

Video Image Based Bottle Filling System

¹Deenadadayalan.E and ²Senthil. R

¹Research scholar, Sri Chandrasekarendra Saraswathi Mahavidyalaya, Enathur,
Kanchipuram.

deenaieee@yahoo.com

²Department of EIE, KCG College of Engineering and Technology

ABSTRACT:

In automatic bottle filling system the bottles levels are assisted by filling tank level, position sensor, bottle present sensor and valve timings

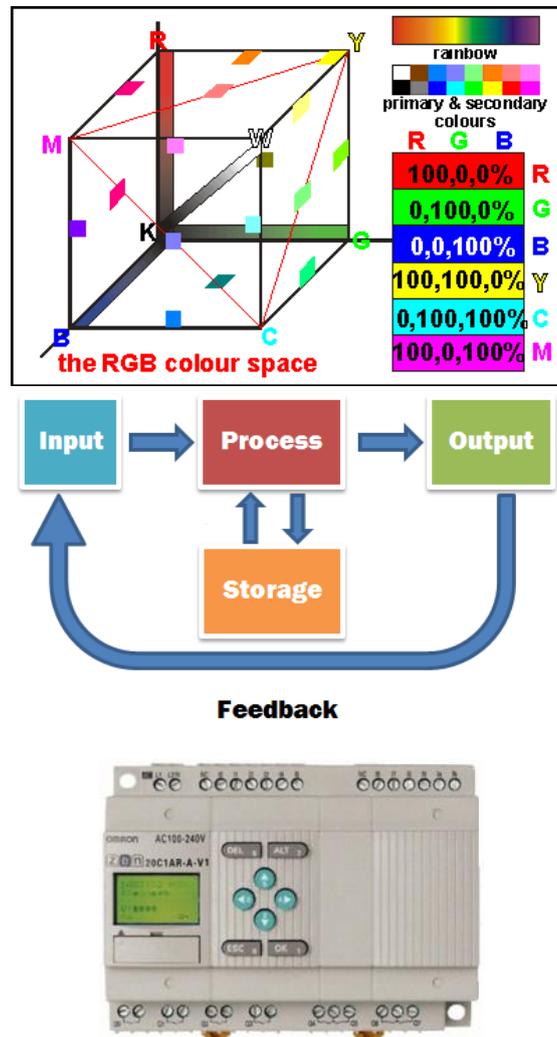
In conventional liquid level control the level accuracy is nothing but the quantity of the liquid. The quantity is proportional to the bottle level. The variation will affect the seller and buyer.

In this proposal the irrespective of the filling tank level and elimination of bottle position sensor and bottle present sensor were done to get accurate quantity of liquid image processing method is used for perfect control. The optical flow technique is used to analyse the liquid level detection. The processed image data will be applied to generate different commands. These commands would be fed to an PLC to change the states of its output pins, and, to control the necessary component of a system.

Key words: Bottle filling system(BFS), Bottle level(BL), Optical Flow, programmable logic Controller(PLC), image controller, Solenoid Valve (SV).

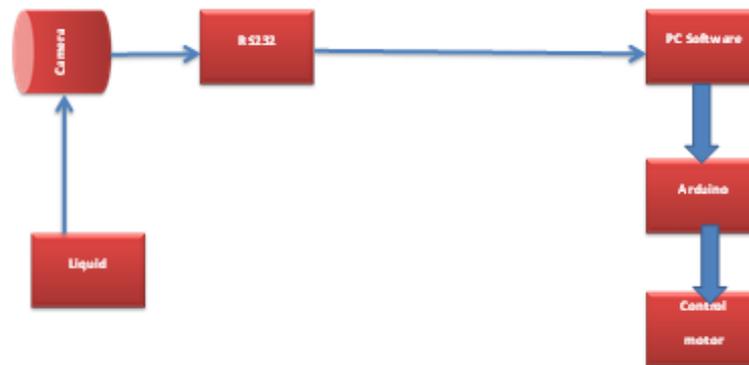
Introduction

Automatic bottling is used to increase the company efficiency than which is done by manually. [1] PLC based bottle filling is mostly used for automatic process. In most of the industries bottles to be filled-up with a coloured liquid are loaded in the conveyor and the remaining processes are sensed and controlled with sensors. The quantity to be filled were already pre-programmed. So the beverage levels may vary depending upon the filling tank level and pressure. If more pressure due to high level then the quantity of liquid is high. On the other hand for low pressure filling tank the quantity liquid in the bottle may be less than the required quantity.



In this proposal filling tank pressure due to its level will not affect the quantity of the beverage level in the tank. Further the bottle handling and filling valve operations are monitored and controlled by a simple video camera mounted at appropriate locations. The PLCs is communicated with the image controller and the information are transferred for drive motors, relays, solenoids etc. this proposal implemented in bottle filling system to achieve higher accuracy than any other existing system. In this proposal a video camera is used to detect the bottle and its level instantaneously.

Proposed System

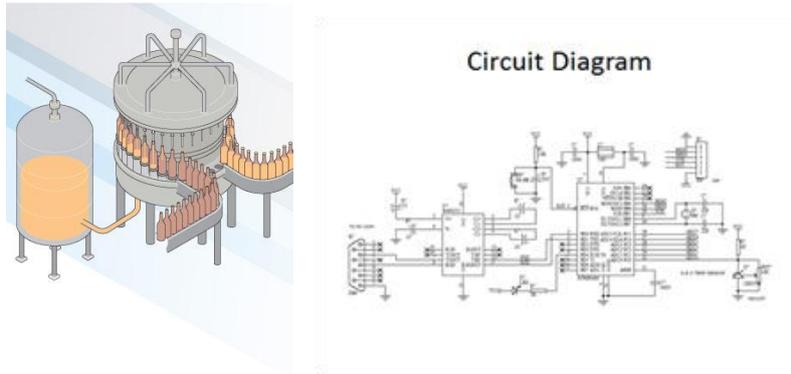


III. METHODOLOGY

A camera is mounted in an optimised position to image the bottling. The images are connected to a computer which detects the Bottles automatically in position in a carton over a conveyor belt; they are sensed to detect their presence. No other sensors are used for sensing the bottles. Everything can be activated from the information gathered from the image.

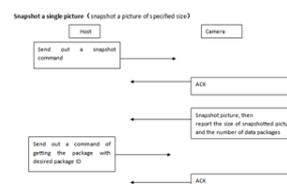
PROCESS DESCRIPTION

As soon as the data received from the image controller(IC) the programmable logic controller will start to control the associated final control elements. The process operation start from the filling tank to receive beverage from main tank and then it is connected to a solenoid valve which is pouring liquid into the bottle. The opening and closing of the solenoid valve (SV) decides the quantity of liquid in the bottle. But there are certain constraints that the SV should not open absence of bottle and filling tank level pressure may act as a load disturbance. Due to this there is an improper level may fill in the bottle. In this proposal these constraints are eliminated with the image correlation. The other process like capping and sealing are monitored with other set of cameras.



INPUT MODULE Serial JPEG Camera

Camera



Be the first to review this product by DFRobot

- 5V Power Supply
- Communication Interface/Protocol: RS232
- Support Capture JPEG from Serial Port
- VGA/QVGA/160 x 120 Resolution

The 0.3M Pixel Serial JPEG Camera has a compact size, low power consumption, and stable operation. 5.0V DC Supply. UART: Up to 115200bps for transferring JPEG images. The camera uses the advanced Omni Vision OV7725 VGA color sensor JPEG CODEC for different resolutions. The camera also features down sampling, clamping and windowing circuits for VGA, QVGA, and no need for external DRAM. The use of the Omni Vision CMOS VGA color sensor makes this a low powered consumption unit.

Applications

- Embedded systems for imaging acquisition and control
- Security and Control systems
- Remote or Public Monitoring
- Retrieved/object detection and recognition
- Robot/Industrial control, vehicle and medical systems

BOTTLE DETECTION USING CMOS CAMERA

CMOS CAMERA is used to capture video to detect the presence of bottles in the holder. Depending on the output of the image detection the filling and capping operation takes place. No time delay is given in order to set the status of the bottles. From the image if bottle present the corresponding status bit in PLC is set to 1 else it is set to 0. The outputs of the PLC will take care about the final control element interfacing. The bottle placing, bottle detection are very precise. Thus if all the n bottles are present in the input side then the image gives the corresponding output to the PLC which in turn switches ON the corresponding pumps for filling operation to take place. If a particular bottle is not present the corresponding solenoid will be OFF.

FILLING OPERATION

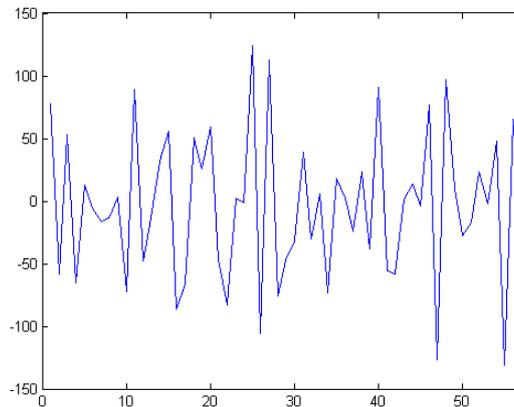
Video camera capturing image frames are processed using optical flow technique. Then the autocorrelation is performed on that frame. The computation of the autocorrelation tells us that level of the liquid exists in that particular bottle.

Given two functions, a , b , their cross-correlation is defined as

$$a * b = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} a(\xi - x, \eta - y) b(\xi, \eta) d\xi d\eta$$

The auto-correlation of a function is the cross-correlation between itself:

$$\phi_{aa} = a * a = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} a(\xi - x, \eta - y) a(\xi, \eta) d\xi d\eta$$



The filling timing is controlled by controlling the solenoid valve opening time. This is done by image feedback system with the set value of the user.

USER-DEFINED VOLUME

Image based filling operation is accompanied with a user defined volume selection menu. The desired volume is fed into the PLC and depending on the volume the filling of liquid takes place. The filling is done using image processing operations. Thus the pump remains ON. The value of the image does switch off once it meets the set point. Once the filling process is done the conveyor starts moving again.

Image Based CAPPING OPERATION

The bottles are further moved on the conveyor to the capping arrangement. Camera image used to stop the bottles in the desired position for capping to take place. Once the bottles reach the position the conveyor motor switches OFF. The capping of bottles is done using actuator arrangement. There is no provision available in conventional control system to detect the capping fit. But in this proposal if the capping is not done then the recapping is done immediately. So this technique ever ensure the guarantee of the capping.

CONCLUSION

Image based control technique is most easy for sequential operation. Because bottle filling system is based on the sequential operation. The parameters present in the conventional system were transferred into an image and then image analyses were done to extract the parameter values. Once the parameters are obtained its values were transferred to PLC. Then the PLC controls its control elements. In this proposal the number of camera may be decided by the user. In high speed control action an enhanced version of image controller can be used.

REFERENCES

- [1]. M. A. Laughton, D. J. Warne (ed), Electrical Engineer's Reference book, 16th edition, Newnes, 2003 Chapter 16 Programmable Controller.
- [2]. Harms, Toni M. & Kinner, Russell H. P.E., Enhancing PLC Performance with Vision Systems. 18th Annual ESD/HMI International Programmable Controllers Conference Proceedings, 1989, p. 387-399.
- [3] Shaukat.N, ,PLC based automatic liquid filling process, Multi Topic Conference 2002, IEEE publications.
- [4] Dunning Gray (1998) - 'Introduction to Programmable Logic Controllers' - Delmar publishers, pp.421-428.
- [5] Petruzella, Frank D. (2010) - 'Programmable logic Controllers' - Tata McGraw Hill Education, pp.6-12.
- [6] Rashid, M.H. (2010) – 'Power Electronics'- British Library of Congress
- [7] Rehg, James A. Glenn J Sartori (2009) – 'Programmable Logic Controllers'- Pearson prentice Hall ,pp. 230-239.
- [8]. **“Application of PLC for Arranging Bottle in Beer Filling Production Line”** ZHANG Tianxia, DONG Feng , YUAN Hao Tianjin Key Laboratory of Process Measurement and Control, School of Electrical Engineering and Automation Tianjin University, Tianjin 300072, China.