Automated End Of Line Product Validation For Soft Drink Bottles

Dr. D. Bhavana, G. Anish kumar, B. Abhilash K. Rohit Prathyush I. Ram Kumar, Dr. K. Kishore Kumar,

Abstract: The Fast-Moving Consumer Goods (FMCG) industry is furiously focused. In this way, for the accomplishment of organization, adaptable powerful business strategies is fundamental which can be changed quickly at whatever point new difficulties are gone up against. In showcasing, bundling and brand worth has a significant job in deciding the eventual fate of an item. It is the brand which conveys confidence and fulfilment among the purchasers. To satisfy the hopes of their buyers, organizations need to put their earnest attempts to keep everything set up. They utilize mechanized apparatus in each progression of creation prompting higher efficiency and consistency in items. Notwithstanding, in spite of cautious creation, a few deformities still creep inn which may be in the form of incorrect barcode being printed, illegible or no labelling, no caps, improperly filled bottles etc. This checking turns into a difficult undertaking for a human monitor when huge quantities of items are to be assessed and can prompt human mistakes. Therefore, to guarantee in general nature of the created articles, computerizing the investigation procedure appears to be a feasible arrangement. The complete validation is provided by implementing processing an image technique on one of the platforms called LabVIEW. In this process there is no disturbance in high-speed line in production. A Smart Camera 1742 from National Instruments is used to acquire images of goods and products travelling on a conveyor belt and those are processed to fulfil the above needs and requirement.

Index words- Consumer goods, earnest attempts, mechanized apparatus, deformities, image technique, LabVIEW, conveyor belt.

1. INTRODUCTION

Computerization underway line is an exceptionally fundamental component of the FMCG business. Robotized systems are broadly applied to check the nature of the completed item. On the off chance that a container is found to contain ill-advised marks, bottle tops, amount, and so on fitting control choices prompting flaw alert are to be created with the goal that the defective jug can be expelled from the generation line. By utilizing honourable picture preparing systems on NI stage. A high-goal camera is utilized which gain pictures of soda pop jugs at legitimate moments and procedures the pictures utilizing fitting calculations for abandons. If a deformity is experienced at any stage, a caution will be raised and that jug under investigation will be dropped from the generation line. Therefore, all out item quality control is accomplished. Smart Cameras contains powerful onboard imaging sensors and processors into an all-in-one vision system. Digital I/O in Smart Camera contains inputs which are digital opt isolated inputs andoutputs, Gigabit Ethernet ports, a RS232. Smart Camerascan be configured with the integrationof Vision Builder for Automated Inspection (AI) software and camera can be programmed with the LabVIEW Real-Time Module and the Vision Development Module. The Smart Camera from National Instruments is available in different configurations and models. All models of smart camera depend on processor, digital I/O and an image sensor in a compact and strong housing. In general, all NI smart cameras have an RS-232 serial port, a standard C-mount lens and aGigabit Ethernet ports.Quadrature encoders will get support from Direct Drive lighting controller.

- *Dr. D. Bhavana, Associate professor ,Department of Electronics and communication, koneru Lakshmaiah Education foundation, vaddeswaram,Guntur, india*
- *Dr. K. Kishore Kumar, Associate professor, Department of Mechanical Engineering, koneru Lakshmaiah Education foundation, vaddeswaram,Guntur, india*
- *B. Abhilash, K. Rohit Prathyush ,I. Ram Kumar Graduating students Department of Electronics and communication koneru Lakshmaiah Education foundation, vaddeswaram*

These are the feature available for some smart cameras. The Direct Drive light controller in National Instruments Smart Camera is to connect controller with directly power a different type of lights that are current controlledfrom third party. The NI smart camerais alsoincluded withfour DIP switches to specify start-up options,LEDs for communicating system status, isolated inputs, and outputs for connecting to external devices.

1.1 NI Vision Builder in Automated Inspection

Vision Builder for Automated Inspection (Vision Builder AI) is configurable machine vision programming that can be utilized to arrange the NI Smart Camera and model, benchmark, and send machine vision applications. Vision Builder AI is utilized to arrange and stamp a successive arrangement of visual assessment steps and to introduce the visual examination framework for robotized review. We can Perform ground-breaking visual investigation procedure and settle on choices dependent on the consequences of individual errands with Vision Builder AI. The arranged review can be changed over to LabVIEW, improving the abilities of the applications if important.

1.2 NI Vision Acquisition Software

NI MAX to design the NI Smart Camera. We can set the IP address, update programming on the brilliant camera, arrange activating, and set up the lighting highlights. NI-IMAQ is the interface way between the brilliant camera and application programming. NI-IMAQ additionally controls the picture procurement and I/O on the keen camera.NI-IMAQ contains a selective library of VIs that can call from LabVIEW. These VIs contains schedules for video arrangement, trigger control, consistent and single-shot picture securing. The NI-IMAQ driver programming does all capacities essential for sparing pictures in the wake of securing however doesn't perform examination of picture. NI-IMAQ highlights both low-level and significant level capacities. A component that secures pictures in proceeds with mode or single shot is a case of a significant level capacity. An element that requirements propelled comprehension of picture procurement, such as designing a picture arrangement, is a case of a low-level capacity.

1.2.1 Field of View

The field of view goes under the region of under investigation. it will be imaged by the NI Smart Camera. It is basic to guarantee that the field of perspective on our framework incorporates the article we need to review. To ascertain the even and vertical field of view (FOV) of our imaging framework, we utilize the accompanying condition

$$FOV = \frac{Pixel\ Pitch \times Active\ Pixels \times Working\ Distance}{Focal\ Length}$$

Where FOV is the field of view in either the vertical or even heading, Pixel Pitch estimates the separation between the focuses of nearby pixels in either the vertical or level course. Dynamic Pixels is the quantity of pixels in either the vertical or flat bearing, Working Distance is the good ways from the article under examination to the front component (outer glass) of the focal point, and Central Length estimates how firmly a focal point veers (diffuses) or meets (centers) light.

1.2.2 Partial Scan Mode

Incomplete output mode is a procedure of higher edge rates obtaining by perusing out some piece of the picture from the sensor. This procedure is often utilized when an application needs higher speed, however it gives less goals when contrasted with sensor offers in full sweep mode. The NI Smart Camera bolsters 1/4 and 1/2 sweeps.

1.2.3 Binning

Binning can improve the light affectability of the sensor by accepting neighboring pixels as a solitary pixel. Binning grants the picture sensor to accumulate more electrons per pixel, which diminishes the measure of required light and introduction time. Binning brings about lower spatial goals and higher casing rates in the vertical bearing. The National Instruments Smart Camera bolsters 1 × 2 binning.

1.2.4 Exposure

The NI Smart Camera enables us to control the picture sensor presentation time utilizing programming. The introduction time is the measure of time that light can strike the sensor to deliver a picture. At the point when light strikes the outside of the sensor, it ousts electrons. As progressively light hits the sensor, more electrons are liberated, building up a charge on the sensor. For the gave light, the sensor accumulates more charge during a more drawn out introduction time than a shorter presentation time. Since the charge is what is perused out to deliver the picture, it is essential to have an ideal measure of light and introduction time for your application. Dull, low difference picture may come if uncovering the picture sensor for excessively shorter time comparative with the measure of light in the earth. Splendid, low complexity picture may come if uncovering the picture sensor for excessively longer time comparative with the measure of light in the earth. At the point when the picture sensor is uncovered for a suitable measure of time interim to the light in the earth, obtained pictures will give proper complexity to effectively recognize both light and dull highlights. Complexity is a key factor in acquiring great outcomes from picture preparing calculations. at the point when item under assessment is going on, the introduction time must be considered cautiously while structuring applications. The resultant image will be blurry and unsuitable for processing If the object goes significantly during the exposure.

1.2.5 Acquiring Images

We can design the NI Smart Camera to get pictures dependent on interior planning or an outer trigger sign. In both cases, At the camera's maximum frame rate can be acquired in full frame images using NI Smart camera. If binning or fractional filtering are empowered, obtaining of pictures can be quicker than the full edge greatest edge rate in NI Smart camera.

2. METHOD

To solve the problem of defects in the soft drink bottle at the end of manufacturing line. We introduced our model based on image processing. In this model we are inspecting the bottle defects such as label is printed or not, bottle cap is fixed or not and quantity of soft drink is filled properly or not. For this we are using NI Smart camera to acquire the image from manufacturing line. Camera will be focused towards the bottle for live acquisition of bottle images for inspection. Those images will be acquired in monochrome format by the NI Smart Camera for processing. Bottle Cap: from the acquired image bottle cap checking is done using measure intensity. Measure intensity is used to measure the intensity of a region of interest in the image. If cap is present it will be in dark color, it's intensity will be low. If cap is not present it will be bright color its intensity is high. By considering all the environmental conditions we will give some threshold if the intensity is greater than threshold it means the cap is not present it will be considered as fail case.

Figure 1.1

Quantity Check: Quantity checking is important in any soft drink it will be one of the feature extractions in image processing. By using Find Edges. Find Edges is used to Locate and counts intensity transitions along a line in the image. In this we have two types detecting the edge from dark to bright change. Second is detecting the edge from bright to dark. From the bottle if it is filled it will be in dark color. So, the edge can be identified as bright to dark from left to right another line will be from bottle to outside it will be dark to bright. During inspection if it detects two lines then it will be pass else it will be failed case.

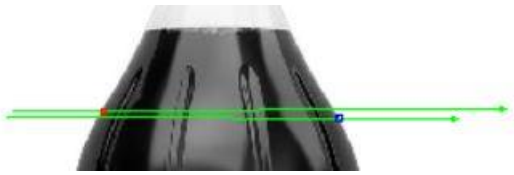

Figure 1.2

Label Inspection: After acquiring the bottle image using Read/verify text. Read/Verify Text reads characters in a

region of interest and compares the read string to a reference string. we are extracting the text by setting the parameters manually from the standard image. By placing in various positions, we are collecting the images and training has been given such that from any direction if it identifies label it is prefect. If it did not identify the part of label it treats it as fail condition. Program should be done to both pass and fail condition.

Figure 1.3

After checking these three conditions if all conditions are pass then finally it will indicate as Pass else it will be indicated as Fail be sending a warning signal.
Programming in the vision builder is quite different from normal programming in C, C++, Java, Python. In this our programming is graphical programming. Taking the inspection requirement and model according to our requirements is observed. All this inspection are arranged in a systematic manner in program part, all three individual inspection results are given to system variable programmatically and form that reading to objects to show pass or fail.

3. EXPERIMENTS

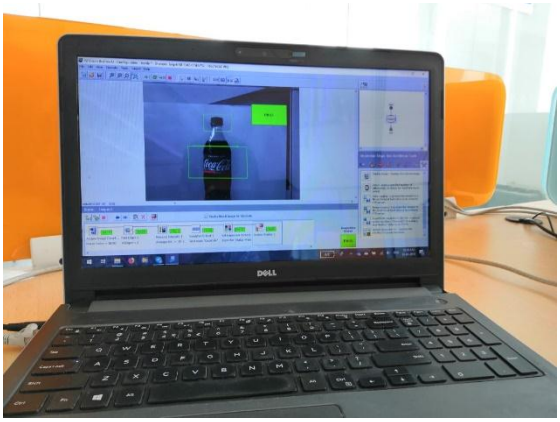

Figure 3.1 *Models detects bottle is pass*

In the above result our model detects that bottle is pass. Its meat all the requirements such as bottle cap is proper, Quantity is correct, and label is printed so it is showing pass on right top corner.

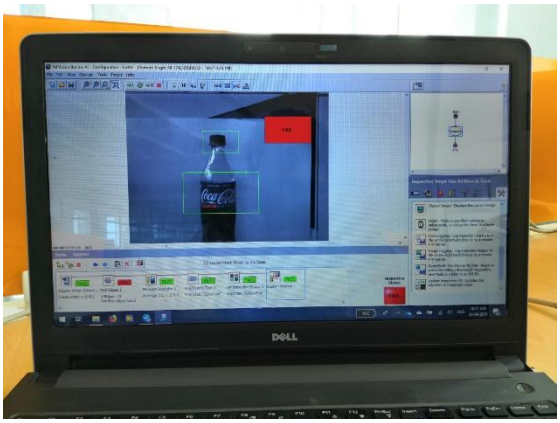

Figure 3.2 *Model detects the bottle as Fail*

In this case smart camera detects the bottle is failed because it does not meet the requirements of Quantity. It was not filled to certain limit. So, it was failed even its cap is fixed, and label is printed. We can find a FAIL object over top right corner.

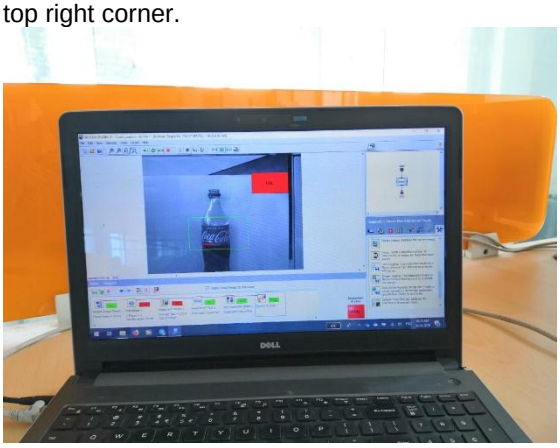

Figure 3.3 *Model detects the bottle as Fail*

In this case smart camera detects the bottle as fail because it does not meet the requirements of Quantity as well as bottle cap. So, it was failed even its label is printed. In this also we can see the fail object at the top right corner.

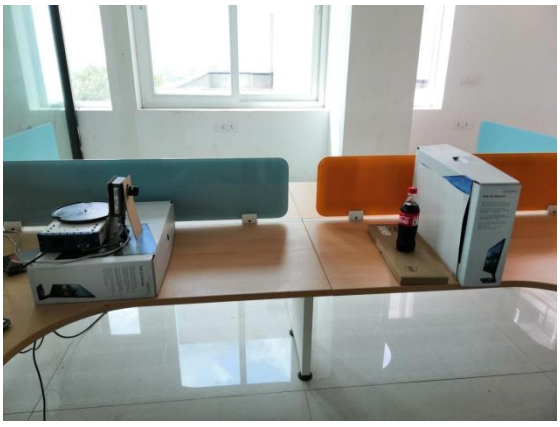

Figure 3.4 *Hardware setup*

This is the hardware how we place our model for soft drink bottle inspection. One side is NI Smart camera and other side is bottle in industry it will be conveyer belt.

4. CONCLUSION

A mark quality control framework for mechanical bundled FMCG is planned and executed utilizing NI equipment and NI Vision Builder AI. The framework productively distinguishes the imperfection in marks assuming any. From the outcomes acquired, the proposed procedure has accomplished the set target agreeably and rouses for modern usage. Since the whole handling is completed on programming, alteration and expansion for doing the proposed assignment on any comparative FMCG item. In our venture we are distinguishing the imperfections in soda pop container like Company Label, Bottle top, Quantity viably. Our undertaking is versatile as far as speed and Company bottle. We can reconstruct our undertaking for another organization name and dull soda pops. It is a lot of dependable as most of the businesses are accepting and utilizing NI Hardware. In Future it can be implemented with automatic process where machines are used to check and remove the defected products from conveyer belt.

References:

[1] Shen, Hao, Shuxiao Li, Duoyu Gu, and Hongxing Chang. "Bearing defect inspection based on machine vision." Measurement 45, no. 4 (2012): 719-733.

[2] Shafait, Faisal, Syed Muhammad Imran, and Sven Klette-Matzat. "Fault detection and localization in empty water bottles through machine vision." In E-tech 2004, pp. 30-34. IEEE, 2004..

[3] Derganc, Jože, Boštjan Likar, Dejan Tomaževič, and Franjo Pernuš. "Real-time automated visual inspection of color tablets in pharmaceutical blisters." Real-Time Imaging 9, no. 2 (2003): 113-124.

[4] Huang, Bin, Sile Ma, Ping Wang, Huajie Wang, Jinfeng Yang, Xinyi Guo, Weidong Zhang, and Huiquan Wang. "Research and implementation of machine vision technologies for empty bottle inspection systems." Engineering science and technology, an international journal 21, no. 1 (2018): 159-169.

[5] Chmielewska, Agata, Adam Dąbrowski, Andrzej Namerła, Paweł Pawłowski, Radosław Weychan, and M. Stankiewicz. "Comparison of NI LabVIEW and NI Vision Builder Al environments in fast prototyping of video processing algorithms for CCTV using smart camera." Elektronika: konstrukcje, technologie, zastosowania 52, no. 5 (2011): 72-76.

[6] NI Smart Camera 17xx user manual.

[7] Han, Yu, Jingge Gao, and Shuqiang Zhang. "Research on the automatic detection system for cracked egg based on LabVIEW." In 2010 International Conference on Measuring Technology and Mechatronics Automation, vol. 3, pp. 190-193. IEEE, 2010.

[8] He, Zhendong, Yaonan Wang, Feng Yin, and Jie Liu. "Surface defect detection for high-speed rails using an inverse PM diffusion model." Sensor Review 36, no. 1 (2016): 86-97.

[9] Lee, Kyu-Bong, Min-Seok Ko, Joan Jae Lee, Tak-Mo Koo, and Kil-houm Park. "Defect detection method for TFT-LCD panel based on saliency map model." In 2004 IEEE Region 10 Conference TENCON 2004., pp. 223-226. IEEE, 2004.

[10] Ghorai, Santanu, Anirban Mukherjee, M. Gangadaran, and Pranab K. Dutta. "Automatic defect detection on hot-rolled flat steel products." IEEE Transactions on Instrumentation and Measurement 62, no. 3 (2012): 612-621.

[11] Strokina, Nataliya, Jiri Matas, Tuomas Eerola, Lasse Lensu, and Heikki Kälviäinen. "Detection of bubbles as concentric circular arrangements." Machine Vision and Applications 27, no. 3 (2016): 387-396.