ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 4, Issue 7, July 2017

Assessment of the purity of silk and its mixed fabric using image processing in textile showrooms

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Abstract: **In today's world where there is a lot of interest towards fashionable and expensive clothing ,the quality and purity of the material is expected to be of high standards. Especially when it comes to silk clothing, people always are doubtful about the purity of the material, due to the high costs people invest on such clothing. In this paper we aim at determining the purity of silk clothing by using image processing algorithms .We basically take a microscopic image of the fabric and compare it with a dataset of pure silk fabric images and hence determine the percentage purity in mixed fabric clothing**

***Key words*- mixed fabric clothing , purity , silk , image processing**

1. INTRODUCTION

Silk is a natural animal protein fibre used in a large variety of industrial and commercial applications such as clothing , wall curtains , window treatment , luxury fabric,etc. One of its major applications include the making of silk sarees where genuineness plays a major role from the customer's point of view. Accounting to the cost of such clothing, people are very cautious and doubtful when buying them. In today's world, what guarantee does the textile showroom give to ensure the purity of silk sarees? In the past people determined the purity of silks by a few physical test like lustre , weave pattern , hand touch , friction , etc.Later on a few technical tests such as the burn test, chemical test and microscopic tests came into existence.But most of these tests either needed a laboratory setup or it may involve in damaging the fabric. Hence, in this paper we will be looking at developing a simple electronic instrument that gives an estimate of the purity of the silk clothing.Here ,we aim to accomplish the task by capturing microscopic images of the material and compare it with a dataset of pure silk fibre(microscopic) image repository to determine the percentage of match and hence to tell its purity.

RESEARCH METHODS:

When it comes to laboratory testing and assessment of the genuineness of silk we usually employ two techniques namely, IR spectroscopy test and microscopic imaging test. To solve our purpose a microscopic test is sufficient since we aim at determining the percentage of silk in its mixed fabric .

● *HARDWARE SETUP AND CONFIGURATION:*

The setup deployed is a relatively simple and portable one where we use a magnifying lens of 100x power, over which a small camera is placed which is connected via usb to a processing chip(for eg,raspberry pi).

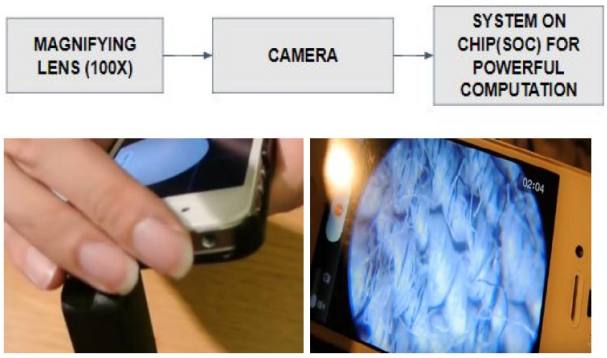

fig.1 Hardware setup of the image acquisition system for cotton fibre is shown

MAGNIFYING LENS:
A 100x powerful magnifying lens which could be fitted to a phone camera is made use here.This Lens is made out of abs resin with 3 LR3310 batteries and one LED lamp with an approximate size of 170mm*65mm*30mm.

CAMERA:
In this case we use an iphone 6s 12mp camera as it serves the purpose .

SYSTEM ON CHIP:
For experimental purposes we have used a laptop as a processing medium for the images.But for real time applications a computing platform such as the raspberry pi could be used.

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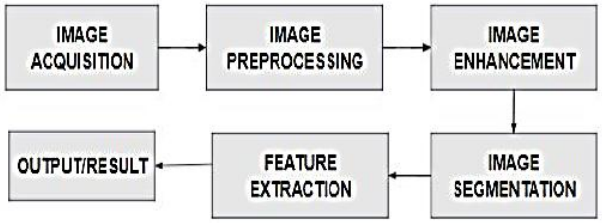
● ***SOFTWARE DESCRIPTION:***

The major part of the computing and image processing is carried out here. We use open source image processing platforms such as opencv to carry out the image comparison-algorithm .



Fibre	*Longitudinal Section: Appearance*	*Cross-section: Appearance*
Cotton	Flat, irregular convoluted ribbons which change direction with the twist (mercerised cotton is smoother and less irregular)	Peanut or bean shaped with lumen* running through the *length.
Wool	Rough surface with scales protruding out	Nearly round, medulla present in coarse fibres is concentric and irregular in size.
Silk (degummed)	Smooth with distinct lengthwise striations.	Mostly triangular, irregular.
Viscose Rayon	Striated, smooth	Irregular, serrated
Nylon, polyester, polypropylene	Smooth, rod-like	Regular, round
Acrylic	Flat, irregular striations	Irregular, dog-bone shape

fig.2 Test for identification of natural fibres [7].

IMAGE ACQUISITION:

Image acquisition phase happens from the images captured by the camera .The images captured must be kept at maximum zoom and the focus must be adjusted so as to get a clear picture .

IMAGE PREPROCESSING:

Some basic preprocessing techniques are used to convert the coloured image(rgb) into a grayscale format .

```
1.  Y = (0.299 x R) + (0.587 x G) + (0.114 x B);
2.  U = (B - Y) x 0.565;
3.  V = (R - Y) x 0.713;
4.  UV = U + V;
5.  R1=R*0.299;
6.  R2=R*0.587;
7.  R3=R*0.114;
8.  G1=G*0.299;
9.  G2=G*0.587;
10. G3=G*0.114;
11. B1=B*0.299;
12. B2=B*0.587;
13. B3=B*0.114;
14. R4=(R1+R2+R3)/3;
15. G4=(G1+G2+G3)/3;
16. B4=(B1+B2+B3)/3;
17. I1=(R4+G4+B4+UV)/4;
```

fig 3.This is the algorithm to convert rgb colours into a grayscale format [9]

IMAGE ENHANCEMENT:

The obtained grayscale image now has to be enhanced so as carry out colour based sorting algorithms.The images must be brightened so that in the further steps the colour based sorting works at a higher efficiency.

IMAGE SEGMENTATION:

This is the major process since it separates out the fibres based on a colour-sorting algorithms.The fibres are segmented based on hue and saturation parameters of the image.The fibre which is darker in colour is characterised as a synthetic fibre and the percentage of silk is determined
based on this .

fig 4 A grayscale(microscopic) image of the silk fibre

fig 5 ,A grayscale image of a silk rayon mixed fabric

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FEATURE EXTRACTION:

The main feature here is the colour difference.The other major features are correlation, contrast and homogeneity of the three colours such as red ,green and blue separately .

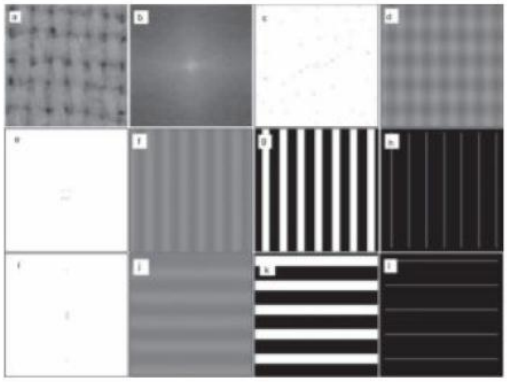

Fig. 3 image (a) is a plain woven fabric; image (b) is Power spectrum; image (c) keeps all the principal Peaks in the power spectrum only, and image (d) is Its reconstructed image (c); image (e, f, g, h) present Horizontal selected peaks, warp image (f), the Binary image of image and the thinned image of Image (g) respectively; image (i, j, k, l) present the Vertical selected peaks, weft image, the binary Image of image (j) and the thinned image of image (k) respectively [4]

Thus various spectrums of the image is analysed. These are then compared with a dataset of 580 images created by capturing pictures of pure silk in various angles.After preparing a dataset we label the images and its attributes as pure and mixed accordingly.This dataset is then given to the processor for training .Hence we have made an analysis of the silk content in a mixed fabric clothing.

RESULTS:

We have made an attempt to determine the purity of silk and its mixed fabric.Here we have achieved a good result when it comes to pure silk fabric.In case of mixed fabric we get a sufficiently accurate result which distinguishes the synthetic fabric from the silk.

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