**IOSR Journal of Engineering (IOSRJEN)** **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Volume 9, PP 59-64

# Bottle Sorting in Production Line

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***Abstract :*** *The project is based on the field of Image Processing and mainly used in manufacturing plants and industries.It finds it extensive use in automation process due to its reliability, lack of manpower required.The main objective of this project is to highlight how Image Processing can be effeciently used for Automation and Inspection without the need of human supervision.The main concept or element of this project is the "VISUAL INSPECTION SYSTEM". The VIS is an important element which carries out the primary function of capturng the images of the product and inspecting it to determine if any fault is present.In presence of any fault the VIS will in form the processing section to intercept and remove the bottle from the production line.*
*The image processing is done by the use of morphological operators and use of algorithms. The image is processed through MATLAB software platform.A camera is used to capture the real time images which are sent to the processing section.The processing section consists of computer and microprocessor which are the heart of the system.The sensors, camera, processing unit together form the "VISUAL INSPECTION SYSTEM". The conveyor belt and the motor arm form the executing section of the project. Servo motors are used to drive the conveyor belt.*

***Keywords:*** *Automation , Conveyor Belt , Image Processing , Morphological Operators , Visual Inspection system*

## I. Introduction

The project aims to implement automation in manufacturing process. A lot of industry still uses manpower for sorting products and removing defective bottles. Human supervision can be tedious and ineffective at times. To overcome this obstacle automation must be implemented which is reliable and accurate and at the same time economical to set up. The project does the job of sorting the bottles based on their sizes and eliminates the defective bottles in a whole single unit. It is a reliable method with minimum error rate and is reliable.

## II. Software Description

MATLAB stands for Matrix Laboratory. It was initially released in 1984 and it works on C,C++ and java. It is a multi paradigm computational software which works on matrix manipulation, in implementing graphs and algorithms in a structured code. MATLAB has an added advantage of creation of user or graphical interface according to the user's convenience. MATLAB is a flexible software in that it can implement code for embedded system, interface with microprocessors and simulate various programs, plots, graphs and graphical interface. It also has an added package of "Simulink", which adds graphical multi domain simulation and model based design analysis for embedded systems.

MATLAB, nowadays has become an important and flexible tool to implement in lots of embedded systems, simulations and graphical analysis. In our project MATLAB does the function acquiring an image and performing morphological operations on the image captured. MATLAB through help of microprocessor ATMEGA 89S52 controls the entire system wherein the microprocessor controls the conveyor belt and the hardware, instructing the camera to take photos etc. The MATLAB software helps with the image processing part of the system. It analyses the images and verifies that the bottle is not defective or has any physical deformities. The decision that MATLAB makes is given to the microprocessor through serial port and the microprocessor takes the action accordingly.

## III. Hardware Used

**IR Sensors**

The infrared sensor is an electronic device which is used to detect the presence of an object in its surrounding. It consists of a transmitter and a receiver. The transmitter emits an infrared ray in the surrounding. When the ray is incident on an object it is reflected back and received by the receiver. By this method the IR sensor detects the presence of an object in its vicinity. The emitter is an IR LED and the receiver is a photodiode which is sensitive to the Infrared wavelength. There are 2 IR sensors present in this project, one at the bottom and other at the top. When only the bottom sensor is activated, the system knows that the bottle is small. When the both the sensors are activated, the system registers the bottle as big.


**Fig 01:** Infrared Sensor

**MAX 232**

The microprocessor and Computer port cannot communicate with each other because they are not compatible with each other. The computer uses RS 232 standard whereas the microprocessor uses the TTL standard.TO facilitate a smooth communication between the microprocessor and the computer, RS 232 must be used. The RS 232 helps the serial port of the computer communicate with the microprocessor.

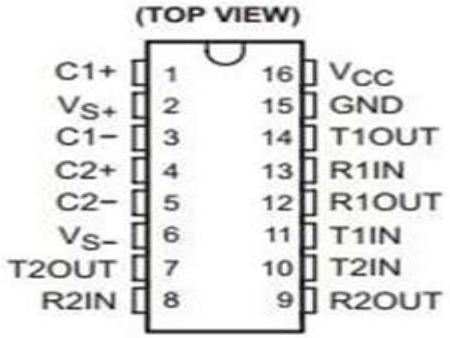



**FIG 02:** Rs 232 Pin Diagram

**Atmega 89s52**

The AT89S52 is a 8 bit CMOS which requires low power and gives high performance. It also has a 8k bytes of in system flash memory which is programmable. An on-chip flash is provided which allows the program memory to be reprogrammed. It has a versatile 8 bit CPU set up on a monolithic chip. ATMEGA 89S52 has 32 I/O lines which enables the system to give many inputs simultaneously and 3 timers/counters to count pulses. It is fully static operable from 0-24 MHz. Also it has low power idle and power down mode when not in use.

## IV. Block Diagram

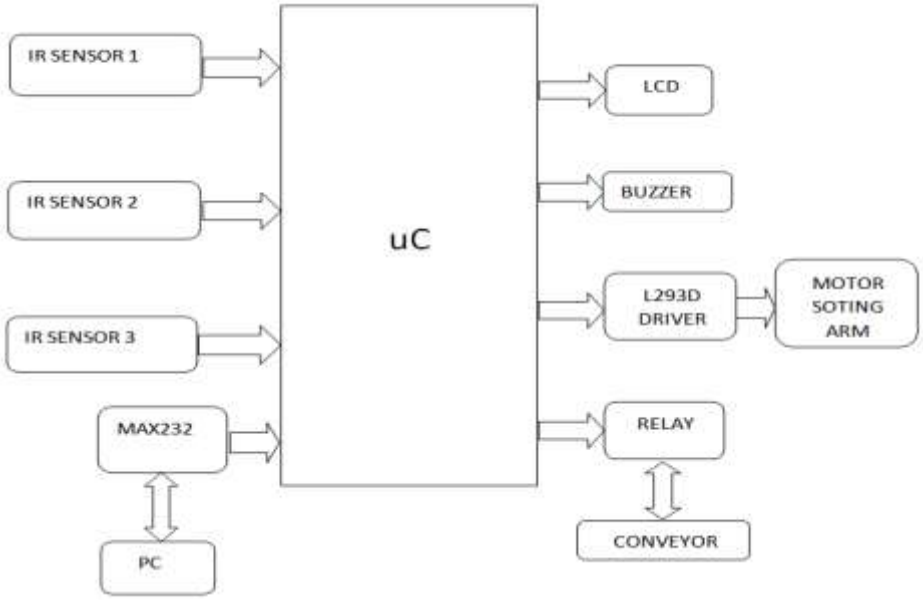
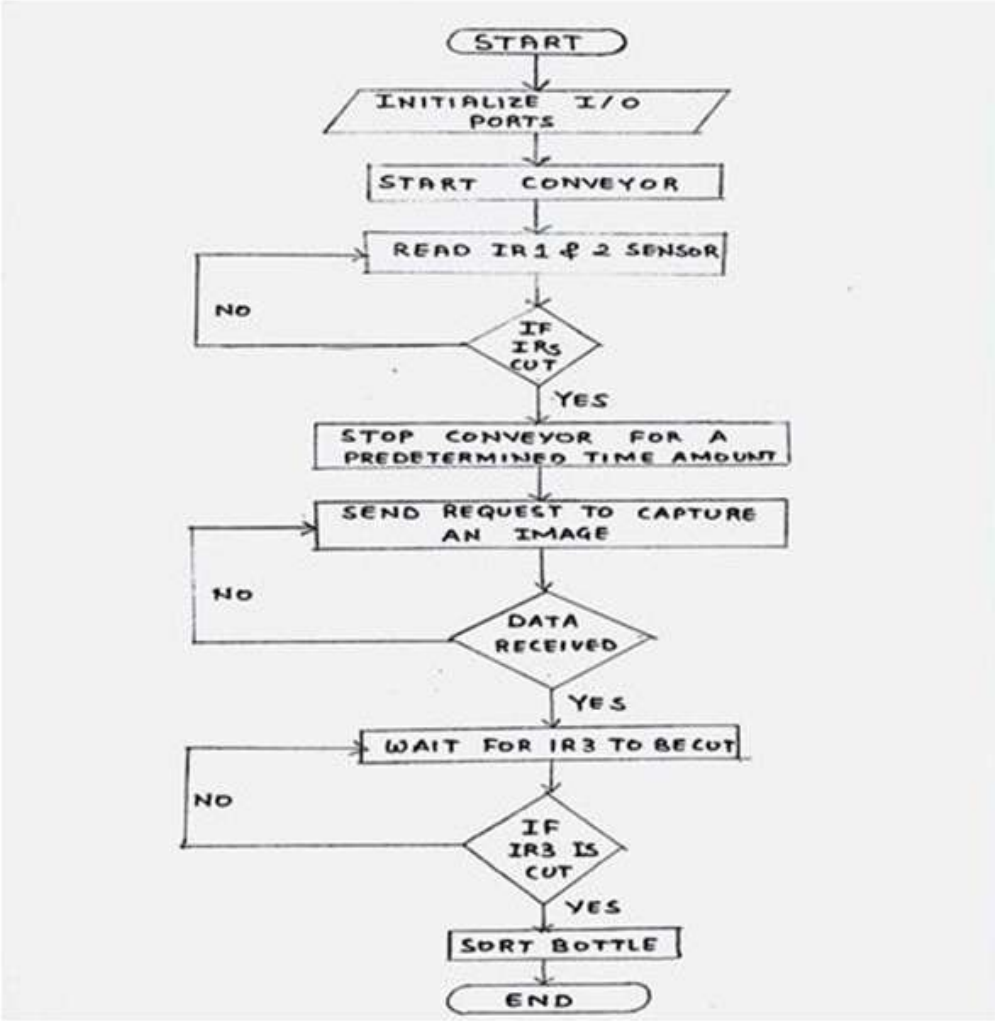



**FIG 03:** Block Diagram

## V. Working

The bottles is first placed on the conveyor belt as it rolls along the Visual Inspection System unit or VIS. The VIS consists of a camera which captures the images in real time, the computer in which the image processing is done. The image processing is done by the help of MATLAB software. There are two sensors present an upper IR sensor and a lower IR sensor. If only the lower sensor is cut then the system registers the bottle as small and if both the sensors are cut then the system registers the bottle as big. The camera captures the image of the bottle and sends it to the computer which in turns performs various operations on the image to determine the presence of any defects. If a defect is recognized the computer notifies the microprocessor. The detection of fault is done by the help of code written in MATLAB software. Various morphological operations are applied to the image to check whether if there is any dents, cracks or deformities on the bottle. The microprocessor then with the help of the motorized sorting arm eliminates the defective bottle. The conveyor belt is driven by the help of servo motors. A RS 232 IC is required to facilitate a communication between the microprocessor and the computer port. At the end of the line, the motor sorting arm separates the bottles accordingly.

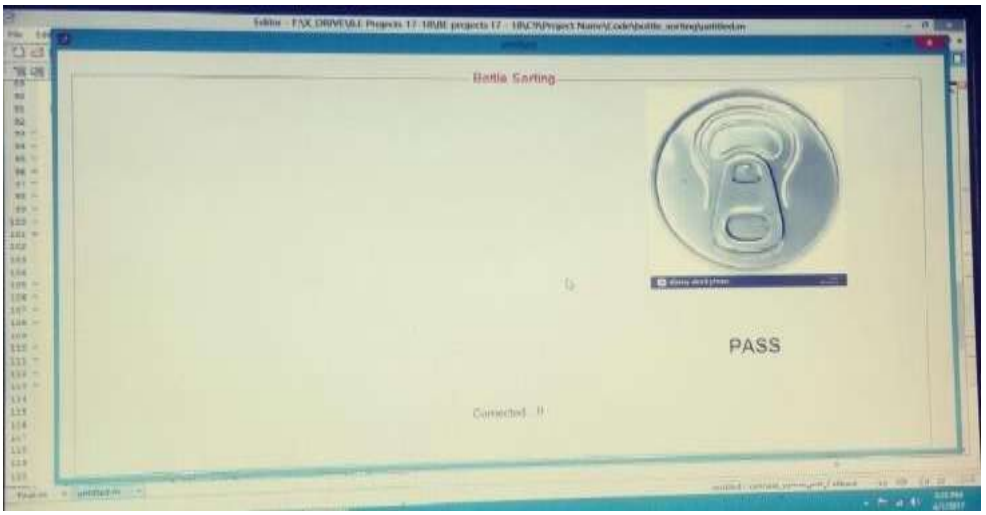



Flowchart Of The Process

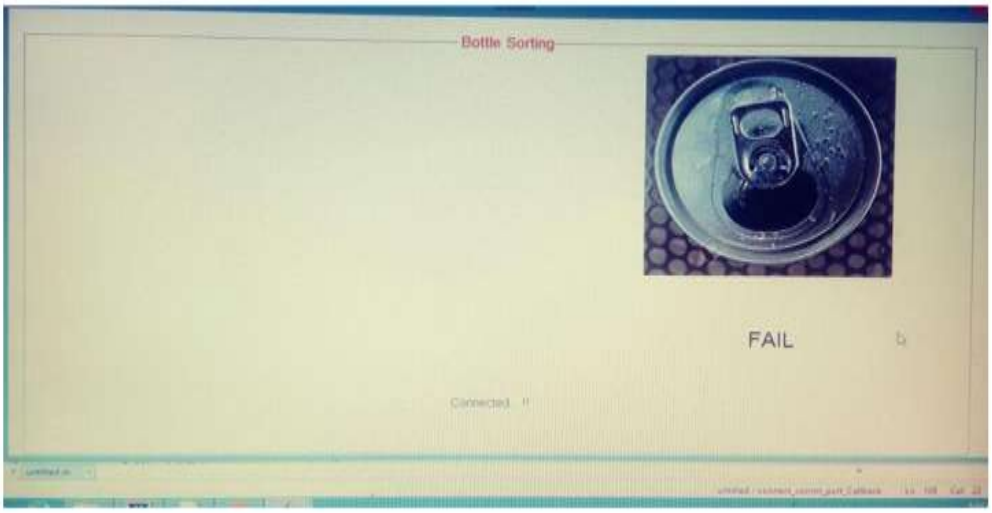
## VI. Result

Following are the simulation run sample image results for the image processing analysis done on the bottles.

This is the image of sample photo which shows that the MATLAB indicates this bottle does not have any defect or physical deformities and has indicated it by displaying the result "PASS". This is after the camera has captured the image and it has been processed. Now the computer will inform the microprocessor to sort the bottle accordingly. Hence MATLAB is the brain of the system while microprocessor is the executing arm.


Another image of a bottle that has passed on inspection after image processing has been done to it.
This is an image in which the bottle under inspection has failed the test. The bottle has a flaw which is detectedbyMATLAB.e



## VII. Conclusion

The main advantage of this system is that automates the process of manufacturing thus requiring less manpower. With the help of Vision Inspection System the bottles are sorted on the production line itself. Also the defective bottles are detected on the production line. Hence a need for separate quality control department is eliminated. A main drawback of this system is that designed for a specific product (bottles in this case) which limits its ability to detect any other products which maybe produced in the plant.

## Acknowledgements

We are grateful to ATHARVA COLLEGE OF ENGINEERING for giving us the opportunity to do the project work in Department of Electronics and Telecommunication Engineering We feel privileged to express our deepest sense of gratitude and sincere thanks to our project guide Prof. Nilesh Gode for his continuous support and guidance throughout our project work. We would also like to thank our H.O.D. Prof. Jyoti Kolap for approving our project. We also wish to thank them for their patience and co-operation, which proved beneficial for us.

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