



Implement Image Processing Library for Visual Inspection Head

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Abstract:

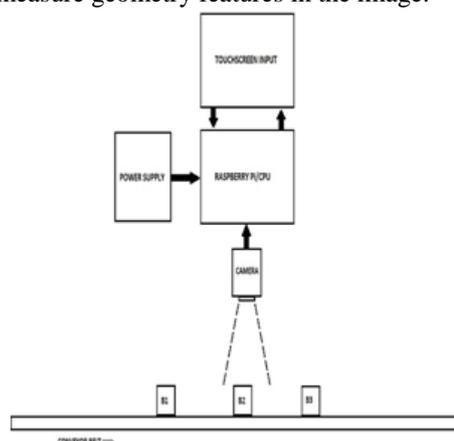
Most of the Industrial and Agricultural sectors in India employ manual labours to carrying out various operations instead of automation. Although Nowadays, Automation had led into the industries. But still it needs to be modified to be a smarter intelligent system. Like lots of manual interventions are required especially in the grading and sorting of objects. Because inspection of any object for quality and identifying defective ones by manual inspection is a difficult task and often fails because of human weariness less. But in the field of automation there are various types of libraries which is use to carry out different types of operations. In every task to carry out different operations requires different types of libraries according to the type of task and compatibility of platform which is based on computer vision. This gives rise to concept of Implementation of Image Processing Library for Visual Inspection Head to modernize the Agricultural and Industrial areas and to meet their quality standards. The project is to create Visual Image Processing Library which is collection of number of predefined functions which can be used in any program and system which is compatible for execution on any embedded platform.

1.INTRODUCTION:

In this paper, we discuss about embedded system which is based on computer vision and open CV libraries. The process involved for estimating the geometry parameters makes use of sequence of complex library functionality. Computer Vision is nothing but the core technology of automated image analysis which is used in many sectors. Implementation of Image Processing Library aims at providing all in one defined functional library which gives flexibility to use single library instead of no of libraries related to image processing to geometry features detections. The entire development task involves in dynamic capturing of image from camera when the objects are moving on the mechanical conveyor belt. This unit would be used as a platform for building visual quality inspection machines. Applications would contain mechanical fixtures and conveyors to bring the object to be inspected under the camera and image would be captured for inspection of features and geometry. System is implemented using python language and using open CV libraries.

Proposed System:

This is an embedded platform with camera, display and raspberry pi processor with visual image processing library to implement machine vision project for Industrial and Agricultural applications. Basically it is 2D image processing to measure geometry features in the image.



Visual Inspection Head System

The system of Visual Inspection Head consists of a computer and cameras to capture images, to process images, and to make suitable inspection decisions. The captured images are analysed by image processing hardware and software according to predefined functions to extract the required object features and quality parameters. Based on these results, a decision on the objects quality is taken by software considering the end user's requirements.

The Following functions to be implemented in library to features out objects:-

Geometry Functions-

1. Line_fit (LineBlob) using best fit line where direction from start to end
2. Arc_fit (ArcBlob) using best fit Arc where direction from start to end
3. Intersect_LineLine (L1, L2) return point
4. Intersect_LineArc (L1, Arc) return point
5. Intersect_ArcArc (Arc, Arc) return point
6. Intersect_Arc2Circle (Arc) return circle
7. Intersect_LineSeg2LineVector (X1Y1, X2Y2 → X, Y, θ) return point

Image Handling Functions-

1. Threshold (FOV, Level) return FOV with only 0 and 1 (binary image)
2. Integrate (FOV, FOV) return sum of Intensity
3. Average (FOV) return Average Intensity image
4. Histogram (FOV, ΔI)
Return no of points within intensity zones of ΔI from 0 to Max values
Return List of Blobs of each zone with (Xi, Yi, Intensity)
5. Enhance (Gain factor) (length of array = length of blob array)
6. Merge (array of Blobs) return FOV
7. Subtract_Image (FOV1, FOV2) for each pixel I1-I2
8. Smoothen_Image (FOV) where replace intensity by average of all neighbour pixels

9. SubPixel (FOV) Increase FOV size 4 times

Features Detections Functions-

1. FindLine (Rect_zone, FOV, 1/0) where direction 1= black to white 0 = white to black
2. FindArc (Arc_zone, FOV, Direction) return ArcBlob
3. FindPoint (X1Y1, X2Y2, Direction) return XiYi

Zone Detections Functions-

1. ClipFOV (FOV, Zone) return Blob (array of points within zone)
2. ClipBlob (Blob, Zone) return SubBlob (subblob within blob given points within zone)

System flow:

The entire system is classified into two parts – Hardware and Software. The developed system consists of conveyor assembly, camera, touch screen panel, raspberry pi processor, power supply and according to predefine functions image

processing algorithms access from open source libraries such as openCV, Numpy, Matplotlib, imutils, etc. This machine vision system consist of a belt conveyor to convey the objects and camera located in an image acquisition module with lighting system for image capture and a computer with an image frame grabber to process the captured image. Pre-processing of an image can include thresholding, integrating, averaging, enhancing, merging, subtracting and many more algorithms. All of the processes permanently change the pixel values inside an image so that it can be analysed by a computer. The second set of stages in a typical embedded vision algorithm pipeline are concerned with converting raw images into information about objects. A wide variety of techniques can be used to feature out the geometry and identifying objects based on edges, motion, colour, size, or other attributes. The final set of stages in a typical embedded vision algorithm pipeline is concerned with making presumption about objects.

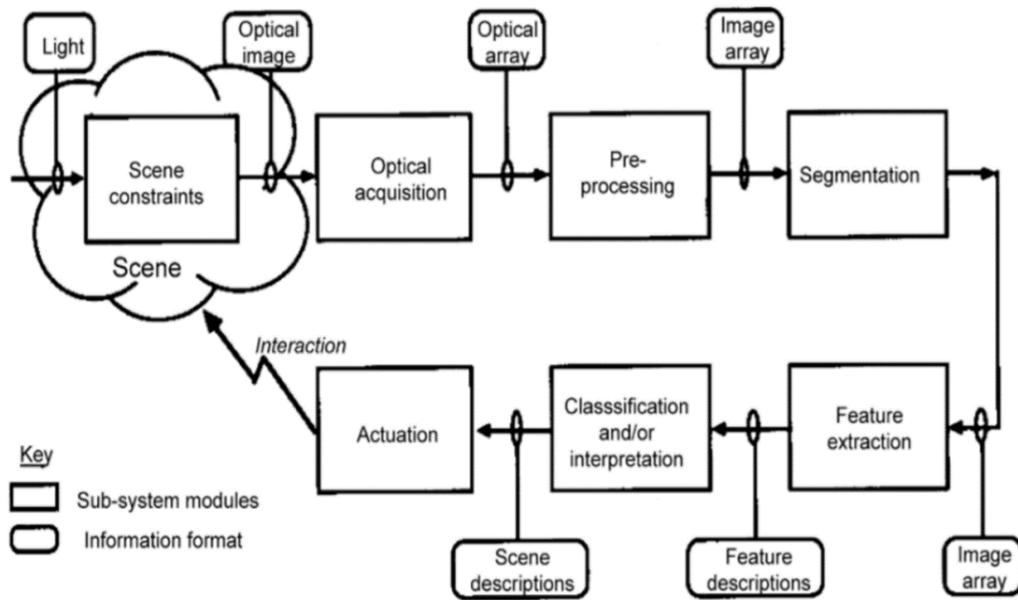


Figure.1. Software Architecture

II. TOOLS AND LIBRARIES USED:

1. Raspberry Pi:

The **Raspberry Pi** is a series of credit card-sized single-board fully functional Linux computer which can be Plugs into a TV or monitor.



2. Computer Vision:

Computer vision is nothing but the capability of system to automatic extraction, analysis and understanding of useful information from a single image or a sequence of images.

Transformation of data from a video or still camera into either a conclusion or a new representation is called Computer Vision.

3. OpenCV:

OpenCV is an open source computer vision library that is used in real time computer vision. It is designed and optimized for real time applications. The OpenCV library contains hundreds functions that cover many areas in computer vision such as robotics, medical image processing, security.

3. NumPy:

NumPy is the fundamental computing package use in python. It provides large, multi-dimensional arrays object for fast operations on arrays, including logical, mathematically, sorting, shape manipulation and much more.

4. MatPlotLib: Matplotlib is basically plotting library in python which is use to analyse the images. It provides numerical mathematics extension Numpy. It supports object-oriented API for embedding plots into applications using general-purpose GUI. Matplotlib is a great tool whether

plotting the overall accuracy of search systems or simply viewing the image itself.

5. Imutils:

Imutils is open source python package. It supports basic image processing operations such as translation, rotation, resizing, skeletonization, and displaying Matplotlib images easier with OpenCV and Python.

III. LITERATURE WORK:

Author [1] discuss about the operations like grading and sorting generally are manual which is costly as well as unreliable. That's why Machine vision provides one alternative for an automated, and cost-effective technique to accomplish these requirements.

Author [2] present a developed application for multiple objects detection based on OpenCV libraries. The proposed application deals with real time systems where the cases of object detection applications may be more complex and where it may be simpler.

Author [3] discussed Traffic Sign Recognition using OpenCV application. The images were pre-processed in stages with image processing techniques such as threshold technique, Gaussian filter, canny edge detection, Contour.

It shows to perform different type of task we need no of different type of functions to access from different libraries. That's why we come with the single source library which includes no of predefined functions related to image processing.

IV. CONCLUSION & FUTURE WORK:

The Visual Inspection Head is basically 2D image processing to measure geometry features in the image according to predefined functions. It realized here all the processes were successfully implemented the embedded platform with camera, display and raspberry pi processor with visual image processing library to implement machine vision project. This unit would be used as a platform for building visual quality inspection machines. As the unit would process results in real time, very high speed of inspection would be possible and it took less space on system as all the operations perform through single source library. Such machines would be used at factories, farms and food processing units to inspect and sort out the objects in Agricultural and Industrial applications. Future work that can possible in this project is, we can extend the single camera vision inspection into multi camera inspection. Since it employs distributed network architecture with additional setup of hardware and software modules. And we can increase the object quantity in inspection section. At the product level we can implement this in different sector by changing simple software and hardware.

V. REFERENCES:

[1].Nandi.C.S, Tudu.B, Koley.C, "An Automated Machine Vision Based System For Fruit Sorting And Grading" Sixth international Conference on Sensing Technology (ICST), IEEE publications.

[2]. Multiple Object Detection using OpenCV on an Embedded Platform, Anass Mansouri Sidi Mohammed Ben Abdellah University, Morocco

[3].Traffic Sign Detection and Recognition Using OpenCV, ICICES2014 - S.A.Engineering College, Chennai, Tamil Nadu, India

[4].Real-time Moving Vehicle Detection, Tracking, and Counting System Implemented with OpenCV, Da Li1, 2 Bodong Liang1, 3 Weigang Zhang2 1. School of Automotive and Transportation Engineering, Shenzhen Polytechnic, Shenzhen 518055, China

[5].Real time Finger Tracking and Contour Detection for Gesture Recognition using OpenCV, 2015 International Conference on Industrial Instrumentation and Control (ICIC) College of Engineering Pune, India. May 28-30, 2015

[6].Analysis of Lane Detection Techniques using openCV, Sunil Kumar Vishwakarma1 Information Technology AIMT Lucknow, India.