Fabric Fault Identification System

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Abstract - **In recent years most of the textile industries are automated. Many sewing, knitting and dyeing units involve both manual and automated processes. Detecting faults in fabric manually, by human visual inspection is a tedious task. Its accuracy depends upon the skill of human operator and varies from person to person. The main objective of this project is to detect faults in fabric using image histogram techniques and the histograms of reference image and test image are compared and error is calculated. This output can be given to a microcontroller which is programmed such that on identifying a fault i.e. when the error exceeds the maximum permissible value, it is displayed on the screen and the motor of the machinery is turned off. Faults like scratch, hole, dirt, spot, fly, crack-point and colour bleeding can be identified automatically. This method eliminates human inspection and increases accuracy, thereby increasing productivity in textile industries. The softwares used for this project are MATLAB and Keilµvision3.**

Index Terms- Fabric fault, Microcontroller, Matlab, Keil

I.INTRODUCTION

Quality is an important aspect in the production of textile fabrics. Fabric quality is consisting of two components, i.e., fabric properties and fabric defects. Fabric faults or defects are responsible for nearly 85% of the defects found by the garment industry. Manufacturers recover only 45 to 65 % of their profits from seconds or off-quality goods. It is imperative, therefore, to detect, to identify, and to prevent these defects from reoccurring. Surveys carried out in the early 1975 shows that inadequate or inaccurate inspection of fabrics has led to fabric defects being missed out, which in turn had great effects on the quality and subsequent costs of the fabric finishing and garment manufacturing processes [1].

Fabric texture refers to the feel of the fabric. It is smooth, rough, soft, velvety, silky, lustrous, and so on. The different textures of the fabric depend upon the types of weaves used. Textures are given to all types of fabrics, cotton, silk, wool, leather etc., In textile, different types of faults can be found such as hole, scratch, stretch, fly yarn,dirty spot, slub, cracked point, colour bleeding etc; if not detected properly these faults can affect the production process massively[2].

II. RELATED WORK

Fabric defect detection using digital image processing has received considerable attention during the past two decades and numerous approaches have been proposed in the literature.

Navneet Kaur [3] proposed a Gabor filter scheme. A Gabor filter was chosen as a suitable representative of this class of techniques. This research then successfully applied optimized 2-D Gabor filters to the textile flaw detection problem and provided a further support of their suitability for this task.

Digital image analysis permits a detailed analysis of basic structural parameters of linear textile products as thickness, hairiness and number of twists. Technique also enables the estimation of other characteristic features of the external structure of linear textile products, such as twist parameter and linear density coefficient. Defects can be classified as local or global. Global defects cause an overall distortion of the basic structure of the fabric and can be detected by means of Fourier analysis. Local defects only affect a small area of the image of the fabric under inspection. In the proposed thesis work, it is proposed to develop an algorithm for detection of local as well as global defects from the fabrics online so as the corrective measure could be started at the time of detection of the defect.

Texture analysis provides measures of properties such as smoothness, coarseness and regularity. There are three principal approaches in image processing are statistical, structural and spectral [4]. Statistical approaches yield characterization of textures as smooth, grainy and so on.
Structural techniques deals with the arrangement of image primitives such as description of texture based on regularity spaced parallel lines. Spectral techniques are based on properties of the Fourier spectrum and are used primarily to detect global periodicity in an image by identifying high energy, narrow peaks in the spectrum.

A Gabor filter scheme in the spatial domain following a fast pyramid implementation for computational efficiency is applied for texture analysis. An image with the joint contribution of the complete set of multi-resolution and multi-orientation channels is binarized. In the binary output image local defects appear segmented from the background.
The only considerations that require attention are optical conditions such as lightness and scale to guarantee optimal performance, and a preliminary analysis of a prototype defect-free sample to extract the mean and standard deviation of its texture descriptors.

S.Priya [5] has separating a digital image into its bit planes is useful for analyzing the relative importance played by each bit of the image. Instead of highlighting gray level images, highlighting the contribution made to total image appearance by specific bits is examined. Most of the algorithms used today for fabric defect localization.

III. TYPES OF FABRIC DEFECTS

In order to identify the most detrimental defects in textile fabrics, an industry survey was conducted to identify the most frequently occurring defects and the most costly defects as far as points were concerned[6].
Data from leading fabric manufacturers was collected for their typical defects and the number of points lost by each. Broken picks, harness drops, and start marks top the list of the most frequently occurring defects. Broken ends, broken picks, waste and coarse picks were the most costly defects.

A wide variety of defects are represented; many defects are a direct cause of machine malfunction while others are from faulty yarns. The various types of defects detected during quality controls are broadly classified as follows:.

Critical Defects – Defects which are likely to cause hazard to the health of individuals using it.

Major Defects – More serious defects which are likely to affect the purchase of the product.

Minor Defects – Include small faults which have no effects on the purchase of the product.

IV. STRUCTURE OF FABRIC FAULT DETECTION SYSTEM

The structure of fabric fault detection system consists of image acquisition, greyscale conversion, noise filtering and histogram comparison as shown in Figure 1.

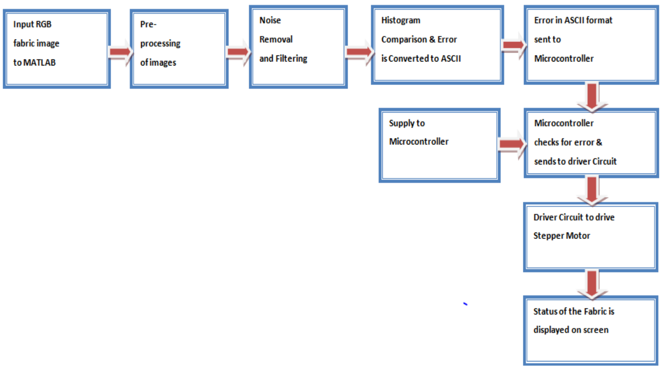

Figure 1 Block Diagram of Fabric Fault Detection System

V. IMPLEMENTATION

A. *Image Acquisition*

Acquire Input colour fabric image to MATLAB in image processing system. The input fabric image is tested for faults by human inspection. And hence a fault free fabric image is considered as the reference image. The image formats are .tif, .Jpeg, and .png. RGB images of the form .Jpeg are used in this paper.

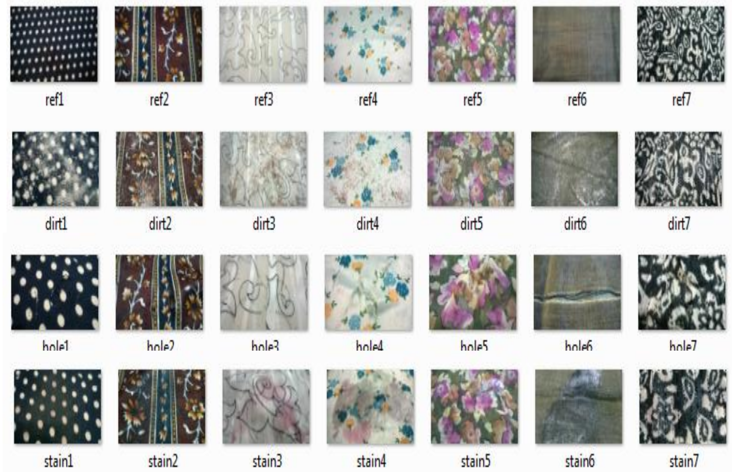

Figure 2 Test Images

B. *Greyscale Conversion*

The RGB image is converted to double precision and then to Greyscale. The gray scale image conversion is really very important since the further processing of the system is to be done on the gray image only.

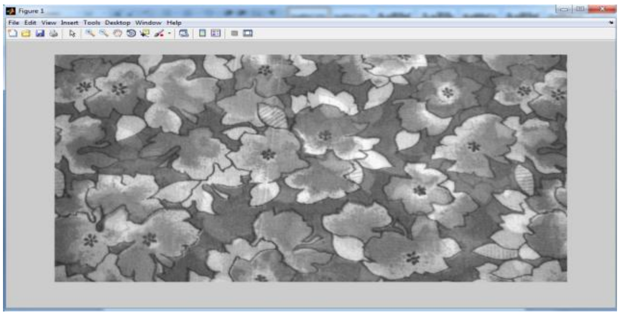

Figure 3 Greyscale of Reference Image

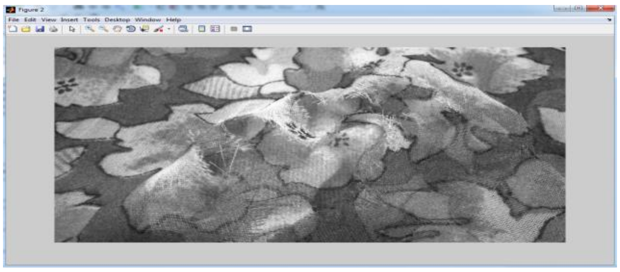

Figure 4 Greyscale of Test Image

C. *Noise Removal and Filtering Using Mean Filter*

The image that is converted to the gray scale image is being given as an input to the noise removal part of the system. In this part of the system the removal of the noise signal is done in order to analyse the image for the defects in the image that is the fabric. The noise removal is one of the crucial parts of the system since the noise in the image acts as the impurities in the image that can cause the degraded output of any system. Here in our system the noise can

affect the level of the intimation of the faults that the system is going to predict at the end.
Image noise is random (not present in the object imaged) variation of brightness or colour information in images, and is usually an aspect of electronic noise. It can be produced by the sensor and circuitry of a scanner or digital camera. Image noise can also originate in film grain and in the unavoidable shot noise of an ideal photon detector. Image noise is an undesirable by-product of image capture that adds spurious and extraneous information.

The original meaning of noise was and remains unwanted signal; unwanted electrical fluctuations in signals received by AM radios caused audible acoustic noise ("static"). By analogy unwanted electrical fluctuations themselves came to be known as "noise". Image noise is, of course, inaudible.

The magnitude of image noise can range from almost imperceptible specks on a digital photograph taken in good light, to optical and radio astronomical images that are almost entirely noise, from which a small amount of information can be derived by sophisticated processing (a noise level that would be totally unacceptable in a photograph since it would be impossible to determine even what the subject was) [7]

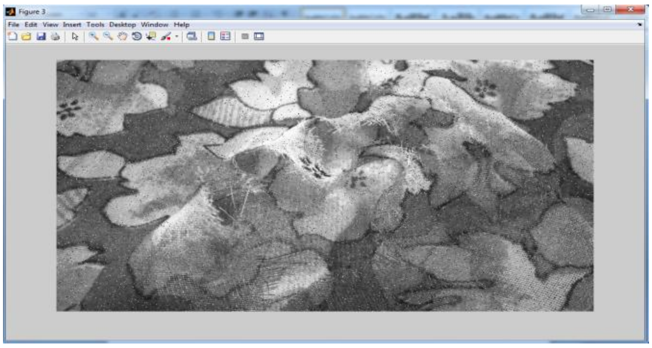

Figure 5 Noisy Test Image

Noise Filtering is preformed using Mean filter which is a simple and easy method to implement smoothening of images. It reduces the amount of intensity variation between one pixel and the next.

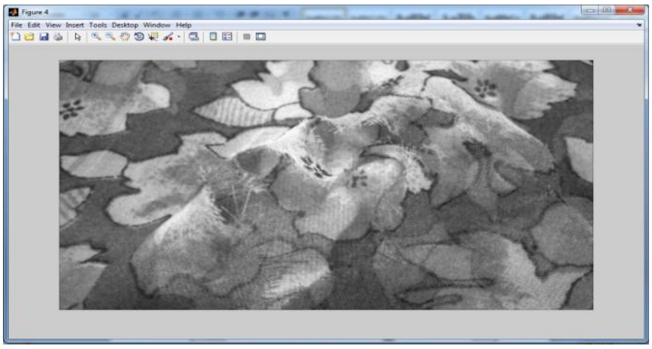

Figure 6 Filtered Test Image

D. Image Histogram

The horizontal axis of the graph represents the tonal variations, while the vertical axis represents the number of pixels in that particular tone. The left side of the horizontal axis represents the black and dark areas, the middle represents medium grey and the right hand side represents light and pure white areas. The vertical axis represents the size of the area that is captured in each one of these zones. Thus, the histogram for a very dark image will have the majority of its data points on the left side and center of the graph. Conversely, the histogram for a very bright image with few dark areas and/or shadows will have most of its data points on the right side and center of the graph[8]

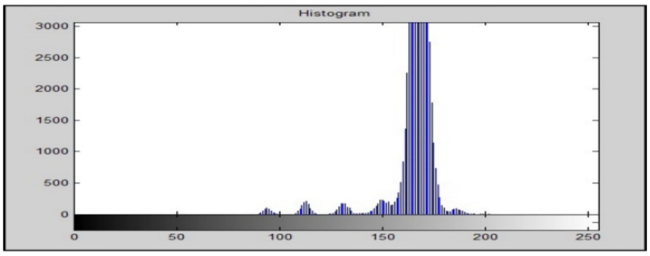

Figure7 Histogram of the Reference Image

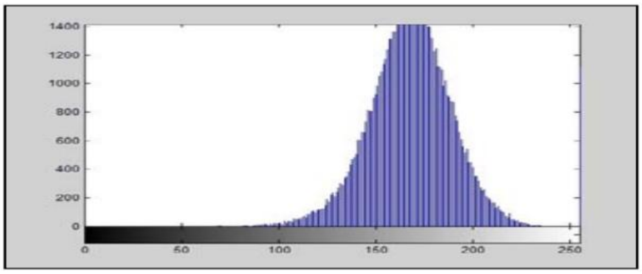

Figure 8 Histogram of the Test Image

E. Histogram Comparison

The reference image histogram and the test image histogram are compared. Then the error between them is calculated.

The maximum allowable error is found to be 0.0001. If the test image histogram is equal to the reference image histogram, the error will be 0.0001 and hence the fabric is fault free.

If the reference image histogram and test image histogram are not equal, the error exceeds the maximum allowable error of 0.0001 and hence the fabric is faulty.

Table 1 Errors Generated for different fabric types

Type of error	Dirt	Hole	Stain	Overthread
Ref1	0.0099	0.00043118	0.0033	0.00015118
Ref2	0.0036	0.00094309	0.00064209	0.0027
Ref3	0.0042	0.0059	0.0160	0.0021
Ref4	0.0013	0.0005581	0.0063	0.0062
Ref5	0.000049078	0.0007888	0.00046956	0.000463
Ref6	0.0029	0.0024	0.0036	0.00049574
Ref7	0.00093954	0.00024285	0.00039682	0.00010327

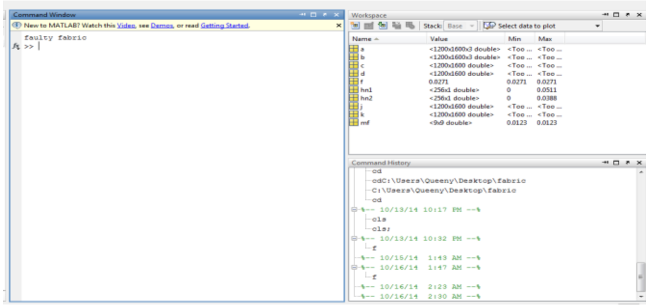

Figure 9 Error Value

F. Control Action of Stepper Motor

AT89C51 microcontroller and stepper motor are interfaced with PC as shown in Fig 5.4. When the error exceeds the maximum permissible value, ie., when the fabric is faulty, 1 is assigned to a variable and when the fabric is non-faulty, 0 is assigned. This array is converted into a text file and added to the Sourcegroup in Keiluvision.

Figure 10 Hardware Unit

The value from the ASCII file generated in MATLAB is loaded into Keil µvision and when it is 1, ie., when a fault is found, the stepper motor is stopped. When the value is 0, no fault is found, hence the motor runs normally. The status of the fabric is displayed on the LCD screen. Along with that the buzzer of the system is alerts the operator.

Figure 11 Display the status of Fabric on LCD Screen

V. CONCLUSION AND FUTURE SCOPE

It is easy to identify faults on fabric images and process by using this method. Faults such as hole, scratch, fading and other faults on fabrics can be identified and processed. The manual textile quality control usually goes over the human eye inspection. Notoriously, human visual inspection is tedious, tiring and fatiguing task, involving observation, attention and experience to detect correctly the fault occurrence. The accuracy of human visual inspection declines with dull jobs and endless routines. Sometimes slow, expensive and erratic inspection is the result. Therefore, the automatic visual inspection protects both: the man and the quality. Here, it has been demonstrated this method is capable of detecting fabrics' defects with more accuracy and efficiency.

In future this work may be extended such that the output is given to neural network and the Microcontrollers of any type can be utilized and programmed such that it can detect the faulty fabric part. Continuous video streaming of the images is done and faults are identified in real-time.

REFERENCES

[1] Jagruth Mahure Y.C. Kulkarni Fabric Fault

[2] Dr.R.S.Sabeenian,M.E.Paramasivam, P.M.Dinesh. Detection and Location of Defects in Handloom Cottage Silk Fabrics Using MRMRFM and MRCSF

[3] Navneet Kaur.Application of Machine Vision Techniques in Textile Quality Analysis

[4] Miharan Tucerayn and Anil K. Jain Texture Analysis

[5] Pritpal Singh and Omkar Chand Sharma Texture Analysis in Fabric Material For Quality Evaluation

[6] Dr.R.S.Sabeenian, M.E.Paramasivam, P.M.Dinesh Computer Vision Based Defect Detection in Handloom Silk Fabrics

[7] http://en.wikipedia.org/wiki/Image_noise

[8] Jagtri Pate, Meghna Jain. Location of Defects in Fabrics Using Feature Extraction Technique