approximated contours are identified, and distances between consecutive corners are calculated using Euclidean distance to measure straight edges. An additional function calculates the arc length between points for curved segments.

These measurements are overlaid on the image for visualization, providing a clear representation of the distances between edges. The output image displays all annotated length measurements for easy interpretation.



2. **Integration of Multi-Camera Setup:**
    - Modified the system and front-end interface to support input from three cameras (front, top, and side views).
    - This update allows for a more complete 3D perspective, improving the accuracy and reliability of object dimension measurements.

Experimental Setup: The experimental setup included a Lenovo laptop connected to the system and an additional camera rig with multiple angles. We initially used the Lenovo webcam for image capture but found the image quality unsatisfactory for precise measurements. To overcome this issue, we switched to using an iPhone camera, which provided higher resolution and better image clarity for accurate analysis. This change significantly improved the reliability of dimension measurements and the overall system output.

Difficulties Faced:

- **Image Quality Issues:** The primary challenge was the insufficient image quality from the Lenovo webcam, which did not capture detailed enough images for accurate measurement. This required us to pivot to using an iPhone camera, adding additional

steps for setup and integration but resulting in much improved image resolution and accuracy.

Conclusion: The progress made this week has substantially advanced the project, particularly in terms of precision in dimension measurement and multi-camera integration. Although we faced initial challenges with image quality, the switch to a better camera source enabled us to maintain the accuracy needed for industrial inspection tasks. Moving forward, we plan to refine the calibration process for the multi-camera setup and continue testing under varied lighting and object conditions.