

# Review Paper on Smart Line Scan Camera Using Beagle Board

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**Abstract:** In the automation field product quality, time to market, number of workers required for the production, cost, technology, ease of availability of components etc. are all important considerations to increase the company profile in the market. All are depends on the controlling actions and the technology used for it. Based on the application different controlling actions are taken place like Programmable Logic Controller (PLC), Distributed Control System (DCS), Supervisory Control And Data Acquisition (SCADA), image processing etc. among these, image processing uses camera and the controller or processor for automation process. Here to increase the production speed, reduce the cost and based on ease of availability of components line scan sensor and Beagle Board is used for controlling the process. Using these, the line scan camera is designed and image processing is done for detecting the defects present in the object moving on the conveyor line and the controlling action will be taken by itself. Using single Beagle Board the camera is designed as well as controlling action is taken.

**Keywords:** Automation, Image processing, Line scan sensor, Beagle Board, ARM cortex A8

## I. INTRODUCTION

To detect defects present in the objects moving on the conveyor line the captured image must be free of noise with high clarity. If the moving object is captured using area scan camera the resultant image will be blur, so the line scan camera is chosen which is designed using line scan sensor and it overcomes the blooming problem while capturing the image. The line scan camera captures the image line by line with high speed, later these lines are combined for image processing so the image is free of blur. Here mainly the camera is designed in such a way that the image capturing is done with different integration time. The Beagle Board is chosen because it works with its own Operating System (OS) and it has ARM Cortex A8. As it has ARM Cortex A8 processor the Beagle Board is mainly used in automation application. The Beagle Board does both image processing and controls the process. The communication with external world is easy as it has many communication ports even browsing is possible through Ethernet connection.

Present system uses line scan camera, processor and controller. The cost of line scan camera is more because it has its own processor for converting analog to digital conversion and making the image free of noise and setting the integration time etc. this in turn connected to processor it does the image processing with different image processing algorithms and the controller is used for taking the controlling actions. Here it increases the cost and processing time as it increases the processing path. But this system uses only line scan sensor and Beagle Board so the cost and the processing path are reduced. Here both image processing and the controlling actions are performed by Beagle Board. The Beagle Board consists of ARM Cortex A8. The ARM Cortex A8 is mainly used for processing the automation applications and it is very easy to communicate with external world. The steps involve in designing the camera is as shown in figure 1.

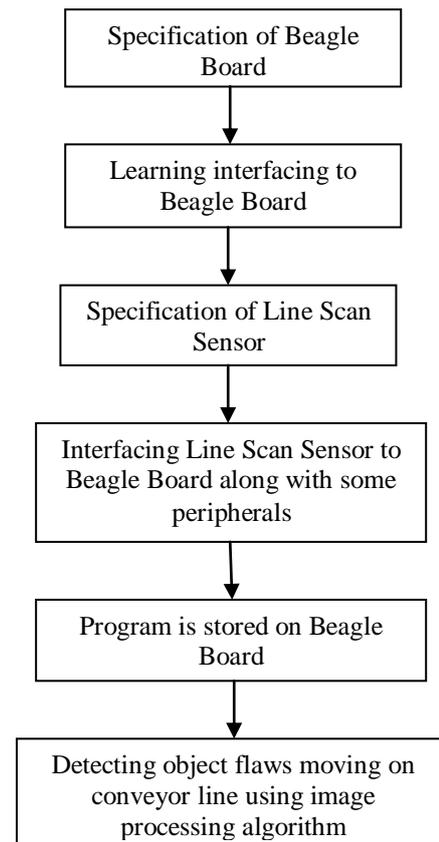


Fig. 1 Steps need to follow in designing the camera

Based on the requirement of application the specification of the Beagle Board is chosen such as memory requirement and communication port availability etc. and also the line scan sensor is chosen based on the requirement of the pixels, pixel size and object capturing

distance etc. These all parameters are considered and also the proper lens is chosen for the line scan sensor with proper focal length. The line scan sensor is interfaced to Beagle Board then program is stored in the memory then integration time is set based on the requirement. The image processing is done on the captured lines stored in the memory. The process controlling involves two types based on application

1. Direct controlling of the device either turning ON or OFF if even a small defect is found.
2. Based on defects present in the object, the defects are classified in various levels as small, medium and major defects. The controlling actions will be taken based on these levels separately.

## II. LITERATURE SURVEY

In textile industry the quality is checked, based on it the cloths are passed to market [1]. It detects the fault present in the cloth by using neural networks. The image is captured using CCD camera/GigE camera. Initially the image is captured and the RGB image is converted into gray scale images. Those images are carried out for particle analysing. The FireWire cable is used for communication between camera and the vision system and Ethernet cable is used for communication between the Embedded Vision System (EVS) and work station. The captured images are pre-processed in LabVIEW (Laboratory Virtual Instrumentation Engineering Workbench) vision builder toolkit. Here image processing is performed on gray scale image this intern subjected to thresholding and then vision system takes the controlling action. In this way the faults are detected. Here the main disadvantage is GigE camera is costly, separate LABVIEW toolkit is used for image processing and for controlling vision system is used.

Optical 3D measurement of objects is necessary in numerous industrial applications. The shape acquisition of weak textured objects is carried out in this paper [2]. Examples are repetition parts made of plastic or ceramic such as housing parts or ceramic bottles as well as agricultural products like tubers, here the 3D shape acquisition is performed. Here 3D surface reconstruction of weak textured objects or scenes, that are acquired at one shot. The system consists of auxiliary laser pattern generator and multiple camera pairs. It uses infrared camera and area scan camera for geometry and depth estimation of an object also it requires PC System with MS Windows 7, 64 bit and a quad core processor Intel core i5 at 3.5 GHz. The images captured by camera pairs are processed in software that is implemented using C++ language. Based on this 3D image of the object is studied to acquire the required shape of the product. Area scan camera has a problem of blooming if the object is moving on conveyor line during production. Different and more cameras are required such as area scan camera and infrared camera to capture the 3D image to know the depth of the object. Based on the two sensor data, the defect in the object is identified. In many places of production, if

3D image acquisition is required then in each place placement of the PC is required for detecting the defect.

In this paper video tracking is accomplished for the surveillance purpose, video annotation and traffic monitoring [3]. The system is designed for detecting and tracking of moving objects from the video scenes. Video tracking is the process where the particular area of interest is processed with the help of segmentation from the different frames and then tracking the movement of object. The video tracking is done using Python Opencv software and the implementation of the tracking system is done on the Beagle Board. The idea of video tracking can be used in the areas of vehicle navigation, video surveillance, automobile driver assistance, robotics, video games, and biometrics in the field of medical sciences. The camera used is normal USB webcam. But the webcam cannot be used in automation field. It cannot capture the moving data on conveyor belt properly as conveyor line moving at high speed. As if it captures the moving objects, it is very difficult to identify the fault present in the object. This is due to less accuracy of captured image or video.

The human machine communication is done using ARM Cortex A-8 processor. The Real Time Hand Gesture Recognition for Human Machine Communication is performed. Here the gesture is a form of non-verbal communication, in which visible bodily actions communicate particular messages [4]. A novel method proposes for human machine communication via gesture. The real time system employs a USB web camera, Beagle board XM and HDMI Monitor. Web cam is used for capturing sequence of images to handle image recognition. Object recognition was in real time gesture detector and working with only image intensities. Beagle board XM acts as mini CPU which is interfaced to monitor. The board consists of ARM cortex A8 Processor which takes real time video to capture gesture image. Here again it is implemented with web cam it cannot be used for automation purpose.

So the line scan camera is designed using Beagle Board [5] [7] and also used for controlling of the automation process hence it is named as smart line scan camera.

## III. CONCLUSION

The line scan camera is designed using line scan sensor [6] [8] and Beagle Board. The different integration time is set for capturing the lines based on the requirement and application. These lines are stored in the memory then image processing is done with different image processing algorithms for detecting defects present in the object moving on the conveyor line. Those defects are indicated or controlled using Beagle Board based on the application of automation field.

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