Detection of Foreign Substances

S. Subasangkari, P.Dhilip Kumar, J. Dilli Srinivasan, K. Arulvendhan

Abstract--- This paper deals with the reviews of various methods used for the detection of foreign substances. On studying this paper one can easily come up with the best suitable method he/she needed for working in respective sectors. The main focus of the paper is digitalmethodsand notusual traditional methods. Here three different methods are studied for the detection of foreign substances, Video image processing, online monitoring and MLP neural network and SVM techniques.

Keywords--- Real-Time Video Image Processing, 3D Scanning,CCD Image Sensor.

I. INTRODUCTION

Three different paper deals with three different methods, but the common motto was to find the unidentified foreign substances that are present in the medium of testing. Video image processing was done on the plastic bottle that contains medicine solution; On-line detection was done on glass bottle that is filled with transfused solutions through computer vision.

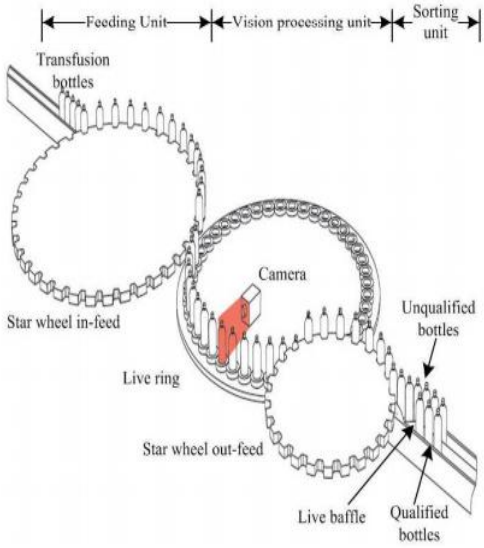
II. SHORT REVIEW

- **Computer vision techniques used in detecting the foreign substances mixed up with the glass bottles that are filled with the transfusion solution.**

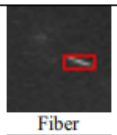
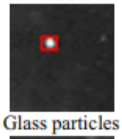
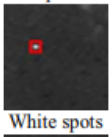
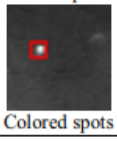
In this paper foreign substances are detected through computer aided vision where foreign substances contaminated with transfusion solution are detected from bottle side wall by a relative movement between the bottle in the resting position and within the solution which in the movement.

This project has two stages of operation; they are carried one after other after successive completion of one stage. At stage one the 250 ml transfusion bottle is distinguished for the movement by the condition of static bottle walls and the movement of particles inside the bottle. This movement is differentiated with the technique of background subtraction by enabling normalised cross correlation. This is performed every time before every starting ofon-line detection technique, whereas stage two is performed after successive completion of stage one. Stage two uses adaptive mean -shift tracker that uses adaptive searching window for finding the falling particles that is unknown and could be easily removed from the solvent of the solution. The falling particle need not be solute, it could be of any solvent with lesser density than the solution which when on elapsation of time for stage one automatically settles at bottom of the glass bottles.

III. INSPECTION SYSTEM



The inspection unit comprises of three units such as input units, image processing units and identifying units. Feeding units comprises of star wheel in feed that rotates the circular shaft to the vision processing units for computer aided vision detection. Here the foreign substances are divided into fibre, glass particles, white and coloured spots these conclusions were arrived because of the repeated identification of these substances in the transfusion bottle.

Type	Description	
	Color	Source
 Fiber	White	Dust in the air
 Glass particles	Transparent	Collision between bottles
 White spots	White	Rubber tops
 Colored spots	Yellow, Red	Rust from apparatus

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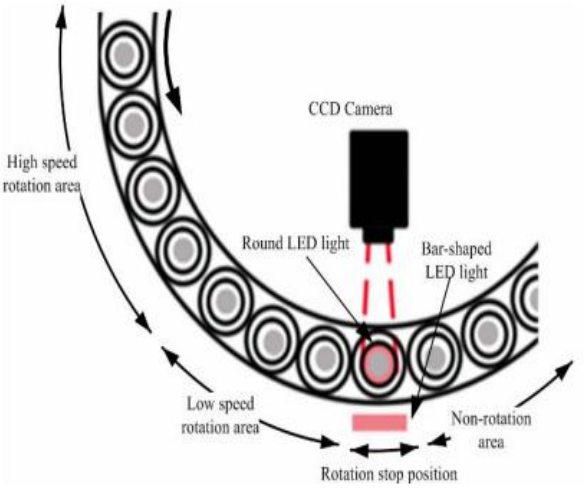
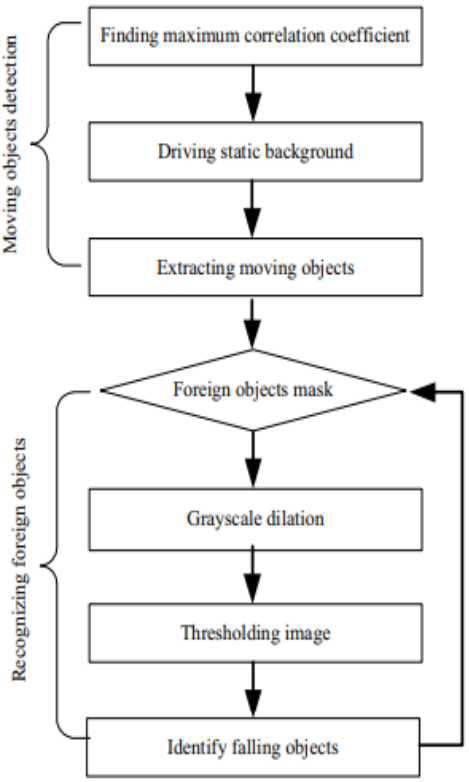
These substances are so small such that they can be seen only in the fluorescent light; substances that are marked in red rectangles appear as bright or dull spots against a black background when they are exposed to the various colours.



The second main part of the inspection unit is the vision processing unit, here the transfusion bottle are checked for the amount of foreign substances that are present in the transfusion bottle, once the amount reaches the negligible standards set by medical department the transfusion bottle are separated from the feeder chain and are removed from the stock. This eliminates any risk of damages that can be caused by these foreign substances.



This is the algorithm that is followed in this method where the objects in movement are detected first and then they are analysed and processed later.

This project is limited to identification of only still object; however, detection and elimination of moving objects cannot be done with the methodology of on-line detection method using computer aided vision.

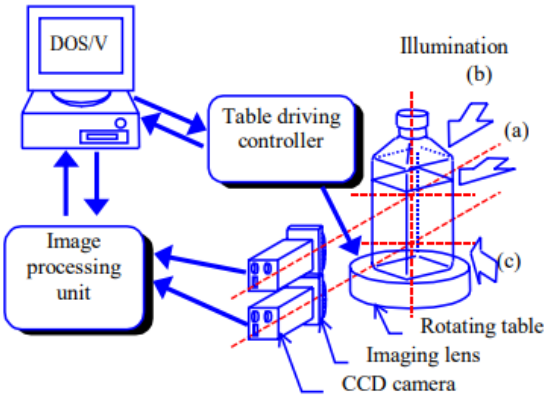
- **Video image processing techniques used for the detection of foreign substances mixed with plastic bottles filled with medicinal solution.**

In this paper, the foreign substances that are present in the plastic bottle of solution are removed by using real time video image processing. Here the hardships like corners, embossed symbols, graduation of surfaces are considered and it is removed by capturing the section passing through it vertically.

Centre of the plastic bottle. The solution is 3D scanned for detection of foreign substances and it is rotated further for the detection of colloidal movement inside the medicine solution, then these are viewed under CCD image sensor device which views the solution at video outline rate. The substances that are contaminated appearas black spots. However, the detection rate is limited to 90% in identifying the foreign substance.

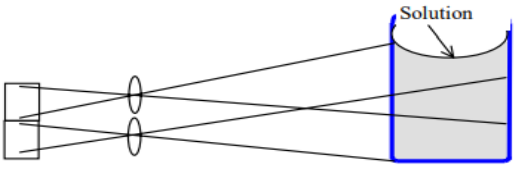
Here the foreign substance is divided into two types based on the appearances as, Black and white. Substances other than them appear as a bright spots in the coloured lights. The two main source of foreign substance in the medicine are rubber hair and styrene resin chemical fibre that are mixed unnoticeable by the package workers during manufacturing.

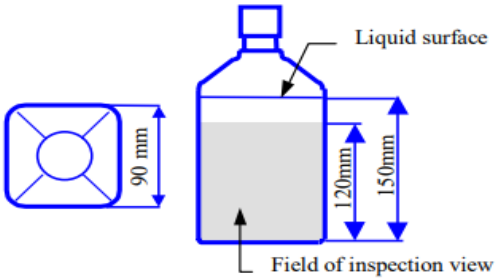
Type		Size	Source
Black	Rubber	0.3 mm cube	Bottle mouth packing
	Hair	ø0.12×7 mm	Workers
White	Styrene resin Chemical fiber	0.4 mm cube ø0.35× 0.55 mm	Bottle mouth packing Cleaning cloth



The process involved here is, the medicine solution in the plastic bottle is held at the rotating table, which first rotates at a greater speed or sequentially lesser speed continuously, this results in production of vortex. The solution moves according to the changes in the inertia from the vortex making the foreign substances available at the middle of the bottle containment.

Black coloured substance can be identified by illuminating the solution with 2D arrayed LED panel and extra illumination is offered by mounting a fluorescent lamp with the apparatus set up.





The two CCD cameras take pictures of the clear side wall of the containers. Such that the cameras take images possibly including foreign substances. Foreign substances are detected by processing all the images.

- **MLP Neural Network and SVMused for the detection of foreign substances that is mixed up with medical vials & Results**

This paper deals with the medicine liquids whose quality is the major threat for the company as well as the patients, when it is not properly manufactured in terms of purity, Ph, density and other liquid properties. There is always a need to detect the property of the liquids automatically for the detection of foreign substances if present any. The need for detection and classification of foreign substances is done by machine vision through number of cameras that are present in the production lines. The camera captured content is analysed, gathered and collected. The collected content is classified and distinguished between foreign substance and bubbles. The defect in the bottle surfaces and scratches are also identified. The efficiency of this method is nearly 93% to 97%.

The detected foreign substances are usually,

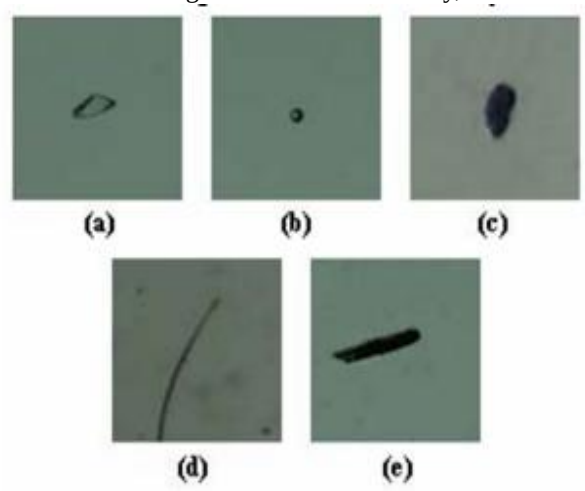


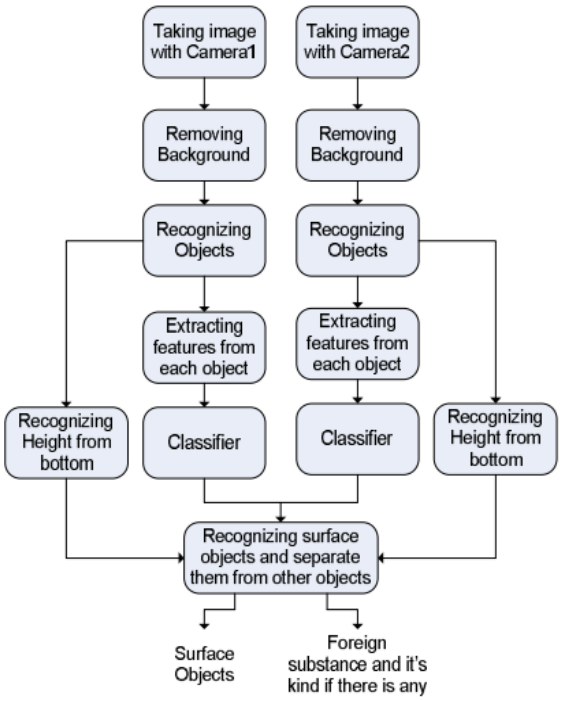
Fig. 1 (a): Glass (b) Bubble (c) Other (d) Hair (e) rubber

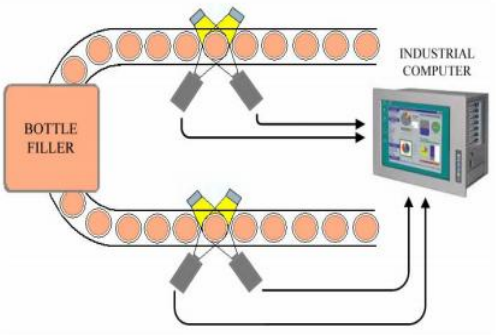
The size, shape and sources of the detected foreign particles are,

	size	shape	source
Hair	0.05×1 to 0.2×30 mm	Line	Workers
Glass	0.1 to 2 mm in each side	Polygon	Bottle collision
Rubber chips	0.1×0.1 to 3×3 mm	Rectangular	Bottle mouth packing
Other substances	Any size	Any shape	Mixer
Bottle surface	Any size	Any shape	Washing machine

This paper involves two methods

- Taking images of the empty bottle before filling it with medicine solution, the shape and characteristics were analysed for any fault, if the fault is big enough, the bottle is rejected.
- The other method involves Stereo vision imaging technique which is used to identify the floating substances as well as settled substances present in the solution. The images from the cameras are compared using processor.





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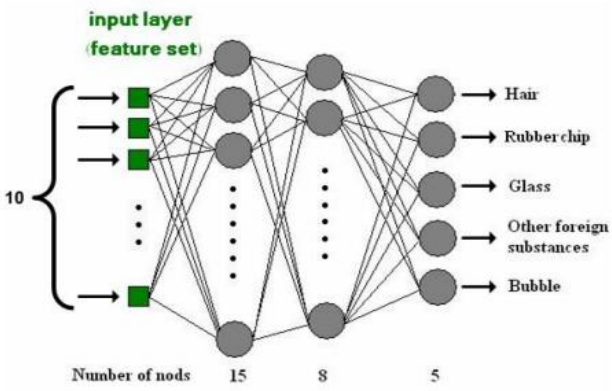
The system uses two inputs for the classifier unit, after extracting the features from this method. This unit has two main duties,

1. Identifies the bubbles from foreign particles.
2. And distinguishes the foreign particles into 4 types.

There are two types of classifier used,

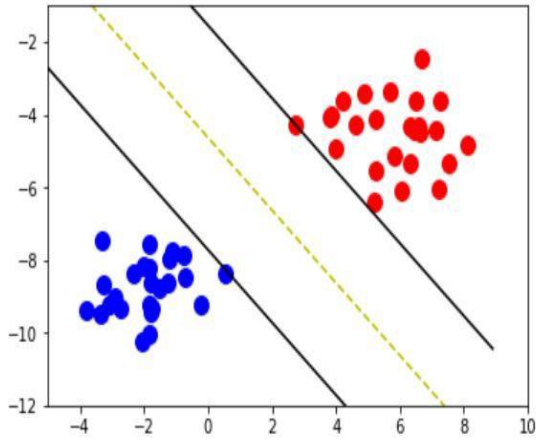
- MLP neural network
- Support vector machine (SVM)

MLP neural network



MLP's are valuable in research for their capacity to take care of issues stochastically, which frequently permits rough solutions for very unpredictable issues like fitness approximation. At the point when reaction variable is straight out MLP's make great classifier calculations.

IV. SUPPORT VECTOR MACHINE (SVM)



Experiments show that SVMs possess substantially higher accuracy on searching, than other schemes after nearly three to four rounds of relevant feedback. The SVM algorithm is being used in a wide plethora of applications, especially in biomedical applications. They have been used to differentiate between the different class's proteins with accuracy rates ranging around 90%. Permutation tests based on SVM weights have been suggested as a means of interpreting SVM models.

V. CONCLUSION

Above papers were studied and the method of digital identification of foreign substance was analyzed and the particle size and their elimination were discussed in detail. This review paper gives comparison between the three methods such as on-line detection, Video image processing and MLP neural network and SVM techniques, so that the researcher could choose the best method out of this for his/her work. From our comparison study we found that MLP neural network and SVM technique is better than other two techniques.

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